Hodgins, Faith (2017) *A mixed methods evaluation of Childsmile's targeted and tailored Dental Health Support Worker intervention.* PhD thesis.

http://theses.gla.ac.uk/8086/

Copyright and moral rights for this work are retained by the author

A copy can be downloaded for personal non-commercial research or study, without prior permission or charge

This work cannot be reproduced or quoted extensively from without first obtaining permission in writing from the author

The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the author

When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given

Enlighten:Theses
http://theses.gla.ac.uk/
theses@gla.ac.uk

A mixed methods evaluation of Childsmile's targeted and tailored Dental Health Support Worker intervention

Faith Hodgins, BSc

School of Medicine, Dentistry & Nursing, College of Medical, Veterinary and Life Sciences, University of Glasgow

Submitted in fulfilment of the degree of Doctor of Philosophy

April 2017

Abstract

Background

This thesis contributes to a national evaluation of a Dental Health Support Worker (DHSW) intervention in Scotland. The DHSW intervention is a targeted component of Childsmile; an oral health improvement programme which aims to improve the oral health of children and reduce oral health inequalities. DHSWs facilitate families in registering with, and attending, a dental practice, support oral health behaviour change at home, and signpost families to wider community initiatives.

In programme development, elements proposed to be critical to the success of the DHSW intervention were: effective targeting of 'the right children' and ensuring the intervention is 'tailored to families' needs'. When the programme was rolled out across Scotland, there was a lack of consensus about how these elements should be implemented. Furthermore, some aspects of the programme were adapted to suit the characteristics of the local Scottish health boards.

Aims

This thesis aims to explore how 'targeting' and 'tailoring' were being implemented in the DHSW intervention, how they *should* be implemented in order to be optimally effective, and the effect of the DHSW intervention on dental participation at the early phase of implementation.

Methods

A systematic review and mixed methods study were conducted. The systematic review synthesised evidence on the implementation of tailoring in effective lay health worker interventions. The mixed methods study looked at how targeting and tailoring were implemented within the Childsmile DHSW intervention and its impact on child dental participation. The mixed methods study involved quantitative analysis of linked administrative health datasets and qualitative

analysis of focus groups and interviews with Childsmile stakeholders, synthesising the findings from a pragmatic stance.

Findings and conclusions

Findings show that 'the right children' were defined by stakeholders as any child in a family identified as vulnerable (for whatever reason) whose family must be ready to engage with the intervention. The right child is not every child or children in families facing acute health or social issues that may inhibit engagement.
In the early stage of implementation of the intervention, there was some evidence of targeting of the right children from a socio-economic and oral health risk position. Nonetheless, there were differences between health boards in the extent to which this targeted approach was adopted and the extent to which the Childsmile referral pathway was being utilised.

'Tailoring to families' needs' should involve assessing individual families' needs and then providing differential support matched to those specific needs. There was some evidence that DHSWs were tailoring the intervention in line with some of the features of tailoring found to be effective in other LHW programmes; however, there were many barriers that restricted DHSWs' freedom to tailor to families' needs. Barriers included: health visitors not providing background information with the referral; DHSWs having responsibilities outside of Childsmile Practice; dental practices not notifying DHSWs of children who fail to attend appointments; a lack of consensus within the programme on whether DHSWs should deliver a brief intervention or whether it can be more intensive support where necessary; and, communication difficulties across language barriers.

Despite this, there was clear evidence that the DHSW intervention had been effective at this early stage of implementation. Moderate effects on dental participation were observed across Scotland in all risk groups. Across Scotland, there was a 17% difference in dental participation between groups who did and did not receive the intervention, and children were more likely to participate sooner if they had received an intervention.

Recommendations for the Childsmile programme follow three key themes: (1) reform the referral pathway; (2) develop working policies to help reduce organisational barriers to DHSWs delivering an effective intervention; and, (3) although challenging within the health service system, improve selection criteria of DHSWs and enhance subsequent training to highlight the unique benefits lay people bring to these roles.

Table of Contents

Abstract 2
Table of Contents 5
List of Tables 12
List of Figures 13
Acknowledgements 16
Author's Declaration 18
Abbreviations 19
1 General Introduction 21
1.1 Introduction 21
1.2 The caries problem 21
1.2.1 The impact of caries 22
1.3 Oral health inequality in Scotland 23
1.3.1 Defining and identifying health inequality 24
1.3.2 Social gradient 25
1.3.3 The social determinants of health 25
1.4 Tackling health inequality by targeting and tailoring interventions 26
1.4.1 Targeted interventions 26
1.4.2 Tailored interventions 27
1.5 Childsmile 28
1.5.1 Aims and objectives of the Childsmile programme 29
1.5.2 Childsmile Core 29
1.5.3 Childsmile Nursery & School 29
1.5.4 Childsmile Practice 30
1.5.5 The DHSW role in Childsmile Practice 33
1.5.6 Origins of the lay health worker concept 34
1.5.7 Defining 'lay health worker' 34
1.5.8 Lay health worker programmes 36
1.6 Evaluation of Childsmile 40
1.6.1 National evaluation 40
1.6.2 Theory-based evaluation 40
2 Aims and objectives 46
2.1 Aims 46
2.2 Objectives 46
2.3 Summary 48
3 Methodology 51
3.1 Introduction 51

3.2 The Pragmatist approach 52
3.3 Identifying the appropriate methods 53
3.3.1 Systematic literature review 53
3.3.2 Mixed methods study 54
3.4 Summary 55
4 How lay health workers tailor in effective health behaviour change interventions: a systematic review 57
4.1 Introduction 57
4.1.1 Definition of 'lay health worker' 57
4.1.2 Definition of tailoring 59
4.1.3 Evidence for the effectiveness of tailored interventions and LHW interventions 59
4.2 Aims and objectives 62
4.3 Method 62
4.3.1 Eligibility criteria 62
4.3.2 Information sources 64
4.3.3 Search strategy 64
4.3.4 Data management and selection process 65
4.3.5 Data extraction 66
4.3.6 Quality assessment 66
4.3.7 Data analysis 67
4.4 Results 69
4.4.1 Search results 69
4.4.2 Intervention characteristics 70
4.4.3 LHW characteristics 72
4.4.4 Theoretical basis for LHW intervention 77
4.4.5 Assessment of needs 81
4.4.6 Features of tailoring in successful interventions 96
4.5 Limitations 101
4.6 Summary 103
5 A mixed methods study of a targeted and tailored Dental Health Support Worker intervention 106
5.1 Introduction 106
5.2 Aims 106
5.3 Research questions 106
5.4 Ethical approval 109
5.4.1 NHS 109
5.4.2 Privacy Advisory Committee 109
5.4.3 University of Glasgow 109

5.5 Qualitative methods 110
5.5.1 Design 110
5.5.2 Conducting the research 113
5.5.3 Analysis 122
5.6 Quantitative methods 126
5.6.1 Design 126
5.6.2 Data sources 127
5.6.3 Data linkage 131
5.6.4 Quality assurance and data cleaning 134
5.6.5 Coding of variables and derived variables 135
5.6.6 Coding of variables and derived variables 136
5.6.7 Statistical methods 139
5.7 Integration of data 142
5.7.1 Timing and ordering 143
5.7.2 Weighting 144
5.7.3 Mixing 144
6 Results: Description of the cohort 146
6.1 Introduction 146
6.2 Implementation of the Childsmile referral pathway 146
6.3 Overview of the cohort 147
6.3.1 CHS assessment variables 147
7 Results: Targeting the right children 151
7.1 Introduction 151
7.2 Who are the right children? Targeting versus universalism 152
7.3 Who are the right children? The challenge of engaging health visitors in targeting the right children 154
7.4 Who are the right children? Targeting families who are ready to be referred 155
7.5 Patterns of health visitor referral for DHSW intervention across Scotland over time 156
7.6 Geographic and family factors influencing health visitor referral through the Childsmile referral pathway 158
7.6.1 Patterns of health visitor referral through the Childsmile referral pathway across Scotland 158
7.6.2 Family variables 165
7.6.3 A multivariable analysis of factors independently influencing health visitor referral for DHSW intervention: across Scotland 169
7.6.4 A multivariable analysis of factors independently influencing health visitor referral for DHSW intervention: within health boards 171
7.7 Summary 172

8 Implementation of the Childsmile referral pathway 174
8.1 Introduction 174
8.2 Do DHSWs respond to all referrals made by health visitors through the Childsmile referral pathway? 175
8.3 Are health visitors referring children for DHSW intervention using the Child Health Surveillance form as expected? 178
8.3.1 Geographic and family factors influencing referral for DHSW intervention through all available pathways 180
8.4 Summary 184
9 Results: Defining tailoring and its importance in the context of the DHSW role 186
9.1 Introduction 186
9.2 How 'tailoring' is defined by Childsmile stakeholders 186
9.3 The importance of tailoring for the effectiveness of the DHSW intervention 188
9.3.1 Tailoring is evidence based 188
9.3.2 Tailoring provides a flexible framework for addressing needs and barriers 188
9.4 Summary 189
10 Results: Training DHSWs to deliver a tailored intervention 190
10.1 Introduction 190
10.2 Initial NHS Education Scotland (NES) training 190
10.3 Skills development 192
10.4 Simulated practice 193
10.5 Shadowing 194
10.6 Summary 196
11 Results: Assessing families' needs 198
11.1 Introduction 198
11.2 Health visitors and DHSWs should work collaboratively to assess families' needs 198
11.3 Maintaining day-to-day communication with health visitors about families' needs 203
11.4 Summary 205
12 Results: Tailoring the 'dosage' of the DHSW intervention 206
12.1 Introduction 206
12.2 Number of 'doses' delivered by DHSWs 206
12.3 Tailoring the dosage of DHSW intervention 208
12.3.1 Children receiving different dosage 208
12.3.2 Geographic, demographic and lifestyle variables associated with dosage across Scotland 209

12.3.3 Multivariable logistic regression of variables influencing dosage: across Scotland 217
12.3.4 Multivariable analysis of factors influencing dosage: within health boards 217
12.3.5 Univariable analysis of influence of level of risk on dosage..... 218
12.4 Factors affecting DHSWs' freedom to tailor the 'dosage' of intervention 220
12.4.1 Other responsibilities 220
12.4.2 Following up families who fail to attend dental appointments.. 222
12.5 How DHSWs should determine the right intensity of intervention ... 223
12.5.1 Brief intervention versus long-term support 223
12.5.2 Building rapport and a supportive relationship..... 225
12.5.3 Tailoring to empower 227
12.6 Summary 229
13 Results: Tailoring the timing and communication of oral health messages 231
13.1 Introduction 231
13.2 Tailoring the timing of oral health messages 231
13.3 Tailoring communication of oral health messages 234
13.3.1 Being responsive..... 235
13.3.2 Increasing the relevance of messages 235
13.3.3 Adapting the communication style 236
13.3.4 Accommodating literacy and language barriers 238
13.4 Summary 240
14 Results: Tailoring to individual families' practical and psychological barriers 241
14.1 Introduction 241
14.2 Tailoring to overcome families' barriers 241
14.2.1 Identifying families' needs and barriers..... 241
14.2.2 DHSWs accommodating families' barriers..... 244
14.2.3 Dental practices accommodating families' barriers 245
14.2.4 Signposting families to additional support/ resources 246
14.3 Tailoring contact type to reduce barriers..... 247
14.3.1 Geographical association with contact type 249
14.4 Reducing barriers in the immediate delivery environment..... 255
14.4.1 Comfort 256
14.4.2 Minimising distractions 256
14.4.3 Appropriate resources 256
14.5 Summary 257
15 Results: Assessing the effectiveness of the DHSW intervention 259
15.1 Introduction 259

15.2 The impact of the DHSW intervention on the percentage of children participating at a dental practice 260
15.2.1 Impact of DHSW intervention on time to participation 262
15.2.2 Impact of DHSW intervention by level of need 264
..... 275
15.3 Summary 275
16 Discussion of the research findings 277
16.1 Introduction 277
16.2 Targeting the right children 278
16.2.1 Defining 'the right child' 278
16.2.2 Effective targeting 279
16.2.3 Developing an effective referral pathway 280
16.3 Delivering a tailored intervention 281
16.3.1 Defining tailoring 281
16.3.2 Training DHSWs to tailor the intervention 281
16.3.3 Assessing families' intervention needs 283
16.3.4 Signposting 285
16.3.5 Freedom to tailor the dose of intervention 286
16.3.6 Tailored communication 287
16.3.7 Addressing barriers 289
16.3.8 The importance of being 'lay' 290
16.4 Evidence for effectiveness 292
16.5 Strengths and limitations 293
16.5.1 Systematic literature review 293
16.5.2 Use of mixed methods 293
16.5.3 Stakeholder recruitment 294
16.5.4 Use of routine NHS data 296
16.6 Recommendations 298
16.6.1 Recommendations for the Childsmile programme 298
16.6.2 Recommendations for the design and implementation of lay health worker programmes 302
16.6.3 Recommendations for further research 303
17 Conclusions 305
References 307
Appendices 322

List of Appendices

Appendix 1- Inclusion/exclusion criteria for the systematic review 322
Appendix 2- Search strategies for each database 324
Appendix 3- Data extraction form 330
Appendix 4- Study 'clusters' included in the systematic review 332
Appendix 5- West of Scotland Research Ethics Service approval 337
Appendix 6- University of Glasgow Medical, Veterinary and Life Sciences ethics approval 338
Appendix 7- Consent form 339
Appendix 8- Study information sheet 340
Appendix 9- Topic guide for Childsmile Executive 341
Appendix 10- Topic guide for Childsmile coordinators 342
Appendix 11- Topic guide for Childsmile Dental Health Support Workers 343
Appendix 12- Topic guide for parents 344
Appendix 13- Topic guide for health visitors 345
Appendix 14- Theme development diagrams 346
Appendix 15- 6-8 week Child Health Surveillance form 348
Appendix 16- Health Informatics Centre form for the Dental Health Support Worker intervention 349
Appendix 17- GP17 form for dental remuneration (MIDAS data) 350
Appendix 18- Univariable and multivariable regressions of factors associated with health visitor referral through the Childsmile referral pathway 351
Appendix 19- Univariable logistic regression of association between 'level of risk' and health visitor referral through the Childsmile referral pathway 353
Appendix 20- Multivariable regression within health boards of factors associated with health visitor referral through the Childsmile referral pathway 356
Appendix 21- Univariable and multivariable regressions of factors associated with referral by any pathway 361
Appendix 22- Univariable logistic regression of association between 'level of risk' and referral by any pathway 363
Appendix 23- Multivariable regression within health boards of factors associated with referral by any pathway 365
Appendix 24- Example of a local referral form 370
Appendix 25- Univariable and multivariable regressions of factors associated with 'dosage' 371
Appendix 26- Univariable logistic regression of association between 'level of risk' and 'dosage' 373
Appendix 27- Multivariable regression within health boards of factors associated with 'dosage' 374

List of Tables

Table 1.1- Characteristics of lay health workers at either end of the natural helping-paraprofessional continuum (adapted from Eng et al., 1997) 35
Table 4.1- Characteristics of included interventions 73
Table 4.2- Characteristics of LHW training 76
Table 4.3- Theories informing tailoring 78
Table 4.4- Characteristics of tailoring 83
Table 4.5- Analysis of features of tailoring 100
Table 5.1- Focus group and interview participants 114
Table 5.2- Theoretical sampling matrix for health visitors 116
Table 5.3- Extract from a framework matrix 125
Table 5.4- Stages of framework analysis 126
Table 6.1- Demographics of the September 2010-September 2012 Child Health Surveillance cohort, followed through attempted DHSW interventions and dental participation 148
Table 6.2- Demographics of the September 2010-September 2012 Child Health Surveillance cohort, followed through attempted DHSW interventions and dental participation 149
Table 11.1- Criteria used by health visitors and DHSWs to assess families' oral health needs 202
Table 15.1- Median time to survival (participation) and results from Cox regression 263

List of Figures

Figure 1.1- Key roles in the delivery of Childsmile Practice 31
Figure 1.2- The Childsmile Referral Pathway 32
Figure 1.3- Extract from the Childsmile Practice logic model, as recorded in November 2009 42
Figure 2.1- Research questions and chapter index for the first step of implementation 48
Figure 2.2- Research questions and chapter index for the second step of implementation 49
Figure 2.3- Research questions and chapter index for the third step of implementation 50
Figure 4.1- Research questions relating to delivering the DHSW intervention ... 58
Figure 4.2- Flow chart of study selection 70
Figure 5.1- Research questions relating to targeting 'the right children' 107
Figure 5.2- Research questions relating to delivering the DHSW intervention . 108
Figure 5.3- Research questions relating to child participation at dental practices 109
Figure 5.4- Screenshot of the electronic link between summaries (left) and the original source material (right) 123
Figure 5.5- Maximum number of months between attempted DHSW interventions (or 'doses') for all children who had more than one 130
Figure 5.6- A timeline of the three linked administrative health datasets: Child Health Surveillance (CHS), Health Informatics Centre (HIC), and Management Information & Dental Accounting System (MIDAS) 131
Figure 5.7- Diagram of the data linkage process 133
Figure 6.1- Timeline of health board implementation of the Childsmile referral pathway where children are referred for DHSW intervention by health visitors using the 6-8 week Child Health Surveillance form 146
Figure 6.2- Flow diagrams of cohort used in the analysis for each quantitative research question 150
Figure 7.1- Research questions relating to targeting 'the right children' 151
Figure 7.2- Line graph showing how health visitor referrals made through the Early Years Referral Pathway change as it becomes more established. Time of implementation is equal to the time at which health visitors in each health board could first refer children 157
Figure 7.3- Health visitor referrals for whole cohort across Scotland from 1st September 2010- 30th September 2012- excluding those where the referral pathway was not in operation (n=56, 963) 159
Figure 7.4- Health visitor referral patterns shown by health board from 1st September 2010-30th September 2012 where the Childsmile referral pathway was implemented (N=57134) 161
Figure 7.5- Health visitor referrals shown by (a) national and (b) local SIMD distribution (N=57002) 162
Figure 7.6- Health visitor referrals shown by urban-rural classification of the area where children live (N=57002) 164
Figure 7.7- Health visitor referrals shown by feeding practice (N=56327) 165
Figure 7.8- Health visitor referrals shown by parental smoking (N=57134)) 166
Figure 7.9- Health visitor referrals shown by HPI at 6-8 week (N=54464) 167
Figure 7.10- Health visitor referrals shown by 'level of risk' (N=57134) 169

Figure 8.1- Research questions relating to the implementation of the Childsmile referral pathway 174
Figure 8.2- Rates of DHSW attempted intervention per 1000 person months between referral and event (event is either attempted DHSW intervention or end of cohort period, whichever occurs first)..... 177
Figure 8.3- Health visitor referrals through the Early Years Referral Pathway for all children in the HIC database (i.e. all children for whom a DHSW attempted an intervention). *Note: NHS Borders, Grampian, Tayside, Lothian, Forth Valley, Dumfries & Galloway and the Islands are not shown due to small numbers resulting in the figures disclosing sensitive personal data.* 179
Figure 9.1- Research questions relating to defining 'tailoring' and its importance 187
Figure 10.1- Research questions relating to DHSW training 191
Figure 10.2- Comparison between shadowing as conceived and as manifested in practice 195
Figure 11.1- Research questions relating to the assessment of individual families' needs 199
Figure 12.1- Research questions relating to tailoring the intensity of the DHSW intervention..... 207
Figure 12.2- Dosage of DHSW interventions for whole cohort 208
Figure 12.3- Dosage of DHSW interventions by health board. Ns for NHS Forth Valley, NHS Dumfries & Galloway, and the Islands are suppressed due to small numbers meaning there is a risk of disclosure of confidential personal information (N=18392) 210
Figure 12.4- Dosage of DHSW interventions by area-based deprivation (SIMD) (N=18354) 212
Figure 12.5- Dosage of DHSW interventions by urban-rural classification of the area in which the child lives (N=18354)..... 213
Figure 12.6- Dosage of DHSW interventions by family variables (a) feeding (N= 18073), (b) smoking (N=18392), (c) health plan indicator (N=16600) 215
Figure 12.7-Dosage of intervention by level of risk (N=18392)..... 216
Figure 13.1- Research questions relating to how DHSWs should tailor the timing and communication of oral health messages..... 232
Figure 14.1- Research questions relating to how DHSWs should tailor to individual families' practical and psychological barriers..... 242
Figure 14.2- Behaviour Change Wheel..... 243
Figure 14.3- Type of contact shown for all attempted DHSW contacts with families across Scotland 248
Figure 14.4- Type of contact used by DHSWs shown by health board..... 249
Figure 14.5- Type of contact used by DHSWs shown by (a) national and (b) local SIMD distribution (N=29136)..... 251
Figure 14.6- Type of contact used by DHSWs shown by urban-rural classification of the area where children lived (N=29136)..... 252
14.7- Type of contact used by DHSWs shown by (a) infant feeding (N=28727), (b) smoking (N=29202) (c) HPI at 6-8 weeks (N=26435)..... 254
Figure 14.8- Type of contact used by DHSWs shown by level of risk (N=29202) 255
Figure 15.1- Research questions relating to the effect of the DHSW intervention on dental participation 259
Figure 15.2- Participation at a dental practice, according to whether they received a DHSW intervention or not..... 261
Figure 15.3- Survival curves and Cox regression output for (a) the whole cohort and (b) DHSW intervention versus no intervention..... 262

Figure 15.4- Participation for those who were referred/not referred by health visitors through the Childsmile referral pathway and who did/did not receive a DHSW intervention..... 266
Figure 15.5- Survival curves and Cox regression output for health visitor referrals through the Childsmile referral pathway combined with DHSW intervention .. 267
Figure 15.6- Participation and DHSW intervention/no intervention by area-based deprivation (SIMD) 269
Figure 15.7- Survival curves and Cox regression output by area-based deprivation (SIMD) 270
15.8- Survival curves and Cox regression output for DHSW intervention versus no intervention by area-based deprivation (SIMD 1 & 2)..... 270
15.9- Survival curves and Cox regression output for DHSW intervention versus no intervention by area-based deprivation (SIMD 3 & 4)..... 271
15.10- Survival curves and Cox regression output for DHSW intervention versus no intervention by area-based deprivation (SIMD 5)..... 271
Figure 15.11- Survival curves and Cox regression output by 'level of risk'..... 273
Figure 15.12- Participation and DHSW intervention/no intervention by family 'level of risk..... 274
15.13- Survival curves and Cox regression output for DHSW intervention versus no intervention by 'level of risk' (0 risk factors and 1 risk factor)..... 275
15.14- Survival curves and Cox regression output for DHSW intervention versus no intervention by 'level of risk' (2 risk factors and 3 or more risk factors) 275

Acknowledgements

I would like to express my sincere gratitude to my supervisors, Dr Wendy Gnich, Dr Andrea Sherriff and Dr Al Ross. Their support, insightful comments and constructive critique over the last four years have been invaluable. They gave their time and experience generously and worked together to provide seamless supervision.

I would like to thank Prof. Lorna Macpherson and the members of the Childsmile Executive board for approving the funding required for this research and for providing advice, insight and encouragement along the way.

Thanks to Childsmile regional researcher, Leigh Deas, for providing feedback on early drafts of the qualitative analysis and for offering words of wisdom and reassurance on many occasions. Thanks also to the rest of the Childsmile regional research team who, at the beginning of this process, helped me understand how the Childsmile programme operated 'on the ground', contributed to the development of the research questions, and assisted in establishing relationships with Childsmile coordinators.

I offer a special thanks to those who participated in focus groups or interviews and who trusted me to report their views and experiences faithfully. I would particularly like to mention the Childsmile coordinators who not only participated in the research but acted as a gateway for recruiting Dental Health Support Workers, health visitors and parents.

Many thanks to Prof. David Conway for leading the, often complex, negotiations required for the linkage of health databases used in the mixed methods study. Also, to Jamie Kidd who specified the variables required for the linkage and made himself readily available for my questions about the collection, management and linkage of the databases.

I would like to thank Carole Morris, John Nolan and Katrina Smith at Information Services Division (ISD) Scotland who coordinated the linkage of the health

databases, acted as my main contacts with ISD, and monitored all tables and graphs for accidental disclosure of sensitive patient information.

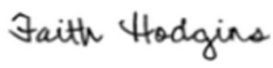
For administrative support, I thank Yvonne Morley, for assisting with the practical aspects of arranging focus groups and interviews, John McHugh, for transcribing many of them, and Pauline Daniel, who aided the management of a busy supervisory team.

I would like to thank my fellow office mates and Community Oral Health postgraduate students for the stimulating discussions and much appreciated moral support. In addition, I would like to acknowledge two very good friends and colleagues. First, thanks to Mairi Young with whom I started and finished this 'journey'. I am not convinced it would have been possible without her and it certainly would have been a lot less fun. Secondly, Dr Sandra Winter, who showed me what could be achieved with a little conscientious effort and regularly reassured me that the end was in sight.

Last, but not least, I would like to thank my friends and family; the people who fed and watered me in the final weeks of writing and who *tried* to remember not to ask, "When will your thesis be finished?"!

Author's Declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.



Faith Hodgins

Abbreviations

The following abbreviations are used throughout this thesis:

CHP	Community Health Partnership
CHS	Child Health Surveillance
DHSW	Dental Health Support Worker
EDDN	Extended Duty Dental Nurse
EYRP	Early Years Referral Pathway
GP	General Practitioner
HIC	Health Informatics Centre
ISD	Information Services Division Scotland
LHW	Lay Health Worker
MIDAS	Management Information & Dental Accounting System
MRC	Medical Research Council
NDIP	National Dental Inspections Programme
NHS	National Health Service
PAC	Public Advisory Committee
SDCEP	Scottish Dental Clinical Effectiveness Programme
SIMD	Scottish Index of Multiple Deprivation
UK	United Kingdom

USA	United States of America
WHO	World Health Organisation

AA	NHS health board, Ayrshire & Arran
B	NHS health board, Borders
D&G	NHS health board, Dumfries and Galloway
F	NHS health board, Fife
FV	NHS health board, Forth Valley
G	NHS health board, Grampian
GGC	NHS health board, Greater Glasgow & Clyde
H	NHS health board, Highland
ISL	NHS health boards, Western Isles, Orkney & Shetland
L	NHS health board, Lothian
La	NHS health board, Lanarkshire
T	NHS health board, Tayside

1 General Introduction

1.1 Introduction

This thesis contributes to a formative theory-based evaluation of a targeted and tailored lay health worker intervention. This lay health worker intervention is part of Childsmile, a national child oral health improvement programme implemented throughout Scotland. This chapter provides background relevant to this thesis and context for the research undertaken. First, the problem of dental caries in the Scottish population is described. Issues related to tackling health inequalities are explored, followed by a description of the Childsmile programme and the Dental Health Support Worker (DHSW) intervention. Importantly, discussion of lay health worker programmes designed to address health inequalities is included. Lastly, the approach to the overarching evaluation of the Childsmile programme and the DHSW intervention is outlined, including where this doctoral research fits within Childsmile's national programme evaluation.

1.2 The caries problem

Dental decay, also known as dental caries, is the most common oral disease worldwide. Over 90% of all adults and 60-90% of school children are affected by it (World Health Organisation, 2012). Newly erupted teeth are at a greater risk of caries due to the difficulty in thoroughly cleaning them and because the enamel is less resistant before maturing. Consequently, children are especially vulnerable to developing caries (Reich et al., 1999). Dental caries in children may lead to toothache and increases the likelihood of undergoing an extraction (Tickle et al., 2008), often under general anaesthetic, as well as potentially affecting their physical development and quality of life (Sheiham, 2006).

Caries develop when sugars in food and drink react with acidogenic bacteria (*Mutans Streptococci* and *Lactobacilli*) in dental plaque. The acid produced by this reaction causes a fall in plaque pH which leads to calcium and phosphate minerals diffusing out of the tooth and into the plaque. This is known as demineralisation. When the pH of plaque and saliva increase again, calcium and phosphate may diffuse back into the tooth, reversing the effect of

demineralisation. Oral health can be compromised, however, when there is frequent intake of sugars into the oral cavity, producing a prolonged acidic environment. This environment favours the demineralization process where calcium and phosphate minerals diffuse out of the tooth. Measures shown to be effective in enhancing protective factors and limiting the pathological processes of demineralization include reducing intake of sugars and brushing teeth with fluoridated toothpaste (Frencken et al., 2012), drinking fluoridated water (Iheozor-Ejiofor et al., 2015), chewing sugar-free gum to increase salivary production (Mickenautsch et al., 2007), and applying fluoride varnish to the tooth surfaces (Marinho et al., 2003).

Factors often reported to be associated with caries in children include poor oral hygiene, diet, socio-cultural background, and environmental risk factors (Harris et al., 2004). Oral health in the general population has been shown to be socially patterned (Watt & Sheiham, 2012) and oral disease is, therefore, like many other diseases, associated with socio-economic status.

A review of global dental caries highlights the growing problem of caries worldwide and the trend for the highest prevalence of caries to be contained within countries' more deprived areas (Bagramian et al., 2009). Global oral health is not, therefore, simply being challenged by a universal problem of caries, but also by inequalities.

1.2.1 The impact of caries

Caries, and associated infection, can cause pain which, in turn, can have a range of consequences for a child. Pain from dental caries has been reported to affect children's ability to sleep and play (Filstrup et al., 2003). Pain while eating can lead to affected children eating less food. This can affect the physical development of children with caries (Acs et al., 1992; Ayhan et al., 1996). These factors lead to a decrease in oral health related quality of life for affected children (Filstrup et al., 2003; Low et al., 1999).

In addition, there is a psychosocial impact of dental caries. Oral health has been found to affect children's social interactions and self-esteem, as children without caries view their own smiles more positively, smile more widely, and are

perceived by parents to have better smiles than children with caries (Patel et al., 2007).

Caries in early childhood can potentially have lifelong implications as poor oral health is associated with school absences and lower school performance (Garg et al., 2012; Jackson et al., 2011). Furthermore, early childhood caries has the potential to impact on the future oral health of a child as carious 'baby teeth' are a risk factor for caries in permanent teeth (al-Shalan et al., 1997) and children who have carious primary teeth extracted are more likely to develop orthodontic problems with their permanent teeth (Law, 2013). In Scotland, between 2014 and 2015, there were 1565 hospital procedures carried out for tooth extraction under general anaesthesia in children aged 0-4 years. This amounted to approximately 17% of all procedures on children in this age group (ISD Scotland, 2016).

Health services are under immense strain as they try to deal with the long-term consequences of poor oral health in individuals' early childhoods. Over and above the impact on health services, there is an indirect impact of childhood dental caries on the economy. There are costs related to productivity losses worldwide, due to absenteeism from school and work (as parents take time off to look after children with dental pain and take them to clinic or hospital appointments). A global study conducted using oral disease estimates from the 2010 Global Burden of Disease Study and 2010 values of gross domestic product provided by the International Monetary Fund, have estimated these costs to be US$2.09 billion for caries in deciduous ('baby') teeth (Listl et al., 2015).

1.3 Oral health inequality in Scotland

Scotland's National Dental Inspection Programme (NDIP) in 2003 reported that decay experience (number of decayed, missing and filled teeth) for Scottish five year olds was among the worst in Western Europe, with areas in the west of Scotland showing the poorest dental health (NDIP Reports, 2016). Compared with statistics from 1999, the state of children's dental health in Scotland had remained fairly static in terms of the number of decayed, missing and filled teeth, whilst improvements had been seen in adult dental health. The report also highlighted the presence of a social gradient in the oral health of five year

olds in Scotland. NDIP uses an area-based measure of deprivation known as the Scottish Index of Multiple Deprivation (ISD Services, 2016). The latest NDIP report shows improvements in the last decade. In 2014 it was reported that overall 68% of children aged 4-5 years have no obvious decay experience; however, there is still inequality as 53% of those in the most deprived SIMD quintile of Scotland have caries experience and have not yet met the national 2010 target of 60% (NDIP Reports, 2016).

In Scotland, dental registration is lower in areas of high deprivation in 0-2 year olds (ISD Scotland, 2016b). Ideally, children would begin attending a dental practice in the early years in order to begin a lifelong habit of preventive rather than restorative care. The low percentage of registration in the early years in Scotland means that a high proportion of children are missing out on anticipatory care at a time when life-long health behaviours are being established (Shaw et al., 2009).

1.3.1 Defining and identifying health inequality

Health inequalities are caused by differences between people or communities. These differences may be, for example, social, geographical, or biological factors which contribute to the most disadvantaged people experiencing poorer health and, even, shorter lives (National Institute for Health and Care Excellence, 2012).

Whitehead and Dahlgren (2007) propose that there are three features by which health inequality can be identified. The first feature is that differences in health across a population are not random, but are distributed in a systematic fashion. Mortality, morbidity and poor health increase with declining social circumstances. This is a pattern observed to a greater or lesser extent in every country throughout the world. The second feature by which inequality can be identified is that it is a product of social processes and not an inevitable consequence of the 'Laws of Nature' (Whitehead & Dahlgren, 2007). The third feature is that the unequal distribution of health across a population is widely considered to be unfair. An example of this is that most people share the view that all children should have the same chance of survival, regardless of their social position (Whitehead and Dahlgren, 2007). The agreed values regarding

what is ‘fair’ are enshrined in the World Health Organisation (WHO) Constitution ("Constitution of the World Health Organization, 1946.," 2002) which states that “the highest standards of health should be within reach of all, without distinction of race, religion, political belief, economic or social condition”.

1.3.2 Social gradient

The ‘health gap’ between the least and most disadvantaged in a population is a concern; however, there is a pattern in health data across low-, middle- and high-income countries that supports the argument that it is not just the ‘health gap’ that should concern us but the social gradient in health (Victoria, 2003). This gradient (in some circumstances, more stark than others) shows that when a population is stratified by socioeconomic indicators, those in the “middle” have poorer health than the least disadvantaged but better health than the most disadvantaged. This social gradient reflects the level of exposure to risk factors which is inversely related to social position (Watt et al., 2014). These risk factors are broadly termed the ‘social determinants’ of health.

1.3.3 The social determinants of health

The social determinants of health are ‘the conditions in which people are born, grow, live, work and age; and the structural drivers of those conditions- the inequitable distribution of power, money and resources’ (World Health Organisation, 2016). A social determinants approach to health inequality recognises that individual health-related behaviours (downstream determinants of health) are shaped by the conditions in which people live and work (upstream determinants) through exposure to risk factors and limitations of choice. Living and working conditions, in turn, are influenced by wider social and economic circumstances (MacIntyre, 2007).

The recognition that individuals’ health status is determined by their social and economic environment has led to the development of health policies and programmes that aim to improve health and address health inequality by addressing the social determinants, rather than focusing solely on persuading individuals to change their health behaviours. General policies that aim to reduce health inequalities should tackle educational failure, unemployment,

housing standards and other factors that cause stress to individuals or lead to social exclusion (Wilkinson & Marmot, 2003). Indeed, individual programmes should take environmental factors into account. The Childsmile programme, which is described in more detail in the following sections, was designed to address inequality in oral health in Scotland by taking account of social determinants. Childsmile is based on the WHO Ottawa Charter for Health Promotion (World Health Organisation, 1986) which recommends community action and reorientation of health services to focus on 'the total needs of the individual as a whole person'.

1.4 Tackling health inequality by targeting and tailoring interventions

1.4.1 Targeted interventions

In 'The World Oral Health Report 2003' (Petersen, 2003) WHO highlighted the issue of oral health inequalities and advocated community-centred projects for promoting oral health, with a focus on populations living in areas of higher deprivation. The idea behind such targeted interventions is to eliminate inequalities by 'levelling up' the health of the most disadvantaged to the level of the most advantaged in society. The health experienced by the most advantaged indicates what it is possible for the least advantaged to attain (Whitehead and Dahlgren, 2007).

A strategic review undertaken in England (Marmot et al., 2010) advocates investing resources universally, with a scale and intensity that is in proportion to the level of disadvantage, rather than simply investing resources in the most deprived communities. This "proportionate universalism" is based on Aristotelian principles of proportional justice (Ruger, 2006). In a health context, this means that an ideal or threshold level of functioning is set by policy makers and efforts are applied to bring disadvantaged people closer to this threshold level. Considering the social gradient apparent in population health, this disproportionate effort should not be permitted to reduce the level of functioning of the rest of the population below the threshold level. Therefore, while priority is given to the most at risk, health promotion efforts may still be exercised for the rest of the population, in proportion to need.

It has been proposed that when universal and targeted approaches are combined, a programme is more likely to be effective at reducing inequality (Marmot et al., 2010). The theory behind this is that a universal programme can be readily implemented and can achieve population coverage; however, it may lose momentum before 'hard-to-reach' groups become engaged with it. Therefore, the addition of efforts that are targeted at the 'hard-to-reach' (and most at risk) groups makes it more likely that the social gradient will be attenuated. The concept of 'proportionate universalism' informed the design of the Childsmile programme components which are described in Section 1.5.

1.4.2 Tailored interventions

While targeted interventions are aimed at a particular community or group of people with shared characteristics, in tailored interventions "information about a given individual is used to determine what specific content he or she will receive, the contexts or frames surrounding the content, by whom it will be presented and even through which channels it will be delivered" (Hawkins et al., 2008). Tailoring an intervention may make it more successful with individuals from marginalised groups who are not engaging with generic information or services as the process of tailoring brings into focus the information that will be most salient for individuals and their journey toward health behaviour change (Campbell & Quintiliani, 2006).

Tailoring within health promotion interventions can range from a component as simple as personalising information leaflets with a participants' name, to adapting the content of an intervention, and any resources provided, to match each participants' perceived barriers to change (Campbell and Quintiliani, 2006). In a sense, there is a continuum of 'tailoring' ranging from minimally personalised information to highly tailored, individualised interventions (Kreuter et al., 1999).

'Tailoring' is a broad term under which many behaviour change strategies would fit. On one hand, interventions that use tailored printed materials as the primary method of communication are often based on psychological theories that predict behaviour change, such as the health belief model or transtheoretical (stages of change) model (Prochaska et al., 1992). On the other hand, interventions

delivered face-to-face by a health professional or lay health worker may offer content and support that is tailored to an individual's needs without being based on any specific underlying behavioural theory. Conversely, such interventions may include multiple behaviour change strategies, based on multiple theories, which could be said to be 'tailored'. For example, such behaviour change techniques as feedback, monitoring, goals and planning, and social support (Michie et al., 2013) could all be components of a community health worker intervention tackling obesity, with each component involving an element of tailoring to the individual.

There is some evidence to support the claim that tailoring an intervention is more effective than not tailoring; however, it is unclear which features of tailoring contribute to intervention effectiveness. This will be addressed in more detail in Section 4.1.3.

One component of the Childsmile programme that is tailored to individual need is the Dental Health Support Worker intervention, which sits within the Childsmile Practice component. The following sections will describe where this intervention fits within the Childsmile programme and how children at high risk of poor oral health should be targeted, referred, and receive the tailored intervention.

1.5 Childsmile

Due to the high prevalence of oral disease in Scottish children, action needed to be taken to improve the state of child oral health in Scotland and to reduce inequalities. A Scottish Government *Action Plan for improving oral health and modernising NHS dental services in Scotland* (The Scottish Government, 2005), published in 2005, paved the way for the development of the Childsmile programme which aimed to improve child oral health, address inequalities in achieving good oral health and inequalities in accessing dental services. Components of the programme were piloted in Scotland from 2006 and, in 2011, the integrated programme was launched throughout Scotland (Macpherson et al., 2015).

1.5.1 Aims and objectives of the Childsmile programme

Childsmile is a Scottish government funded complex intervention which aims to improve the oral health of children and reduce oral health inequalities. Whilst the aims were shaped by policy, the methods selected to achieve these aims were developed primarily from evidence of the "gold-standard", clinically-trialled, peer-reviewed type as well as practitioners' experience (Deas et al., 2013). Childsmile integrates universal, targeted and tailored initiatives for improving oral health and reducing inequalities.

1.5.2 Childsmile Core

The Core element of the programme includes daily supervised toothbrushing which should be undertaken in every nursery school (3-5 years old children) across Scotland. In addition, the programme supports supervised toothbrushing up to primary 1 and 2 in schools located within areas of highest need. This is usually determined by the proportion of children attending a school who live in an area of relative disadvantage. Free dental care packs which include a toothbrush, toothpaste and oral health information are available for children in Scotland and, depending on the local health authority, distributed to all children at around 6-8 weeks of age by health visitors, at nursery school, on commencing the first year of school, and to those deemed to require them in dental practices and community settings.

1.5.3 Childsmile Nursery & School

The Nursery and School programme involves delivering an oral health intervention in the form of fluoride varnish to children attending nurseries and schools located in areas of highest need.

Extended Duty Dental Nurses (EDDNs) are dental nurses who have undergone Childsmile training and are qualified to apply fluoride varnish in nurseries and schools. Fluoride varnish is a topically-applied, preventive, prescription-only medicine. The treatment process allows the EDDNs an opportunity to check children's teeth for obvious signs of decay, to identify those children not registered at a dental practice, and to notify parents if their children require

further assessment and treatment at a dental practice. EDDNs are often supported in this work by Dental Health Support Workers (DHSWs). DHSWs are lay health workers who are employed by the National Health Service (NHS) in Scotland to work with priority groups. They perform a primarily administrative role during fluoride varnish sessions. The majority of DHSWs in Scotland have a role which is focused more on the Practice element of the programme which is described below.

1.5.4 Childsmile Practice

Childsmile Practice offers universal access to oral health advice and six-monthly fluoride varnish application from two years of age delivered by a dental health professional in a dental practice. Extended Duty Dental Nurses (EDDNs) are trained to give oral health advice, to provide free dental packs and carry out fluoride varnish applications. In addition, Practice offers support outside the dental practice setting.

1.5.4.1 Key roles in Childsmile Practice delivery

Figure 1.1 describes the key roles in Childsmile Practice delivery. This includes the Childsmile executive board, Childsmile coordinators, DHSWs, health visitors, and the dental practice team.

This thesis focuses on the implementation of the pathway by which children are referred to a DHSW and the implementation of the DHSW intervention. The Childsmile referral pathway is part of the wider Early Years Referral Pathway (EYRP) which is the assessment and communication pathway for health visiting teams and other health services. It is through this pathway that health visitors refer children to DHSWs. A diagram of the Childsmile referral pathway is shown in Figure 1.2.

Key roles in Childsmile Practice delivery	
Childsmile Executive	The executive board comprises of two programme directors, regional programme managers, and Childsmile's national evaluation manager. The Executive oversee the development and implementation of the whole Childsmile programme.
Coordinators	Childsmile coordinators manage the day-to-day implementation of the Childsmile programme. They often line manage DHSWs, administrative staff and other members of the oral health improvement team. Coordinators in each health board are line managed by the regional programme manager.
DHSWs	DHSWs aim to facilitate families in registering with a dental practice and attending regularly, linking the referred child to a practice as early as possible, and to support oral health behaviour change. The number of contacts a DHSW makes with a family, and the content and delivery of the intervention, should be tailored to their needs.
Health visitors	Health visitors collaborate with (and in some areas supervise) DHSWs. Health visitors conduct a Child Health Surveillance assessment when a child is 6-8 weeks old. At this point, health visitors determine whether a child should be referred for DHSW intervention. Health visitors remain the case holder for each child and DHSWs can raise any concerns about a referred family with the child's health visitor.
Dental Practice team	Dentists are expected to give oral health messages to families and apply fluoride varnish to all children's teeth from 2 years of age. They may employ and/or supervise an Extended Duty Dental Nurse (EDDN) in their practice. EDDNs are dental nurses who are trained to apply fluoride varnish to children's teeth in nurseries, schools and dental clinics. EDDNs may deliver tailored oral health education and advice to families who attend appointments at dental practices. If a child repeatedly fails to attend dental appointments, it is expected that the dental team will inform the DHSW who may discuss the case with the child's health visitor in order to determine the best course of action.

Figure 1.1- Key roles in the delivery of Childsmile Practice

1.5.4.2 The Childsmile referral pathway

Health visitors are the first in the pathway to have contact with the child and family. They carry out an assessment of each newborn at 6-8 weeks of age. At this stage, or at a later date, the health visitor may decide that the family would benefit from further support with their child's oral health, in which case they are referred to a DHSW.

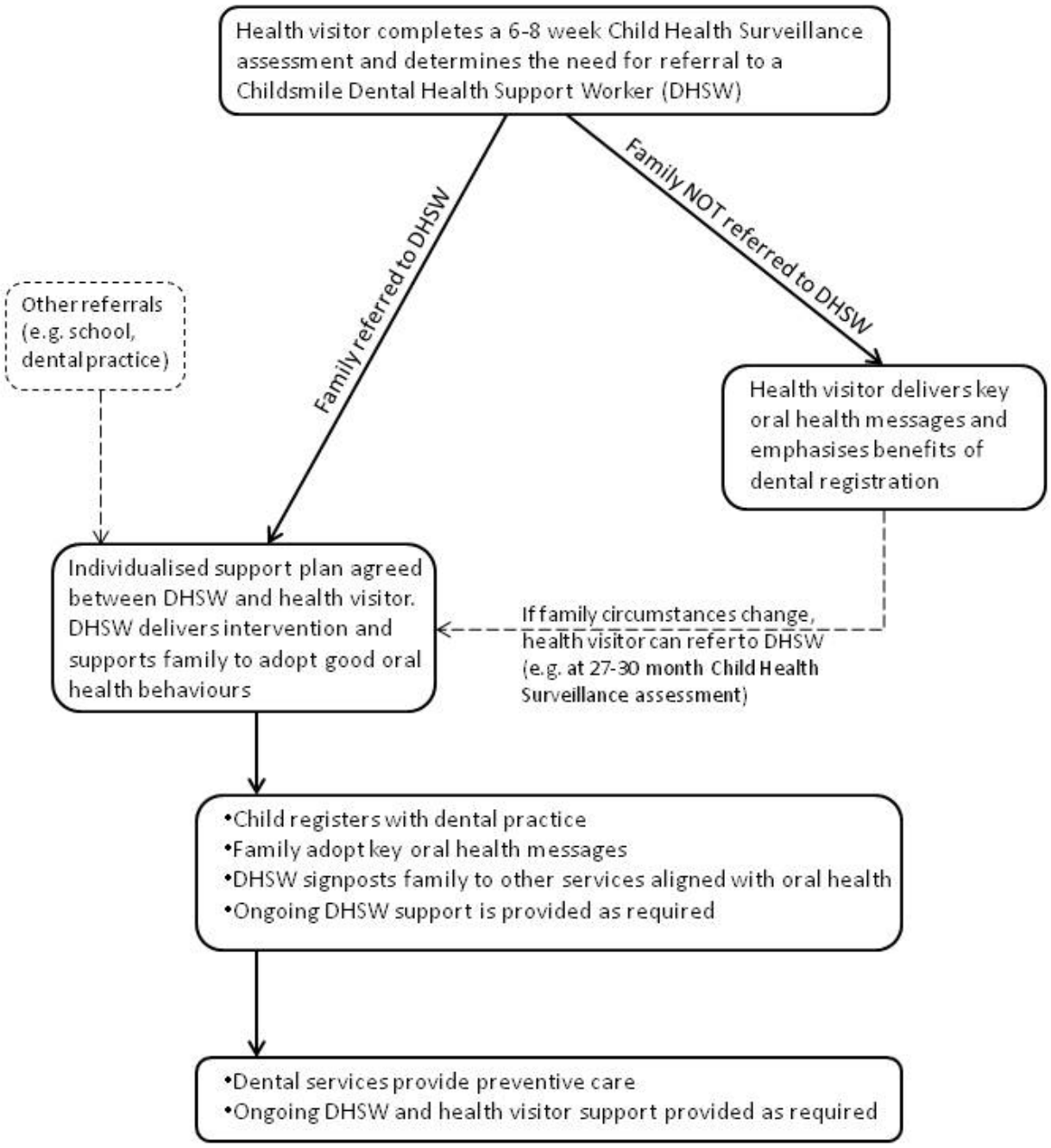


Figure 1.2- The Childsmile Referral Pathway

1.5.5 The DHSW role in Childsmile Practice

The DHSW role was conceived as a lay health worker (LHW) role, inspired by practitioner experience and the positive outcomes of community-based oral health promotion interventions delivered by a combination of professional and lay people. Home visiting was used in "Starting Well", an initiative in Glasgow, Scotland, aiming to improve child health in areas with high deprivation and inequality. One of the reported outcomes of Starting Well most salient for the Childsmile programme is that intensive home visiting seemed to result in higher levels of dental registration (Mackenzie, 2004). An oral health initiative called 'Time to Smile', which was trialled in two of the most socio-economically deprived districts of Glasgow, made use of voluntary community activists who delivered oral health promotion activities in community settings. The implementation of 'Time to Smile' was found to be associated with an increased percentage of children with no obvious decay experience; an effect that was not seen in areas where the intervention had not been implemented (Blair, 2006).

The role of a DHSW is to facilitate families in registering with a dental practice and attending regularly (linking the referred child to a practice as early as possible) and to support oral health behaviour change. Once referred by a health visitor, a DHSW will contact the family when the child is around 3 months of age.

Through telephone calls, home visits, and clinic appointments, DHSWs may deliver: oral health messages; a toothbrushing demonstration; dietary advice; assistance with registering at a practice and arranging an appointment; and, the family may be linked with other community health initiatives. The number of contacts a DHSW makes with a family, and the intervention itself, should be tailored to their needs.

The dental team, in the practice setting, should also provide support that is tailored to the needs of the child and family. This support may be delivered by an EDDN, dental hygienist/therapist, or dentist. If children fail to attend more than one dental appointment, it is recommended that the practice contact the DHSW to inform them of this. The DHSW may notify the relevant health visitor to discuss the family's needs before making contact with them again.

1.5.6 Origins of the lay health worker concept

The earliest usage of a lay health worker model can be traced back to barefoot doctors in China (Zhang & Unschuld, 2008) and village health workers in Thailand in the 1950s (Lehmann & Sanders, 2007). In the 1970s, it became clear that in order to address widening health inequalities, the model for primary health care would have to evolve in order to reach people who were marginalised due to poverty, living rurally, or in receipt of culturally inappropriate health promotion (South et al., 2012).

The implementation of LHW programmes grew throughout the 1970s and 1980s, with programmes often linked to research, resulting in a dominance of literature on lay health worker programmes from the USA (South et al., 2010). The UK, by contrast to the USA, Africa and Asia, began to adopt the lay health worker concept into public health programmes only in the last twenty years. As a Labour Government (1997-2010) began to accept the importance of addressing health inequality and the social determinants of health, and with the pressure of health care costs increasing, health promotion programmes that relied on or included a lay health worker element were established (South et al., 2012

1.5.7 Defining 'lay health worker'

South et al. (2010) identified five broad models of lay health worker (LHW) from the literature. First, there is the 'peer education' model in which LHWs communicate health information to peers. Secondly, there is the 'peer support' model in which LHWs provide information and support to protect recipients against identified stressors. Thirdly, 'popular opinion leaders', who are selected due to their popularity within the target population, and tasked with disseminating information and acting as a role model within their social networks. The fourth model, closest in description to the Childsmile Dental Health Support Worker (DHSW) role is the 'bridging role', where LHWs translate health messages for community members and act as a bridge between the community and health services. Lastly, the 'community mobilising' model involves LHWs mobilising community resources and building local capacity to address health issues.

Swider (2002) describes the main responsibilities as any of the following:

- supporting people to work towards appropriate use of services;
- health behaviour change;
- improved health status; or
- improved knowledge of health maintenance and disease prevention.

Lay health worker roles in various health programmes lie somewhere along a continuum of formality between natural and paraprofessional helping (Eng et al., 1997). The typical characteristics of roles at either end of this spectrum are described in Table 1.1.

Table 1.1- Characteristics of lay health workers at either end of the natural helping-paraprofessional continuum (adapted from Eng et al., 1997)

Informal, natural helping	Formal, paraprofessional helping
• Not paid	• Often paid
• No qualifications required. Receive an induction but not formal training	• Must meet minimum qualifications and complete formal training related to the role
• Immersed in the target community or group. Involved in meeting health promotion and navigation needs of people in their social networks. Mobilize resources in the community and the health system to sustain health improvements.	• An extension of the healthcare system. Perform some tasks normally carried out by health professionals (e.g. General Practitioner, nurse, health visitor).

LHW roles across health programmes differ in many characteristics; however, the features that unify them under this broad umbrella term are that their purpose is to serve hard to reach individuals and communities and they do so utilising their natural connection with the intervention target group or

community. Section 1.5.5 described the evolution of the DHSW role from the concept of the 'natural helper' used in the 'Time to Smile' and Starting Well initiatives to a formal, paraprofessional role through the adoption of the role into the National Health Service (NHS). Section 1.5.8 will highlight suggestions that this loss of 'natural helping' is inevitable where such roles are incorporated into the NHS.

Although LHWs may be recruited for a supportive role, within a health context their aim is usually to bring about some form of health behaviour change or change in health outcome. Health behaviours include any activity undertaken for the purpose of preventing or detecting disease or for improving health and well-being (Kasl & Cobb, 1966) . Health behaviour change interventions can be defined as "coordinated sets of activities designed to change specified behaviour patterns" (Michie et al., 2011). Health behaviour change interventions aim to change individuals' and/or communities' behaviour in order to reduce their risk and vulnerability. The issues around establishing the effectiveness of LHWs at achieving health behaviour change goals will be discussed in Section 4.1.3.

1.5.8 Lay health worker programmes

Lay health worker (LHW) activities are hugely diverse within and between countries. One of the major critiques of the implementation of LHW programmes in the UK is that the potential community development aspect of the role has been lost and, instead, lay health workers focus almost exclusively on individual behaviour change; often in the form of lifestyle interventions. The Health Trainer programme in England, launched in 2004, has been described as one example of this individual-level rather than community-level approach (Mathers et al., 2014).

England's Health Trainers are LHWs who target the most at risk individuals in the community and encourage them to make healthier lifestyle choices. They may set up community initiatives to support healthier lifestyles but the role is focused primarily on the individual. Attree et al. (2012) argue that the focus on individual lifestyle choices means the social determinants of health are not addressed as effectively as they would be if a community development approach

were taken. They outline the three main assumptions on which individual lifestyle interventions are based. These do not touch on social determinants.

(1) The most deprived people engage in more risky health behaviours and make 'poorer' health choices. Therefore, targeting the most deprived will mean those most in need will benefit.

(2) The most deprived people do not access services because they ignore those available to them, do not trust them, or do not believe in the efficacy of these services. Therefore, using health trainers who are from a deprived area to act as a 'bridge' between these targeted individuals and services will be effective as they understand the individual's concerns and have a shared interest in improving their health.

(3) Poor health is the result of poor health behaviours and choices of individuals. Therefore, health trainers can motivate individuals to manage change in their lifestyle and set their own improved behaviour goals.

Dahlgren & Whitehead (2007) argue that in order to address health inequality and the social determinants of health, we need to take account of the material conditions in which people live rather than focusing solely on educating individuals. Similarly, Trayers and Lawlor (2007) argue that we need to consider change at the environmental *and* individual level if we are to realise change. They provide an example of trying to encourage people living in areas of high deprivation to be more physically active and state, "the failure of individual-based initiatives to result in sustained increases in physical activity may not be surprising since these interventions are in effect trying to persuade individuals to participate in activities in environments that are (or are perceived to be) hostile to the very activities they promote". These critics advocate for policies that aim to redistribute wealth, allowing interventionists to consider how we might shape the environment so that individuals are enabled to make healthy choices. This could be achieved, for example, by increasing job opportunities and access to healthy food.

A second criticism of LHW roles is that, in the White Paper, *Choosing Health,* where this role was first introduced, it was described as a movement in public

health from ‘advice from on high to support from next door’ (Department of Health, 2004, p106). In its implementation, however, the programme has, in some areas, been implemented quite differently. Mathers et al. (2014) describe how local programmes started to recruit more qualified people for the Health Trainer role which undermined the ‘peerness’ of the role. Mathers et al. (2014) suggest that *Choosing Health*, which had introduced the role of Health Trainers, fed an assumption that people want to change but find it difficult. This conflicted with the experiences of those implementing these programmes as they found it difficult to engage with the target groups. It was also challenging for Health Trainers to record their engagement-related activities on standardised forms used to track their output and productivity. As a result, Health Trainer’s efforts were diverted to less resource-intensive responsibilities such as addressing the needs of people referred from GPs, therefore, no longer targeting the ‘hard-to-reach’ or working on community development.

Atun et al. (2010) have argued that it is the process of integrating a targeted intervention, like a lay health worker intervention, into a pre-existing health system, such as the UK National Health Service, that causes the theory and evidence underlying the intervention to be compromised. Successful integration relies on a number of factors, including: perceptions of the nature and scale of the problem the intervention is designed to address; the perceived benefits of the new intervention over existing interventions/protocols; the receptivity of the health system; characteristics of the health system (e.g. governance, finance, planning, evaluation); and, the broader context (e.g. political, economic and social environments). The complexity of the intervention enhances the challenge of integration as the benefits are not apparent within a timeframe and it is difficult, often impossible, to link cause-and-effect to the intervention.

In a ‘state of the evidence’ review on Community Health Workers, conducted for the World Health Organisation, Lehmann and Sanders (2007) report that there are several factors that need to be considered when implementing a lay health worker programme in order for it to be effective, which include:

- careful selection of the right people for the role combined with adequate training and continuous support over time;

- realistic expectations about what can be achieved and the substantial resources for training, management, supervision and logistics that will be required for large-scale implementation; and,

- allowing the programme to be driven, owned and embedded with the target community. This will enhance its sustainability. Community mobilisation (of people, money, materials) needs to precede and be tied with the design and development of a lay health worker intervention.

This report emphasised the need for LHW programmes to be designed in collaboration with the target community and driven by them. Lehmann and Sanders (2007) report that this may be easier to achieve in small-scale programmes, driven by local community groups, such as NGOs or churches. This is quite a contrast compared to LHW models where the programme is integrated with health services (e.g. the NHS in the UK). This also fits with Whitehead and Dahlgren's (2007) recommendations that, in order to "give a voice to the voiceless" (pp.20), efforts should be made to consult lay people, particularly marginalised groups, in order to ensure their participation in decisions that affect their health.

Other criticisms of lay health worker interventions relate to the lack of robust evaluation of their content and effectiveness. It is difficult to form conclusions about whether LHWs are effective as a channel for intervention delivery due to the lack of robust studies conducted with comparison or control groups. In addition, as previously mentioned, the evidence for the effectiveness of a LHW compared to a health professional is inconsistent. The conventional approach of conducting a randomised controlled trial in order to assess effectiveness would not necessarily be appropriate for these multifaceted, complex interventions.

Atree et al. (2012) argue that there is a need for theory-based or realist evaluation of LHW programmes. These approaches would tie the evaluation to

the underlying programme logic models; that is, the model of how intervention activities are expected to lead to intended outcomes.

The evaluation of the DHSW intervention within Childsmile provides an important opportunity to add to the knowledge base and address some of these criticisms through a theory-based evaluation.

1.6 Evaluation of Childsmile

1.6.1 National evaluation

The national evaluation of Childsmile is a critical component of the programme (Macpherson et al., 2015). Currently, all components of the Childsmile programme (Core, Nursery & School, and Practice) are undergoing extensive, theory-based evaluation. This consists of continuous process evaluation, cost-effectiveness analysis and analysis of programme effectiveness. Research and evaluation output, and subsequent recommendations, are regularly fed back to the programme board so that the components can evolve towards optimal implementation. This thesis contributes to the formative evaluation of the Dental Health Support Worker intervention within Childsmile Practice.

1.6.2 Theory-based evaluation

A key aim in theory-based evaluation is to establish what are the mechanisms, or 'active ingredients' by which an intervention works (Michie et al., 2005). This aids both the understanding of causal chains within the intervention and the translation of interventions across contexts. Within Childsmile, it is therefore essential to develop a sound understanding of how particular features of the DHSW intervention lead to intended outcomes, in order for the processes to be improved and the intervention optimised.

Medical Research Council (MRC) guidance strongly recommends that, in the development stages of an intervention, the processes by which the intervention components are thought to bring about the desired outcome (according to evidence or expert opinion) should be mapped (Craig et al., 2008). One method

that can be used to map the components and processes involves creating a 'logic model'.

A logic model is "a pictorial representation of the theory of how a programme works" (Hawe, 2015). Figure 1.3 shows an extract from the Childsmile programme logic model, which shows those aspects of the model that relate to the DHSW intervention.

It can be seen from Figure 1.3 that the theorised long-term outcomes of the programme include: reducing dental decay in all children in Scotland; reducing oral health inequalities; improving oral health and oral health-related quality of life in children; reducing the need for reactive dental care; increasing cost-effectiveness of oral health activity; and, improving oral health behaviours and oral health in the general population. In order to achieve these long-term outcomes, it has been theorised that certain planned activities will lead to certain outputs which will, in turn, bring about short-term and interim outcomes.

This map of processes and outcomes aids evaluation, as vulnerable points in the causal chain can be identified (Moore et al., 2015). At the time of first implementation of Childsmile Practice, it was known that certain activities would be carried out and it was hoped that these activities would lead to the various outcomes. However, little was known about the processes, mechanisms, or 'active ingredients' necessary for each link in the chain to operate effectively. For example, how health visitors should identify children in need of Dental Health Support Worker (DHSW) intervention or what that intervention should involve in order to achieve a greater percentage of children registering and attending primary care dental services.

The Childsmile programme can be said to be a 'complex intervention'; however, the DHSW intervention could be referred to as a complex intervention in its own right as there are a number of behaviours required of those delivering and receiving the intervention; there are a number of various intended outcomes; and a degree of tailoring is required (Craig et al., 2008).

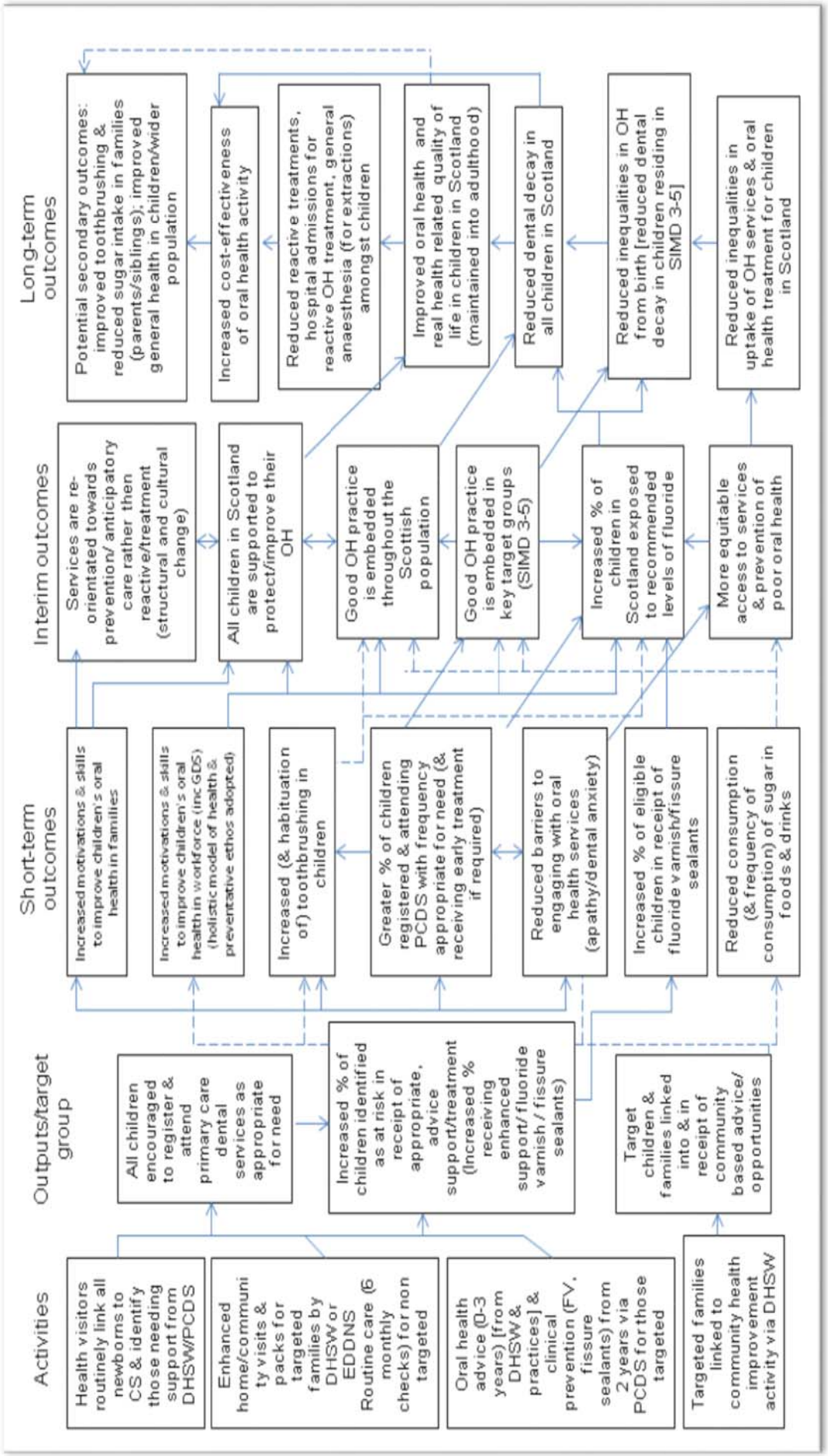


Figure 1.3- Extract from the Childsmile Practice logic model, as recorded in November 2009

One aspect of conducting a theory-based evaluation on a complex intervention is the need to attend to the issue of unintended variation. In large-scale implementation of interventions, variation is almost inevitable. One of the challenges for implementing complex interventions, such as the DHSW intervention, is in achieving the implementation of an 'adaptive' intervention that is effective.

An adaptive intervention is one that is permitted a degree of variation in domains such as the addition, deletion or modification of components (Perez et al., 2016). Such adaptations affect the fidelity of the intervention to the proposed model; however, this does not necessarily undermine the programme effectiveness, and may even enhance it. Therefore, it is not only important to understand the links in the causal chain of the logic model but also what level and type of variation is necessary for the intervention to be effective and what may be counter-productive (Moore et al., 2015).

1.6.2.1 Explicating the DHSW intervention

As a complex intervention is rolled-out, it is recommended that an ongoing process evaluation be undertaken (Moore et al., 2015). A process evaluation records any incongruence between the design and the implementation of an intervention. This is essential information as, if the intervention were to be shown to be ineffective, process evaluation data can shed light on whether the intervention design was inherently flawed or if the lack of success was possibly due to partial implementation.

Process evaluation of the Childsmile programme is conducted continuously. Quantitative and qualitative process evaluation reports are published at regular intervals. The findings show that there is considerable variation in how the DHSW intervention has been implemented across Scotland (Childsmile Process Evaluation Reports, 2010-2015; Childsmile- National Headline data, 2011-2015).

One example of such variation is the type of team within which a DHSW may be placed. This may either be within a Public Health Nursing Team or a Dental Services Team. There is variation in other aspects of the implementation of the role in each Health Board and even at the Community Health Partnership (CHP)

level. As the integrated Childsmile programme was rolled out across Scotland, health boards adapted the DHSW role to allow for factors such as the characteristics of the health boards (e.g. rural or urban), the organisational structures, available resources and pre-existing roles and responsibilities.

Another challenge to the implementation of the DHSW role, reported by Deas et al. (2013) is that, although key actors in the development of Childsmile were supportive of the planned community development approach, they have acknowledged that there was a lack of evidence to support it. Key stakeholders also did not hold a joint vision of what 'community development' should mean for the DHSW role. In some cases, those employed as DHSWs were over-qualified and did not come from the targeted communities; therefore, the 'peerness' of the DHSW role was lost. This was, in part, a consequence of recruitment for the role being subjected to NHS recruitment processes, which require vacancies to be offered those displaced from NHS posts.

Central to the programme of research reported in this thesis are the concepts of targeting the right children and tailoring an intervention to meet individual families' needs. Neither of these concepts had been adequately explicated when the programme had been implemented and much of the detail on how to 'target' and 'tailor' was left open to interpretation by those implementing the DHSW intervention 'on the ground'.

Childsmile monitoring data had shown that there was variation across Scotland in the degree to which health visitors were engaging with the pathway for referring targeted individuals for DHSW intervention. Furthermore, there was a lack of clear consensus in the Childsmile literature on the characteristics of 'the right children'.

Throughout data collection for the process evaluation, when asking those implementing the programme 'on the ground' how aspects of the intervention were being delivered, Childsmile researchers repeatedly came across the phrase "it's tailored to individual families' needs". It was unclear, however, what specific strategies or actions were involved in 'tailoring' the intervention to individual families' needs, how the implementation of this undefined concept

varied across Scotland and, indeed, how this 'tailoring' *should* be carried out in order to be effective.

After Childsmile Practice was rolled out across Scotland, it was known that there was variation in the implementation of the DHSW intervention (Eaves & Gnich, 2013). A key question is what effect this variation had on targeting the right children and tailoring to their needs. It was important to explore whether this variation was adaptive or if it was diluting the effectiveness of the intervention. Ultimately, it was clear that the DHSW intervention needed further development before it underwent summative evaluation. In order to optimise the intervention, it was necessary to explore how it was being implemented, how it *should* be implemented, and what the impact of the intervention on dental participation was at the early phase of implementation.

This thesis takes a mixed methods approach to evaluation. The implementation of mixed methods was carried out from a pragmatic stance. Therefore, data collection methods were chosen based on their ability to answer each research question and, in analysis and interpretation, convergence between data sources was used as an indication of the reliability of the results (Davies, et al., 2003). Each results chapter in this thesis relates to a particular research question, with qualitative and quantitative data presented together in each chapter where appropriate. Key results are provided in the summaries at the end of each results chapter. Key emerging themes are discussed in the context of the wider literature in the final chapter.

2 Aims and objectives

2.1 Aims

The overall aim of this research was to explore how to effectively implement a targeted and tailored lay-delivered health behaviour change intervention. The desired outcome was to gain an understanding of the factors that have an impact on Childsmile Dental Health Support Workers' (DHSW) ability to deliver such an intervention effectively, so that recommendations could be made for the optimisation of the DHSW intervention within Childsmile Practice.

2.2 Objectives

In pursuit of achieving these aims, we developed several research questions. We aimed to gain insight into the implementation of targeted and tailored elements of the DHSW intervention and the features of tailoring associated with success in lay health worker programmes. The objectives were to examine whether the intervention was being implemented as intended, to find out how it *should* be implemented in order to be effective, and the extent to which it was having an effect on dental participation at the early phase of implementation. The key research questions relating to the Childsmile programme included the following:

1) Are 'the right children' being targeted and referred by health visitors?

2) Is the Childsmile referral pathway being implemented as intended?

3) How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?

4) Are DHSWs adequately trained to tailor the intervention?

5) How are individual families' intervention needs assessed and how should they be assessed?

6) Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?

7) How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?

8) How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?

9) Has the DHSW intervention, as it has been implemented, had an impact on dental participation?

For each research question, we aimed to examine the variation between health boards across Scotland, as well as examining the implementation of the intervention at a national level.

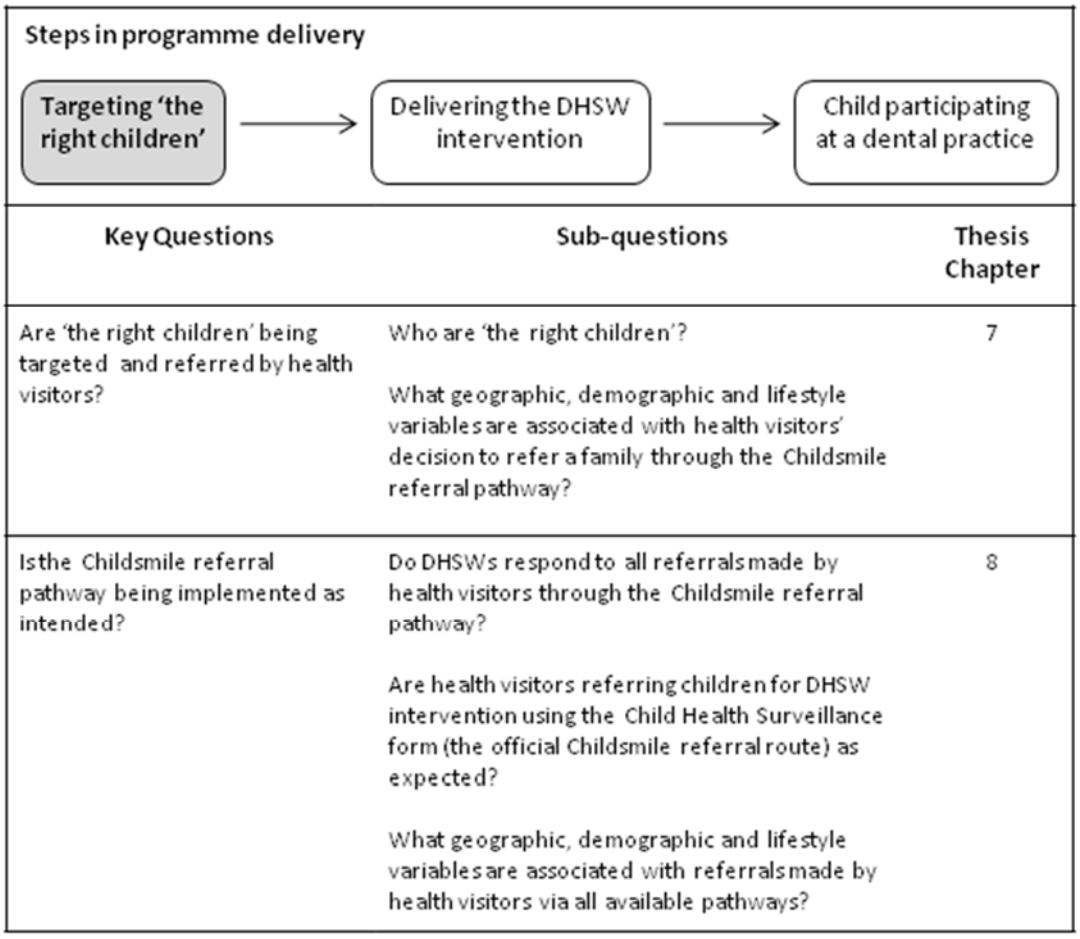
In addition, we wanted to examine the features of tailoring associated with effectiveness in lay health worker programmes so that we could apply this learning to the Childsmile programme. We aimed to answer the following question:

10) How do lay health workers tailor their support in effective health behaviour change interventions?

These key questions, and detailed sub-questions, are listed in Figures 2.1, 2.2 and 2.3 alongside the chapter number where the results are reported. Each figure corresponds to one of three steps in the delivery of the DHSW intervention: targeting the right children; delivering the DHSW intervention; and, children participating at dental practice.

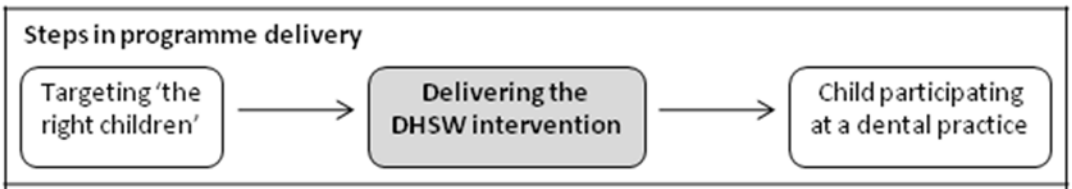
2.3 Summary

This section has outlined the aims and objectives of this doctoral work. The following section describes and justifies the methodological approach taken, outlining the specific methods chosen in order to optimally answer the research questions.



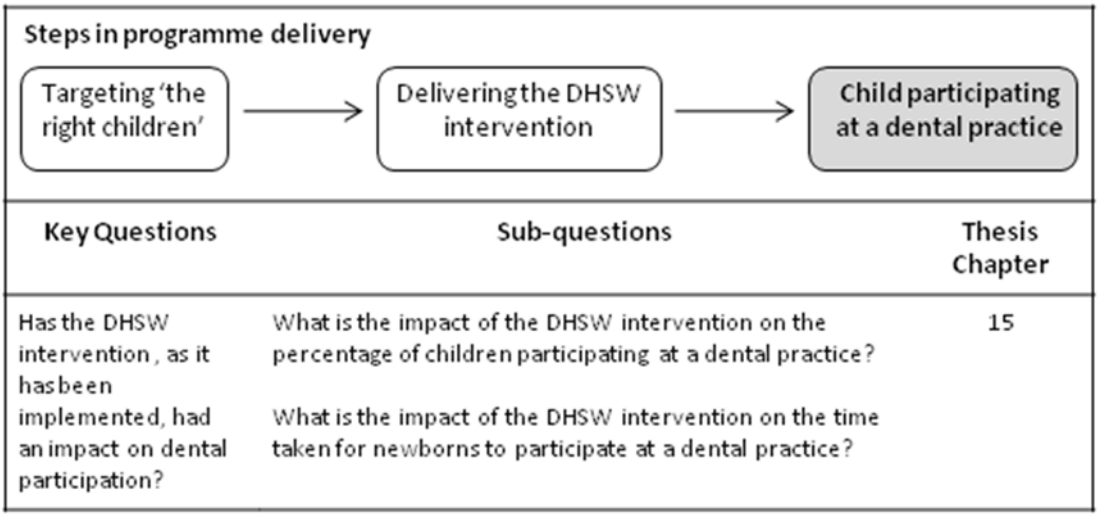
Key Questions	Sub-questions	Thesis Chapter
Are 'the right children' being targeted and referred by health visitors?	Who are 'the right children'? What geographic, demographic and lifestyle variables are associated with health visitors' decision to refer a family through the Childsmile referral pathway?	7
Is the Childsmile referral pathway being implemented as intended?	Do DHSWs respond to all referrals made by health visitors through the Childsmile referral pathway? Are health visitors referring children for DHSW intervention using the Child Health Surveillance form (the official Childsmile referral route) as expected? What geographic, demographic and lifestyle variables are associated with referrals made by health visitors via all available pathways?	8

Figure 2.1- Research questions and chapter index for the first step of implementation



Key Questions	Sub-questions	Thesis Chapter
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which factors are associated with success of the interventions?	4
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders? Why is 'tailoring' important for the effectiveness of the DHSW intervention?	9
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs? Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?	10
How are individual families' intervention needs assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs? How is, and how should, this assessment be implemented?	11
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered? How do, and how should, DHSWs determine the right intensity of intervention? What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?	12
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages? How do, and how should, DHSWs tailor the communication of oral health messages?	13
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSW tailor the intervention to families' practical and psychological barriers to engaging with the intervention? How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?	14

Figure 2.2- Research questions and chapter index for the second step of implementation



Key Questions	Sub-questions	Thesis Chapter
Has the DHSW intervention, as it has been implemented, had an impact on dental participation?	What is the impact of the DHSW intervention on the percentage of children participating at a dental practice? What is the impact of the DHSW intervention on the time taken for newborns to participate at a dental practice?	15

Figure 2.3- Research questions and chapter index for the third step of implementation

3 Methodology

3.1 Introduction

This chapter describes the overarching methodological approach chosen for this doctoral work. Each subsequent chapter provides, or refers to, a detailed description of the specific methods undertaken in each study. The purpose of this applied research was to formulate practical recommendations for optimising the DHSW intervention in order to inform the future direction of the DHSW role within Childsmile Practice. The aims and objectives could therefore be best achieved by a practical, applied approach. This doctoral work was inspired by the paradigm of pragmatism which demands the prioritisation of the research question, rather than any one ontological or epistemological stance. The methods deemed best suited to address the research questions were a systematic literature review and a mixed methods study.

The systematic review synthesised evidence on the implementation of tailoring in effective lay health worker (LHW) interventions, while the mixed methods study looked at how targeting and tailoring were implemented within the Childsmile DHSW intervention and its impact on child dental participation. In using these different research methods, we gathered information from inside and outside the Childsmile programme, comparing and contrasting the data produced from each source in order to better understand, and make recommendations for, the optimisation of LHW interventions; specifically, the DHSW intervention within Childsmile Practice. This is a study of which examines the early part of the national implementation of the Childsmile Practice intervention.

This doctoral work provides an example of a systematic narrative review of literature and the application of a convergent mixed methods design in the evaluation of a lay health worker intervention.

3.2 The Pragmatist approach

As this was applied research that was essentially oriented to the outcome we hoped to achieve, a pragmatic approach to investigation was chosen.

Pragmatism, as opposed to simple practicality, is viewed as a philosophical paradigm in its own right (Tashakkori and Teddlie, 1998). It has also been described as a set of philosophical tools to address inherent conflict between other positions (Biesta, 2010), such as the antithetical nature of positivist versus interpretivist approaches.

One widely agreed element of pragmatism is the idea that actions, and the situations within which those actions occur, are inseparable (Morgan, 2014). From a pragmatist viewpoint, therefore, there can be no 'objective' truth about the consequences of an action. Instead, it is only possible to deduce likely outcomes based on previous experiences of particular actions yielding the same outcomes across different contexts. As it is not possible to precisely recreate the same context twice, beliefs about the outcomes of actions are provisional. 'Truth' is whatever offers the best practical solution. It is limited by the context in which it was discovered and is ever-changing. It is "what works at the time" (Creswell, 2007). Due to this transactional nature of truth, the pragmatist philosopher John Dewey preferred to refer to it as "warranted assertions" (Biesta, 2010); meaning that whatever is discovered to work in one situation may indeed work in another, but we can only discover this when we act.

Another element of pragmatism is the idea that two people who have unique worldviews will share some beliefs about a particular situation. To the extent that their beliefs overlap, people are likely to act in similar ways and give similar meanings to the outcomes (Morgan, 2014). Richard Rorty, another prominent pragmatist philosopher, rejected the idea that there could ever be one truth; however, he accepted that there was value in consensus between different viewpoints in terms of understanding conditional truths (Rorty, 1999). A mixed methods approach therefore fits well with this stance as it provides the opportunity to compare and contrast different viewpoints and identify where there is consensus.

Dewey stressed that in conducting scientific investigation, one should cast aside "the notion, which has ruled philosophy since the time of the Greeks, that the office of knowledge is to uncover the antecendently real" and instead focus on producing "the kind of understanding which is necessary to deal with problems as they arise" (Dewey, 1988, p14). In this way, pragmatism can indeed address the clash between other philosophical positions.

Consequently, rather than allow this doctoral research to become entangled in debates over the nature of reality and its objectivity or subjectivity, subsequently selecting methods of investigation congruent with the chosen stance, the applied research questions were prioritised and the methods best suited to answering each of them were chosen.

3.3 Identifying the appropriate methods

A detailed description of the methods is provided in Section 4.3 (systematic review) and Chapter 5 (mixed methods study); however, the justification for the chosen methods and a brief overview of the implementation of each is outlined here.

3.3.1 Systematic literature review

We addressed the research question of "how lay health workers tailor their support in effective health behaviour change interventions" by conducting a systematic review of the literature on tailored interventions delivered by lay health workers (see Chapter 4). We wished to produce "a meticulous summary of all the available primary research" (Clarke, 2011) related to this research question; synthesising evidence on tailored LHW interventions.

After systematically searching for, and identifying, the relevant literature, we extracted the descriptive information relating to 'tailoring to assessed needs' mentioned in the reported interventions. These data were then integrated, through a process of aggregation and summarisation, under over-arching themes that were deductively generated (and sub-themes that were inductively generated). Each individual paper was quality assessed for risk of bias so that the reliability of the reported 'effectiveness' or 'success' of the interventions

could be determined, based on the rigour of the applied methods. The findings were thus appropriately weighted, with high, medium and low quality of evidence reported alongside intervention 'success'.

3.3.2 Mixed methods study

The remaining research questions were addressed using evidence available from within the Childsmile programme. These research questions related specifically to the implementation of the DHSW intervention within Childsmile Practice.

It has been suggested that the research objectives of a study should define the method of inquiry (Crabtree and Miller, 1999). While quantitative research lends itself well to exploring observable phenomena, qualitative research is more useful for looking at the processes behind phenomena (Silverman, 2000), such as complex human behaviours, systems, needs and cultures (Ritchie and Spencer, 1994).

Johnson, Onwuegbuzie and Turner (2007) examined 19 different definitions of mixed methods and, from these, developed the following composite definition:

> "mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g. use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purposes of breadth and depth of understanding and corroboration" (pp.123).

The mixed methods approach taken in this study is justified due to the research questions requiring: a) a description of the observable practice of the DHSW intervention (at least the aspects that could be quantified); and b) an understanding of the ethos, ideals and processes underlying the delivery of the intervention, which must be gathered indirectly, primarily through self-report.

A mixed methods approach sits well within the pragmatist paradigm. It has been said that pragmatism is a "philosophical partner for mixed methods research" (Johnson & Onwuegbuzie, 2004, p16). Although it was agreed that mixed methods would be appropriate for addressing our aims and objectives, we faced a considerable challenge in determining precisely how we would implement this.

There is considerable diversity in the application of mixed methods and heterogeneity in the definitions offered by prominent mixed methods researchers. Johnson, Onwuegbuzie and Turner (2007) have described how the mixed methods approach has been defined in the following ways:

(1) Mixing methods, methodologies, or types of research;

(2) Mixing at the stage of data collection and/or analysis;

(3) Mixing data and/or mixing worldviews;

(4) Mixing for the purposes of breadth and/or corroboration; and,

(5) As a bottom-up approach (where the research questions prompt the adoption of mixed methods) or a top-down approach (where the researcher has a desire, first and foremost, to use mixed methods to more accurately represent and explicate the phenomena being studied).

In this mixed methods study, we used qualitative and quantitative methods which were selected in a bottom-up fashion and mixed at the stage of analysis, in order to examine the observable practice of the DHSW intervention and gain an understanding of the ethos, ideals and processes underlying the delivery of the intervention.

3.4 Summary

This chapter described and justified the pragmatist approach selected for this doctoral work. This work has been driven first and foremost by the research questions, with methods being selected based on their ability to address each research question. The methods for the systematic review and the mixed methods study are described in full in Chapter 4 and Chapter 5 respectively.

Portions of the 'Methods' section in the following chapter have been extracted from the following publication: Hodgins, F. et al. (2016). How lay health workers tailor in effective health behaviour change interventions: a protocol for a systematic review. *Systematic Reviews* 5(1): 1-6.

4 How lay health workers tailor in effective health behaviour change interventions: a systematic review

4.1 Introduction

This chapter synthesises evidence from lay health worker programmes in order to determine the features of tailoring that are associated with the effectiveness of these programmes. This chapter focuses on the delivery of lay health worker interventions and is therefore relevant to the research questions related to the second step in Dental Health Support Worker (DHSW) programme delivery, as shown in Figure 4.1.

4.1.1 Definition of 'lay health worker'

Lay health workers (LHWs) can form part of interventions that aim to serve 'hard-to-reach' individuals and communities. While LHWs are aligned to some extent to institutional health services, and are supported by health professionals to deliver health promotion information and activities, they are different from other health workers due to their lack of formal professional training and their potential to have a shared background with the intervention target group or community.

Although LHWs may be recruited for a supportive role, within a health context their aim is usually to bring about some form of health behaviour change or change in health outcome. Health behaviours include any activity undertaken for the purpose of preventing or detecting disease or for improving health and well-being (Kasl et al., 1966). Health behaviour change interventions can be defined as "coordinated sets of activities designed to change specified behaviour patterns" (Michie et al., 2011).

The concept of 'the lay health worker' is discussed in more detail in the General Introduction to this thesis (Section 1.5).

Steps in programme delivery

Targeting 'the right children' → **Delivering the DHSW intervention** → Child participating at a dental practice

Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 4.1- Research questions relating to delivering the DHSW intervention

4.1.2 Definition of tailoring

Within a health promotion context, tailoring has been defined as:

"Any combination of information or change strategies intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and have been derived from an individual assessment" (Kreuter et al., 1999), and

"Creating communications in which information about a given individual is used to determine what specific content he or she will receive, the contexts or frames surrounding the content, by whom it will be presented and even through which channels it will be delivered" (Hawkins et al., 2008).

These definitions suggest that, in order to tailor an intervention to an individual's needs, one would need to conduct some form of individual assessment of a person's characteristics and circumstances and, subsequently, adapt the intervention delivery according to this information.

4.1.3 Evidence for the effectiveness of tailored interventions and LHW interventions

A number of systematic reviews and meta-analyses have provided evidence to suggest that tailored interventions are moderately more effective than non-tailored interventions. In a systematic review of tailored interventions for smoking, there was evidence that print-based tailored self-help materials were more effective at achieving abstinence at 6 months follow-up than no materials and non-tailored materials (RR 1.28; 95%CI= [1.18, 1.37]) (Noar et al., 2007). In a review of tailored print interventions for physical activity, 7 out of 12 studies reported significant positive changes in physical activity between 3 and 18 months post-intervention (Short et al., 2011).

A meta-analysis of interventions to improve dietary behaviours found that tailored interventions led individuals (predominantly white, females in most

trials) to consume significantly more servings of fruit and vegetables per day (weighted mean difference=0.35; CI= [0.19, 0.52], p=<0.0001) and receiving lower percentages of energy from fat (weighted mean difference=-2.20%; CI= [-2.97, -1.43], p=<0.0001) than generic interventions (Eyles & Mhurchu, 2009). These reviews were limited in the conclusions that could be drawn regarding the features of tailoring (i.e. the participant-specific variables used to inform the individualised intervention delivery; the channel, format or 'dosage' of tailoring; or, the theory underpinning the tailored approach) that are most effective in inciting behaviour change, as this information is often not reported in sufficient detail in individual studies.

A meta-analysis of 6 randomised controlled trials (Wanyonyi et al., 2011) pooled data from studies where tailored information delivered face-to-face was compared with either usual care, generic health promotion, or tailored print materials. The meta-analysis showed an overall positive effect on health behaviour (diet/physical activity, diabetes self-management, alcohol abuse, smoking cessation) using face-to-face delivery of tailored information (pooled standardised mean difference= 0.487; 95% CI=[0.02, 0.96], p=0.04). Only two of the studies were deemed to have included "specific accounts" of how theory translated to action. This is also the case across many health domains. For example, in the smoking cessation literature (an area of health behaviour change research that is in many other aspects well-developed), Yuan et al. (2012) have commented that "there is a noticeable gap in the literature regarding strategies and effectiveness of tailored face-to-face tobacco cessation interventions".

There are other reasons why conclusions drawn from the data on tailored interventions are limited. The majority of the data in the aforementioned systematic reviews comes from studies conducted in North America and Europe where interventions have been delivered to individual adults. The data therefore do not apply to interventions delivered to whole families and across other cultures. Furthermore, the included studies are randomised controlled trials, controlled trials, or before-and-after studies with a control group. There is limited 'process' information regarding intervention implementation reported in the individual studies and, consequently, the systematic reviews. This greatly

limits any conclusions about *how* the tailored elements are delivered in effective interventions.

Similarly, there are gaps in the literature relating to the features of LHW interventions that contribute to effectiveness. An updated Cochrane review concluded that LHWs, when compared to usual care, have been effective in bringing about a range of positive health or health behaviour changes in communities in many different countries; however, the underlying reasons for why lay health workers may have been effective in these cases have not yet been explored (Lewin et al., 2010). The task of understanding the essential mechanisms at work within LHW interventions is complicated by the fact that the literature on such interventions provides only a partial account of the specific strategies that may be driving effectiveness.

A systematic review of interventions to improve diabetes care for socially disadvantaged adults in industrialized countries found that the features associated with positive programme outcomes included: delivery by a lay health worker; cultural tailoring; individualised assessment; delivering the intervention according to tailoring algorithms; and, providing individualized feedback (Glazier et al., 2006). This review is limited to the management of diabetes, however, and does not examine the features of tailoring implemented within LHW interventions for prevention of disease.

There is clearly a paucity of review evidence that synthesises and systematically explores the ways in which LHWs implement the assessment of individuals' needs and how they tailor health messages and support across programmes. This exploration and synthesis of the content of LHW interventions, and the application of health behaviour change theories in effective interventions, is necessary if the mechanisms for LHW effectiveness are to be better understood. This review focused specifically on the content of LHW interventions that relates to tailoring the intervention to individuals' needs and the features of such tailoring that are associated with effectiveness of the intervention.

4.2 Aims and objectives

The aim of this systematic review was to synthesise the existing literature on the implementation of tailoring in lay health worker (LHW) interventions; in order to develop a better understanding of 'what works' to inform future LHW interventions and the optimisation of Childsmile's Dental Health Support Worker (DHSW) intervention.

Specific objectives for this systematic review were:

1. To examine the theoretical basis for tailoring in lay health worker interventions
2. To develop a taxonomy of the variables or constructs used for individual assessment of recipients' needs
3. To develop a taxonomy of the ways in which messages or actions are tailored by lay health workers
4. To explore how support (i.e. appropriate messages or actions) is matched to assessed needs
5. To examine the evidence for the effectiveness of approaches to tailoring in lay health worker interventions

The ultimate aim of this review was to provide evidence of the use of tailoring strategies implemented in effective interventions, with a view to aiding the development of interventions that are optimally tailored to recipients' needs.

4.3 Method

The PRISMA-P guidelines for systematic review protocols have been followed for developing the methods for this review (Moher et al., 2015). The process was also guided by similar reviews (Carr et al., 2011; Harris et al., 2015). The protocol for this review has been registered with PROSPERO (PROSPERO CRD42015030071) and published in *BMC Systematic Reviews* (Hodgins et al., 2016).

4.3.1 Eligibility criteria

Peer-reviewed studies that report an evaluation of a health behaviour change intervention were eligible for inclusion in this systematic review.

4.3.1.1 Population

The interventions may have been delivered to children, or adults, or delivered to parents as a strategy to change child health behaviour. Studies reporting interventions conducted in developed countries with healthcare similar to the UK model were included (i.e. Western Europe, North America, Australia and New Zealand). The study was included if the individual delivered the intervention to their own family, but only when this was part of delivering it to a wider network (friends/colleagues) or community.

4.3.1.2 Intervention

The included studies comprised of interventions where a LHW (or multiple LHWs) was the key individual delivering the intervention. Individual and group interventions were included where there was evidence that an individual assessment of needs/characteristics had taken place. The intervention must have allowed for two-way communication between an individual and a LHW; therefore, face-to-face and telephone interventions were included and email, forum and text messaging interventions may have been included if there was an exchange (back and forth) between the individual and a LHW. Interventions taking place in all contexts and settings were considered for inclusion. The study must have provided evidence that the intervention delivered was tailored; that is, one or all of the content, contexts or frames, and channels of delivery must have been based on an individual assessment (formal or informal) of a person's needs or characteristics.

4.3.1.3 Outcome

The outcome of the intervention must have been a change in health behaviour. This may have been the secondary or tertiary outcome where, for example, the primary outcome was a change in health status/physiological measurement. Studies where the intervention focused solely on disease management (e.g. diabetes management etc.) were excluded.

Language was restricted to English. There were no date restrictions. Quantitative studies (e.g. randomised controlled trials and cohort studies) were

included along with qualitative studies where service users self-reported behaviour change as an outcome of the intervention. A table of the inclusion and exclusion criteria is provided in Appendix 1.

4.3.2 Information sources

A dedicated Medical, Veterinary and Life Sciences University Librarian helped to identify health and psychology electronic databases through which the relevant studies were highly likely to be sourced. EMBASE, CINAHL, MEDLINE and PsycINFO were searched. Reference lists of a number of reviews in the area of LHW interventions were examined. Articles that were deemed to be potentially relevant were included. We employed a 'cluster searching' technique (explained in section 4.3.3.2) in order to identify all published papers related to a relevant intervention.

4.3.3 Search strategy

4.3.3.1 Search terms

The search terms were developed from scoping the LHW literature and from MeSH subject headings. Search terms used in similar reviews (e.g. Lewin et al., 2010 & Wanyonyi et al., 2011) were examined and used in a trial search. Key papers were identified through this search. Key terms, related to our inclusion criteria and, used in the titles and abstracts of these papers were mapped in order to produce the minimum number of search terms required to retrieve the maximum number of relevant articles. Key terms related to our inclusion criteria included: lay health worker (e.g. community health worker, health trainer), tailoring (e.g. individualise, personalise) and terms related to the kinds of activities LHWs undertake in tailored programmes, such as gaining access to hard-to-reach individuals (e.g. marginalised) and home visiting (e.g. home visit). Other key terms included: health behaviour change (e.g. health promotion, behaviour change) and terms related to programme evaluation (e.g. treatment outcome, service evaluation). Also key to our inclusion criteria was that the studies originated from developed countries similar to the UK context. In *Ovid MEDLINE* and *EMBASE* MeSH terms were used to limit the search to Europe, North America, Australia and New Zealand. In PsycINFO and CINAHL the search was

limited to these countries by including all variants in the search terms. Boolean operators (AND, OR, proximity) were used to construct and refine the search. The search strategies are provided in Appendix 2. The EMBASE search strategy was constructed first and adapted for the other databases.

4.3.3.2 Cluster searching

Once individual studies were identified, we employed a "cluster searching" (Harris et al., 2015) technique. Cluster searching refers to "any systematic attempt, using a variety of search techniques to identify papers or other research outputs that relate to a single study" (Harris et al., 2015). We did this in an effort to maximise the breadth and depth of the qualitative description of the implementation of the intervention as well as insuring we had all available peer-reviewed literature relating to the effectiveness of the programme. Cluster searching was carried out by checking the reference list of the key paper for 'companion studies', checking electronic databases for more recent references that cite the key paper, looking up the corresponding author's more recent publications, and a general Google search (Google Inc. Menlo Park, CA, USA) of the intervention and corresponding author, using a computer based in a medical sciences building on the university campus. Hereafter, 'clusters' were the unit of analysis. A list of the studies included in each 'cluster' is provided in Appendix 4.

4.3.4 Data management and selection process

Records from all searches were imported into *EndNote* software. The records from the different databases were combined and duplicates removed. Three researchers independently reviewed titles and abstracts in *EndNote* in relation to the inclusion/exclusion criteria. Papers were included or excluded at this stage on the basis of a majority consensus, followed by discussion on disagreements.

Full text copies of the papers were then obtained in order to assess eligibility for inclusion. At this stage, all studies were checked to ensure that there was sufficient content reported related to 'tailoring'. An iterative approach was used

to develop the criteria for 'sufficient content'. A study was deemed to have sufficient content if the authors described either a formal assessment of individuals' needs and/or characteristics, or to have described how the intervention was adapted based on needs/characteristics informally gathered, or intuitively perceived, by the LHWs. If we were still unable to classify the study as tailored or not tailored, we searched for further study information (such as a website) online, searched for programme process evaluations and, as a last resort, contacted the corresponding author for more information. Calibration was carried out amongst the review team.

4.3.5 Data extraction

The recommended reporting standards for studies of tailored interventions (Harrington & Noar, 2012) were adapted to provide the structure for the extraction form. Data were extracted from the clusters of literature related to each intervention. A draft data extraction form was developed and piloted (see Appendix 3). The categories in the final form included details of the design of each study conducted, the intervention, the variables/constructs used for individual assessment, the theoretical foundation for the tailoring that was implemented, and how this theory (or the 'idea' of tailoring, if no theory was stated) was put into action considering the needs/characteristics of individuals.

One team member was responsible for initially extracting the data. Each of the other team members was assigned a bundle of clusters for independent data extraction. The process was iterative as the secondary reviewers reviewed the data extracted by the first and, after discussion, revised the content of the extraction form to ensure all relevant data were captured and in a consistent format and level of detail.

4.3.6 Quality assessment

An assessment of the quality of the included studies was carried out collaboratively by two researchers with discrepancies resolved through discussion. In the case of each cluster of papers, it was the papers reporting the

outcome of the intervention (i.e. the effectiveness of the intervention) that were quality assessed.

Quantitative studies were assessed using the *Quality Assessment Tool for Quantitative Studies*, developed by the Effective Public Health Practice Project, ON, Canada (EPHPP, 2003), which was used in a similar review (Carr et al., 2011) and generates a strong, moderate or weak quality rating. The advantage of this tool is that is can be used to assess quality across many study designs (e.g. randomised controlled trials, cohort studies, etc.). The tool allows assessment of: selection bias; study design; identified confounders; blinding; data collection methods; withdrawals/drop-outs; intervention integrity; and, whether the statistical analysis was appropriate to the question. We considered the risk of bias when assessing the overall quality of the body of evidence.

Qualitative studies were assessed using the Critical Appraisal Skills Programme (CASP) checklist for qualitative research (CASP, 2006), which was one of the tools recommended by the Cochrane Qualitative Research Methods Group (Hannes et al., 2011). The CASP checklist was the qualitative assessment tool that the research group was most familiar with as it had been used regularly in a journal club attended by those involved with this review. The CASP checklist assesses first whether there is a clear statement of the aims of the research, and then whether a qualitative approach was appropriate. The qualitative studies were graded as low quality if they did not 'pass' these two 'screening criteria'. They were then be graded as moderate/high quality on the remaining questions: study design and rationale; the appropriateness of recruitment and data collection, considering the aims; whether the relationship between the research and the participants was adequately considered; ethical issues; rigour of the analysis; whether there is a clear statement of the findings; and the value of the research.

4.3.7 Data analysis

Data synthesis and analysis was conducted with the aim of establishing the strategies used to tailor in effective programmes. Due to the heterogeneity of the studies, we embarked on a narrative synthesis of the extracted data, using a

method described in two previous reviews (Glazier et al., 2006; Kawamoto et al., 2005), to identify the features of tailoring in LHW interventions associated with successful or unsuccessful outcomes.

The data extracted from the studies provided the information from which features of tailoring could be identified. A summary of the tailored aspects of each intervention was produced by one reviewer from the extracted data. Features of tailoring were identified from the summaries by one reviewer and refined iteratively in collaboration with a second reviewer. The summaries ('description of tailoring') and features are reported in Table 4.4. We also looked at the association between underlying theories and success of interventions.

For each intervention, two reviewers independently determined whether or not it was 'successful' in achieving health behaviour change. This judgement relied primarily on the study reporting a statistically significant difference, or self-reported difference in health status or health behaviour. Success is reported in all tables alongside the study quality rating to allow the reader to take this into account.

For each of the features the total percentage of successful interventions with the feature was calculated, along with the percentage of successful interventions without the feature. The rate difference was then calculated by subtracting the percentage of successful interventions without the feature from the percentage of interventions with the feature. Positive rate differences indicate that the interventions with the feature are more often associated with success, and negative rate differences indicate that the interventions without the feature are more often associated with success. As in Glazier et al. (2006) this was a descriptive, exploratory, exercise rather than a statistical approach.

4.4 Results

4.4.1 Search results

The initial search identified a total of 2444 unique citations (Figure 4.2). After screening titles and abstracts, 485 were accepted for screening of the full text. Of these, 36 satisfied the inclusion criteria and 15 related companion papers were identified through cluster searching. In addition, 4 studies identified by hand searching reference lists of included studies and reviews met the inclusion criteria.

In total, 33 clusters met the inclusion criteria (n=55 individual papers). Papers were excluded based on not meeting any one of the inclusion criterion. The most common reasons for exclusion at full text screening included:

- There was not enough information reported to extract a description of the tailoring implemented in the intervention;
- The intervention was not focused on health behaviour change (occupational health and general support were excluded, for example);
- The intervention, or the tailored element of the intervention, was not delivered by a lay health worker; and,
- There was no peer reviewed outcome evaluation of the intervention available.

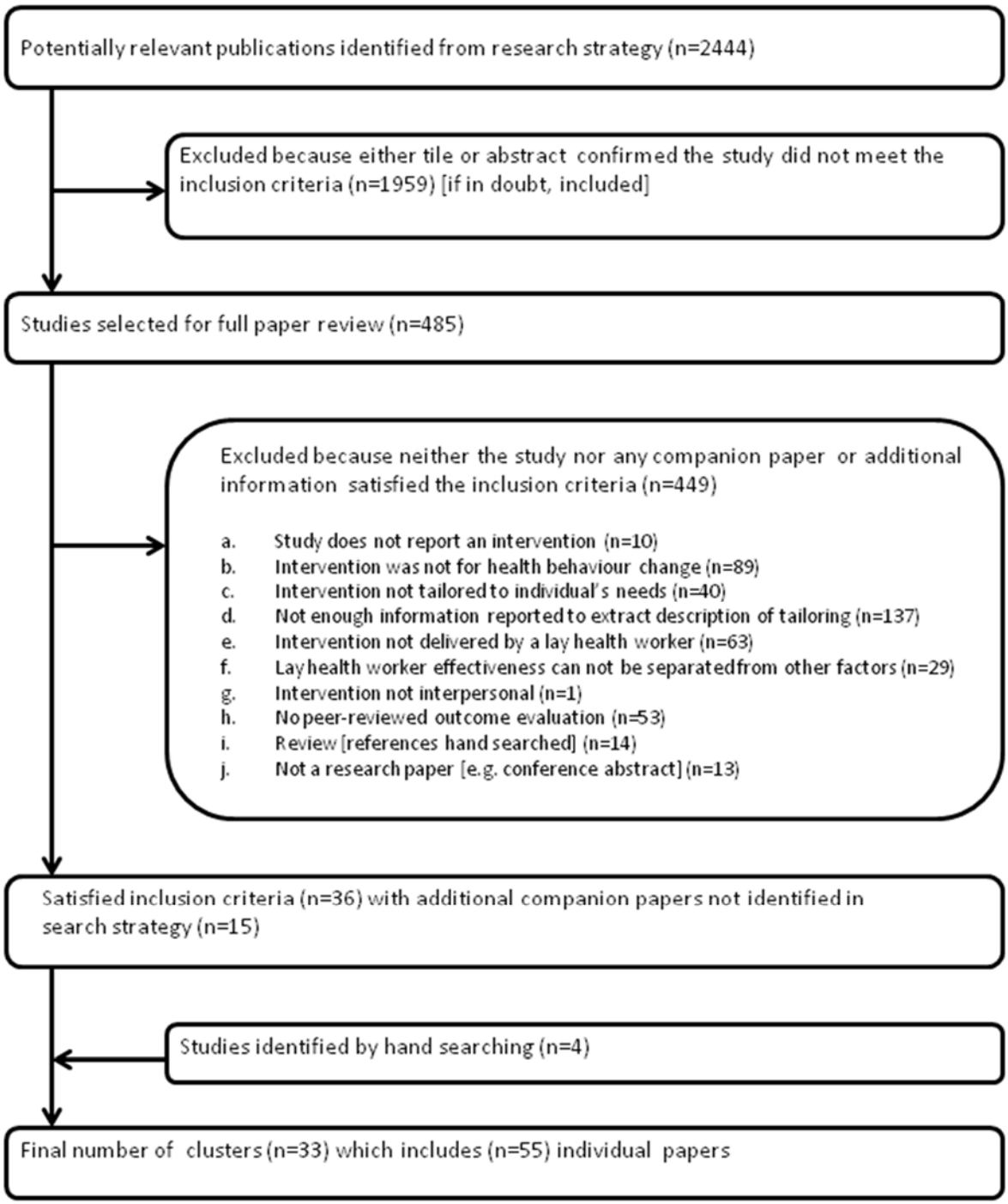


Figure 4.2- Flow chart of study selection

4.4.2 Intervention characteristics

The intervention characteristics can be viewed in Table 4.1.

4.4.2.1 Study design and methodological quality

Nineteen interventions were evaluated by randomized controlled trial (RCT). Additionally, two interventions were evaluated for effectiveness by RCT and

additional outcomes were evaluated using a cohort study method. Eight interventions were evaluated by cohort study only and four were qualitative (two of which included some descriptive quantitative data).

The outcome evaluations for 16 interventions (48.5%) were rated as low quality. Thirteen (39.4%) were rated as being of moderate quality and just four (12.1%) were deemed to be of high quality.

4.4.2.2 Date and location

Outcome evaluations for the studied interventions were published between years 1993 and 2015. Of the 33 included interventions, 22 were implemented in the USA; two were implemented in the USA & Canada; and one in Canada only. Six were implemented in England and two in Scotland.

4.4.2.3 Target health behaviour

The health behaviours the included interventions aimed to change included: screening for disease (n=10); breastfeeding (n=5) or weaning (n=1); diet and physical activity (n=3); dietary behaviours only (n=2); physical activity only (n=1); smoking cessation (n=2); illicit drug use (n=1); behaviours associated with infant mortality risk (n=1), diabetes (n=2) or cardiovascular disease (n=1); and, mothers having rapid repeat births (n=1). Three interventions were not specific in the health behaviours they aimed to change.

4.4.2.4 Target population

Among the 33 interventions, 17 targeted specific ethno-racial groups, including African Americans (n=3), groups described as Mexican-American/Latino/Hispanic (n=5), Korean-American (n=2), Chinese-American (n=2), Vietnamese-American (n=1), Sikh Asian Indian (n=1) and Bangladeshi or Pakistani (n=2). Of 33 interventions, 18 interventions targeted women, two interventions specifically targeted men and one targeted adolescent girls. One intervention purposefully did not have a specific target group. Eight interventions targeted parents or

pregnant women in order to change the health status of their children, including five interventions for breast feeding.

4.4.2.5 Intervention success

Twenty-three interventions were deemed to have been successful in achieving health behaviour change. This number should be treated with caution however, as only four of 33 studies looked at long-term maintenance of behaviour change and 20 relied solely on self-reported outcomes.

4.4.3 LHW characteristics

4.4.3.1 LHW type

We had planned to categorise the type of LHW in each included intervention using categories reported by South et al. (2010); however, the LHW descriptions in the interventions did not fit within these broad categories, in many cases. For example, it was difficult to tell from the manuscripts, and challenging for reviewers to agree on, whether a LHW role was limited to 'peer support' or better fit the descriptor of 'peer education'. As South's (2010) categories were not intended to be a definitive taxonomy applied in this way, we decided to categorise the LHW roles more broadly as being either necessarily 'recruited from the target community' and 'not recruited from the target community'. In Table 4.1 we have identified those programmes where LHWs were recruited because they shared some characteristics with the target group (e.g. speak the same minority language, have breastfeeding experience etc.) but were not from the same community. In this way, we have captured what we agreed to be the most relevant aspect of the role; how 'lay' the LHWs really are.

Table 4.1- Characteristics of included interventions

Intervention outcome evaluation publication	Country	Target population	Target health behaviour	LHW recruited from the target community	Study design	Intervention success	Evaluation quality rating
Auslander et al. (2002)	USA	African American women	Diet	Yes	RCT	Yes	Moderate
Bailey et al. (2012)	England	People with mental illness	Lifestyle (general/not specified)	No	Qualitative (plus some descriptive data)	No	Low
Barnet et al. (2009)	USA	Pregnant women	Rapid repeat births	Shared characteristics	RCT	Yes	High
Begh et al. (2011)	England	Bangladeshi/Pakistani men	Smoking cessation	Yes	RCT	Yes	Low
Birkel et al. (1993)	USA	Injection drug users	HIV screening and risk behaviours	Yes	Cohort	Yes	Low
Bungay et al. (2013)	Canada	Female sex workers	STI and HIV screening	Yes	Qualitative	Yes	High
Chapman et al. (2013)	USA	Women	Breastfeeding	Shared characteristics	RCT	No	Low
Elder et al. (2005-2009)	USA	Latino	Diet	Yes	RCT	No	Moderate
Fouad et al. (2010)	USA	African American women	Breast cancer screening	Yes	Cohort	Yes	Low
Gross et al. (1998)	USA	Pregnant African American women	Breastfeeding	Shared characteristics	Group RCT and cohort	Yes	Low
Han et al. (2009)	USA	Korean-American women	Breast cancer screening	Yes	Cohort	Yes	Low
Hayashi et al. (2010)	USA	Hispanic/Latina women	Diet and physical activity	Yes	RCT	Yes	Low
Hunte et al. (2004)	USA	Pregnant African American women	Health behaviours associated with infant mortality	Yes	Cohort	No	Moderate
Hunter et al. (2004)	USA	Women	Screening (multiple)	Yes	RCT	Yes	Moderate
Islam et al. (2013)	USA	Korean	Diabetes-risk related lifestyle	Yes	RCT	No	Low
Islam et al. (2014)	USA	Sikh Asian Indian	Diabetes-risk related lifestyle	Yes	RCT	Yes	Low
Jolly et al. (2012)	England	Pregnant women	Breastfeeding	Yes	RCT	No	Moderate
Koniak-Griffin et al. (2015)	USA	Hispanic/Latina women	Diet and physical activity	Shared characteristics	RCT	Yes	High
Krantz et al. (2013)	USA	Anyone living/working in target community	Cardiovascular disease-risk related	No	Cohort	Yes	Low
McInnes et al. (2000)	Scotland	Pregnant women living in area of high deprivation	Breastfeeding	Yes	Cohort	Yes	Low
Mier et al. (2011)	USA	Mexican-American women	Physical activity	Shared characteristics	Cohort	Yes	Low
Muirhead et al. (2006)	Scotland	Pregnant women	Breastfeeding	Shared characteristics	RCT	No	Moderate
Paskett et al. (2011)	USA	Women in need of Pap test	Cervical cancer screening	Yes	RCT and cohort	Yes	Moderate
Pringle et al. (2013)	England	Men	Lifestyle (general/not specified)	No	Cohort	Yes	Moderate
Resnick et al. (2009)	USA	Parent with overweight child	Diet and physical activity	No	RCT	No	Low
Smith et al. (2006)	England	Bangladeshi families with young children	Appropriate weaning	Yes	Qualitative (plus some descriptive data)	Yes	Moderate
Studts et al. (2012)	USA	Women rarely or never screened	Cervical cancer screening	Yes	RCT	Yes	Low

Intervention outcome evaluation publication	Country	Target population	Target health behaviour	LHW recruited from target community	Study design	Intervention success rating	Evaluation quality rating
Taylor et al. (2002)	USA & Canada	Chinese women	Cervical cancer screening	Shared characteristics	RCT	Yes	Moderate
Taylor et al. (2009)	USA & Canada	Chinese	Hepatitis B testing	Shared characteristics	RCT	No	Moderate
Taylor et al. (2010)	USA	Vietnamese-American women	Cervical cancer screening	Shared characteristics	RCT	Yes	Moderate
Visram et al. (2014)	England	Not standardised	Lifestyle (general/not specified)	No	Qualitative	Yes	High
Woodruff et al. (2014)	USA	Drug users	Illicit drug use	Shared characteristics	RCT	No	Moderate
Woodruff et al. (2002)	USA	Latino	Smoking cessation	Shared characteristics	RCT	Yes	Low

Table 4.1- continued

4.4.3.2 LHW training

Of 33 study clusters, 26 supplied information about training (Table 4.2); however detail was lacking. Of those that quantified the training LHWs received, five reported training of at least 90 hours, and 14 reported training of 10-50 hours in length.

It was reported that LHWs in 16 of the interventions received knowledge-based training on health topics related to the target health behaviour. Only two intervention clusters reported training LHWs on theories of behaviour change. In both cases, this was the Transtheoretical Model. Five clusters reported that LHWs were trained in motivational interviewing and three clusters reported training in communication skills. There were six reports of LHWs being trained in administration skills or research study skills.

Use of role play was reported as a training method for nine interventions. Scenario-based discussion was reported in one intervention, as was shadowing experienced LHWs.

Training was not examined in relation to intervention success due to the idiosyncratic nature of the combinations of training methods used in each intervention, the inextricable effect of the quantity of training hours, and the lack of information on the quality of the training provided.

Table 4.2- Characteristics of LHW training

	Intensity	Content					Methods		
Intervention	**Hours/days**	**Health topic-specific**	**Role play**	**Admin/ Research study skills**	**Motivational interviewing**	**Commun-ication/ facilitation**	**Theory-specific training**	**Discussion of Scenarios**	**Shadowing**
Auslander et al. (2002)	192 hours	✓	✓	✓		✓			
Bailey et al. (2012)									
Barnet et al. (2009)	2.5 days		✓		✓		✓		
Begh et al. (2011)			✓						
Birkel et al. (1993)									
Bungay et al. (2013)		✓		✓					
Chapman et al. (2013)	50 hours	✓							✓
Elder et al. (2005-2009)		✓	✓						
Hayashi et al. (2010)	2.5 days	✓	✓	✓			✓		
Fouad et al. (2010)	12 hours	✓							
Gross et al. (1998)	25 hours								
Han et al. (2009)	16 hours	✓							
Hunte et al. (2004)	160 hours	✓							
Hunter et al. (2004)									
Islam et al. (2013)	90 hours	✓							
Islam et al. (2014)	135 hours	✓			✓				
Jolly et al. (2012)	40 days								
Koniak-Griffin et al. (2015)	10 hours								
Krants et al. (2013)		✓			✓				
Pringle et al. (2013)	>=2 days	✓							
McInnes et al. (2000)	15 hours		✓						
Mier et al. (2011)						✓			
Muirhead et al. (2006)	Approx. 3 days							✓	
Paskett et al. (2011)	Approx. 5 days								
Resnick et al. (2009)	36 hours	✓	✓						
Smith et al. (2006)	30 hours	✓				✓			
Studts et al. (2012)		✓		✓					
Taylor et al. (2002)									
Taylor et al. (2009)									
Taylor et al. (2010)									
Visram et al. (2014)									
Woodruff et al. (2014)			✓		✓				
Woodruff et al. (2002)	25 hours	✓	✓		✓				
TOTAL	Mean=50 hours*	**16**	**9**	**5**	**5**	**3**	**2**	**1**	**1**

4.4.4 Theoretical basis for LHW intervention

It was possible to identify underlying theories of tailoring for fourteen of the included interventions. A range of theories were described (Table 4.3).

Ten of the included interventions used the Transtheoretical Model to inform the tailoring of the LHW component (Auslander et al., 2002; Barnet et al., 2009; Elder et al., 2005-2009; Fouad et al., 2010; Han et al., 2009; Hayashi et al., 2010; Krantz et al., 2013; Mier et al., 2011; Pawskett et al., 2011; Woodruff et al., 2013-2014), four of these also incorporating other theories (Elder et al., 2005-2009; Han et al., 2009; Krantz et al., 2013; Pawskett et al., 2011) (see Table 4.3). In seven of these interventions, authors described interventionists formally assessing a participant/client's stage of change, by pen and paper (Fouad et al., 2010; Han et al., 2009; Hayashi et al., 2010; Pawskett et al., 2011; Woodruff et al., 2013-2014) or software-assisted questionnaire (Barnet et al., 2009; Krantz et al., 2013), and subsequently matching the intervention to the participant/client's stage of change.

One intervention was described as being informed by Social Cognitive Theory only (Woodruff et al., 2002). When including all other interventions that described using Social Cognitive Theory to some extent, there was a considerable lack of reporting in relation to how this theory informed practice (Elder et al., 2005-2009; Krantz et al., 2013; Paskett et al., 2011; Studts et al., 2012). Descriptions, which were quite vague, are reported in Table 4.3.

The Health Belief Model, combined with other theories, informed tailoring in two interventions (Han et al., 2009; Studts et al., 2012). The common factor being that it provided the justification for addressing individuals' beliefs about the value of the desired health behaviour and the need to address their specific barriers to change.

Communication Behaviour Change/Communication Persuasion theories were used in two interventions to inform the development and presentation of tailored written materials (Elder et al., 2005-2009; Paskett et al., 2011).

Table 4.3- Theories informing tailoring

Theory informing tailoring	Interventions	Target health behaviour	How theory informed intervention design/practice
Transtheoretical Model (Stages of Change)	Auslander et al. (2002)	Diet	The LHW assessed each participant's readiness to change each of the five dietary patterns and then tailored the session content to that stage.
	Barnet et al. (2009)	Rapid repeat births	Used a questionnaire based on the transtheoretical model, and administered by computer software to assess sexual relationships and contraception-use intentions and behaviours, and readiness to engage in pregnancy prevention. The assessment produced risk summaries that guided LHWs in motivational interviewing participants.
	Elder et al. (2005-2009)	Diet	The transtheoretical model informed the content of individually tailored newsletters which guided discussions with the LHW.
	Fouad et al. (2010)	Breast cancer screening	A demographic survey prompted the lay health worker to ask whether a woman had had a mammogram in the past year. The response determined the version of the baseline survey used by the LHW, all versions of which were adapted from the Stages of Change. After completing the baseline survey, a tracking card was generated for the participant which contained either the date of the participants' last screening or a screening deadline of January 1 the following year (for women who had never been screened). The back of the card contained tailored messages for each stage. Stage 1 comprised women with no previous mammogram. Tailored messages for this stage were designed to reduce fear and increase awareness that early detection of breast cancer can save lives. Stage 2 comprised women who had had a previous mammogram but not in the past year. Tailored messages for this stage were designed to reduce fear and to motivate, remind, and support women in scheduling and keeping their mammography screening appointments. Stage 3 comprised women who had had a mammogram during the past year. Stage 3 women were commended for their efforts and were encouraged to maintain regular participation in annual mammography screenings.
	Han et al. (2009)	Breast cancer screening	Participants' stage of change was assessed. Stages were defined as following: precontemplation (not thinking about getting a mammogram in the next 6 months), contemplation (thinking about getting a mammogram in the next 6 months), action (having a mammogram in the last 12 months) and maintenance (being adherent with mammograms for past 2 years). The approach to follow-up (individually tailored counselling via telephone or home visits) was determined by the participant's readiness to move to the next stage.

Theory informing tailoring	Interventions	Target health behaviour	How theory informed intervention design/practice
	Hayashi et al. (2010)	Diet and physical activity	A 12-item instrument was used to assess participants' readiness for behaviour change (based on the transtheoretical model). This information was used to assist in identifying areas for LHW counselling.
	Krantz et al. (2013)	Risk behaviours for CVD	Used a questionnaire based on the transtheoretical model, and administered by computer software, to assess participants' readiness to change. This informed the LHW approach.
	Mier et al. (2011)	Physical activity	LHWs worked with participants using individualised problem-solving and self-management approaches to discuss behaviour change strategies according to the participants' readiness level.
	Paskett et al. (2011)	Cervical cancer screening	Participants' stage of change was assessed. Stages were defined as following: pre-contemplation (never heard of a Pap test or had one in past but did not plan to have one in nect 6 months), contemplation (had a Pap test in the past and planned to have one in the next 6 months but not within the next month), preparation (planned to have a Pap test in the next month), action (self-reported having a Pap test within last 6 months), maintenance (had a Pap test at least 6 months ago and plan to have one in coming year). Stage of change determined the content of posted tailored materials and lay health worker discussions with participants.
	Woodruff et al. (2013-2014)	Illicit drug use	Participants' readiness to change was assessed using a 4 point scale. For example, participants were asked, "How ready are you at the present time to change your use of [specific drug]?" Participants answered "not at all ready to change", "slightly ready", "moderately ready" or "very ready to change". The readiness information was used to guide additional discussion about the participant's drug use.
Social Cognitive Theory	Elder et al. (2005-2009)	Diet	SCT provided the context for the cognitive, attitudinal and behavioural strategies employed in the intervention and evaluation design.
	Krantz et al. (2013)	Risk behaviours for CVD	The process of creating achievable goals, setting achievable action plans, and monitoring of action plans via follow up calls was based on SCT.
	Studts et al. (2012)	Cervical cancer screening	Not specified
	Woodruff et al. (2002)	Smoking cessation	The intervention content was based on social cognitive principals including positive reinforcement, stimulus control, modelling, social support, problem solving, and practical skills and techniques for quitting. Social and family concerns, rather than a focus on the individual, were given greater emphasis in the intervention.
	Paskett et al. (2011)	Cervical cancer screening	The design of the educational program, namely how messages were presented, was based primarily on this theory (i.e. behaviour is determined by expectancies and incentives).

Theory informing tailoring	Interventions	Target health behaviour	How theory informed intervention design/practice
Health Belief Model	Han et al. (2009)	Breast cancer screening	The model provided the basic concepts for an effective intervention program. These include (i) an increase in perceived susceptibility (ii) an increase in perceived benefits (iii) a decrease in perceived barriers and (iv) a cue to action, such as a reminder for screening appointments.
Health Belief Model and Social Cognitive Theory	Studts et al. (2012)	Cervical cancer screening	Elements from these were integrated to assess and facilitate remediation of participant-identified barriers. E.G. Beliefs about cervical cancer and screening, health insurance coverage, and social support for screening.
Communication- Behaviour Change Model/Communication Persuasion	Elder et al. (2005-2009)	Diet	The communication persuasion model informed the development of the tailored print materials. LHWs used these to guide discussions and suggest opportunities for skills development.
	Paskett et al. (2011)	Cervical cancer screening	Communication-Behaviour Change model used as a foundation for choosing communication approach to take with individual women (e.g. addressing personal relevance of the behaviour by tailoring message to specific barriers).
Multiple, unspecified	Visram et al. (2014)	Not standardized Included: diet, physical activity smoking cessation and others	Health trainer (LHW) handbook includes advice and materials to support activities such as motivational interviewing, goal setting, planning behaviour change, building confidence/self-efficacy, self-monitoring, and using social support. This was informed by multiple theories, referenced in the handbook. These include social cognitive theory, Carver and Sheier's Control Theory, Gollwitzer's implementation-intention theory.

4.4.5 Assessment of needs

The needs of individuals reported to have been considered in the interventions depended to an extent on the health behaviour the intervention aimed to address (see Table 4.4). Needs were formally assessed in eight interventions. In seven of these, assessments were based on the Transtheoretical Model (Auslander et al., 2002; Barnet et al., 2009; Fouad et al., 2010; Han et al., 2009; Hayashi et al., 2010; Paskett et al., 2011; Woodruff et al., 2013-2014) and categorised client's needs based on their Stage of Change while, in one intervention, clients' level of risk for having a heart attack was calculated based on a formal assessment, which then determined the course of the intervention they received (Krantz et al., 2013).

Amongst the interventions focused on screening for disease, a common theme mentioned in all was the need to consider clients' barriers to accessing health care services. These could have been financial, logistical, or psychological. The client's readiness to attend screening was described as being considered in three out of ten of these interventions (Fouad et al., 2010; Han et al., 2009; Paskett et al., 2011).

For interventions focused on diet and/or physical activity, there was an appreciation of the need to consider and understand the clients' current lifestyle (Auslander et al., 2002; Elder et al., 2005-2009; Hayashi et al., 2010; Koniak-Griffin et al., 2015; Mier et al., 2011; Resnick et al., 2009). Among those interventions focused more generally on 'lifestyle', the client's own goals and priorities were considered before determining the best course of intervention (Bailey et al., 2012; Pringle et al., 2013; Visram et al., 2014). For example, for some clients this meant helping them to eat more healthily and for other clients it meant helping to build the client's confidence so they could independently partake in physical activity programmes.

Smoking cessation interventions considered barriers and individual concerns with the impact of smoking cessation on other factors (e.g. fear that engaging with

smoking cessation services would lead to disclosure of smoking status to family members; fear of weight gain) (Begh et al, 2011; Woodruff et al, 2002).

An intervention for illicit drug use considered the clients' readiness to change and risk level (Woodruff et al, 2014). For those who were high risk and using illicit drugs regularly, LHWs were to refer them to professional services.

Interventions for diabetes-risk related behaviours took place within the community and in group sessions combined with individual phone calls. The two diabetes-risk related interventions included in this review targeted minority populations. The interventions were offered in the preferred language of the clients and were sensitive to clients' availability and preference for location (Islam et al., 2013; Islam et al., 2014).

The only intervention for cardiovascular disease-risk related behaviours included an assessment of clients' risk of having a heart attack (Krantz et al., 2013). This helped the LHW to determine a client's values related to health behaviours, their barriers and their referral needs.

Interventions for breastfeeding (Chapman et al., 2013; Gross et al., 1998; Jolly et al., 2012; McInnes et al., 2000; Muirhead et al., 2006) and weaning (Smith et al., 2006) offered contact with a LHW according to the client's needs. In general, mothers' attitudes, beliefs, experiences and challenges related to breastfeeding and weaning were considered and the support given was deigned to be responsive to these factors.

Table 4.4- Characteristics of tailoring

	Needs assessed/considered	Description of tailoring	Features	Intensity
Screening for disease				
Birkel et al. (1993)	• drug and needle use patterns • sexual behaviour • AIDS information sources • drug treatment • incarceration history • health status	• Referral made to appropriate services • At subsequent contacts areas of remaining risk were identified and addressed through further reinforcement and elaboration of standardised messages • Transportation to clinics/social services provided if necessary • Standardised materials available in English or Spanish • Number of contacts with LHW tailored to need	• Signposting/referring to services based on needs • Content matched to areas of risk • Assistance to overcome logistical barriers • Verbal/written communication offered in another language • Number of contacts with LHW tailored to need	Series of 3 structured sessions (however, LHWs were unwilling to limit the number of contacts to the prescribed number)
Bungay et al. (2013)	• knowledge of STI and HIV transmission • readiness to attend testing • current access to health care services • social support system • preference to see same LHW consistently	• Information about STI and HIV transmission was tailored to educational needs • Referral to service for assistance in obtaining medical services plan coverage if necessary • If woman preferred to see same LHW consistently then tried to accommodate	• Content matched to educational needs • Signposting/referring to services based on needs • Accommodating client preferences for same LHW	Not mentioned (probably 1 session)
Fouad et al. (2010)	• stage of change • barriers to attending screening appointment	• Content of messages delivered was tailored to stage of change of the client- according to a formal assessment and pre-defined algorithm • LHW contacted client 1 month prior to appointment and 2 days before appointment to discuss barriers and make plans to overcome them	• Content stage-matched; pre-defined algorithm • Assistance to overcome logistical barriers • Number of contacts with LHW tailored to need	At least 4 sessions- then varied according to need

		• Number of contacts tailored to need		
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Han et al. (2009)	• readiness to change behaviour • logistic barriers • preferred language (English/Korean)	• Content of messages delivered was tailored to stage of change of the client- according to a formal assessment and pre-defined algorithm • Navigation assistance was offered to address specific logistic barriers (e.g. referrals to health provider) • LHW could offer intervention in English/Korean	• Content stage-matched; pre-defined algorithm • Assistance to overcome logistical barriers • Verbal/written communication offered in another language	Between 3 and 9 sessions (mean=5.7 +/- 1.0)
Hunter et al. (2004)	• Barriers to going to a clinic for screening	• Discussed barriers to attending clinic • Facilitated scheduling of an appointment	• Assistance to overcome barriers (logistical and other not specified)	1 session
Paskett et al. (2011)	• Possession of health insurance • Client's perceived lifetime cervical cancer risk • Cervical cancer screening barriers • Stage of change	• Assistance in locating free or reduced-cost screening in the community if necessary (i.e. no health insurance) • Content of messages delivered was tailored to stage • Stage of change was reassessed at subsequent contacts and the messages tailored accordingly	• Signposting/referring to services based on needs • Content stage-matched; pre-defined algorithm	4 interpersonal and 4 mailed tailored postcards
Studts et al. (2012)	• Barriers to cervical cancer screening (e.g. beliefs about cervical cancer screening, health insurance coverage, social support for screening)	• LHW prepares a tailored newsletter, adding specific information regarding the participants' barriers (e.g. if transportation is a barrier, information about local transportation is included)	• Assistance to overcome barriers (logistical and other not specified) • Personalisation of written materials • Signposting/referring to services based on needs	1 session

		• The newsletter also contains local references, photos and descriptions of facilities and services		
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Taylor et al. (2002)	• preferred language (English/Chinese) • client preference to watch educational video during LHW visit or at another time • Barriers to going to a clinic for screening	• LHW could offer intervention in English/Chinese • If the woman preferred to watch the video at another time, a copy was left in the home • Barriers accommodated included: clinic referral and assistance in scheduling an appointment; medical interpreter services; transportation assistance	• Verbal/written communication offered in another language • Accommodating client preferences for timing of intervention • Signposting/referring to services based on needs • Assistance to overcome logistical barriers	2 sessions
Taylor et al. (2009)	• Gender • Attitude to hepatitis testing	• Client and LHW were matched by gender • LHWs provided tailored responses to client's attitudes to testing (e.g. that it is unnecessary for asymptomatic people)	• LHW and client matched based on demographic information • Content matched to educational needs	1 session
Taylor et al. (2010)	• Attitude to cervical cancer screening	• LHWs provided tailored responses to client's attitudes to screening (e.g. that it is unnecessary for asymptomatic women)	• Content matched to educational needs	1 session plus follow up telephone calls
Diet and physical activity				
Hayashi et al. (2010)	• Preferred language (Spanish/English) • Current diet and physical activity behaviours (e.g. how often buy/eat fruit & vegetables, what kind of	• Counselling tailored to readiness to change • LHW could offer intervention in Spanish/English	• Content informed by stage of change (no algorithm mentioned) • Verbal/written communication offered in another language	3 sessions

	exercise they do and how often • Barriers to good diet and exercise (e.g. crime, traffic or lack of sidewalks) • Readiness to change physical activity and diet.			
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Koniak-Griffin et al. (2015)	• Preferred language (Spanish/English) • Current diet and physical activity behaviours • Availability	• LHW could offer intervention in Spanish/English • Food and physical activity diaries were discussed during individual sessions • Additional individual sessions were available to make up missed group classes	• Verbal/written communication offered in another language • Feedback (descriptive, comparative progress, evaluative) • Accommodating client availability	8 weekly classes plus 8 individual sessions
Resnick et al. (2009)	• Availability • Preferred type of contact • Topics parents (the clients) wanted to discuss	• The time of contact was determined by parent preferences • Type of contact (home visit, phone call, other) was determined by parent preferences • Parents selected the topics discussed during each session from choices provided by LHW • Number of contacts with LHW tailored to need	• Accommodating client availability • Accommodating client preferences for type of contact • Content was client-led • Number of contacts with LHW tailored to need	At least 1 (mean= 3.4 sessions)
Diet				
Auslander et al. (2002)	• Stage of change	• At each session, the LHW assessed the client's stage of change and tailored content to that stage	• Content informed by stage of change (no algorithm mentioned)	6 groups sessions + 6 individual sessions
Elder et al. (2005-2009)	• Demographic, acculturation and psychosocial variables	• Assessed needs were used to create tailored Newsletters and activity	• Personalization of written materials	12 sessions

	(e.g. points of influence for change) • 3 consecutive 24 hour dietary recalls • Height, waist and hip measurements • Current shopping habits and food preparation techniques • Meal frequency • Readiness to change individual dietary behaviours (fat, fibre, fruit, vegetables)	inserts using a pre-defined algorithm • Newsletters provided: feedback on the assessment (e.g. BMI in comparison to national norms, number of fruit consumed per day); "dish tips" based on the most frequently prepared dishes and stage of change; restaurant/snack & lifestyle tips; maintaining a budget and staying organised to reduce stress; and, family support and interaction activities • LHWs worked with each participant to negotiate behaviour change goals	• Content stage-matched; pre-defined algorithm • Feedback (comparative normative, comparative progress) • Individualised goal-setting	
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Physical activity				
Mier et al. (2011)	• Lifestyle • Barriers to walking • Readiness to change • Availability	• Group sessions included discussions and activities related to ways to incorporate walking into the women's lifestyle; barriers to walking, injury prevention, benefits of physical activity, establishing a walking plan; and using social support • LHWs worked with clients using an individualised problem-solving and self-management approach to discuss behaviour change strategies to increase walking levels according to the participants' readiness level • Meetings were arranged at times to suit clients. Some sessions were	• Assistance to overcome logistical barriers • Accommodating client availability	12 group sessions

		rescheduled to accommodate school activities and, due to childcare issues, some clients brought their children to sessions		
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Lifestyle (general)				
Bailey et al. (2012)	• Client's own goals/priorities • current ability/state of fitness • preferences for particular activities • preferences for time	• Activities and target health behaviour determined by client's own goals (eating healthily, more exercise) • LHW accommodated client's preferences for session time • Number of contacts with LHW tailored to need	• Content was client-led • Accommodating client availability • Accommodating client preferences for activity • Number of contacts with LHW tailored to need	Not standardised (depended on client's needs)
Pringle et al. (2013)	• Underlying determinants of health affecting client (e.g. unemployment, workplace environment) • availability • current ability/state of fitness	• LHWs worked with the Job Centre to find employment for clients • LHWs delivered interventions at times that suited clients (e.g. badminton running from midnight - 2 am for taxi drivers, restaurant and takeaway employees) • Accommodating individual abilities/fitness by offering a range of activities	• Accommodating client availability • Accommodating client preferences for activity	Not standardised
Visram et al. (2014)	• Client's own goals/priorities • Complex needs (e.g. housing) • Availability • Barriers to engaging in physical/social activities (e.g. confidence)	• Health behaviour addressed depended on client's own goals and priorities • LHWs were encouraged to signpost 'complex' clients to appropriate professional support or services • Helped clients find activities that fit around their other commitments	• Content was client-led • Signposting/referring to services based on needs • Accommodating client availability	Not standardised (depended on client's needs)

		• Took more time with clients who needed additional input to build confidence and could accompany clients to other agencies or activities • Number of contacts with LHW tailored to need	• Assistance to overcome barriers (psychological) • Number of contacts with LHW tailored to need	
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Smoking cessation				
Begh et al. (2011)	• age • religious identity • individual interests (e.g. sport) • barriers to using smoking cessation services • barriers to using nicotine replacement therapy • availability	• LHWs adapted communication depending on age of client and religious identity ("street language" for younger smokers and "uncle" for older, "assalamu alaikum" if Muslim) • LHWs addressed barriers to using nicotine replacement therapy (e.g. if fasting (Ramadan) wear patch after completion of day's fast) • LHWs provide interpreting service • Set up own LHW smoking cessation clinics within taxi bases and bus depots so could accommodate irregular working hours • Also provided clinic for youth who feared disclosure from doctor or other community members to parents	• Personalisation (identification) • Assistance to overcome logistical barriers	Not standardised
Woodruff et al. (2002)	• Client concerns and challenges with smoking cessation	• Although the content of each session was pre-defined and not based on client needs, at each session the LHW discussed the client's experiences while quitting smoking, the results of the quit attempt, and aspects of quitting the	• Assistance to overcome barriers (psychological)	4 sessions

		participant was finding challenging (e.g. weight gain)		

	Needs assessed/considered	Description of tailoring	Features	Intensity
Illicit drug use				
Woodruff et al. (2014)	• Readiness to change	• Based on readiness to change assessment and a motivational interviewing process, content was tailored as follows: (1) Brief intervention for at-risk individuals- included feedback, exploring ambivalence, and negotiation/commitment to abstain or reduce use (2) Brief treatment for high-risk individuals- 6 individual sessions with professional counsellor. LHW offered to make first appointment (3) Referral to treatment for severe-risk individuals- offered all the above plus signposted to local agencies for further assessment and support	• Content informed by stage of change (no algorithm mentioned) • Feedback • Assistance to overcome logistical barriers • Signposting/referring to services based on needs	1 session (and referral according to needs)
Diabetes-risk related behaviours				
Islam et al. (2013)	• Age • Preference for location	• LHW expressed respect for program participants, many of whom were	• Personalisation (identification)	

	• Availability • Current diet and physical activity levels • Preferred language (Korean/English)	older adults, by referring to them as "sung seng nim" a term of respect in Korean • Organising sessions on weekends and offering make up sessions to those who miss a group session • Sessions were hosted in community locations convenient for clients • Follow-up phone calls helped reinforce key messages and goal-setting exercises allowed the LHW to provide tailored advice • LHWs could deliver the intervention in Korean/English	• Accommodating client availability • Meeting client in preferred location • Assistance to overcome logistical barriers • Individualised goal-setting • Verbal/written communication offered in another language	6 group sessions and 10 individual follow-up phone calls
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Islam et al. (2014)	• Preference for location • Availability • Current diet and physical activity levels • Preferred language (Punjabi/English)	• LHWs could deliver the intervention in Punjabi/English • Sessions were hosted in community locations convenient for clients • Organising sessions on weekend and mid-day when women have a break from household and childcare responsibilities. Offering make up sessions to those who miss a group session • LHWs discussed individualised strategies with clients and action plans for improving diet, physical activity and reducing stress	• Accommodating client availability • Meeting client in preferred location • Assistance to overcome logistical barriers • Individualised goal-setting • Verbal/written communication offered in another language	6 group sessions and 10 individual follow-up phone calls
CVD-risk related behaviours				
Krantz et al. (2013)	• Framingham Risk Score (risk of having a heart attack)-based on demographics, health care information, health history, dietary	• Computer software guided the content of the intervention based on the calculated risk of having a heart attack	• Content determined by Framingham Risk Score; pre-defined algorithm	Not standardised (depended on client's needs)

	practices, physical activity levels, health goals, risk factor values.	• LHWs used motivational interviewing techniques to provide counselling and to develop an action plan with the client to promote healthy behaviours. This technique focused on reflective listening and participant values related to behaviour change • At-risk participants also received medical referrals as well as information about available community lifestyle resources • LHWs conducted a follow-up call 2 weeks later to check on the status of referrals and action plans and assist participants with overcoming any barriers • Any changes to the risk score from previous LHW interactions were communicated to the client • Number of contacts with LHW tailored to need	• Feedback (descriptive and evaluative) • Signposting/referring to services based on needs • Individualised goal-setting • Assistance to overcome barriers (not specified) • Feedback (comparative progress) • Number of contacts with LHW tailored to need	

	Needs assessed/considered	Description of tailoring	Features	Intensity
Infant mortality-risk behaviours				
Hunte et al. (2004)	• Barriers to attending physician appointments; • literacy skills (poor) • general issues/problems reported by client or observed by LHW	• Can accompany client to appointments • Help identify necessary resources • Help filling out paperwork • Agree specific goals to be addressed • Number of contacts with LHW tailored to need	• Assistance to overcome logistical barriers • Signposting/referring to services based on needs • Individualised goal-setting • Number of contacts with LHW tailored to need	Not standardised (depended on client's needs)

Rapid repeat births				
Barnet et al. (2009)	• Client's preferences for location (home or community) • Intentions (family planning) and current behaviours (contraception) • Sexual relationships • Readiness to engage in pregnancy prevention	• Most interventions took place in home setting but some teenager preferred to meet in other community-based locations • Computer-assisted motivational intervention algorithms measured the teenager's motivation to prevent a repeated pregnancy and STIs. This influenced the educational and motivational interviewing component of the intervention • LHW conducted motivational interviewing based on identification of discrepancies between client intentions (not wanted another pregnancy) and current behaviours (continuing to have intercourse without contraception)	• Meeting client in preferred location • Content stage-matched; pre-defined algorithm • Feedback (descriptive and evaluative)	After birth of child: Less intensive intervention- 1 session every 3 months up to child is 2 years of age More intensive intervention- 1 session each month up to child is 2 years of age

	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Breastfeeding				
Chapman et al. (2013)	• Resources required to support behaviour	• Tailored resources/incentives: if separated from infant by work or school, received electric breast pump with correctly sized flanges (otherwise got manual pump) • LHW sessions tailored to client's needs and covered breastfeeding benefits, breastfeeding myths, positioning, and common breastfeeding problems); in-hospital visits to assist with latch and positioning and to educate	• Assistance to overcome logistical barriers • Content matched to educational needs • Number of contacts with LHW tailored to need	3 prenatal visits, daily in-hospital visits after delivery, and up to 11 postpartum home visits

		• regarding infant cues and breastfeeding frequency • Number of contacts with LHW tailored to need		
Gross et al. (1998)	• Woman's attitudes to infant feeding • beliefs about breastfeeding	• Corrected misconceptions • Attempted to contact mother weekly to address any problems or questions • Number of contacts with LHW tailored to need	• Content matched to educational needs • Assistance to overcome barriers (not specified) • Number of contacts with LHW tailored to need	1-16 sessions (depended on client's needs)

	Needs assessed/considered	Description of tailoring	Features	Intensity
Jolly et al. (2012)	• the duration of session required by client • barriers or concerns • breastfeeding problems	• The duration of support sessions was based on need • Support with barriers or concerns offered • LHW could observe breast feeding to help identify problems • Number of contacts with LHW tailored to need	• Content was client-led • Assistance to overcome barriers (not specified) • Number of contacts with LHW tailored to need	3 sessions minimum (depended on client's needs)
McInnes et al. (2000)	• age, area of residence, number of children • availability • choice of feeding	• Age, area of residence, number of children all used to match to a LHW with similar background • Arranged visits at convenient times • Those who were hostile to the topic of breastfeeding were provided with written information and a contact number and encouraged to get in touch if they wished, as were those who knew enough and had sufficient support. Those who were receptive to further information and support were encouraged to	• LHW and client matched based on demographic information • Accommodating client availability • Content matched to educational needs and interest • Number of contacts with LHW tailored to need	Not standardised (depended on client's needs)

		think about breastfeeding, were provided with written information and a visit was arranged for later in pregnancy • Number of contacts with LHW tailored to need		
Muirhead et al. (2006)	• Breastfeeding problems	• Breastfeeding problems encountered were solved where possible during a home visit or by telephone advice • Number of contacts with LHW tailored to need	• Assistance to overcome barriers (not specified) • Number of contacts with LHW tailored to need	Approximately 16 contacts but could be more (depended on client's needs)
	Needs assessed/considered	**Description of tailoring**	**Features**	**Intensity**
Weaning				
Smith et al. (2006)	• mother's experiences of feeding her child and knowledge of appropriate weaning • Preferred language (Bangla/English)	• LHW completed a questionnaire at each visit which was designed to enable a mother to articulate her experience of feeding her child. This informed subsequent advice. • LHWs could deliver the intervention in Bangla/English • Number of contacts with LHW tailored to need	• Content matched to educational needs • Assistance to overcome logistical barriers • Verbal/written communication offered in another language • Number of contacts with LHW tailored to need	Generally, 1 session per month up to 1 years old (depended on client's needs)

4.4.6 Features of tailoring in successful interventions

Features of tailoring and their association with success are displayed in Table 4.5. For an explanation of the method used to calculate the success rates and rate differences, see Section 4.3.7.

Seven theories or combinations of theories were identified from the included interventions. There were too few interventions based on any one theoretical model to be able to determine association with success, except for those that were informed by the Transtheoretical Model (n=6, rate difference=28.8). It appears that interventions informed by the Transtheoretical Model are more associated with successful health behaviour change. It is important to bear in mind, however, that other features associated with success were present in these interventions. Importantly, these interventions employed a formal assessment of client's needs which was also a feature associated with success (rate difference= 43.4). It is not possible within this review to separate the effects of the influence of the Transtheoretical Model and formal assessment due to lack of interventions for comparison.

Twenty-five features of tailoring were identified from the interventions. Fourteen of these features appeared in fewer than five studies each, limiting any judgement about their association with success.

4.4.6.1 Tailoring the number of contacts

Tailoring the number of contacts was associated with success (rate difference=5.3), although the majority of evaluation studies were of low quality (Bailey et al., 2012; Birkel et al., 1993; Chapman et al., 2013; Fouad et al., 2010; Gross et al., 19998; Hunte et al., 2004; Jolly et al., 2012; Krantz et al., 2013; McInnes et al., 2000; Muirhead et al., 2006; Resnick et al., 2009; Smith et al., 2006; Visram et al., 2014) . Tailoring the number of contacts to need was a more common feature in interventions aimed at changing mothers' behaviours (infant mortality-risk behaviours, breastfeeding, weaning) where the LHW took on a supportive role.

4.4.6.2 Assistance to overcome barriers

'Assistance to overcome barriers (all)' was positively associated with success (rate difference=32.9), as was 'assistance to overcome logistical barriers' (rate difference=19.1); however, again, the majority of studies were of low quality. Examples of ways in which assistance was provided included the following: LHWs offering transportation to clinics or other services (Birkel et al., 1993; Studts et al, 2012; Taylor et al., 2002); help with arranging medical insurance or financial aid (Bungay et al., 2013); facilitation to schedule a medical appointment (Hunter et al., 2004; Taylor et al., 2002); arranging interpreting services (Begh et al., 2011; Taylor et al., 2002); accompanying clients to services (Hunte et al., 2004); and help with filling out paperwork (Hunte et al., 2004).

4.4.6.3 Accommodating client availability

'Accommodating client availability' was associated with success (rate difference=15.2). Although two of the studies were of high quality (Koniak-Griffin et al., 2015; Visram et al., 2014), the majority were moderate (Pringle et al., 2013) or low quality (Bailey et al., 2012; Islam et al., 2013; Islam et al., 2014; McInnes et al., 2000; Mier et al., 2011; Resnick et al., 2009). In some interventions, clients were accommodated in this way by offering individual 'catch up' sessions if they were unable to attend a group meeting. In others, the time of contact simply depended on the client's preference.

4.4.6.4 Verbal/written communication in an alternative language

'Verbal/written communication offered in another language' was a feature more relevant to some interventions than others (i.e. those that target specific minority groups); however, it could be argued that all interventions should be flexible on this point. Even when including interventions where this feature may have been less essential, offering communication in another language was found to be positively associated with success (rate difference=39.0). The majority of studies were low quality. In one intervention, the LHW intervention was supported by written materials in Spanish and English (Birkel et al., 1993); however, in the other interventions where another language was offered, the LHWs could speak the required language (Han et al., 2009; Hayashi et al., 2010;

Islam et al., 2013; Islam et al 2014; Koniak-Griffin et al., 2015; Smith et al., 2006; Taylor et al., 2002).

4.4.6.5 Signposting/referring to services

'Signposting/referring to services' was associated with success (rate difference=23.5) and the quality of studies was moderate on average. Examples of actions related to this feature included the following: referring clients to screening services (Birkel et al., 1993; Bungay et al., 2013; Paskett et al., 2011; Taylor et al., 2002); referring clients to professional services (e.g. counselling) (Krantz et al., 2013; Woodruff et al., 2014; Visram et al., 2014); supplying information about the location and availability of these services (Han et al 2009; Studts et al., 2012); supplying information about local community initiatives (Krantz et al., 2013); and referring clients for assistance in obtaining medical cover (Bungay et al., 2013).

4.4.6.6 Content stage-matched

Delivering an intervention with content that is matched to a participant's stage of change was found to be associated with success (rate difference=23.5). In all these cases the interventions included a formal assessment of needs; therefore, it is not clear whether one feature or both combined are associated with success. The quality of the interventions was moderate on average. For those that were stage-matched with an algorithm (Barnet et al., 2009; Elder et al., 2005-2009; Fouad et al., 2010; Han et al., 2009; Paskett et al., 2011), there was more of an association (rate difference=22.4) than those that were stage-matched with no algorithm (rate difference=3.1) (Auslander et al., 2002; Hayashi et al., 2010; Woodruff et al., 2014), although there were only a small number of interventions that were stage-matched with no algorithm.

4.4.6.7 Content matched to educational needs

Matching intervention content to educational needs was found to be associated with success (rate difference=16.9). These studies were of moderate quality on average.

Examples of the implementation of this feature included tailoring information

related to the following: information about risk and presentation of disease (Bungay et al., 2013; Taylor et al., 2009; Taylor et al., 2010); information about performing the desired behaviour (Chapman et al., 2013); and correcting misconceptions (e.g. breastfeeding) (Gross et al., 1998; McInnes et al., 2000; Taylor et al., 2009; Taylor et al., 2010).

4.4.6.8 Individualised goal-setting and feedback

Providing 'individualised goal-setting' did not appear to be associated with success (rate difference=-23.6) and neither was 'individualised feedback' (rate difference=-0.6). It is important to note, however, that there were only five studies with each of these features. In the case of 'individualised goal-setting', the majority of studies were low quality (Elder et al., 2005-2009; Hunte et al., 2004; Islam et al., 2013; Islam et al., 2014; Krantz et al., 2013), while for 'individualised feedback' the studies were of moderate quality, generally (Barnet et al., 2009; Elder et al., 2005-2009; Koniak-Griffin et al., 2015; Krantz et al., 2013; Woodruff et al., 2014).

4.4.6.9 Recruiting LHWs from the target community

In Table 4.5 the success rates of interventions where LHWs had been recruited from the target community were compared with those who had not. LHWs who had shared characteristics with the target group (as noted in Table 4.1), but were not recruited from the target community, were included in the 'not recruited from the target community' category. Interventions that recruited LHWs from the target community were associated with success (rate difference= 14). The majority of these studies were or low quality which may indicate that there is increased complexity in conducting evaluations on interventions which use this 'natural helping' model. Interestingly, looking back at Table 4.1, three out of the five interventions where the LHWs were not recruited from the target community (and were not recruited based on shared characteristics) were successful (Krantz et al., 2013; Pringle et al., 2013; Visram et al., 2014). This would have led to a rate difference of 16.5 in favour of interventions with indigenous LHWs.

Table 4.5- Analysis of features of tailoring

			Success Rate (%)		
	Feature prevalence N (%)	**Quality of evidence for intervention effectiveness**	**With feature**	**Without feature**	**Rate difference**
Theories informing LHW tailoring					
Transtheoretical Model	6 (18.2)	3xL, 2xM, 1xH	83.3	54.5	28.8
Transtheoretical Model + Social Cognitive Theory + Communication Behaviour Change/Communication-Persuasion	2 (6.1)	2xM	50.0	66.7	-16.7
Transtheoretical Model + Social Cognitive Theory	1 (3.0)	1xL	100.0	66.7	33.3
Transtheoretical Model + Health Belief	1 (3.0)	1xL	100.0	66.7	33.3
Health Belief and Social Cognitive Theory	1 (3.0)	1xL	100.0	66.7	33.3
Social Cognitive Theory	1 (3.0)	1xL	100.0	66.7	33.3
Multiple unspecified	1 (3.0)	1xH	100.0	66.7	33.3
Assessment of needs					
Formal assessment	8 (24.2)	5xL, 3xM, 1xH	88.9	45.5	43.4
Tailoring					
Number of contacts tailored	13 (39.4)	8xL, 4xM, 1xH	53.8	48.5	5.3
Assistance to overcome barriers (all)	19 (57.6)	11xL, 7xM, 1xH	63.2	30.3	32.9
• Assistance to overcome logistical barriers	13 (39.4)	8xL, 5xM	61.5	42.4	19.1
• Assistance to overcome psychological barriers	2 (6.1)	1xL, 1xH	100.0	60.6	39.4
• Assistance to overcome barriers (not specified)	4 (12.1)	2xL, 2xM	50.0	63.6	-13.6
Accommodate client availability	9 (27.3)	6xL, 1xM, 2xH	66.7	51.5	15.2
Verbal/written communication offered in another language	8 (24.2)	5xL, 2xM, 1xH	87.5	48.5	39
Signposting/referring to services	8 (24.2)	3xL, 3xM, 2xH	75.0	51.5	23.5
Content stage-matched	8 (24.2)	3xL, 4xM, 1xH	75.0	51.5	23.5
• Stage-matched with algorithm	5 (15.2)	2xL, 2xM, 1xH	80.0	57.6	22.4
• Stage-matched with no algorithm	3 (9.1)	1xL, 2xM	66.7	63.6	3.1
Content matched to educational needs	7 (21.2)	3xL, 3xM, 1xH	71.4	54.5	16.9
Individualised goal-setting	5 (15.2)	3xL, 2xM	40.0	63.6	-23.6
Individualised feedback	5 (15.2)	1xL, 2xM, 2xH	60.0	60.6	-0.6
Content client-led	4 (12.1)	2xL, 1xM, 1xH	25.0	66.7	-41.7
Personalisation	4 (12.1)	1xL, 3xM	75.0	63.6	11.4
Meet in preferred location	3 (9.1)	2xL, 1xH	66.7	63.6	3.1
LHW and client matched on key characteristics	2 (6.1)	1xL, 1xM	50.0	66.7	-16.7
Content matched to risk score	2 (6.1)	2xL	100.0	63.6	36.4
• Matched to risk score based on algorithm	1 (3.0)	1xL	100.0	66.7	33.3
• Matched to risk score, no algorithm	1 (3.0)	1xL	100.0	66.7	33.3
Accommodate client preference for LHW	1 (3.0)	1xH	100.0	66.7	33.3
Deliver intervention components at preferred time	1 (3.0)	1xM	100.0	66.7	33.3
Accommodate client preference for type of contact	1 (3.0)	1xL	0.0	69.7	-69.7
Accommodate client preference for type of activity	2 (6.1)	1xL, 1xM	50.0	66.7	-16.7
LHW recruited from target community vs. 'other'	13 (39.4)	8xL, 4xM, 1xH	76.5	62.5	14

4.5 Limitations

First and foremost, it is important to acknowledge that the majority of the evidence was deemed to be of low or moderate quality. In addition, conclusions have been based on the isolation of each variable (or feature) of interest, although there are multiple confounders. These limitations mean that the findings must be treated with caution.

Another limitation of this review is that all the included studies took place in the United Kingdom or North America. The criteria for inclusion allowed studies to be included from the rest of Europe, Australia and New Zealand. Indeed, the search results included studies from these countries but they did not meet the other criteria for inclusion in the review. This may limit the application of the findings; however, it should be noted that the interventions included took place in a range of contexts and targeted a wide range of different groups who experienced marginalisation from health services for a number of different reasons.

One of the most important criteria for inclusion in this review was the description of at least one tailored intervention feature. A large percentage of studies in the wider literature did not meet this criterion, even though a search for companion material was carried out. A Cochrane review has reported that, while LHW interventions appear to be effective, it is not known what the 'active ingredients' are that contribute to the effectiveness (Lewin et al., 2010). This is, to a greater extent, due to a lack of detailed reporting of the contents and activities of the interventions. Some of the study clusters which produced the richest information for this review were published as an RCT and a qualitative companion paper.

Another consequence of the lack of detail of reporting was that it was not possible to evaluate the association of some features with intervention effectiveness. There was a marked deficiency in information on LHW training which meant this feature could not be analysed to the same extent as those shown in Table 4.5.

It is perhaps surprising that 21 out of the 33 included interventions were evaluated using a RCT design as many of them were either trials or in an early phase of implementation. This design has been proposed to be inappropriate for evaluating complex interventions at the early phase of implementation (Craig et al., 2008). It is possible that the inclusion criterion which stated the intervention must have been evaluated and an outcome (i.e. effective or not effective) reported biased the selection of studies towards RCTs.

Probably due to publication bias, most interventions reported some form of effectiveness. For this reason, associations of features of tailoring with 'success' are reported, rather than 'effectiveness', in order to reinforce the idea that it was not necessarily statistical or clinical significance that was being assessed in this review.

It was challenging for reviewers to assess whether the interventions had been successful as some interventions were reported as having achieved interim goals but not long-range ones. In addition, some studies reported changes in health behaviours but it was difficult to determine whether it was enough of a change to actually have an impact on participants' health. In order to categorise the interventions, reviewers agreed that any positive outcome for behaviour change would be deemed to indicate intervention success.

It was not possible to categorise the LHW types using the broad categories described by South et al., (2010). Instead, an attempt was made to categorise LHWs as either being indigenous to the target group or not. This was not a straightforward task as some studies lacked the optimum level of description necessary to make a reliable judgement, although most studies published information about the characteristics of the LHWs recruited. The categorisation should, therefore, be treated as somewhat crude. A

n attempt was made to explore the association of the type of LHW with effectiveness in the included interventions. As there is a great deal of LHW literature that would be relevant to this question, it is recommended that a systematic review be conducted on this topic. Such a review could adopt more stringent criteria on what should constitute 'effectiveness' and produce more robust results.

4.6 Summary

The features found to be associated with intervention success included: tailoring the number of LHW contacts to the client's needs; providing assistance to overcome barriers; accommodating client availability; offering communication in another language; signposting/referring to services; and matching intervention content to the client's educational needs. It was also found that basing an intervention on the Transtheoretical Model and implementing this with a formal assessment of the client's 'Stage of Change', matching intervention content to stage based on a pre-defined algorithm, was more likely to lead to success. This may indicate that an element of structure may be beneficial when implementing an intervention with non-professional health workers.

Tailoring the number of contacts to need was found to be a more common feature in interventions aimed at changing mothers' behaviours. It is possible that in the design of such interventions, there is an understanding among programme developers that women in the ante- and post-natal periods can be dealing with multiple priorities and benefit from support provided as and when needed. Increased investment in 'Early Years' interventions in recent years may have meant that more funding was available for this type of more intensive intervention.

It is understandable that accommodating client availability is important. This could be a relatively simple action for building rapport with clients as it allows them to partake in the programme, to some extent, on their own terms and may help to ensure maximum engagement.

As mentioned previously, offering communication in another language is more essential in some interventions than others. It depends on the characteristics of the target community. The included interventions that implemented this feature were aimed at communities where this was beneficial, if not essential. Moreover, the LHWs in all but one of these interventions were recruited based on their ability to converse in the alternative language. Although studies were low quality, and care should be taken in applying these findings to other

contexts, the delivery of the intervention in the language of clients' choice may have been strong factor in the success of these interventions.

It is important to note that any signposting/referral to services that took place within the included interventions was relevant to the desired intervention outcome. With the exception of general lifestyle change interventions, signposting was on-topic and LHWs were not widely reported to address wider health issues (e.g. signposting to smoking cessation services as part of a breastfeeding intervention).

It is, in a sense, logical that it should be important to consider the educational needs of a client when conducting an intervention. Clients would, at the very least, need to be informed about the disease (or desired outcome) and how to implement the desired behaviour. It is to be expected that the amount of information and explanation required would differ depending on the client.

It is surprising that 'individualised goal-setting' and 'individualised feedback' were not associated with success in this review. For individualised goal setting, one intervention that was not successful was a pilot. Another, which also used individualised feedback, was deemed to be unsuccessful because outcomes at 6 and 12 months post-intervention were not favourable to the tailored LHW intervention. It is important to note that this was one of the very few studies that looked at long-term outcomes of tailored LHW interventions.

On exploring the association between how 'lay' the LHWs are and intervention success, it was found that interventions that used indigenous LHWs were associated with success more so than interventions that did not make efforts to recruit from within the target communities. Although this is not a feature of tailoring in itself, in recruiting LHWs from the target community, programme developers are making an assumption that 'indigenous' LHWs will have an enhanced ability to tailor to the community and individuals' needs. The results here provide tentative evidence that this assumption may be well founded.

This review identified 25 features of tailoring that have been implemented in LHW interventions. Here, we have described how the implementation of 11 of

these features, and the use of LHWs recruited from the target community, were each found to be associated with intervention success.

The following chapters report a mixed methods study of a lay health worker intervention within Childsmile. This study aims to explore how 'targeting' and features of 'tailoring' were implemented in the DHSW intervention, and how they *should* be implemented in order to be optimally effective. The findings are discussed in relation to findings from the systematic review in Chapter 16.

5 A mixed methods study of a targeted and tailored Dental Health Support Worker intervention

5.1 Introduction

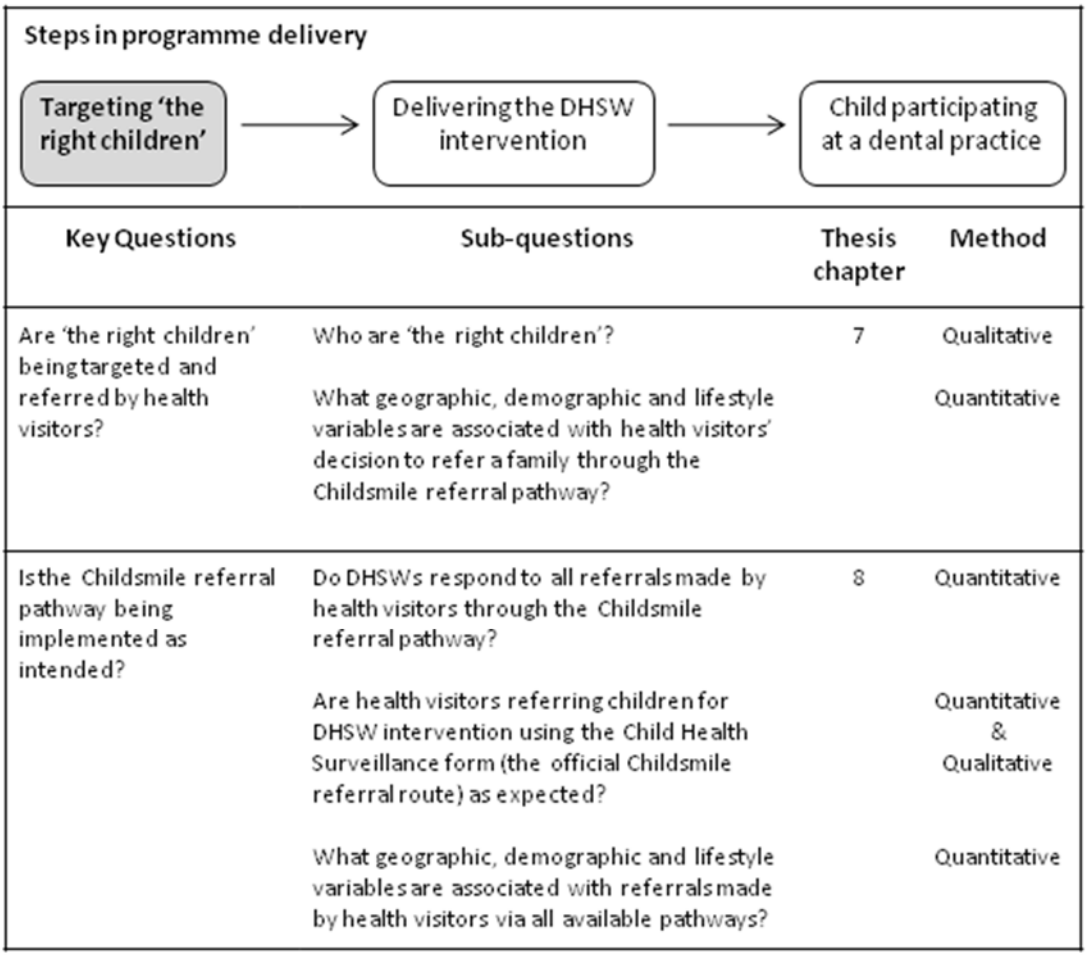
This section of the thesis reports a mixed methods study of the DHSW intervention, including the Childsmile referral pathway. The results and findings are presented across nine chapters. Chapter 6 describes the study cohort. Chapter 7 and 8 explore the targeting of 'the right children' and the implementation of the Childsmile referral pathway. Chapter 9 reports definitions of what it means to tailor to families' needs. Chapter 10 contains findings relating to training DHSWs to deliver the intervention. Chapter 11 focuses on how DHSWs assess individual families' needs, while Chapters 12-14 report how, and the extent to which, DHSWs implement tailored support. Finally, Chapter 15 assesses the effectiveness of the DHSW intervention by evaluating its impact on dental participation.

5.2 Aims

The aim of this mixed methods study was to explore whether the referral pathway and DHSW intervention were implemented as intended and assess the impact of the intervention on child dental participation. We also aimed to explore those aspects of the intervention that were working well and those that were not. We hoped to gain an understanding of the factors that had an impact on DHSWs' ability to deliver the intervention effectively, so that recommendations could be made for its optimisation.

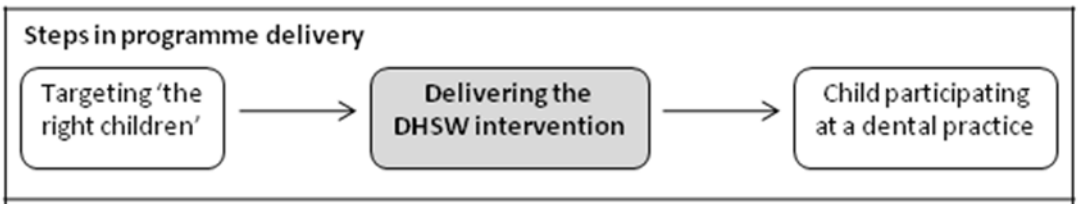
5.3 Research questions

The research questions addressed by this mixed methods study are listed, along with the relevant methods in Figures 5.1, 5.2 and 5.3. Each figure corresponds to a step in programme delivery.



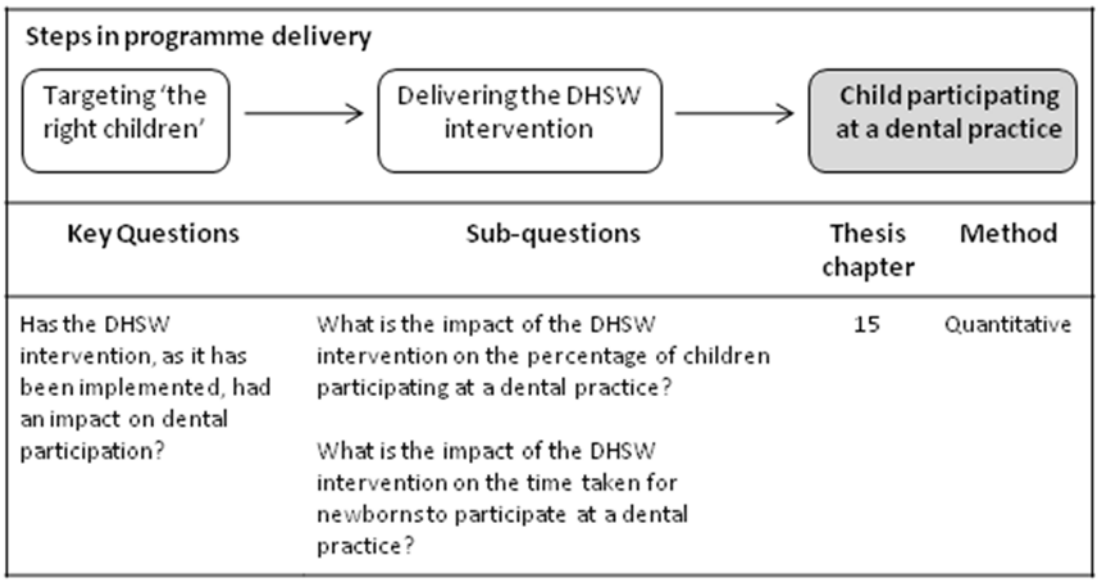
Key Questions	Sub-questions	Thesis chapter	Method
Are 'the right children' being targeted and referred by health visitors?	Who are 'the right children'?	7	Qualitative
	What geographic, demographic and lifestyle variables are associated with health visitors' decision to refer a family through the Childsmile referral pathway?		Quantitative
Is the Childsmile referral pathway being implemented as intended?	Do DHSWs respond to all referrals made by health visitors through the Childsmile referral pathway?	8	Quantitative
	Are health visitors referring children for DHSW intervention using the Child Health Surveillance form (the official Childsmile referral route) as expected?		Quantitative & Qualitative
	What geographic, demographic and lifestyle variables are associated with referrals made by health visitors via all available pathways?		Quantitative

Figure 5.1- Research questions relating to targeting 'the right children'



Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 5.2- Research questions relating to delivering the DHSW intervention



Key Questions	Sub-questions	Thesis chapter	Method
Has the DHSW intervention, as it has been implemented, had an impact on dental participation?	What is the impact of the DHSW intervention on the percentage of children participating at a dental practice? What is the impact of the DHSW intervention on the time taken for newborns to participate at a dental practice?	15	Quantitative

Figure 5.3- Research questions relating to child participation at dental practices

5.4 Ethical approval

5.4.1 NHS

This study was deemed to be service evaluation by the West of Scotland Research Ethics Service (WOSRES) and, therefore, did not require NHS ethical review. Individual health boards' clinical governance departments were notified of the evaluation being undertaken. Documentation confirming the WOSRES approval can be viewed in Appendix 5.

5.4.2 Privacy Advisory Committee

As the study involved linking anonymous data obtained from NHS patients, Privacy Advisory Committee (PAC) (now the Public Benefit and Privacy panel) approval was required. This study was included in the PAC approval for multiple Childsmile service evaluation studies submitted in one joint PAC application.

5.4.3 University of Glasgow

Ethical approval from the University of Glasgow Medical Veterinary and Life Science (MVLS) College Ethics Committee was already in place for the on-going Childsmile service evaluation. MVLS Ethics approval was extended to include this

study. Documentation confirming the University of Glasgow MVLS approval can be viewed in Appendix 6.

5.5 Qualitative methods

This section presents the methods of data collection and analysis for the qualitative elements of evaluation. The qualitative methods are described as they were implemented chronologically; starting with the design, then sampling and recruitment, moving on to data collection, and finally, data analysis.

5.5.1 Design

5.5.1.1 Choosing qualitative methodology

In choosing an appropriate methodology, the research objectives of a study should define the method of inquiry (Crabtree and Miller, 1999). As the research objectives for this study were to explore the meaning of targeting 'the right children' and tailoring to their needs, and how these elements should be implemented from the perspectives of those involved, a qualitative investigation was deemed most appropriate.

As described in Chapter 3, I adopted a pragmatist paradigm for this doctoral work (Cresswell, 2007). As there are pre-existing satisfactory definitions of 'tailoring' in the literature (Hawkins et al., 2008; Kreuter et al., 1999), we were not concerned with identifying an emergent 'all-encompassing' theory of tailoring through use of methods such as Grounded Theory (Glaser and Strauss, 1967; Glaser, 1992). Rather, we wanted rich description of the practical application of the concept of tailoring within the Childsmile programme.

We were also less interested in taking a phenomenological approach (Moustakas, 1994), which would involve detailed examination of stakeholder descriptions of their own experiences of delivering and receiving a tailored intervention. Instead, highlighting the variation in the intervention as delivered or received was of greater pragmatic interest.

While much applied qualitative research in the health services sector has been described as 'generic' and thus guilty of not making reference to theory (Kelly,

2010), a pragmatic approach necessitates that the research question be given central importance and debates about 'theory' be put aside (Cresswell, 2007). This study was outcome-oriented and the aim was to gain knowledge that could be applied in a practical way to improve the delivery of the DHSW intervention. With health services research such as this, it is possible to harness the benefits of Framework Analysis (Ritchie & Spencer, 1994) in order to meet the research aims. This approach is described in further detail in Section 5.5.3.

5.5.1.2 Focus groups and interviews

Focus groups were the main method of data collection for this study. Where it was not possible to carry out a focus group for logistical reasons, I conducted face-to-face, or telephone, interviews.

Focus groups have been increasingly used as a method of data collection among social scientists since the 1980s (Krueger and Casey, 2014). Originally used in the United States military during the Second World War, focus group methodology was adopted by market researchers, social anthropologists, and health researchers for several decades before researchers across the social sciences realised its potential (Kitzinger & Barbour, 1999).

A focus group consists of a group of people brought together in a 'permissive, non-threatening environment', to discuss an issue of which they have a shared experience, without pressure being put on participants to reach a consensus (Kreuger and Casey, 2014). Groups are facilitated by a moderator who introduces the discussion topic, gently keeps the group from going off on a tangent and probes for more information on themes of interest.

Groups are often homogenous, but with enough variation between participants to allow for discussion and debate (Kreuger and Casey, 2014). The group's discussion is focused on a particular issue and the participants interact; responding and building on views expressed by others in order to produce a range of opinions, ideas and experiences. One advantage of focus groups is that a great amount of information can be gathered quickly and efficiently (Krueger and Casey, 2014), increasing the potential number of participants in any given

study. The ability to capture a range of experiences and opinions in a short space of time was essential for this study.

Another advantage of using focus groups is that, compared to an interview, the group environment can be less intimidating for participants. In addition to this, the feeling of cohesiveness that group members experience encourages the expression of ideas (Vaughn, Schumm & Sinagub, 1996). This environment was ideal for this study as I wanted participants to feel comfortable sharing information about situational and interpersonal factors that may affect DHSWs' ability to deliver a targeted and tailored intervention.

As we were interested not only in how the intervention was being implemented but also the barriers and facilitators to implementation, focus groups had the advantage of providing an environment where participants could discuss potential solutions to problems or barriers that were identified (Duggleby, 2005).

A particular benefit for this study, where we wanted to gather a range of views from Childsmile stakeholders in different roles across Scotland, was that we were able to repeat focus groups several times with different participants so that data could be compared and contrasted in relation to the research questions (Kreuger and Casey, 2014).

Considering the wealth of information available and pre-conceived ideas gathered from the ongoing Childsmile process evaluation, focus groups were useful because they provided a forum for hypothesis generation and hypothesis testing (Kreuger and Casey, 2014), where 'hunches' could be validated by participants who had, or had not, previously been consulted in the Childsmile process evaluation.

I used interviews as the method of data collection only where it was not logistically possible to access groups of participants from a particular region or stakeholder group.

Structured interviews have a strict question protocol that does not differ between participants. Unstructured interviews start with a very broad question and an informal conversation flows from that point (Crabtree and Miller, 1999).

Semi-structured interviews, by contrast to the other formats, follow a set of open-ended questions that may be used flexibly; the aim being to encourage the participant to talk about a particular topic, with the interviewer gently probing specific themes, checking meanings and guiding the responses back on topic (DiCicco-Bloom & Crabtree, 2006).

As our overall approach was deductive in nature, we chose to conduct semi-structured interviews in order to elicit the level of detail we desired and allow issues salient for individual participants to emerge, while keeping participants' responses relevant to our specific research questions.

5.5.2 Conducting the research

5.5.2.1 Sampling and recruitment

In order to explore stakeholders' views and experiences in relation to the research questions, we wanted to sample a range of stakeholders involved in implementing Childsmile Practice. This sample of stakeholders was to be representative of all key groups involved in the delivery of the DHSW programme component. In addition, we decided that it was essential to understand tailoring from the service user perspective; this meant sampling parents who had received DHSW support.

The sample included programme directors, programme managers, coordinators, DHSWs, health visitors and parents. A table showing the number of participants from each stakeholder group and region can be found in Table 5.1.

Theoretical sampling is defined as a method used to "collect data from places, people, and events that will maximize opportunities to develop concepts in terms of their properties and dimensions, uncover variations, and identify relationships between concepts" (Corbin & Strauss, 2008, pp.143). In order to maximize the opportunities to do this, we wanted to include stakeholders from all roles and from each health board. As it would not be possible to include every single stakeholder across Scotland, we used a theoretical sampling technique in order to achieve *theoretical saturation*; a point where no new data was emerging from further focus groups or interviews (Sandelowski, 2001; Corbin & Strauss, 2008).

Through the theoretical approach taken, we sampled with the specific purpose of capturing variation within and between the groups.

Table 5.1- Focus group and interview participants

Role	Method	Region	Population	No. participated
Directors & managers	Focus group	All	5	5
Coordinators	Focus group	East	5	4
	Focus group	West	4	3
	Focus group	North	11	8
DHSW	Focus group	East	≈55	10
	Focus group	West	≈135	6
	Focus group	North	≈51	7
	Focus group	North		3
	Focus group	West & North		6
	Interview	Islands	1	1
	Interview	Island	2	1
	Interview	Island	3	1
Health visitor	Focus group	East	≈422	13
	Focus group	West	≈1043	6
	Focus group	West		6
	Focus group	North	≈409	2
	Interview	North		1
Parents	Interviews	NHS GGC		5
	Interviews	NHS Lanarkshire		4
			TOTAL	**92**

Due to the pragmatic nature of this research, we did not commit to one recruitment strategy, which would have limited the number of participants that could be included as one strategy would not have been effective with all participant groups. Instead, we employed different recruitment strategies for each stakeholder group. These are described in the following sections.

5.5.2.1.1 Childsmile staff

Childsmile staff volunteered willingly to participate and seemed interested in the research. Where possible, we took advantage of national and regional staff meetings; asking stakeholders to set aside time in their meeting agenda for a focus

group. I was allowed 2 hours after a national programme directors' meeting and 2 hours after regional coordinators' meetings. This approach was successful in recruiting all programme directors and programme managers. Some coordinators could not participate in their regional groups; however, there were sufficient respondents in these groups that I was satisfied a breadth of views was represented.

DHSWs were recruited through coordinators, and took part in regional focus groups. We made efforts to ensure all health boards were represented at the DHSW level and, although one health board did not have the capacity to allow DHSWs to participate, we were satisfied with the breadth represented as, in the later groups, no new themes emerged from the focus group discussions and it was probable that theoretical saturation (Sandelowski, 2001) had been achieved.

5.5.2.1.2 Health visitors

It was more challenging to recruit health visitors. Recruiting health visitors in every health board would have required a substantial extension to the timeline and costs of this research. It was therefore agreed that a theoretical sample would be appropriate. Theoretical sampling meant selecting health visitors "on the basis of their potential manifestation or representation of important theoretical constructs" (Patton, 2001, p. 238). This would ensure that, while some health boards would be excluded from the study, a variety of views about tailoring would be captured.

Comments in the focus groups carried out with Childsmile staff indicated that communication between health visitors and DHSWs could be an influence on, and influenced by, attitudes to targeting and tailoring to the needs of 'the right children'. Where DHSWs were based in the same office as health visitors, it was suggested that there were increased opportunities for communication and increased quality of communication. We decided to take 'being based in the same office' and 'being line managed by health visitors' as a proxy for good communication between health visitors and DHSWs.

The Childsmile programme also expects health visitors to be responsible for ensuring the DHSW intervention is targeted at the right children. According to the 6-8 week referral pathway, health visitors should make a decision about which families need DHSW support and which families do not. Differences in the number of referrals made by health visitors in each health board could, therefore, indicate differences in their views regarding who should be targeted and how support should be tailored to their needs.

The median proportion of referrals made by health visitors in the year immediately preceding the commencement of this study (April 2012-March 2013) was 8.6% across Scotland. For the purpose of theoretical sampling criterion, at health board level percentages higher than 8.6% are considered 'high' and proportions of lower than this are considered 'low'.

In order to capture the variation in health visitors' views, a theoretical sampling matrix was developed (Table 5.2).

Table 5.2- Theoretical sampling matrix for health visitors

Theoretical sampling matrix								
Referrals	**High**				**Low**			
Line managed by health visitor	**Yes**		**No**		**Yes**		**No**	
Based in same office	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
Health board	GGC		AA La	B D&G H L			G	F FV T

From this matrix, one health board from each category in the matrix was selected by the convenience sampling method described below. This sample included NHS Greater Glasgow and Clyde, NHS Lanarkshire, NHS Highland, NHS Grampian and NHS Fife.

We obtained contact details for the Lead Health Visitors in each health board and worked down the lists systematically, contacting each Lead Health Visitor until we received a response. The most opportune time to conduct focus groups with health visitors was during regular health visitor team meetings.

Health visitors could only afford 30-45 minutes for a focus group. Although we would have preferred to have longer focus groups with health visitors, after discussion with the Childsmile Regional Researchers and Team Leads from several health boards, we decided this was the only viable way to access groups of health visitors. In one health board, it was proving to be impossible to access a group of health visitors. In this case, a face-to-face interview was conducted with a Lead Health Visitor from this health board.

5.5.2.1.3 Parents

As with health visitors, it was not practical within the time limits of this research to include parents from every health board. We decided to recruit parents from health boards in the West as this is where Childsmile Practice had been established for the longest time. The two health boards selected were NHS Greater Glasgow and Clyde and NHS Lanarkshire. These were the health boards where the DHSW intervention was first piloted so they had the greatest number of families who had experienced an intervention. We selected NHS Greater Glasgow and Clyde as this is a health board with many areas of high deprivation. We wanted to explore how DHSWs were tailoring the intervention to the needs of those children whom the intervention was designed to target. We selected NHS Lanarkshire because DHSWs here operate on a system of 'universal referrals'. This means that they are expected to deliver the intervention to every child unless specifically requested not to by a health visitor. We wanted to explore what effect 'universal referrals' might have on parents' experiences of receiving the DHSW intervention.

The first method of recruitment we attempted was attending the clinics where parents brought babies and young children to receive vaccinations. We attempted to recruit parents in the waiting room. We offered parents the opportunity to do the interview in a private room at the clinic or to leave their contact details and we would conduct a telephone interview at a time that was convenient for them. This method was recommended by health visitors who had participated in the focus groups.

We trialled this method in NHS Greater Glasgow and Clyde; however, many clinics were attended only to recruit one or two parents (sometimes none at all) each time. Another disadvantage of this method was that often several months or up to a year had passed since the parent had had contact with a DHSW so they were unable to remember the support they had received in detail.

We found no difference in the descriptive detail offered in parents' responses when comparing telephone interviews to face-to-face interviews. Although using telephone interviews meant that it was not possible to pick up on parents' non-verbal cues, of the nature that were recorded in field notes during focus groups, it was thought to be the best method for contacting parents at a time convenient to them within the time and budget available for this study. We, therefore, took a different approach to recruitment in NHS Lanarkshire. We contacted a DHSW and asked her to compile a list of families she had been in contact with during the previous 6 months. Parents on the list were phoned and invited to participate in a telephone interview. For discussion of the various sampling strategies employed, see Section 16.5.3.

5.5.2.2 Topic guide preparation

The topic guides used in focus groups and interviews with Childsmile staff and health visitors were developed based on the research questions and issues that could have been having an impact on the implementation of a targeted and tailored intervention. These issues were identified from the national process evaluation for Childsmile (Childsmile Process Evaluation Reports, 2010-2015) and lay health worker literature. The format of the focus groups and interviews was semi-structured. Questions were designed to be open and not leading. The topic guide was designed to be used flexibly, allowing for variation in question order depending on how discussions within groups evolved naturally.

The topic guides can be found in Appendices 9-13. The guides for the Childsmile staff and health visitors began by asking participants what 'tailoring' meant to them in the context of a health intervention and why it was thought to be important. The next set of questions aimed to explore the process of assessing a family's needs; aiming to reveal who is involved in the process and what tools or heuristics are used. The questions following this probed for detailed accounts of

the practical implementation of a tailored approach. The penultimate topic was the characteristics of DHSWs that may give them an advantage in delivering a tailored intervention before the final questions which addressed the barriers and facilitators to tailoring support to families' needs.

In all topic guides an opportunity for respondents to bring up any issues that had not yet been prompted by the facilitator or the group was positioned at the end.

The topic guide for the parent interviews was developed based on findings from the focus groups conducted with the other stakeholders. To help build rapport and make parents feel comfortable at the start of the interview, general questions about how many children the parent had and where they first heard of Childsmile were positioned at the beginning. Questions that were more challenging, such as 'what were/are the kinds of difficulties you face as a parent with your child's oral health?' were positioned towards the end. This topic guide was designed to try an obtain accounts of parents' experiences of receiving the intervention and whether they thought it had been appropriately tailored to their needs.

5.5.2.3 Managing focus groups and interviews

Before each focus group or interview began, participants were given: a brief summary of the research (Appendix 8); guidelines about the focus group or interview; and the confidentiality and anonymity guarantee. Then written consent to record (oral consent in the case of telephone interviews) was obtained (Appendix 7).

I used fresh paper copies of the topic guide in each interview and made notes either on the topic guide or a notepad to keep track of questions that had been asked in a different order. In order to remain engaged and manage the focus group discussions and interviews effectively, I took very few notes during the focus groups and interviews, relying on the audio recording which was later transcribed. I made some post-interview notes in a notebook at the first opportunity and word processed them when I returned to my office.

Although the tables provided at each location were not circular, I placed chairs around the table in an oval shape and made sure to position myself at neither head of the table. I organised the focus groups in this way because I wanted to be able to make eye contact with all participants, create a convivial atmosphere to put participants at ease, and encourage natural discussion. Stewart & Shamdasani (1990) suggest that sitting in such an arrangement, where all group members can see each other, facilitates discussion and reduces the risk of any member dominating the group.

I aimed to limit my facilitation to the following:

- steering the conversation back on topic
- managing the tempo of the discussion by moving it along at appropriate times
- asking for more information or examples where I felt a comment needed to be explicated and,
- playing devil's advocate in order to stimulate more discussion.

The recommended number of participants in each focus group is between six and twelve (Onwuegbuzie et al., 2009), although Kreuger & Casey (2014) and Morgan (2007) have advocated using smaller groups of three or four when participants in the group have specialized knowledge of the topic at hand. Bearing this in mind, I tried to ensure that there were at least three participants in each group and up to, but not more than, eight. On one occasion, I could only get two health visitors together. In this case, I conducted the session as a dyad interview (n=2) and analysed it in the same way as the interviews and focus groups. On two other occasions, I ended up with more than eight participants; once when more DHSWs turned up to a focus group than had been invited, and again when there were more health visitors at a team meeting than expected. I decided to proceed with the number of participants present rather than turn anyone away.

5.5.2.3.1 Childsmile staff

Focus groups and interviews with Childsmile programme staff were scheduled for two hours in length and usually lasted between one and two hours. Literature on the design of focus group studies generally recommends between one and two hours (Morgan, 1997; Vaughn et al., 1996). A meeting room was booked at a

location that required the shortest travel time for the majority of participants. Focus groups took place around a table laid with refreshments.

Interviews with DHSWs from the island health boards were conducted by telephone. Due to the DHSW role on the islands being more limited than on the mainland (e.g. no home visits), they were unable to provide many examples of tailoring in their role. I spent only a short amount of time probing around questions that did not seem to be applicable to the role of these DHSWs. The telephone interviews lasted between twenty and thirty minutes.

5.5.2.3.2 Health visitors

Focus groups with health visitors were fixed between thirty and forty-five minutes. As I was invited by the Health Visitor Team Leads to attend a team meeting and conduct a focus group as part of the meeting agenda, I had less control over the layout of the room. I at least ensured that from my seating position I could make eye contact with all the health visitors, and spent some time introducing myself and the research topic in order to reinforce the break between the focus group and the preceding meeting agenda.

5.5.2.3.3 Parents

Three of the interviews with parents in Glasgow took place in a health centre. I had access to a private room in which to conduct the interviews. The rest of the parent interviews took place by telephone. The parent interviews were between five and fifteen minutes in length. Many of the questions did not stimulate a lengthy response and it was challenging to probe for more information as, in many cases, the interviews took place several months after the DHSW intervention and parents could not remember the details of the intervention they had received.

5.5.3 Analysis

5.5.3.1 Preparing the data

The audio-recorded focus groups and interviews were transcribed into *Microsoft Word* (2010) documents. I undertook the majority of the transcription as this is suggested to help with the process of familiarising and immersing oneself in the data. Some interviews were transcribed by a research secretary who similarly transcribed the interviews verbatim. As the audio recordings were transcribed, they were made anonymous by replacing names with participant numbers.

5.5.3.2 Coding the data

We made a decision to inductively code several of the transcripts and develop a hierarchical, iteratively refined, list with which the remaining transcripts could be coded. Transcripts were coded using *QSR International's NVivo 10* (2012) software before moving on to manage and analyse the data using the Framework Analysis approach. Using the 'Framework Matrix' function in *NVivo 10* had the benefit of enabling me to retain an electronic link between the original data and thematically-organised summaries of the data, as shown in Figure 1. The inductive sub-themes were organised under the deductively produced research questions, used as headings.

5.5.3.3 Framework Analysis in NVivo

Framework Analysis (Ritchie and Spencer, 1994) has gained popularity in healthcare research since its conception at the UK National Centre for Social research. Framework Analysis is a method of qualitative data management and analysis whereby data is summarised in a matrix and analysed thematically (i.e. a table). This involves a process of developing a hierarchical thematic framework which is used to categorise data by key themes and subthemes. Each source of data (e.g. a focus group or interview transcript) is represented as an individual case in the matrix. Cases are set out in rows. Themes and subthemes, deductively or inductively identified, are set out in columns.

The Framework approach can be used in both a deductive and inductive manner (Gale et al., 2013). In this study, the research questions deductively guided the

development of themes and determined the organisation of the Framework matrices. Transcripts were coded inductively, allowing unanticipated themes to emerge. These unanticipated themes were organised as subthemes, under relevant overarching deductive research questions.

Data relating to each case and subtheme are summarised in the corresponding matrix cells. Once complete, it is possible to look across the entire matrix for patterns within the data, associations between themes and cases, and explanations.

A link is retained between the summaries and raw data. The link means an audit trail is created that can be followed from the beginning of the analysis to the end. This allows for a degree of transparency, which is beneficial for ensuring the quality of the research, as findings can be easily linked back to raw data. This is shown in the screenshot in Figure 5.4.

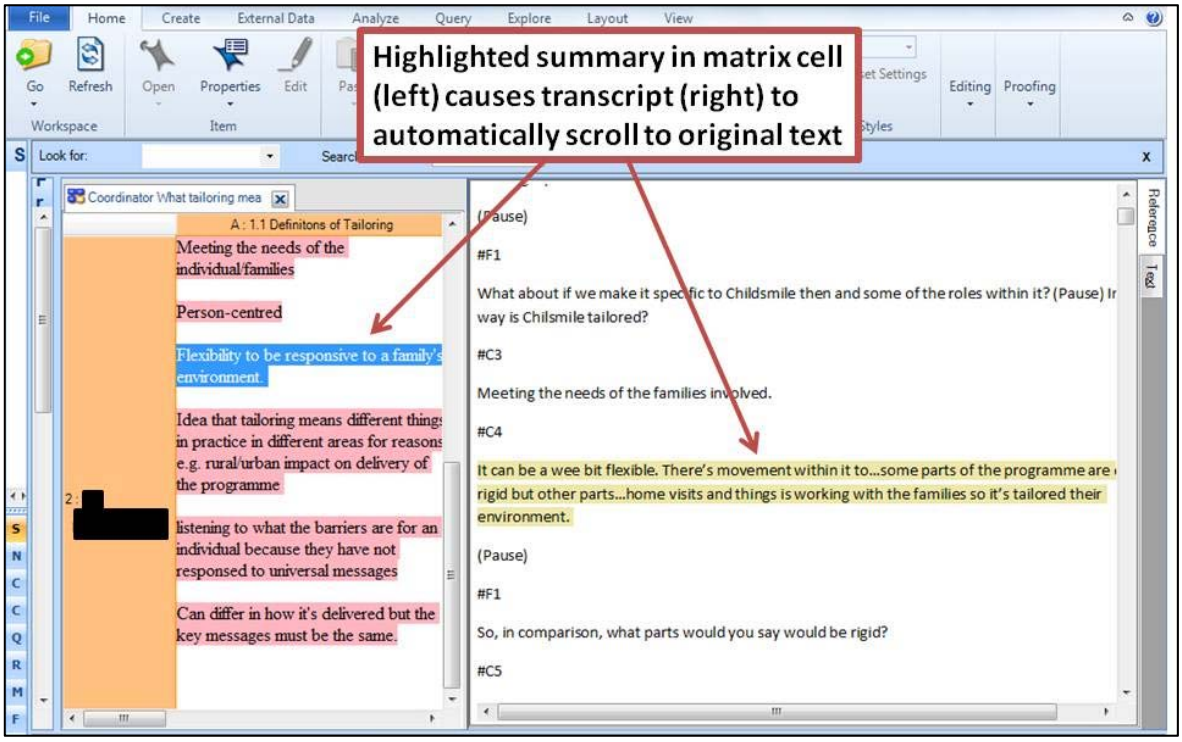


Figure 5.4- Screenshot of the electronic link between summaries (left) and the original source material (right)

The Framework approach lends itself well to the healthcare domain where substantial evaluation projects can involve multiple researchers and the emphasis is on rigorous research to inform evidence-based care (Ritchie & Spencer, 1994).

The retention of the link between original transcripts and the summarisations reduces the risk of the analysis becoming overly subjective and eases the process of reworking ideas.

An additional benefit of having the summarised data charted in a matrix is that it adds an additional step to the process of analysis, compared to thematic analysis, bringing the researcher 'closer' to the data by compelling them to digest the data into summaries. The matrix summaries support comparisons between and within individual cases or groups of cases allowing in this study, for example, the comparison of DHSW responses from different regions and the comparison of DHSW and coordinator responses.

We chose to use *NVivo 10* software to aid the data management and analysis. *NVivo 10* has a 'Framework Matrices' tool incorporated into the program. This was beneficial because the raw data and matrices can be stored in one file and the links between the raw data in the focus group transcripts and the matrix summaries are maintained by the software.

The key stages of the Framework Analysis undertaken are detailed in Table 5.3; however, in summary, a matrix was created for each research question. The example in Table 5.3 shows the summaries for three cases and three subthemes explored in one matrix under the research question 'how is tailoring implemented?' By organising the data by this method, we were able to compare and contrast participant responses across regions of Scotland, and between professional groups, by viewing the summaries contained within each matrix.

We followed the five key stages of Framework Analysis as described by Ritchie and Spencer (1994). These stages are detailed in Table 5.4. Stages 1-2 were carried out with transcripts printed in hard copy. Stages 3-5 were carried out using QSR International's NVivo 10 (2012) software.

Stages 1-4 were carried out as the data collection was ongoing. This meant that we were able to use early findings to inform my approach to subsequent sessions. We were able, therefore, to ask new groups and interviewees about issues that had been pertinent to previous ones. In this manner I occasionally brought

additional topics of discussion, which were not generated organically, to some sessions (Kreuger and Casey, 2000).

After completing Stage 5 of the Framework Analysis I began to summarise and write up the findings under the overarching higher level themes. Through this process, the themes and content were further refined. A theme development diagram for all the final themes can be found in Appendix 14.

Table 5.3- Extract from a framework matrix

Research Question: How do DHSWs deliver the right level and type of support?			
	Preparedness for change	**Developing relationship**	**Communication strategies**
DHSWs East	May need to work on parents' oral health before the child – parent may be in pain, have dental phobia/anxiety or take time to see oral health as priority	Working long term with some families Gaining parent's trust with first visit, then coming back Phoning after 6 months to check –in	Phone, letter, cold call to house Use resources where appropriate Wheel of Needs
Coordinators East	May just mention one message and not go into detail. Depends on family circumstances	Allow family to ask questions Important to get to know family first	Using phone calls, texts, sending out letters Using resources to get family to focus or occupy child
Programme managers	Consider what will be effective long term May not be immediate goal to get them to dentist	Talk to someone about what they want to talk about first- building rapport	Not necessarily waiting to make an appointment with a family but taking advantage of any opportunity to get the messages across when meeting the parents

Table 5.4- Stages of framework analysis

Stage of Analysis	Description
1. Familiarisation	I became immersed in the data and gained a comprehensive overview of the material by listening to audio recordings of focus groups and interviews, transcribing them myself, where time allowed, and reading through the transcripts. Some of the sessions were transcribed by a research secretary.
2. Identifying a thematic framework	I examined each line of each transcript and noted the key concepts or themes mentioned in each phrase or section. A hierarchical coding map began to emerge with themes and sub-themes relating to each research question.
3. Indexing	I applied the coding map to the transcripts in a systematic way, reading every part of each transcript and annotating with the corresponding codes.
4. Charting	I developed Framework matrices for each research question. The themes relating to each research question are charted as column headings and each focus group or 'case' is represented in a row. In each available cell in the matrix, I summarized the pre-coded data corresponding to each theme-case pair.
5. Mapping and interpretation	I examined themes across the matrix in order to compare and contrast the data in relation to the research questions. My aim was to establish whether any relationship existed between concepts. This process resulted in the emergence of higher level themes which addressed the research questions.

5.6 Quantitative methods

As shown in Figures 5.1, 5.2 and 5.3, many of the research questions were to be addressed using routinely collected quantitative data. Here, the quantitative methods are described.

5.6.1 Design

In order to answer the research questions, a cohort study design was considered to be the most appropriate, allowing evaluation of the Childsmile referral

pathway, delivery of the DHSW intervention, and dental participation using data collected prospectively as part of routine administrative data. The three administrative health datasets used for this study were linked and managed by Information Services Division Scotland (ISD).

5.6.2 Data sources

Data from the following sources were linked: the Child Health Surveillance (CHS) database, the Health Informatics Centre (HIC) database, and the Management Information & Dental Accounting System (MIDAS) database.

5.6.2.1 The 6-8 week Child Health Surveillance assessment data

In Scotland, policy recommends that children be reviewed by a health visitor or General Practitioner at 6-8 weeks of age. In practice, it is usually a health visitor who completes the review which is known as a Child Health Surveillance (CHS) assessment. A 6-8 week CHS assessment involves a holistic assessment of a child's circumstances and development. The aim is to identify any support needs or issues. The option to assess and refer a child for a DHSW intervention was included in the form and rolled out across Scotland in a staggered fashion from 1st September 2010. See Appendix 15 for a copy of the CHS form.

When the 6-8 week CHS assessment has been completed, the assessment form is returned to a local child health department which processes the form and enters the data on to the electronic child health system. ISD then receive quarterly downloads of CHS data from the child health system.

5.6.2.2 Health Informatics Centre (HIC) data

The HIC database holds all data recorded by DHSWs regarding their Childsmile Practice and Nursery & School duties. HIC Services is a University of Dundee research support unit which collects and manages the Dental Health Support Worker data related to the delivery of the intervention, as well as administrative data related to other aspects of the Childsmile programme. See Appendix 16 to view screenshots from the online forms DHSWs complete after an intervention (or attempted intervention) takes place.

view screenshots from the online forms DHSWs complete after an intervention (or attempted intervention) takes place.

5.6.2.3 Management Information & Dental Accounting System (MIDAS) data

MIDAS is a computerised payments system that holds all data recorded that relate to payments made to dental practices for patient registration and treatment at General Dental Services. In order to receive payment, dentists submit a GP17 form after patient registration or treatment within 3 months of the completion date. See Appendix 17 to view a copy of the GP17 form. The MIDAS data is collected and managed by Information Services Division (ISD) Scotland. Data available include unique health identifier, date of participation, type of treatment, dental practice list number and location.

5.6.2.4 The study population

This PhD started on 1st October 2012 and the data available at that time was used as the baseline cohort. The CHS extract used in this study includes data from all CHS assessments conducted between 1st September 2010 (when this system started) and 30th September 2012. In total there were 114, 097 children who make up the study cohort. We stopped the cohort at 30th September 2012, 3 months before the last available data, to allow sufficient time for children who had a CHS assessment to reach at least our primary endpoint (i.e. receive an attempted DHSW intervention and appear in the HIC dataset).

The HIC extract used in this study includes data from the Childsmile Practice database for those children in our cohort who had a 6-8 week CHS assessment between 1st September 2010 and 30th September 2012. We have allowed the HIC dataset to follow up these children to 31st December 2012 in order for sufficient time to pass between CHS assessment and an attempted DHSW intervention. We allowed a 3 month lag because the Childsmile manual states that families would normally be contacted by DHSWs by the time the child is 3 months old. There were 22956 children in the HIC database who had a CHS assessment during the cohort period.

5.6.2.5 Determining the maximum follow-up time for primary endpoint (DHSW attempted intervention

The available data for the HIC dataset runs from 1st September 2010 to 31st December 2012. All children in the HIC database have received an 'attempted DSHW intervention' (see Section 5.6.5.2 for a definition of 'attempted DHSW intervention'). For some research questions, we wanted to distinguish children who had *successfully* received a DHSW intervention from those who had not and also to establish the 'dosage' of intervention received.

In order to do this, we needed to establish a primary endpoint for the dataset which would allow every child to have the same opportunity to complete all their doses of the intervention. For example, a child who had their first intervention on 1st November 2012 may have continued to receive DHSW support beyond 31st December 2012 but this could not be known from the available data; therefore, they would be recorded as having had only one dose when they may have had multiple 'doses' taking place after 31st December 2012.

In order to establish an optimal cut-off point for the dataset that would allow enough follow-up time to capture most children's full 'dosage' of interventions, we examined the spread of the data for the maximum time (in months) between 'attempted DHSW interventions' for each individual. Figure 5.5 shows the maximum number of months between 'attempted interventions' for all children who had more than one 'attempted intervention'.

The maximum number of months between 'attempted interventions' ranged from 0 ('doses' delivered within 1 month) to 24 months. The mean was 2.2 months, the median was 1 month and the upper quartile was 2 months; indicating that the maximum number of months was skewed. The histogram in Figure 2 shows that, for the vast majority of children (81%), the maximum number of months between 'doses' was 3 months or less.

Based on this information, we decided to apply an endpoint to the cohort of 30th September 2012. As 31st December 2012 is the end of the cohort period, 30th September 2012 is the last date on which children could receive a 'dose' followed by a 3 month period with no subsequent 'attempted intervention'.

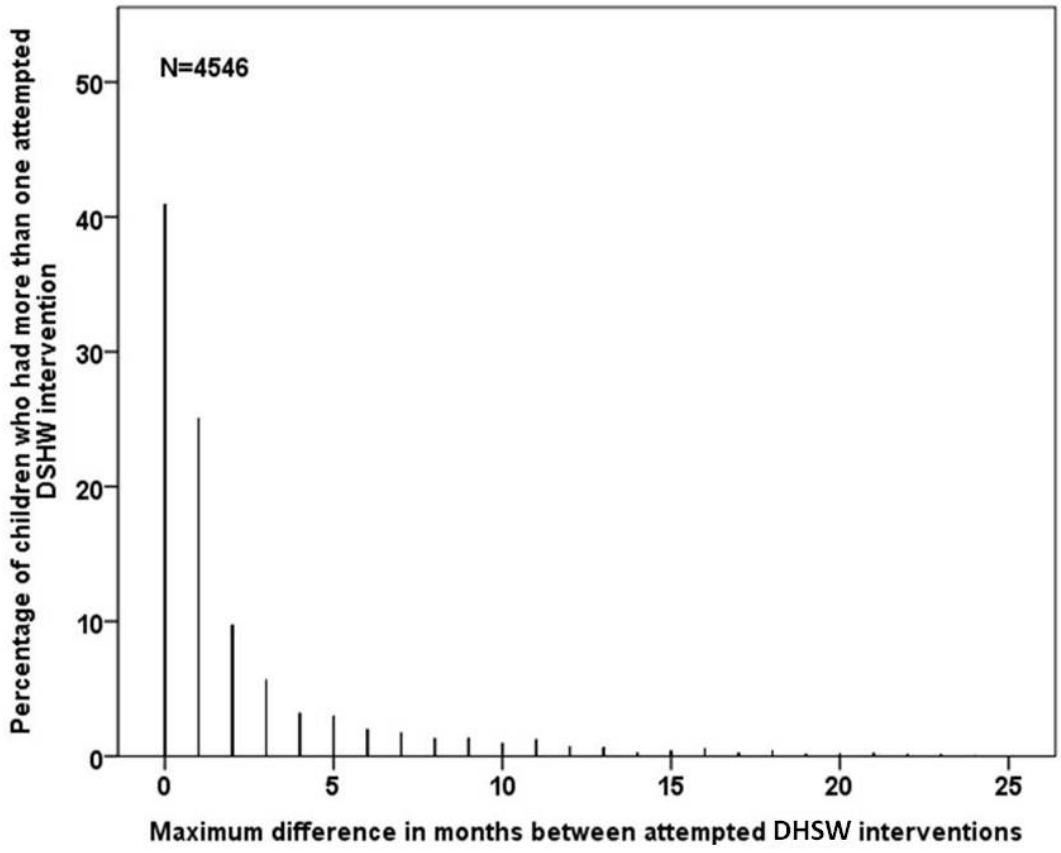


Figure 5.5- Maximum number of months between attempted DHSW interventions (or 'doses') for all children who had more than one

In applying this endpoint to the dataset, we excluded n=2382 (10%) of children from the total number in Figure 5.5. The total number of children in the cohort who are likely to have completed their 'dosage' of 'attempted DHSW interventions' is n=20574. We then excluded all those who did not have successful contact (i.e. none of the intervention components were recorded as delivered) (n=2182) which brought the final total to 18392 children who received at least one DHSW intervention (see 5.6.5.3 for a definition of 'DHSW intervention').

The extract used in this study includes data from the MIDAS database for children who had a 6-8 week CHS assessment between 1st September 2010 and 30th September 2012. We have followed these children's' dental participation up to 30th September 2013 as this is the latest date in the MIDAS data linked by ISD.

There were 74901 children in the MIDAS database who participated (registered and/or attended) a dental practice during the cohort period.

In summary, children who had a CHS assessment between 1st September 2010 and 30th September 2012 were followed up in the HIC dataset between 1st September 2010 and 31st December 2012 and in the MIDAS dataset between 1st September 2010 and 30th September 2013. A timeline of the datasets can be seen in Figure 5.6.

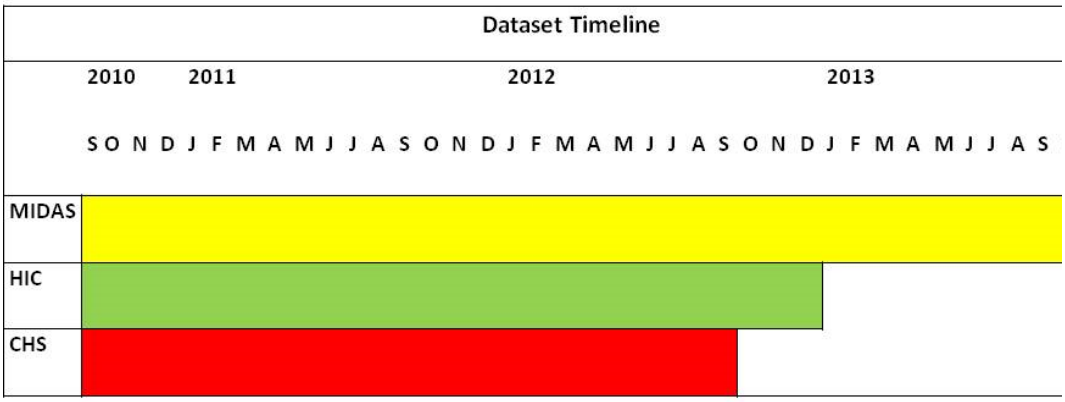


Figure 5.6- A timeline of the three linked administrative health datasets: Child Health Surveillance (CHS), Health Informatics Centre (HIC), and Management Information & Dental Accounting System (MIDAS)

5.6.3 Data linkage

Data linkage is a process whereby several datasets are temporarily joined together in order to create a new and richer source of data. In the case of this study, linking data on individual children (e.g. breastfeeding, smoking household, SIMD) collected during a health visitor assessment to data on the DHSW support offered to these children has allowed us to evaluate how successful the Childsmile programme has been at targeting "the right children". Linking these data to dental participation data has allowed us to evaluate how effective DHSW support has been at increasing dental participation.

5.6.3.1 Probability matching

The data linkage for this study was conducted by the 'electronic Data Research and Innovation Service' (eDRIS) within Information Services Division (ISD)

Scotland. Probability matching techniques based on Howard Newcombe principles (Newcombe et al., 1986) were used to link three health databases.

In Scotland every individual who has had contact with health services (including every newborn child) is assigned a unique Community Health Index (CHI) number which is a 10-character numeric identifier. All further contact with health services can be recorded using this CHI number which means that data relating to one person, recorded in several health databases, can be linked. This was the case in the CHS, HIC and MIDAS databases.

5.6.3.2 Linkage process

The rather complex process by which the datasets were linked is summarised in Figure 5.7. The three datasets came from the Child Health Surveillance (CHS), the Health Informatics Centre (HIC), and the Management Information & Dental Accounting System (MIDAS) databases. The three data providers managing each database isolated the personal identifiers (e.g. CHI number, postcode) in their dataset and sent these to the indexing team at ISD. The indexing team matched these personal identifiers to the population using probability-based algorithms. Next, the indexing team generated a unique person index number specifically for each of the three datasets and sent these back to the data providers. The data providers attached these new unique person index numbers to their datasets, removing the original personal identifiers (CHI) from the datasets, and sent these to the Research Coordinator. The research coordinator sent two files to the linkage agent (an automated computer programme that carries out the linkage). One file contained the datasets with the new unique person index numbers. The second file contained a master person index number matched to the unique person index numbers. The linkage agent replaced the unique person index numbers in the three datasets with one master index number. The three datasets could then be linked using this master index number which is unique to each case (i.e. each child in this study).

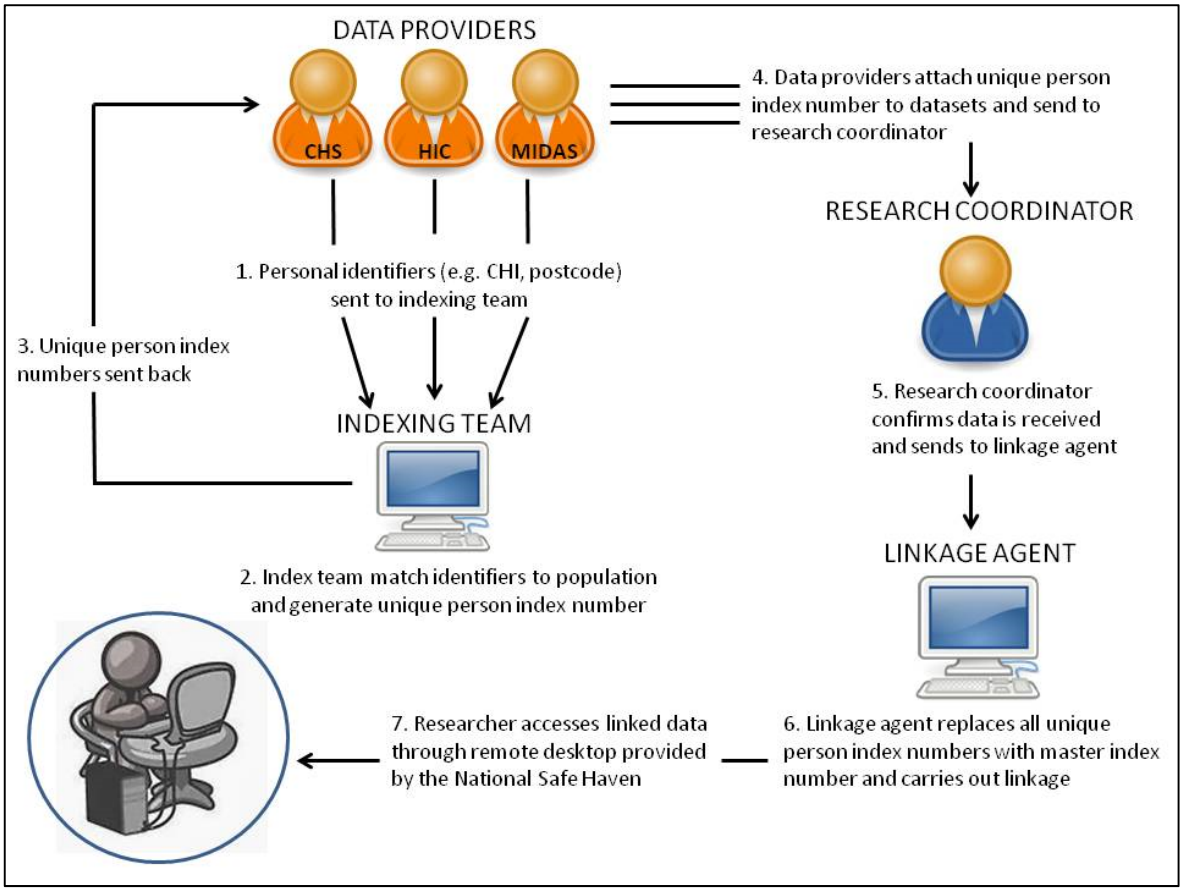


Figure 5.7- Diagram of the data linkage process

5.6.3.3 Data protection

In Scotland, the primary legislation on the use of personal data is the Data Protection Act 1998. This Act allows for 'data controllers' (called Caldicott Guardians in Scotland) to ensure that personal data are only made available for research purposes when there is a clear public benefit and the data is not going to be processed in a way that would cause substantial damage or distress to an individual. It is generally accepted by the Scottish public that administrative data is used for research without patient consent for each specific study. In an effort to protect individuals' personal data, health datasets are not stored together but held by various data providers and only brought together when there are research questions with a clear public benefit. The data controllers consider each study independently in order to determine whether permission to access to the data should be granted.

It is essential that sensitive information about the health of individuals remains anonymous. Probability matching across datasets is done using personal identifiers such as CHI, name, date of birth and postcode. As health information is particularly sensitive and confidential, the three datasets used in this study were made anonymous and linked externally by ISD so that anyone working with the final dataset would be unable to identify individuals through such personal information.

Analysis was undertaken through a secure research portal provided by the National Safe Haven. Access to the safe haven was achieved by connecting to a remote desktop via a virtual private network (VPN). This meant that the analysis could be conducted securely from any location (including the University of Glasgow Dental Hospital & School) rather than from a physical safe haven, which would usually be a secure room at ISD headquarters.

5.6.4 Quality assurance and data cleaning

5.6.4.1 Date of birth matching and alignment to birth registry

The HIC and MIDAS datasets were compared with the CHS dataset in order to check that the same children were represented by the same index number across the datasets. This was done by checking the percentage of matches for date of birth and gender for each child record across the datasets. We found a 99.9% date of birth match and a 98.5% gender match between CHS and HIC data and 100% date of birth match and a 100% gender match between CHS and MIDAS.

The number of children in the cohort was checked against the number of children born in Scotland between 1st September 2010 and 30th September 2012. The number of children born during this period was 121,797; therefore, there are 6.3% of children born in Scotland who are not included in the cohort. There are multiple possible reasons for the discrepancy. An audit of children with no record of a 6-8 week review showed that around 5.5% of children do not receive their recommended 6-8 review (Wood & Stirling, 2010). This figure was found to be consistent over time and higher in areas of higher deprivation. In around half of these cases, children appear to have missed their review, while in the rest of

cases it appears that the health visitor review form has gone astray and has not been processed.

5.6.4.2 Data cleaning

The data accessed through the SHIP virtual desktop were checked for duplicate records and every variable was checked individually for missing data. Records with obvious incorrect dates of birth or dates of DHSW intervention were removed (e.g. 01/01/1900). Frequency distributions and histograms were used to check for obvious transcriptional errors for all variables before derivation of new variables.

5.6.4.3 Treatment of missing data

Missing data was coded as 'system missing' in the statistical software (SPSS and Stata) and not included in the analysis. The exception to this was the missing category of the 'smoking' variable which was coded as 'missing' and included in the descriptive and statistical analysis due to the large number of missing data for this variable.

5.6.5 Coding of variables and derived variables

5.6.5.1 Health visitor referral code (Child Health Surveillance data)

Health visitors enter a code on the 6-8 week Child Health Surveillance assessment form to indicate whether or not a child should be referred to a DHSW. The field can be completed as follows:

- no referral is made- 'N'
- a referral to a DHSW made- 'Y'
- a parent has refused the offer of a DHSW referral- 'R'
- a health visitor has left the referral box incomplete- 'I'

5.6.6 Coding of variables and derived variables

5.6.6.1 Health visitor referral code (Child Health Surveillance data)

Health visitors enter a code on the 6-8 week Child Health Surveillance assessment form to indicate whether or not a child should be referred to a DHSW. The field can be completed as follows:

- no referral is made- 'N'
- a referral to a DHSW made- 'Y'
- a parent has refused the offer of a DHSW referral- 'R'
- a health visitor has left the referral box incomplete- 'I'

5.6.6.2 Attempted DHSW intervention (Health Informatics Centre data)

This binary variable is defined as any attempt made by a DHSW to deliver an intervention to a family, whether successful or not. If a record for a child appears in the HIC database, this indicates that a DHSW has attempted to deliver an intervention (=1). A '0' indicates that the family have not had an attempted intervention or that they were contacted solely to arrange the delivery of an intervention later.

5.6.6.3 DHSW Intervention

A tick box completed by DHSWs indicates whether they have delivered any of a number of intervention components to a family. No detail is provided on how this is done. We have defined a "successful" DHSW intervention (=1) as a recorded intervention where at least one of the following components has been delivered:

- Toothbrushing advice
- Dietary advice
- Dental pack

- Signposting
- Referral to a health visitor
- Further home support
- Family linked with dental services

This is different to the previously defined variable 'attempted DHSW intervention' because, here, a '0' indicates that an intervention was never attempted or that an attempt was not 'successful' (e.g. the parent refused the intervention, the family were not at home when the DHSW attempted a home visit, the DHSW made contact with the family but did not deliver any of the aforementioned components).

5.6.6.4 Participation at dental practice (MIDAS data)

Participation at dental practice is defined as a child being either registered at and/or attending a dental practice for treatment. This is the variable recommended by ISD. The earliest date for either of these events was taken as the 'date of participation'. In this way we overcame the problems where (1) some children in the dataset had a treatment date but no registration data and vice versa and (2) some treatment dates preceded registration dates.

5.6.6.5 Scottish Index of Multiple Deprivation (SIMD) (2009) (linked to datasets by ISD)

The SIMD is based on geographical area in which children live and provides a relative ranking of deprivation across Scotland. The geography of Scotland is divided into data zones and these data zones are ranked based on seven deprivation indicators. These indicators are income, employment, health, education, access to services, housing and crime (The Scottish Government, 2009). Ranks are then grouped into categories, such as the quintiles reported in this study with categories ranging from 1 (20% most deprived) to 5 (20% least deprived).

As this study tracked changes in health boards over time, we used the SIMD release for 2009 which is the year closest to the time the Childsmile referral box "went live" on the Child Health Surveillance form. Using one SIMD release throughout the analysis is recommended for studies taking this approach (ISD, 2010).

National SIMD provides the rankings relative to national levels of the indicator measures, whereas local SIMD provides the rankings relative to levels within the health boards.

5.6.6.6 Urban/Rural classification (linked to datasets by ISD)

This variable indicates the urban/rural classification of the area in which a child lives based on the child's postcode. There are six categories ranging from 'large urban area' as the most populated to 'remote rural' as the least populated.

5.6.6.7 Health Board of Exam (Child Health Surveillance data)

This variable indicates the health board within which the health visitor conducting the 6-8 week CHS assessment is based. Data from the island boards have been grouped to limit potential disclosure of otherwise anonymous personal information. The health boards are as follows: NHS Ayrshire & Arran (AA); NHS Borders (B); NHS Fife (F); NHS Greater Glasgow & Clyde (GGC); NHS Highland (H); NHS Lanarkshire (La); NHS Grampian (G); NHS Lothian (L); NHS Tayside (T); NHS Forth Valley (FV); NHS Dumfries & Galloway (D&G); and, the Islands (ISL) which included NHS Orkney, NHS Shetland, and NHS Western Isles.

5.6.6.8 Feeding (Child Health Surveillance data)

This variable indicates whether a child is breastfed, bottle-fed or both breast and bottle-fed at the time of the 6-8 week CHS assessment.

5.6.6.9 Smoking (Child Health Surveillance data)

This variable indicates whether or not a health visitor recorded that a child resided in a household with a smoker at the time of the 6-8 week CHS assessment. A 'missing' category was included due to the high percentage of

missing values for this variable. This was due to health visitors leaving this section of the CHS form incomplete.

5.6.6.10 Health Plan Indication (HPI) (Child Health Surveillance data)

This variable is used by health professionals to indicate whether a child has been assessed as requiring a core, additional or intensive programme of support. 'Core' indicates that the child requires only that support which is universally available to all children. 'Additional' indicates that structured support should be put in place in addition to the universal programme. 'Intensive' indicates that intensive inter-agency support is required.

5.6.6.11 Level of risk

We calculated the 'level of risk' for each individual child in the dataset. This is an aggregated risk score based on four factors: area-deprivation (SIMD), type of feeding, smoking, and health plan indicator. Each child in the dataset was given a score of 1 for each of these four risk factors, and a '0' otherwise:

- Living in the most deprived areas (SIMD 1)
- Being bottle-fed
- Living in a smoking household
- Being assigned an 'intensive' health plan by a health visitor at 6-8 weeks

We report outcomes in relation to '0 risk factors', '1 risk factor' 2 'risk factors' and 'high risk'. 'High risk' is 3 or more risk factors.

5.6.7 Statistical methods

Data management and statistical analysis were undertaken using Stata (Stata Version 14) and SPSS (SPSS Version 22).

5.6.7.1 Statistical power

This study uses a large cohort of children (n=114,097) which is the population of children who had a Child Health Surveillance assessment between 1st September 2010 and 30th September 2012. This is a large population cohort which is geographically defined, with a pre-determined sample size, therefore a conventional power/sample size calculation is not appropriate. With this large sample, small effect sizes may be statistically significant but not "important" from a public health perspective. We therefore placed more emphasis on the effect sizes and precision of estimates than on the p-values alone.

5.6.7.2 Descriptive statistics

Differences in outcomes (health visitor referral through the Childsmile referral pathway; referral through any pathway; 'dosage' of intervention; type of contact) according to geographical (area-deprivation, health board, urban-rural classification) and family (feeding, smoking, HPI, level of risk) variables were explored descriptively and presented in stacked column charts and bar charts. Dental participation was examined descriptively by health visitor referral through the Childsmile referral pathway, DHSW intervention, area-based deprivation and 'level of risk'. This was presented descriptively in bar charts and plot point charts.

5.6.7.3 Univariable regression models

For each binary outcome (health visitor referral through the Childsmile referral pathway; referral through any pathway; 'dosage' of intervention), geographical and family variables were entered into a univariable logistic regression model.. Odds-ratios (OR) were calculated and Wald p-values and 95% confidence intervals (95% CI) were given for each OR. The c-index was calculated as a measure of the predictive ability of each variable.

5.6.7.4 Multivariable regression models

Multivariable logistic regression modelling was carried out in order to examine the factors associated with following binary outcomes: health visitor referral, referral through any pathway, and 'dosage' of the DHSW intervention. For each outcome, a stepwise regression model was used, entering each geographical and

family variable in turn. P-values for entry were fixed at 0.05 due to the large sample size. 'Local SIMD' and 'level of risk' were not entered into the multivariable models due to their strong association (inter-correlation) with other variables in the model ('national SIMD' and smoking, feeding and HPI at 6-8 weeks). Adjusted odds-ratios (AOR) were calculated and Wald p-values and 95% confidence intervals were given for each AOR. The c-index was calculated as a measure of the predictive ability of each multivariable model.

Multi-level analysis was considered as a method for determining which 'level' of the data (e.g. family, health board, urban-rural geography) would best explain the variation in the selected outcomes. The reason a multi-level analysis was not carried out was due to descriptive statistics revealing that health board was indeed the most influential factor. As this study included data from the early phase of the national roll out of the DHSW intervention, there was not enough data available from all health board to conduct a multi-level analysis within each health board.

5.6.7.5 Interpretation of the c-index

A c-index is reported for each of the univariable and multivariable models. The c-index indicates the area under a Receiver Operating Characteristic (ROC) curve. This is a plot of sensitivity versus (1-specificity) for the model being tested. In a ROC curve, the accuracy of the model at separating the groups into those with or without the relevant outcome is being tested. We have taken this as a measure of the models' "predictive ability" and, for clarity, used broad categories for the accuracy of prediction based on a 'rule of thumb' adapted from Zou et al. (2007) (1.0 is interpreted as excellent predictive ability through to less than 0.5, which is worse than chance). Calculating rates

In order to examine whether the rates of attempted DHSW interventions improved over time, the rate of attempted interventions was calculated for each quarter (3 month period) from 1st September 2010. The rate was calculated as an incidence rate in order to account for varying time periods of follow-up for each child in the cohort as some children are in the cohort for longer than others.

The calculation was as follows:

$$\text{Incidence rate} = \frac{\text{Number of attempted DHSW interventions in each 3 month period}}{\text{Total person} - \text{months in the cohort in each 3 month period}}$$

This incidence rate was multiplied by 1000 to give the rate of attempted DHSW interventions per 1000 person months.

5.6.7.6 Survival analysis

In order to explore the effect of the DHSW intervention on dental participation, while taking account of the fact that children in the dataset had unequal lengths of time in which to reach this outcome, survival analysis was undertaken.

In this survival analysis 'time to event' meant time taken for a child to participate at a dental practice. This was calculated from the time of birth to time of dental participation. The effects of the DHSW intervention and implementation of the Childsmile referral pathway were examined in relation to survival. Any differences in effect of the DHSW intervention between area-based deprivation categories and 'level of risk' were also examined.

Life tables were produced in order to ascertain the median number of months taken for children to participate. Following this, Cox regressions were performed in order to look at the effects of the DHSW intervention and the implementation of the Childsmile referral pathway. The results are presented as survival curves and regression tables.

The proportional hazards assumption that the hazard ratio remains constant for the groups being tested over time was deemed to hold by examining the plots produced for the Cox regression by SPSS. The lines of the survival curves did not overlap and we were satisfied that the assumption held.

5.7 Integration of data

Creswell and Plano Clark (2007) suggest that there are three critical decisions that determine the structure of a mixed methods design. The first is "the timing

decision", the second is "the weighting decision", and the third is "the mixing decision".

5.7.1 Timing and ordering

The timing and ordering decision relate to when the qualitative and quantitative data are collected and whether they are collected simultaneously or sequentially. In some research designs, qualitative data may be collected to inform quantitative survey design. In such a scenario, the qualitative data would be collected and analysed before the quantitative data. Here the former are often viewed as generating questions to be tested more definitively. Alternatively, qualitative data may be used to explore quantitative findings in more depth by looking at the processes that give rise to the observable phenomena. Here, the former explore issues raised by a definitive result or statistical pattern. In such a scenario, qualitative data would be collected after quantitative data had been collected and analysed.

In our study, the quantitative data already existed in administrative health databases and only had to be linked rather than collected. It was our initial intention to analyse the quantitative data first, identify any problems with the implementation of the referral pathway or the DHSW intervention and then explore these and other issues in more depth through qualitative data collection. The quantitative data linkage was conducted by ISD and, as the datasets required for this study were only a subset of several datasets that were being linked for the purposes of evaluating the wider Childsmile programme, the process took longer than anticipated. In the meantime, we used the results of the process evaluations and the available aggregated data from Childsmile monitoring reports to anticipate the kind of problems that might be identified through the quantitative analysis of the linked data. In the end, the qualitative and quantitative analysis took place simultaneously with the results of each illuminating the other.

The quantitative data available in the administrative datasets related to children who had a health visitor assessment between 1st September 2010 and 30th September 2012. These were the most recent data available at the time the data linkage occurred. The qualitative data were collected from June to

November 2013. Although the “observation” periods for the quantitative and qualitative data differ, we were confident that any changes to organisation structure that may have affected the way the intervention was targeted or tailored between September 2012 and mid-2013 would be mentioned by participants in the qualitative focus groups and interviews and could be taken into account in our interpretation of the data.

5.7.2 Weighting

The weighting decision relates to whether an equal or unequal weight, in terms of relative importance, will be assigned to qualitative or quantitative data. As previously mentioned, the approach I took to this research was to prioritise the research questions and then choose the most appropriate methods. On one hand, there were some research questions that could be answered in more detail with the qualitative data, while the quantitative data corroborated certain points. On the other hand, there were other questions where the quantitative data were able to provide a more complete and detailed overview of implementation while qualitative data offered some explication of the quantitative results. Neither qualitative nor quantitative data were given more weighting in terms of validity or reliability beyond the capability to answer each research question sufficiently.

5.7.3 Mixing

The options for mixing suggested by Creswell and Plano Clark (2007), and represented in the mixed methods literature, are (1) transforming the data types so they can be merged and integrated, (2) embedding one type of data within another, or (3)presenting the data separately, but connecting them together to answer the same, or similar, research questions.

I chose to present the data in a separate but connected way for three reasons:

(1) The quantitative and qualitative data related to slightly different time periods

(2) The variables in the quantitative data did not map directly on to themes I wanted to explore through qualitative data collection

(3) The weight assigned to each data type differed depending on the research question.

By connecting the data in this way, this mixed methods study took a convergent design (Creswell, 2011). This meant that, for many aspects of most of the research questions, there was 'triangulation' of evidence as one data type corroborated or challenged the findings of the other.

In mixed methods studies, qualitative data is often used to provide illustration for quantitative findings, adding breadth and depth to the analysis; however, we have taken a pragmatic approach and do not accept that qualitative data is subordinate to quantitative data (or vice versa). Rather, our approach has been 'validatory triangulation' which involves "using the degree of convergence between different data sources as an indicator of the validity of results" (Davies et al., 2003). In practice, this meant that we looked at the hypotheses generated by the quantitative and qualitative data relating to how the DHSW intervention was being implemented and looking for corroboration. Where there was discord, a new hypothesis was generated and the data were examined again to test this hypothesis.

6 Results: Description of the cohort

6.1 Introduction

This chapter describes the study cohort and will provide clarity on the origins and timeline of the data used at each stage of analysis. An explanation of the staggered implementation of the Childsmile referral pathway is presented. A table of the cohort with explanatory variables is followed by diagrams of the sub-cohorts used in the analysis for each research chapter.

6.2 Implementation of the Childsmile referral pathway

The Childsmile referral pathway (see Figure 1.1) was implemented in a staggered fashion across Scotland. NHS Ayrshire & Arran, NHS Borders, NHS Lanarkshire and NHS Highland trialled the referral pathway initially with other health boards implementing the pathway at later dates, in a staggered fashion. The timeline for implementation of the Childsmile referral pathway is shown in Figure 6.1.

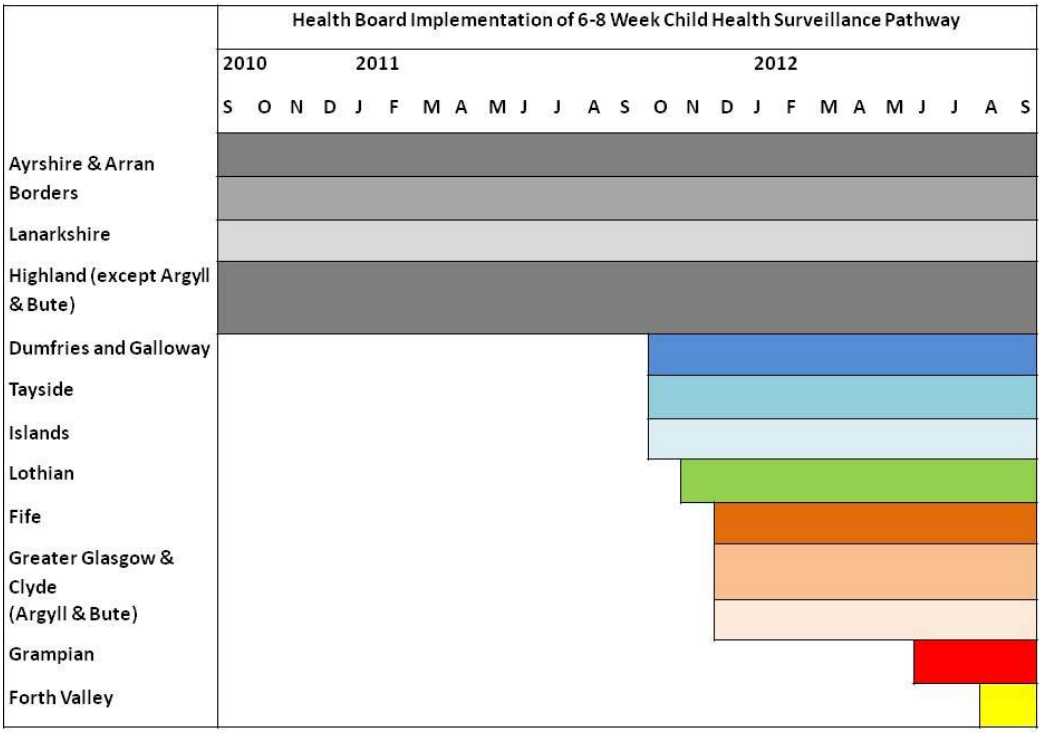


Figure 6.1- Timeline of health board implementation of the Childsmile referral pathway where children are referred for DHSW intervention by health visitors using the 6-8 week Child Health Surveillance form

6.3 Overview of the cohort

6.3.1 CHS assessment variables

Tables 6.1 and 6.2 present the characteristics of the cohort. These tables then presents the subsample of children from this cohort to whom DHSWs attempted to deliver an intervention (children in HIC) and the subsample of children for whom there was evidence of dental participation (children in MIDAS).

It can be seen from the figures that the majority of children in the whole cohort were bottle-fed (62%), 53% were assessed as requiring additional support (receiving additional health visiting support and/or support from other agencies), and 62% came from non-smoking households (note the high percentage of 'missing' values for smoking at 26%). The majority of the children in the cohort live in urban areas (large urban-41%, other urban-32%).

Of the 114097 children in the cohort, DHSWs attempted to deliver an intervention to 20% and there was evidence of dental participation for 66%.

Table 6.1- Demographics of the September 2010-September 2012 Child Health Surveillance cohort, followed through attempted DHSW interventions and dental participation

	Children who had a Child Health Surveillance assessment		Children who received an attempted DHSW contact (in HIC dataset)		Children who participated at a dental practice	
Dates	1st September 2010-30th September 2012		1st September 2010-31st December 2012		1st September 2010-30th September 2013	
	N	%	N	%	N	%
Dataset Total	114097	100	22956	20.1	74901	65.6
Gender						
Male	58513	51.3	11707	51.0		
Female	55584	48.7	11249	49.0		
National SIMD						
1 (Most deprived)	28931	25.4	9383	40.9	18093	24.2
2	24214	21.2	5070	22.1	15677	20.9
3	21738	19.1	3932	17.1	14592	19.5
4	20574	18.0	2698	11.8	14002	18.7
5 (Least deprived)	18253	16.0	1821	7.9	12359	16.5
Unknown	387	0.3	52	0.2	178	0.2
Local SIMD						
1 (Most deprived)	29005	25.4	6980	30.4	17602	23.5
2	23887	20.9	5355	23.3	15598	20.8
3	22241	19.5	4268	18.6	14806	19.8
4	20685	18.1	3643	15.9	14194	19.0
5 (Least deprived	17892	15.7	2658	11.6	12523	16.7
Unknown	387	0.3	52	0.2	178	0.2

	Children who had a Child Health Surveillance assessment		Children who received an attempted DHSW contact (in HIC dataset)		Children who participated at a dental practice	
Dates	1st September 2010-30th September 2012		1st September 2010-31st December 2012		1st September 2010-30th September 2013	
	N	%	N	%	N	%
Dataset Total	114097	100	22956	20.1	74901	65.6
Health Board						
Ayrshire & Arran (AA)	7606	6.7	1958	8.53	5264	7.0
Borders (B)	2124	1.9	329	1.43	1478	2.0
Fife (F)	8357	7.3	471	2.05	5635	7.5
Greater Glasgow & Clyde (GGC)	27423	24.0	11345	49.4	18948	25.3
Highland (H)	5768	5.1	16454	7.2	3935	5.3
Lanarkshire (La)	11597	10.2	6454	28.1	8494	11.3
Grampian (G)	11852	10.4	97	0.4	6863	9.2
Lothian (L)	20198	17.7	36	0.2	12007	16.0
Tayside (T)	8621	7.6	127	0.6	5085	6.8
Forth Valley (FV)	6329	5.5	49	0.2	4083	5.5
Dumfries & Galloway (D&G)	2873	2.5	416	1.8	1958	2.6
Island boards (ISL)	1349	1.2	25	0.1	1151	1.5

Table 6.2- Demographics of the September 2010-September 2012 Child Health Surveillance cohort, followed through attempted DHSW interventions and dental participation

	Children who had a Child Health Surveillance assessment		Children who received an attempted DHSW contact (in HIC dataset)		Children who participated at a dental practice	
Dates	1st September 2010-30th September 2012		1st September 2010-31st December 2012		1st September 2010-30th September 2013	
	N	%	N	%	N	%
Dataset Total	114097	100	22956	20.1	74901	65.6
Urban-Rural Classification						
Large urban area	47102	41.3	12257	53.4	30220	40.3
Other urban area	35994	31.5	5925	25.8	23666	31.6
Accessible small town	9194	8.1	1681	7.3	6233	8.3
Remote small town	4188	3.7	962	4.2	2856	3.8
Accessible rural	11800	10.3	1394	6.1	7855	10.5
Remote rural	5432	4.8	685	3.0	3893	5.2
Unknown	387	0.3	52	0.2	178	0.2
Feeding type						
Breast	29713	26.0	4593	69.8	20303	27.1
Mixed	11768	10.3	1941	20.0	7659	10.2
Bottle	71295	62.5	16017	8.5	46075	61.5
Unknown	1321	1.2	405	1.8	864	1.2
Smoking						
No	70530	61.8	14685	64.0	8582	11.5
Yes	14330	12.6	3401	14.8	47688	63.7
Missing	29237	25.6	4870	21.2	18631	24.9

	Children who had a Child Health Surveillance assessment		Children who received an attempted DHSW contact (in HIC dataset)		Children who participated at a dental practice	
Dates	1st September 2010-30th September 2012		1st September 2010-31st December 2012		1st September 2010-30th September 2013	
	N	%	N	%	N	%
Dataset Total	114097	100	22956	20.1	74901	65.6
Health Plan Indicator						
Core	43258	37.9	10920	47.6	29948	40.0
Additional	60833	53.3	8930	38.9	38583	51.5
Intensive	3421	3.0	900	3.9	2008	2.7
Unknown	6585	5.8	2206	9.6	4362	5.8
Level of Risk						
No risk factors	66506	58.3	10763	46.9	45091	60.2
1 risk factor	37697	33.0	9096	39.6	23853	31.8
2 risk factors	8959	7.9	2767	12.1	5402	7.2
High risk	935	0.8	330	1.4	555	0.7
Health visitor referral code						
Yes	13333	11.7	6925	30.2	39695	53.0
No	25522	22.4	1777	7.7	11263	15.0
Incomplete	17425	15.3	6282	27.4	14645	19.6
Refused	854	0.8	269	1.2	8788	11.7
Unknown	56963	49.9	7703	33.6	510	0.7

Figure 6.2 shows the adaptations made to the cohort in order to answer research questions that required quantitative analysis. It may be useful for the reader to refer to this figure at the beginning of the relevant results chapters.

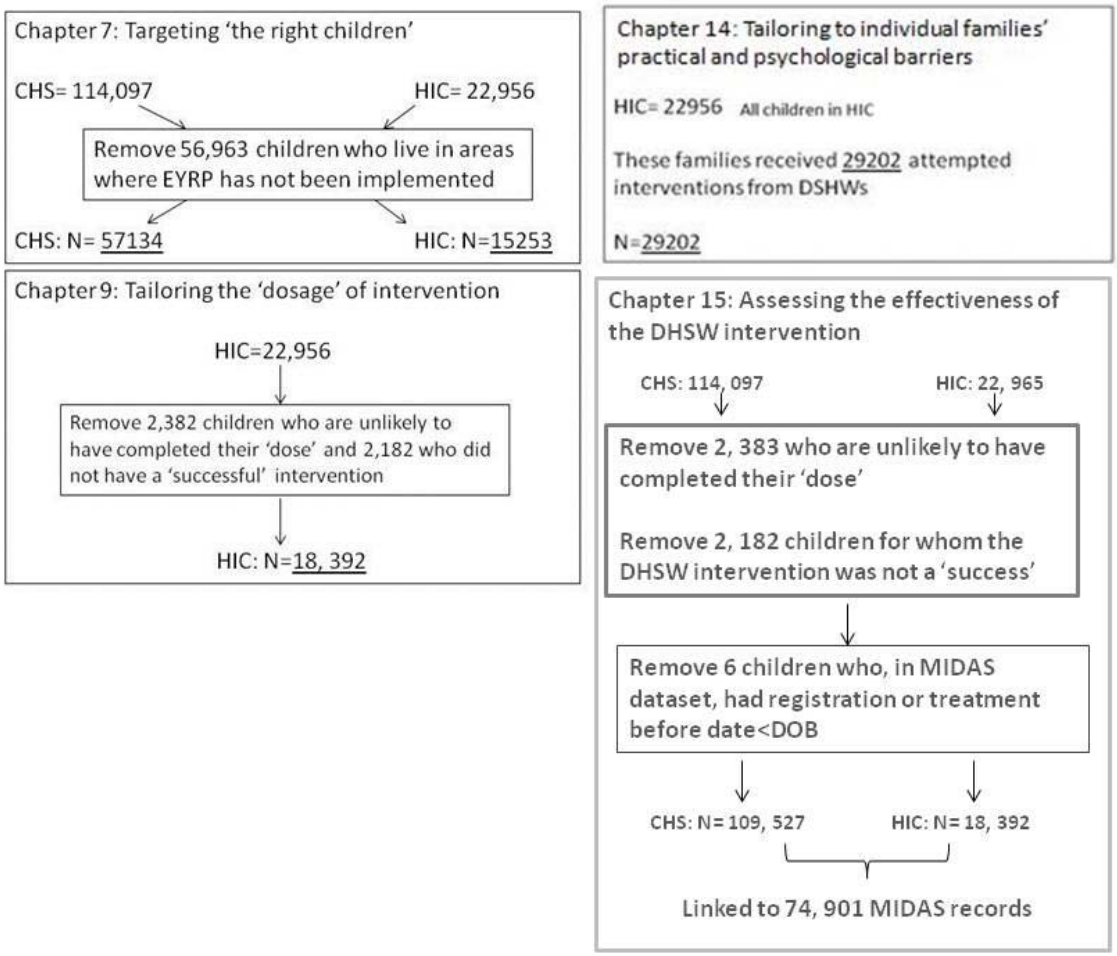
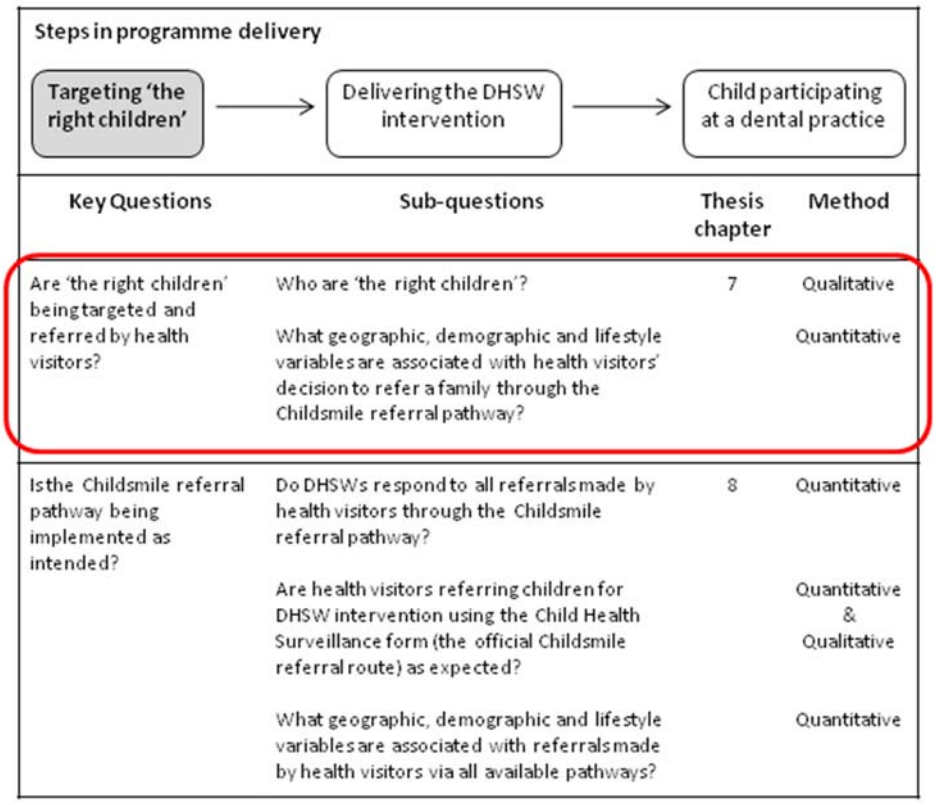


Figure 6.2- Flow diagrams of cohort used in the analysis for each quantitative research question

7 Results: Targeting the right children

7.1 Introduction

This chapter, and the subsequent chapter, will assess the characteristics of children and their families who were referred to a Dental Health Support Worker (DHSW) through the Childsmile referral pathway by a health visitor. It is through this referral pathway that children who may benefit from DHSW support are identified by health visitors and targeted by DHSWs. A description and diagram of the Childsmile referral pathway can be found in the General Introduction chapter (Figure 1.1). The aim here is to determine how 'targeted' health visitors' referrals were within health boards (if they *were* targeted), the factors that predicted if a child would be referred and, ultimately, if these were the right children. The research questions indicated in the diagram in Figure 7.1 are addressed in this chapter.



Key Questions	Sub-questions	Thesis chapter	Method
Are 'the right children' being targeted and referred by health visitors?	Who are 'the right children'?	7	Qualitative
	What geographic, demographic and lifestyle variables are associated with health visitors' decision to refer a family through the Childsmile referral pathway?		Quantitative
Is the Childsmile referral pathway being implemented as intended?	Do DHSWs respond to all referrals made by health visitors through the Childsmile referral pathway?	8	Quantitative
	Are health visitors referring children for DHSW intervention using the Child Health Surveillance form (the official Childsmile referral route) as expected?		Quantitative & Qualitative
	What geographic, demographic and lifestyle variables are associated with referrals made by health visitors via all available pathways?		Quantitative

Figure 7.1- Research questions relating to targeting 'the right children'

The Childsmile manual states that health visitors should "identify children and families who would most benefit from targeted direct Childsmile support"

(Childsmile Manual, pp.8). These children 'who would most benefit', also referred to as 'the right children' are not a well-defined group. The manual refers to SDCEP guidelines (SDCEP, 2010) which report the main evidenced-based indicators of caries risk in children to be considered. These include:

- previous caries experience;
- residence in an area of deprivation; and,
- the healthcare worker's opinion (i.e. the health visitor's opinion based on professional experience).

Using the data available from the 6-8 week Child Health Surveillance assessment carried out by health visitors, we examined the factors associated with health visitors' decision to refer children for DHSW support through the Childsmile referral pathway. First, however, the attitudes of Childsmile staff and health visitors towards the targeted nature of the DHSW intervention, and reflections on the challenge of identifying and targeting the right children are reported.

7.2 Who are the right children? Targeting versus universalism

This section presents information gathered through focus groups and interviews with Childsmile staff and health visitors. When discussing the issue of identifying the right children, some of the participants began to debate the relevance of the socioeconomic background of people who should receive the DHSW intervention. This is one of the evidenced-based indicators of high caries risk in children reported in the SDCEP guidelines (SDCEP, 2010). Across all groups there were participants who suggested that this should not be the deciding factor as need is not necessarily related to socioeconomic factors. They suggested, therefore, that referring any family could be justified simply if there were issues with the family's oral health.

While the majority of health boards have a policy of targeting the DHSW intervention at a specific population, there are some health boards and Community Health Partnerships (CHPs) that have rolled out the service

universally. Among DHSWs from NHS Lanarkshire and CHPs in NHS Greater Glasgow & Clyde, where the intervention was offered to all families, there was a strong feeling that it should be offered to everyone universally. In this group the idea that universality was 'fair' was emphasised.

Some DHSWs from NHS Highland also suggested everyone should be entitled to receive the intervention as there were many reasons that a family could benefit from support. These reasons would not be included in traditional definitions of vulnerability.

> DHSW 21, North: I think everyone's entitled to it, it's just what level of information they require and what support. But I don't think it's fair just to say, 'We're only going to see vulnerable families'. 'Cause I've got a lot, especially in this area, I've got a lot of women whose husbands work away offshore. Or they work out on the rigs and they are by themselves, and it's maybe just a bit of a hassle to get up to the dental clinic, whereas I can pop along…but I would never, ever class them as vulnerable.

Some health visitors suggested that providing DHSW support universally would be the 'gold standard', however, they recognised DHSWs as being a limited resource. Consequently, it was agreed by health visitors that targeting those children and families most in need, and offering tailored support, would be more efficient than taking a universal approach.

Within coordinator groups in the West and North, there were a minority of participants who agreed with taking a universal approach. In contrast, one coordinator in the North group expressed the majority view that as 60% of children are caries free in Scotland, 60-70% of children should not need the DHSW intervention.

> Coordinator 8, North: I think we've got to remember that pre-Childsmile, if we look at dental health statistics for children, […] two thirds of Scotland's children were getting to five years of age without any decay experience. So […], arguably, there's at least 60-70 percent of the population [that] do not need a tailored intervention 'cause, you know, pre-Childsmile they were responding to whatever messages were out there already, so you could argue that the proportion that need the tailored [support] should be […] certainly less than maybe 30 percent.

7.3 Who are the right children? The challenge of engaging health visitors in targeting the right children

The Executive group (Childsmile programme directors and programme managers) acknowledged that health visitors were not consistently referring the target group for DHSW intervention across all geographical areas. It was suggested that this jeopardised the delivery of tailored support as DHSW time and resources were allocated more sparsely across all referred families. Specific examples of this were given by the coordinator and DHSW groups.

For example, in one health board in the East, health visitors were generally not using the 6-8 week referral pathway but were referring older children for whom they had 'cause for concern'. The coordinator suggested that the health visitors may not have understood that the objective of DHSW support was early intervention to prevent dental caries and so they were, consequently, mostly referring children who already had caries.

A second example from a coordinator in the North was that Childsmile staff were frustrated that some health visitors did not understand the targeted nature of the DHSW intervention and were referring every child, under the impression that they were doing Childsmile 'a favour'. In this health board the coordinator was concerned that efforts to correct referrals may result in health visitors becoming disengaged.

> Coordinator 2, North: …it's a really fine line to tread between sort of putting them off referring completely and referring too many people.

A coordinator and DHSWs from the North provided another example of health visitors not targeting the right children. They mentioned that some health visitors were referring all families for whom English was a second language, regardless of their need for support. This placed a strain on DHSW resources and their capacity to tailor support for all families. In the DHSWs' experience, many of these families only needed to be told how and where to register with a dentist, which most DHSWs perceived to be within the remit of health visitors.

From the health visitors' point of view, those from North and East boards, where Childsmile Practice had been in operation the shortest length of time, suggested that it would be helpful if they had a better understanding of the kind of support they could expect DHSWs to provide.

> Health visitor 17, East: I'd probably like to see a job description […] now that you've […] [asked] us if there's anything that could be added to their training. I would like to maybe see what is the existing training or what's expected of them, 'cause I've never seen… Maybe […] we could ask more of them or maybe we can't. But maybe it would be a good idea…

7.4 Who are the right children? Targeting families who are ready to be referred

Participants across a number of groups described the importance of targeting families based on their readiness for change. It was reported that a family may not be sufficiently prepared for change at a particular time (or best suited to the DHSW intervention) because of varied issues such as homelessness, poor parental mental health or parental dental anxiety.

Sometimes, after contact had been initiated, it became apparent that a DHSW intervention had been attempted at the wrong time, considering other pressures the family was under. In these circumstances, respondents described a feedback loop by which DHSWs could refer the family back to their health visitor who would take appropriate action; perhaps by providing more intensive support themselves. A health visitor may recommend that a DHSW contact the family again in the future.

> Health visitor 5, West: Equally, I think if there's been a situation where it's not really […] going anywhere or there's other things going on, I know [a DHSW] has kind of stopped the visit and said 'I'll come back another time', and came back and said to me 'that was really chaotic' or you know, this was going on or that was going on …I know [DHSW]'s gone back in for me even months later.

Although a child may be identified by a health visitor as having a high oral health risk, it is necessary to also consider the family's circumstances. In some cases,

oral health may be a priority and a chronic family issue, but the family may face acute issues and challenges (e.g. homelessness, short-term unemployment, poor parental mental or physical health) that affect their ability to engage with the intervention. Depending on the family's circumstances, it may be necessary for the health visitor and other Early Years team members to provide intensive holistic support, and postpone a Childsmile referral until a time when oral health can be a priority for the child.

The previous sections have dealt with understanding who 'the right children' are. We will now use the available administrative data to evaluate the implementation of 'targeting'.

7.5 Patterns of health visitor referral for DHSW intervention across Scotland over time

Before the Childsmile referral pathway was initiated in each health board, each child's referral status on the Child Health Surveillance database was recorded as 'unknown'. Figure 7.2 shows how the pattern of health visitor referral (and, therefore, engagement with the referral pathway) changed as Childsmile Practice became more established in each health board.

From Figure 7.2 it can be seen that, at the moment when the referral pathway became operational in each health board (T=0), the percentage of records processed as 'unknown' dropped dramatically. Some records were still processed as 'unknown' after T=0 because some Community Health Partnerships (CHPs) within heath boards delayed the introduction of the pathway. Up to the time of implementation (T-1 to 0 months) the situation was in flux as some CHPs trialled the referral pathway before the official start date. Over the first 15 months we can see a pattern that reflects a 'settling-in' period before the pattern of referrals from health visitors stabilized.

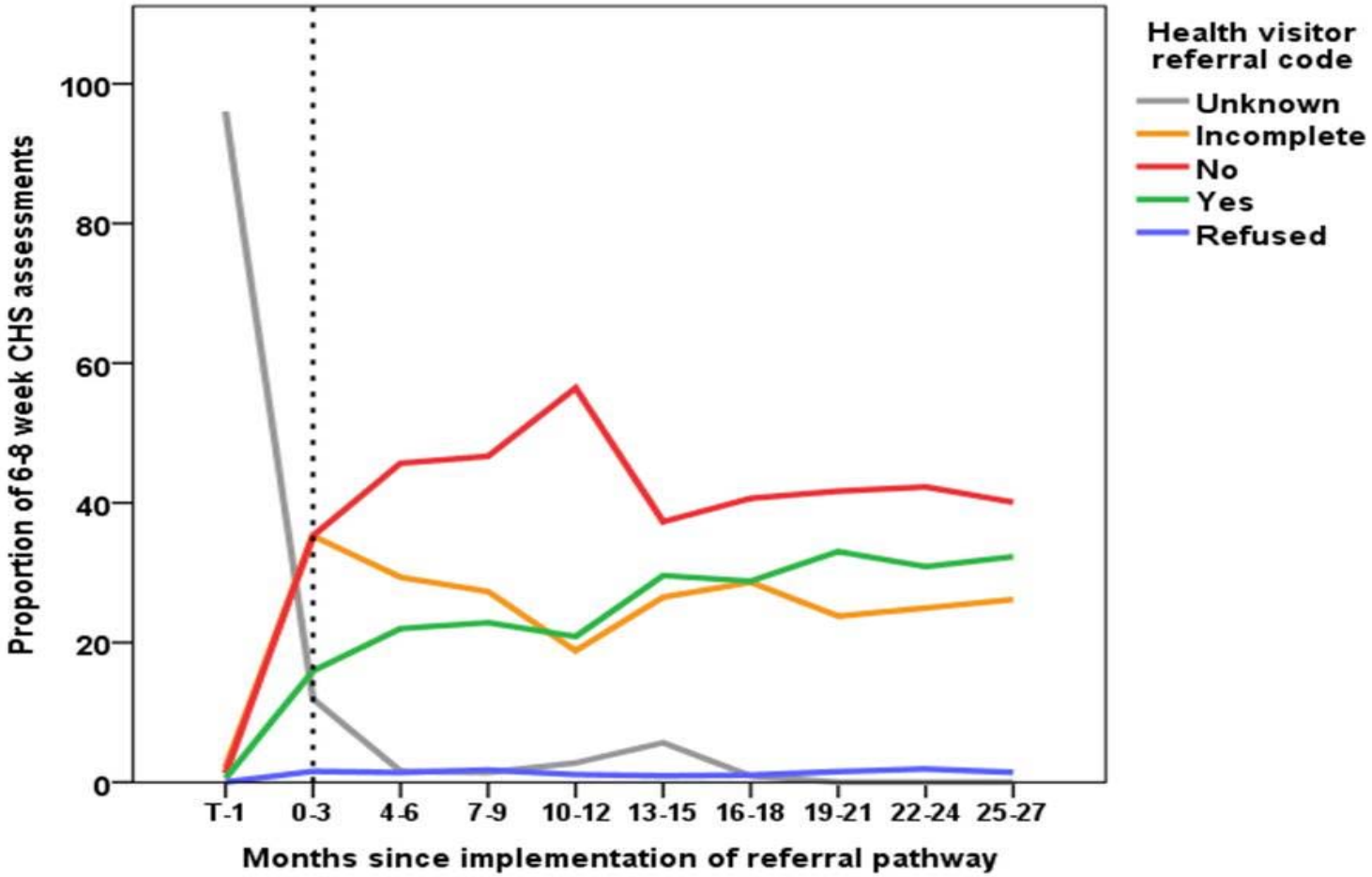


Figure 7.2- Line graph showing how health visitor referrals made through the Early Years Referral Pathway change as it becomes more established. Time of implementation is equal to the time at which health visitors in each health board could first refer children

7.6 Geographic and family factors influencing health visitor referral through the Childsmile referral pathway

This section will focus on the Childsmile referral pathway in those areas and times where it was operational (see Figure 6.1). This means that all children for whom the Childsmile section on the Child Health Surveillance (CHS) form was processed as 'unknown' are excluded (n=56963). For these children, the official Childsmile referral pathway was not available.

7.6.1 Patterns of health visitor referral through the Childsmile referral pathway across Scotland

Figure 7.3 shows the pattern of health visitor referrals for the study cohort across Scotland.

From Figure 7.3 it can be seen that, across the whole cohort of children who had a CHS assessment, there was a substantial percentage of 'Incomplete' (31%) forms. 'Incomplete' forms indicate that the Childsmile referral pathway was operational but the protocol for referring children was not followed (i.e. the Childsmile section of the CHS form was not completed by health visitors). There was a higher percentage of children deemed by health visitors not to require a referral (45%) than were referred (23%) for a DHSW intervention. A small proportion of parents refused a referral when offered (2%).

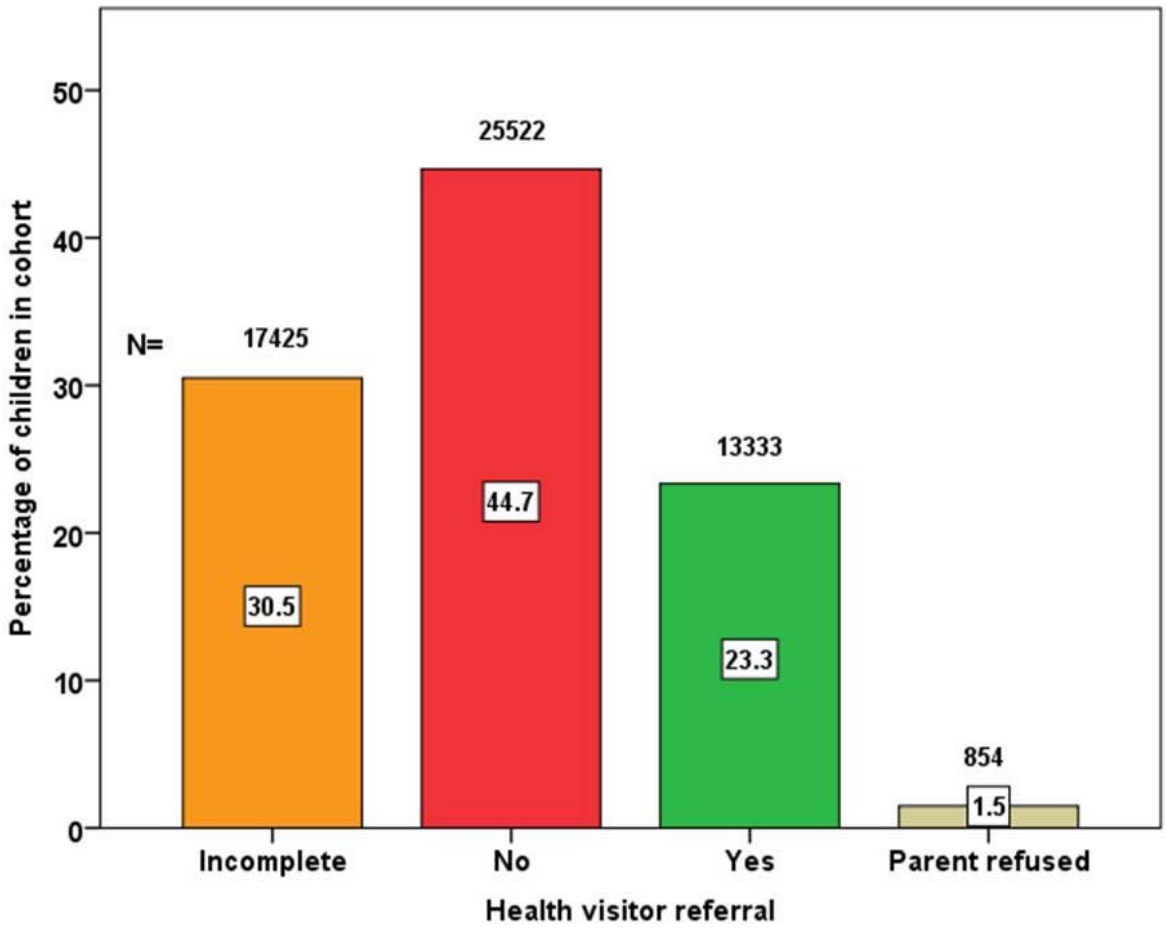


Figure 7.3- Health visitor referrals for whole cohort across Scotland from 1st September 2010- 30th September 2012- excluding those where the referral pathway was not in operation (n=56, 963)

In order to assess who the right children were, health visitors were expected to base their decision on whether a child had any previous caries experience, whether they lived in an area of high deprivation and a 'hunch', informed by their professional experience, that a child may be at risk. Using the variables available, theoretically, a high risk profile would be a bottle-fed child, living in a smoking household in an area of high deprivation, who had been assigned an 'additional' or 'intensive' care plan by their health visitor.

The following section examines the data available from the 6-8 week Child Health Surveillance assessment, and reports on the extent to which geographical, demographic and lifestyle variables were associated with health visitor referrals. First, it is instructive to assess whether referral patterns differ by health board and, thereafter, whether area-based deprivation or urban-rural classification are associated with health visitor referrals.

7.6.1.1 Health boards

Figure 7.4 shows that the pattern of health visitor referrals varies considerably between health boards. 'Yes' referrals ranged from 3.5% in NHS Tayside to 34% in NHS Ayrshire & Arran. NHS Greater Glasgow & Clyde (51%) and NHS Lanarkshire (62%) have the highest percentage of 'incomplete' forms. This issue is explored further in Section 8.1.2. NHS Greater Glasgow and Clyde (3%) and NHS Grampian (3%) have the highest percentage of parents who refused a referral.

Univariable regression models were developed for each variable. These can be viewed in Appendix 18. Referral rates were highest in NHS Ayrshire & Arran and NHS Greater Glasgow & Clyde compared to other health boards.

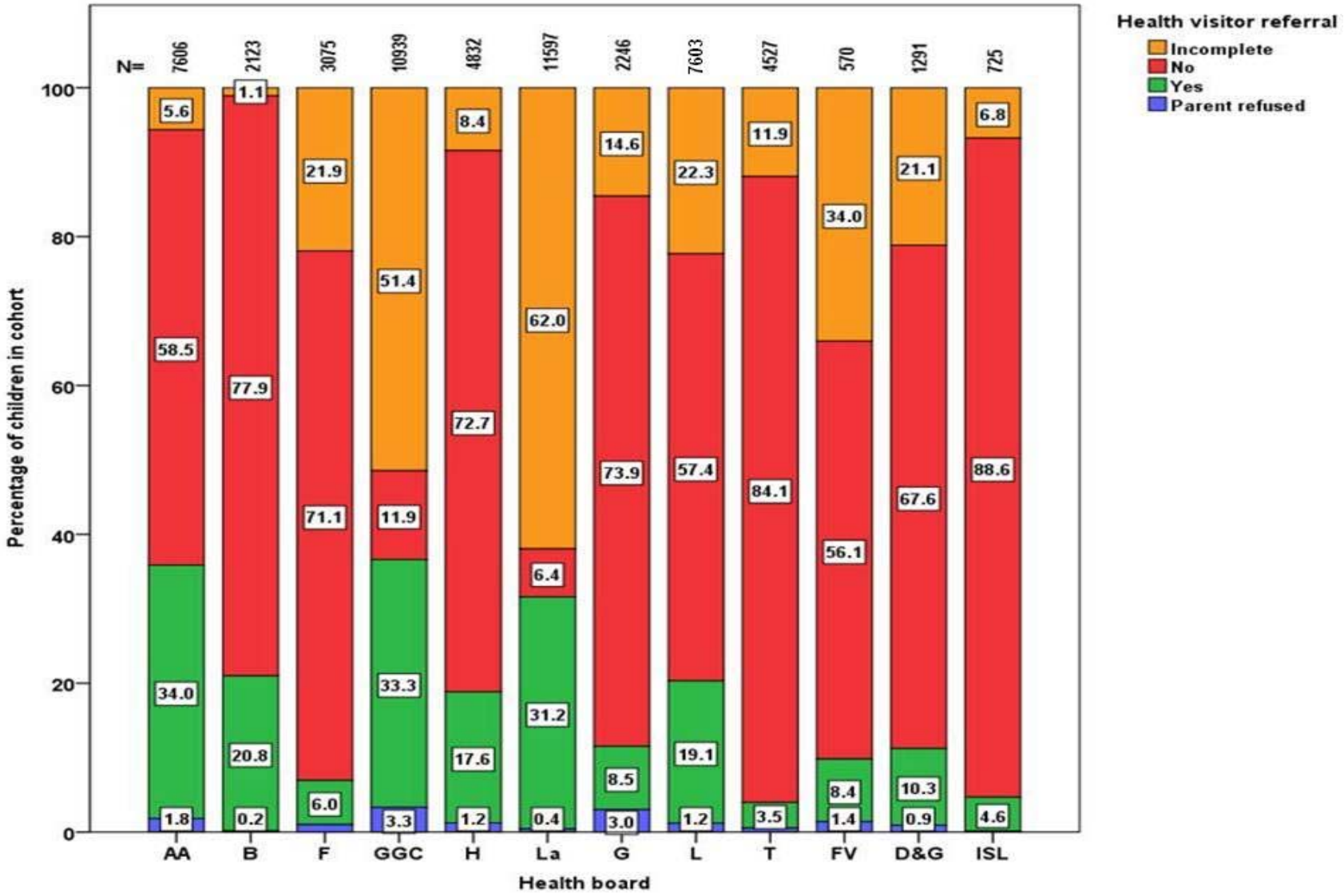


Figure 7.4- Health visitor referral patterns shown by health board from 1st September 2010-30th September 2012 where the Childsmile referral pathway was implemented (N=57134)

7.6.1.2 Area-based deprivation

Figure 7.5a and 7.5b show health visitor referrals by area-based deprivation according to national (Figure 7.5a) and local (Figure 7.5b) SIMD.

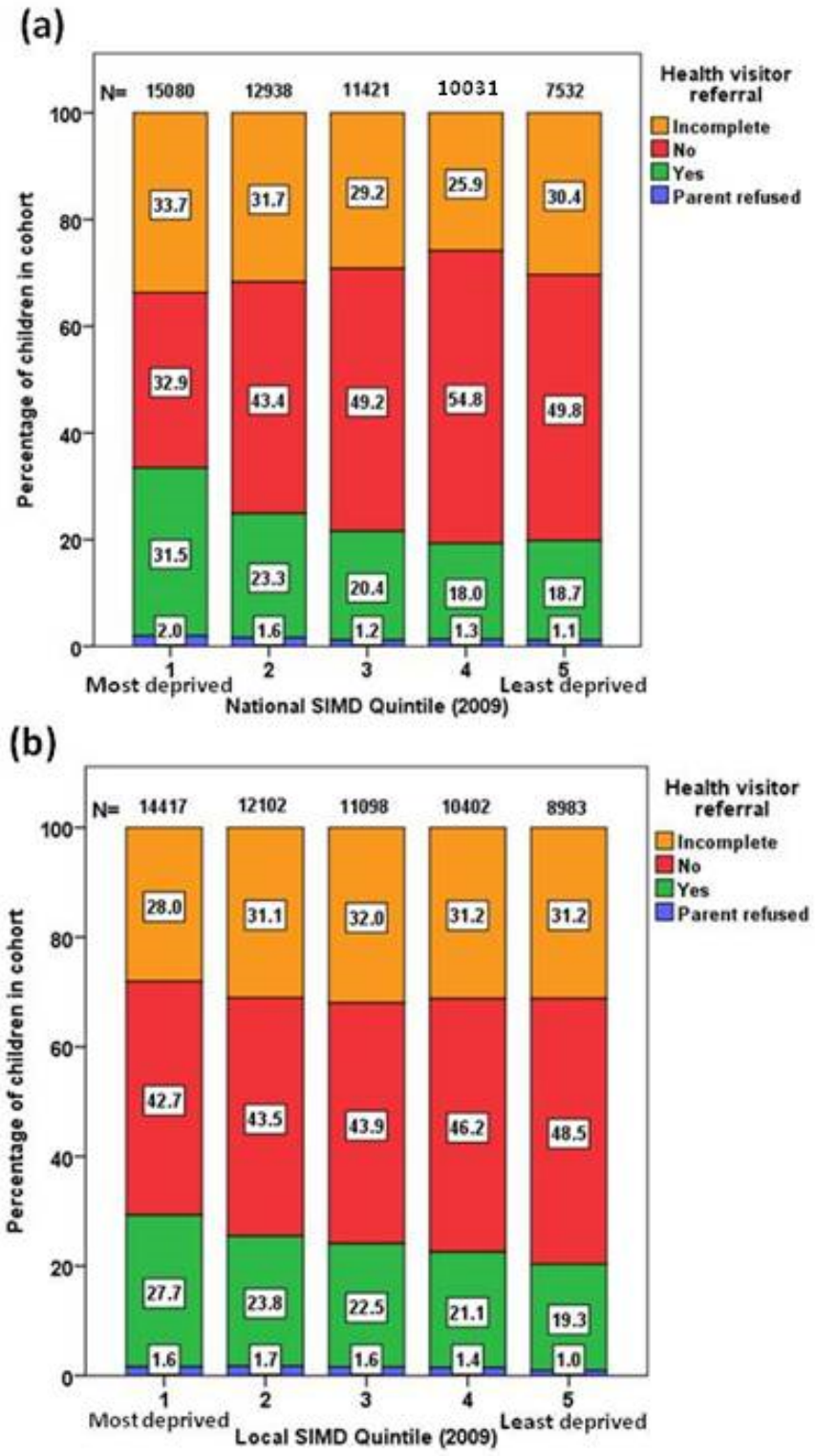


Figure 7.5- Health visitor referrals shown by (a) national and (b) local SIMD distribution (N=57002)

From Figure 7.5a and 7.5b we can see that the percentage of children who are referred to a health visitor increased with deprivation and the percentage of children not referred was greater among those living in more affluent areas. The percentage of parents who refused a referral was also greater in more deprived areas (SIMD 1 & 2). The percentage of incomplete forms was similar across SIMD categories.

The gradient in the percentage of children referred was not as distinctive as would be expected from a targeted programme as there were 19% of children in the least deprived areas referred for support compared to 28-32% in the most deprived areas.

In a univariable model, there was a gradient in association between SIMD and referral through the Childsmile referral pathway. For national SIMD, those children living in the 20% most deprived areas (SIMD 1) were twice as likely to be identified for referral through the pathway (OR=2.03 95% CI [1.90, 2.17], p=<0.001) compared to the 20% least deprived. Those in SIMD 2 were 1.3 times more likely (OR=1.34 95% CI [1.25, 1.43], p=<0.001) and those in SIMD 3 were 1.1 times more likely (OR=1.11 95% CI [1.04, 1.20], p=0.004) to be identified for referral. In a univariable model, local SIMD showed a similar gradient as national SIMD (see Appendix 18).

7.6.1.3 Urban-rural classification

Figure 7.6 shows variation in the pattern of referrals across urban-rural areas. A higher percentage of children were referred in urban areas (26% in 'large' and 'other' urban areas) and small towns (19-21%) compared to rural areas (16% in 'accessible' and 13% in 'remote' rural areas). There were also a higher percentage of 'incomplete' forms in large urban areas (41%) and accessible small towns (31%). This probably reflects the demographics of NHS Greater Glasgow & Clyde and NHS Lanarkshire which are highly populated and have the highest percentage of 'incomplete' forms (see Figure 7.4).

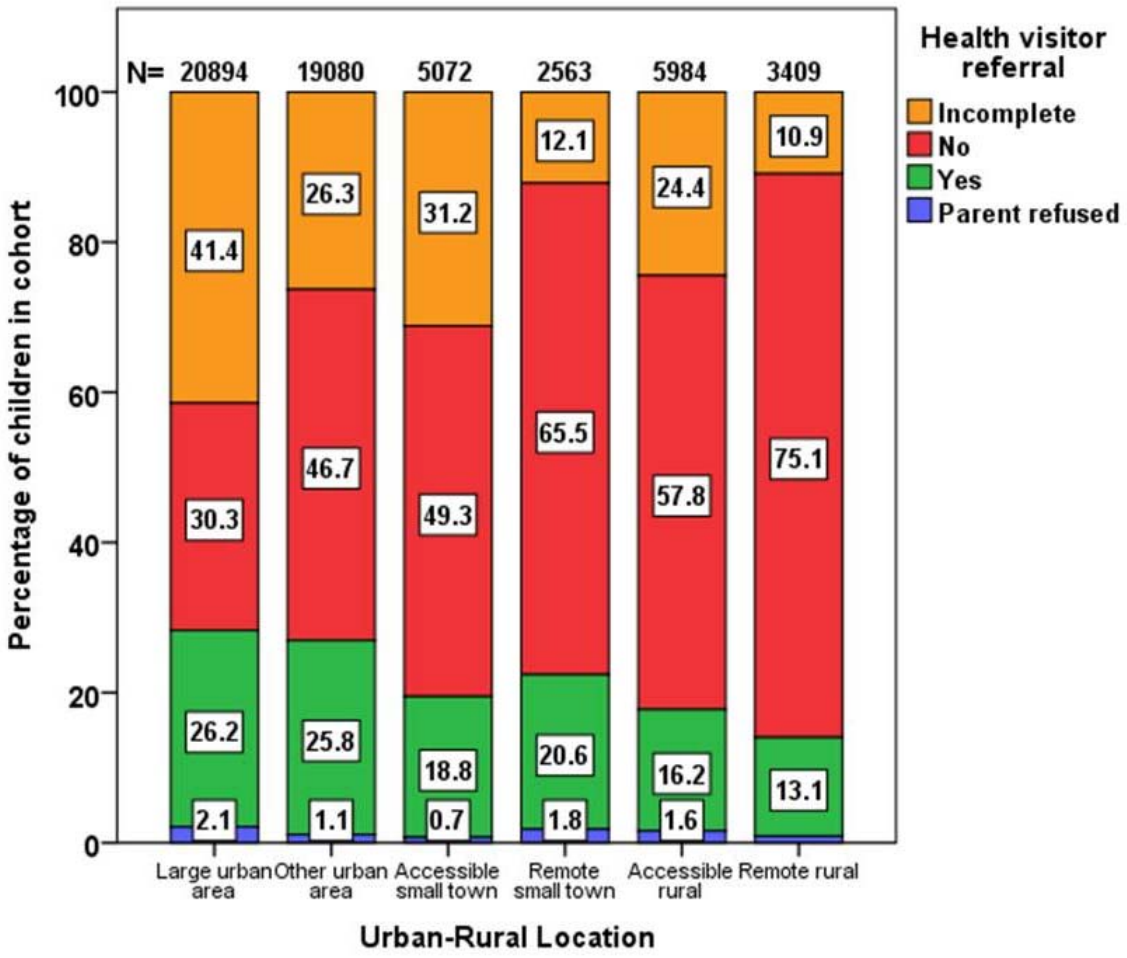


Figure 7.6- Health visitor referrals shown by urban-rural classification of the area where children live (N=57002)

A univariable model showed that children living in urban areas (large urban= OR=2.42 95% CI [2.19, 2.68], p=<0.001; other urban= OR=2.26 95% CI [2.04, 2.51], p=<0.001), small towns (accessible small towns= OR=1.48 95% CI [1.32, 1.67], p=<0.001; remote small town= OR=1.77 95% CI [1.55, 2.02], p=<0.001) and accessible rural (OR=1.32 95% CI [1.18, 1.49], p=<0.001) areas were more likely to be identified for referral than children living in remote rural areas.

7.6.2 Family variables

This section reports the extent to which breastfeeding, smoking and health plan indicator (HPI) variables were associated with health visitor referrals.

7.6.2.1 Health visitor referrals by feeding practice

Figure 7.7 shows the pattern of health visitor referrals by feeding practice (breast, bottle, or mixed).

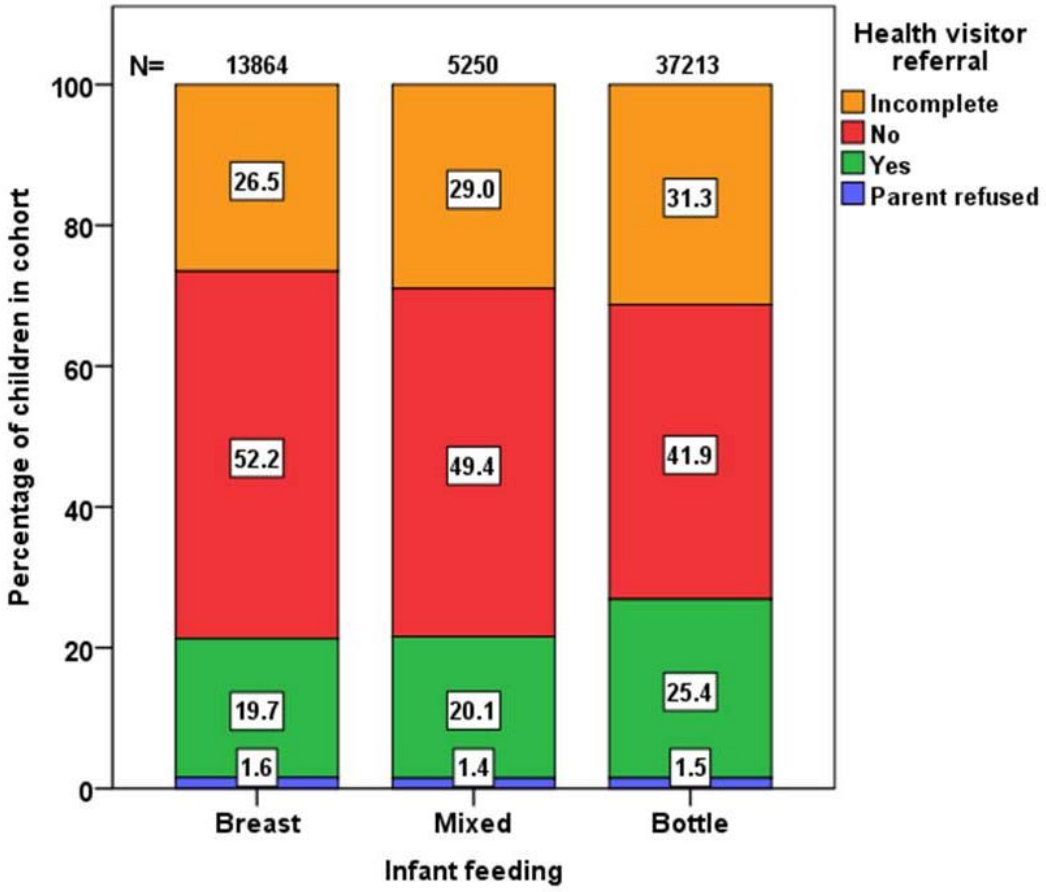


Figure 7.7- Health visitor referrals shown by feeding practice (N=56327)

From Figure 7.7 it can be seen that there were slight differences in referral patterns for breast, bottle and mixed-fed children. There was a higher percentage of bottle-fed children (25%) referred compared to breast or mixed-fed children. There were slightly higher percentages of 'incomplete' forms for bottle-fed children (31%) than breastfed (27%) or mixed-fed (29%) children. This may reflect the underlying pattern of NHS Greater Glasgow & Clyde and NHS

Lanarkshire having a high percentage of 'incomplete' forms, as these health boards had higher percentages of bottle-fed children.

A univariable model showed that children who were bottle-fed were more likely to be referred than breastfed children (OR=1.36 95% CI [1.30, 1.43], p=<0.001).

7.6.2.2 Parental smoking

Figure 7.8 shows variation in referral patterns between smoking and non-smoking households.

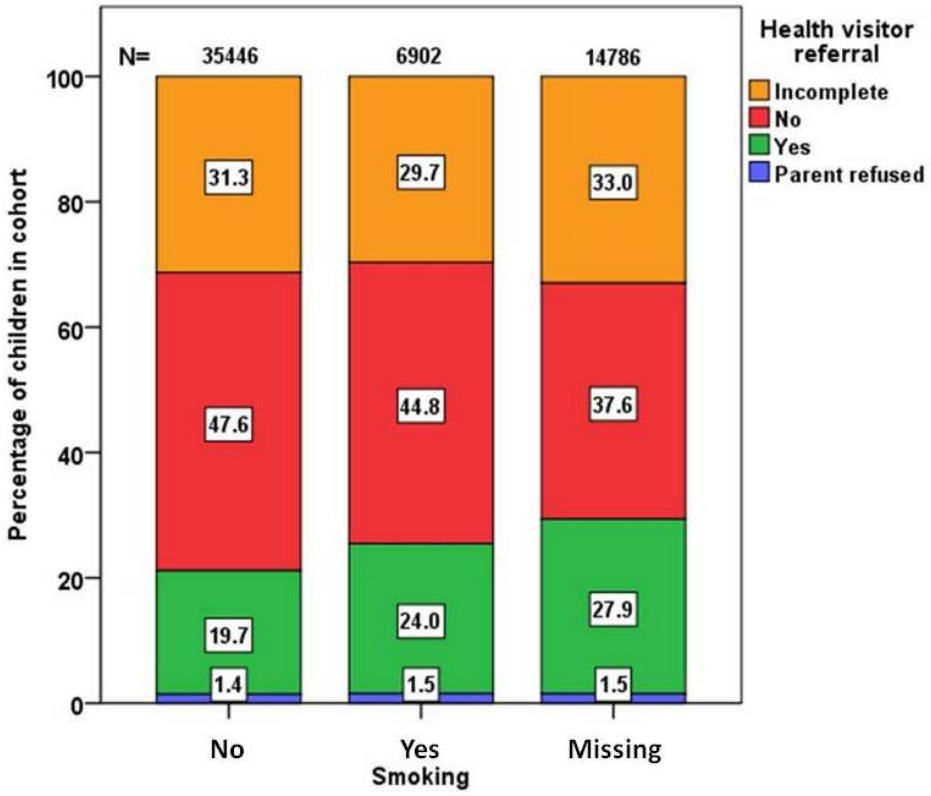


Figure 7.8- Health visitor referrals shown by parental smoking (N=57134))

From Figure 7.8 it can be seen that a slightly higher percentage of children in smoking households (24%) were referred compared to non-smoking households (20%). Results for this variable are interpreted with caution due to the large percentage of missing data for this variable.

A univariable model showed that children who lived in a smoking household were more likely to be referred than children living in a non-smoking household (OR=1.22, 95% CI [1.15, 1.29], p=<0.001).

7.6.2.3 Assessment of additional support (non-Childsmile)

Figure 7.9 shows the variation in referral patterns between HPI as assessed by health visitors at 6-8 weeks.

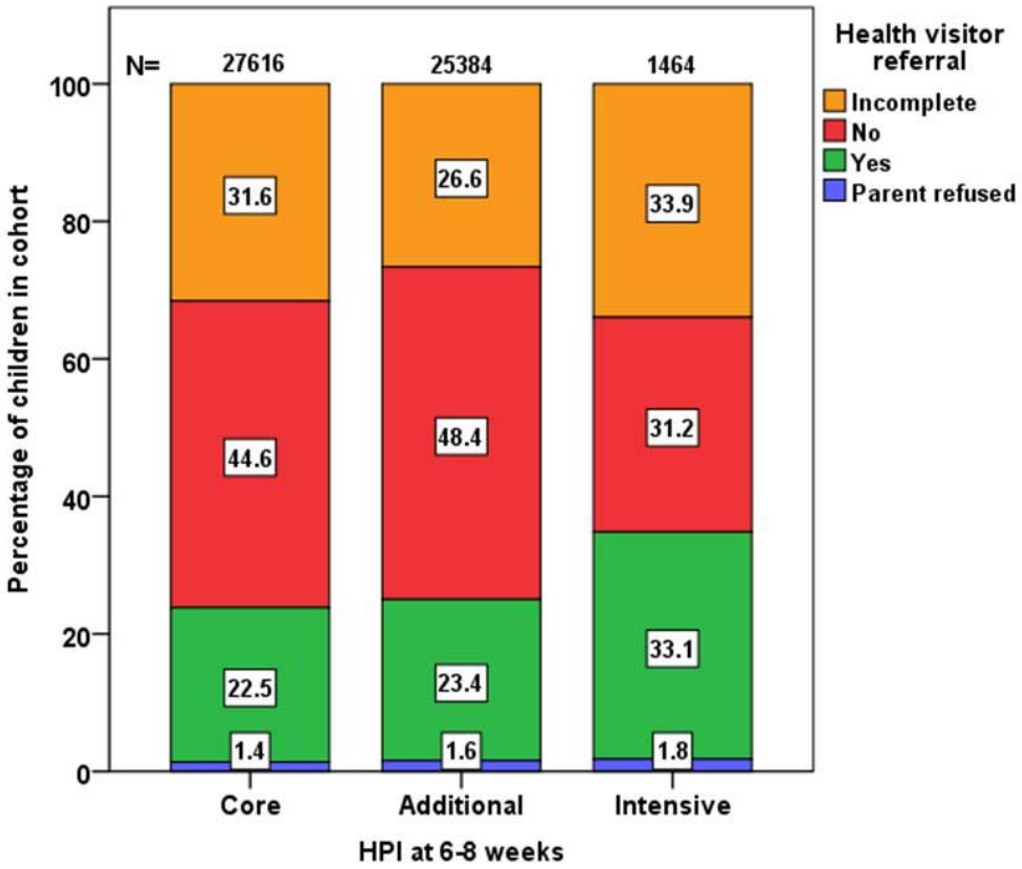


Figure 7.9- Health visitor referrals shown by HPI at 6-8 week (N=54464)

From Figure 7.9 it can be seen that referral rates to Childsmile were higher for those considered to require intensive support (non-Childsmile support) by a health visitor. A univariable model showed that children who were assigned an 'additional; care plan and those assigned an 'intensive' care plan were more likely to be referred through the pathway than those on a 'core' plan ('Additional'= OR=1.07 95% CI [1.03, 1.11], p=0.002; 'Intensive'= OR=1.71 95% CI [1.53, 1.91], p= <0.001). These results should be interpreted with caution as the

HPI categories are not associated with the same levels of support across all health boards.

7.6.2.4 Level of risk

Figure 7.10 shows the variation in referral patterns by the level of risk, which is a combined risk score calculated for each child based on their area-deprivation, feeding type, living in a smoking household and health plan indicator. In order to explore the association between risk and health visitor referral, we categorised the cohort into those children who had 'no risk factors', 'one risk factor', 'two risk factors', and 'three or more risk factors'. The risk factors included in this analysis were: living in an area of high deprivation (SIMD 1); being bottle-fed; living in a smoking household; and, being assigned an 'intensive' care plan.

From Figure 7.10 it is possible to see a gradient in health visitor referral with around 20% of children with no conventional risk factors being referred compared to 37% with three or more risk factors.

A univariable model showed that, when compared to no risk factors, there is an increasing likelihood of children being identified for referral by health visitors as the number of risk factors they are exposed to increases (1 risk factor=OR=1.46 95% CI [1.40, 1.52], p=<0.001; 2 risk factors= OR=1.80 95% CI [1.68, 1.93], p=<0.001; 3 or more risk factors= OR=2.45 95% CI [1.99, 3.01], p=<0.001).

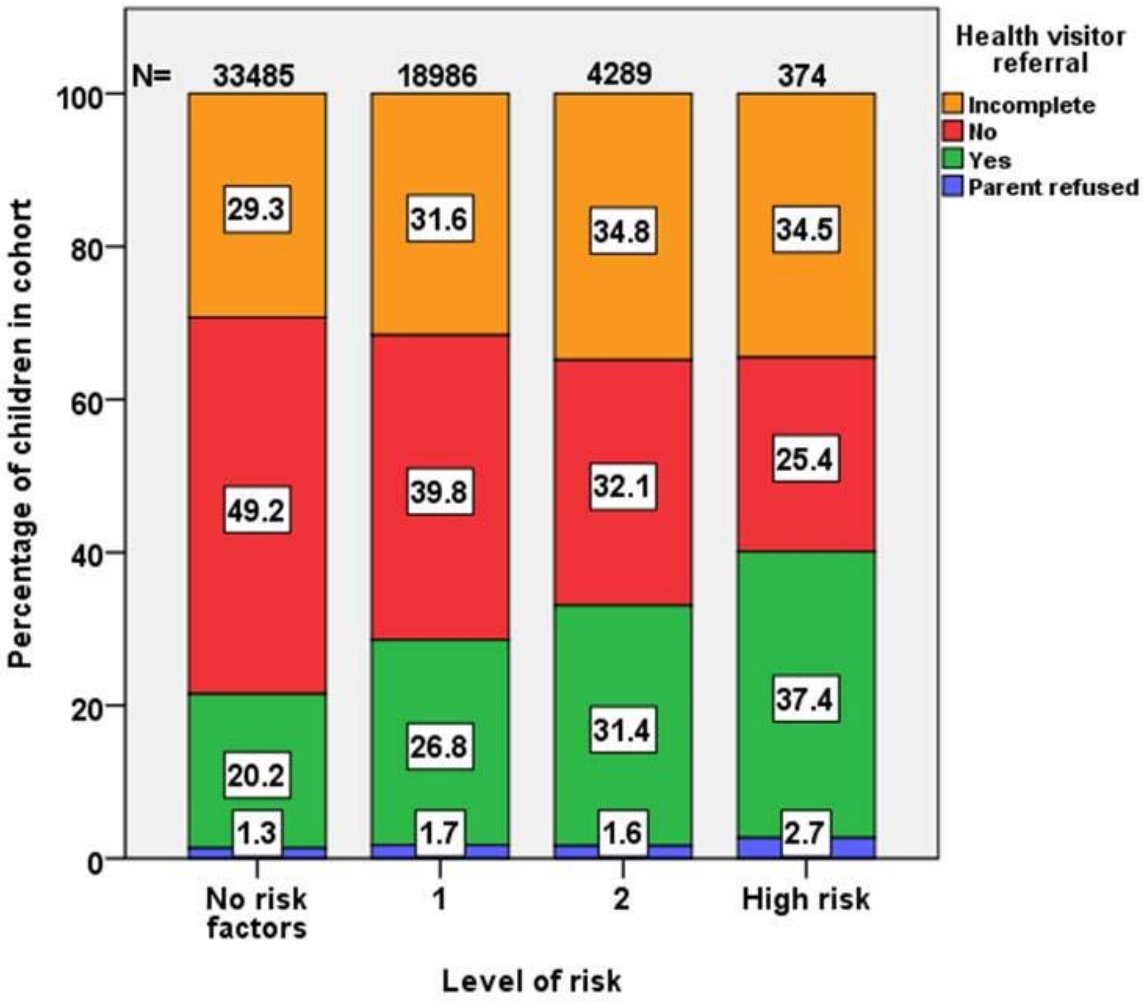


Figure 7.10- Health visitor referrals shown by 'level of risk' (N=57134)

7.6.3 A multivariable analysis of factors independently influencing health visitor referral for DHSW intervention: across Scotland

A multivariable logistic regression model to establish the key variables associated with a referral from a health visitor for DHSW support through the Childsmile referral pathway was carried out. As we specifically wanted to evaluate whether health visitors were identifying the right children, we grouped the health visitor referral ('yes') and those who were offered a referral but refused ('parent refused') and compared this to the 'no' and 'incomplete' categories. The results table can be viewed in Appendix 18. The multivariable model had a higher predictive capacity (c-index=0.70 95% CI [0.70, 0.71], p=<0.001) than any one of the individual variables (ranged from c-index= 0.52 [0.51, 0.52], p=<0.001 for Health Plan Indicator to c-index= 0.67 95% CI [0.66,

0.67], p=<0.001 for health board). Overall, variables significantly associated with health visitor referral in the univariable analysis remained so in the multivariable model, although most effect sizes were attenuated.

When adjusting for all variables in a multivariable model, children in most health boards were less likely to be identified for referral through the Childsmile referral pathway compared to NHS Ayrshire and Arran; however, there was a great deal of variation between boards which can be seen in the table in Appendix 20.

The observed gradient in association between area-based deprivation and referral through the Childsmile referral pathway was attenuated only slightly when accounting for all variables in the multivariable model. Local SIMD was not entered into the multivariable model due to its close correlation with national SIMD.

The associations found in the univariable model for urban-rural classification were attenuated in a multivariable model. Children living in urban areas were still more likely to be identified for referral through the pathway (large urban= AOR=1.16 95% CI [1.02, 1.32], p=0.02; other urban=AOR=1.40 95% CI [1.24, 1.58], p=<0.001) compared to remote rural areas. In accessible small towns children were less likely to be referred (AOR=0.87 95% CI [0.75, 0.99], p=0.04). The only other significant association was with remote small towns, in which children were more likely to be identified for referral through the pathway than remote rural areas (AOR=1.52 95% CI [1.32, 1.75], p=<0.001).

When adjusting for all other variables, children who were bottle-fed were still more likely to be referred than breastfed children (AOR=1.06 95% CI [1.01, 1.12], p=0.02), as in the univariable model, although the effect was attenuated (see Appendix 18).

The effect of living in a smoking household on referral through the pathway was much weakened within the multivariable model when compared to the univariable model, probably due to confounding with other social and family variables. When adjusting for all other variables, children who lived in a smoking household were not more likely to be referred through the Childsmile referral

pathway than children living in a non-smoking household (AOR=1.06, 95% CI [0.99, 1.13], p=0.10).

When adjusting for all other variables, children who were assigned an 'additional; care plan and those assigned an 'intensive' care plan were still more likely to be referred through the pathway than those on a 'core' plan ('Additional'= AOR=1.32 95% CI [1.26, 1.38], p=<0.001; 'Intensive'= AOR=1.58 95% CI [1.39, 1.78], p= <0.001), independent of area-based deprivation, urban-rural classification, feeding type, and smoking.

7.6.4 A multivariable analysis of factors independently influencing health visitor referral for DHSW intervention: within health boards

7.6.4.1 Multivariable model

Due to the marked observed variation in referral patterns between health boards, it was important to explore whether different factors predicted health visitor referral within each health board. A multivariable logistic regression to establish the key variables associated with a referral was carried out for each individual health board. The results table can be viewed in Appendix 20.

National SIMD and level of risk are excluded from the multivariable regression due to overlapping with other variables. Urban-rural is also excluded as there are too few children in each category when this variable is broken down by health board.

Within health boards, very few showed the clear gradient of association for area-based deprivation that was seen with the multivariable regression for the whole of Scotland. Only NHS Ayrshire & Arran and NHS Greater Glasgow & Clyde had this gradient, although in NHS Fife, NHS Highland, NHS Lothian, NHS Dumfries & Galloway, and the island health boards the most deprived were more likely to be referred than the least deprived. Interestingly, in NHS Lanarkshire, children living in increasingly more deprived areas were less likely to be identified for referral than those in the least deprived areas.

Smoking was only included in the final model for NHS Borders and NHS Lothian. The pattern of association with feeding type was sporadic. In some boards it was not included in the final model, in others mixed feeding was more likely to result in referral and in others bottle-feeding was more likely to result in referral. For HPI, NHS Ayrshire & Arran, NHS Lanarkshire, NHS Lothian and NHS Tayside still showed an association of referral, but not the other health boards.

7.6.4.2 Univariable regression model with 'level of risk'

Importantly, in a univariable regression at the national level (see Appendix 19), when compared to no risk factors, there was an increasing likelihood of children being identified for referral by health visitors as the number of risk factors they were exposed to increased in most health boards. Within NHS Lanarkshire, however, this pattern is not present. The percentages of children referred in each risk category were very similar (31.2-35.1%) and there was no significant association between risk and referral (see Appendix 19).

7.7 Summary

It was somewhat challenging to extract a precise definition of who the right children were from the responses of Childsmile staff and health visitors. Many participants stressed the importance of not relying on socioeconomic status as the sole indicator of who would benefit from the intervention. It was clear that participants would accept that any family who had issues with oral health would benefit. However, Early Years prevention was suggested to be the priority for DHSWs, rather than focusing on children who already had caries.

Other cases where families need not be referred included those who require straightforward information about where and how to register with a dental practice and those families dealing with acute health, economic or social issues which may affect their ability, or willingness, to engage with the DHSW intervention.

Some Childsmile staff discussed the challenge of engaging health visitors with Childsmile protocol, in particular, with referring families for DHSW intervention.

Health visitors described a need for up-to-date information on the nature of the DHSW intervention.

Not everyone who participated in focus groups and interviews agreed with taking a targeted approach to oral health intervention. Interestingly, though, it was only DHSWs who emphasised that health programmes should be rolled out in a universal manner due to a need for 'fairness'. While it was only a minority who expressed this view, targeting is, arguably, fundamental to the success of the DHSW intervention. The lack of understanding of the underlying rationale for the targeted approach indicates a potential need for development of the theoretical training modules for DHSWs.

Each of the following variables were found to be independently associated with the health visitor's decision to refer: health board, area-deprivation, urban-rural classification, feeding type, household smoking, and HPI. It is important to note that there was a lot of variation between health boards as to what factors appeared to drive referrals.

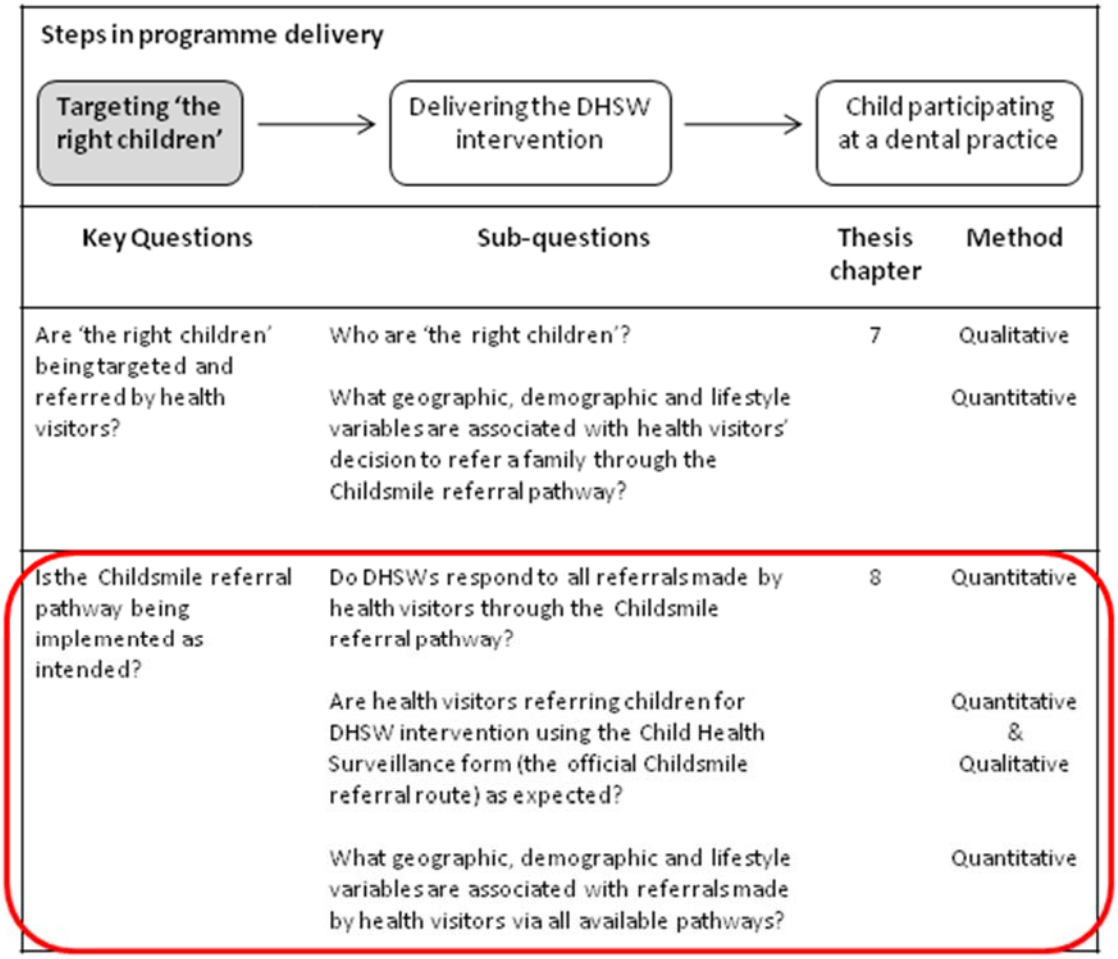
There is evidence that health visitors were targeting referrals to include children who were most in need of the intervention (i.e. those with a high risk score); although, the gradient for referrals by deprivation was found to be less pronounced than expected and not present for NHS Lanarkshire. Indeed, level of risk was associated with referral and showed a gradient in association within health boards, while NHS Lanarkshire was a notable exception. This may reflect referral practice in Lanarkshire, where the universal approach to implementing the DHSW intervention may be unnecessarily stretching resources as those who are not 'the right children' are also being referred.

The following chapter focuses on whether the Childsmile referral pathway has been implemented as intended. As a consequence of the discovery that health visitors are using 'unofficial' referral pathways, the variables associated with referrals are re-examined, taking into account referrals by all means for those children who had a Child Health Surveillance assessment between 1st September 2010 and 30th September 2012.

8 Implementation of the Childsmile referral pathway

8.1 Introduction

This chapter, following on from the previous chapter, will assess the correspondence between health visitor referrals and the Dental Health Support Worker (DHSW) intervention. The aim is to determine whether the Childsmile referral pathway is being implemented as intended. The research questions indicated in the diagram in Figure 8.1 are addressed in this chapter.



Key Questions	Sub-questions	Thesis chapter	Method
Are 'the right children' being targeted and referred by health visitors?	Who are 'the right children'?	7	Qualitative
	What geographic, demographic and lifestyle variables are associated with health visitors' decision to refer a family through the Childsmile referral pathway?		Quantitative
Is the Childsmile referral pathway being implemented as intended?	Do DHSWs respond to all referrals made by health visitors through the Childsmile referral pathway?	8	Quantitative
	Are health visitors referring children for DHSW intervention using the Child Health Surveillance form (the official Childsmile referral route) as expected?		Quantitative & Qualitative
	What geographic, demographic and lifestyle variables are associated with referrals made by health visitors via all available pathways?		Quantitative

Figure 8.1- Research questions relating to the implementation of the Childsmile referral pathway

8.2 Do DHSWs respond to all referrals made by health visitors through the Childsmile referral pathway?

At the outset of this study we made an assumption that a health visitor referral would lead to a DHSW contact on a 1=1 basis and children not referred by health visitors through the Childsmile referral pathway would not receive DHSW contact. This was not found to be the case. Due to the nature of the dataset, it was difficult to tell whether children who were referred, but did not appear in the Health Informatics Centre (HIC) dataset (the data related to DHSW intervention activity), were never contacted by a DHSW or would, given enough time, be contacted. This section reports the results of investigation into cases where children had been referred by health visitors through the Childsmile referral pathway but did not appear in the HIC data; therefore, indicating that there had been no DHSW response to the referral. We plotted rates of attempted DHSWs intervention over time. We wanted to investigate how the pattern of attempted DHSW interventions delivered to children changed as the referral pathway and the DHSW role was established in each health board.

Figure 8.2 shows the trend lines for the whole of Scotland and each individual health board. The green and orange lines show the rates of attempted interventions for referred children overall and attempted interventions made within 3 months of referral. The Childsmile manual states that families would normally be contacted by DHSWs by the time the child is 3 months old. We have, therefore, used contact within 3 months of referral as a benchmark for evaluating the intended implementation of the Childsmile referral pathway.

The black line shows the total number of children referred through the Childsmile referral pathway. The 9th quarter (3 month period) is omitted as this only contains data for the month of September 2012 and does not represent data for a whole quarter.

The Childsmile referral pathway was implemented at several different time points across health boards and adopted at a local level to different extents. As a result, the trend lines vary considerably between health boards.

Some health boards implemented the pathway towards the end of the cohort period. NHS Grampian and NHS Forth Valley are included in this category. NHS Lothian did not have DHSWs in post until after April 2012. The population of children referred through the pathway is low in these boards at this early phase of implementation.

We can see that while the number of children referred through the Childsmile referral pathway may fluctuate, the rates of children who receive an attempted DHSW intervention (and an attempted intervention within 3 months) steadily increase.

A number of boards show some clear improvement in the rate of referrals picked up by DHSWs (NHS Ayrshire & Arran, Borders, NHS Lanarkshire, NHS Greater Glasgow & Clyde, NHS Highland, and NHS Dumfries & Galloway). The island boards have a low number of referrals so the pattern looks quite erratic but this is as would be expected.

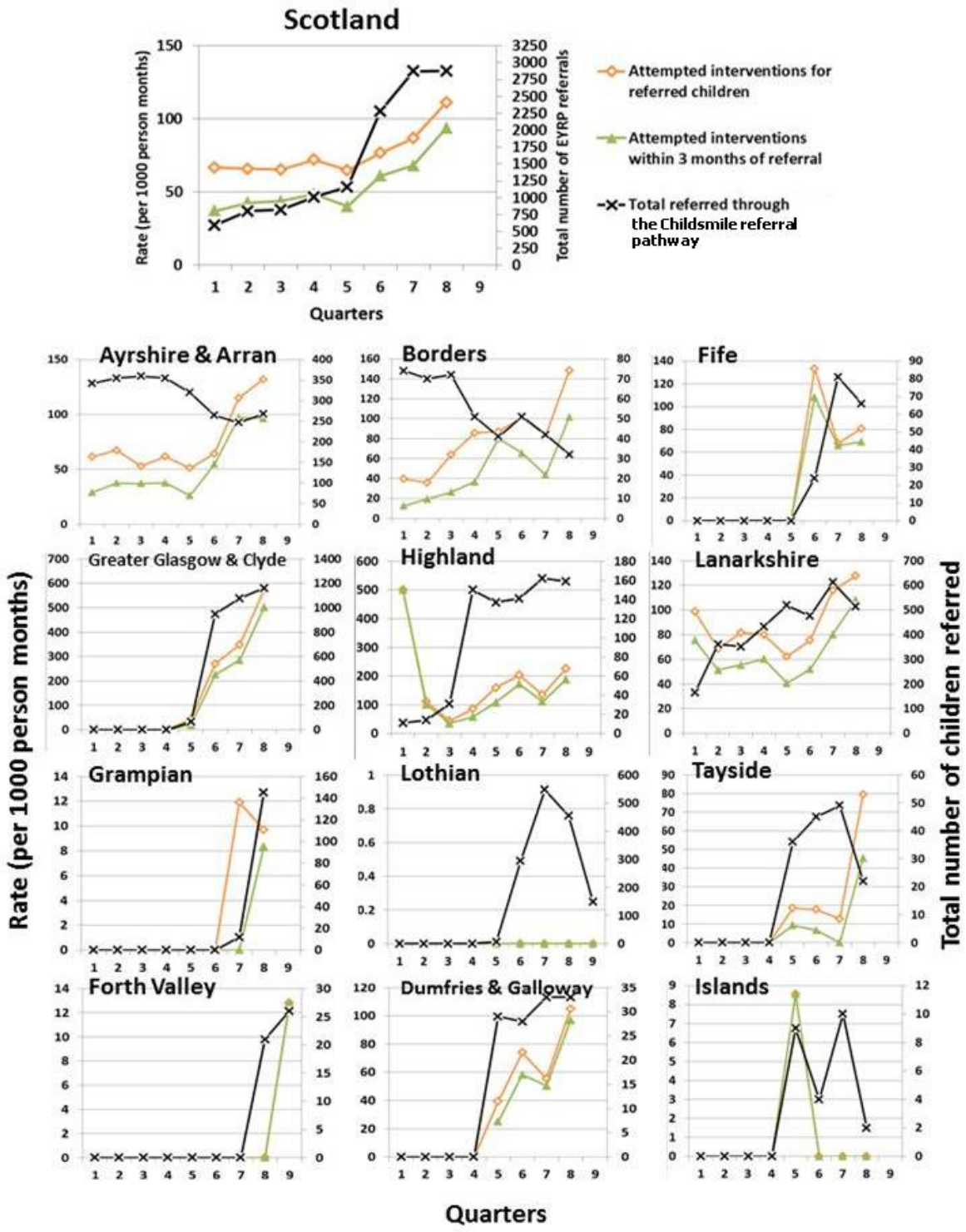


Figure 8.2- Rates of DHSW attempted intervention per 1000 person months between referral and event (event is either attempted DHSW intervention or end of cohort period, whichever occurs first).

8.3 Are health visitors referring children for DHSW intervention using the Child Health Surveillance form as expected?

The analysis of health visitor referrals described so far shows that referrals were sometimes targeted and sometimes not (see Chapter 7). In some areas where the Childsmile referral pathway was officially 'live' there were high percentages of 'incomplete' forms. This has already been highlighted in a previous section (Section 7.5.2.1).

We therefore wanted to ensure that children, who required additional support, were referred; however, in the focus groups and interviews Childsmile staff and health visitors had described using locally developed referral forms as well as, or instead of, the Childsmile section on the Child Health Surveillance form (see Section 11.2 for more detail about these forms). It was therefore important to link DHSW activity data from the Health Informatics Centre database to health visitor referral data, in order to establish the extent to which DHSWs received referrals by 'other pathways'.

Figure 8.3 shows the health visitor referral codes recorded for the children who appear in the Health Informatics Centre (HIC) dataset and who, therefore, were referred by some means (Childsmile referral pathway if 'Yes' and 'other pathway' if 'Incomplete', 'No' or 'Refused') to a DHSW. For most health boards, the focus group and interview data suggest that children who are in the HIC dataset but were not referred through the Childsmile referral pathway were most likely referred to a DHSW through a locally developed form or another pathway. An example of this is NHS Lanarkshire, shown in Figure 8.3. In NHS Lanarkshire, the coordinator and DHSWs reported that they contacted families of all children who are recorded in the local birth book which is maintained by health visitors. Rather than rely on health visitors to refer children who need support, they relied on health visitors to tell them about any children who should not be contacted. This means the Childsmile referral pathway was underused in this health board.

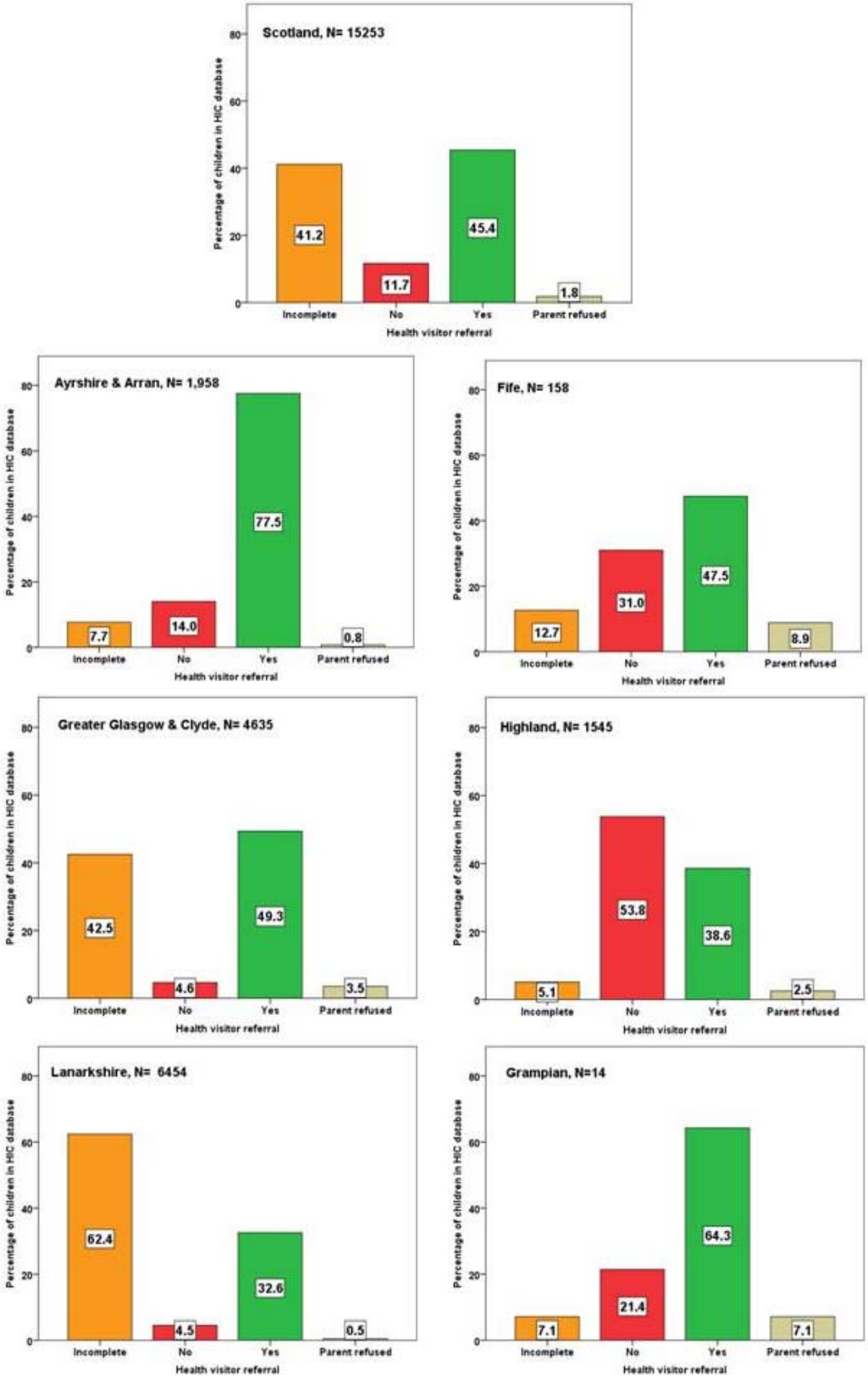


Figure 8.3- Health visitor referrals through the Early Years Referral Pathway for all children in the HIC database (i.e. all children for whom a DHSW attempted an intervention). *Note: NHS Borders, Grampian, Tayside, Lothian, Forth Valley, Dumfries & Galloway and the Islands are not shown due to small numbers resulting in the figures disclosing sensitive personal data.*

Figure 8.3 shows the high percentage of children (62%) who had incomplete forms in Lanarkshire, yet received an attempted DHSW intervention. The percentage of children who received an attempted intervention who were referred via the Childsmile referral pathway is almost half that of children with incomplete forms (33%).

This use of 'local systems' for referring children can explain the percentages of children receiving DHSW interventions where no referral has been made through the pathway. We were concerned that some children in need of support were not being referred and, therefore, not getting support; however, this is evidence that more children are being referred for DHSW intervention than is reflected by the Child Health Surveillance data and, therefore, the previous analysis in Chapter 7. Consequently, section 8.1.3, below, examines the factors associated with referrals made by any means (Childsmile referral pathway plus 'other pathways') which should more accurately reflect the extent to which the right children are targeted.

8.3.1 Geographic and family factors influencing referral for DHSW intervention through all available pathways

8.3.1.1 A multivariable analysis of factors independently influencing a referral for DHSW intervention through all pathways: across Scotland

A consequence of the underuse of the Childsmile referral pathway is that looking at the factors associated with health visitor referrals through this pathway does not accurately inform us about the factors associated with whether the right children were being targeted by any pathway, including local forms and birth books. This problem could only have been identified after the data had been linked during the project and, although surprising, highlighted a major issue with the referral pathway, that would not have been picked up without the linkage. We now address this issue in this section.

Section 8.2 has shown that some health visitor referrals through the Childsmile referral pathway did not result in a response from a DHSW and section 8.3 has shown that some 'incomplete' records resulted in a DHSW response. In order to assess if the right children were being referred, it was therefore necessary to look at DHSW response (attempted intervention) rather than health visitor

referral. 'Attempted DHSW intervention' is an indicator that a child has been referred through an available pathway.

The numbers and percentages of children referred for DHSW intervention by all pathways is broken down by geographical and family variables in the cohort table in Table 6.1 and 6.2 under the heading 'Children who received an attempted DHSW intervention 1st Sept 2010-31st Dec 2012'.

Univariable and multivariable logistic regression models were produced to establish the key variables associated with a referral by any pathway. The results table can be viewed in Appendix 21. Multivariable results are reported and any deviation from the univariable models is identified in the following descriptions.

8.3.1.2 Health board

The models show a greatly reduced likelihood for children in some health boards to receive an attempted intervention when compared to NHS Ayrshire and Arran. It should be considered that this is, in many cases, due to the DHSW role being established at a later date in some health boards than in NHS Ayrshire and Arran, which was one of the health boards in which the role was first introduced.

8.3.1.3 Area-based deprivation

In both the univariable and multivariable models there is a gradient in association between SIMD and attempted DHSW intervention, as there was for health visitor referral through the Childsmile referral pathway. Those children living in increasingly deprived areas are increasingly more likely to receive an attempted DHSW intervention.

8.3.1.4 Urban-rural classification

In a univariable regression, children living in large urban areas are more likely to receive an attempted DHSW intervention than those in remote rural areas. This association is no longer significant in a multivariable model. Children living in all other types of urban and rural area are more likely to receive an attempted intervention than those living in a remote rural area, when accounting for all

other factors ('other urban area' AOR=1.14 95% CI [1.01, 1.29]; 'accessible small town' AOR=1.79 95% CI [1.56, 2.09]; 'remote small town' AOR=2.67 95% CI [2.33, 3.06]; 'accessible rural' AOR=1.26 95% CI [1.10, 1.44]). Unlike the association with health visitor referral through the Childsmile referral pathway, those living in large urban areas were not significantly more likely to receive an attempted intervention that those living in remote rural areas.

8.3.1.5 Feeding type

The association between feeding type and health visitor referral through the Childsmile referral pathway is also seen for attempted DHSW intervention. Children who are bottle-fed are slightly more likely to receive an attempted DHSW intervention than those who are breastfed (AOR=1.06 95% CI [1.00, 1.13], p=0.04), independent of all other factors.

8.3.1.6 Smoking

Smoking was not found to be independently associated with attempted DHSW intervention (AOR=0.95 95% CI [0.89, 1.02], p=0.19) across Scotland.

8.3.1.7 Health Plan Indicator

In a univaraible model, those with an 'additional' care plan are shown to be less likely to receive an attempted DHSW intervention than those on a 'core' plan (OR=0.59 95% CI [0.57, 0.61], p=<0.001). However, when adjusted for all other variables in a multivariable model, children who were assigned an 'additional; care plan and those assigned an 'intensive' care plan were more likely to be referred by any means than those on a 'core' plan ('Additional'= AOR=1.26 95% CI [1.20, 1.32], p=<0.001; 'Intensive'= AOR=1.52 95% CI [1.32, 1.75], p= <0.001).

8.3.1.8 Level of risk

In a univariable regression level of risk had a gradient in association with attempted DHSW intervention, with attempted intervention being increasingly more likely as the number of risk factors increased. There was a slightly stronger gradient of association for this analysis of all referral pathways than for the Childsmile referral pathway only. Level of risk was not entered into the multivariable regression model due to it being composed of other variables that

were included. The model for Scotland and each health board can be viewed in Appendix 22.

8.3.1.9 A multivariable analysis of factors independently influencing referral for DHSW intervention through all pathways: within health boards

A multivariable regression for NHS Forth Valley, NHS Grampian, NHS Lothian and the Island boards could not be performed due to low numbers of children receiving attempted interventions in these health boards at this early stage of implementation. There was substantial variation in the factors influencing referral within health boards, with referrals in some health boards being much less influenced by geographic or family variables than others. Where the same factors emerged from the model, the size of effects differed.

The association between attempted DHSW intervention and area-based deprivation held a gradient for the majority of health boards (NHS Ayrshire & Arran, NHS Fife, NHS Greater Glasgow & Clyde, and NHS Tayside) and those in the most deprived areas were also more likely to receive an attempted DHSW intervention in NHS Highland, and NHS Dumfries & Galloway. Results can be viewed in Appendix 23. In NHS Lanarkshire, those in the three most deprived groups were more likely than the least deprived to receive an attempted DHSW intervention but there was not a clear gradient and the likelihood of referral was similar between categories ('SIMD Q1' AOR=1.21, 95% CI [1.08, 1.37]; 'SIMD Q2' AOR=1.30, 95% CI [1.15, 1.47]; 'SIMD Q3' AOR=1.14, 95% CI [1.01, 1.29]).

Where feeding type was included in the final regression models, children who were bottle-fed were more likely to receive an attempted intervention. Where smoking was included, children who were exposed to smoking were more likely to receive an attempted intervention. There was a gradient in association for HPI in NHS Ayrshire & Aran, NHS Fife, NHS Greater Glasgow & Clyde and NHS Dumfries & Galloway. In NHS Borders, NHS Highland and NHS Lanarkshire, the 'additional' care plan was associated with increased likelihood of attempted DHSW intervention.

A univariable regression for level of risk was carried out for each health board (Appendix 22). Within health boards the likelihood of an attempted intervention increased as the number of risk factors increased in all but NHS Lanarkshire (NHS

Grampian, NHS Lothian, NHS Forth Valley and the Island boards could not be included due to low numbers in each risk category). As with health visitor referral through the Childsmile referral pathway (see Chapter 7), in NHS Lanarkshire the percentages of children in each risk category were similar (48.65-55.34%) and there was no significant association between level of risk and referral by any means.

8.4 Summary

The analysis has shown that, as the Childsmile referral pathway and the DHSW role became more established in each health board, the rate of correspondence between health visitor referral through the pathway and attempted DHSW interventions increased. We can therefore conclude that DHSWs did respond to referrals made by health visitors through the referral pathway and that this became more efficient over time.

In order for the referral pathway to be implemented as intended, children should be assessed for DHSW support by their health visitor during the 6-8 week Child Health Surveillance (CHS) assessment. Section 8.3 has shown that some health visitors may not record a referral on the CHS form, resulting in it not being officially recorded. There are local forms and systems in place in health boards which may take precedence over the Childsmile section on the CHS form. This may be because health visitors and DHSWs find these local forms more useful as they provide opportunities for the health visitor to record background information about the family and the reasons for referral. Details about these forms and their use are described in Section 11.2.

When considering only those referrals made through the Childsmile referral pathway, each of the following variables were found to be independently associated with the health visitor's decision that a child would benefit from a referral: health board, area-based deprivation, urban-rural classification, feeding type, and HPI (see Chapter 7). When looking at referrals through all pathways, such as local forms and birth books, as well as the Childsmile referral pathway the same variables were found to be associated with attempted DHSW intervention, although the effect sizes were stronger. The multivariable model for health visitor referral through the Childsmile referral pathway had a c-index

of 0.70 [0.70, 0.70], while the model for attempted DHSW intervention had a c-index of 0.83 [0.82, 0.83] indicating that the variables included in the models better predict attempted DHSW intervention (and, therefore, referral by any pathway) than referral through the Childsmile referral pathway. This means that more of the right children were being contacted by DHSWs than the figures from the Childsmile referral pathway would suggest.

Considerable variation in the factors influencing DHSW intervention (by both the Childsmile referral pathway and all pathways) was seen across health boards. Most notably, NHS Lanarkshire did not show a consistent trend with other health boards. Although in NHS Lanarkshire the most deprived (by area-based deprivation) were more likely to receive an attempted DSHW intervention than the least deprived, level of risk was not significantly associated with attempted intervention. As mentioned in Chapter 7, this lack of a relationship between risk and referral or intervention may indicate that the universal approach to implementing the DHSW intervention means children receive the intervention irrespective of need.

It is important to note the value of converging data from multiple sources. Without the information gathered in focus groups and interviews about the use of the Childsmile referral pathway and local systems for referral, the high number of 'incomplete' CHS forms in some health boards, noted in Chapter 7, would have been difficult to interpret. In addition, the true impact that the use of these local pathways had on the 'official' Childsmile referral statistics could not have been realised from qualitative investigation alone.

Chapters 7 and 8 have addressed the initial step in the pathway to DHSW support and increased dental participation. The following chapters (9-14) will address the implementation of support that is tailored to families' needs, starting with how respondents in focus groups and interviews defined tailoring and its importance in the DHSW role.

9 Results: Defining tailoring and its importance in the context of the DHSW role

9.1 Introduction

This chapter presents the views of respondents involved in the delivery of Childsmile's DHSW intervention. This includes: the Childsmile Executive committee (programme directors and area managers); Childsmile coordinators, DHSWs; and health visitors. The findings presented here are drawn from focus groups and interviews only. The research questions addressed in this chapter are indicated in Figure 9.1.

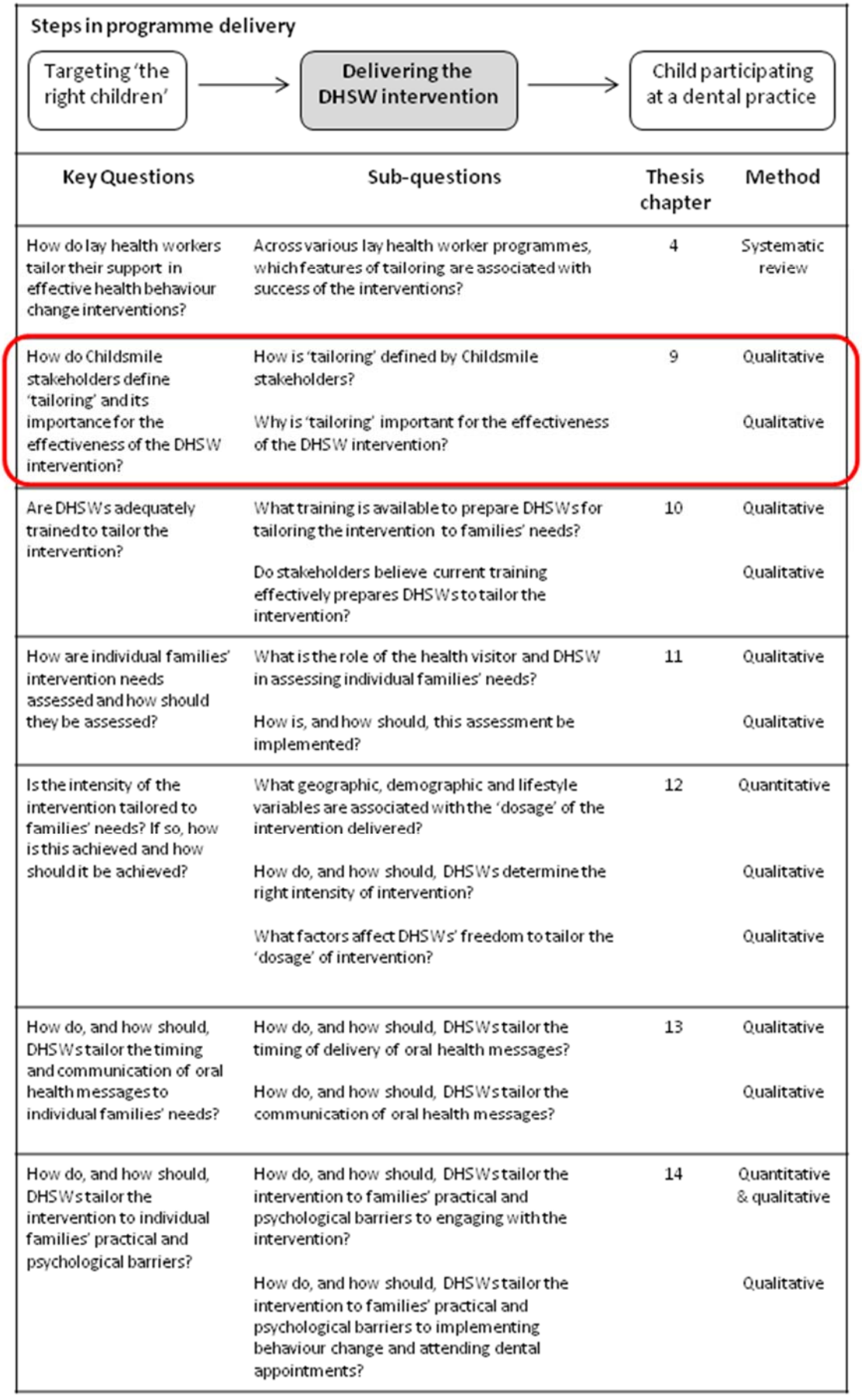
9.2 How 'tailoring' is defined by Childsmile stakeholders

When asked what it means to tailor the DHSW intervention, many respondents found it difficult to move past high level concepts such as 'being accommodating' and 'adapting'. All focus groups and interviewees defined tailoring as being about 'looking at the family's individual needs' and stressed the importance of 'not treating everybody the same'.

The majority of groups described tailoring as a two-step process. First, an individual family's needs are assessed and, secondly, support is provided differentially according to these identified needs.

> DHSW 18: An assessment for each individual family.
>
> DHSW 17: A needs-led intervention…
>
> DHSW 18: Make changes to how you put things across.

Chapter 11 will report how the assessment of families' needs is carried out and Chapters 12, 13 and 14 will report how DHSWs respond to individual families' needs.



Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 9.1- Research questions relating to defining 'tailoring' and its importance

9.3 The importance of tailoring for the effectiveness of the DHSW intervention

Respondents agreed that tailoring is important for the DHSW intervention. Two reasons were offered as to why it is important in Childsmile Practice. First, a tailored approach is based on evidence from behaviour change theory and Childsmile programme monitoring data. Secondly, taking a tailored approach means operational staff are given the flexibility required to address barriers to child registration and attendance.

9.3.1 Tailoring is evidence based

Respondents agreed that tailoring is essential for the success of Childsmile practice. An Executive respondent described how adopting a tailored approach was congruent with "health promotion and health behaviour change and those sorts of approaches" (Executive 2), implying that tailoring is widely accepted as facilitating behaviour change. Direct experience of delivering Childsmile Practice had reinforced the idea that non-tailored intervention was likely to be unsuccessful. One example offered by a coordinator referred to attempts to get families to attend dental appointments; a primary objective of Childsmile Practice:

> Coordinator 9, East: [The DHSWs] were literally going in, ringing up and getting the dental appointment, putting the phone down and leaving in the shortest amount of time possible, which was under thirty minutes…they were in and out in one visit and that was it. We looked back at the last two years [at] how many of our families stayed at the dental practice and it was less than fifty percent, so that obviously wasn't working.

9.3.2 Tailoring provides a flexible framework for addressing needs and barriers

Offering tailored support means that DHSWs had the flexibility to address a family's specific needs and barriers, which was thought to make this approach

more likely to be successful with hard-to-reach families than a 'one-size-fits-all' intervention.

> Coordinator 14: 'Cause each individual child matters and their needs aren't necessarily the same of even their siblings or their peers. Therefore, […] the personal approach and the individual approach to a child works better than trying to do a broad brush sweep because […] you invariably will miss the people at most risk.

In order to achieve the desired outcome of dental practice attendance and improved oral health behaviours, the DHSW intervention should accommodate different levels of need and barriers faced by individual families.

> DHSW 26: I very much believe that if we didn't allow folk to say what was best for them, if we just dictated 'you will be in [a dental practice] at this date and this time' I don't think we would get them all.

Tailoring to these specific needs, with a more intensive approach to reach out to those most at risk, was valued by those implementing the programme.

9.4 Summary

Congruent with widely cited definitions of tailoring, respondents described it as requiring two steps. The first step was an assessment of an individual's or families' needs and the second step was providing support matched to the identified needs. In terms of defining a tailored approach as adapting the content of an intervention, the contexts and frames, and the channels of delivery, respondents struggled to articulate this succinctly but were able to provide examples of tailored practice that were in-keeping with such a definition.

Respondents involved in programme delivery agreed that tailoring was essential for the success of Childsmile Practice. Respondents were confident that tailoring, as a concept, was evidence-based and believed that this approach provided a flexible framework for addressing needs and barriers.

10 Results: Training DHSWs to deliver a tailored intervention

10.1 Introduction

This chapter focuses on the training DHSWs receive that prepares them for delivering a tailored intervention. The findings are drawn from focus groups and interviews with Childsmile staff (Chidsmile Executive committee, Childsmile coordinators and DHSWs) and health visitors. The initial DHSW training provided by NHS Education Scotland is discussed, along with opportunities for continuing professional development, shadowing, and the use of vignettes in simulated practice. The research questions addressed in this chapter are indicated in Figure 10.1.

10.2 Initial NHS Education Scotland (NES) training

While the NES training gave a comprehensive induction in the key oral health messages, DHSW focus groups agreed that it did not sufficiently cover the practical aspects of the role, such as how to tailor health messages to individuals' needs. Rather than the current focus on written assessments, DHSWs suggested that the training should be geared towards interactive aspects of delivery, such as communicating with families.

When asked which particular training programmes had helped DHSWs develop their skills in assessing families' needs and delivering tailored support, several DHSWs referred to training they had received during previous employment in the health or education sectors.

> DHSW 33, West: All the tools that I […] [got] from my old job, [have] […] been like really invaluable for this role. I don't think I could have done it without the background that I came from…I was a health coach, so I encouraged…[it was about] motivating behaviour change, really.

This reliance on previous experience may indicate that current training is not in itself adequately preparing DHSWs for the Childsmile Practice role.

Steps in programme delivery

Targeting 'the right children' → **Delivering the DHSW intervention** → Child participating at a dental practice

Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 10.1- Research questions relating to DHSW training

10.3 Skills development

In addition to initial NHS Education Scotland (NES) training, DHSWs complete Continuing Professional Development (CPD) courses available to NHS staff. Respondents in the Childsmile Executive group expressed doubt over whether or not the initial NES training prepares DHSWs to motivate families to engage in behaviour change. They suggested the CPD courses and shadowing opportunities would address this skills gap.

The majority of DHSWs in the groups could not think of specific examples of ongoing training they had attended which had prepared them for delivering tailored support. Courses that were mentioned by a minority of DHSWs were entitled 'Brief Interventions' and 'Developing Effective Practice'. Both these courses were described as dealing with behaviour change and behaviour change techniques. One DHSW also suggested that the 'Motivational Interviewing' course was useful for communicating with parents and supporting families, although she was the only DHSW in the group to have attended.

An indication that DHSWs do not feel adequately prepared for Childsmile Practice is that, despite the availability of CPD courses, several experienced DHSWs expressed a desire to undertake a 'refresher' Childsmile course. There was a need for reassurance, identified by DHSWs in several groups, that they carried out their home visits in the required manner. There was only one coordinator who described having a system in place where DHSWs would be observed on a home visit and given feedback.

> Coordinator 7, North: What we also do, though, is we go out after they've been in post a while…usually about the sort of six month point […], just [to] review what they're doing…somebody, like the team leader or somebody like that, […] [will] go out and just assess [them]. It's about quality assurance.

When health visitors were asked about further training they thought DHSWs should receive, those informed enough to comment on DHSW training gave examples of training on addiction issues and how to deal with difficult families.

Coordinators pointed out that further training should be tailored to the circumstances a DHSW is likely to encounter within their community.

> Coordinator 5, North:[…] From meetings in the past we've talked about the role of the dental health support worker going into a family where there's drug problem or alcohol [problem] […]. That obviously affects the tailoring of the training needs […] for the dental health support worker in different areas, whereas we don't have these problems to the same extent [in this area].

Some DHSWs have been trained to deliver 'Triple P- Positive Parenting Programme', a programme designed to prevent, and provide support with, social and behavioural problems in children. In one health board in the West there was a difference of opinion among DHSWs, coordinators and health visitors about the usefulness of 'Triple P' training. While the coordinators suggested that 'Triple P' training might inform DHSWs how to better support families in their Childsmile role, they were clear in their opinion that a DHSW should not be responsible for implementing the 'Triple P' programme as part of the intervention. Health visitors from this health board had a more holistic view of the DHSW role and saw training in delivering 'Triple P' as being in line with DHSW objectives and, along with weaning talks, an opportunity for reinforcing health messages to parents. DHSWs, however, described the 'Triple P' training not only as an inconvenience but something they did not feel confident delivering.

> Facilitator: Did you find that it helped you in your Childsmile role?
>
> DHSW 13, West: No, not really. I liked the advice like, say, for personal reasons, but I don't feel comfortable delivering it. […] They always want 2 delivering it and they're supposed to be equal but I always […] try and make out like I'm the assistant because they always pair me with someone that works with the libraries […]. They're called Parenting Team. […] All they do is Triple-P, so they've got more experience. I do it maybe once or twice a year.

10.4 Simulated practice

A beneficial method for developing skills in providing tailored support, mentioned by a minority of respondents, involved simulated vignettes. Fictional

scenarios were used as a means to facilitate peer group discussion of issues that may be encountered.

> Executive 2: We did something actually [...] at that training day where we sort of gave a scenario. You were visiting a family...child...baby that's been referred to you, [and] has not been registered yet but the older sibling has pain. So what do you do? I mean, that's just an artificial scenario...

In some health boards this type of training exercise has already been used as a training tool and the modality has received positive feedback from DHSWs and coordinators. DHSWs agreed that this would be particularly beneficial if it were done collaboratively with DHSWs from different areas or health boards so they could share knowledge and experience. A reported barrier to organising these types of training events is the cost of reimbursing travel expenses and running the event.

10.5 Shadowing

All groups were supportive of shadowing as a training method. The management and health visitor groups agreed that shadowing was the most effective method for DHSWs to learn how to deliver tailored support; however, DHSWs reported that the opportunities for shadowing were limited.

DHSWs highlighted a discrepancy between shadowing as imagined by the management groups and shadowing in reality. These differences are described in Table 10.1.

DHSWs in employment since the piloting phase of Childsmile Practice reported receiving more opportunities for shadowing health visitors than others. New recruits in these boards had shadowed more experienced DHSWs. It was emphasised that the extent to which shadowing was a useful exercise depended primarily on the working practices observed. In some cases, where experienced DHSWs were shadowed, a prescribed, rather than tailored, approach had been witnessed by those new to the role.

> DHSW 10, East: We shadowed when we first started but, like you described earlier, […] [the visit was done at] six to eight weeks [of age]. They went in, they gave their spiel, and they registered them.

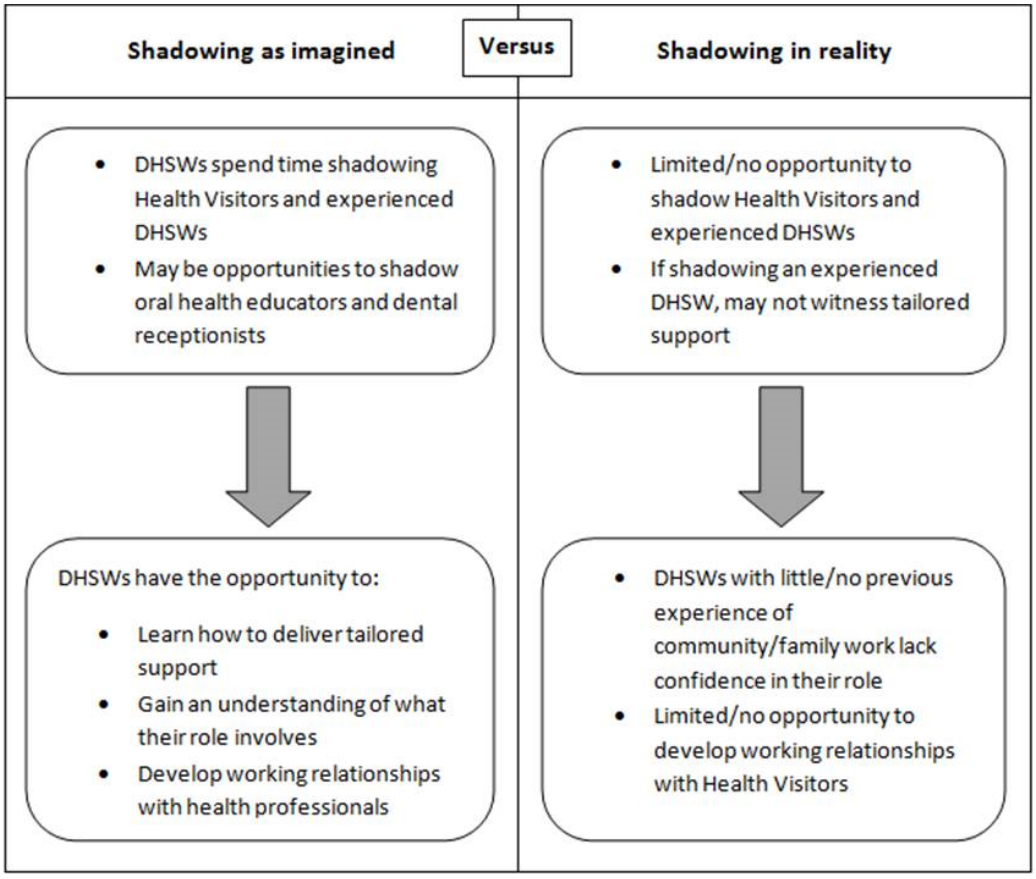


Figure 10.2- Comparison between shadowing as conceived and as manifested in practice

Although the benefits of shadowing more experienced DHSWs were discussed, one DHSW highlighted that DHSWs are not 'trained to train' other DHSWs. The result was said to be that shadowing may not have been as effective as it could have been.

Within the DHSW group from the East, it was clear that there was wide variance in previous experience and associated needs of new DHSWs with respect to confidence gained through shadowing. Those DHSWs who had worked in similar roles before Childsmile were more comfortable with receiving limited opportunities for shadowing than those who had not.

> DHSW 4, East: Well, for me, I had worked in nurseries before. I'm very confident in the nurseries, you know, working with small kids but when I went to this job I thought 'god, what am I going to say to these families?'

> DHSW 7, East: Well, I'm kind of the opposite because I've worked with families. That's what I've done for years and years, so the home visit thing didn't faze me.

Reasons given for the lack of opportunities for shadowing include: difficulty in contacting and arranging suitable times to shadow health visitors; limited time available for DHSWs to shadow others; and a lack of guidance for coordinators from the Childsmile programme directorate regarding the recommended number of shadowing sessions.

10.6 Summary

Practical 'hands-on' training was reported to be essential for developing the confidence and skill necessary for implementing tailored support. In reality, however, NES training was reported to focus primarily on knowledge of health messages and theoretical principles of behaviour change. Opportunities for practical training were limited and some DHSWs suggested that their prior work experience had been the best preparation for their role.

Shadowing was reported to be difficult to arrange. In addition, shadowing experienced DHSWs was not guaranteed to lead to observation of a tailored intervention. It is important to note that there was no official recommendation from the Childsmile programme regarding what an appropriate amount of time spent on shadowing would be. This is likely to be relative to individual DHSW confidence and competence. As the Childsmile Executive, coordinators, DHSWs and health visitors agreed that shadowing had essential benefits for DHSW skill development, it may be in the interests of the programme to set a recommended or minimum number of shadowing visits or hours for new DHSWs.

The uptake of different CPD courses varies at a local level. DHSWs found it difficult to recall specific courses that helped them develop skills in tailoring. The fact that experienced DHSWs expressed a desire to take a Childsmile 'refresher' course highlights that some DHSWs did not feel confident in their intervention delivery. It is possible that if DHSWs had opportunities to receive feedback on their home visits occasionally or if they were able to discuss their

practice with colleagues (e.g. using vignettes), they may have more confidence in their practice.

Opportunities for meeting with DHSWs from other areas for training days, where practice was simulated using vignettes, were highly valued by coordinators and DHSWs who had attended them. Despite being thought to be an effective training method however, coordinators were reluctant to invest the limited Childsmile funds in these kinds of events.

11 Results: Assessing families' needs

11.1 Introduction

Chapter 9 described how assessing families' needs was seen by respondents as an integral first step to providing tailored support. This section reports how such an assessment is implemented in DHSW practice. Here we outline how respondents envisioned the process to work in an ideal scenario and how parents experienced it, using data gathered in focus groups and interviews with Childsmile staff, health visitors, and parents who received DHSW support. The research questions addressed in this chapter are indicated in Figure 11.1.

11.2 Health visitors and DHSWs should work collaboratively to assess families' needs

The Childsmile programme places responsibility for assessing a family's needs with both the health visitor and DHSW. In order for DHSWs to tailor to families' needs, they need to have an idea of what those needs may be. Working collaboratively with health visitors and dental practices was reported to be essential in order for all parties to identify the oral health needs of individual children and to relate them to the family context.

There was agreement among respondents that, in an ideal scenario, a health visitor would outline a family's needs and communicate these to a DHSW in advance of DHSW contact being made. This background information could be given either face-to-face, over the phone, by email, or by adding additional background information on a local referral form (example of a local referral form in Appendix 24).

DHSWs and coordinators from all regions reported that it was important that DHSWs receive background information about a family from a health visitor before making contact. This background information helped DHSWs prepare for the kind of support and resources they needed to provide and set the family's oral health needs into context.

> Coordinator 14, West: They need to know as much as they possibly can so that actually before they enter someone's home [so] at least

they're prepared, [and have] brought with them all the visual aids that they need [...] but also that they have some [idea of] [...] the background to the family situation, if [...] [the information is] available at all.

Steps in programme delivery

Targeting 'the right children' → **Delivering the DHSW intervention** → Child participating at a dental practice

Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 11.1- Research questions relating to the assessment of individual families' needs

The background information DHSWs found useful included:

- information about the family's oral health needs;
- the age of the referred child and siblings;
- information that is more holistic in nature, such as family vulnerabilities (e.g. homelessness, addiction, parental mental health);
- whether the parents' first language is not English; and,
- how to access the building where the family lives.

DHSWs report that some health visitors gave a satisfactory amount of information on these forms; however, this was the exception to the norm. Some forms had 'tick boxes' where health visitors could indicate basic background information such as whether the child was already registered at a dental practice or not and/or the reason for referral. In one North health board, the coordinator reported that DHSWs had access to children's health notes so they could check any information the health visitor had recorded about a family and write up the content of their visit along with any concerns.

In NHS Ayrshire & Arran, health visitor referrals were received by telephone in order to cut down the amount of time between health visitors completing a referral form and DHSWs receiving the form. A reported benefit of this was that health visitors could be asked for further information over the telephone at the time the referral was being made.

DHSWs discussed the consequences of not having adequate background information from a health visitor. This could mean that DHSWs were unprepared as they would not have the necessary resources (e.g. visual aids, toothbrushing packs, activities to keep older children occupied) for carrying out an effective visit and may be unaware of any personal risk involved in carrying out the home visit.

> DHSW 10, East: We've got the box [for additional information on the referral form] but they rarely write in it so then it's up to you to phone and chase up the health visitors. A couple of times I have and […] [the health visitor has said] 'don't go there, there's domestic violence' but they didn't write that on the sheet. So I could have turned up to someone's house and the wee boy doesn't live there now, he's been taken away and you're turning up on the doorstep…

Health visitors understood that giving background information about a family was part of the referral process; however, they did not seem to realise how much importance DHSWs placed on this information. This incongruence was most obvious in the comparison of responses from DHSWs and health visitors in the East. Health visitors from one health board in the East did not see it as necessary to describe family background information that was not directly related to the family's dental needs or staff safety.

> Health visitor 10, East: You've got to be careful…you put dental background. I think that would be all.
>
> Health visitor (unknown), East: Unless there was an issue about safety for the worker.
>
> Health visitor 17, East: And then that would be the joint visit box you would tick.

This is at odds with the desire of most of the DHSWs from the East to take a more holistic support approach; taking into account all the factors affecting a family while addressing their oral health needs.

Having received the referral, DHSWs carried out an informal assessment when they met with the family. Being in the home gave DHSWs the opportunity to see how the family lived and interacted with each other. If family life was chaotic, this may have helped the DHSW understand where oral health was placed in the family's priorities.

> DHSW 11, West: Well maybe if they've got a bottle of Irn-Bru lying in the living room. Chocolate, yeah. Whatever's lying about. So you're assessing the whole home when you go in. You're, you know, you're risk assessing, you're assessing […] the standard of the house. Just various things. And then you would ask, you would actually ask the mum, you know? You would ask […] 'who drinks Irn-Bru?'

Such information, gathered through observation and conversation, helped the DHSW to, for example, select appropriate communication strategies to engage the family (discussed further in Section 13.3).

DHSWs and health visitors described using several criteria to assess families' oral health needs. These are listed in Table 11.1.

Table 11.1- Criteria used by health visitors and DHSWs to assess families' oral health needs

Criteria for assessing families' needs
• Is anyone in the family registered with a dental practice and regularly attending? • Do the parents or siblings of the referred child have poor oral health? • What are the parents' attitudes towards oral health? • Are there issues with the child's diet/oral health routine (e.g. "a bottle of Coca-cola and a baby bottle" (Health visitor 11, East) • Does the family require help with registering at a dental practice? • Does the family require assistance in getting to a dental practice?

Health visitors supported the idea that assessing families' oral health needs should be part of the DHSW role. One health visitor team leader from the West region suggested that DHSWs may benefit from guidelines on how to implement an informal assessment.

> Health visitor 8: I think there would be some merit in having some sort of guideline rather than just it being open…to capture and identify […] those at higher risk. And, you know, questions like 'were you phobic about the dentist?' and, you know, gain that information.

Parents who were interviewed were unable to describe in detail how their needs were assessed. Some of the parents recalled being asked about which dental

practice they were registered with and what they planned to do to maintain their child's oral health.

> Parent 7, Lanarkshire: She kind of asked me what I was doing and things like that and what I was planning to do as regards everything and I think she was quite happy with the kind of things [I was planning to do].

One parent described how the DHSW already had a significant amount of information about her family before they met. This could indicate that health visitors were working collaboratively with this DHSW.

> Interviewer: Did you feel like they took time on your visit to get to know you?
>
> Parent 1, Glasgow: Well, no, not exactly because she already had my information. I suppose I can't be too surprised, right?...because they've got all my records. But she was really…she was okay. I think I found her very helpful.

None of the parents interviewed expressed any objection to their information being shared between health visitors, DHSWs and dental practices.

11.3 Maintaining day-to-day communication with health visitors about families' needs

Communication between DHSWs and health visitors was reported to be vital for the intervention to be effective (e.g. assessing needs and DHSW planning for tailoring) and for the wellbeing of families (e.g. identifying family vulnerabilities and putting appropriate support in place).

DHSWs from all regions reported examples of good relationships and communication with health visitors. DHSWs suggested that face-to-face communication worked best with health visitors. Indeed, there seemed to be a relationship between DHSW satisfaction with communication and being based in the same workplace as health visitors.

Face-to-face relationships could be difficult to develop as health visitors and DHSWs did not always work the same hours and DHSWs may have been covering large geographical areas and travelling significant distances. This meant DHSWs did not have time to 'pop in' and see health visitors. DHSWs in the East expressed frustration about not being able to get in touch with health visitors by

telephone, either to find out about changes to a family's contact details or to update the health visitor about a change in a family's circumstances.

While some DHSWs in the North argued that being based in the same workplace as health visitors did not guarantee good communication links, they acknowledged that having a relationship with a health visitor could ease communication and that this was difficult to achieve whether based in the same office or not.

> DHSW 24, North: I think [that due to] the part-time aspect of our work and their work it's difficult to meet them [face-to-face]. And I think we've got quite a good relationship but you're always passing them and we never [meet]…it's emails or…

Health visitors who had a DHSW based in their workplace found this encouraged two-way communication; with DHSWs reporting back to health visitors after home visits.

> Health visitor 5, West: I think we're quite lucky that the dental health support worker who works with our team is actually based onsite. So it's easy enough for us to go and speak to her, and for her to come and speak to us. And if she picks up on any issue, she's very good at coming back and identifying it. It may not just be around dental health. It may be about other social circumstances, and it's very good that there's that kind of two-way feed of information.

Health visitors from two health boards in the North also expressed a desire for two-way communication with DHSWs. They suggested that DHSWs could feed back to health visitors and the improved communication would help ensure they had "equal goals" (Health visitor 9, North) for referred families.

11.4 Summary

Respondents involved in programme delivery agreed that, in an ideal scenario, health visitors should outline a family's needs and communicate these to a DHSW in advance of DHSW contact being made. This was thought to be important for DHSWs' preparation for delivering a tailored intervention. When meeting the family, DHSWs should carry out an informal assessment of oral health needs when they meet with the family.

Conducting a home visit gives the DHSW the advantage of being able to use clues from the home environment to assess needs as well as ask the parents questions. Parents were able to give some examples of the kind of questions DHSWs had asked them in order to assess their needs. These included being asked about which dental practice they were registered with and what they planned to do to maintain their child's oral health. This allows the DHSW to set the family's oral health needs into the context of other factors affecting the family that may be more visible in the home than when meeting in a clinical setting.

Interestingly, the idea of family information being shared among health visitors, DHSWs and dental practices was not brought up as an issue by parents and, in at least one case, it was expected or, at least, the parent was resigned to the idea of information-sharing across services.

12 Results: Tailoring the 'dosage' of the DHSW intervention

12.1 Introduction

The following chapters focus on the delivery of DHSW support, making use of the linked administrative datasets, as well as focus group and interview responses. This chapter reports the findings related to how DHSWs should deliver the right intensity of support (referred to as 'dosage'). The research questions addressed in this chapter are indicated in Figure 12.1.

12.2 Number of 'doses' delivered by DHSWs

This chapter will consider the 'dose' of a Dental Health Support Worker (DHSW) intervention delivered to all children referred to DHSWs by the Childsmile referral pathway or 'other pathways'. Children who had a Child Health Surveillance assessment between 1st September 2010 and 30th September 2012 are included and followed up until 31st December 2012. There were 18392 children who received a dose of DHSW intervention. Of these, 94% received only 1 'dose', 5% received 2 doses, and 1.4% received 3 or more doses. The histogram in Figure 12.2 shows the number of intervention doses received by referred children.

Steps in programme delivery

Targeting 'the right children' → **Delivering the DHSW intervention** → Child participating at a dental practice

Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 12.1- Research questions relating to tailoring the intensity of the DHSW intervention

12.3 Tailoring the dosage of DHSW intervention

12.3.1 Children receiving different dosage

Figure 12.2 shows the dosages of DHSW intervention received by all children in the cohort (n=18392).

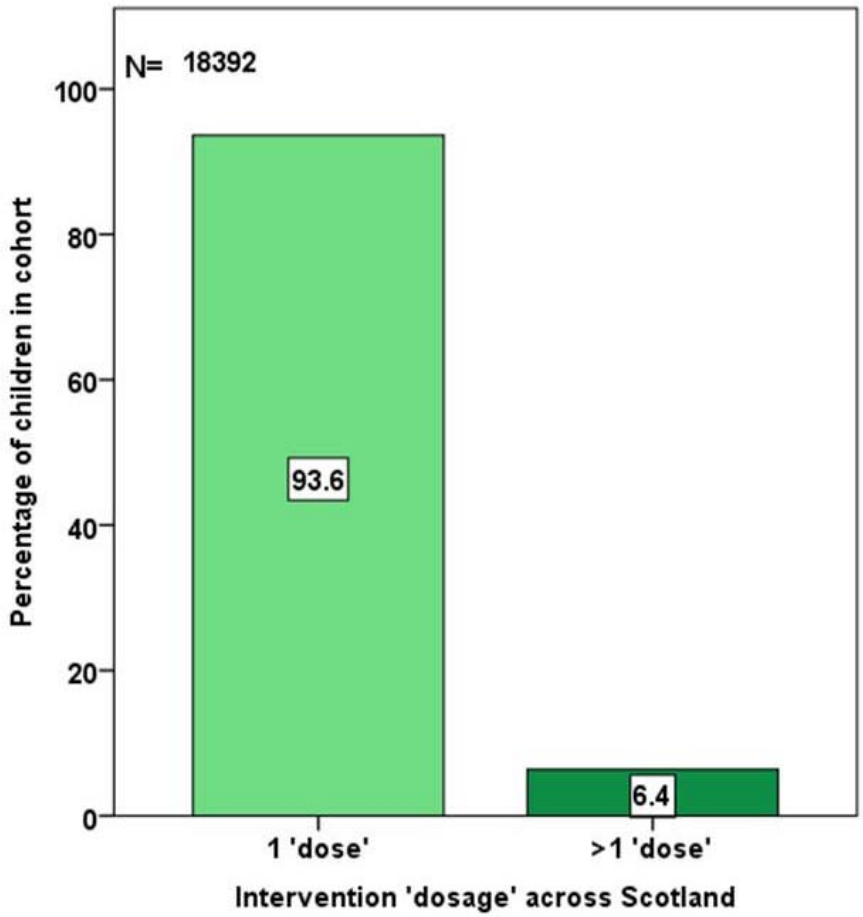


Figure 12.2- Dosage of DHSW interventions for whole cohort

Figure 12.2 shows that the majority of children (94%) in this selected cohort receive only one dose. It is relatively uncommon to receive multiple doses, as 6.4% receive more than one dose.

We will now explore whether geographic or family variables influence the dosage.

12.3.2 Geographic, demographic and lifestyle variables associated with dosage across Scotland

Here, we present the findings from the descriptive analysis and the univariable analysis across Scotland in the first instance; then we present the multivariable analysis at the Scotland level, and lastly, within health boards.

12.3.2.1 Health board

Figure 12.3 shows the variation across health boards in the dosage of DHSW interventions delivered. In some health boards the intervention is more established than in others due to the staggered nature of the rollout of Childsmile Practice and the DHSW role (see Figure 6.1)

Figure 12.3 shows that, in all health boards, the majority of children receive only one dose.

A univariable logistic regression (see Appendix 25) examining the association between health board and one versus more than one dose showed that, compared to NHS Ayrshire & Arran, children in NHS Borders were more likely to have multiple doses (OR=4.63, 95% CI [3.33, 6.44]), along with children in NHS Fife (OR=5.41, 95% CI [4.11, 7.12]) and NHS Tayside (OR=5.66, 95% CI [3.56, 9.02]), perhaps a reflection that the number of children in the cohort from these health boards was small and, therefore, there was capacity to deliver multiple doses. Conversely, children in NHS Greater Glasgow & Clyde (OR=0.45, 95% CI [0.37, 0.55]) and NHS Lanarkshire (OR=0.26, 95% CI [0.20, 0.32]) were significantly less likely to have multiple interventions.

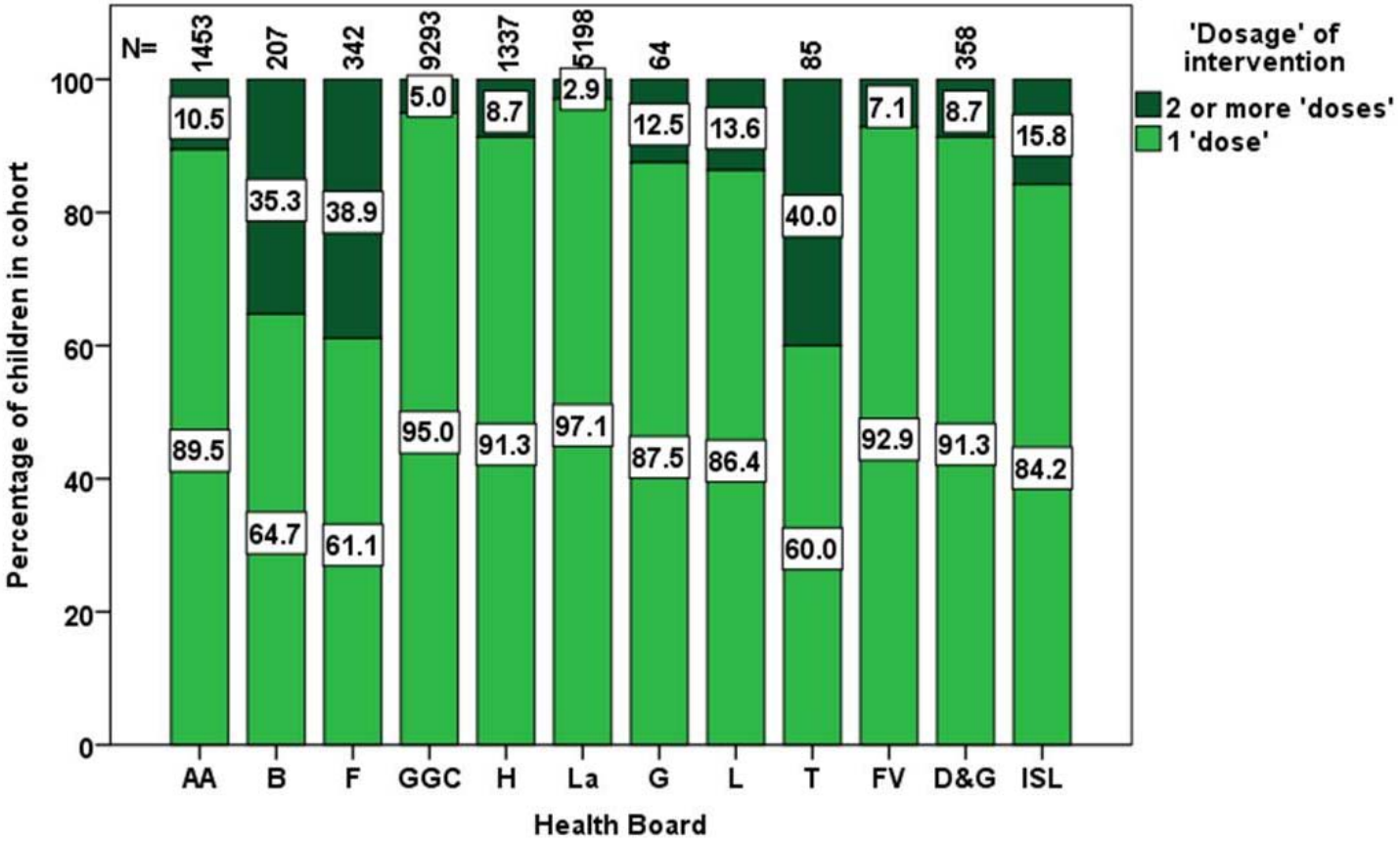


Figure 12.3- Dosage of DHSW interventions by health board. Ns for NHS Forth Valley, NHS Dumfries & Galloway, and the Islands are suppressed due to small numbers meaning there is a risk of disclosure of confidential personal information (N=18392)

12.3.2.2 Area-based deprivation

Figure 12.4 shows the variation in dosage across deprivation categories for all of Scotland.

Figure 12.4 shows only a slightly higher percentage of children in the least deprived areas (SIMD 5, 96%) received only one dose compared to those in the most deprived areas (SIMD 1, 91-92%). There was a slight gradient in this relationship, with the percentage of children receiving only one dose increasing with decreasing deprivation, however it is clear that the majority only receive one dose.

A univariable logistic regression (see Appendix 25) examining the association between national SIMD and one versus more than one dose showed that, compared to the 20% least deprived areas, children in SIMD 1 are more than twice as likely (OR=2.09, 95% CI [1.57, 2.78], p=<0.001), and children in SIMD 2 are 1.7 times more likely (OR=1.71, 95% CI [1.1.26, 2.31], p=0.001) to have multiple doses. A c-index of 0.45 (95% CI [0.43, 0.46]) indicates that national SIMD is not a good predictor of intervention dosage. A similar pattern was found for local SIMD.

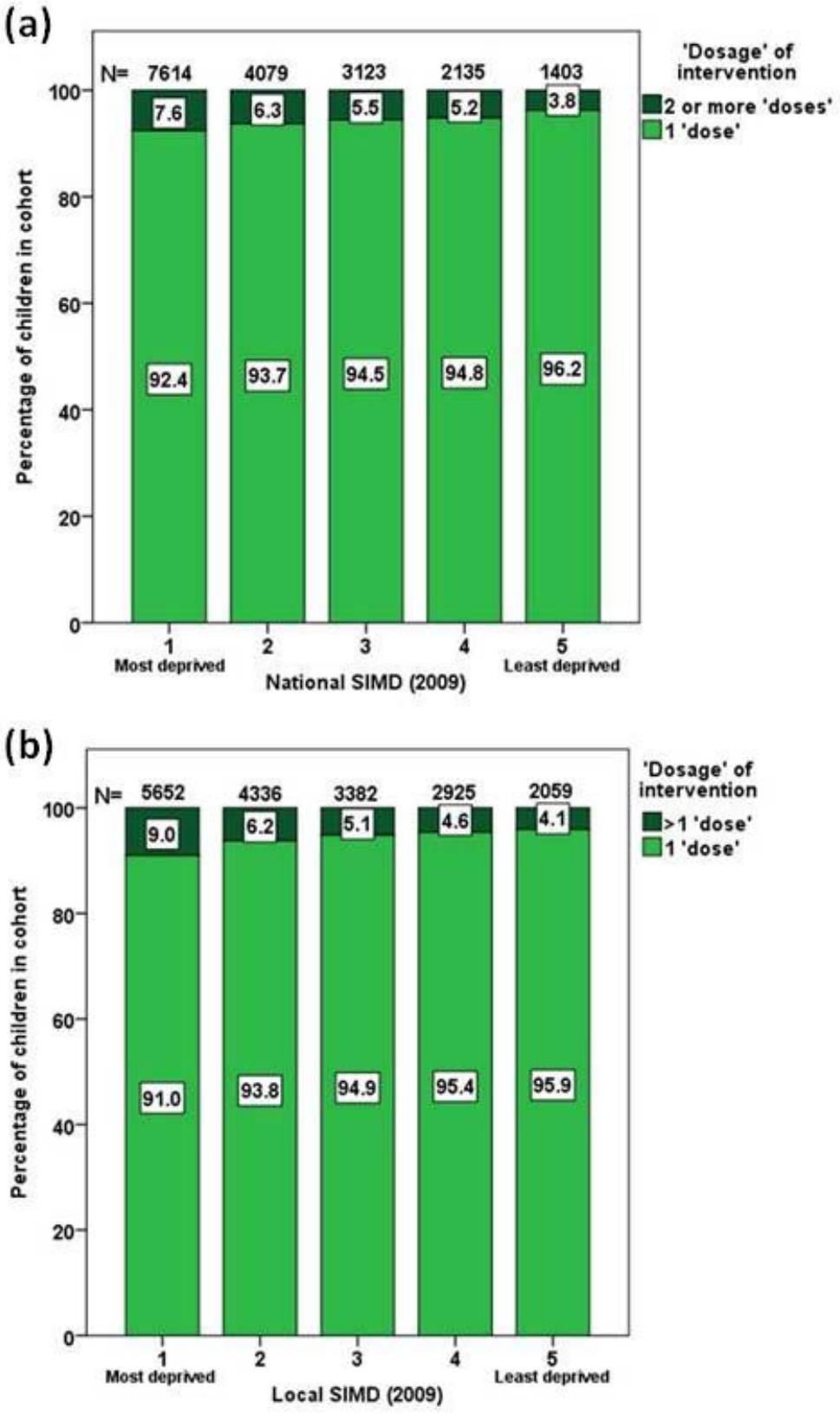


Figure 12.4- Dosage of DHSW interventions by area-based deprivation (SIMD) (N=18354)

12.3.2.3 Urban-rural classification

Figure 12.5 shows the dosage by urban-rural classification of the area in which children live.

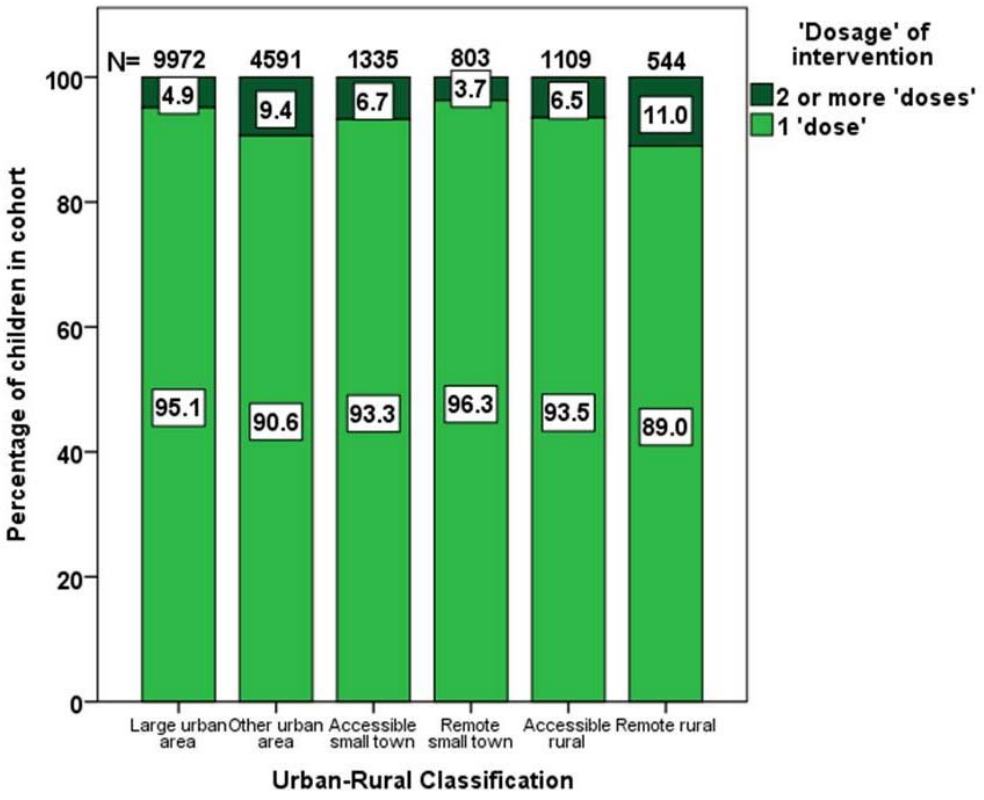


Figure 12.5- Dosage of DHSW interventions by urban-rural classification of the area in which the child lives (N=18354)

While the percentage of multiple doses is highest in the remote rural areas, the pattern is very similar across other geographical areas. A univariable logistic regression (see Appendix 25) has shown that, when compared to remote rural areas, children living in large urban areas (OR=0.42, 95% CI [0.31, 0.55], p=<0.001), accessible small towns (OR=0.58, 95% CI [0.41, 0.82], p=0.002) remote small towns (OR=0.31, 95% CI [0.20, 0.49], p=<0.001), and accessible rural areas (OR=0.56, 95% CI [0.39, 0.80], p=0.002) are less likely to have multiple interventions. With a c-index of 0.56 (95% CI [0.54, 0.57]), this variable has little predictive capacity.

12.3.2.4 Family variables

Figure 12.6a, b, and c show the dosage of DHSW interventions delivered according to family variables which include infant feeding, smoking and Health Plan Indicator (HPI) at 6-8 weeks.

There is very little difference in the percentages of children receiving one or multiple doses across the categories of feeding and smoking, although bottle-fed children (OR=1.38, 95% CI [1.17, 1.62], p=<0.001) and children living in a smoking household (OR=1.32, 95% CI [1.13, 1.55], p=<0.001) were more likely to receive multiple doses in a univariable regression (Appendix 25). Within the HPI categories, 19% of children who were assessed by health visitors as requiring intensive support (non-Childsmile support) received multiple 'doses' (OR=4.42, 95% CI [3.60, 5.44], p=<0.001) compared to 5% of 'core' and 7% of 'additional' children (OR=1.48, 95% CI [1.30, 1.68], p=<0.001).

All c-indices for family variables are between 0.5 and 0.6, indicating a weak predictive capacity of these variables in relation to dosage.

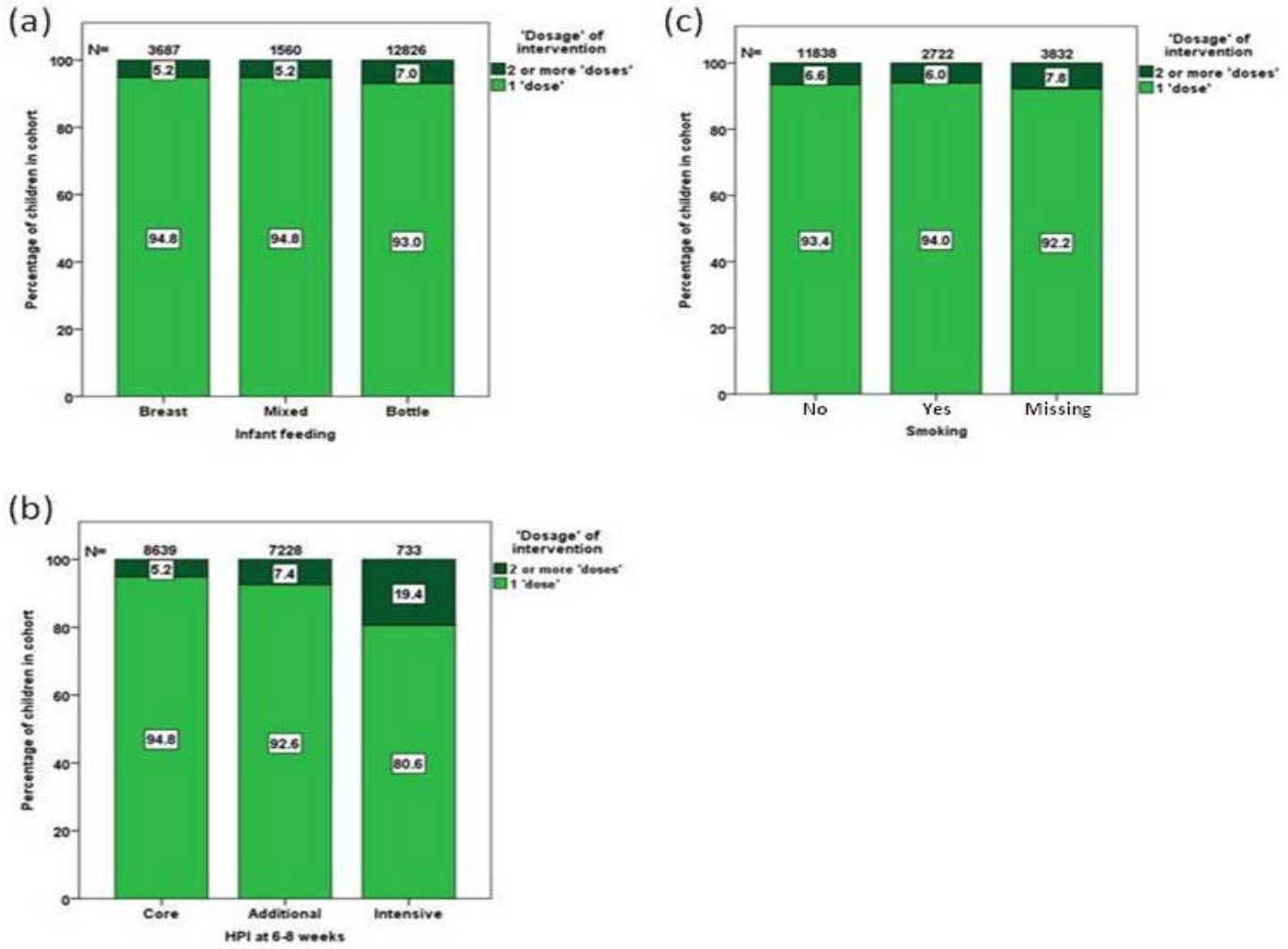


Figure 12.6- Dosage of DHSW interventions by family variables (a) feeding (N= 18073), (b) smoking (N=18392), (c) health plan indicator (N=16600)

12.3.2.5 Level of risk

Figure 12.7 shows the dosage of DHSW interventions by the level of risk calculated for each child. Level of risk is an aggregated risk score based on four factors: area-deprivation (SIMD), type of feeding, smoking, and health plan indicator

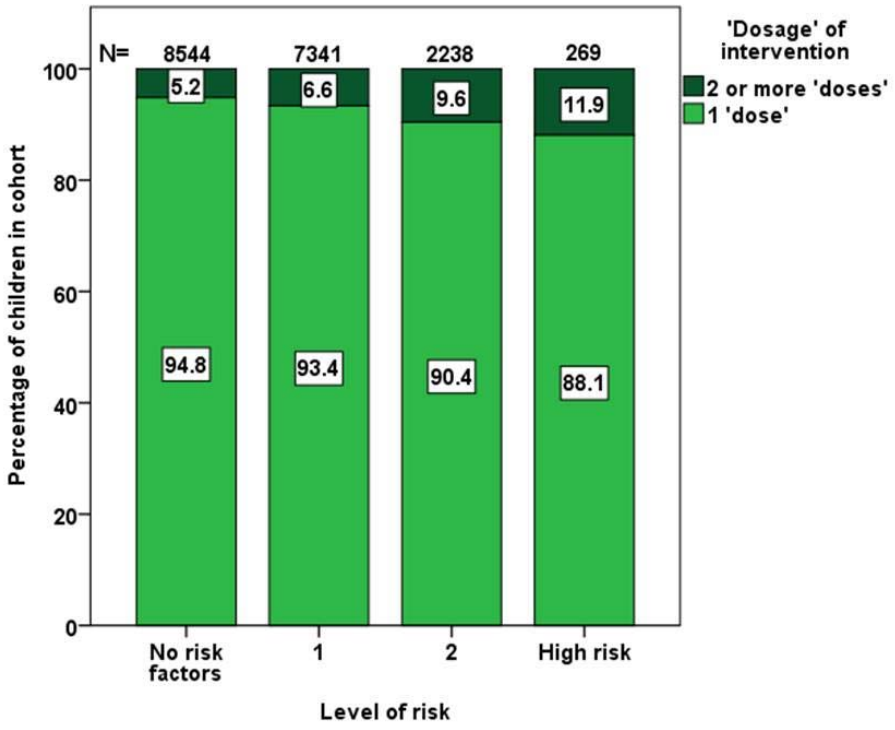


Figure 12.7-Dosage of intervention by level of risk (N=18392)

Figure 12.7 shows that there is a gradient in the relationship between level of risk and multiple doses of DHSW intervention. As the number of risk factors an individual is exposed to increases, the likelihood of them receiving more than one intervention dose increases ('1 risk factor': OR=1.30, 95% CI [1.14, 1.49], p=<0.001; '2 risk factors': OR=1.94, 95% CI [1.64, 2.30], p=<0.001; 'high risk': OR=2.48, 95% CI [1.69, 3.62], p<0.001). The c-index is 0.56 (95% CI [0.55, 0.58]) so level of risk is also not a good predictor of dosage (see Appendix 25 for regression tables).

12.3.3 Multivariable logistic regression of variables influencing dosage: across Scotland

A multivariable logistic regression model offered all variables in a stepwise fashion, excluding local SIMD and level of risk (see Appendix 25). When controlling for all other variables, a small number of differences in the association between the explanatory variables and dosage were shown.

Feeding and smoking were not kept in the model at the final step. The association between dosage and HPI at 6-8 weeks was only slightly attenuated, and still significant, in the multivariable model.

The adjusted odds ratios for the health boards showed a similarly varied pattern of association as for the univariable model with the exception of NHS Highland, in which children were significantly more likely to receive multiple doses (AOR=1.83, 95% CI [, 1.32, 2.54 p<0.001) compared to NHS Ayrshire & Arran.

The adjusted odds ratios for SIMD 1 (AOR=1.86, 95% CI [1.36, 2.55], p<0.001) and 2 (AOR=1.53, 95% CI [1.11, 2.13], p=0.01) were slightly attenuated but still significant.

Children living in 'other urban areas' became 1.5 times more likely than those in a 'remote rural area' to receive multiple doses (AOR=1.47, 95% CI [1.01, 2.15], p=0.04) in the multivariable model.

The c-index for this model is 0.73 (95% CI [0.72, 0.75], p=<0.001). This is higher than the best single predictor, which was HPI at 6 to 8 weeks (0.59, 95% CI [0.57, 0.60]) which indicates that this multivariable model has considerably improved predictive power. To conclude, health board, urban-rural classification, area-based deprivation and Health Plan Indicator were found to be independently associated with dosage at the national level.

12.3.4 Multivariable analysis of factors influencing dosage: within health boards

Multivariable regression models of variables associated with dosage could only be run for NHS Ayrshire & Arran, NHS Greater Glasgow & Clyde, NHS Highland

and NHS Lanarkshire (see Appendix 27). Area-based deprivation (SIMD) was only included in the final model for NHS Ayrshire & Arran and NHS Greater Glasgow & Clyde where it was found that the 20% most deprived children were significantly more likely to have received more than one dose than the least deprived (NHS Ayrshire & Arran= AOR=3.92, 95% CI [1.54, 9.98], p=0.001; NHS Greater Glasgow & Clyde= AOR=2.43, 95% CI [1.52, 3.89], p=<0.001). In NHS Greater Glasgow & Clyde and NHS Ayrshire & Arran, children who are more at risk are more likely to receive more than one dose.

HPI was included in the final models for all four health boards but only the 'intensive' category was significantly associated with dosage in NHS Ayrshire & Arran (AOR=5.63, 95% CI [3.22, 9.87], p=<0.001) and NHS Highland (AOR=4.06, 95% CI [1.52, 10.87], p=0.005). NHS Greater Glasgow & Clyde and NHS Lanarkshire showed a gradient across the 'additional' (NHS Greater Glasgow & Clyde= AOR=1.34, 95% CI [1.06, 1.70], p=0.01; NHS Lanarkshire= AOR=1.54, 95% CI [1.10, 2.17], p=0.01) and 'intensive' (NHS Greater Glasgow & Clyde= AOR=3.86, 95% CI [2.83, 5.26], p=<0.001; NHS Lanarkshire= AOR=5.16, 95% CI [1.78, 14.95], p=0.003) categories when compared to 'core'. In these four health boards, children at greater need were more likely to receive multiple doses.

Smoking was included in the model for NHS Highland due primarily to the 'missing' category and smoking status was borderline associated with dosage (AOR=1.77, 95% CI [0.98, 3.20], p=0.06).

These models had poor to fair predictive capacity (NHS Ayrshire & Arran= c-index= 0.67, 95% CI [0.63, 0.72]; NHS Greater Glasgow & Clyde= c-index= 0.65, 95% CI [0.62, 0.68]; NHS Highland= c-index= 0.58, 95% CI [0.52, 0.64]; NHS Lanarkshire= c-index= 0.56, 95% CI [0.51, 0.61]).

12.3.5 Univariable analysis of influence of level of risk on dosage

Due to clear differences in dosage across health boards, we looked at the association of the number of risk factors with dosage within health boards (see Appendix 26) in a univariable regression model for each health board. Only NHS Ayrshire & Arran, NHS Greater Glasgow & Clyde, and NHS Highland could be

included as the other health boards had small numbers of children in each risk category. These health boards showed that DHSWs are more likely to deliver multiple doses to families exposed to a greater number of risk factors. DHSWs in these health boards therefore appear to tailor the dosage to individuals' level of risk; however it is important to note that 'level of risk' has limited predictive capacity in each of these health boards (NHS Ayrshire & Arran= c-index= 0.61, 95% CI [0.55, 0.65]; NHS Greater Glasgow & Clyde= c-index= 0.59, 95% CI [0.57, 0.62]; NHS Highland= c-index= 0.59, 95% CI [0.54, 0.65]).

To conclude, 'level of risk' was found to be associated with 'dosage' in NHS Ayrshire & Arran, NHS Greater Glasgow & Clyde and NHS Highland (Appendix 26). This was not a good predictor of 'dosage', however. While HPI was associated with dosage in NHS Ayrshire & Arran, NHS Greater Glasgow & Clyde, NHS Highland and NHS Lanarkshire, area-based deprivation was only associated with dosage in NHS Ayrshire & Arran and NHS Greater Glasgow & Clyde.

In contrast to findings at the national level, within health boards area-based deprivation is not always associated with dosage and it appears that variables linked to identifying those who need the intervention predict dosage to a greater or lesser extent depending on the health board. This may indicate either that these variables are not good indicators of individual families' need for the DHSW intervention or that there are factors present within health boards that affect DHSWs freedom to offer multiple doses where needed.

The following sections include findings from focus groups and interviews with stakeholders. These findings support the idea that the dosage of intervention a family receives is not determined by their DHSW but, rather, by particular barriers and facilitators within each health board.

12.4 Factors affecting DHSWs' freedom to tailor the 'dosage' of intervention

In focus groups and interviews, it became clear that there were instances where dosage had not been dictated by families' needs but, rather, by external factors. These included other public health responsibilities and following up families who failed to attend dental appointments.

12.4.1 Other responsibilities

Respondents discussed several issues affecting DHSWs' capacity to carry out their Practice role within the context of other job and task demands. The issue that featured most often and provoked lengthy discussion was the difficulty of balancing the demands of Practice with other elements of the role; particularly for DHSWs with multiple roles.

For example, DHSW and coordinator groups discussed how DHSWs in several health boards in the North and West would soon have their role extended to cover other priority groups. There were concerns about how additional tasks, such as monitoring toothbrushing in residential care for the elderly, would affect DHSW capacity for carrying out Childsmile Practice. In one North health board, DHSWs were following up FTA notifications for every child under 17 years of age. Consequently, these DHSWs did not have the capacity to attend to new referrals from health visitors.

> DHSW 21, North: That is really a load of our work, isn't it? The phone goes, it's a dentist, 'Oh, 4 children […] [have] failed to attend'. And you've got to go and stop doing your home visits and that, to catch up with the ones that [have failed to attend].

Many DHSWs had a dual role where they covered Practice and Nursery & School duties. The volume of responsibilities arising from each role was suggested, by DHSWs in all groups, to have directly affected their capacity to carry out home visits. DHSWs described how they were 'snowed under' with Nursery & School duties due to the HEAT target of at least 60% of 3- and 4-year-old children in each SIMD quintile receiving at least two applications of fluoride varnish per year. The fact that there was a clear performance target for Nursery & School, and not for Practice, has meant that Nursery & School activities took priority. In

contrast to Nursery & School, Practice activity was reported by coordinators and DHSWs as difficult to quantify due to the high failure rate in attempting to contact families.

> Coordinator 14, West: If you're trying to actually reflect […] [your attempts to contact families] in your diary or any other paperwork […] …[it is difficult because] you might go through some unfortunate patches where you do have to go back in quite a few times.

In each DHSW focus group there was a mix of DHSWs with dual and single roles. DHSWs of each type agreed that having a single role would allow DHSWs to deal with referrals more efficiently and work long term with a family if that is what is required to meet a family's needs. It was also suggested that DHSWs would have more time available to follow families up after attending an appointment to discuss their experience of attending the dentist and to check how they were getting on with implementing the oral health advice they have received. The examples given by DHSWs who had worked with families over several weeks or months were all given by DHSWs with a single role; supporting the idea that it is DHSWs with this single focus that are able to provide intensive support when needed.

In some health boards it was thought that there would not be enough DHSWs to carry out the Nursery & School fluoride varnishing programme if some had a single role. Coordinators had developed different strategies for trying to manage the effect that a dual role had on the capacity for carrying out Practice activities. In NHS Borders, the DHSWs had one day each week set aside for doing the administration for Childsmile Practice. They carried out Nursery and School duties and home visits on other days of the week. In NHS Lanarkshire, DHSWs focused almost exclusively on Nursery & School during school term time and focused on home visits during school holidays.

In some health boards, where DHSWs were line managed by health visitors, coordinators and DHSWs expressed concerns about additional health improvement tasks and training assigned to DHSWs by health visitors that may impact on the time they can spend tailoring to families' oral health needs.

Coordinators were concerned that the DHSW oral health role may become diluted, due to other health related support tasks being passed on to them. A health visitor from NHS Grampian predicted that role dilution would be a likely side effect of line management by health visitors should such a system be put in place in her area. As reported in Section 10.3, there was evidence that this has happened in the aforementioned West health board as some DHSWs in this board took on additional tasks such as delivering the 'Triple P' parenting programme.

In one health board in the West, where DHSWs were line managed by a health visitor and a Childsmile coordinator, DHSWs expressed negative feelings about this arrangement. DHSWs in this position reported that a consequence of being line managed by health visitors and a Childsmile coordinator, is that DHSWs were dealing with competing demands, which diverted their time away from supporting families.

> DHSW 11, West: But you need one boss as well, you don't need levels of bosses. We've got so many bosses and so many tiers. We've got (name) and all that coming from Childsmile, we've got a team leader from the health visitors, we've got (name) from, well, in our area, from oral health. You've got so many people in on you that, you just need one structure, one person coordinating […].

12.4.2 Following up families who fail to attend dental appointments

DHSWs and coordinators from all regions discussed the lack of an effective protocol for notifying DHSWs of children who fail to attend an appointment. In such cases, the DHSW would attempt to make contact with the family and intervene again.

> DHSW 11, North: You need to know they've failed. That's the big problem. We don't always know that they've failed to attend. We would need the dentists to let us know and that doesn't happen.

> DHSW 13, North: It used to happen when there were forms, monitoring forms that came to us. And they would say they attended or they failed. And then that's how we knew but we don't get that anymore.

In all cases it was non-salaried practices ('high street dentists' who receive remuneration from the NHS for each treatment delivered to a patient) that were

described as being the least engaged with existing protocols. Some coordinators suggested that the high turnover of staff in dental practices made it difficult to build relationship and strong lines of communication.

In contrast to the general experience, DHSWs based in a dental practice in a North health board reported that their FTA process worked well. They had access to the R4 Practice Management system; a database used by practices. They could use this system to check who had failed to attend. One coordinator reported that communicating with practices about FTAs by email had been more successful than by telephone.

Variation in the percentage of multiple doses across health boards may, at least partially, be attributed to levels of engagement with FTA protocols as DHSWs may have been more likely to deliver a subsequent dose to those families who had a child who had not been present for an arranged appointment.

12.5 How DHSWs should determine the right intensity of intervention

12.5.1 Brief intervention versus long-term support

Figure 12.2 shows that, in most cases, DHSWs appeared to be delivering a brief, one-off, intervention. When discussing the boundaries of the DHSW role, the Executive group seemed to agree that, while DHSW support should vary in intensity according to families' needs, it was not intended to be long-term support for families who did not readily engage with the programme. The Executive group emphasised that DHSW support was a brief intervention and that the ultimate aim was to get the parent to take the child to practice themselves.

> Executive 3: I think it's a brief intervention[…], so you have to keep that in mind. […] I mean, […] it's hard to quantify but you have to think, if you've gone, say, three or four times and you're getting nowhere […] …there's only so much you can talk to them about with regards to that and if you're getting nowhere then it's a case of going back to somebody with a bit more experience or knowledge.

In cases where families do not engage with dental services after receiving some DHSW support, it was suggested that DHSWs should discuss the families' support needs with somebody more knowledgeable and experienced, such as a health visitor or coordinator.

Accounts of building long term relationships with families were sporadic throughout the groups. This indicated that only in certain cases, where a family is considered to be more vulnerable, would support be provided over more than one or two doses. Figure 12.2 provides evidence that this is generally how the intervention has been rolled out as the majority of children only receive one 'dose'.

There were mixed views amongst DHSWs regarding whether one dose was sufficient. There was a feeling from some that one dose would not be sufficient for oral health behaviour change to take place and for a supportive relationship to develop.

> DHSW, North: …sometimes I've gone in and they're maybe having juice in the bottle and I've suggested diluting it down, and they're 'Oh no, no way, they can't have diluting juice.' So [I say] 'well, I'll tell you what, why don't we'… even though they've attended the appointment, I'll go back out [or another visit] and say, 'Look, how [are] you getting on?' […] I don't know about anybody else, sometimes I feel like you're a saleswoman and you're selling something. Sometimes I feel like I've just sold you something so I'm going to walk away now. I don't like to feel like that.

In one DHSW group there was discussion about where the role of the Extended Duty Dental Nurse (EDDN) fit in with Childsmile Practice. The majority of the DHSWs seemed to believe that behaviour change was a key part of the DHSW role, however, some DHSW and coordinator respondents, including at least one Executive member, expressed the opinion that, once families were attending practice, they should get advice on behaviour change from the dentist or EDDN and, in such a case, DHSWs would not need to continue to support a family.

All but one of the parents interviewed said they only had one dose of the DHSW intervention. For this parent, when the DHSW returned to visit the parent for a second time, she brought a second DHSW with her. This could have been a

training exercise for the second DHSW as, in this health board; joint visits were not a common practice. Due to the lack of follow-up visits in the sample, this could reflect that the parent sample was not high risk.

12.5.2 Building rapport and a supportive relationship

As, in most cases, DHSWs met with families on only one occasion, the concept of building rapport with families was deemed to be crucial in order to maximise the potential impact of the intervention. In some cases, DHSWs met with a family multiple times; firstly building rapport and a trusting relationship and, secondly, addressing the family's oral health needs.

Building a relationship with families was identified by most respondents as important for assessing and meeting families' needs. What a 'relationship' meant to respondents varied between and within groups. All agreed on the importance of building informal rapport through "having a laugh, talking and blethering" (DHSW 33, West) but some described building a more intimate, long-term relationship with vulnerable families.

Having a good relationship was reported to be beneficial as parents who trust their DHSW were more likely to 'open up' and disclose oral health needs, risks and barriers; thereby allowing the DHSW to provide appropriately tailored support.

It seems essential that DHSWs engage with families in naturalistic ways to allow meaningful rapport to be built. The idea of being 'genuine' was described in terms such as being "like one of their family" (DHSW 32, West), not going in with a 'professional hat' on and keeping it 'informal'. In order to achieve this, participants described how DHSWs might talk to a parent about issues in their lives before discussing oral health messages. It was suggested to be particularly counterproductive to by-pass this stage when parents are isolated or vulnerable.

> DHSW 24, North: They're isolated. You could be the only person they've seen that day or that week. So you're that one person that they'll want to sit and talk to. And the oral health side comes last. You know, you have to gauge [it] sometimes. They can tell you their whole life story. And you've got to listen. You can't just go,

> ‘I’m sorry, I can’t do that.’ You just can’t do that.

Sometimes these stages spanned multiple visits. One DHSW described how her first visit with one parent was focused on gaining a parent’s trust so that she was “more like a wee friend” (DHSW 4, East) and returning for a second visit which was more focused on oral health.

For some DHSWs, being genuine meant sharing stories and experiences of raising their own children. This was one way of grounding the oral health messages as parents would “relate to a story” (DHSW 29, West). It was also one way DHSWs could vocalise their empathy for parents, gain their trust and deliver oral health messages “without being preachy” (DHSW 24, North).

While some DHSWs mentioned using such personal disclosure in their communication with parents, they seemed unsure of whether or not it was appropriate. This may reflect an internal conflict faced by DHSWs as they try to balance professionalism with devices that come naturally to developing human relationships.

> DHSW 24, North: You’re not meant to personalize anything, and it’s completely wrong what I do, but […] quite often, I’ll say, ‘grans and granddads, they’re the worst. I don’t know what your parents are like, but my parents are always like, you know, packing them full of sweeties before teatime’…and just get chit-chatting that way.

Respondents also suggested DHSWs could show empathy, acceptance and gain a parent’s trust by showing respect for their home environment.

> DHSW 15, East: “I’ll have a drink or something, just to make a nice atmosphere, and pat the dog”

For DHSWs on the islands there is less of an emphasis on forming new relationships with parents and more emphasis on the fact that DHSWs are immersed in their island communities, often already know families to some extent, and are recognised within their community for their role. Being

immersed in the community means that DHSWs are more recognisable and trusted by children and parents, which was thought to be beneficial for encouraging them to engage in positive oral health behaviours.

While having good relations with families was reported to be important, some respondents talked about the delicate balance that needed to be struck between empowering families to maintain good oral health behaviours and developing a dependent relationship. The following section deals with this need to provide an intensity of support that empowers parents.

12.5.3 Tailoring to empower

'Tailoring to empower' emerged as a theme from the focus groups and interviews and relates to the dosage and intensity of the support offered. The idea of the DHSW intervention being about empowering parents was mentioned by a minority of participants, however, when it was mentioned it was thought to be an important aspect of the support worker role. Those who mentioned it described the challenge DHSWs faced in getting the dosage or intensity of support right so that parents were supported to engage with good oral health behaviours but did not become dependent.

Respondents explained what empowerment meant by showing how it contrasted with the approach of a clinically-oriented intervention where health services control all aspects of a treatment. The DHSW intervention, by contrast, aims to encourage parents to develop their own skills and meet their family's needs.

> Coordinator 14, West: It's exactly what it says. It's dental health support. It's not to solve all your ills. It's to give you the right information and turn you round and push you in the right direction and let you get your own momentum going…for the individual to develop their own skills and to get some satisfaction that they managed to achieve something.

Empowerment was described as being achieved by striking a delicate balance between helping parents and 'spoonfeeding' them. Tailoring plays a role in striking this balance. It was said to be important to gauge the right type and intensity of intervention for each family. If too little support is provided, the

parents may not feel sufficiently empowered and may fail to take the child to practice. Too much support, and the parents may simply become dependent.

> DHSW 21, North: That's what's happening with one of my ones, it's gone back to square one. After a year of going, I stopped going and she's now failed [to attend] the past three [appointments] so I've got to start going back again in October 'cause the dentist got on the phone [to tell me].

Respondents suggested three strategies DHSWs could use to try and ensure support empowered parents to be active partners in change rather passive receivers of 'spoonfeeding'. One strategy is to try and ensure the parent took responsibility for the course of the intervention from the start. The idea that parents "need to have personal responsibility" (DHSW 34, West) was shared across several groups. The 'Behaviour Change Wheel' (Figure 13.2) is a resource described by participants which would support this.

Having an "exit strategy" (Coordinator 2, North) was also suggested. This means supporting the family until it was an appropriate time to withdraw. If the parents failed to attend practice with their child then the DHSW continued to support the family.

> Coordinator 2, North: If everything is working, then that is the appropriate time to sort of withdraw because they're attending off their own steam. It's when they don't that you sort of go back to the drawing board.

The third strategy is for DHSWs to constantly assess whether the parents are becoming dependent on the support and work out what needed to be done in order to move from dependency to empowerment. As striking this balance is a particularly challenging part of the role, it was thought by one health visitor that DHSWs should be able to rely on some form of supervision; however, it was not clear if the supervision should be from health visitors or coordinators.

12.6 Summary

The data show that the majority of children across Scotland received only one dose of attempted DHSW intervention. The factors found to be independently associated with dosage at the national level included: health board, urban-rural classification, area-based deprivation, and Health Plan Indicator at 6-8 weeks.

It is not possible, with the available data, to conclude whether the health board variation is a result of local management preference for a brief intervention or long-term support model or if DHSWs have less capacity to deliver multiple doses in some health boards due to more competing demands on their time. However, DHSWs in some focus groups believed that having a 'single role', focused solely on Childsmile Practice, would enable them to tailor to families' needs more effectively as they would have more freedom to deliver more than one dose where appropriate.

If we consider just those health boards where the DHSW role was more established (n of attempted interventions>=99), we can see that it was health boards in the East (NHS Fife, NHS Borders and NHS Tayside) which had the highest percentages of children receiving multiple 'doses'. In these health boards, DHSWs were line managed by Childsmile coordinators. According to respondents in focus groups and interviews, this is a factor which should help protect DHSW time from competing demands. This is the case in NHS Highland, which had a low percentage of multiple doses. This may be a reflection of the health board having a largely rural geography, making delivery of more than one dose difficult. Line management, therefore, is not the only factor that needs to be considered.

NHS Lanarkshire had the lowest percentage of multiple doses compared to all other health boards. It is possible that this is intentional, with Childsmile management backing a 'one dose only' strategy in order to get children registered with a dental practice, leaving oral health behaviour change in the hands of the EDDN and dentist. An alternative explanation would be that the untargeted nature of DHSW support in NHS Lanarkshire has had an impact on DHSWs' capacity to tailor and provide more doses to those who would most benefit. Indeed, although HPI at 6-8 weeks was found to be independently

associated with dosage in NHS Lanarkshire, the predictive capacity of this variable was weak.

Childsmile staff focus group and interview respondents also mentioned FTA protocol as a factor that limits DHSW capacity to tailor the intensity of their support. It may be possible to attribute at least a degree of health board variation to variation in levels of engagement with FTA protocols. If DHSWs were made aware of children who FTA then they would be more likely to provide subsequent doses of support to these families. This is not possible where DHSWs are not made aware of FTAs.

The DHSW intervention was suggested by respondents across groups to be a brief intervention, meaning that long-term support should be the exception to the norm. It was reported that DHSWs needed to establish good rapport with families in order to maximise the effects of the intervention. In some cases, this takes longer than others and may require a DHSW to meet with a family several times, in order to gain their trust, before addressing their oral health needs. Evidence that DHSWs sometimes take a "baby steps" approach is reported in the following chapter (Chapter 13).

DHSWs are challenged by the need to strike a balance between empowering parents to take action and allowing a dependent relationship to develop. This challenge was only identified by a minority of respondents, indicating a potential area for development in DHSW training.

13 Results: Tailoring the timing and communication of oral health messages

13.1 Introduction

This chapter reports on the content of the DHSW intervention, focusing on how the timing and style of delivery of intervention components are tailored to families' needs. The research questions addressed in this chapter are shown in Figure 13.1.

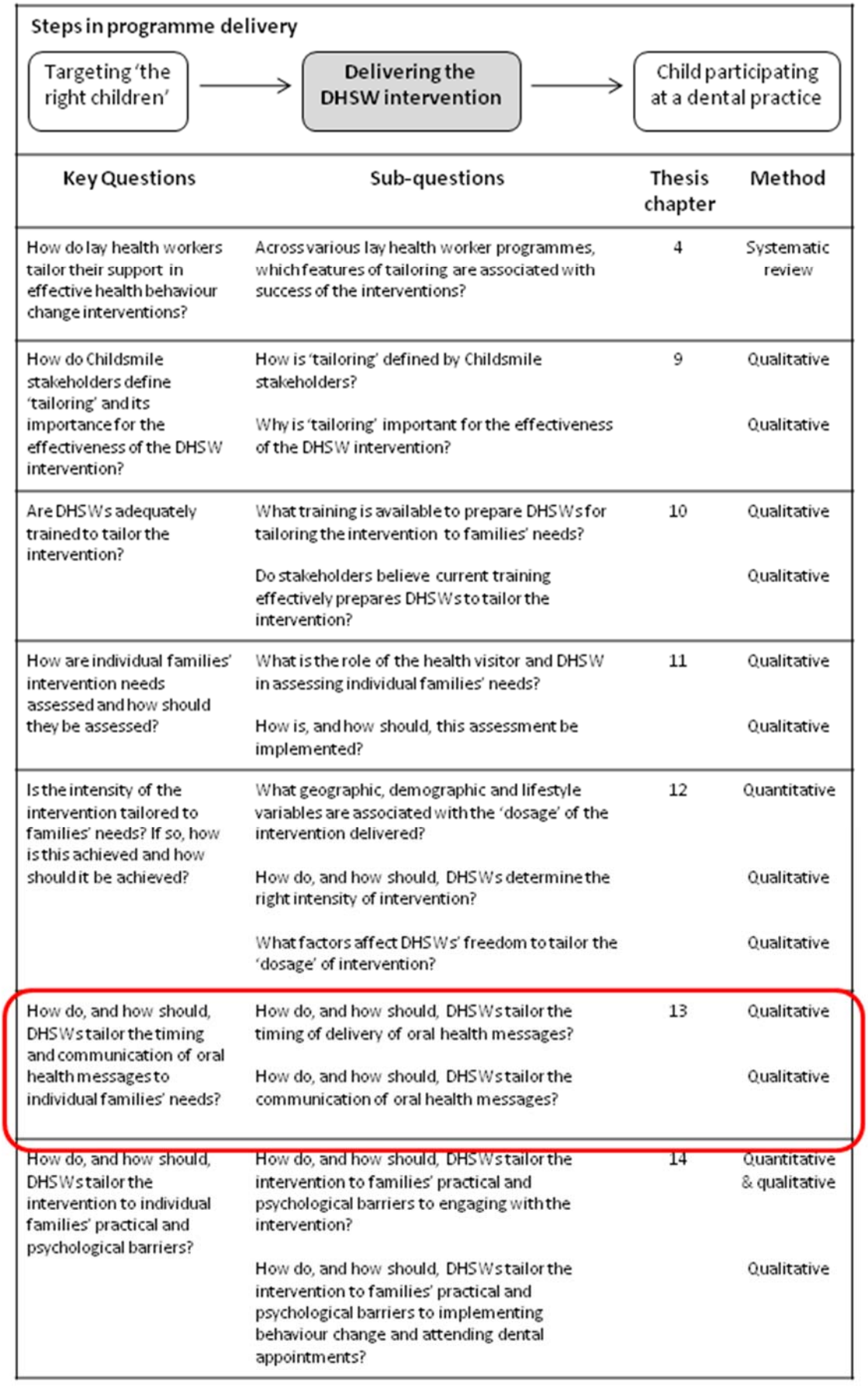
Families can receive a range of intervention components, including; dietary and toothbrushing advice, a dental pack (containing a toothbrush and toothpaste), signposting information, and being linked by the DHSW to a dental practice. The quantitative data on DHSW activity is limited in the information it can provide regarding the quality and quantity of information delivered at each intervention; however, focus group and interview discussions provided information about how DHSWs should adapt the style of delivery in order to make the content understood and related to each families' needs.

13.2 Tailoring the timing of oral health messages

In some cases, DHSWs may proceed with an intervention with a vulnerable family. DHSWs described proceeding with the intervention in small incremental steps if necessary; acknowledging that the support required for some families should be more intensive and provided over a longer period of time than others.

Examples of situations where this kind of support had been provided included where a parent had a mental health issue, poor dental health, or lacked the resources for behaviour change at that time. In these cases, the DHSWs worked intensively with the parents before addressing their child's oral health.

> DHSW 7 East: It's building up their trust, taking your time. The first week might just be a blether, the next week it might be just put your toothpaste on there [points to lower front teeth]…



Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 13.1- Research questions relating to how DHSWs should tailor the timing and communication of oral health messages

This 'baby steps' approach was supported by the coordinator groups and health visitors who suggested that, in these circumstances, it might be appropriate to focus on one simple aim, or communicable message, and not go into full programme detail.

> Coordinator 11, East: It's also knowing that you maybe only mention one element on that visit, you know. You've only got the one room that they're all living in and it's just a mattress on the floor and you don't have to go into fluoride varnish and things on your first visit.
>
> Health visitor 13, East: You're talking about changing from coke in a bottle to coke in a cup.

Respondents discussed the need for DHSWs to ensure families were ready to successfully attend a dental appointment before linking them to a dental practice. Relationships with practices could be damaged if appointments were made for families who were likely to fail to attend; however, it could be difficult to assess a family's readiness to attend practice. One DHSW described how she had resorted to a trial and error approach.

> DHSW 19, North: That happens quite a bit, doesn't it? You think they're going, they're attending regularly, and you pull your service. And [you] find very quickly that you have to go[and] put your service back in […] to remind them to keep going, you know?

This trial and error approach worked where there was adequate communication between practices and DHSWs regarding families who have failed to attend, however, these feedback loops were not working effectively in all areas.

Finally, there were some families who did not meet the basic threshold for continued DHSW attempts to support change. Some health visitors and DHSWs described the difficulty of working with families who were "never going to change" (Health Visitor 2, North). They were fatalistic about the outcomes for such families.

> DHSW 24, North: …for some families it's just not even on their radar.
>
> DHSW (unknown), North: No, it'll not ever be important to them.

DHSWs suggested that trying to engage with such families was more within the health visitor's remit.

Another aspect of supporting families that DHSWs agreed was more within the health visitors' remit was dealing with those who consistently fail to attend appointments. In the DHSWs' view, if they attempted to contact a family several times without progress then it was not within their remit to persist with the case. In these circumstances, some DHSWs reported that they would refer the family back to a health visitor who could then decide how to deal with the situation. Health visitors, however, were not sure what Childsmile expected of them when dentists or DHSWs notified them of families who failed to attend.

> Health visitor 1, North: Dental services are getting in touch with us, and asking us to do something about it but actually, I don't know what they expect us to do. It's a bit bemusing […], why would they go if we asked them to, rather than the dentist?

13.3 Tailoring communication of oral health messages

This section deals with how the content of the intervention is communicated to individual families in a tailored manner.

When asked how DHSWs implement a tailored approach, the majority of groups discussed using a range of communication strategies. These strategies ensure that the key oral health messages are delivered in a way that is relevant and specific to families' needs. The four communication strategies mentioned by participants included: being responsive to what a parent is saying; increasing the relevance of the messages: adapting the communication style; and accommodating literacy and language barriers.

13.3.1 Being responsive

Respondents described a non-tailored approach as 'robotic'. DHSWs who used this approach may view the intervention they deliver as an 'information drop', where only standardised key messages were given. A lack of responsiveness and a lack of effort to make information relevant to a family were described as equating to little more than a 'sales pitch'.

> Health Visitor 6, West: You need to make it familiar to the family and something that they are interested in…[otherwise] it's kind of the same as the window glazing person coming to my door last night: "*Off you go, thanks*"!

A prescriptive approach was theorised to lead to disengagement. Messages not tailored to a family's needs were less likely to have personal relevance for them. DHSWs described noticing clues in the environment, such as juice being given to a child in a bottle, and listening to parents. This gave them opportunities to ask questions; allowing DHSWs to find out what information was likely to be most valuable and to work out the best way to communicate.

13.3.2 Increasing the relevance of messages

Respondents recommended using resources that are appropriate to the age of the child, the environment and the parents' level of understanding which helps to increase the relevance of messages. There was a range of resources that DHSWs may have had access to, including: leaflets with guidance on what drinks and snacks are appropriate for children; a toothbrushing pack; toothbrushing charts; puppets; and baby bottle caries models.

Some DHSWs advocated emphasising the effects of good and poor oral health to parents who did not see oral health as relevant. For example, the potential effects on the child's appearance if they had extractions or the potential benefits of a lower sugar diet for a child's general health and behaviour. One DHSW described drawing on an example from popular culture that they believed would resonate with a particular parent.

> DHSW 34, West: See, I've been in a house and '*The Only Way Is Essex*' has been on [television]. And you'll be like that, 'Well, see their teeth? They've paid thousands. You want your daughter to have this, you need to start now. The longer you've got your baby teeth...'

Some DHSWs tell parents about their own experiences of raising children in an effort to make the challenge of implementing good oral health behaviours more relevant to everyday family life. Sharing experiences in this way is also described in Chapter 12 as a strategy for building relationships with parents.

13.3.3 Adapting the communication style

13.3.3.1 Ensuring messages can be understood

Respondents discussed a need for DHSWs to adapt their communication style in order to make parents feel at ease and ensure the messages are understood. Avoiding the use of jargon helped DHSWs communicate clearly without patronising parents. Mimicking colloquialisms used by a family was suggested as beneficial as "some people just don't understand if you're uber-polite" (DHSW 31, West) and doing so may make DHSWs seem more approachable.

13.3.3.2 Framing messages positively

It was reported to be important to ensure questions about a child's oral health are non-threatening and non-confrontational. Instead of asking a question such as "are you brushing your child's teeth?" DHSWs suggested phrasing the question as "how did they [the child] get on [with toothbrushing]?" or "how important is it for you to look after you kid's teeth?" (DHSW 33, West).

Keeping communication positive was reported to be important. One coordinator was considering adopting an approach to positive communication gleaned from the Family Nurse Partnership training. This approach involves focusing on parents' strengths rather than focusing on what they are not managing to do for their child.

> Coordinator 13, West: Instead of going in and saying you've got to do this, this, this and this you go in and you say your baby's beautifully dressed today, now what we've got to do is make sure you really look after them and one part of that will be to make sure you look after their teeth.

Although the majority of examples of tailored communication were positive in tone (e.g. emphasised benefits of oral care), in two DHSW groups, participants mentioned that in cases where parents did not seem to be taking the information on board, it may be appropriate to emphasise the negative consequences of not looking after their children's teeth.

> DHSW 21, North: …then they're going to wake up in a recovery room with tubes down their throat and blood everywhere, so it's really up to you "cause you can stop this".

13.3.3.3 Making use of appropriate resources

Another way to adapt the communication style is to make use of available Childsmile resources. The majority of respondents were able to access a range of resources and felt that these were important facilitators of tailored communication in particular. There were a number of generic resources available to the majority of DHSWs that included:

- flipchart diagrams and pictures- useful for giving talks to groups of parents or in clinic waiting rooms
- smaller (A4 size) pictures and diagrams- useful for talking one-to-one with a parent
- puppets- useful for engaging children during a home visit

There were examples of resources that support tailoring which have been developed and implemented at a local level. These include:

- leaflets with oral health advice- tailored to stages of child development

- translated letters for mailbox communication with families who do not speak English

- adult toothbrushes- for distribution to vulnerable parents

- the 'Behaviour Change Wheel'- used to identify barriers and opportunities for change and to guide the progress of the intervention (see Section 14.2).

In addition to these, the 'Chatterbox' intervention, which was trialled in several health boards, was reported to be beneficial for opening up conversations with families and identifying barriers. 'Chatterbox' is a toolkit that aids parents and DHSWs in constructing a storyboard of the family's day, identifying opportunities for change. Some respondents had reservations about the use of the toolkit, describing it as an extensive resource that had too many components to spread out in peoples' homes.

13.3.4 Accommodating literacy and language barriers

Taking account of language barriers and literacy issues was reported to be essential in order for communication to be effective.

Respondents spoke about the challenge of communicating with families who have limited English. Recent immigrants were often assessed by health visitors as requiring DHSW support due to their unfamiliarity with the process for accessing health services. In some cases, however, families also needed oral health promotion messages. DHSWs and coordinators from two urban areas in the North and West reported a lack of resources supporting their work with families who had limited English. While some Childsmile leaflets were available in several different languages, in some health boards, such as those with large urban areas, the immigrant population was more diverse than the available leaflets. In addition, it was argued that leaflets in other languages that were available to print out "don't look good" (DHSW 11, West).

Although DHSWs were aware of the NHS telephone translation service, it seems this service was reserved for cases where the language barrier was particularly

bad. The reason for this may be as one health visitor explained:

> Health visitor 6, West: When you're using interpreters, it can be quite difficult to know exactly how much they're picking up.

In most cases, DHSWs seem to overcome this by employing a number of strategies, such as:

- Using pictorial resources
- Enlisting the help of someone else such as another family member or a family friend, who speaks English, to be present during the home visit or attend a dental appointment with the family
- Using *Google Translate* or similar websites to translate phrases during interaction with a family
- Using translated forms and letters for mailbox communication with families who do not speak English

DHSWs from a group in the North did not have a mobile phone but thought it would be useful to have a mobile device with access to the internet and a translation service such as *Google Translate*.

DHSWs also gave examples of where they had used tailored communication strategies to help parents with literacy issues. One strategy is to deliver all the messages verbally rather than simply handing over the Childsmile leaflets.

13.4 Summary

DHSWs should tailor the timing of delivery of oral health messages. Focus group and interview discussions highlighted respondents' opinion that there is a difference between a family *needing* an oral health intervention and a family being *ready* for an oral health intervention. Although some DHSWs worked with some families more intensively, taking a "baby steps" approach, it was agreed that there was a limit to how much behaviour change a DHSW could be expected to work towards when dealing with a family who were not adequately prepared for change.

Health visitors agreed that there were some families who were particularly difficult to work with and would be unlikely to respond positively to a DHSW intervention. Although the DHSWs' response in such cases was to refer these families back to health visitors, health visitors expressed frustration at this protocol. There seems to be a need for dialogue between health visitors and Childsmile stakeholders regarding who should be responsible for tailoring to the needs of families who do not engage with DHSWs or dental services. Even more pertinent, would be to investigate what these families' needs are and how they differ from hard-to-reach families who do, eventually, engage with DHSWs and dental services.

Focus group and interview discussions about tailoring communication of oral health messages to families' needs highlighted a need for further development of resources for communicating with families across language barriers. DHSWs were implementing strategies for communicating with people who had limited English; however, it is not known how effective these strategies have been in delivering oral health messages and encouraging behaviour change.

14 Results: Tailoring to individual families' practical and psychological barriers

14.1 Introduction

This chapter presents converging qualitative and quantitative findings which relate to the ways in which DHSWs tailor to families' practical and psychological barriers to engaging with the DHSW intervention and attending dental appointments. The research questions addressed in this chapter can be seen in Figure 14.1.

14.2 Tailoring to overcome families' barriers

As described in Chapter 1: General Introduction, tailoring to families' needs is an integral part of the DHSW model, as theorised by Childsmile. Each health board has the freedom, however, to implement the DHSW intervention as suited to the local context. Nevertheless, respondents across all Childsmile staff groups put forward the idea that part of meeting a family's needs was identifying barriers to the family adopting good oral health behaviours and helping the family overcome those barriers.

14.2.1 Identifying families' needs and barriers

Respondents from one health board described a systematic way of identifying families' barriers, using the 'Behaviour Change Wheel'; a resource that was under development. The wheel is divided into segments with one question about an oral health behaviour corresponding to each segment and is shown in Figure 14.2.

Using the wheel, parents score how well they believe they are currently doing with each of the oral health behaviours and their score is recorded on the relevant segment. This gives a visual clue as to where barriers and opportunities may lie. Next, parents choose which of the behaviours they would like to address first. The DHSW then gives the relevant tailored advice.

Key Questions	Sub-questions	Thesis chapter	Method
How do lay health workers tailor their support in effective health behaviour change interventions?	Across various lay health worker programmes, which features of tailoring are associated with success of the interventions?	4	Systematic review
How do Childsmile stakeholders define 'tailoring' and its importance for the effectiveness of the DHSW intervention?	How is 'tailoring' defined by Childsmile stakeholders?	9	Qualitative
	Why is 'tailoring' important for the effectiveness of the DHSW intervention?		Qualitative
Are DHSWs adequately trained to tailor the intervention?	What training is available to prepare DHSWs for tailoring the intervention to families' needs?	10	Qualitative
	Do stakeholders believe current training effectively prepares DHSWs to tailor the intervention?		Qualitative
How are individual families' intervention needs assessed and how should they be assessed?	What is the role of the health visitor and DHSW in assessing individual families' needs?	11	Qualitative
	How is, and how should, this assessment be implemented?		Qualitative
Is the intensity of the intervention tailored to families' needs? If so, how is this achieved and how should it be achieved?	What geographic, demographic and lifestyle variables are associated with the 'dosage' of the intervention delivered?	12	Quantitative
	How do, and how should, DHSWs determine the right intensity of intervention?		Qualitative
	What factors affect DHSWs' freedom to tailor the 'dosage' of intervention?		Qualitative
How do, and how should, DHSWs tailor the timing and communication of oral health messages to individual families' needs?	How do, and how should, DHSWs tailor the timing of delivery of oral health messages?	13	Qualitative
	How do, and how should, DHSWs tailor the communication of oral health messages?		Qualitative
How do, and how should, DHSWs tailor the intervention to individual families' practical and psychological barriers?	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to engaging with the intervention?	14	Quantitative & qualitative
	How do, and how should, DHSWs tailor the intervention to families' practical and psychological barriers to implementing behaviour change and attending dental appointments?		Qualitative

Figure 14.1- Research questions relating to how DHSWs should tailor to individual families' practical and psychological barriers

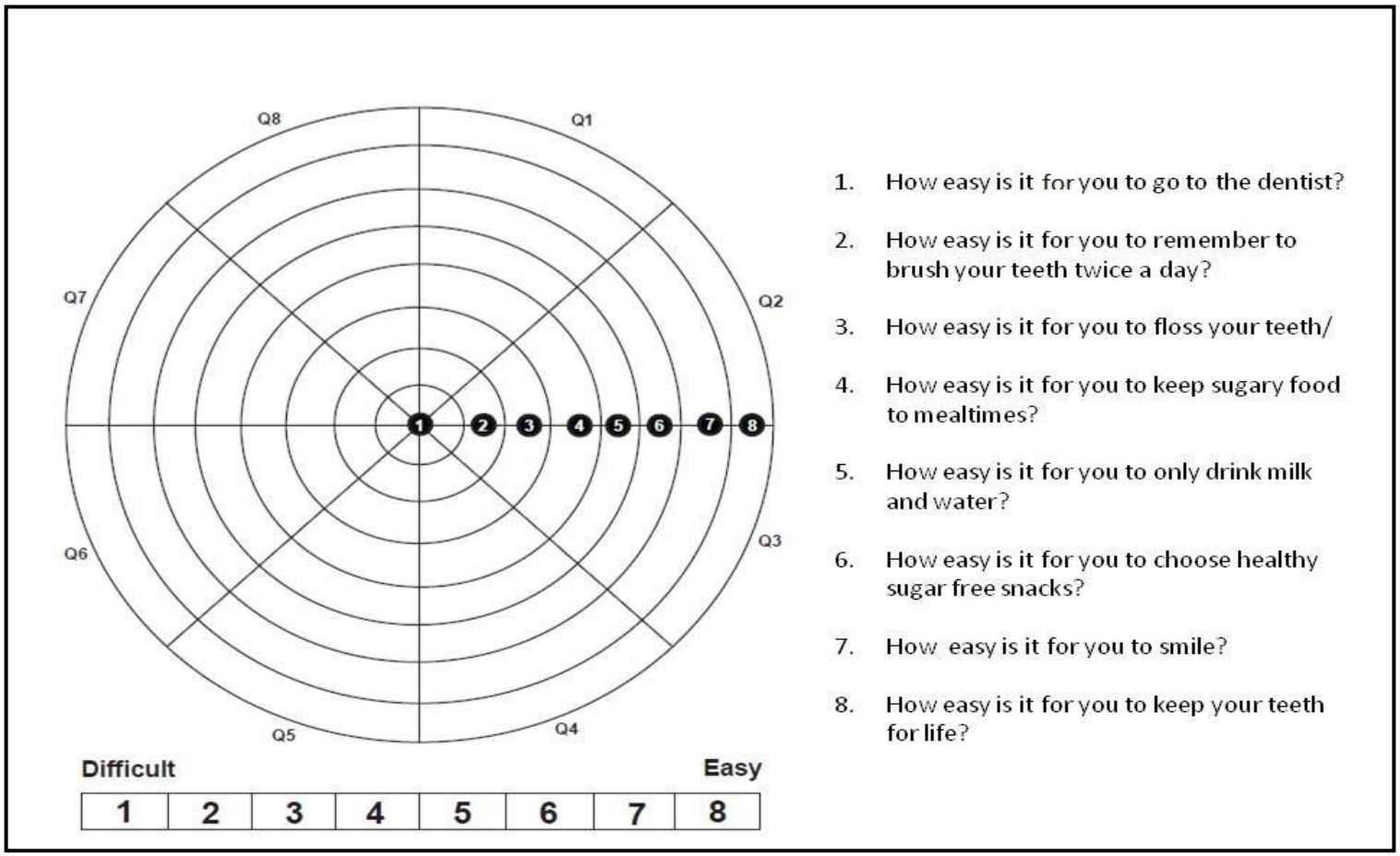


Figure 14.2- Behaviour Change Wheel

While the primary aim of this Behaviour Change Wheel resource is to engage parents in the process of identifying barriers, a secondary aim is to make the process of change less daunting for a parent and ensure parents take responsibility for the course of the intervention.

14.2.2 DHSWs accommodating families' barriers

Whether or not such a systematic approach is taken, once barriers have been identified, DHSWs work with families to overcome them. The importance of being 'accommodating' emerged from Childsmile staff discussions about how to do this in practice. Examples of barriers and ways to be accommodating included the following:

- accommodating family routines by contacting parents in the afternoon when families would be home after school;
- sending reminder texts about appointments to those who are likely to forget;
- meeting a parent at a location that is convenient for them;
- helping a parent arrange transport to get to a dental practice;
- accommodating language barriers by registering a family with a dentist who speaks their language or communicating with the family using translated resources;
- helping a parent with literacy issues complete paperwork associated with dental registration;
- providing resources such as toothbrushing packs to vulnerable families;
- supporting a parent to attend a dental practice with their child if they are anxious or, where the service is available, referring the family to an Oral Health Promoter through the anxious patient referral system;

- allowing parents to choose which oral health behaviour they would like to address and how much change they would be willing to incorporate into their routine; and

- arranging for classroom assistants to take children to dental appointments where parents cannot/refuse to take them.

DHSWs in NHS Highland, a health board with vast rural geography, suggested that in places where there was limited public transport, the best solution would be to drive the family to an appointment; however this was not permitted.

Parents who were interviewed gave examples of ways in which DHSWs had been accommodating. When contacting parents to arrange a convenient home visit time, DHSWs have texted a parent rather than repeatedly try to reach them by phone. One parent explained that it was 'quite handy' (Parent 9, Lanarkshire) for her to pick up a text compared to answering a phone call.

Parents reported that their DHSWs had arranged convenient times to visit them at home. In one case, a parent had met a DHSW opportunistically in a clinic. Although parents were unable to recall specific barriers that had been addressed by their DHSW, in most cases the DHSW had offered to contact a dental practice and arrange an appointment for the family. Parents reported that their needs had been met and some expressed the view that all possible support had been offered.

> Parent 2, Glasgow: I mean, apart from actually come round and brush your children's teeth for you there's not really a lot more that they can do. To find you a dentist, be helpful with the advice, giving out freebies…you know, like I say, compared to down the road [in England] I'm quite stunned that it even happens up here. So, no, they were really good.

14.2.3 Dental practices accommodating families' barriers

DHSWs and coordinators provided examples where dental practices had facilitated the provision of tailored support. Salaried practices (e.g. community dental practices) were particularly accommodating in responding to special requests, such as seeing a child as soon as possible. DHSWs expressed confidence

in dentists' ability to deal with patients and parents who were anxious or phobic.

Another way in which practices facilitated tailoring was by having an Extended Duty Dental Nurse (EDDN) available to provide oral health advice to vulnerable families. DHSWs from several health boards suggested that it was important to have good relationships with the EDDNs in practices. Having a good interpersonal relationship with EDDNs was thought to have enhanced the experience of support for families as they formed an impression of a 'Childsmile family'. In one health board in the East, DHSWs described meeting up with EDDNs in informal settings from time to time, indicating that they had a close relationship.

DHSWs from several health boards reported that some practices were not fully cooperating with Childsmile's objectives by:

- not registering children unless the parents also register;
- not arranging dental appointments if the child is considered too young; or
- not accommodating requests for appointments to be arranged for convenient times.

These responses were described as creating unnecessary barriers to children receiving dental care.

14.2.4 Signposting families to additional support/ resources

Participants in focus groups did agree that 'signposting' was a means of helping a family overcome barriers and change health behaviours and there were reports that this was being delivered "a lot" (DHSW 1, East). There was evidence, however, that it was not always clear whether 'signposting' included all community services or just those directly related to oral health.

> DHSW 24, North: We don't do as much signposting but it's like, 'Why don't you go to mothers and toddlers' or this or that.

In addition, not all DHSWs saw this as a significant part of their role. In these cases, they either believed that the health visitors were already signposting, that they lacked time to put signposting information together, or that there was a lack of local resources and programmes to which to signpost.

14.3 Tailoring contact type to reduce barriers

The Childsmile programme guidance suggests that the ideal location to deliver an intervention to a family would be in their home. It is expected that particular efforts would be made to deliver the intervention during a home visit when dealing with children who are at greater risk of poor oral health.

Although the most common location DHSWs met with parents was in the family home, DHSWs and coordinators mentioned other locations where the intervention had taken place. In some health boards, DHSWs met families in antenatal clinic waiting rooms or approached parents when they brought their child to an immunisation clinic. In one CHP in NHS Highland, DHSWs primarily delivered the intervention in baby immunisation clinics rather than home visits.

In some cases, DHSWs agreed to meet a parent at a neutral location as they preferred not to have a visitor in their home. The location was tailored to the parent's preference. Neutral locations that have been used include a *McDonald's* restaurant, a coffee shop, a library, a *Home-Start* centre and a public house.

Respondents debated the type of location that would be optimal for the DHSW intervention. This led to the conclusion that while no particular location would ever be guaranteed to be optimal, having time set aside for one-to-one engagement with a parent would be ideal. This was most likely to occur on a home visit. In addition, some coordinators put forward the view that following the model of the public health nursing teams, by visiting people within their home, allows DHSWs to "get a little bit of a feel for the environment they're in and…the big picture" (Coordinator 14, West).

Figure 13.3 shows the use of phone calls, home visits, clinic appointments, and 'other' locations across Scotland. In this chapter, all attempted interventions

are included. This means that some families are represented by more than one data point if they had more than one of these contacts.

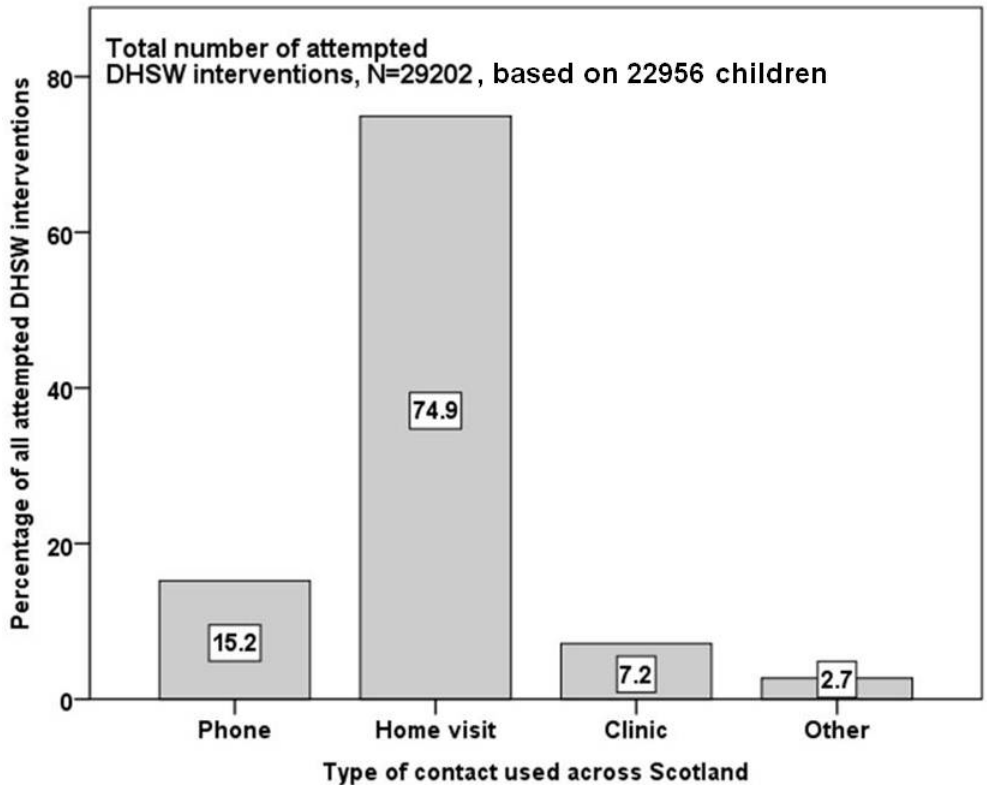


Figure 14.3- Type of contact shown for all attempted DHSW contacts with families across Scotland

Figure 14.3 shows that 75% of contacts are home visits. Phone contacts are the next most popular method (15%), followed by clinic contacts (7%). Almost 3% of contacts take place in another type of location. This could support the examples, provided in focus groups and interviews, of DHSWs accommodating families by meeting in other locations.

14.3.1 Geographical association with contact type

14.3.1.1 Contact type by health board

Figure 14.4 (below) shows that the pattern of contact types varies between health boards.

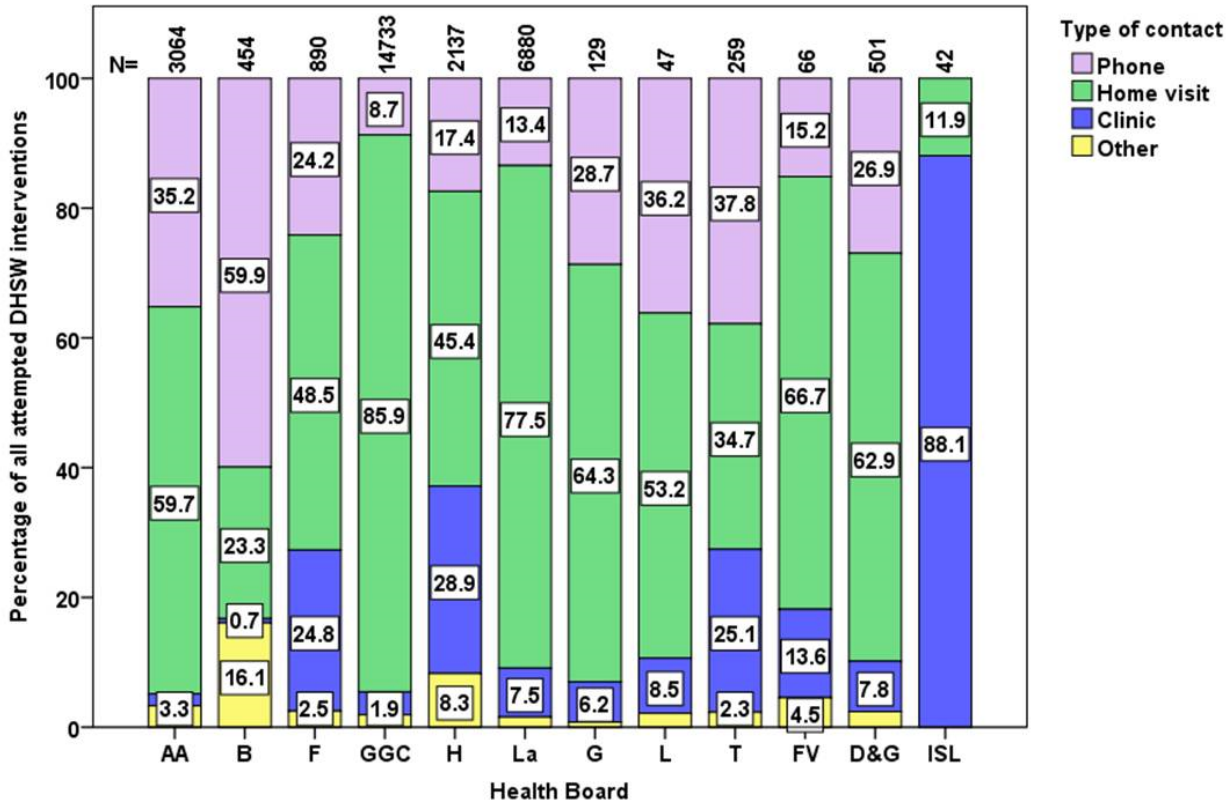


Figure 14.4- Type of contact used by DHSWs shown by health board

The percentage of contacts that were home visits ranged from 12% in the Islands to 86% in NHS Greater Glasgow and Clyde. Over 50% of contacts were home visits in NHS Ayrshire & Arran, NHS Greater Glasgow & Clyde, NHS Lanarkshire, NHS Grampian, NHS Lothian, NHS Forth Valley, and NHS Dumfries & Galloway.

In a focus group, the Childsmile Executive expressed concerns that if some DHSWs did not have the capacity to carry out their dual (Nursery & School and Practice) role activities they may resort to delivering the intervention by In a focus group, the Childsmile Executive expressed concerns that if some DHSWs did not have the capacity to carry out their dual (Nursery & School and Practice)

role activities they may resort to delivering the intervention by telephone rather than carrying out home visits.

> Executive 3: 'Cause I think phone…telephone calls can be one of the things that happens and that's a bit of a worry is [if] you're getting all these calls.

Despite these concerns, DHSWs in the focus groups did not mention using such a strategy and the data appears to support this as a high percentage of families receive home visits in most health boards. There are indications that the real barrier to DHSWs conducting home visits was how rural or inaccessible the family's home may have been.

NHS Borders, a health board which is predominantly rural, had the highest percentage of telephone interventions (60%), one of the lowest proportions of home visits (23%) and the highest proportion of contact taking place elsewhere (16%). In addition, the majority of interventions on the Island health boards take place in clinics (88%).

The variation by geographical location likely indicates that DHSWs may be limited in the type of contact they can offer due to organisational or resource considerations (e.g. time taken to travel to families' homes in the Island health boards). These geographically-related limitations are more evident when examining contact type by urban-rural location, as shown in Figure 14.6.

14.3.1.2 Contact type by area-based deprivation

In order to look at whether contact type is tailored to deprivation, contact type is presented by SIMD quintile in Figure 14.5. Figure 14.5 (next page) shows that the type of contact is slightly tailored to deprivation as an increasingly higher percentage of families receive a home visit in more deprived areas. A higher percentage of those living in less deprived quintiles receive telephone interventions, perhaps indicating awareness that children in these families require less intensive DHSW input; hence, a phone call is sufficient.

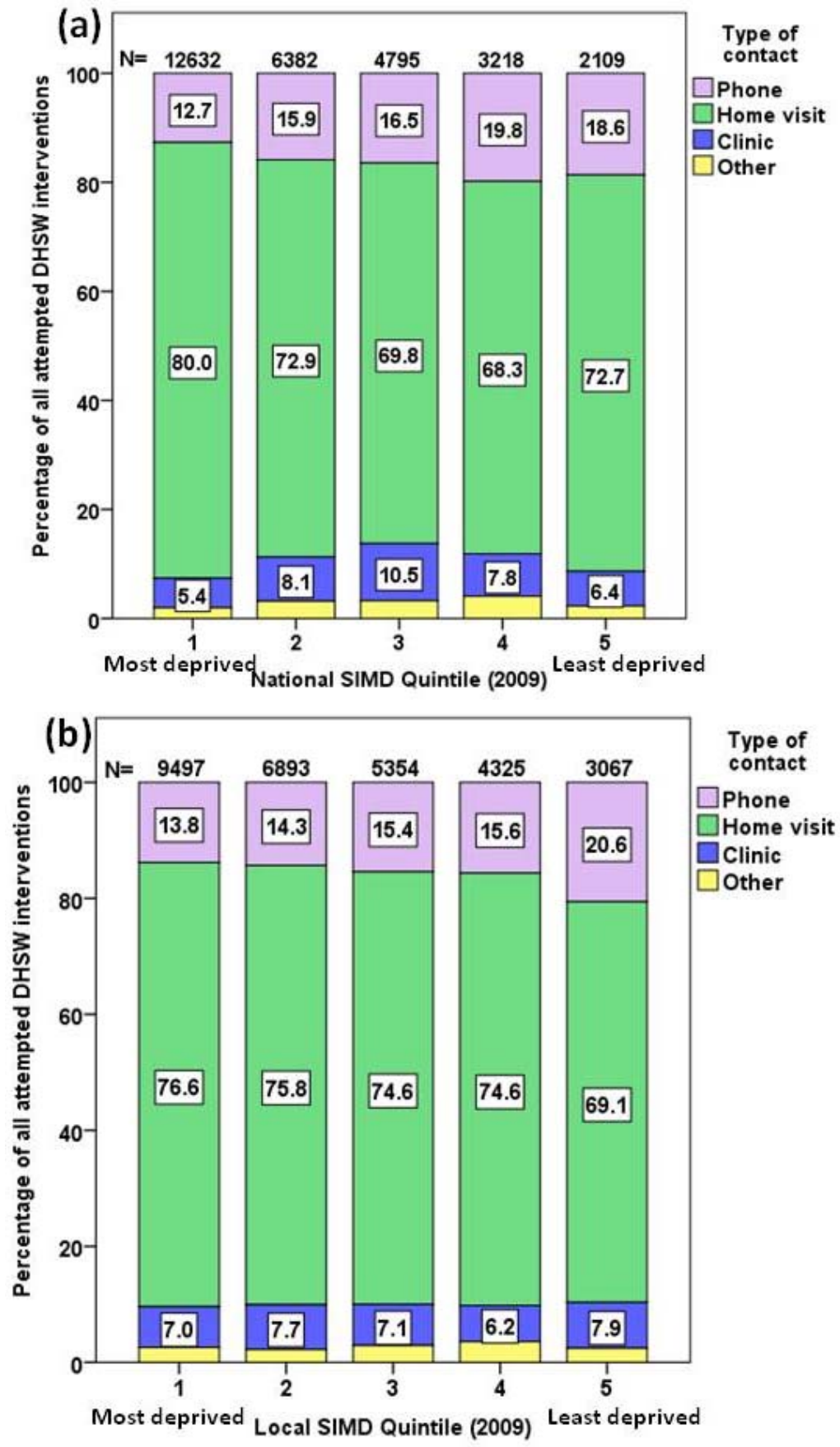


Figure 14.5- Type of contact used by DHSWs shown by (a) national and (b) local SIMD distribution (N=29136)

14.3.1.3 Type of contact by urban-rural classification

Figure 14.6 shows variation across urban-rural locations.

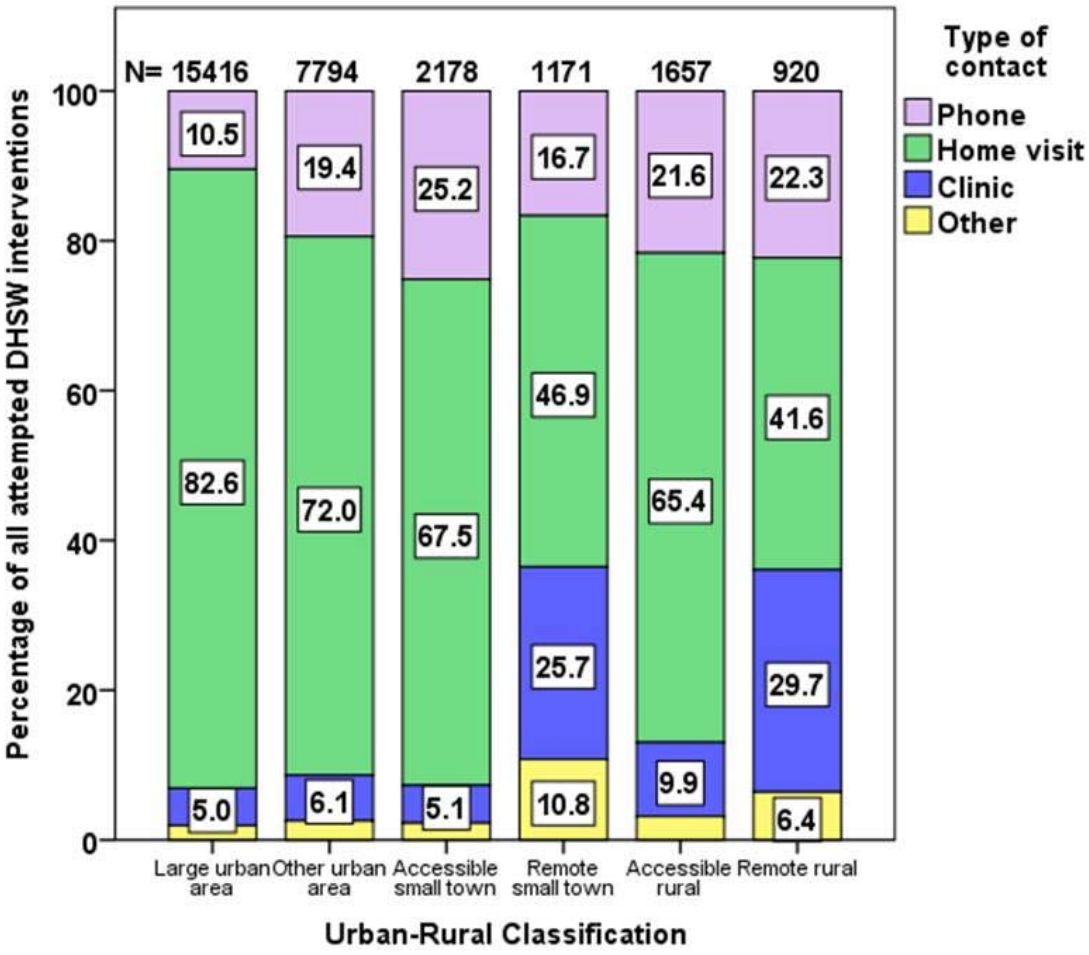


Figure 14.6- Type of contact used by DHSWs shown by urban-rural classification of the area where children lived (N=29136)

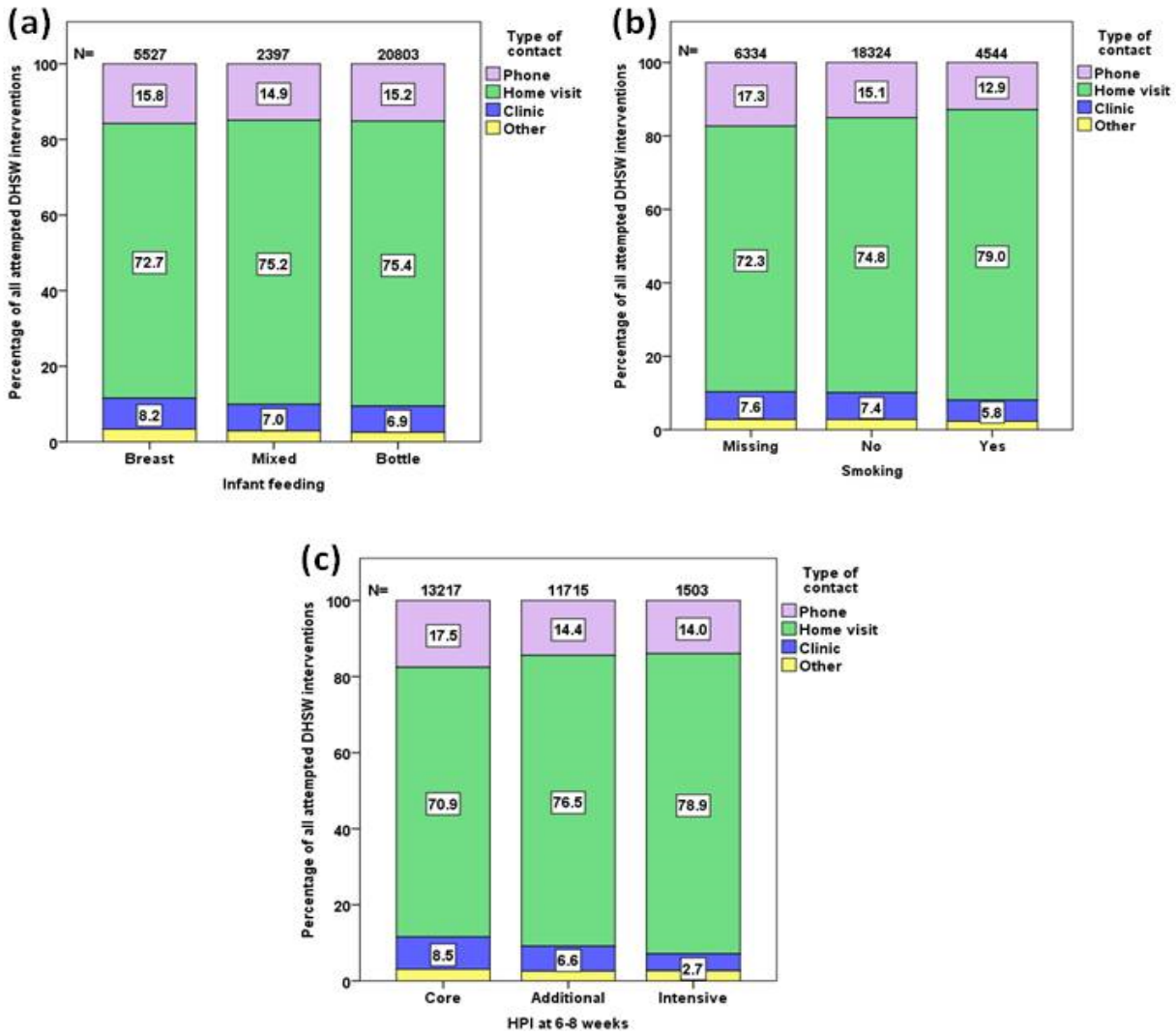
In urban areas (83%- large urban; 72%- other urban) and accessible rural areas (65%), there were a higher percentage of home visits. In more remote areas there was a higher percentage of contact in clinics (30%- remote rural; 26%- remote small town) and 'other' (6%- remote rural; 11%- remote small town) locations. This could be evidence that, in remote areas, DHSWs were constrained by the time and financial resources (e.g. fuel costs) that would have been necessary in order to carry out a home visit.

In these circumstances, DHSWs needed to find other ways to meet families' needs, such as phoning families, meeting families in a clinic or mutually convenient location, or working closely with health visiting teams to ensure at least one person (health visitor or DHSW) was providing tailored oral health support to a family.

> Coordinator 5, North: We've got a limited population but it's so spread out [that it is difficult] for us to go to the different areas. We don't have a support worker on every island, but we do have a dental practice on all our islands so we're not going to send a support worker and pay £100 on a ferry to go and visit someone who might not answer the door which is why we would take the other route of just directly phoning them and giving them the opportunity to go to the practice themselves. So obviously coming down to finance in that respect…

14.3.1.4 Type of contact by family variables

Figure 14.7 (below) shows that there were not large differences in contact type between different feeding methods, and parental smoking versus non-smoking. The type of contact, therefore, did not appear to be influenced by these family factors. There was a trend for more home visits for children on an 'additional' and 'intensive' care plan; indicating a degree of tailoring.



14.7- Type of contact used by DHSWs shown by (a) infant feeding (N=28727), (b) smoking (N=29202) (c) HPI at 6-8 weeks (N=26435)

14.3.1.5 Type of contact by level of risk

Figure 14.8 shows that there is a slightly higher percentage of children in the 'high risk' category who receive a home visit. The likelihood of receiving a home visit appears to increase with number of risk factors.

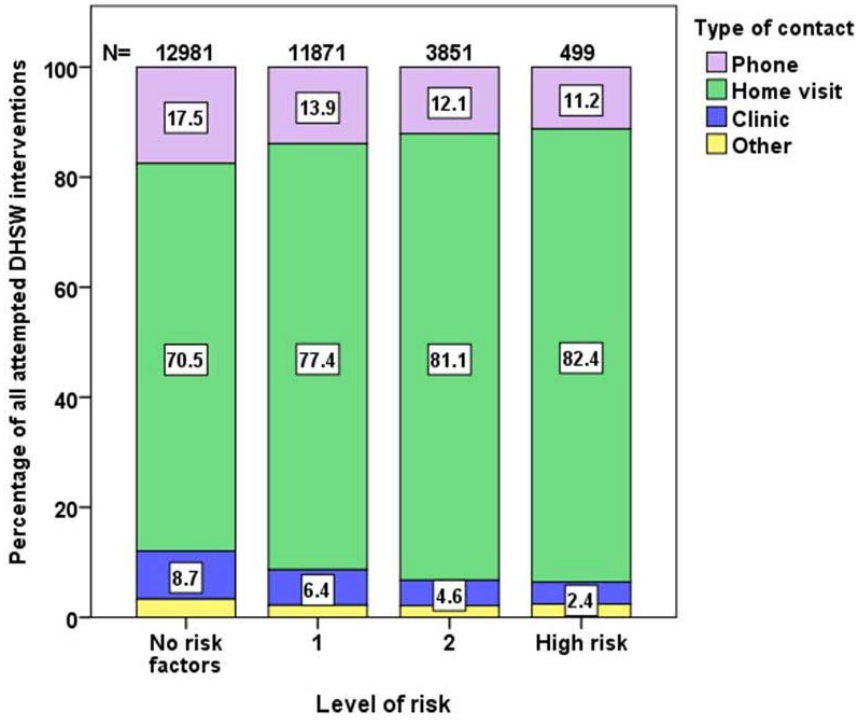


Figure 14.8- Type of contact used by DHSWs shown by level of risk (N=29202)

14.4 Reducing barriers in the immediate delivery environment

Respondents discussed how each delivery environment could affect the quality of the intervention for better or worse. The majority of groups discussed the importance of ensuring that environmental conditions were optimal for effective communication. Creating an optimal environment required that (1) the family

felt comfortable (2) distractions were minimized and (3) the DHSW used appropriate resources for the context.

14.4.1 Comfort

Respondents described how some parents may feel uncomfortable having a visitor in their home, while others may feel uncomfortable talking about personal issues in a public place. It is important, therefore, that DHSWs consider tailoring the delivery environment to ensure that the family feels comfortable. If meeting a parent or family in a public place, some DHSWs suggested removing features that may identify them as an NHS employee, such as their identification badge or uniform, so as not to stigmatise the family.

14.4.2 Minimising distractions

It was agreed to be important to maximise potential engagement with the parents by minimising distractions in the environment. If the presence of children was a potential distraction, DHSWs described how they could use resources such as tooth models and puppets to engage the children with the messages. Alternatively, some DHSWs had brought colouring-in sheets and crayons to occupy children while talking to their parents. Some DHSWs described techniques they had developed to tactfully ask a parent to turn down the television, a common distraction DHSWs reported encountering when in the family home. Often there were distractions in the home that DHSWs had no control over, such as family friends visiting. In these cases, it was said to be better to carry out the visit at another time.

14.4.3 Appropriate resources

Several groups discussed the importance of using resources that were appropriate for the delivery environment. *Chatterbox* was mentioned as a resource that is useful for focusing a parent's attention; however, some respondents who had been involved in piloting *Chatterbox* mentioned that people did not have space in their homes to lay all the components out and so this resource was more appropriate in some homes than others. Other resources affect the communication style of the DHSW using them. Using a 'flip' chart for presentation was thought to lead to a 'lecturing' style of delivery. It was

suggested that this resource may be more appropriate in a waiting room or mother and toddler group than in a family home.

14.5 Summary

Some DHSWs described working collaboratively with families to identify and address barriers to engaging with the intervention, implementing behaviour change and attending dental appointments. Although there was no standardised way of doing this, in one health board the Childsmile staff had developed a resource known as 'the behaviour change wheel' which was designed to support the process of identifying barriers.

Parents who were interviewed were satisfied that they had been adequately supported to implement behaviour change and attend dental appointments, with some parents declaring that their DHSW had done everything for them regarding finding a dentist and providing resources to encourage good oral health behaviours. This calls into question whether, in some cases at least, DHSWs were not empowering parents to make changes themselves. There is a risk that this may lead to dependency or an expectation of continuation of support. This is discussed in Chapter 11: 'Tailoring the 'dosage' of DHSW intervention'.

It is important to note that not all DHSWs thought signposting families to other services and resources was a significant part of their role and there was a lack of clarity regarding what signposting actually meant in practice.

The findings show that DHSWs make use of all available contact methods when attempting to deliver the intervention as a way of accommodating families' needs and addressing barriers to engagement. The qualitative data informed interpretations of the 'other' contact category, which we now know can be a range of mutually convenient locations. Contrary to the Executive's concerns that DHSWs may resort to delivering the intervention by telephone when overwhelmed by Nursery & School duties, the findings suggest that home visits were agreed to be the best environment for delivery and telephone contact, if chosen, is more often used with families who live very rurally.

It is interesting that, while referrals made to DHSWs show a pattern whereby higher percentages of the most deprived are referred (see Figure 7.7), there was no relationship between home visits and area-based deprivation. This may mean either that DHSWs do not tailor the type of contact to families' need or that there is a significant percentage of families living in affluent areas that require this more intensive type of contact.

Ensuring the family does not feel stigmatised within the delivery environment requires that DHSWs consider avoiding delivering the intervention in a public place or removing items of uniform that identify them as an NHS employee. DHSWs also need to consider what they can do to minimise distractions in the environment and which resources will be most appropriate for the setting.

15 Results: Assessing the effectiveness of the DHSW intervention

15.1 Introduction

This final chapter of results examines the impact of the DHSW intervention, as it was implemented between 1st September 2010 and 30th September 2012, on child dental participation; one of the key outcomes for the programme identified from the logic models. Dental participation is defined as a child being either registered at and/or attending a dental practice for treatment, and is the variable commonly advocated by ISD. Here, the effects of the DHSW intervention on participation at a dental practice, and the effect on time taken to participate, are examined. Time to participation is calculated as months from birth until participation. As some children in the cohort had a 6-8 week Child Health Surveillance Assessment many months after their birth, the longest time a child took to participate at practice was 41 months. The shortest time is less than 1 month. The research questions addressed can be seen in Figure 15.1.

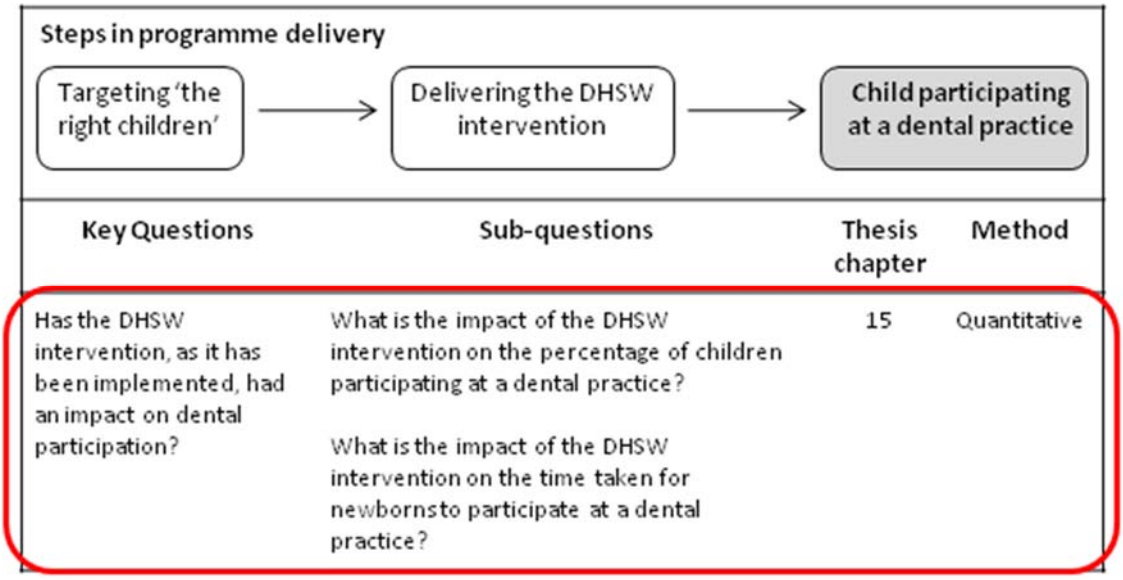


Figure 15.1- Research questions relating to the effect of the DHSW intervention on dental participation

To assess the effectiveness of the DHSW intervention at facilitating participation at a dental practice, a randomised controlled trial would have been most appropriate, where those families considered in need of additional support

would have been randomised to the intervention arm or treatment as usual. These two groups would have been followed up in order to assess how effective the DHSW was at facilitating attendance at practice. This was not possible due to the Childsmile programme being rolled-out across Scotland by the NHS before such a design could be implemented.

We therefore adopted a natural experimental approach which took advantage of the divergence from intended implementation of the Childsmile referral pathway between and within health boards to assess whether the DHSW intervention was effective in increasing participation at practice. This approach cannot unequivocally infer causation, but is a powerful means of addressing research questions in an observational study such as this one (Craig et al., 2012).

15.2 The impact of the DHSW intervention on the percentage of children participating at a dental practice

Figure 15.2 shows the percentage of children, across Scotland and within health boards, in the cohort who participated at a dental practice, according to whether they received a DHSW intervention or not.

Overall across Scotland, 65.5% (71781/109527) of the cohort participated at a dental practice (see Figure 6.2 for description of the cohort). In those who received a DHSW intervention, this figure was 79.2% (14570/18392), and in those who did not receive an intervention, it was 62.8% (57211/91136). Furthermore, in all health boards, it can be seen that there is a clear difference in participation between those receiving and not receiving the intervention, which is 17% overall across Scotland. At the health board level the difference ranges from +8% in NHS Grampian to +22% in NHS Highland.

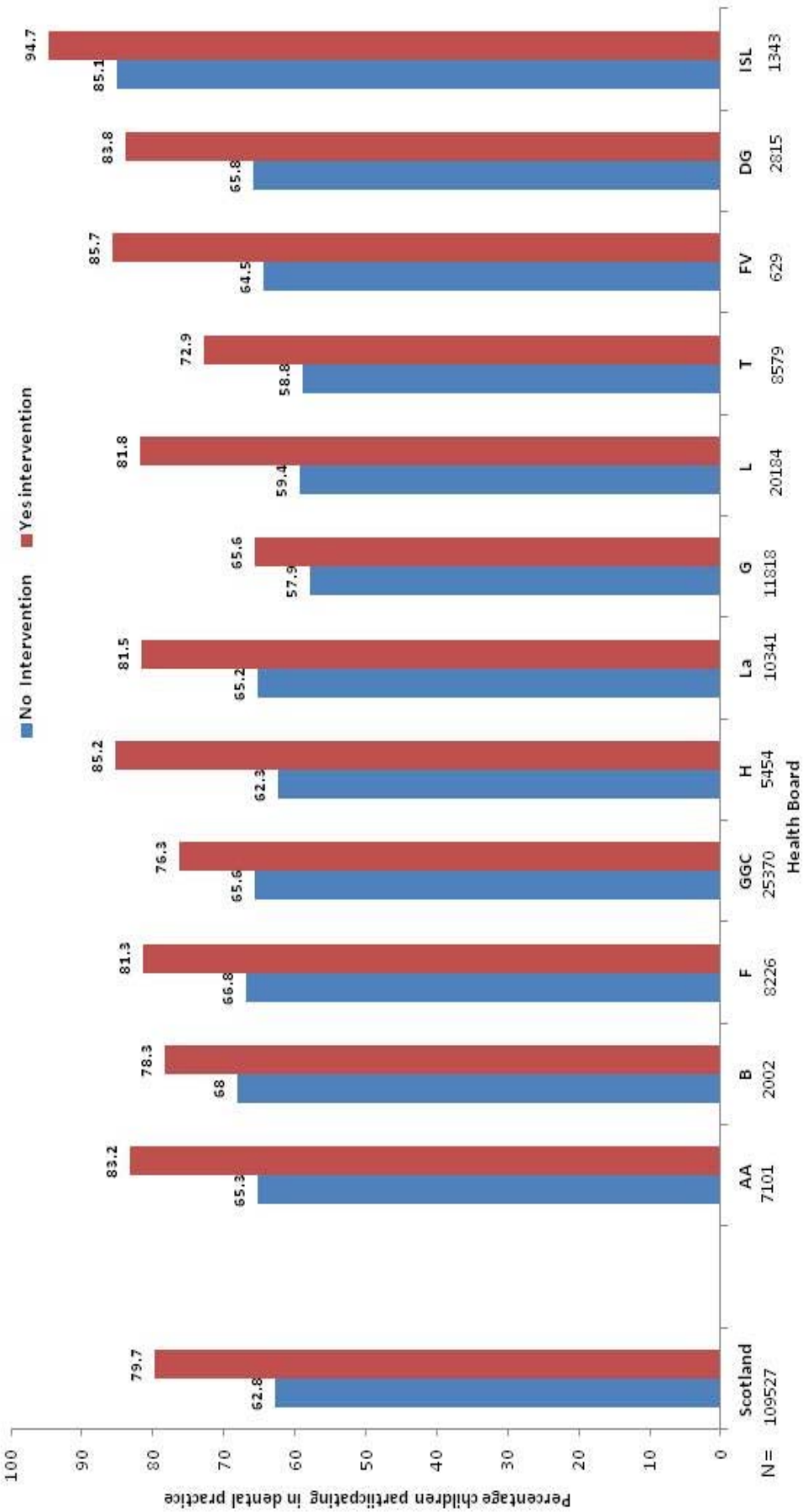


Figure 15.2- Participation at a dental practice, according to whether they received a DHSW intervention or not

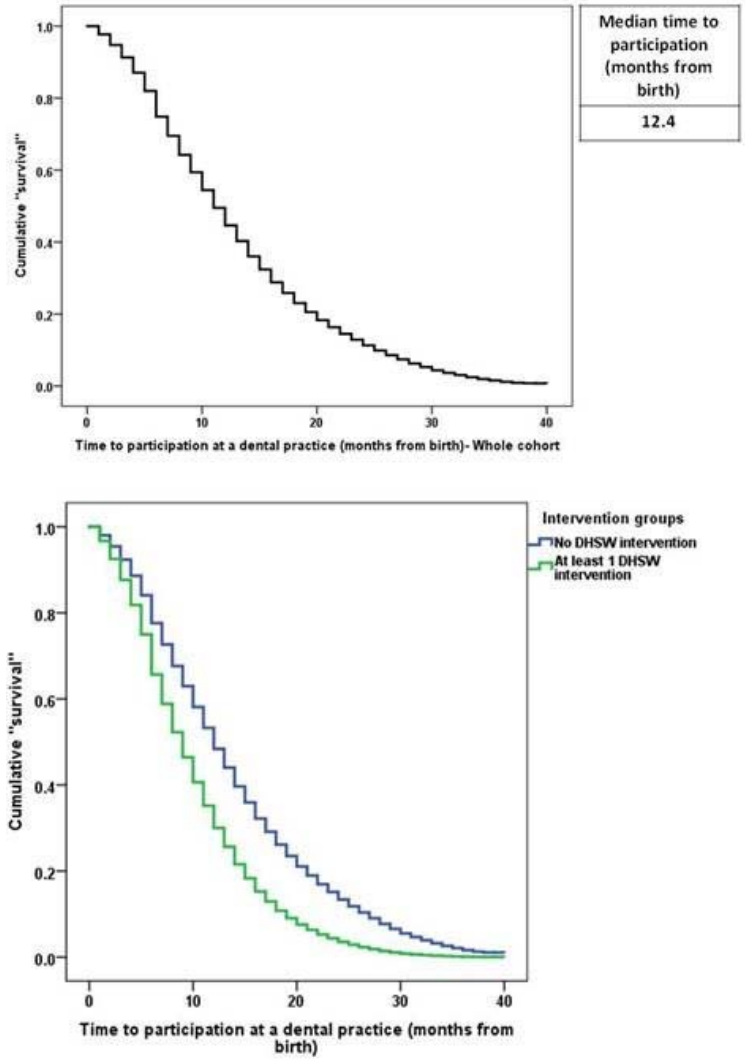


Figure 15.3- Survival curves and Cox regression output for (a) the whole cohort and (b) DHSW intervention versus no intervention

15.2.1 Impact of DHSW intervention on time to participation

Figure 15.3(a) shows the survival curve of the time taken for children in the cohort to participate at a dental practice. The median time for the whole cohort is 12.4 months. Figure 15.3 (b) shows the time taken for those children who had no DHSW intervention compared to those who had at least one intervention. From the figure above and the results reported in Table 15.1, it is clear that the median time to participation is lower in the group who had the DHSW intervention (7.8 months compared to 13.7 months). A Cox regression has shown that children who had a DHSW intervention were 1.7 times more likely to have

participated at a dental practice (Hazard Ratio=1.66, 95% CI [1.63, 1.69], p-value=<0.001) than those who did not receive an intervention (see Table 15.1).

Table 15.1- Median time to survival (participation) and results from Cox regression

	Group	N in group	Median time to participation (months from birth)	Cox Regression Unadjusted Hazard Ratio [95% confidence interval]	p-value Main effect
Whole Cohort	**DHSW intervention**				
	No	57211	13.7	[ref]	
	Yes	14570	7.8	1.66 [1.63, 1.69]	<0.001
Health visitor referral/ DHSW intervention	HV no/DHSW no	13243	13.9	[ref]	
	HV yes/DHSW yes	3953	7.5	1.93 [1.87, 2.00]	<0.001
	HV yes/DHSW no	3607	11.3	1.34 [1.30, 1.38]	<0.001
	HV no/DHSW yes	1080	8.0	1.61 [1.58, 1.65]	<0.001
Area-based deprivation (SIMD)	**DHSW intervention**				
Q1 (most deprived)	No	11149	13.9	[ref]	
	Yes	5791	7.8	1.68 [1.63, 1.74]	<0.001
Q2	No	11754	13.8	[ref]	
	Yes	3235	7.9	1.46 [1.41, 1.70]	<0.001
Q3	No	11458	15.4	[ref]	
	Yes	2566	10.1	1.74 [1.45, 2.09]	<0.001
Q4	No	11787	13.5	[ref]	
	Yes	1801	7.9	1.68 [1.60, 1.77]	<0.001
Q5 (least deprived)	No	10921	13.8	[ref]	
	Yes	1150	8.1	1.63 [1.53, 1.73]	<0.001
			p-value for interaction with DHSW intervention		0.14
Level of risk	**DHSW intervention**				
No risk factors	No	36480	13.6	[ref]	
	Yes	7019	7.8	1.68 [1.63, 1.72]	<0.001
1 risk factor	No	17016	13.8	[ref]	
	Yes	5666	7.8	1.66 [1.61, 1.72]	<0.001
2 risk factors	No	3385	14.5	[ref]	
	Yes	1697	8.1	1.71 [1.61, 1.81]	<0.001
3 or more risk factors	No	330	15.4	[ref]	
	Yes	188	10.1	1.74 [1.45, 2.09]	<0.001
			p-value for interaction with DHSW intervention		0.93

15.2.2 Impact of DHSW intervention by level of need

We have seen from previous chapters that the DHSW intervention was to some degree targeted to those most in need, however, there was a good deal of variation across health boards as to the extent of this targeting (Chapters 7 & 8). It was therefore important to assess whether the observed positive effect of the DHSW intervention was similar across the cohort with respect to perceived level of need. If the actual effect of the DHSW intervention was to improve participation rates only in those least at need (but more likely to respond to an intervention), this would have the effect of widening inequalities. We were therefore interested to explore if those considered to be least in need benefited most from an intervention that was designed to narrow, not widen inequalities. To do this, we were able to use a natural experimental approach, that compared participation rates in those who did and did not receive the intervention according to their level of perceived need.

For example, we know that there were children, whom the health visitors did not consider required additional DHSW support, yet for some reason they received it; and conversely, there were children whom the health visitor referred for DHSW support who did not receive it (see Chapter 8). This variation and deviation from intended process offered us an opportunity to use this natural experiment to explore this issue further.

We used the following three variables defining level of need:

1. Health visitor assessment of need through the Childsmile referral pathway (Yes/No) following up those who subsequently received DHSW intervention (Yes/No);

2. Area-based deprivation quintile (SIMD);

3. Level of risk (number of risk factors (0-3) child exposed to: bottle-feeding, smoking household, most deprived area of residence, ‘intensive’ care plan).

To determine whether there was a differential effect in dental participation for those who received an intervention, but did not require it, compared to those who received an intervention and did require it, we offered an interaction term between the risk variable (health visitor referral, SIMD, risk score) and the intervention variable to the Cox's regression models (Table 15.1).

15.2.2.1 Health visitor assessment of need

It is worth noting that we consider the health visitor "hunch" that a child would benefit from an intervention to indicate the child is in greater need and that those not referred are not in need.

Figure 15.4 shows the percentage participation for those who were referred by health visitors and received a DHSW intervention (Yes/Yes), with those who were referred but did not receive an intervention (Yes/No). Also shown are those who were not referred by a health visitor through the Childsmile referral pathway but received an intervention (No/Yes) and those who were neither referred nor received an intervention (No/No).

Across Scotland, children referred to Childsmile by the health visitor who actually received an intervention (Yes/Yes), the percentage participating at practice was 77.7% (3953/5087), compared to 56.3% (3607/6408) of children, who were referred but did not receive an intervention (Yes/No). This indicates a 20% increased participation rate. This association was observed across all health boards with varying effect sizes, with the exception of Grampian where the Childsmile referral pathway was only implemented from June 2012 (towards the end of the cohort period). Notably, across the majority of health boards, the highest participation rates were from those children who received a DHSW intervention but were not referred to a DHSW by a health visitor through the Childsmile referral pathway. It was not clear if the impact of the intervention was stronger in those whom the health visitor referred (blue bars versus red bars) compared to those who were not referred (green bars versus purple bars). The differential effect varies across health boards and requires further exploration beyond the scope of this thesis.

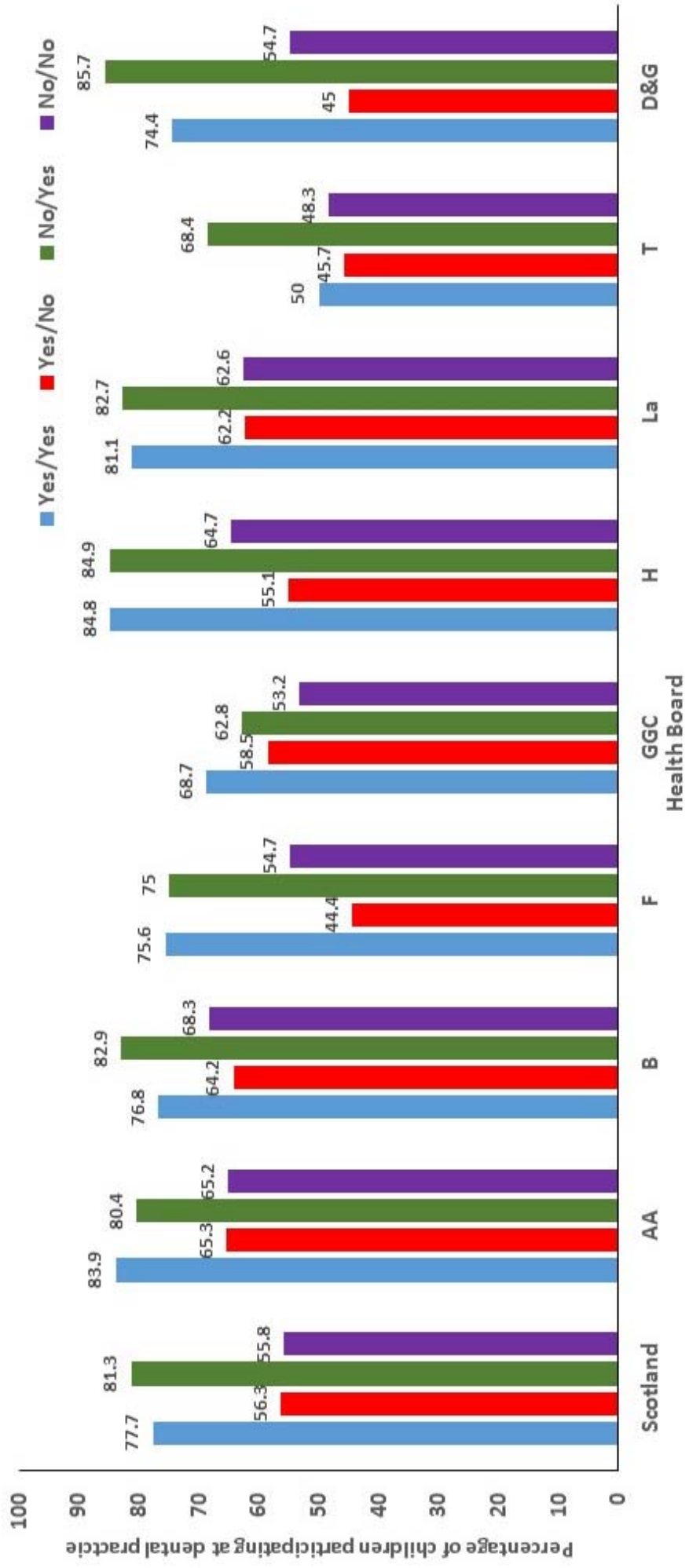


Figure 15.4- Participation for those who were referred/not referred by health visitors through the Childsmile referral pathway and who did/did not receive a DHSW intervention

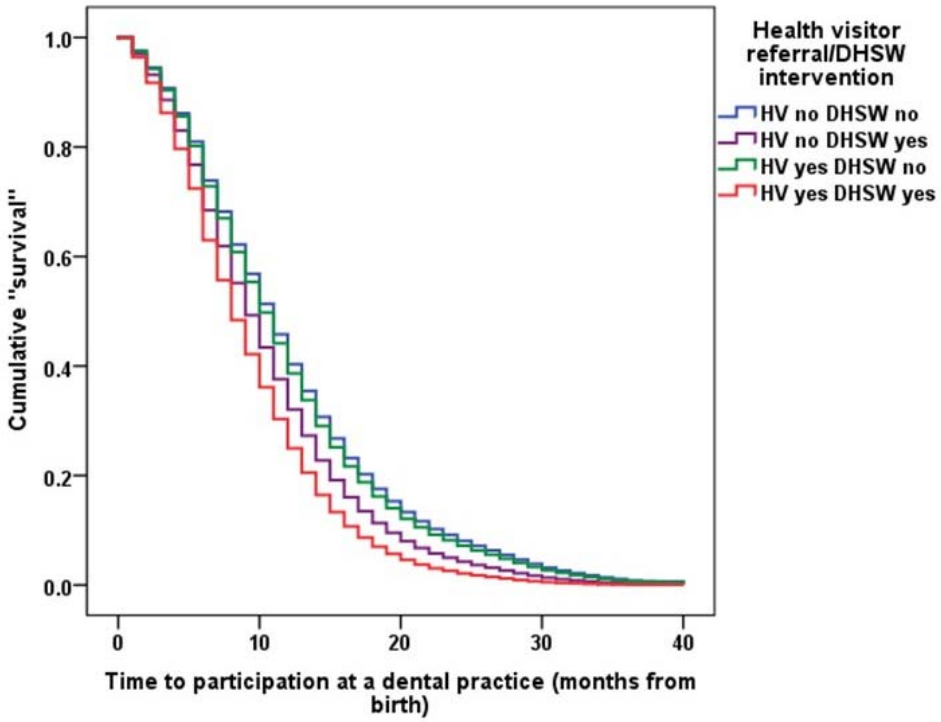


Figure 15.5- Survival curves and Cox regression output for health visitor referrals through the Childsmile referral pathway combined with DHSW intervention

Figure 15.5 shows a survival curve of the time to participation for children in each of the four health visitor referral/DHSW intervention groups, as seen previously in Figure 15.4. It is clear that the median time to participation is lower in the two groups who had the DHSW intervention. It took a median of 7.5 months (green line) for those referred by a health visitor through the Childsmile referral pathway and 8.0 months (purple line) for those who weren't referred via this pathway but received the intervention. The group who were referred through the pathway but had no DHSW intervention took a median of 11.3 months (orange line) to participate and the group who were neither referred through the pathway nor had a DHSW intervention took 13.9 months (blue line). A Cox regression has shown that, compared to children who were neither referred through the pathway nor received an intervention, children in the other groups were more likely to have participated at a dental practice (Table 15.1).

15.2.2.2 Area-based deprivation

The impact of the DHSW intervention on the percentage of children participating at a dental practice was explored by area-based deprivation (SIMD) at the national and health board levels. Figure 15.6 (overleaf) shows the results.

It can be seen that, across Scotland, receiving the DHSW intervention results in a proportionately higher percentage (approximately 20 percentage points) of participation across all deprivation categories. The effect can be seen across most health boards; however, there are some notable exceptions. In NHS Ayrshire & Arran, NHS Greater Glasgow & Clyde, NHS Highland, and NHS Lanarkshire, the effect of the intervention on participation is weaker for children from less deprived areas compared to those from the most deprived areas. In NHS Borders, NHS Tayside and NHS Grampian the pattern differs, probably due to small numbers and this being an analysis of the early phase of intervention implementation. Further work will use more recent data to confirm if these early trends have continued over time.

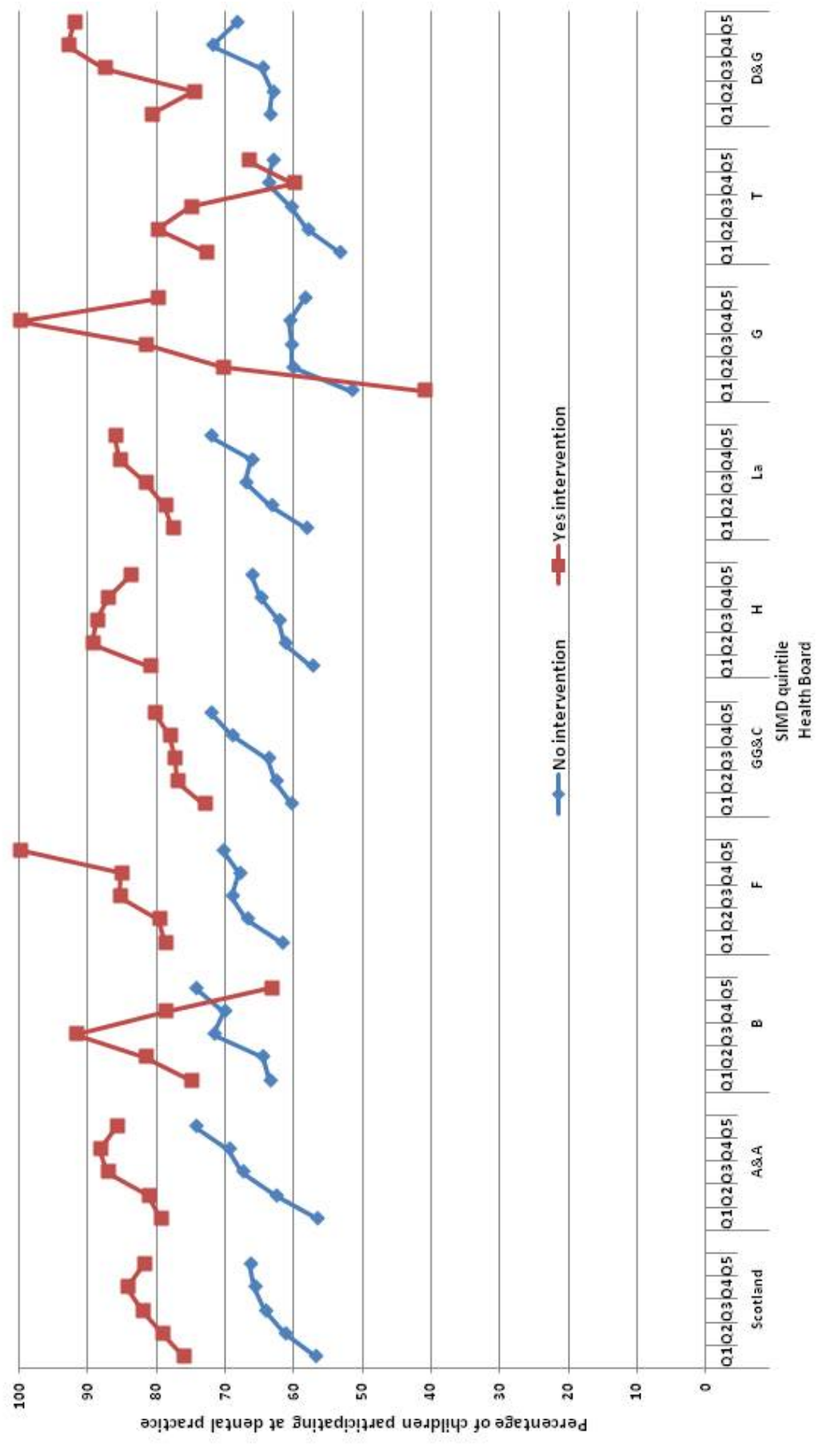
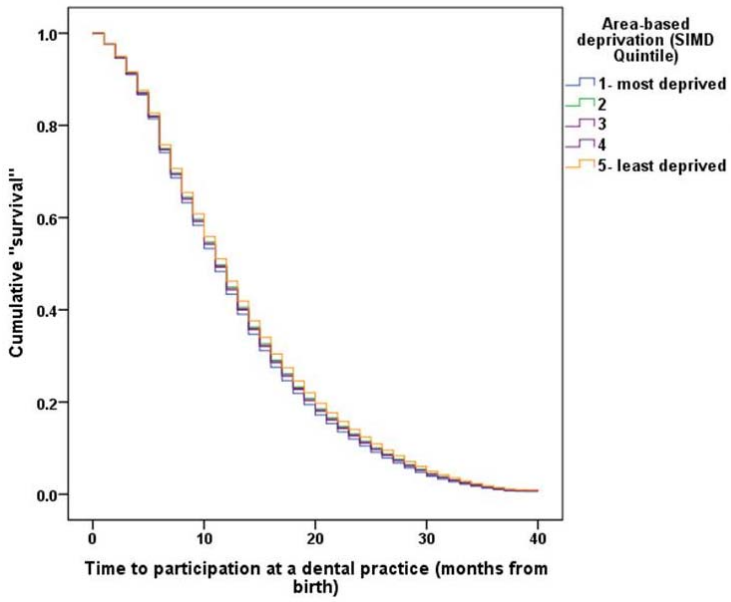
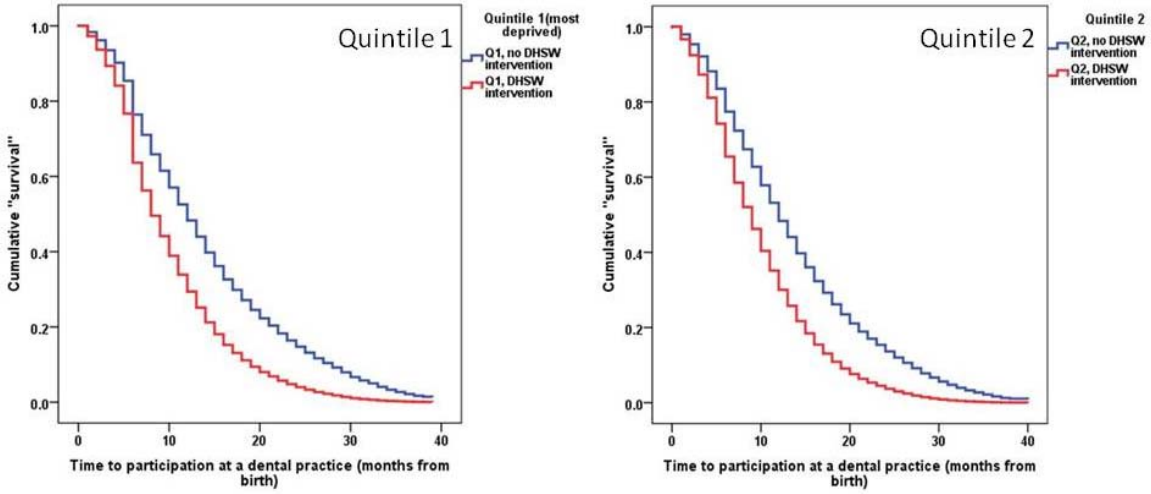


Figure 15.6- Participation and DHSW intervention/no intervention by area-based deprivation (SIMD)

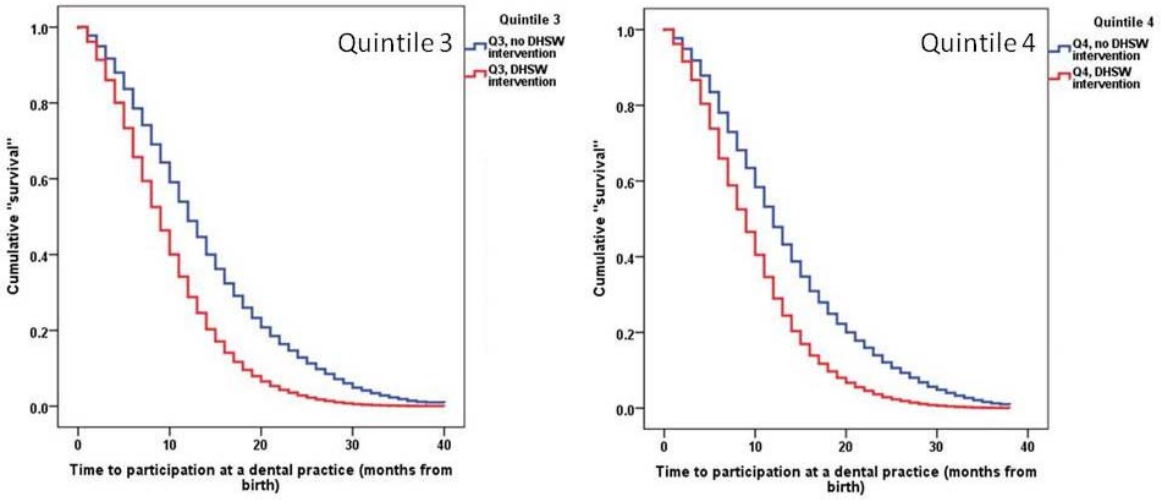


SIMD Quintile	Hazard Ratio [95% CI]	p-value
1- most deprived	1.08 [1.06, 1.11]	<0.001
2	1.04 [1.01, 1.06]	0.002
3	1.06 [1.03, 1.08]	<0.001
4	1.05 [1.02, 1.07]	<0.001
5- least deprived	[ref]	<0.001

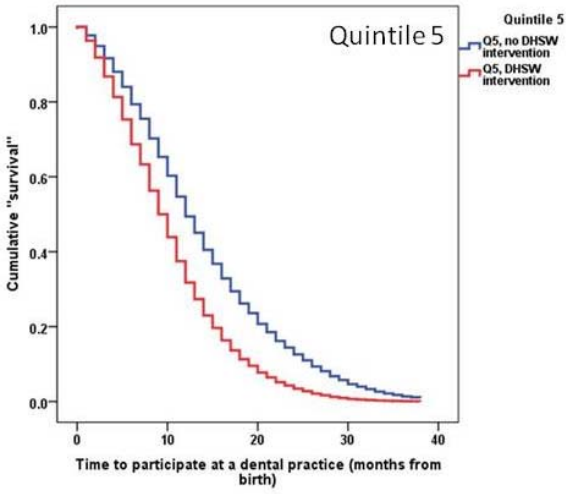
Figure 15.7- Survival curves and Cox regression output by area-based deprivation (SIMD)



15.8- Survival curves and Cox regression output for DHSW intervention versus no intervention by area-based deprivation (SIMD 1 & 2)



15.9- Survival curves and Cox regression output for DHSW intervention versus no intervention by area-based deprivation (SIMD 3 & 4)



15.10- Survival curves and Cox regression output for DHSW intervention versus no intervention by area-based deprivation (SIMD 5)

Figure 15.7 shows that across Scotland, children in the least deprived categories were more likely to participate at practice sooner that children in the least deprived categories. Figures 15.8-15.10 show that across all categories of area-based deprivation, children who had a DHSW intervention participated at a dental practice earlier than children who did not have an intervention. There does not seem to be a differential effect across the area-based deprivation categories as shown in a test for interaction (Table 15.1).

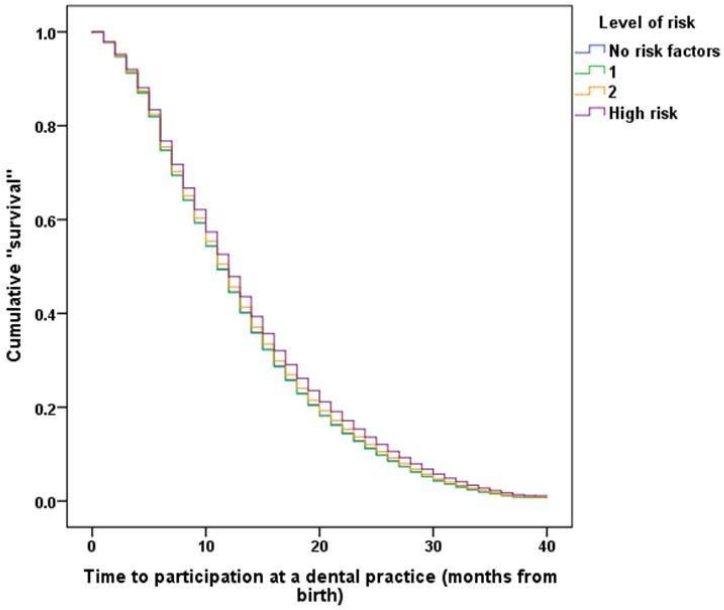
15.2.2.3 Impact by level of risk

Figure 15.12 compares the percentage of children participating at a dental practice by 'level of risk' where '0' indicates the family had none of the risk factors and '3' indicates the family had three or more risk factors.

In Figure 15.13 a pattern similar to that observed for area-based deprivation can be seen. Nationally, and in most health boards, the DHSW intervention is associated with a higher participation rate across all risk categories. In some health boards (NHS Ayrshire & Arran, NHS Borders, NHS Fife, NHS Dumfries & Galloway), the difference between the two groups in the percentage participation is larger for children with 2 or 3 risk factors that for those with fewer risk factors (Table 15.1). As with the association with area-based deprivation, NHS Grampian has an unusual pattern. Of those who had one risk factor, there is a lower percentage of children who had the intervention participating than those who did not have the intervention and there is no difference between the groups for those who have two risk factors, probably due to the small number of data available.

Figure 15.12 shows that across Scotland, children with no risk factors were more likely to participate at practice sooner that children with more risk factors. Figure 15.11 shows that those who had no risk factors were more likely to participate sooner than those with two or more risk factors. Figures 15.13-15.14 show that across all risk categories, children who had a DHSW intervention participated at a dental practice earlier than children who did not have an intervention (difference in median months to participation ranged from 5.3 to6.4). As with area-based deprivation, there does not seem to be a differential

effect across the level of risk categories as shown in a test for interaction (Table 15.1).



Level of risk	Hazard Ratio [95% CI]	p-value
No risk factors	[ref]	
1 risk factor	1.01 [0.99, 1.02]	0.50
2 risk factors	0.97 [0.94, 1.00]	0.03
High risk	0.91 [0.84, 0.99]	0.03

Figure 15.11- Survival curves and Cox regression output by 'level of risk'

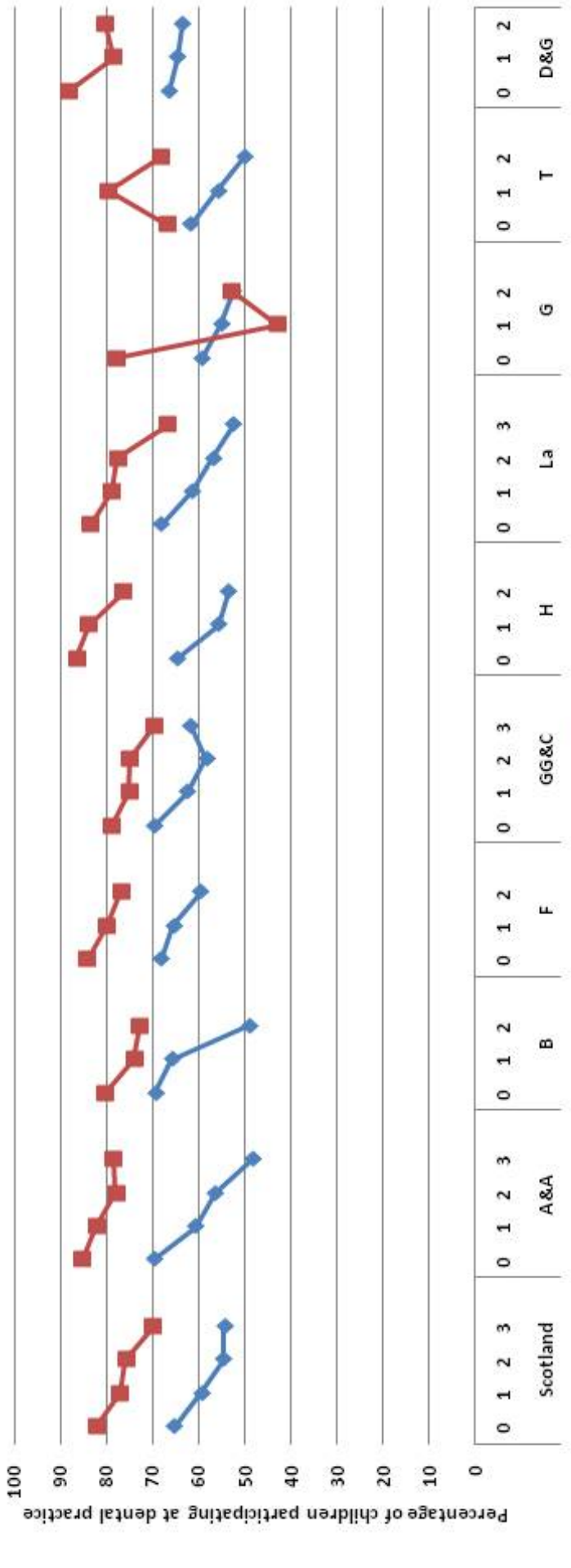
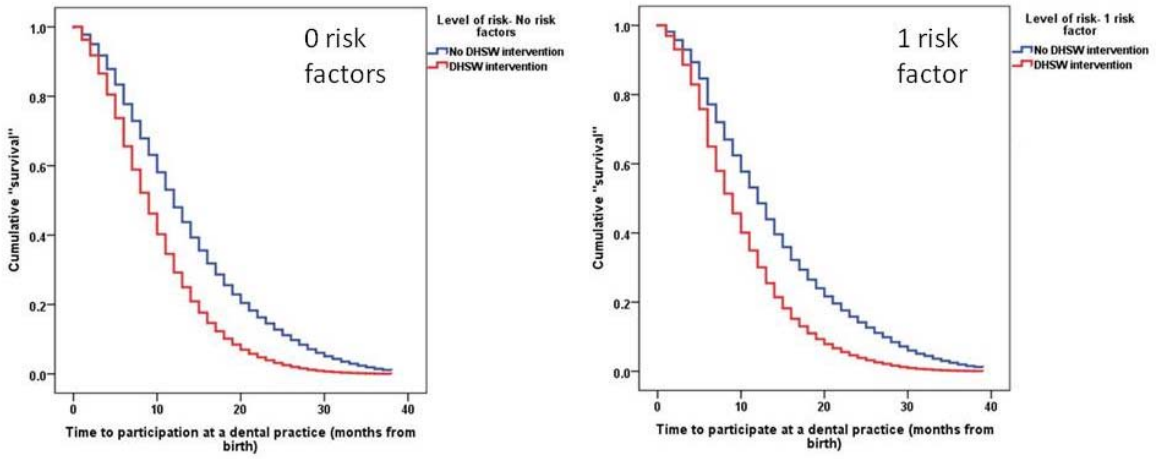
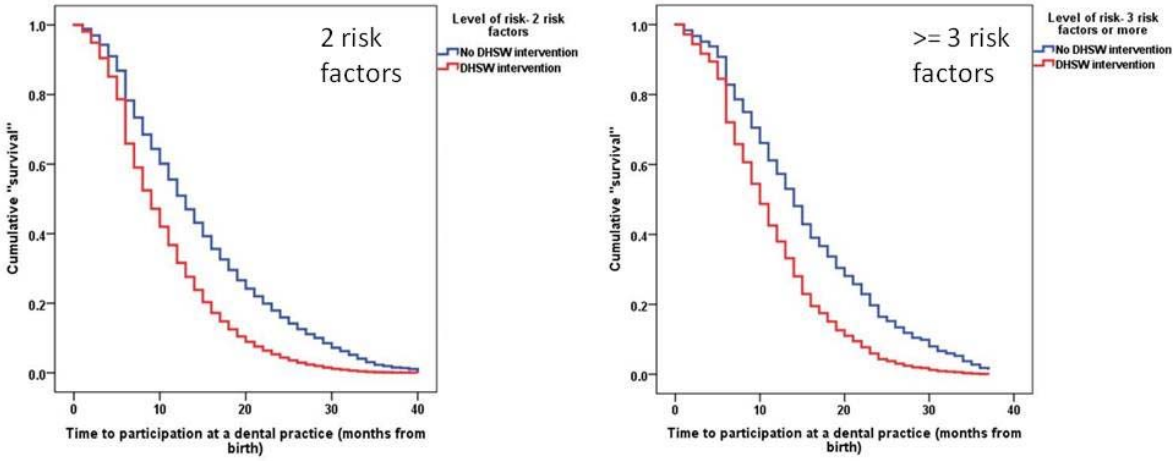


Figure 15.12- Participation and DHSW intervention/no intervention by family 'level of risk



15.13- Survival curves and Cox regression output for DHSW intervention versus no intervention by 'level of risk' (0 risk factors and 1 risk factor)



15.14- Survival curves and Cox regression output for DHSW intervention versus no intervention by 'level of risk' (2 risk factors and 3 or more risk factors)

15.3 Summary

There is clear evidence that the DHSW intervention had a positive effect on dental participation in this cohort of children, with a higher percentage of children who had a DHSW intervention participating at a dental practice (+17% across Scotland) and more likely to participate earlier in life (HR=1.66, 95% CI [1.63, 1.69], p-value<=0.001). It is notable that, at this stage, we have only looked at 'intervention' and not the impact of content, quality or dosage. There

is no evidence that the effect of the intervention is greater in those typically considered less at need (defined in three different ways).

This effect was observed across Scotland as a whole and within all health boards, although the size of the effect varied. In some health boards, there appeared to be a possible differential effect of the intervention on those considered most in need (defined in three ways), but this was not universal, not statistically significant at the national level, and further work is required to understand this.

In NHS Borders and NHS Tayside, the DHSW intervention was shown to have almost no beneficial effect, or even a negative effect, on participation among the least deprived. NHS Grampian also showed an unusual pattern as it appeared that children from the most deprived group who received the DHSW intervention had worse participation outcomes that those who did not receive the intervention. These unexpected patterns are likely to be the result of the small numbers of data available for these health boards at this early phase of implementation and will be explored further as more recent data become available.

16 Discussion of the research findings

16.1 Introduction

The aim of this study was to identify how an effective targeted and tailored lay health worker intervention should be implemented to optimise effectiveness. The specific objectives were: to examine whether the intervention was being implemented as intended; to find out how it *should* be implemented in order to be effective; and, to explore the extent to which it was having an effect on dental participation at the early phase of implementation.

Taking a mixed methods approach to look at evidence within the Childsmile programme, we found that, overall, there was some fidelity to the intended implementation and delivery of the DHSW intervention with respect to targeting and tailoring. Moderate effects on dental participation were observed across Scotland in all risk groups. Across Scotland, there was a 17% difference in dental participation between groups who did and did not have the intervention, and children were more likely to participate sooner (by almost 6 months) if they had received an intervention. There was, however, considerable variation across health boards in the targeting, tailoring and effectiveness of the intervention. In addition, there were differences between groups of stakeholders relating to experiences of implementing the intervention and perspectives on how it *should* be implemented in order to be effective.

The systematic review of evidence from outside the Childsmile programme highlighted key features of tailoring in effective lay health worker interventions, which included: formal, individual needs assessment; tailoring the number of contacts to individual needs and preferences; assisting clients to overcome barriers, whether psychological or practical; accommodating clients' availability by tailoring the time and place of intervention delivery; offering verbal and/or written materials in alternative languages suitable for the target population; signposting or referring clients to other services (e.g. for professional help, financial aid or health services); and, matching the content of the intervention

to individual clients' educational needs. The review helped to provide evidence from outside the Childsmile programme on improvements to implementation.

Taken together, this chapter aims to discuss the findings and consider how they confirm and expand current understanding of effective lay health worker programmes in the wider literature. Recommendations are made for the development of Childsmile's Dental Health Support Worker (DHSW) intervention, lay health worker programmes in general and future research. Key results have been provided in summaries at the end of results chapters. Here, findings are discussed according to key emerging themes in the context of the wider literature.

16.2 Targeting the right children

16.2.1 Defining 'the right child'

The DHSW intervention is one of the targeted components of Childsmile. The programme, as a whole, is built on the principle of proportional universalism which, in practice, means investing resources with a scale and intensity that is in proportion to the level of disadvantage (Marmot et al., 2010). In order to reduce inequality, it would be expected that the DHSW intervention be offered primarily, or even only, to the right children.

While the prevalence of dental caries has been shown to follow a socio-economic gradient (NDIP, 2014), results from the mixed methods study showed that Childsmile stakeholders believed there were some reasons a family might benefit from a DHSW intervention that go beyond socioeconomic factors, each of which could impact on a family's ability or willingness to engage in positive oral health behaviours.

The right children were collectively defined by Childsmile stakeholders in the following ways:

- children in families identified as vulnerable (for whatever reason);

children in families who are ready to engage with the intervention;

- not children in families facing acute health or social issues that may inhibit engagement;

- not every child;

- not older children who have been identified as 'cause for concern' for oral health by health visitors, as the DHSW intervention is focused on prevention; and,

- not children from families for whom English is a second language unless this is identified as a barrier to oral health or they meet the other listed criteria.

16.2.2 Effective targeting

There was evidence that health visitors were more likely to refer children at greater oral health risk (as defined by area-based deprivation and level of risk score); however the gradients of referrals in relation to area-based deprivation and level of risk was not as steep as expected, given the gradient in the socio-economic distribution of early childhood caries (NDIP, 2014).In addition, there was variation between health boards in the extent to which this targeted approach was adopted.

The' inverse care law' states that "the availability of good medical care tends to vary inversely with the need for it in the population served" (Hart, 1971). This means that the DHSW intervention is likely to be accessed by those who least need it unless adequate 'targeting' is employed. However, due to the lower than expected levels of 'targeting' being implemented by health visitors (by any referral pathways), it is likely that many children who would have benefited from the DHSW intervention did not receive it and those who did not need it did receive it. In order for the right children to be targeted effectively, personnel involved in identifying and referring children need to commit to the philosophy and implementation of proportional universalism.

It was not only health visitors who lacked universal engagement with 'targeting'. There was evidence that a minority of DHSWs believed 'targeting' to be 'unfair'

and had failed to grasp the rationale behind it. Although it was a minority of DHSWs, this attitude was present in more than one health board. A similar issue was reported in a school-based toothbrushing programme in Wales, UK. Support workers, who were lay people, wanted to involve all children in the intervention regardless of the programme's objective of targeting those at risk of oral disease (Trubey & Chestnutt, 2013).

As DHSWs work with a degree of autonomy, that is necessary for such community-based roles, it is essential that they are wholly invested in the programme's objectives.

16.2.3 Developing an effective referral pathway

There was variation in the extent to which the Childsmile referral pathway was being utilised. At the local level, other methods for referring children (i.e. locally-developed forms) had been adopted and were preferred by many health visitors and DHSWs.

A similar problem was encountered in Bath and North East Somerset, UK when child health services were incorporated into one referral pathway (Simpson & Stallard, 2004). Health professionals were dissatisfied with the length of time it took for referrals to go through the administrative process in order to reach the relevant service; however, this was not identified as a concern during the early phase of implementation. Some health professionals preferred to make the referral to the relevant services directly which created a two tiered referral pathway. This practice was accepted and a simple administrative procedure was developed by which direct referrals were recorded.

In reforming the pathway for the DHSW intervention, stakeholders should consider balancing DHSWs' need for family background information with health visitors' need to refer families with minimal additional paperwork, and the programme's need to have accurate records of referrals for the purpose of evaluation.

16.3 Delivering a tailored intervention

16.3.1 Defining tailoring

Established definitions of 'tailoring' describe it as involving the adaptation of information or strategies based on information about an individual, which has been derived from an individual assessment (Kreuter et al., 1999; Hawkins et al., 2008). While Childsmile stakeholders found it difficult to succinctly articulate the meaning of 'tailoring', through analysis of examples provided, it was evident that all stakeholders were describing the same phenomenon and had an understanding of what it meant to 'tailor' congruent with literature on the subject.

16.3.2 Training DHSWs to tailor the intervention

It was not possible to examine the effect of different philosophies, modes and content of lay health worker training in the systematic review due to the lack of data on these topics in the included studies. Similarly, South et al. (2010) and Lewin et al. (2005) reported a similar lack of detail on training in their vast reviews of lay health worker programmes. In addition, they found that reporting of lay health worker education levels varied considerably.

Respondents from within the Childsmile programme agreed that, in order to deliver an effective tailored intervention, DHSWs need to be adequately prepared for their role. There are several aspects of DHSW training that were identified as requiring further development.

16.3.2.1 Shadowing

Evidence from expert hearings that included academics, national programme leads, practitioners supporting lay workers, and lay people from across the UK showed that experts valued practical training activities for lay workers, as well as training that took place in the community setting (South et al., 2010).

Childsmile stakeholders highly recommended shadowing health visitors as a method for preparing DHSWs to deliver a tailored intervention in the community setting. The reality, however, was that there were many barriers to shadowing

taking place, such as a lack of protocol regarding who has responsibility for setting up shadowing experiences, the effort required to establish a shadowing appointment with a health visitor and a perception that DHSWs' time is too constrained. In addition, DHSWs made the important point that shadowing a DHSW colleague would not necessarily guarantee that a tailored intervention would be observed.

Only one study in the systematic review reported using shadowing as a method of training. In a programme aiming to increase breastfeeding in overweight and obese women, newly recruited peer counsellors shadowed experienced peer counsellors for 3 to 6 months in addition to theoretical training (Chapman et al., 2013).

16.3.2.2 Simulated practice

An alternative form of problem-based learning received enthusiastic support from Childsmile coordinators and DHSWs. This involved DHSWs from several areas meeting with a facilitator to undertake discussion of problems and ideas in a simulated practice activity. This facilitated 'debriefing' after role-play activities is now a widely recognised method for training healthcare professionals (Cant & Cooper, 2010; Levett-Jones & Lapkin, 2014). Rather than restricting such learning to the initial DHSW National Health Education Scotland (NES) training, it may be beneficial to implement this with groups of DHSWs who have different levels of experience in order to encourage knowledge-sharing and innovation.

16.3.2.3 Other training

It is interesting to note that the training, suggested by health visitors as being relevant to 'tailoring', included topics on the periphery of oral health, such as addiction and how to deal with difficult families. While health visitors may only have their own training to which to refer, it would be remiss not to appreciate the benefits of having a wide knowledge base of social issues. This is especially so when conducting an intervention in families' homes, where it is expected that support will be provided and families signposted or referred to other services. Lay health workers from other programmes have expressed a need for training

in topics not directly related to the intervention they are delivering, such as common health problems and domestic problems (Glenton et al., 2013).

16.3.2.4 Balancing empowerment and 'spoonfeeding'

The need for DHSWs to balance empowering families with 'spoonfeeding' was an issue raised by a small minority of stakeholders. Individual empowerment is about enhancing an individual's skills, self-esteem, and coping ability and can lead to increased personal control, improved well-being and improved health status (Woodall, 2010). In practice, empowerment involves the target individual actively participating in the identification of a problem, formulating the solution and performing the required action to overcome the problem (Tengland, 2012). In this context, the DHSW would be an enabler or facilitator rather than acting as a health worker setting the agenda for behaviour change. The use of the 'Behaviour Change Wheel' described in section 14.2.1 may be an example of an approach which values empowerment that was being used by some DHSWs.

'Spoonfeeding', by contrast, refers to support that requires no input from the individual receiving support and can result in the individual being less able to cope without support. It may be that DHSWs did not need to consider the risk of families becoming dependent on their support because, generally, DHSWs only delivered a one-off intervention. If the concept of long-term support and working more intensively with families were to become more commonplace, the need to consider the importance of empowerment would become more relevant.

16.3.3 Assessing families' intervention needs

In assessing families' needs, communication between the health visitor and DHSW is key. DHSWs stressed the value of any family background information shared with them by health visitors which was believed to aid preparation for the intervention. Not all health visitors were aware of the value this information held for DHSWs and some were wary of divulging information not directly related to oral health.

Both parties claimed to desire good communication links, however there were barriers to achieving this. The barriers included difficulty getting in contact with health visitors and a lack of opportunity for face-to-face communication. One

suggestion for addressing this barrier was to have DHSWs based with, and line managed by, health visitors; however this solution has disadvantages as there is a risk that DHSWs who are separated from oral health promotion teams will be assigned other tasks. Another suggestion was for DHSWs to introduce themselves at health visitor team meetings as a first step to building interpersonal connections. This should facilitate better communication as the relationship develops.

The systematic review showed that assessing clients' needs with a formal assessment was associated with effectiveness in lay health worker interventions. Most examples of this involved an assessment of the clients' stage of change (Prochaska et al., 1992). The intervention protocol was then matched to a client's stage of readiness to change their health behaviour. For example, in an intervention promoting cervical screening (Paskett et al., 2011) and an intervention for diet (Auslander et al., 2002), clients' Stage of Change was assessed at each lay health worker contact and the content of the intervention was tailored accordingly.

Childsmile's DHSWs conduct an informal assessment of families' needs by asking parents questions and observing the home environment. DHSWs described how this informal assessment informed the intervention they delivered. One health visitor focus group suggested that DHSWs may benefit from more structure in their assessment of families' oral health needs, such as a checklist. Further work would be required to explore whether the addition of a formal assessment (checklist-based, for example) would be useful and effective.

Within Childsmile, the Chatterbox toolkit was being trialled as a resource to aid DHSWs and families to identify the factors influencing dental attendance at the time that focus groups and interviews with stakeholders were being conducted. This toolkit involves DHSWs working with parents to create a pictorial narrative of their day, allowing the parents to identify the most appropriate time to arrange appointments and the logistical barriers to getting to an appointment (Nanjappa & Freeman, 2014). Parents are encouraged though the process of problem-solving by the DHSW. While the Chatterbox toolkit was not specifically mentioned by respondents as a method for assessing families' needs (probably due to a lack of DHSWs involved in trialling Chatterbox included in the sample),

it clearly has the potential to provide DHSWs with the tools to conduct a formal assessment of needs and barriers while erring on the side of parent empowerment rather than 'spoonfeeding'.

Another finding related to needs assessment is the need for health visitors to consider whether a family is ready to engage with an oral health intervention as some families may face acute issues and challenges (e.g. homelessness, short-term unemployment, poor parental mental or physical health) that affect their ability to engage. It may not be in the DHSW's remit to deal with families facing such complex social issues. The systematic review provided examples where there were clear separate pathways of care for lay health worker clients with different levels of need. In an intervention for illicit drug use, for example, lay health workers did not deliver the full intervention to the clients if they were already regular drug users. These more challenging cases were referred for professional help (Woodruff et al., 2014). Opportunities for DHSWs to discuss more complex cases with health visitors and come to a joint agreement about the intervention pathway that would be suitable for such a family are important.

16.3.4 Signposting

The systematic literature review showed that signposting or referring clients to other services was associated with the effectiveness of lay health worker interventions. It is important to note that the signposting activities carried out were always closely linked to the theme of the intervention. For example, in an intervention for illicit drug use, LHWs delivered a brief intervention but would refer 'severe-risk' individuals to local agencies for professional support (Woodruff et al., 2014). In another intervention for cardio-vascular risk behaviours, clients who were at-risk received a LHW intervention, and also medical referrals and information about available community resources (Krantz et al., 2013).

Engaging with community services has the potential to enhance families' ability to overcome the wider social determinants of health issues. A systematic review conducted for an MSc dissertation looked at cluster randomised controlled trials of signposting services based in a clinical setting. It was found that a higher percentage of mothers (between 15-17.8% higher) who had been signposted to

community services were more likely to have enrolled in a new community resource than mothers who did not receive the signposting intervention (Burns, 2016).

There was evidence that Childsmiles' DHSWs were not signposting to the extent that would have been expected. There was a lack of clarity at all levels of programme implementation regarding whether signposting should include all community services or just those directly related to oral health. There was a lack of belief among DHSWs that signposting would make a difference as it was thought that health visitors would already have notified the families of any additional services. In addition, DHSWs claimed they did not have enough time to collate information about local services. The systematic review provides evidence that signposting need not be a comprehensive list of all available community and health services. Signposting families to local services that are closely related to oral health promotion may be sufficient.

16.3.5 Freedom to tailor the dose of intervention

The systematic literature review shows that tailoring the number of contacts to clients' needs was associated with effectiveness. This was a more common feature in interventions where LHWs provided support to, and aimed to change the child-orientated health behaviours of, parents (e.g. breastfeeding (Chapman et al. 2013; Gross et al., 1998; Jolly et al., 2012; McInnes et al., 2000; Muirhead et al., 2006;); weaning (Smith et al., 2006); infant mortality (Hunte et al., 2004); and, diet and physical activity (Resnick et al., 2009)).

Within Childsmile, there was some evidence that DHSWs were providing multiple doses of the intervention; however, this was in a small minority of cases. The study uncovered multiple pressures within health boards that had an effect on the 'dosage' of intervention families receive. These included:

- DHSWs having a role involving multiple health improvement responsibilities (including Childsmile Nursery & School activities);

- dental practices not following the protocol for notifying DHSWs of children who fail to attend multiple appointments;

- lack of clarity, at the programme level, regarding whether the intervention should be a brief, one-off intervention or longer-term support in some cases.

Barriers to DHSWs tailoring the 'dose' of the intervention to families' needs may have had an effect on the ability of DHSWs to spend more time with families who are less prepared to change their behaviour. It is important to note that the 'dose' of an intervention that is appropriate for one group of the population may not be appropriate for another. Co-morbidity makes health interventions, usually designed with the assumption that individuals have a single health issue, less effective. Co-morbidity, particularly psychological distress, is more prevalent in the most socially deprived groups and, therefore, some families will require more doses than others (Watt, 2002).

The results of the systematic review provide a strong case that DHSWs need to have the freedom to deliver more than one 'dose' of the intervention where appropriate. Being able to do so allows DHSWs an opportunity to build rapport and trust and to deliver the right information at the right time for families where this cannot be achieved in one session.

It would have been interesting to explore the effect of single versus multiple doses of DHSW intervention on dental participation for the most at risk groups; however, at this early stage of implementation, there was not enough data when this feature was broken down by area-based deprivation or level of risk.

16.3.6 Tailored communication

16.3.6.1 Delivering oral health messages

The systematic literature review showed that matching intervention content to clients' educational needs was associated with effectiveness. Examples of matching intervention content to needs included: tailoring information about risk and perception of disease (Bungay et al., 2013; Taylor et al., 2009; Taylor et al., 2010); providing information about performing the desired behaviour where knowledge was lacking (Chapman et al., 2013); and correcting misconceptions

(Gross et al., 1998; McInnes et al., 2000; Taylor et al., 2009; Taylor et al., 2010).

Evidence from the focus groups and interviews with Childsmile stakeholders shows that DHSWs delivered the same oral health messages to every family but, in many cases, made an effort to make the messages seem more relevant to the families' interests, needs and circumstances. Delivering the same messages to everyone may not be necessary, for example, where families are aware of the key messages but have been referred for a DHSW intervention because they are struggling to implement them. Focusing on empowerment, rather than 'spoonfeeding' families information, would allow families to identify the problems most meaningful to them and work with the DHSW to find relevant information and solutions (Tengland, 2012).

16.3.6.2 Sharing experiences

The characteristic that unifies the various types of LHW (South et al., 2010) is their ability to utilise their shared experiences in order to connect with the target group or community. Some of the studies included in the systematic review can be used to illustrate this. For example, in a Canadian programme that aimed to increase STI and HIV screening in female sex workers, female lay health workers, with experience of sex work, were employed to deliver the intervention (Bungay et al., 2013) and in a programme that aimed to change weaning behaviours in a Bangladeshi community in the UK, lay health workers of similar South Asian ethnicity were recruited (Smith et al., 2006).

Considering the potential advantages of sharing experiences mentioned by Childsmile stakeholders and in the wider literature, such as increased rapport and ability to increase the relevance of health messages, it was surprising to discover that some DHSWs were unsure if talking about their personal experiences of dealing with their own family's oral health needs would be permitted by the Childsmile programme.

A study of the use of informal conversation, as a facilitator to building rapport between mothers and neo-natal nurses, provides evidence that it is possible to share personal experiences appropriately in a healthcare context. The study also

found that this was a key strategy in building trust (Fenwick et al., 2001). DHSWs should be encouraged to share personal experiences and may benefit from guidance on how to do this effectively.

16.3.6.3 Using mobile translation 'apps'

The systematic literature review showed that providing verbal or written communication in a choice of languages was associated with lay health worker effectiveness. These programmes targeted a specific ethnic minority who were marginalised, at least in part, because of a language barrier. In the majority of these programmes, the LHWs could speak the second language (Han et al., 2009; Hayashi et al., 2010; Islam et al., 2013; Islam et al., 2014; Koniak-Griffin et al., 2015; Smith et al., 2006; Taylor et al., 2002).

For Childsmile's DHSWs, language barriers were raised as an important issue. While written materials had been produced to aid with the communication of essential information, it would not have been possible to employ enough multi-lingual DHSWs to cope with the volume of different languages spoken, particularly in urban areas.

Although there was a NHS telephone translation service which could be arranged in advance, many DHSWs had made use of translation websites and apps in order to retain face-to-face, live, interactive communication with families. The use of multi-lingual mobile translation applications have been trialled in clinical settings with promising results in terms of aiding communication and usability within the clinical setting (Albrecht et al., 2013). There is potential for DHSWs to trial a range of translation apps for communicating across language barriers in the community setting.

16.3.7 Addressing barriers

The systematic literature review showed that providing assistance to overcome barriers to change was associated with effectiveness. In addition, accommodating clients' availability (time of contact and location) was found to be associated with effectiveness.

Childsmile stakeholders provided multiple examples of how DHSWs accommodated families' practical and psychological barriers to receiving an intervention and participating at a dental practice. The ability to accommodate barriers was limited, however, by factors in local areas such as public transport services and willingness of dental practices to take on child patients.

In order to address oral health inequality, it is necessary to consider the social determinants of health, which can be downstream (individual lifestyle factors) or more upstream (the conditions in which people live and work) (MacIntyre, 2007). It could be argued that some of the barriers to accommodating families' needs are more mid-to-upstream. If Childsmile is committed to addressing oral health inequality then consideration should be given to the role of the programme in advocating for changes to mid-to-upstream factors at the local level (e.g. petitioning for better transport links in affected communities).

Advocacy work is an activity that can be carried out by lay health workers (South et al., 2010). This thesis has not explored the local level advocacy work that was carried out by DHSWs. It is possible that it was being done; although, as it was not mentioned by any stakeholders in focus groups and interviews, this requires further study.

16.3.8 The importance of being 'lay'

The findings from the systematic review show that programmes which recruit LHWs from the groups or communities the intervention aims to target, are associated with success to a greater extent that those that do not.

It is important to note that the majority of studies were of low quality and it was not the primary aim of the systematic review to draw conclusions on this topic. Studies were included in the review based on the provision of descriptions of 'tailoring'. As this was often not well-described, many LHW studies were excluded. It would be informative to conduct a systematic review of LHW interventions with the primary aim of determining the difference in rates of 'success' between those using indigenous LHWS and those that do not.

Despite the lack of high quality evidence in the systematic review, there are strong arguments from those experienced in the area of community development and inequalities about the importance of retaining (1) the community development aspect of lay health worker roles and (2) the 'peerness' of the role (Mathers et al., 2014). These elements are proposed to be crucial for addressing the social determinants of health and engaging families experiencing oral health issues.

It could be argued that the DHSW role has taken on characteristics similar to that of the Health Trainer role discussed in section 1.5.8. It has been reported that the integration of the Health Trainer role with NHS services led to: the recruitment of "more qualified" people rather than indigenous LHWs; an expectation of quantification of all output; and, an expectation of results within a short timeframe (Atun et al., 2010; Mathers et al., 2014). It is argued that these pressures led to programmes, which had been intended to focus on community development and social determinants, to become focused on individual behaviour change. Such a strategy is opposed by contemporary thinking and policy on health inequality (Dahlgren & Whitehead, 2007; Trayers and Lawlor, 2007).

The DHSW intervention has its roots in the 'Time to Smile' programme, which recruited volunteers from the local community to engage with the target population (Blair et al., 2006). Deas et al. (2013) have described how, in the translation of the 'Time to Smile' role to the NHS-backed DHSW role, key stakeholders did not hold a joint vision of what 'community development' should mean for the new NHS role. In some cases, those employed as DHSWs were over-qualified and did not come from the targeted communities; therefore, the 'peerness' of the DHSW role was lost. This was, in part, a consequence of recruitment for the role being subjected to NHS recruitment processes, which required vacancies to be offered to those displaced from NHS posts.

As a consequence, the sense that the intervention should be about change at the community level as well as the individual level may have been diluted in the DSHW role. In a sense, if DHSWs are not *lay* health workers then the question needs to be raised about whether they are qualified to address both the social

determinants of health and individual health behaviour change in the marginalised and 'hard-to-reach'.

16.4 Evidence for effectiveness

There was evidence that the DHSW intervention was effective at increasing child dental participation (a difference of 17% between groups who did and did not receive the intervention), and promoting participation earlier in life, with moderate effects on dental participation observed across Scotland in all risk groups.

It is encouraging that the DHSW intervention appears to have had a similar effect across all risk groups. This suggests that the delivery of the intervention may be appropriately tailored to families' needs.

A meta-analysis of randomised and non-randomised controlled trials of health interventions for disadvantaged groups, involving an aspect of community engagement, reported an effect size of $d = 0.33$ (95% CI 0.26, 0.40) for behaviour change (O'Mara-Eves et al., 2015). Unfortunately, this cannot be directly compared with the results from the DHSW intervention. O'Mara-Eves et al. (2015) conducted a sub-analysis of interventions including lay involvement and found that lay-delivered interventions had larger effects than interventions involving community input only in the design or other aspect of the intervention; however, lay-delivery did not explain the variation in effectiveness across study types. The authors suggest that the more frequent (number of contacts) or intense (face-to-face) exposure involved in lay-delivered interventions may be a confounding factor.

This is a relevant point for the interpretation of the analysis of the effectiveness of the DHSW intervention as the mechanism that is producing the effect may simply be the intensity of the intervention. The finding, reported previously, that a cluster-randomised controlled trial of signposting mothers to community services led to a +15% difference in enrolment in a new community resource(Garg et al., 2015) shows that simply informing parents about a service increases participation to a similar degree as the DHSW intervention.

Due to the relatively short period of time over which this study was conducted, it was not possible to explore the impact of the intervention on inequalities in dental participation, or indeed oral health. One way to do this would be to examine, longitudinally, dental participation before and after the introduction of the DHSW intervention in each health board.

16.5 Strengths and limitations

16.5.1 Systematic literature review

The systematic review was the first known review to explore the features of tailored lay health worker (LHW) interventions associated with effectiveness (Hodgins et al., 2016). This review makes an important contribution to literature exploring the 'active ingredients' of LHW interventions and what happens during a LHW intervention.

Limitations of the review had been discussed in Section 4.5.

16.5.2 Use of mixed methods

The main strength of this study was the use of mixed methods. The nature of the research questions allowed for the opportunity to use quantitative and qualitative methods in a convergent manner. Through comparing and contrasting stakeholders' perspectives with findings from analysis of the administrative data, it was possible to develop hypotheses with one dataset and test the validity with the second dataset.

An example of where this approach was crucial for obtaining a true picture of the implementation of the DHSW intervention was where health visitor referrals were examined. From the linked administrative data, it appeared that a large percentage of children were not being assessed by health visitors for DHSW support. The Childsmile referral section of the Child Health Surveillance form was being left 'incomplete'. Stakeholders' descriptions of the use of more detailed referral forms, developed locally, prompted further examination of the relationship between the children who Dental Health Support Workers (DHSWs were aware of and those who were referred by health visitors. This is how the)

extent of the use of these local forms and referral pathways was revealed, as reported in Chapter 8, Section 8.1.2.

Another example of one dataset enhancing the findings from another is the discovery from the linked administrative datasets that signposting activity was rarely recorded, and the explanation from stakeholders as to why signposting was not carried out, as reported in Chapter 14, Section 14.2.4.

By using mixed methods in this way, not only was 'validatory triangulation' (Davies et al., 2003) achieved but it was possible to provide explanations for phenomena discovered through analysis.

16.5.3 Stakeholder recruitment

The ease with which participants were recruited varied depending on their role. The Childsmile Executive and coordinators were pleased to assist where they could, bar any logistical barriers. In order to reduce barriers to participating, focus groups and interviews were arranged at locations as mutually convenient for all participants as possible. Despite these efforts, several coordinators, and DHSWs from one health board, were unable to participate. However, there was evidence that theoretical saturation (Sandelowski, 2001) had been achieved as there was little new information or ideas proposed in the final sessions of data collection.

The pragmatic stance taken for this applied research allowed for flexibility in order to overcome methodological barriers. It was necessary to take advantage of this when recruiting health visitors and parents. Through a process of theoretical sampling (see Chapter 5, Section 5.5.2.1.2), five health boards were chosen from which to recruit health visitors. Health visitors were recruited by contacting Team Leads and asking if it would be possible to run a focus group before or after a team meeting. The first to agree in each health board were recruited. When it came to recruiting parents, again, the selection of two health boards was theoretically justified.

On reflection, the focus groups conducted with health visitors were not as successful as the interview conducted with one health visitor. The health visitor

team meetings involved a large number of health visitors which resulted in the discussion being difficult to manage and keep on-topic. The views expressed may also have been influenced by the fact that the Team Lead, who is the health visitors' line manager, stayed in the room and participated. This may have caused some views, which may have been useful to this evaluation, to be suppressed. It would perhaps have been more beneficial to conduct health visitor focus groups without the presence of the Team Lead.

Another limitation of the health visitor sample was that, although the health boards from which we aimed to draw the health visitor sample were selected based on theoretical concepts, the health visitor groups within each selected board were chosen by convenience sampling. This may mean that the health visitor sample is biased and includes teams that are more engaged with the Childsmile programme. In order to address this bias in future work, health visitor teams could be randomly sampled.

The interviews with parents yielded little useful data relating to the research questions. On reflection, it was not easy for parents to reflect on the aspects of the intervention that they felt were tailored to their needs. This was because, in the majority of cases, the intervention had taken place several months before. In addition, parents only had experience of one type of DHSW intervention and could not know if it had been specially tailored. Parent focus groups, with discussion centred on more open questions such as 'what kind of information, resources, and support would be useful for you?' and 'how does that compare with your experience of the DHSW intervention?' would have been more beneficial for this study.

Parents who responded to the request to participate may have had a more positive experience of the intervention. This was highlighted when, during an attempt to recruit parents at a baby immunisation clinic, a parent expressed strong negative views about their experience of a DHSW intervention but could not be persuaded to participate in an interview. Recruiting the target group, whether they had received the intervention or not, could have been made a priority by posing hypothetical questions regarding the type of intervention these families would find helpful. Running focus groups alongside a playgroup in

an area of high deprivation may be one way to reach those whom the intervention aims to target.

The findings from the parent interviews also lack generalisability as we only included two health boards in the sample. These were NHS Lanarkshire and NHS Greater Glasgow and Clyde. A particular characteristic of these boards that affects the generalisability of the findings is that they are moderately-highly urbanised and do not have the vast areas of rural geography of some of the northern and eastern health boards. Future work should aim to sample parents more widely across the country.

16.5.4 Use of routine NHS data

This is the first study that has linked individual level administrative data from within the Childsmile programme to routine datasets used by health visitors and payment systems used by dentists. The scope of the study was focussed on the role of the DHSW, and we correctly used dental participation as a primary endpoint. Having demonstrated the effectiveness of the DHSW in facilitating participation at dental practice, we recognise that this is an interim outcome for the Childsmile programme (see the logic model in Figure 1.4), and what is of greater importance is the effect this increased participation has on the long term outcomes of improved oral health and a reduction in inequalities. This work is part of a wider evaluation of the Childsmile programme and the methodologies and results will be utilised into the future.

As this was a population cohort there was almost 95% coverage of the Scottish population, and was representative of the population. The size of the dataset allowed comparisons to be made at the health board level, where variation in implementation was observed. There are, however, several limitations of the data.

Delays in the time taken from data collection, to data being available for analysis via the safe haven were substantial, and storage costs were high. The ability to respond quickly to issues identified through this kind of evaluation is key to optimising the programme, and therefore processes around data capture, storage and linkage need optimising. Nonetheless this study was able to give a

unique insight into the development of an intervention at the earliest stages of implementation, which should benefit future studies in this area.

The starting point for the data linkage was children who had a 6-8 week Child Health Surveillance (CHS) assessment between 1st September 2010 and 30th September 2012. The Health Informatics Centre (HIC) data on DHSW activity and the MIDAS dataset were searched for records of these children. This means that the cohort was limited to those children with a CHS assessment during this period. Other DHSW intervention activity was, therefore, not taken into account. This activity would have included delivering interventions to children who had missed their 6-8 week CHS assessment, children referred after their 6-8 week assessment, and older children.

As the analysis related to the early phase of programme implementation, the data available became limited when stratified by different groups. This limited the analyses that could be undertaken. For example, it was not possible to examine the effect of single versus multiple doses of DHSW intervention on dental participation for the most at risk groups as there was not enough data when this feature was broken down by area-based deprivation or level of risk.

One aspect of the intervention that could not be explored was the quality of the intervention DHSWs delivered. It is not possible to quantify the quality of delivery with the administrative data or to know if the content of the intervention was tailored to families' needs. This is something that will require further work.

In addition, there was a limited range of variables available in the administrative datasets from which to identify "at risk" children. We were confined to a handful of variables, none of which individually defined the right child, and in combination, did not satisfactorily cover all aspects we would have desired. This highlights the trade-off between the cost-effective, efficient collection and storage of routine data covering the majority of the population, and more detailed data collected in standalone research projects on much smaller samples.

Another challenge was the validity and reliability of some of the variables collected via the administrative datasets. In exploring the use of the Childsmile referral pathway, it was discovered that where a health visitor indicated 'no', 'parent refused' or left the Childsmile 'box' blank on the CHS form, it did not necessarily mean the child was not referred to a DHSW. This discovery required further investigation, which is reported in Section 8.3. Another issue was the Health Plan Indicator variable, the levels of which do not translate to the same levels of support across health boards; the meaning of 'core', 'additional', and 'intensive' care plans varies. Attention was drawn to this limitation in Section 7.5.3.3. These issues cause challenges for evaluation but not for implementation. This is an inherent problem with using administrative data for research.

There are obvious challenges in evaluating a programme such as Childsmile, where the implementation has not been experimentally designed, in order to test effectiveness. A cleaner evaluation may have been possible had the roll out been designed in a way to allow robust testing of component parts of the programme, including the DHSW intervention. However, this was not the case, and is more often the rule rather than the exception for such national programmes. Despite this, there was sufficient variability in the roll out and the implementation of the DHSW intervention locally to allow us to use natural experiments to test hypotheses (Craig et al., 2012), and to reach conclusions, that, although were not strongly causal, could be strongly suggestive.

16.6 Recommendations

The recommendations from these findings have been divided into those directed towards the Childsmile programme, those directed at lay health worker programmes in general, and those relating to further research.

16.6.1 Recommendations for the Childsmile programme

16.6.1.1 Training

- In order for children in families with oral health issues to be targeted, those implementing the intervention need to have a clear understanding

of the rationale for doing so. One way of doing this could be through the NHS Education Scotland (NES) training for DHSWs. This training could be developed in some areas to ensure that the concept of proportional universalism is communicated effectively.

- Shadowing health visitors provides an opportunity for DHSWs to observe tailored support delivered in the home environment. As the Childsmile Executive, coordinators, DHSWs and health visitors agreed that shadowing had essential benefits for DHSW skill development, it may be in the interests of the programme to set a recommended or minimum number of shadowing visits, or hours, for new DHSWs.

- There are operational difficulties in organising shadowing. DHSW line managers should be aware that, if a DHSW shadows a colleague they may not observe a tailored intervention. Shadowing could be supplemented, or substituted, by group problem-based learning using simulated scenarios.

- DHSWs should continue to take Continuing Professional Development (CPD) courses in a range of issues and skills, even those on the periphery of oral health, which would be useful for working in the community setting.

- The fact that experienced DHSWs expressed a desire to take a Childsmile 'refresher' course highlights that some DHSWs do not feel confident in their intervention delivery. If DHSWs had opportunities to receive feedback on their home visits occasionally or if they were able to discuss their practice with colleagues (e.g. during a simulated practice training day), they may have more confidence.

16.6.1.2 Referral of families

- DHSWs require more detail about a referred child than the 'Childsmile box' on the 6-8 week Child Health Surveillance form provides. Stakeholders involved in programme delivery agreed that health visitors should outline a family's needs and communicate these to a DHSW in advance of DHSW contact being made. Useful information would include:

(1) the reason for referral (2) family background. In addition, a record of health visitors' reasons for not referring a child would be useful for evaluation purposes.

16.6.1.3 Assessment of families' needs

- DHSWs should carry out assessment of oral health needs when they meet with the family. At the time of data collection, this assessment was conducted informally. Due to evidence from lay health worker literature that a formal assessment was associated with effectiveness, programme developers should consider trialling a structured questionnaire or checklist in order to support DHSWs' assessment of families' needs.

16.6.1.4 Communicating with health visitors

- Health visitors need to understand the DHSW role in order to fully engage in the referral pathway and in supporting DHSWs to tailor to families' needs. DHSWs could introduce themselves at health visitor team meetings to help build interpersonal connections and increase health visitor buy-in to the programme.

- The pathway for communication with health visitors about families who are difficult to work with, or who do not respond, needs to be refined in collaboration with health visitors.

16.6.1.5 Signposting

- A clear statement of what signposting is and how it should be implemented should be circulated amongst DHSWs and their line managers. Thought needs to be given to how DHSWs can keep signposting information up-to-date.

16.6.1.6 Supporting DHSWs to tailor to families' needs

- Evidence shows that tailoring the number of contacts to needs is associated with effectiveness of lay health worker interventions. DHSWs should be given the freedom to tailor the dose of intervention to families'

needs. DHSW line managers should consider whether it would be possible to guarantee the time DHSWs spend doing Practice related activities.

- DHSWs should continue to have freedom to accommodate families' needs by delivering the intervention in the context that suits the family (e.g. clinic, Home Start centre, or library); however, home visits are highly recommended, as the home environment can be observed for clues about oral health risk and it can be easier to minimise distractions.

- DHSWs should be encouraged to share personal experiences of dealing with their own family's oral health and may benefit from guidance on how to do this effectively.

- When communicating oral health messages with families across language barriers with leaflets alone, the DHSW intervention is limited to giving families information. Telephone translation services limit rapport-building and are not always practical. Programme developers should consider trialling multi-lingual translation 'apps' to support communication across language barriers, drawing on the experiences of DHSWs already using this technology in the community.

- DHSWs should continue to accommodate families' practical and psychological barriers. Programme developers should consider whether the DHSW role could be developed to include grassroots advocacy work (e.g. petitioning for better public transport so families can access health services) in order to address upstream barriers at the local level.

16.6.1.7 The important of being 'lay'

- The 'Time to Smile' programme, which preceded the DHSW intervention, recruited volunteers from the local community to engage with the target population. NHS recruitment processes have made it difficult for Childsmile to specify the person characteristics or personal background that should be prioritised over formal qualifications for the DHSW role.

  This thesis provides evidence that the *lay* aspect of the role is an

important one and that an important mechanism for effectiveness within the 'lay' concept may be that a lay health worker comes from the target community. Even if not from the community, the systematic review undertaken found that lay health workers who at least have some shared characteristics with the target group are more strongly associated with effectiveness than those who are not recruited by this criterion.

Clarity on the characteristics that should be shared with the communities Childsmile aims to target is required. It is recommended that the feasibility of including these as essential criteria in the recruitment process be revisited by the programme.

16.6.2 Recommendations for the design and implementation of lay health worker programmes

- Lay health worker programmes should consider the following:
    - conducting an individual needs assessment;
    - tailoring the number of LHW contacts to individual needs and preferences;
    - assisting clients to overcome barriers, whether psychological or practical; accommodating clients' availability by tailoring the time and place of intervention delivery;
    - offering verbal and/or written materials in alternative languages suitable for the target population;
    - signposting or referring clients to other services (e.g. for professional help, financial aid, health services); and
    - matching the content of the intervention to individual clients' educational needs.

Consideration should also be given to whether the programme will recruit lay health workers who come from the target group for optimal effectiveness, or simply share characteristics with the target group. In developing lay health worker programmes, consideration should be given to the advantages and disadvantages of incorporating such programmes within a national health service. This can increase credibility, funding and access to infrastructure. However, it also means that the recruitment process becomes more formal and qualifications take precedent over life experience. This can change the nature of the role, removing the true sense of 'layness', or peerness', from it. The risk with this evolution is that lay health workers become de-skilled, as the very characteristic that makes them most qualified for the job of engaging marginalised and hard-to-reach groups is removed as an essential criterion.

16.6.3 Recommendations for further research

- An update of the data linkage and analysis, with the most recent available data, would allow an assessment of whether the use of the Childsmile referral pathway continued to improve over time, levelled-off, or decreased in use. This would aid discussion over whether the 6-8 week Child Health Surveillance form is fit for the purpose of referring children for a DHSW intervention. There may be a need for exploratory work around the best system for referrals in order to maximise information for DHSWs with minimal additional input from health visitors.

- An update of the data linkage and analysis could look at changes over time in all other outcomes explored in this study. It would be particularly useful for the Childsmile programme to explore what the impact of the DHSW intervention was on dental participation as the intervention became more established.

- Further work is required to explore the impact of the DHSW intervention on oral health behaviour change in the home. This could require a qualitative study or a questionnaire.

- Further work is required to explore whether the addition of a formal assessment (e.g. a checklist), based on questions used by health visitors, for determining individual families' needs would be a useful and effective tool for DHSWs.

- Future Childsmile evaluation work should seek the knowledge, experiences and views of the 'hard-to-reach', learning from the challenges experienced in this study relating to recruitment and data collection.

- It would be informative to conduct a systematic review of LHW interventions with the primary aim being to determine the difference in rates of 'success' between those programmes that used indigenous LHWS and those that did not.

- In order to inform future recruitment of DHSWs, it would be useful to explore whether the quality of the intervention delivered differs between a DHSW who is immersed in the local community and a DHSW who is not. A qualitative cross-case comparison of a DHSW living and working in an Island health board and a DHSW working in a large urban area may provide an interesting study of whether 'indigenous' DHSWs deliver a better quality intervention or not.

  The Childsmile process evaluation should continue to collect information on any local oral health advocacy work being carried out by DHSWs or Childsmile coordinators. This would include activities that aim to address upstream barriers to families changing their health behaviours and engaging with oral health services (e.g. local transport issues, dental practices refusing to register children unless parents also register etc.).

17 Conclusions

This thesis explored how to effectively implement a targeted and tailored lay-delivered health behaviour change intervention. This research was necessary due to a lack of consensus within the Childsmile programme regarding how to target the right children and how to tailor to individual families' needs. Evidence was gathered from the wider lay health worker (LHW) literature, administrative National Health Service (NHS) databases, and the perspectives of stakeholders involved in delivery of the Childsmile's Dental Health Support Worker (DHSW) intervention.

Taking a mixed methods approach to look at evidence within the Childsmile programme, we found that, overall, there was some fidelity to the intended implementation and delivery of the DHSW intervention with respect to targeting and tailoring. There was, however, considerable variation across health boards in the targeting, tailoring and effectiveness of the intervention. In addition, there were differences between groups of stakeholders relating to experiences of implementing the intervention and perspectives on how it *should* be implemented in order to be effective.

It was revealed that targeting the right children should involve targeting any child in a family identified as vulnerable (for whatever reason) whose family must be ready to engage with the intervention. The right child is not every child nor children in families facing acute health or social issues that may inhibit engagement. Older children identified as 'cause for concern' for oral health by health visitors should not be referred as the DHSW intervention is focused on Early Years prevention. Children should not be referred solely because English is their families' second language unless this is identified as a barrier to oral health.

The main barrier to targeting the intervention appeared to be engaging health visitors in referring only the right children.

'Tailoring to families' needs' should involve assessing individual families' needs and then providing differential support matched to those specific needs.

There was evidence that DHSWs were tailoring the intervention in line with the features of tailoring found to be effective in LHW programmes; however, there were many barriers that restricted DHSWs' freedom to tailor to families' needs. Barriers included: health visitors not providing background information with the referral; DHSWs having responsibilities outside of Childsmile Practice; dental practices not notifying DHSWs of children who fail to attend appointments; a lack of consensus within the programme on whether DHSWs should deliver a brief intervention or whether it can be more intensive support where necessary; and, communication difficulties across language barriers.

In addition, the DHSW role may have lost some of its 'lay' qualities by being incorporated with, and subject to the recruitment processes of, the NHS. Being from, or sharing characteristics with, the target community is proposed to enhance health workers' capacity to be a catalyst for change among the marginalised and 'hard-to-reach'. Findings from the systematic review provide tentative evidence to support this.

There was evidence that the DHSW intervention was effective at increasing child dental participation (a difference of 17% between groups who did and did not receive the intervention), and promoting participation earlier in life, with moderate effects on dental participation observed across Scotland in all risk groups.

In light of these findings, the Childsmile programme should consider: reforming the referral pathway; developing working policies to help reduce organisational barriers to DHSWs delivering an effective intervention; and, revising the recruitment criteria and working practice of DHSWs to highlight the unique benefits lay people bring to these roles.

References

Acs, G., Lodolini, G., Kaminsky, S., & Cisneros, G. J. (1992). Effect of nursing caries on body weight in a pediatric population. *Pediatr Dent, 14*(5), 302-305.

Al-Shalan, T. A., Erickson, P. R., & Hardie, N. A. (1997). Primary incisor decay before age 4 as a risk factor for future dental caries. *Pediatr Dent, 19*(1), 37-41.

Albrecht, U.-V., Behrends, M., Schmeer, R., Matthies, H. K., & von Jan, U. (2013). Usage of Multilingual Mobile Translation Applications in Clinical Settings. *JMIR mHealth and uHealth, 1*(1), e4.

Attree, P., Clayton, S., Karunanithi, S., Nayak, S., Popay, J., & Read, D. (2012). NHS health trainers: a review of emerging evaluation evidence. *Critical Public Health, 22*(1), 25-38.

Atun, R., de Jongh, T., Secci, F., Ohiri, K., & Adeyi, O. (2010). Integration of targeted health interventions into health systems: a conceptual framework for analysis. *Health Policy and Planning, 25*(2), 104-111.

Auslander, W., Haire-Joshu, D., Houston, C., Rhee, C. W., & Williams, J. H. (2002). A controlled evaluation of staging dietary patterns to reduce the risk of diabetes in African-American women. *Diabetes Care, 25*(5), 809-814.

Ayala, G. X., Elder, J. P., Campbell, N. R., Engelberg, M., Olson, S., Moreno, C., & Serrano, V. (2001). Nutrition communication for a Latino community: formative research foundations. *Fam Community Health, 24*(3), 72-87.

Ayhan, H., Suskan, E., & Yildirim, S. (1996). The effect of nursing or rampant caries on height, body weight and head circumference. *J Clin Pediatr Dent, 20*(3), 209-212.

Bagramian, R. A., Garcia-Godoy, F., & Volpe, A. R. (2009). The global increase in dental caries. A pending public health crisis. *Am J Dent, 22*(1), 3-8.

Bailey, D., & Kerlin, L. (2012). What is the impact of health trainer interventions within a mental health setting? *International Journal of Mental Health Promotion, 14*(3), 139-150.

Baquero, B., Ayala, G. X., Arredondo, E. M., Campbell, N. R., Slymen, D. J., Gallo, L., & Elder, J. P. (2009). Secretos de la Buena Vida: processes of dietary change via a tailored nutrition communication intervention for Latinas. *Health Education Research, 24*(5), 855-866.

Barnet, B., Liu, J., DeVoe, M., Duggan, A. K., Gold, M. A., & Pecukonis, E. (2009). Motivational Intervention to Reduce Rapid Subsequent Births to Adolescent Mothers: A Community-Based Randomized Trial. *Annals of Family Medicine, 7*(5), 436-445.

Barnet, B., Rapp, T., DeVoe, M., & Mullins, C. D. (2010). Cost-effectiveness of a motivational intervention to reduce rapid repeated childbearing in high-risk

adolescent mothers: a rebirth of economic and policy considerations. A*rchives of Pediatrics & Adolescent Medicine, 164*(4), 370-376.

Begh, R. A., Aveyard, P., Upton, P., Bhopal, R. S., White, M., Amos, A., . . . Sheikh, A. (2009). Promoting smoking cessation in Bangladeshi and Pakistani male adults: design of a pilot cluster randomised controlled trial of trained community smoking cessation workers. *Trials, 10*(1), 1-15.

Begh, R. A., Aveyard, P., Upton, P., Bhopal, R. S., White, M., Amos, A., . . . Sheikh, A. (2011a). Promoting smoking cessation in Pakistani and Bangladeshi men in the UK: pilot cluster randomised controlled trial of trained community outreach workers. *Trials, 12*, 197.

Begh, R. A., Aveyard, P., Upton, P., Bhopal, R. S., White, M., Amos, A., . . . Sheikh, A. (2011b). Experiences of outreach workers in promoting smoking cessation to Bangladeshi and Pakistani men: longitudinal qualitative evaluation. *BMC Public Health, 11*, 452.

Biesta, G. (2010). *Pragmatism and the philosophical foundations of mixed methods research.* In Tashakkori, A. & Teddlie, C. (Eds.), Handbook of mixed methods research for the social & behavioural sciences (2nd Ed. Pp. 95-118). Thousand Oaks, CA: Sage.

Birkel, R. C., Golaszewski, T., Koman, J. J., 3rd, Singh, B. K., Catan, V., & Souply, K. (1993). Findings from the Horizontes Acquired Immune Deficiency Syndrome Education project: the impact of indigenous outreach workers as change agents for injection drug users. *Health education quarterly, 20*(4), 523-538.

Blair, Y., Macpherson, L., McCall, D. & McMahon, A. (2006). Dental health of 5-year-olds following community-based oral health promotion in Glasgow, UK. *International Journal of Paediatric Dentistry, 16(6)*, 388-398.

Bungay, V., Kolar, K., Thindal, S., Remple, V. P., Johnston, C. L., & Ogilvie, G. (2013). Community-based HIV and STI prevention in women working in indoor sex markets. *Health Promotion Practice, 14*(2), 247-255.

Burns, J. (2016). *A systematic review of linking schemes from healthcare providers to community resources to engage families in early years interventions with relevance to improving oral health and tackling oral health inequalities.* (Unpublished Masters thesis). University of Glasgow: Scotland.

Campbell, M. K., & Quintiliani, L. M. (2006). Tailored Interventions in Public Health: Where Does Tailoring Fit in Interventions to Reduce Health Disparities? *American Behavioral Scientist, 49*(6), 775-793.

Cant, R. P., & Cooper, S. J. (2010). Simulation-based learning in nurse education: systematic review. *J Adv Nurs, 66*(1), 3-15.

Carr, S., Lhussier, M., Forster, N., Geddes, L., Deane, K., Pennington, M., . . . Donaldson, C. (2011). An evidence synthesis of qualitative and quantitative research on component intervention techniques, effectiveness, cost-effectiveness, equity and acceptability of different versions of health-related

lifestyle advisor role in improving health. *Health Technology Assessment, 15*(9), 1-284.

Caulfield, L. E., Gross, S. M., Bentley, M. E., Bronner, Y., Kessler, L., Jensen, J., . . . Paige, D. M. (1998). WIC-based interventions to promote breastfeeding among African-American Women in Baltimore: effects on breastfeeding initiation and continuation. *J Hum Lact, 14*(1), 15-22.

Chapman, D. J., Morel, K., Bermúdez-Millán, A., Young, S., Damio, G., & Pérez-Escamilla, R. (2013). Breastfeeding Education and Support Trial for Overweight and Obese Women: A Randomized Trial. *Pediatrics, 131*(1), e162-e170.

Childsmile- National Headline data (2011-2015). [ONLINE] *Available at: http://www.child-smile.org.uk/professionals/research-and-evaluation/* [Accessed 29 August 2016].

Childsmile Process Evaluation Reports (2010-2015). [ONLINE] *Available at: http://www.child-smile.org.uk/professionals/research-and-evaluation/* [Accessed 29 August 2016].

Clarke, J. (2011). What is a systematic review? *Evidence Based Nursing, 14*(3), 64.

Coleman, K. J., Farrell, M. A., Rocha, D. A., Hayashi, T., Hernandez, M., Wolf, J., & Lindsay, S. (2012). Readiness to be physically active and self-reported physical activity in low-income Latinas, California WISEWOMAN, 2006-2007. *Preventing chronic disease, 9*, E87.

Constitution of the World Health Organization, 1946. (2002) *Bull World Health Organ* (Vol. 80, pp. 983-984).

Corbin, J. & Strauss, A. (2008). *Basics of qualitative research (3rd ed.): Techniques and procedures for developing grounded theory.* 3rd Ed. Thousand Oaks, California: Sage.

Crabtree, J. & Miller, W. (1999). *Doing qualitative research.* 2nd Ed. London: Sage.

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: the new Medical Research Council guidance. *BMJ, 337*.

Craig, P., Cooper, C., Gunnell, D., Haw, S., Lawson, K., Macintyre, S., . . . Thompson, S. (2012). Using natural experiments to evaluate population health interventions: new Medical Research Council guidance. *Journal of Epidemiology and Community Health,* 66(12), 1182-1186.

Cresswell, J.W., Klassen, A.C., Plano-Clark, V.L., Clegg Smith, K. (2011). *Best practices for mixed methods research in the health sciences.* Washington, DC: Office of Behavioural and Social Sciences Research.

Cresswell, J.W. & Plano-Clark, V. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, CA: Sage.

Critical Appraisal Skills Programme (2006). 10 Questions to help you make sense of qualitative research. England: Public Health Resource Unit. *Available at:* http://www.casp-uk.net/#!checklists/cb36 [Accessed on 29 August 2016].

Davies, J., Ross, A., Wallace, B., & Wright, L. (2003). *Safety management: a qualitative systems approach.* London: Taylor & Francis.

Deas, L., Mattu, L., & Gnich, W. (2013). Intelligent policy making? Key actors' perspectives on the development and implementation of an early years' initiative in Scotland's public health arena. *Soc Sci Med, 96*, 1-8.

Department of Health (2004). *Choosing Health: making healthier choices easier.* London: Department of Health.

Dewey, J. (1988). *The middle works of John Dewey.* Vol 4. Carbondale, IL: SIU Press.

DiCicco-Bloom, B. & Crabtree, B.F. (2006). The qualitative research interview. *Medical Education, 40(4), 314-321.*

Duggleby, W. (2005). What about focus group interaction data? *Qual Health Res, 15(6), 832-840.*

Effective Public Health Practice Project (2003). *Quality assessment tool for quantitative studies.* Public Health Research, Education and Development Program (PHRED). Hamilton: PHRED.

Eisenberg, K., & Woodruff, S. I. (2013). Randomized controlled trial to evaluate screening and brief intervention for drug-using multiethnic emergency and trauma department patients. *Addiction Science & Clinical Practice, 8*(1), 8-8.

Elder, J. P., Ayala, G. X., Campbell, N. R., Arredondo, E. M., Slymen, D. J., Baquero, B., . . . Engelberg, M. (2006). Long-term effects of a communication intervention for Spanish-dominant Latinas. *American Journal of Preventive Medicine, 31*(2), 159-166.

Elder, J. P., Ayala, G. X., Campbell, N. R., Slymen, D., Lopez-Madurga, E. T., Engelberg, M., & Baquero, B. (2005). Interpersonal and print nutrition communication for a Spanish-dominant Latino population: Secretos de la Buena Vida. *Health Psychology, 24*(1), 49-57.

Elder, J. P., Ayala, G. X., Slymen, D. J., Arredondo, E. M., & Campbell, N. R. (2009). Evaluating psychosocial and behavioral mechanisms of change in a tailored communication intervention. *Health Education & Behavior, 36*(2), 366-380.

Eng, E., Parker, E., & Harlan, C. (1997). Lay health advisor intervention strategies: a continuum from natural to paraprofessional helping. *Health Educ Behav, 24(4), 413-417*.

Eyles, H. C., & Mhurchu, C. N. (2009). Does tailoring make a difference? A systematic review of the long-term effectiveness of tailored nutrition education for adults. *Nutrition reviews, 67*(8), 464-480.

Farrell, M. A., Hayashi, T., Loo, R. K., Rocha, D. A., Sanders, C., Hernandez, M., & Will, J. C. (2009). Clinic-based nutrition and lifestyle counseling for Hispanic women delivered by community health workers: design of the California WISEWOMAN study. *Journal of Women's Health, 18*(5), 733-739.

Fenwick, J., Barclay, L., & Schmied, V. (2001). 'Chatting': an important clinical tool in facilitating mothering in neonatal nurseries. *Journal of Advanced Nursing, 33*(5), 583-593.

Filstrup, S. L., Briskie, D., da Fonseca, M., Lawrence, L., Wandera, A., & Inglehart, M. R. (2003). Early childhood caries and quality of life: child and parent perspectives. *Pediatr Dent, 25*(5), 431-440.

Fouad, M. N., Nagy, M. C., Johnson, R. E., Wynn, T. A., Partridge, E. E., & Dignan, M. (2004). The development of a community action plan to reduce breast and cervical cancer disparities between African-American and White women. *Ethn Dis, 14*(3 Suppl 1), S53-60.

Fouad, M. N., Partridge, E., Dignan, M., Holt, C., Johnson, R., Nagy, C., . . . Wynn, T. (2006). A community-driven action plan to eliminate breast and cervical cancer disparity: successes and limitations. *J Cancer Educ, 21*(1 Suppl), S91-100.

Fouad, M. N., Partridge, E., Dignan, M., Holt, C., Johnson, R., Nagy, C., . . . Scarinci, I. (2010). Targeted intervention strategies to increase and maintain mammography utilization among African American women.[Erratum appears in Am J Public Health. 2011 Jul;101(7):1158]. *American Journal of Public Health, 100*(12), 2526-2531.

Frencken, J. E., Peters, M. C., Manton, D. J., Leal, S. C., Gordan, V. V., & Eden, E. (2012). Minimal intervention dentistry for managing dental caries - a review: report of a FDI task group. *Int Dent J, 62*(5), 223-243.

Gale, N.K., Health, G., Cameron, E., Rashid, S., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol, 13(117), 1471-2288.*

Garg, N., Anandakrishna, L., & Chandra, P. (2012). Is there an Association between Oral Health Status and School Performance? A Preliminary Study. *Int J Clin Pediatr Dent, 5*(2), 132-135.

Garg, A., Toy, S., Tripodis, Y., Silverstein, M., & Freeman, E. (2015). Addressing social determinants of health at well child care visits: a cluster RCT. *Pediatrics, 135*(2), 2014-2888.

Glaser, B.G. (1992). *Basics of grounded theory analysis. Emergence vs. forcing.* California: Sociology Press.

Glaser, B.G. & Strauss, A.L. (1967). *The discovery of gronded theory: Strategies for qualitative research.* Chicago: Aldine Pub. Co.

Glazier, R. H., Bajcar, J., Kennie, N. R., & Willson, K. (2006). A systematic review of interventions to improve diabetes care in socially disadvantaged populations. *Diabetes Care, 29*(7), 1675-1688.

Glenton, C., Colvin, C. J., Carlsen, B., Swartz, A., Lewin, S., Noyes, J., & Rashidian, A. (2013). Barriers and facilitators to the implementation of lay health worker programmes to improve access to maternal and child health: qualitative evidence synthesis. *Cochrane Database Syst Rev, 8*(10).

Gross, S. M., Caulfield, L. E., Bentley, M. E., Bronner, Y., Kessler, L., Jensen, J., & Paige, V. M. (1998). Counseling and motivational videotapes increase duration of

breast-feeding in African-American WIC participants who initiate breast-feeding. *Journal of the American Dietetic Association, 98*(2), 143-148.

Han, H.-R., Lee, H., Kim, M. T., & Kim, K. B. (2009). Tailored lay health worker intervention improves breast cancer screening outcomes in non-adherent Korean-American women. *Health Education Research, 24*(2), 318-329.

Hannes K. Chapter 4: critical appraisal of qualitative research (2011). In: Noyes J, Booth A, Hannes K, Harden A, Harris J, Lewin S, Lockwood C, editors. Supplementary guidance for inclusion of qualitative research in Cochrane systematic reviews of interventions. Version 1 (updated August 2011). London: Cochrane Collaboration Qualitative Methods Group. Available at http://cqrmg.cochrane.org/supplemental-handbook-guidance [Accessed on 29 August 2016].

Harrington, N. G., & Noar, S. M. (2012). Reporting standards for studies of tailored interventions. *Health Educ Res, 27(2), 331-342*.

Harris, J., Springett, J., Croot, L., Booth, A., Campbell, F., & al., T. e. (2015). Can community-based peer support promote health literacy and reduce inequalities? A realist review. . *Public Health Research. , 3*(3).

Harris, R., Nicoll, A. D., Adair, P. M., & Pine, C. M. (2004). Risk factors for dental caries in young children: a systematic review of the literature. *Community Dent Health, 21*(1 Suppl), 71-85.

Hart, J.T. (1971). The Inverse Care Law. *The Lancet*, *297(7696), 405-412.*

Hatcher, J., Studts, C. R., Dignan, M., Turner, L. M., & Schoenberg, N. E. (2011). Predictors of Cervical Cancer Screening for Rarely or Never Screened Rural Appalachian Women. *Journal of health care for the poor and underserved, 22*(1), 176-193.

Hawe, P. (2015). Lessons from complex interventions to improve health. *Annu Rev Public Health, 36(18)*, 307-323.

Hawkins, R. P., Kreuter, M., Resnicow, K., Fishbein, M., & Dijkstra, A. (2008). Understanding tailoring in communicating about health. *Health Educ Res, 23*.

Hayashi, T., Farrell, M. A., Chaput, L. A., Rocha, D. A., & Hernandez, M. (2010). Lifestyle intervention, behavioral changes, and improvement in cardiovascular risk profiles in the California WISEWOMAN project. *Journal of Women's Health, 19*(6), 1129-1138.

Hodgins, F., Gnich, W., Ross, A. J., Sherriff, A., & Worlledge-Andrew, H. (2016). How lay health workers tailor in effective health behaviour change interventions: a protocol for a systematic review. [journal article]. *Systematic Reviews, 5*(1), 1-6.

Hunte, H. E. R., Turner, T. M., Pollack, H. A., & Lewis, E. Y. (2004). A birth records analysis of the Maternal Infant Health Advocate Service program: a paraprofessional intervention aimed at addressing infant mortality in African Americans. *Ethnicity & Disease, 14*(3 Suppl 1), S102-107.

Hunter, J. B., de Zapien, J. G., Papenfuss, M., Fernandez, M. L., Meister, J., & Giuliano, A. R. (2004). The impact of a promotora on increasing routine chronic disease prevention among women aged 40 and older at the U.S.-Mexico border. *Health Educ Behav, 31*(4 Suppl), 18S-28S.

Iheozor-Ejiofor, Z., Worthington, H. V., Walsh, T., O'Malley, L., Clarkson, J. E., Macey, R., . . . Glenny, A. M. (2015). Water fluoridation for the prevention of dental caries. *Cochrane Database Syst Rev, 18*(6).

ISD Services (2016). *Geography, Population and Deprivation Analytical Support Team*. *ISD Scotland.* [ONLINE] *Available at: http://www.isdscotland.org/Products-and-Services/GPD-Support/Deprivation/SIMD/* [Accessed on 29 August 2016].

ISD Scotland (2016). *Operations and Procedures.* [ONLINE] *Available at: http://www.isdscotland.org/Health-Topics/Hospital-Care/Operations-and-Procedures/* [Accessed on 29 August 2016].

ISD Scotland (2016b). *General Dental Service.* [ONLINE] *Available at: http://www.isdscotland.org/Health-Topics/Dental-Care/General-Dental-Service/registration-and-participation.asphttp://www.isdscotland.org/Products-and-Services/GPD-Support/Deprivation/SIMD/* [Accessed on 29 August 2016].

Islam, N. S., Zanowiak, J. M., Wyatt, L. C., Chun, K., Lee, L., Kwon, S. C., & Trinh-Shevrin, C. (2013). A randomized-controlled, pilot intervention on diabetes prevention and healthy lifestyles in the New York City Korean community. *Journal of Community Health, 38*(6), 1030-1041.

Islam, N. S., Zanowiak, J. M., Wyatt, L. C., Kavathe, R., Singh, H., Kwon, S. C., & Trinh-Shevrin, C. (2014). Diabetes prevention in the New York City Sikh Asian Indian community: a pilot study. *International Journal of Environmental Research & Public Health, 11*(5), 5462-5486.

Jackson, S. L., Vann, W. F., Kotch, J. B., Pahel, B. T., & Lee, J. Y. (2011). Impact of Poor Oral Health on Children's School Attendance and Performance. *American Journal of Public Health, 101*(10), 1900-1906.

Johnson, R.B. & Onwuegbuzie, A.J. (2004). Mixed methods research: a research paradigm whose time has come. *Educational researcher*, *33(7), 14-26.*

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research, 1*(2), 112-133.

Jolly, K., Ingram, L., Freemantle, N., Khan, K., Chambers, J., Hamburger, R., . . . Macarthur, C. (2012). Effect of a peer support service on breast-feeding continuation in the UK: a randomised controlled trial. *Midwifery, 28*(6), 740-745.

Kasl, S. V., & Cobb, S. (1966). Health behaviour, illness behaviour, and sick role behaviour: II. Sick role behaviour. *Arch Environ Health, 12*.

Kawamoto, K., Houlihan, C. A., Balas, E. A., & Lobach, D. F. (2005). Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *BMJ : British Medical Journal, 330*(7494), 765-765.

Kelly, M. (2010). The role of theory in qualitative health research. *Fam Pract, 27(3), 285-290.*

Kitzinger, J., & Barbour, R. (1999). *Developing focus group research: politics, theory and practice.* Thousand Oaks, CA: Sage.

Koniak-Griffin, D., Brecht, M.-L., Takayanagi, S., Villegas, J., Melendrez, M., & Balcázar, H. (2015). A Community Health Worker-Led Lifestyle Behavior Intervention for Latina (Hispanic) Women: Feasibility and Outcomes of A Randomized Controlled Trial. *International journal of nursing studies, 52*(1), 75-87.

Krantz, M. J., Coronel, S. M., Whitley, E. M., Dale, R., Yost, J., & Estacio, R. O. (2013). Effectiveness of a community health worker cardiovascular risk reduction program in public health and health care settings. *American Journal of Public Health, 103*(1), e19-27.

Krueger, R.A., & Casey, M.A. (2014). *Focus groups: a practical guide for applied research*. Thousand Oaks, CA: Sage.

Kreuter, M. W., Bull, F. C., Clark, E. M., & Oswald, D. L. (1999). Understanding how people process health information: a comparison of tailored and untailored weight loss materials. *Health Psychol, 18(5), 487-494*.

Krok-Schoen, J. L., Oliveri, J. M., Young, G. S., Katz, M. L., Tatum, C. M., & Paskett, E. D. (2016). Evaluating the stage of change model to a cervical cancer screening intervention among Ohio Appalachian women. *Women Health, 56*(4), 468-486.

Law, C. S. (2013). Management of premature primary tooth loss in the child patient. *J Calif Dent Assoc, 41*(8), 612-618.

Lehmann, U., & Sanders, D. (2007). Community health workers: What do we know about them? The state of the evidence on programmes, activities, costs and impact on health outcomes of using community health workers. Geneva: *World Health Organisation*.

Levett-Jones, T., & Lapkin, S. (2014). A systematic review of the effectiveness of simulation debriefing in health professional education. *Nurse Educ Today, 34*(6), 15.

Lewin, S. A., Dick, J., Pond, P., Zwarenstein, M., Aja, G., van Wyk, B., . . . Patrick, M. (2005). Lay health workers in primary and community health care. *Cochrane Database Syst Rev, 25*(1).

Lewin, S., Munabi-Babigumira, S., Glenton, C., Daniels, K., Bosch-Capblanch, X., & Wyk, B. E. (2010). Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *Cochrane Database Syst Rev, 3*.

Listl, S., Galloway, J., Mossey, P. A., & Marcenes, W. (2015). Global Economic Impact of Dental Diseases. *Journal of Dental Research, 94*(10), 1355-1361.

Low, W., Tan, S., & Schwartz, S. (1999). The effect of severe caries on the quality of life in young children. *Pediatr Dent, 21*(6), 325-326.

MacArthur, C., Jolly, K., Ingram, L., Freemantle, N., Dennis, C.-L., Hamburger, R., . . . Khan, K. (2009). Antenatal peer support workers and initiation of breast feeding: Cluster randomised controlled trial. *BMJ: British Medical Journal, 338*(7691).

MacIntyre, S. (2007). Inequalities in health in Scotland: what are they and what can we do about them? *MRC Social & Public Health Sciences Unit, Glasgow.* Occasional Paper, No. 17.

Mackenzie, M. (2004). The independent evaluation of 'Starting Well' Final Report. *Available at http://www.gov.scot/Publications/2005/04/20890/55054*. [Accessed on 29 August 2016].

Macpherson, L. M., Ball, G. E., King, P., Chalmers, K., & Gnich, W. (2015). Childsmile: The child oral health improvement programme in Scotland. *Prim Dent J, 4*(4), 33-37.

Marinho, V. C., Higgins, J. P., Logan, S., & Sheiham, A. (2003). Systematic review of controlled trials on the effectiveness of fluoride gels for the prevention of dental caries in children. *J Dent Educ, 67*(4), 448-458.

Marmot, M., Allen, J., Goldblatt, P., & al., e. (2010). Fair society, health lives: strategic review of health inequalities in England post 2010. *London: Marmot Review Team*.

Mathers, J., Taylor, R., & Parry, J. (2014). The Challenge of Implementing Peer-Led Interventions in a Professionalized Health Service: A Case Study of the National Health Trainers Service in England. *Milbank Quarterly, 92*(4), 725-753.

McInnes, R. J., Love, J. G., & Stone, D. H. (2000). Evaluation of a community-based intervention to increase breastfeeding prevalence. *J Public Health Med, 22*(2), 138-145.

McInnes, R. J., & Stone, D. H. (2001). The process of implementing a community-based peer breast-feeding support programme: the Glasgow experience. *Midwifery, 17*(1), 65-73.

Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., & Walker, A. (2005). Making psychological theory useful for implementing evidence based practice: a consensus approach. *Qual Saf Health Care, 14*.

Michie, S., Richardson, M., Johnston, M., Abraham, C., Francis, J., Hardeman, W., . . . Wood, C. E. (2013). The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. *Ann Behav Med, 46*(1), 81-95.

Michie, S., Rumsey, N., Fussell, A., Hardeman, W., Johnston, M., Newman, S. and Yardley, L. (2008). Improving health: changing behaviour. NHS health trainer handbook. Manual. Department of Health Publications.

Michie, S., Stralen, M., & West, R. (2011). The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*, 6 (42).

Mickenautsch, S., Leal, S. C., Yengopal, V., Bezerra, A. C., & Cruvinel, V. (2007). Sugar-free chewing gum and dental caries: a systematic review. *J Appl Oral Sci, 15*(2), 83-88.

Mier, N., Tanguma, J., Millard, A. V., Villarreal, E. K., Alen, M., & Ory, M. G. (2011). A pilot walking program for Mexican-American women living in colonias at the border. *American Journal of Health Promotion, 25*(3), 172-175.

Mier, N., Medina, B. & Carbajal, E.S. (2007). Vamos a Caminar! Applying CBPR to a physical activity pilot program in South Texas. *TPHA Journal, 59(2).*

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., & Petticrew, M. (2015). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev, 4*.

Moore, G. F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., . . . Baird, J. (2015). Process evaluation of complex interventions: Medical Research Council guidance. *BMJ : British Medical Journal, 350*.

Morgan, D. (1992). *Designing focus group research.* In M. Stewart et al. (Eds.). Tools for Primary Care Research, Vol. 2. London: Sage.

Morgan, D. L. (2014). Pragmatism as a Paradigm for Social Research. *Qualitative Inquiry*. *First published Feb 3, 2014.*

Moustakas, C. (1994). *Phenomenological research methods*. Thousand Oaks, CA: Sage.

Muirhead, P. E., Butcher, G., Rankin, J., & Munley, A. (2006). The effect of a programme of organised and supervised peer support on the initiation and duration of breastfeeding: a randomised trial. *British Journal of General Practice, 56*(524), 191-197.

Nanjappa, S. and Freeman, R. (2014) CHATTERBOX: developing and piloting an interactive communication toolkit for engaging families with dental services. *Journal of Nursing & Care, 3:215.*

National Institite for Health and Care Excellence (2012). *Health inequalities and population health.* [ONLINE] *Accessible at: https://www.nice.org.uk/advice/lgb4/chapter/introduction* [Accessed on 29 August 2016].

NDIP Reports (2016). *National Dental Inspection Programme.* [ONLINE] *Available at: http://ndip.scottishdental.org/ndip-reports/* [Accessed on 29 August 2016].

Newcombe, H.B., Smith, M.E., & Lalonde, P. (1986). "Computerised record linkage in health research: an overview" in *Proceedings of the workshop on computerised linkage in health research (Ottawa, Ontario, May 21-23, 1986).* Howe, G.R. and Spasoff, R.A (Eds). Toronto: University of Toronto Express.

Noar, S. M., Benac, C. N., & Harris, M. S. (2007). Does tailoring matter? Meta-analytic review of tailored print health behavior change interventions. *Psychol Bull, 133*(4), 673-693.

O'Mara-Eves, A., Brunton, G., McDaid, D., Oliver, S., Kavanagh, J., Jamal, F., . . . Thomas, J. (2013). Community engagement to reduce inequalities in health: a systematic review, meta-analysis and economic analysis. *Public Health Res, 1*.

Onwuegbuzie, A.J., Dickinson, W.B., Leech, N.L., & Zoran, A.G. (2009). A qualitative framework for collecting and analyzing data in focus group research. *International Journal of Qualitative Methods, 8(3), 1-21.*

Paskett, E. D., McLaughlin, J. M., Lehman, A. M., Katz, M. L., Tatum, C. M., & Oliveri, J. M. (2011). Evaluating the efficacy of lay health advisors for increasing risk-appropriate Pap test screening: a randomized controlled trial among Ohio Appalachian women. *Cancer Epidemiology, Biomarkers & Prevention, 20*(5), 835-843.

Patel, R. R., Tootla, R., & Inglehart, M. R. (2007). Does oral health affect self perceptions, parental ratings and video-based assessments of children's smiles? *Community Dent Oral Epidemiol, 35*(1), 44-52.

Patton, M. (2001). *Qualitative research and evaluation methods.* Thousand Oaks, CA: Sage.

Perez, D., Van der Stuyft, P., Zabala, M. C., Castro, M., & Lefevre, P. (2016). A modified theoretical framework to assess implementation fidelity of adaptive public health interventions. *Implement Science, 11*(91).

Petersen, P. E. (2003). The World Oral Health Report. Geneva: *World Health Organisation*.

Pringle, A., Zwolinsky, S., McKenna, J., Daly-Smith, A., Robertson, S., & White, A. (2013a). Delivering men's health interventions in English Premier League football clubs: key design characteristics. *Public Health, 127*(8), 716-726.

Pringle, A., Zwolinsky, S., McKenna, J., Daly-Smith, A., Robertson, S., & White, A. (2013b). Effect of a national programme of men's health delivered in English Premier League football clubs. *Public Health, 127*(1), 18-26.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change. Applications to addictive behaviors. *Am Psychol, 47*(9), 1102-1114.

Reich, E., Lussi, A., & Newbrun, E. (1999). Caries-risk assessment. *Int Dent J, 49*(1), 15-26.

Remple, V. P., Johnston, C., Patrick, D. M., Tyndall, M. W., & Jolly, A. M. (2007). Conducting HIV/AIDS research with indoor commercial sex workers: reaching a hidden population. *Prog Community Health Partnersh, 1*(2), 161-168.

Resnick, E. A., Bishop, M., O'Connell, A., Hugo, B., Isern, G., Timm, A., . . . Geller, A. C. (2009). The CHEER study to reduce BMI in Elementary School students: a

school-based, parent-directed study in Framingham, Massachusetts. *Journal of School Nursing, 25*(5), 361-372.

Ritchie, J. & Spencer, L. (1994). *Qualitative data analysis for applied policy research* in Bryman, A & Burgess, R.G. [Eds.] Analyzing qualitative data, pp.173- 194.

Rorty, R. (1999). *Philosophy and social hope*. London: Penguin.

Ruger, J. P. (2006). Ethics and governance of global health inequalities. *J Epidemiol Community Health, 60*(11), 998-1003.

Sandelowski, M. (1995). Sample size in qualitative research. *Res Nurs Health, 18(2), 179-183.*

Schoenberg, N. E., Hatcher, J., Dignan, M. B., Shelton, B., Wright, S., & Dollarhide, K. F. (2009). Faith Moves Mountains: An Appalachian Cervical Cancer Prevention Program. *American Journal of Health Behavior, 33*(6), 627-638.

Shaw, D., Macpherson, L., & Conway, D. (2009). Tackling socially determined dental inequalities: ethical aspects of Childsmile, the national child oral health demonstration programme in Scotland. *Bioethics, 23*(2), 131-139.

Sheiham, A. (2006). Dental caries affects body weight, growth and quality of life in pre-school children. *Br Dent J, 201*(10), 625-626.

Silverman, D. (2000). *Doing qualitative research: a practical handbook.* Thousand Oaks, CA: Sage.

Simpson, N., & Stallard, P. (2004). Referral and access to children's health services. *Archives of Disease in Childhood, 89*(2).

Short, C. E., James, E. L., Plotnikoff, R. C., & Girgis, A. (2011). Efficacy of tailored-print interventions to promote physical activity: a systematic review of randomised trials. [journal article]. *International Journal of Behavioral Nutrition and Physical Activity, 8*(1), 1-13.

Smith, S., & Randhawa, G. (2006). Embracing diversity in community healthcare settings: developing a client-centred approach to weaning support. *Diversity in Health & Social Care, 3*(1), 47-53.

South, J., Kinsella, K., & Meah, A. (2012). Lay perspectives on lay health worker roles, boundaries and participation within three UK community-based health promotion projects. *Health Educ Res, 27*(4), 656-670.

South, J., Meah, A., Bagnall, A.-M., Kinsella, K., Branney, P., & al., e. (2010). People in Public Health- a study of approaches to develop and support people in public health roles. In Report for the National Institute for Health Research Service Delivery and Organisation programme.

SPSS Inc. [Computer software]. Chicago, Il: USA.

StataCorp. (2015). Version 14. [Computer software]. College Station, Texas: USA.

Stewart, D.W. & Shamdasani, P.N. (2014). *Focus groups: Theory and practice*. Sage Publications Inc.

Studts, C. R., Tarasenko, Y. N., Schoenberg, N. E., Shelton, B. J., Hatcher-Keller, J., & Dignan, M. B. (2012). A community-based randomized trial of a faith-placed intervention to reduce cervical cancer burden in Appalachia. *Preventive Medicine, 54*(6), 408-414.

Swider, S. M. (2002). Outcome effectiveness of community health workers: an integrative literature review. [Review]. *Public Health Nurs, 19*(1), 11-20.

Tashakkori, A & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: Sage.

Taylor, V. M., Hislop, T. G., Jackson, J. C., Tu, S.-P., Yasui, Y., Schwartz, S. M., . . . Thompson, B. (2002). A Randomized Controlled Trial of Interventions to Promote Cervical Cancer Screening Among Chinese Women in North America. *Journal of the National Cancer Institute, 94*(9), 670-677.

Taylor, V. M., Hislop, T. G., Tu, S.-P., Teh, C., Acorda, E., Yip, M.-P., . . . Yasui, Y. (2009). Evaluation of a hepatitis B lay health worker intervention for Chinese Americans and Canadians. *Journal of Community Health, 34*(3), 165-172.

Taylor, V. M., Jackson, J. C., Yasui, Y., Nguyen, T. T., Woodall, E., Acorda, E., . . . Ramsey, S. (2010). Evaluation of a cervical cancer control intervention using lay health workers for Vietnamese American women. *American Journal of Public Health, 100*(10), 1924-1929.

Tengland, P.-A. (2012). Behavior Change or Empowerment: On the Ethics of Health-Promotion Strategies. *Public Health Ethics 5(2): 140-153*.

The Scottish Government (2005). An Action Plan for Improving Oral Health and Modernising NHS Dental Services in Scotland. *Accessible at: http://www.scottishdental.org/library/an-action-plan-for-improving-oral-health-and-modernising-nhs-dental-services-in-scotland/* [Accessed 29 August 2016].

Tickle, M., Blinkhorn, A. S., & Milsom, K. M. (2008). The occurrence of dental pain and extractions over a 3-year period in a cohort of children aged 3-6 years. *J Public Health Dent, 68*(2), 63-69.

Trayers, T., & Lawlor, D. A. (2007). Bridging the gap in health inequalities with the help of health trainers: a realistic task in hostile environments? A short report for debate. *J Public Health, 29*(3), 218-221.

Trubey, R. J., & Chestnutt, I. G. (2013). Attitudes towards establishing a daily supervised school-based toothbrushing programme--determined by Q-sort methodology. *Community Dent Health, 30*(1), 45-51.

Vaughn, S., Schumm, J.S., & Sinagub, J.M. (1996). *Focus group interviews in education and psychology*. Thousand Oaks, CA: Sage.

Victoria, C. G. W., A; Schellenberg, J A; Gwatkin, D; Claeson, M; Habicht, J-P. (2003). Applying an equity lens to child health and mortality: more of the same is not enough. *The Lancet, 362*(9379), 233-241.

Visram, S., Clarke, C., & White, M. (2014). Making and maintaining lifestyle changes with the support of a lay health advisor: Longitudinal qualitative study of health trainer services in northern England. *PLoS ONE, 9*(5).

Wanyonyi, K. L., Themessl-Huber, M., Humphris, G., & Freeman, R. (2011). A systematic review and meta-analysis of face-to-face communication of tailored health messages: implications for practice. *Patient Educ Couns, 85*(3), 348-355.

Watt, G. (2002). The inverse care law today. *Lancet, 360(9328), 252-254.*

Watt, R. G., & Sheiham, A. (2012). Integrating the common risk factor approach into a social determinants framework. *Community Dent Oral Epidemiol, 40*(4), 289-296.

Watt, R. G., Williams, D. M., & Sheiham, A. (2014). The role of the dental team in promoting health equity. *Br Dent J, 216*(1), 11-14.

Whitehead, M., & Dahlgren, G. (2007). Concepts and principles for tackling social inequities in health: Levelling up Part 1. Copenhagen, WHO Regional Office for Europe (Studies on social and economic determinants of population health, No. 2).

Wilkinson, R., & Marmot, M. (2003). Social Determinants of Health: The solid facts. Geneva: *World Health Organisation* (Second Edition).

Williams, J. H., Belle, G. A., Houston, C., Haire-Joshu, D., & Auslander, W. F. (2001). Process evaluation methods of a peer-delivered health promotion program for African American women. *Health Promotion Practice, 2*(2), 135-142.

Wood, R., & Stirling, A. (2010). Child Health Surveillance System, Pre-school: Audit of children with no CHSP-PS record of a health visitor first visit and/or 6-8 week review. Information Services Division, Scotland.

Woodall, J., Raine, G., South, J., Warwick-Booth, L. (2010). Empowerment and health & well-being. Evidence Review. Altogether Better. Centre for Health Promotion Research, Leeds Metropolitan University.

Woodruff, S. I., Clapp, J. D., Eisenberg, K., McCabe, C., Hohman, M., Shillington, A. M., . . . Gareri, J. (2014). Randomized clinical trial of the effects of screening and brief intervention for illicit drug use: the Life Shift/Shift Gears study. *Addiction science & clinical practice, 9*, 8.

Woodruff, S. I., Talavera, G. A., & Elder, J. P. (2002). Evaluation of a culturally appropriate smoking cessation intervention for Latinos. *Tobacco control, 11*(4), 361-367.

World Health Organisation (1986). Ottawa Charter for Health Promotion. First International Conference on Health Promotion, 1986. *Accessible at: http://www.who.int/healthpromotion/conferences/previous/ottawa/en/* [Accessed 29 August 2016].

World Health Organisation (2012). Fact Sheet No. 318: Oral health. *Available at:* http://www.who.int/mediacentre/factsheets/fs318/en/ [Accessed on 29 August 2016].

World Health Organisation (2016). *Social determinants of health.* [ONLINE] *Accessible at: http://www.who.int/social_determinants/en/*[Accessed on 29 August 2016].

Yuan, N. P., Castaneda, H., Nichter, M., Wind, S., Carruth, L., & Muramoto, M. (2012). Lay health influencers: how they tailor brief tobacco cessation interventions. *Health Educ Behav, 39*(5), 544-554.

Zhang, D., & Unschuld, P. U. (2008). China's barefoot doctor: past, present, and future. *Lancet, 372*(9653), 1865-1867.

Zou, K. H., O'Malley, A. J., & Mauri, L. (2007). Receiver-operating characteristic analysis for evaluating diagnostic tests and predictive models. *Circulation, 115(5), 654-657.*

Appendices

Appendix 1- Inclusion/Exclusion criteria for the systematic review

Inclusion
1. The study must report an evaluation of a health behaviour change intervention.
2. A LHW (or multiple LHWs) must be the key individual delivering the intervention.
3. Include interventions where a LHW is delivering the intervention to their own family ONLY as part of delivering the intervention to a wider network (friends/colleagues) or community.
4. Include interventions delivered to all children and all adults, but can be delivered to parents/carers to change behaviour in their children.
5. The outcome of the intervention should be a change in health behaviour (excluding disease management- e.g. diabetes management). This may be the secondary or tertiary outcome (e.g. where the primary outcome may be a change in health status/health measure).
6. The intervention must allow for communication (back and forth) between an individual and LHW(s) The following methods of delivery can be included: • Face to face • Telephone The following methods of delivery can be included IF there is an exchange between an individual and LHW(s): • Email • Forum • Text
7. There must be evidence that the intervention is tailored (i.e. one or all of the following must be based on an individual assessment of needs/characteristics: the content/context/frames/channel for delivery of the intervention).
8. Individual and group interventions are included as long as there is evidence that an individual assessment of needs/characteristics has been conducted.
9. Interventions taking place in all contexts/settings are included (e.g. community, clinical). Include interventions taking place in contexts similar to the UK (i.e. Western Europe, North America, Australia and New Zealand).
Exclusion
1. Exclude interventions that are solely delivered by health professionals (people with a formal health profession qualification or degree- e.g. hygienist therapist/nurse/social

worker/doctor would be excluded), or those in training for a professional qualification (e.g. medical students).
2. Exclude interventions where lay workers have an exclusively administrative role.
3. Exclude interventions where a LHW is delivering the intervention to their immediate family only.
4. Exclude interventions that do not involve interpersonal communication (e.g. service user interacting with tailored computer program).
5. Exclude interventions that are not tailored
6. Exclude interventions where the outcome is not a change in health behaviour or where the outcome is disease management (e.g. diabetes management).
7. Exclude papers that do not report an evaluated intervention outcome.
8. Exclude interventions taking place outside of contexts similar to the UK (i.e. anywhere outside of Western Europe, North America, Australia and New Zealand).

Appendix 2- Search strategies for each database

EMBASE

1. mentor*.mp
2. (community adj3 worker* or aide*)).mp
3. paraprofessional*.mp
4. community health worker*.mp
5. (support adj3 worker*).mp
6. (social adj3 (assistant* or support) adj3 worker*)).mp
7. community health advisor*.mp
8. (linkworker* or (link adj1 worker*().mp
9. (health adj3 trainer*).mp
10. (home adj2 visit*).mp
11. exp United States/
12. exp Western Europe/
13. exp Australia/
14. exp New Zealand/
15. exp Canada/
16. 11 or 12 or 13 or 14 or 15
17. health promotion.mp or exp health promotion/
18. (behaviour adj1 change)/mp
19. hard-to-reach.mp
20. (deprivation or deprived).mp
21. marginali*.mp
22. underserved.mp
23. disadvantaged.mp
24. health inequal*.mp
25. health dispar*.mp
26. health visit*.mp
27. counselling.mp or exp counselling/
28. counselled.mp
29. (face-to-face adj3 intervention).mp
30. tailor*.mp
31. personalised.mp
32. personalized.mp
33. personalising.mp
34. personalizing.mp
35. personalise.mp
36. personalize.mp
37. individualise.mp
38. individualize.mp
39. individualised.mp
40. inidividualized.mp
41. individualizing.mp
42. individualising.mp
43. (programme adj3 evaluation).mp
44. (service adj3 evaluation).mp
45. Qualitative research.mp or exp qualitative research/

46. RCT.mp
47. exp “randomized controlled trial (topic)”/
48. exp evaluation study/
49. (cluster adj2 randomised).mp
50. (longitudinal adj4 (evaluation* or stud*)).mp
51. (cohort adj4 study).mp
52. exp treatment outcome/
53. exp exploratory research/or exploratory study.mp
54. (process adj2 evaluation).mp
55. trial*.mp
56. ((worker* or advisor* or support* or helper* or influencer*) adj3 (voluntary or volunteer* or lay or peer*)).mp
57. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 56
58. 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56
59. 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42
60. 16 and 57 and 58 and 59
61. Limit 61 to (human and english language)

CINAHL

1. community N3 worker OR community N3 aide OR community N£ volunteer OR paraprofessional* OR community health worker* OR support N2 worker OR social n3 assistant OR social N3 (support N3 worker*) OR community health advisor* OR (linkworker or (link* N1 worker*)) OR ((home N3 visitor*) or (health N3 trainer*)) OR ((worker* OR advisor* OR support* OR helper* OR influencer*) N£ (voluntary OR volunteer* OR lay OR peer*))
2. (health promotion OR behaviour change OR health education) OR hard-to-reach OR (deprivation OR deprived OR marginili* OR underserved OR disadvantaged) OR (health inequal* OR health dispar* OR health equity OR (health visit* OR (home N2 visit*) OR counsel* OR (face-to-face N3 intervention)) OR (tailor* OR personalise* OR personaliz* OR individualis* OR individualiz*)
3. ((programme N3 evaluation) OR (service N3 evaluation) OR (evaluation N3 stud*) OR (process N2 evaluation)) OR ((qualitative N3 research) OR questionnaire* OR (focus N1 group*) OR interview*) OR ((random* OR controlled) AND trial*) OR trial* OR placebo OR randomized OR (controlled N1 clinical N1 trial*) OR (clinical N1 trial*)) OR mixed N1 method* OR ((randomized N1 controlled N1 trial*) OR (cluster N2 randomised)) OR (longitudinal N4 evaluation) OR (cohort N4 study) OR (exploratory stud*)
4. 1 AND 2 AND 3

LIMITERS: Exclude MEDLINE records; Human; Geographic Subset: Australia & New Zealand, Canda, Europe, UK & Ireland, USA; Publication Type: Journal Article; Language: English

PsycINFO

1. ((community N3 worker) or (community N3 aide) or (community N3 volunteer) or (community N1 health N1 worker*) or (community N1 health N1 advisor*)) OR paraprofessional* OR support N2 worker OR ((social N3 assistant) or (social N3 (support N3 worker*)) or) OR ((linkworker* or (link N1 worker*))) OR (home N3 visitor*) OR (health N3 trainer*) OR ((worker* OR advisor* OR support* OR helper* OR influencer*) N3 (voluntary OR volunteer* OR lay OR peer*))

2. (“united states of america” or “united states” or “USA”) OR Canada OR (“United Kingdom” or “UK” “Great Britain” or “Northern Ireland” or “Scotland” or “England” or “Wales”) OR (Austria OR Scandanavia OR Sweden OR Denmark OR Norway OR Finland) OR (Belgium OR Swtizerland) OR (France OR Spain) OR (Germany OR Portugal) OR (Ireland OR Italy) OR Liechtenstein OR Luxembourg OR Monaco OR Netherlands

3. 1 AND 2

4. (“health promotion” or “behaviour change” OR “health education”) OR “hard-to-reach” OR (deprivation OR deprived OR marginili* OR underserved OR disadvantaged) OR (“health inequal*” OR “health dispar*” OR “health equity”) OR (“health visit*” OR (home N2 visit*)) OR (counsel* OR (face-to-face N3 intervention)) OR (tailor* OR personalis* OR personaliz* OR individualis* OR individualiz*)

5. 3 AND 4

Limiters: Publication Type: Peer Reviews Journal; Language: English; Population Group: Human; Document Type: Journal Article; Methodology: CLINICAL CASE STUDY, EMPIRICAL STUDY, - FLoowup Study, -Longitudinal Study, ---Prospective Study, ---Retrospective Study, FIELD STUDY, INTERVIEW, -Focus Group, -Nonclinical Case Study, -Qualitative Study, -Quantitative Study, -TREATMENT OUTCOME/CLINICAL TRIAL

Medline

1. exp Mentors/px
2. (community adj3 (worker* or volunteer* or aide*)).mp
3. paraprofessional*.mp.
4. exp Community Health Workers/
5. (support adj3 worker*).mp.
6. (social adj3 ((assistant* or support) adj3 worker*)).mp.
7. community health advisor*.mp.
8. ((linkworker* or link) adj1 worker*).mp.

9. ((worker* or advisor* or attendant* or aide* or support* or person* or helper* or carer* or assistant* or influencer*) adj3 (voluntary or volunteer* or untrained or unlicensed or non-professional or nonprofessional or lay or peer*)).mp
10. (home adj3 visitor*).mp. word, rare disease supplementary concept word, unique identifier]
11. (health adj3 trainer*).mp.
12. exp United States/
13. exp Europe/
14. exp Australia/
15. exp New Zealand/
16. exp Canada/
17. 12 or 13 or 14 or 15 or 16
18. exp Health Promotion/
19. health promotion.mp.
20. (behaviour adj1 change).mp.
21. hard-to-reach.mp.
22. (deprivation or deprived).mp.
23. marginili*.mp.
24. mnderserved.mp.
25. disadvantaged.mp.
26. health inequal*.mpm
27. health dispar*.mp.
28. health visit*.mp.
29. counselling.mp.
30. exp Counselling/
31. counselled.mp.
32. counselled.mp.
33. (face-to-face adj3 intervention).mp.
34. Tailor*.mp.
35. Personalised.mp.
36. Personalized.mp.
37. Personalising.mp.
38. Personalizing.mp.
39. Personalise.mp.
40. Personalize.mp.
41. Individualise.mp.
42. Individualize.mp.
43. Individualised.mp.
44. Individualized.mp.
45. Individualising.mp.
46. Individualizing.mp.
47. (home adj2 visit*).mp.
48. (programme adj3 evaluation).mp.

49. (service adj3 evaluation).mp.
50. Exp Qualitative Research/ or qualitative.mp.
51. Quantitative.mp.
52. Exp Randomized Controlled Trials as Topic/ or RCT.mp.
53. 48 or 49 or 50 or 51 or 52
54. Exp Evaluation Studies as Topic/ or evaluat*.mp.
55. (cluster adj2 randomised).mp.
56. Longitudinal adj4 evaluation).mp.
57. (cohort adj4 study).mp.
58. Treatment Outcome/ or outcome*.mp.
59. 53 or 54 or 55 or 56 or 57 or 58
60. Exploratory study.mp.
61. 60 or 59
62. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 11 or 47
63. 18 or 19 or 20 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47
64. 48 or 49 or 50 or 51 or 52 or 54 or 55 or 56 or 57 or 58
65. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
66. 59 or 60
67. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11
68. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47
69. 17 and 61 and 62 and 63
70. 17 and 61 and 62 and 63
71. 17 and 61 and 63 and 65
72. 61 and 63 and 65
73. (process adj2 evaluation).mp.
74. exp Questionnaires/ or mixed method*.mp.
75. exp Interview/ or interview*.mp.
76. exp Focus Groups/ or focus group*.mp.
77. exp Clinical Trials as Topic/ or clinical trial*.mp.
78. randomized controlled trial*.mp.
79. controlled clinical trial.mp. or exp Controlled Clinical Trial/
80. randomized.mp.
81. placebo.mp. or exp Placebos/
82. trial*.mp.
83. ((random* or controlled) and trial*).mp.
84. Health equity.mp.
85. Health education.mp. or exp Health Education/
86. 68 or 84 or 85

87. 48 or 49 or 50 or 51 or 52 or 54 or 55 or 56 or 57 or 58 or 60 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83
88. 17 and 65 and 86 and 87

Appendix 3- Data extraction form

User ID	Date	Intervention reference	Peer reviewed papers (+codes)	Additional materials (+ codes)	Papers to be assessed for risk of bias

Peer reviewed papers		
Study code	Study method	Result supporting effectiveness/no effect

Type of LHW	LHW training	Intervention location	Participant description	Target health behaviour	Theoretical foundation	How theory informed design

Appendix 3 continued- Data extraction form

Assessment: Variables used to determine LHW approach	Type of tailored LHW actions	Specific example of type of tailored LHW actions

Algorithms used	Context	Channel	Format	Dosage	Schedule of assessment and implementation

Appendix 4- Study 'clusters' included in the systematic review

Intervention reference	All related publications
Auslander et al. (2002)	(Auslander et al., 2002). "A controlled evaluation of staging dietary patterns to reduce the risk of diabetes in African-American women." Diabetes Care **25**(5): 809-814 (Williams et al., 2001). "Process evaluation methods of a peer-delivered health promotion program for African American women." Health Promotion Practice **2**(2): 135-142
Bailey et al. (2012)	(Bailey & Kerlin, 2012). "What is the impact of health trainer interventions within a mental health setting?" International Journal of Mental Health Promotion **14**(3): 139-150
Barnet et al. (2009)	(Barnet et al., 2009). "Motivational Intervention to Reduce Rapid Subsequent Births to Adolescent Mothers: A Community-Based Randomized Trial." Annals of Family Medicine **7**(5): 436-445 (Barnet et al., 2010). "Cost-effectiveness of a motivational intervention to reduce rapid repeated childbearing in high-risk adolescent mothers: a rebirth of economic and policy considerations." Archives of Pediatrics & Adolescent Medicine **164**(4): 370-376
Begh et al. (2011)	(Begh et al., 2009). "Promoting smoking cessation in Bangladeshi and Pakistani male adults: design of a pilot cluster randomised controlled trial of trained community smoking cessation workers." Trials **10**(1): 1-15 (Begh et al., 2011a). "Promoting smoking cessation in Pakistani and Bangladeshi men in the UK: pilot cluster randomised controlled trial of trained community outreach workers." Trials [Electronic Resource] **12**: 197 (Begh et al., 2011b). "Experiences of outreach workers in promoting smoking cessation to Bangladeshi and Pakistani men: longitudinal qualitative evaluation." BMC Public Health **11**: 452
Birkel et al. (1993)	(Birkel et al., 1993). "Findings from the Horizontes Acquired Immune Deficiency Syndrome Education project: the impact of indigenous outreach workers as change agents for injection drug users." Health education quarterly **20**(4): 523-538
Bungay et al. (2013)	(Bungay et al., 2013). "Community-based HIV and STI prevention in women working in indoor sex markets." Health Promotion Practice **14**(2): 247-255

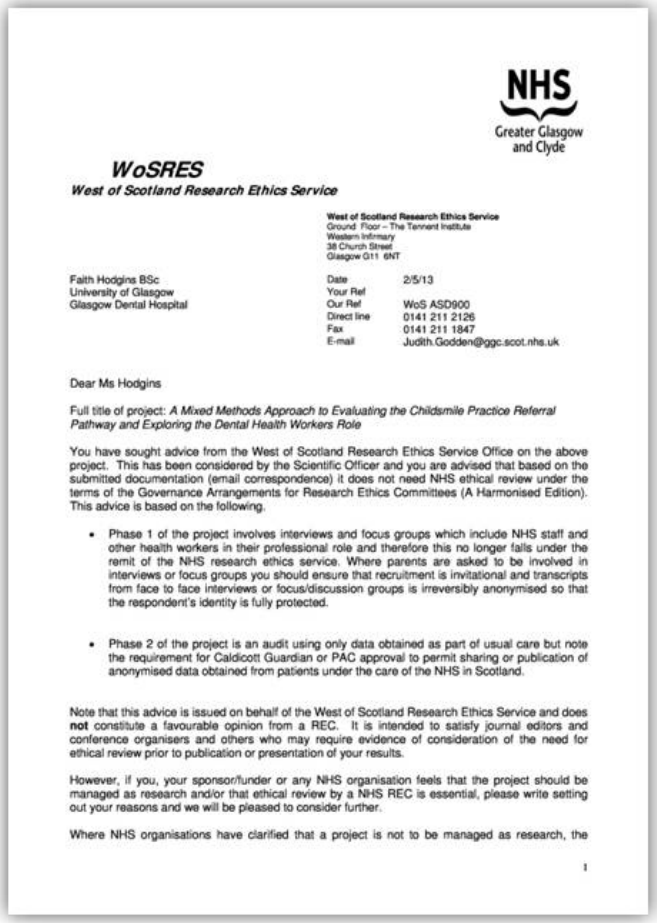
	(Remple et al., 2007). "Conducting HIV/AIDS research with indoor commercial sex workers: reaching a hidden population." Prog Community Health Partnersh **1**(2): 161-168
Chapman et al. (2013)	(Chapman et al., 2013). "Breastfeeding Education and Support Trial for Overweight and Obese Women: A Randomized Trial." Pediatrics **131**(1): e162-e170
Elder et al. (2005-2009)	(Elder et al., 2005). "Interpersonal and print nutrition communication for a Spanish-dominant Latino population: Secretos de la Buena Vida." Health Psychology **24**(1): 49-57 (Elder et al., 2006). "Long-term effects of a communication intervention for Spanish-dominant Latinas." American Journal of Preventive Medicine **31**(2): 159-166 (Elder et al., 2009). "Evaluating psychosocial and behavioral mechanisms of change in a tailored communication intervention." Health Education & Behavior **36**(2): 366-380
Fouad et al. (2010)	(Ayala et al., 2001). "Nutrition communication for a Latino community: formative research foundations." Fam Community Health **24**(3): 72-87 (Baquero et al., 2009). "Secretos de la Buena Vida: processes of dietary change via a tailored nutrition communication intervention for Latinas." Health Education Research **24**(5): 855-866 (Fouad et al., 2010). "Targeted intervention strategies to increase and maintain mammography utilization among African American women.[Erratum appears in Am J Public Health. 2011 Jul;101(7):1158]." American Journal of Public Health **100**(12): 2526-2531 (Fouad et al., 2006). "A community-driven action plan to eliminate breast and cervical cancer disparity: successes and limitations." J Cancer Educ **21**(1 Suppl): S91-100 (Fouad et al., 2004). "The development of a community action plan to reduce breast and cervical cancer disparities between African-American and White women." Ethn Dis **14**(3 Suppl 1): S53-60
Gross et al. (1998)	(Caulfield et al., 1998). "WIC-based interventions to promote breastfeeding among African-American Women in Baltimore: effects on breastfeeding initiation and continuation." J Hum Lact **14**(1): 15-22

	(Gross et al., 1998). "Counseling and motivational videotapes increase duration of breast-feeding in African-American WIC participants who initiate breast-feeding." Journal of the American Dietetic Association **98**(2): 143-148
Han et al. (2009)	(Han et al., 2009). "Tailored lay health worker intervention improves breast cancer screening outcomes in non-adherent Korean-American women." Health Education Research **24**(2): 318-329
Hayashi et al. (2010)	(Coleman et al., 2012). "Readiness to be physically active and self-reported physical activity in low-income Latinas, California WISEWOMAN, 2006-2007." Preventing chronic disease **9**: E87 (Farrell et al., 2009). "Clinic-based nutrition and lifestyle counseling for Hispanic women delivered by community health workers: design of the California WISEWOMAN study." Journal of Women's Health **18**(5): 733-739 (Hayashi et al., 2010). "Lifestyle intervention, behavioral changes, and improvement in cardiovascular risk profiles in the California WISEWOMAN project." Journal of Women's Health **19**(6): 1129-1138
Hunte et al. (2004)	(Hunte et al., 2004). "A birth records analysis of the Maternal Infant Health Advocate Service program: a paraprofessional intervention aimed at addressing infant mortality in African Americans." Ethnicity & Disease **14**(3 Suppl 1): S102-107
Hunter et al. (2004)	(Hunter et al., 2004). "The impact of a promotora on increasing routine chronic disease prevention among women aged 40 and older at the U.S.-Mexico border." Health Educ Behav **31**(4 Suppl): 18S-28S
Islam et al. (2013)	(Islam et al., 2013). "A randomized-controlled, pilot intervention on diabetes prevention and healthy lifestyles in the New York City Korean community." Journal of Community Health **38**(6): 1030-1041
Islam et al. (2014)	(Islam et al., 2014). "Diabetes prevention in the New York City Sikh Asian Indian community: a pilot study." International Journal of Environmental Research & Public Health [Electronic Resource] **11**(5): 5462-5486
Jolly et al. (2012)	(Jolly et al., 2012). "Effect of a peer support service on breast-feeding continuation in the UK: a randomised controlled trial." Midwifery **28**(6): 740-745 (MacArthur et al., 2009). "Antenatal peer support workers and initiation of breast feeding: Cluster randomised controlled trial." BMJ: British Medical Journal **338**(7691)
Koniak-Griffin et al. (2015)	(Koniak-Griffin et al., 2015). "A Community Health Worker-Led Lifestyle Behavior Intervention for Latina (Hispanic) Women: Feasibility and Outcomes of A Randomized Controlled Trial." International journal of nursing studies **52**(1): 75-87

Krantz et al. (2013)	(Krantz et al., 2013). "Effectiveness of a community health worker cardiovascular risk reduction program in public health and health care settings." American Journal of Public Health **103**(1): e19-27
McInnes et al. (2000)	(McInnes & Stone, 2001). "The process of implementing a community-based peer breast-feeding support programme: the Glasgow experience." Midwifery **17**(1): 65-73 (McInnes et al., 2000). "Evaluation of a community-based intervention to increase breastfeeding prevalence." J Public Health Med **22**(2): 138-145
Mier et al. (2011)	(Mier et al., 2011). "A pilot walking program for Mexican-American women living in colonias at the border." American Journal of Health Promotion **25**(3): 172-175 Mier, N., Medina, B. & Carbajal, E.S. (2007). Vamos a Caminar! Applying CBPR to a Physical Activity Pilot Program in South Texas. *TPHA Journal*, 59 (2)
Muirhead et al. (2006)	(Muirhead et al., 2006). "The effect of a programme of organised and supervised peer support on the initiation and duration of breastfeeding: a randomised trial." British Journal of General Practice **56**(524): 191-197
Paskett et al. (2011)	(Krok-Schoen et al., 2016). "Evaluating the stage of change model to a cervical cancer screening intervention among Ohio Appalachian women." Women Health **56**(4): 468-486 (Paskett et al., 2011). "Evaluating the efficacy of lay health advisors for increasing risk-appropriate Pap test screening: a randomized controlled trial among Ohio Appalachian women." Cancer Epidemiology, Biomarkers & Prevention **20**(5): 835-843
Pringle et al. (2013)	(Pringle et al., 2013b). "Effect of a national programme of men's health delivered in English Premier League football clubs." Public Health **127**(1): 18-26 (Pringle et al., 2013a). "Delivering men's health interventions in English Premier League football clubs: key design characteristics." Public Health **127**(8): 716-726
Resnick et al. (2009)	(Resnick et al., 2009). "The CHEER study to reduce BMI in Elementary School students: a school-based, parent-directed study in Framingham, Massachusetts." Journal of School Nursing **25**(5): 361-372
Smith et al. (2006)	(Smith & Randhawa, 2006). "Embracing diversity in community healthcare settings: developing a client-centred approach to weaning support." Diversity in Health & Social Care **3**(1): 47-53

Studts et al. (2012)	(Schoenberg et al., 2009). "Faith Moves Mountains: An Appalachian Cervical Cancer Prevention Program." American Journal of Health Behavior **33**(6): 627-638 (Hatcher et al., 2011). "Predictors of Cervical Cancer Screening for Rarely or Never Screened Rural Appalachian Women." Journal of health care for the poor and underserved **22**(1): 176-193 (Studts et al., 2012). "A community-based randomized trial of a faith-placed intervention to reduce cervical cancer burden in Appalachia." Preventive Medicine **54**(6): 408-414
Taylor et al. (2002)	(Taylor et al., 2002). "A Randomized Controlled Trial of Interventions to Promote Cervical Cancer Screening Among Chinese Women in North America." Journal of the National Cancer Institute **94**(9): 670-677
Taylor et al. (2009)	(Taylor et al., 2009). "Evaluation of a hepatitis B lay health worker intervention for Chinese Americans and Canadians." Journal of Community Health **34**(3): 165-172
Taylor et al. (2010)	(Taylor et al., 2010). "Evaluation of a cervical cancer control intervention using lay health workers for Vietnamese American women." American Journal of Public Health **100**(10): 1924-1929
Visram et al. (2014)	(Michie et al., 2008). Improving health: changing behaviour. NHS health trainer handbook. Manual. Department of Health Publications (Visram et al., 2014). "Making and maintaining lifestyle changes with the support of a lay health advisor: Longitudinal qualitative study of health trainer services in northern England." PLoS ONE **9**(5)
Woodruff et al. (2014)	(Eisenberg & Woodruff, 2013). "Randomized controlled trial to evaluate screening and brief intervention for drug-using multiethnic emergency and trauma department patients." Addiction Science & Clinical Practice **8**(1): 8-8 (Woodruff et al., 2014). "Randomized clinical trial of the effects of screening and brief intervention for illicit drug use: the Life Shift/Shift Gears study." Addiction science & clinical practice **9**: 8
Woodruff et al. (2002)	(Woodruff et al., 2002). "Evaluation of a culturally appropriate smoking cessation intervention for Latinos." Tobacco control **11**(4): 361-367

Appendix 5- West of Scotland Research Ethics Service approval



NHS
Greater Glasgow and Clyde

WoSRES
West of Scotland Research Ethics Service

West of Scotland Research Ethics Service
Ground Floor – The Tennent Institute
Western Infirmary
38 Church Street
Glasgow G11 6NT

Faith Hodgins BSc
University of Glasgow
Glasgow Dental Hospital

Date 2/5/13
Your Ref
Our Ref WoS ASD900
Direct line 0141 211 2126
Fax 0141 211 1847
E-mail Judith.Godden@ggc.scot.nhs.uk

Dear Ms Hodgins

Full title of project: *A Mixed Methods Approach to Evaluating the Childsmile Practice Referral Pathway and Exploring the Dental Health Workers Role*

You have sought advice from the West of Scotland Research Ethics Service Office on the above project. This has been considered by the Scientific Officer and you are advised that based on the submitted documentation (email correspondence) it does not need NHS ethical review under the terms of the Governance Arrangements for Research Ethics Committees (A Harmonised Edition). This advice is based on the following.

- Phase 1 of the project involves interviews and focus groups which include NHS staff and other health workers in their professional role and therefore this no longer falls under the remit of the NHS research ethics service. Where parents are asked to be involved in interviews or focus groups you should ensure that recruitment is invitational and transcripts from face to face interviews or focus/discussion groups is irreversibly anonymised so that the respondent's identity is fully protected.

- Phase 2 of the project is an audit using only data obtained as part of usual care but note the requirement for Caldicott Guardian or PAC approval to permit sharing or publication of anonymised data obtained from patients under the care of the NHS in Scotland.

Note that this advice is issued on behalf of the West of Scotland Research Ethics Service and does **not** constitute a favourable opinion from a REC. It is intended to satisfy journal editors and conference organisers and others who may require evidence of consideration of the need for ethical review prior to publication or presentation of your results.

However, if you, your sponsor/funder or any NHS organisation feels that the project should be managed as research and/or that ethical review by a NHS REC is essential, please write setting out your reasons and we will be pleased to consider further.

Where NHS organisations have clarified that a project is not to be managed as research, the

1

Research Governance Framework states that it should not be presented as research within the NHS. This letter has been copied to NHS Greater Glasgow & Clyde R&D Department for their information

Kind regards

Judith Godden

Dr Judith Godden, WoSRES Scientific Officer/Manager

2

Appendix 6- University of Glasgow Medical, Veterinary and Life Sciences ethics approval

University of Glasgow | College of Medical, Veterinary & Life Sciences

Dr Wendy Gnich
University of Glasgow Dental Hospital & School
378 Sauchiehall Street
Glasgow
G2 3JZ

15 May 2013

Dear Dr Gnich

MVLS College Ethics Committee

Project Title: **Evaluation and development of *Childsmile* – the national oral health demonstration programme for Scotland**

Project No. **FM 04908**

The College Ethics Committee has reviewed the documents you submitted on 9 May 2013 in support of your request for a number of extensions to the above, overarching project.

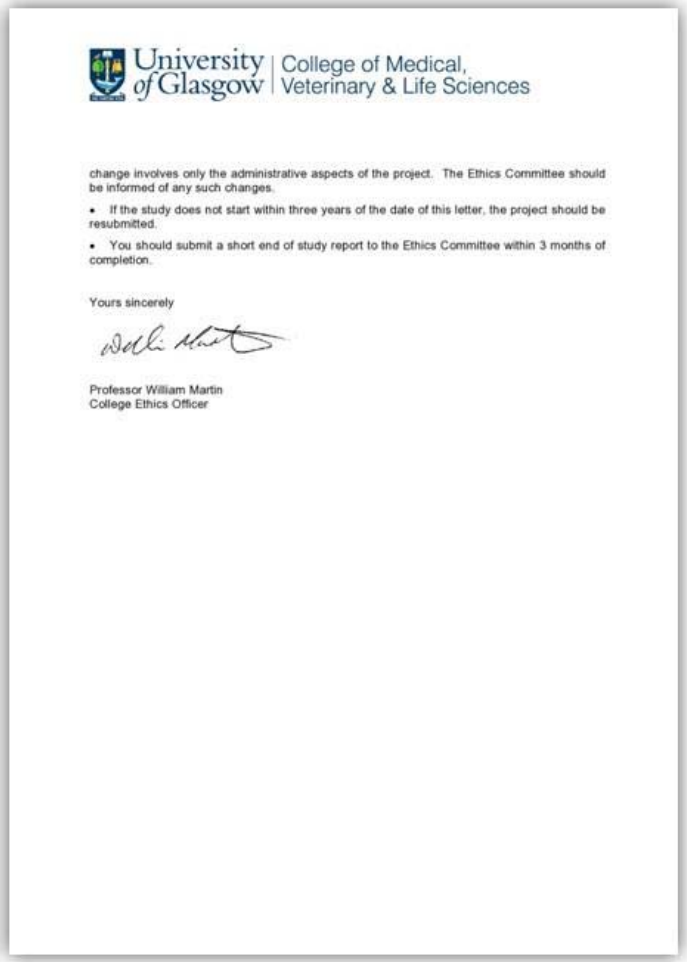
I am pleased to inform you that the Committee has agreed to your requests. Specifically: (i) Since the national evaluation methods remain unchanged, project approval has been extended to 31 December 2016; (ii) As the initial approval was granted on the basis that the project would develop into a number of sub-components, approval is now granted for the two extensions for Mairi Young and Faith Hogins, entitled respectively, "Optimising the role of the DHSW in Childsmile Practice: A case study approach" and "A mixed methods approach to evaluating the Childsmile Practice referral pathway and exploring the Dental Health Support Worker role". The Committee will retain on file the documents relating to these sub-studies and their experimental protocols.

These extensions are granted subject to a number of pre-conditions:

- Mairi Young and Faith Hogins are permitted to interview parents of children. If they wish to interview or otherwise interact with children they would be required to undergo Disclosure/PVG checks with the results communicated to the Ethics Committee in advance.
- Clinical governance approval must be obtained from each NHS Board in which the fieldwork will be conducted.
- The research should be carried out only on the sites, and/or with the groups defined in the application.
- Any proposed changes in the protocol should be submitted for reassessment, except when it is necessary to change the protocol to eliminate hazard to the subjects or where the

Professor William Martin
Professor of Cardiovascular Pharmacology

R507B Level 5
School of Life Sciences
West Medical Building
Glasgow G12 8QQ Tel: 0141 330 4489
E-mail: William.Martin@glasgow.ac.uk



University of Glasgow | College of Medical, Veterinary & Life Sciences

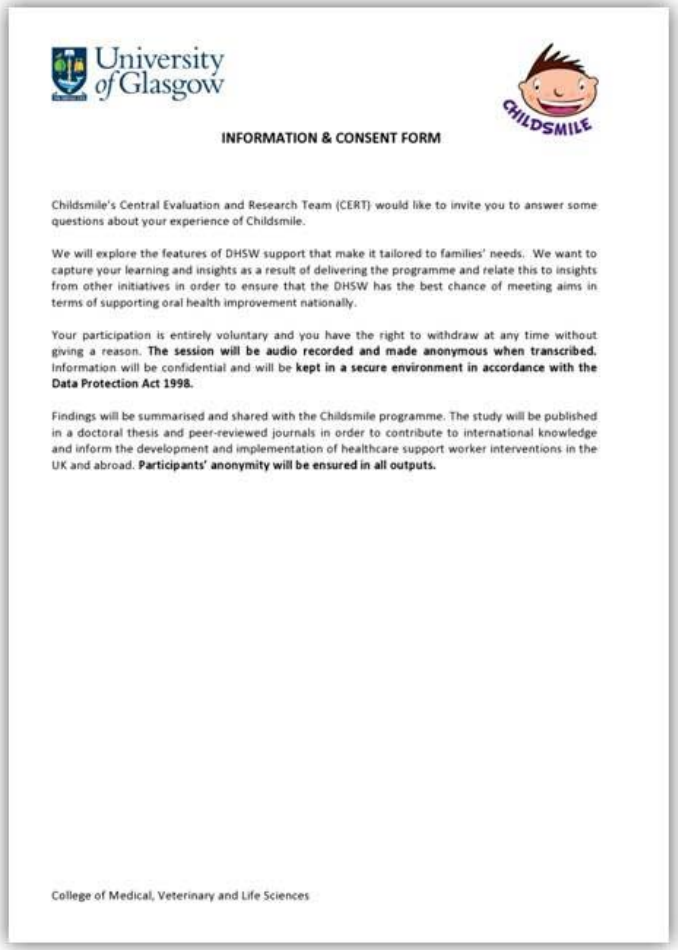
change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.

- If the study does not start within three years of the date of this letter, the project should be resubmitted.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.

Yours sincerely

Professor William Martin
College Ethics Officer

Appendix 7- Consent form



University of Glasgow

INFORMATION & CONSENT FORM

Childsmile's Central Evaluation and Research Team (CERT) would like to invite you to answer some questions about your experience of Childsmile.

We will explore the features of DHSW support that make it tailored to families' needs. We want to capture your learning and insights as a result of delivering the programme and relate this to insights from other initiatives in order to ensure that the DHSW has the best chance of meeting aims in terms of supporting oral health improvement nationally.

Your participation is entirely voluntary and you have the right to withdraw at any time without giving a reason. **The session will be audio recorded and made anonymous when transcribed.** Information will be confidential and will be **kept in a secure environment in accordance with the Data Protection Act 1998.**

Findings will be summarised and shared with the Childsmile programme. The study will be published in a doctoral thesis and peer-reviewed journals in order to contribute to international knowledge and inform the development and implementation of healthcare support worker interventions in the UK and abroad. **Participants' anonymity will be ensured in all outputs.**

College of Medical, Veterinary and Life Sciences

University of Glasgow

Project: Optimising the Dental Health Support Worker Role

CONSENT FORM

Title of Project: Optimising the Dental Health Support Worker Role

Name of Researcher(s): Faith Hodgins

Supervised by: Dr Wendy Gnich, Dr Andrea Sherriff

Please Initial Box

I confirm that I have read and understood the information sheet for the above study and have had the opportunity to ask questions. ☐

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason, without my legal rights being affected. ☐

I agree to the audio recording and transcription of my participation in this study. I understand that the recording and transcription will be made anonymous and stored in accordance with the Data Protection Act. ☐

I understand that anonymous quotations may be published. ☐

I agree to take part in the above study. ☐

Name of participant _____ Health Board _____

Signature _____ Date _____

Name of Researcher _____ Signature _____ Date _____

College of Medical, Veterinary and Life Sciences

Appendix 8- Study information sheet

INFORMATION SHEET FOR FOCUS GROUP PARTICIPANTS

Title of study: A mixed methods approach to evaluating the Childsmile Practice referral pathway and exploring the Dental Health Support Worker role

We would like to invite you to participate in this research project that forms part of a PhD and the Childsmile process evaluation. Before you decide whether you want to take part, you may wish to read this information about why the research is being done and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish. If you require further clarification or information in advance of the focus group session please email f.hodgins.1@research.gla.ac.uk.

What is the purpose of this research?

The aim of this work is to optimise the DHSW role, building on previous work carried out by the regional researchers for the Childsmile process evaluations. The focus of this research is to explore the features of DHSW support that make it tailored to families' needs.

By exploring this issue through focus groups and further research, it is hoped that we will have a better understanding of:

- what 'tailoring' means to the people delivering Childsmile Practice
- whether offering tailored support for families is an important feature of the DHSW role
- the actions a DHSW can undertake during their family interactions to tailor effectively
- whether personal characteristics affect the delivery of DHSW support
- the factors that inhibit a DHSW from being able to provide tailored support
- whether further DHSW training needs to be developed and what form that training should take

Why have I been chosen?

In order to fully explore the DHSW role it is important to hear the views of people involved in different stages of programme delivery. As the programme varies somewhat between health boards, it is important that each health board is represented. Across the regions Childsmile programme managers, coordinators, DHSWs and health visitors are being invited to take part in focus groups with their colleagues.

Do I have to take part?

You have a choice about whether or not to take part. As this work is evaluating the Childsmile programme with the aim of optimising the DHSW role in the future it is hoped that you would take this opportunity to contribute to its development. If you choose to take part you may withdraw at any time without having to give an explanation.

University of Glasgow

What will I have to do if I take part?

You will be asked to attend one focus group with the coordinators in your region. The focus group will last a maximum of 2 hours. We will aim to arrange the time and location to suit everyone.

The group will be made up of coordinators from your region and one postdoctoral researcher. You will be asked to sign a consent form. The researcher will ask the group open-ended questions about the DHSW role and the concept of tailoring to the needs of families. There are no right or wrong answers. The researcher is interested in your views and experiences. Although you may tell others about the general topics that were discussed in the focus group, you will be asked to keep the discussion confidential and not repeat the specifics of what was said to others.

Will I be recorded and how will the recorded media be used?

The focus group session will be audio recorded. This is so the researcher does not have to take detailed notes during the session and can pay full attention to what the group is saying. The audio recording will be transcribed after the session by the researcher. When transcribing the recording, no names or identifiable details will be included in the written transcription. This means the written record will be anonymous. Once transcribed on to word processing software and stored confidentially, the audio recording will be destroyed.

What will happen to the results of the research project?

As a result of this research, recommendations for optimising the DHSW role will be made to the Childsmile programme directors and NES. The results will also be summarised and shared with you at the end of the study. It is likely that the research will be published in journals in the field of programme evaluation and public health in order to contribute to knowledge about support worker interventions.

What are the possible disadvantages and risks of taking part?

Although the audio recording will be destroyed and the written transcription will be anonymous, there is a risk that what you have said in the focus group will be repeated by your colleagues to others outside the group. We will stress the importance of respecting the confidential nature of the discussion to all group members.

What are the possible benefits of taking part?

You will have had an opportunity to air your views, share your experiences and shape the development of the DHSW role for the future. The results of this research will be delivered as recommendations to the Childsmile programme directors and NES. In addition, the publication of this research may aid the development of similar healthcare support worker interventions in the UK and abroad.

Thank you for taking the time to read this information.

University of Glasgow

Appendix 9- Topic guide for Childsmile Executive

FOCUS GROUP QUESTIONS for PROGRAMME MANAGERS

1. **Perceptions of tailoring in Childsmile Practice**

- What is tailoring? What does it mean?
  - Within Childsmile?
- Why is there tailoring within Childsmile?
  - Is it important? Why?
  - Childsmile objectives?
- What opportunities are there for tailoring within Childsmile?

2. **Assessing families' needs**

The Childsmile manual mentions that the DHSW should provide individualised support, which should be at the right level and duration for a family, and that family circumstance should be taken into account.

- How is it decided that a family should get DHSW support?
  - Who is involved?
  - What criteria?
- How can families' needs be assessed?
  - Role of DHSW?

3. **Delivering tailored support**

- What are the ways DHSWs can tailor when
  - Engaging with families
  - Delivering key messages and additional information/advice/signposting
  - Trying to get child registered and attending practice
  - Following up/ending support
- EXAMPLES OF TAILORING/NOT TAILORING
- Do different families require different approaches/styles?
- How can DHSWs decide how to approach/communicate with a family?

4. **Characteristics of the DHSW**

- Do you think DHSWs are like natural helpers or paraprofessionals (moderator gives definitions)?
  - Why?
- What similarities/differences are there between DHSWs and the families they tailor for?
  - How does it differ between areas/health boards?
  - What effect do you think these similarities/differences have on their role?

5. **Barriers /Facilitators to Tailoring**

- Are DHSWs free to tailor in the ways that we have talked about?
  - What kinds of things prevent a DHSW from being able to tailor to a family's needs?
  - What kinds of things help them to tailor to a family's needs?
- How much do you think the way DHSWs are tailoring/the extent to which they are tailoring varies by board?
  - Does it matter?
- What training is in place that you feel prepares DHSWs for assessing families and delivering tailored support?
  - How could this be improved?

6. **Begin to Close**

- Today we have talked about...(quick overview)
- On the subject of tailoring the programme to families' needs through the DHSW Practice role, is there anything anyone feels is important that has not been discussed?

Appendix 10- Topic guide for Childsmile Coordinators

FOCUS GROUP QUESTIONS for COORDINATORS

1. **Perceptions of tailoring in Childsmile Practice**

- What is tailoring? What does it mean?
  - Within Childsmile?

The Childsmile manual mentions that the DHSW should provide individualised support, which should be at the right level and duration for a family, and that family circumstance should be taken into account. Childsmile coordinators have said that it is important for DHSWs to tailor to families' needs.

- Why is there tailoring within Childsmile?
  - Is it important? Why?
  - Childsmile objectives?
- What opportunities are there for tailoring within Childsmile?

2. **Assessing families' needs**

- How is it decided that a family should get DHSW support?
  - Who is involved?
  - What criteria?
- How can a family's needs be assessed?
  - Role of DHSW?
  - How much is this done in practice?

3. **Delivering tailored support**

- What are the ways DHSWs can tailor when
  - Engaging with families
  - Delivering key messages and additional information/advice/signposting
  - Trying to get child registered and attending practice
  - Following up/ending support
- EXAMPLES OF TAILORING/NOT TAILORING
- Do different families require different approaches/styles?
- How can DHSWs decide how to approach/communicate with a family?

4. **Characteristics of the DHSW**

- Do you think DHSWs are like natural helpers or paraprofessionals (moderator gives definitions)?
  - Why?
- What similarities/differences are there between DHSWs and the families they tailor for?
  - How does it differ between areas/health boards?
  - What effect do you think these similarities/differences have on their role?

5. **Barriers /Facilitators to Tailoring**

- Is the role sufficiently tailored?
- Is it different in different boards?
  - Does it need to be different in different boards?
- Are DHSWs free to tailor in the ways that we have talked about?
  - What kinds of things prevent a DHSW from being able to tailor to a family's needs?
  - What kinds of things help them to tailor to a family's needs?
- How much do you think the way DHSWs are tailoring/the extent to which they are tailoring varies by board?
  - Does it matter?
- What training is in place that you feel prepares DHSWs for assessing families and delivering tailored support?
  - How could this be improved?

6. **Measuring tailoring**

- I intend to use the views and experiences of Childsmile staff, health visitors and parents to develop a questionnaire to measure the degree and type of tailored support being offered by DHSWs in Childsmile Practice. What do you think would be the key things to include in this questionnaire?

7. **Begin to Close**

- Today we have talked about...(quick overview)
- On the subject of tailoring the programme to families' needs through the DHSW Practice role, is there anything anyone feels is important that has not been discussed?

Appendix 11- Topic guide for Childsmile Dental Health Support Workers

FOCUS GROUP QUESTIONS for DENTAL HEALTH SUPPORT WORKERS

ASK EVERYONE TO SAY NAME AND CHP

1. **Perceptions of tailoring in Childsmile Practice and DHSW role**

- What is tailoring? What does it mean?
  - Within Childsmile?
- Why is there tailoring within Childsmile?
  - Is it important? Why?
  - Childsmile objectives?
- What opportunities are there for tailoring within Childsmile Practice?

2. **Assessing families' needs**

- How is it decided that a family should get DHSW support? How **should** it be decided?
  - Who is involved?
  - Criteria?
- How do you assess what a family's needs are?
  - By what methods (e.g. questionnaire, conversation with family/HV)?
  - What characteristics/criteria of family taken into account?
  - What guidance/support is there for doing this?

3. **Delivering tailored support**

- What are the ways you can tailor to families' needs?
  - Contacting families and arranging further contact
    - Frequency, type (visit, phone, text), length of contact, getting over threshold
    - Meeting families at antenatal booking clinics- tailoring to location
  - Giving oral health/dietary advice
    - Tailored resources
  - Getting the child registered and attending a dental practice
  - Following up a family after attending practice
- GIVE EXAMPLES OF TAILORING/NOT TAILORING
- How do you decide which approach is most appropriate for a family?
- Which of the features of tailoring we have talked about are key to achieving the objective of Childsmile Practice?

4. **Characteristics of DHSWs**

- In these kinds of health behaviour change interventions, it is sometimes thought that having a person from within the community being targeted delivering the support is a key part of the success of these programmes.
- Do you think that living in the community or having a similar background as the families being targeted affects the way a DHSW would deliver their role? If so, how?

5. **Barriers /Facilitators to Tailoring**

- Do you feel free to tailor in the ways that we have talked about?
  - Is the programme sufficiently tailored?
  - What kinds of things prevent you from being able to tailor to a family's needs?
    - Other tasks- Triple P, Caring for Smiles
  - How can you get around these barriers?
  - Are you able to build a relationship that allows for tailoring?
  - What kinds of things help you to tailor to a family's needs?
- What training is in place that you feel has prepared you for assessing families and delivering tailored support?
  - How could this be improved?
  - Does training like triple P help you to tailor to families' needs?

6. **Begin to Close**

- Today we have talked about...(quick overview)
- On the subject of tailoring the programme to families' needs, is there anything anyone feels is important that has not been discussed?

Appendix 12- Topic guide for parents

Version 2: 30/05/13

FOCUS GROUP DISCUSSION GUIDE: PARENTS

What we are interested in talking about today is the support offered to parents by Dental Health Support Workers. We want to find out how these support workers can provide the right kind of support for parents- support that is tailored to your needs.

1. **Relationship with DHSW**
   - **What has your relationship been like with your DHSW?**
     - How well do you feel you know them?
     - How often do you have contact (phone, visit, text)
     - Always same person?
     - Feel like they took time to get to know you?

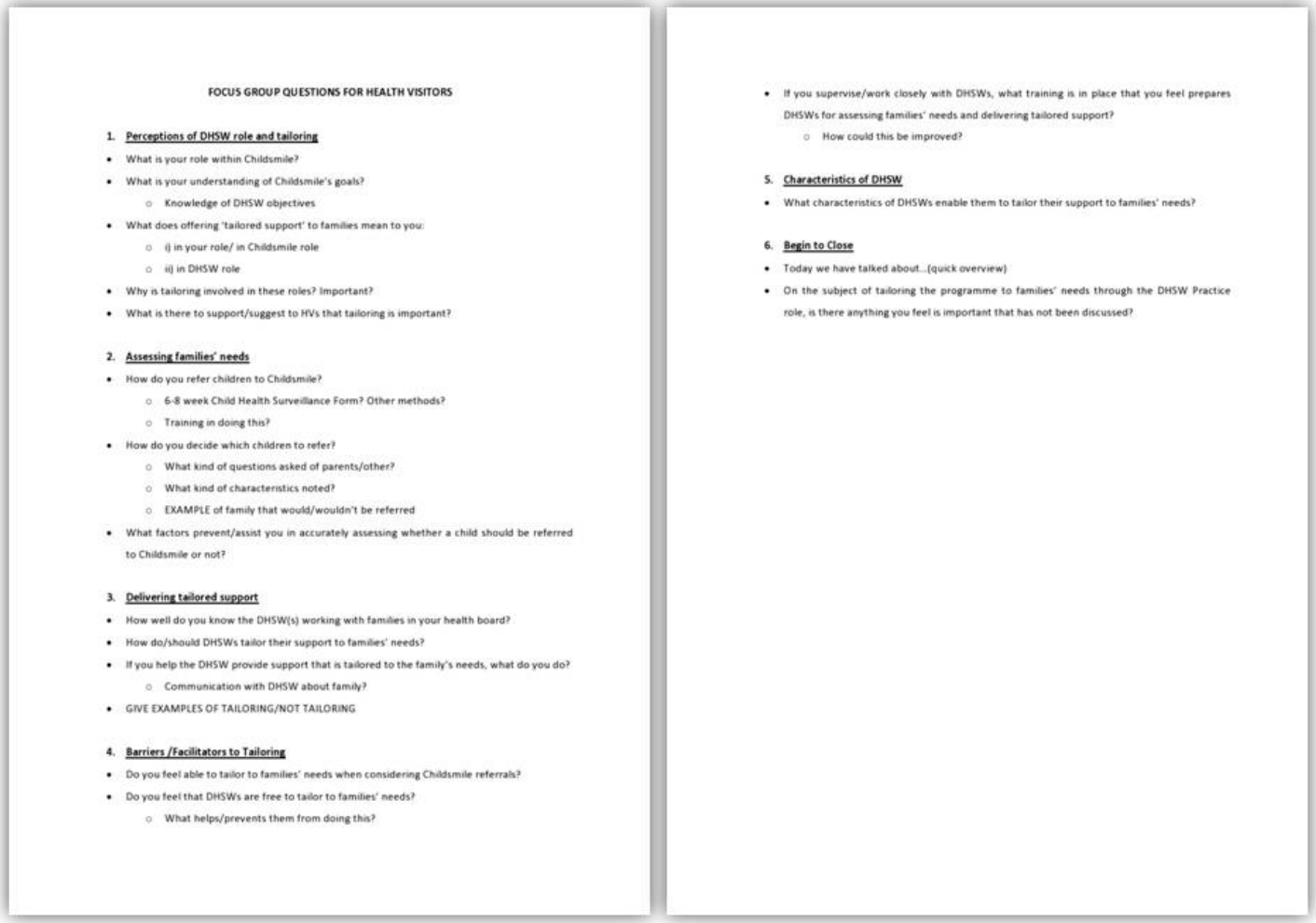
2. **Receiving Support**
   - **What was good/bad about the support offered?**
     - When, where, how much support?
     - Type of contact
     - Flexibility
     - Advice relevant to needs
     - Advice delivered in appropriate way
     - Signposting to other services
     - Getting child registered at practice
     - Getting child along to appointment at practice
     - Setting goals
     - Following-up and ending support

Version 2: 30/05/13

3. **Barriers/Facilitators**
   - **What were/are the kinds of difficulties you face as a parent with your children's oral health?**
     - Did your DHSW take account of these? How?
     - What was helpful/unhelpful and the advice/suggestions they gave?
     - Did you make any changes as a result of talking to your Dental Health Support Worker? What helped you/prevented you from making changes?

4. **Anything else?**
   - **Is there anything else we haven't talked about that you think might have affected whether you received support that was tailored to your needs or not?**
   - Today we have talked about...(quick overview)
     - On the subject of DHSWs, is there anything anyone feels is important that has not been discussed?

Appendix 13- Topic guide for health visitors



FOCUS GROUP QUESTIONS FOR HEALTH VISITORS

1. Perceptions of DHSW role and tailoring

- What is your role within Childsmile?
- What is your understanding of Childsmile's goals?
  - Knowledge of DHSW objectives
- What does offering 'tailored support' to families mean to you:
  - i) in your role/ in Childsmile role
  - ii) in DHSW role
- Why is tailoring involved in these roles? Important?
- What is there to support/suggest to HVs that tailoring is important?

2. Assessing families' needs

- How do you refer children to Childsmile?
  - 6-8 week Child Health Surveillance Form? Other methods?
  - Training in doing this?
- How do you decide which children to refer?
  - What kind of questions asked of parents/other?
  - What kind of characteristics noted?
  - EXAMPLE of family that would/wouldn't be referred
- What factors prevent/assist you in accurately assessing whether a child should be referred to Childsmile or not?

3. Delivering tailored support

- How well do you know the DHSW(s) working with families in your health board?
- How do/should DHSWs tailor their support to families' needs?
- If you help the DHSW provide support that is tailored to the family's needs, what do you do?
  - Communication with DHSW about family?
- GIVE EXAMPLES OF TAILORING/NOT TAILORING

4. Barriers /Facilitators to Tailoring

- Do you feel able to tailor to families' needs when considering Childsmile referrals?
- Do you feel that DHSWs are free to tailor to families' needs?
  - What helps/prevents them from doing this?

- If you supervise/work closely with DHSWs, what training is in place that you feel prepares DHSWs for assessing families' needs and delivering tailored support?
  - How could this be improved?

5. Characteristics of DHSW

- What characteristics of DHSWs enable them to tailor their support to families' needs?

6. Begin to Close

- Today we have talked about...(quick overview)
- On the subject of tailoring the programme to families' needs through the DHSW Practice role, is there anything you feel is important that has not been discussed?

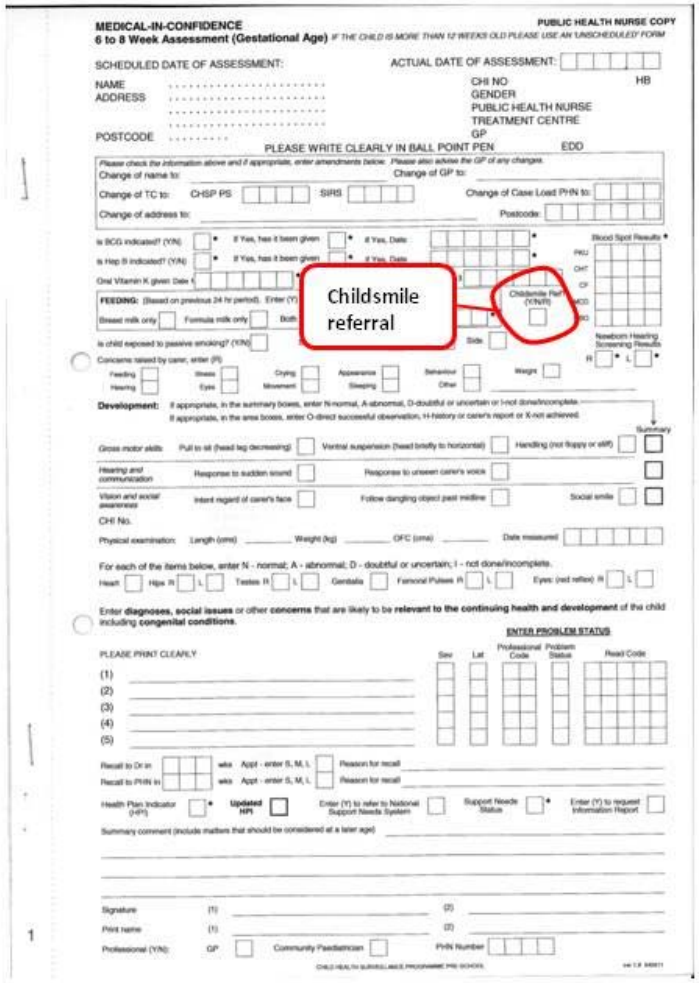
Appendix 14- Theme development diagrams

Targeting 'the right children'		
FINAL THEMES	MID-LEVEL ABSTRACTIONS	EXTRACTED ELEMENTS
Targeting versus universalism	Should support be targeted or universal?	Should support be targeted or universal?
The challenge of engaging health visitors in targeting 'the right children'	Health visitors as barriers/facilitators to targeting 'the right children'	Health visitors as barriers/facilitators to targeting 'the right children'
Tailoring to preparedness for change	Providing the right person to deliver support at the right time	Providing the right person to deliver support at the right time

Defining tailoring and its importance in the DHSW role		
FINAL THEMES	MID-LEVEL ABSTRACTIONS	EXTRACTED ELEMENTS
Defining tailoring		
Difficult for participants to move beyond high level concepts/definitions	Difficult for participants to move beyond high level concepts/definitions	Difficult for participants to move beyond high level concepts/definitions
A two-step process involving (1) identifying individual families' needs (2) providing differential support	A two-step process involving (1) identifying individual families' needs (2) providing differential support	A two-step process involving (1) identifying individual families' needs (2) providing differential support
Why tailoring is important in the context of the DHSW role		
Tailoring provides a flexible framework for addressing needs and barriers	Every family has differing needs	"It's not always typical or what we might imagine" "Every family's different"
	Family circumstances and home environment differ	"Mum just won't take it in" Tailoring by being responsive to the family's environment more likely to be engaging
	Making it personal	"breaking down barriers", "building rapport", "cooperation"
	Reaching people most at risk	"Works better than trying to do a broad brush sweep"
Tailoring is evidence-based (behaviour change theory and Childsmile programme monitoring data)	Tailoring is more effective	Tailoring is more effective than not tailoring
	REMOVED: content was more relevant to implementation of tailoring than justification	Tailoring promotes engagement by allowing for two-way communication

Implementation of tailoring in the DHSW intervention		
FINAL THEMES	MID-LEVEL ABSTRACTIONS	EXTRACTED ELEMENTS
Training DHSWs to deliver a tailored intervention		
▪Initial NHS Education Scotland training ▪Skills development ▪Simulated practice ▪Shadowing	Training is a barrier/facilitator to tailoring	Training is a barrier/facilitator to tailoring
Assessing family's needs		
Health visitors and DHSWs work collaboratively to assess families' needs	Assessing and responding to differing needs	Assessing and responding to differing needs
Maintaining day-to-day communication with health visitors about families' needs	Health visitors as barriers/facilitators to assessing needs	Health visitors as barriers/facilitators to assessing needs
Tailoring the 'dosage' of the DHSW intervention		
Brief intervention versus long-term support	Brief intervention versus long-term support	Should it be a brief intervention or long-term support?
Factors affecting delivery of more that one 'dose' of DHSW intervention	DHSW freedom to tailor	DHSW capacity to provide support (competing demands) Travel time/distance
	Following up families who fail to attend dental appointments	Dental practices as a barrier/facilitator to following up families who fail to attend
Building rapport and a supportive relationship	Developing a relationship/trust/buy-in	Developing a relationship/trust/buy-in
Tailoring to empower	Parent empowerment/influence	Parent-led, two-way communication
Tailoring the timing and communication of oral health messages		
Tailoring the timing of oral health messages	Considering a family's preparedness for change	Parent-led, two-way communication Family readiness to change Looking at what will be effective for a family now and long-term
Tailoring communication of oral health messages	Utilising flexible communication strategies	Responding to differing needs
	Resources (or lack of) as barriers/facilitators	Resources (or lack of) as barriers/facilitators
Taking personal and situational limitations into account		
Tailoring to overcome families' barriers	Being accommodating to families' needs	Being accommodating to families' needs
Tailoring contact type to meet families' needs	Tailoring contact type to meet families' needs	DHSW should meet family face-to-face Location of delivery as a barrier/facilitator
Taking account of the environment in intervention delivery	Taking account of the delivery environment	Taking account of family circumstances and home environment

Appendix 15- 6-8 week Child Health Surveillance form



MEDICAL-IN-CONFIDENCE — **PUBLIC HEALTH NURSE COPY**

6 to 8 Week Assessment (Gestational Age) *IF THE CHILD IS MORE THAN 12 WEEKS OLD PLEASE USE AN 'UNSCHEDULED' FORM*

SCHEDULED DATE OF ASSESSMENT: ACTUAL DATE OF ASSESSMENT:

NAME
ADDRESS
POSTCODE

CHI NO — HB
GENDER
PUBLIC HEALTH NURSE
TREATMENT CENTRE
GP

PLEASE WRITE CLEARLY IN BALL POINT PEN — EDD

Please check the information above and if appropriate, enter amendments below. Please also advise the GP of any changes.

Change of name to: — Change of GP to:

Change of TC to: CHSP PS SIRS — Change of Case Load PHN to:

Change of address to: — Postcode:

Is BCG indicated? (Y/N) — If Yes, has it been given — If Yes, Date — Blood Spot Results

Is Hep B indicated? (Y/N) — If Yes, has it been given — If Yes, Date — PKU CHT CF CDD SCD

Oral Vitamin K given Date

FEEDING: (Based on previous 24 hr period). Enter (Y) — Childsmile Ref (Y/N/R)

Breast milk only — Formula milk only — Both — Side

Is child exposed to passive smoking? (Y/N) — Newborn Hearing Screening Results R L

Concerns raised by carer, enter (R)

Feeding — Illness — Crying — Appearance — Behaviour — Weight
Hearing — Eyes — Movement — Sleeping — Other

Development: If appropriate, in the summary boxes, enter N-normal, A-abnormal, D-doubtful or uncertain or I-not done/incomplete.
If appropriate, in the area boxes, enter O-direct successful observation, H-history or carer's report or X-not achieved.

Summary

Gross motor skills — Pull to sit (head lag decreasing) — Ventral suspension (head briefly to horizontal) — Handling (not floppy or stiff)

Hearing and communication — Response to sudden sound — Response to unseen carer's voice

Vision and social awareness — Intent regard of carer's face — Follow dangling object past midline — Social smile

CHI No.

Physical examination: Length (cms) _____ Weight (kg) _____ OFC (cms) _____ Date measured

For each of the items below, enter N - normal; A - abnormal; D - doubtful or uncertain; I - not done/incomplete.

Heart — Hips R L — Testes R L — Genitalia — Femoral Pulses R L — Eyes: (red reflex) R L

Enter **diagnoses, social issues** or other **concerns** that are likely to be **relevant to the continuing health and development** of the child including **congenital conditions**.

ENTER PROBLEM STATUS

PLEASE PRINT CLEARLY — Sev — Lat — Professional Code — Problem Status — Read Code

(1)
(2)
(3)
(4)
(5)

Recall to Dr in ___ wks Appt - enter S, M, L — Reason for recall
Recall to PHN in ___ wks Appt - enter S, M, L — Reason for recall

Health Plan Indicator (HPI) — **Updated HPI** — Enter (Y) to refer to National Support Needs System — Support Needs Status — Enter (Y) to request Information Report

Summary comment (include matters that should be considered at a later age)

Signature (1) (2)
Print name (1) (2)
Professional (Y/N): GP — Community Paediatrician — PHN Number

CHILD HEALTH SURVEILLANCE PROGRAMME PRE-SCHOOL

Childsmile referral

CHILD HEALTH SURVEILLANCE PROGRAMME PRE-SCHOOL

Items marked with an * will be pre-printed with data, if already recorded on the system

Professional Code
11 Adolescent Psychiatrist
36 Audiology
21 Audiometrician - Education
20 Audiometrician - Health Service
38 Careers Service
37 Chest Physician
10 Child and Family Psychiatrist
02 Community Child Health Doctor
01 Consultant Community Paediatrician
17 Dentist
15 Dermatologist
26 Dietician
13 Ear Nose and Throat Specialist
03 General Practitioner
09 General Surgeon
32 Hospital Paediatrician
06 Neurosurgeon
25 Occupational Therapist - Paediatric
24 Occupational Therapist - Social Work
14 Ophthalmologist
19 Optometrist
33 Orthopaedic
18 Orthoptist
16 Other Hospital Specialist
08 Paediatric Cardiologist
12 Paediatric Neurologist
07 Paediatric Surgeon
23 Physiotherapist
27 Podiatrist
34 Police
40 Pre-school Educational Visitor
29 Psychologist - Clinical
28 Psychologist - Educational
04 Public Health Nurse
35 Reporter
05 School Nurse
30 Social Work
39 Specialist Nurse
22 Speech & Language Therapist
31 Voluntary Agency
99 Other

Health Plan Indicator
C Core Programme
A Additional Programme
I Intensive Programme
U Unknown

Blood Spot Result
BLANK No result
NORM Not suspected
REF Suspected (referred to Specialist)
VER Awaiting verification
UNKN Unknown / Unavailable
RFSD Refused / Declined
LATE Late tested (CF only)
NONE Test not done

Newborn Hearing Screening Result
P Pass
R Refer
W Withdrawn
I Not done/Incomplete

Severity (Sev)
? Query
1 Mild
2 Moderate
3 Severe
4 Profound

Laterality (Lat)
R Right
L Left
B Bilateral

Support Needs Status
0 Not active on SNS
1 Active - Not Yet Notified to Doctor
2 Active - Not Yet Assessed
3 Active - Being Assessed
4 Previously on SNS
8 No Planned Assessment

Childsmile Ref
Y Yes
N No
R Refused

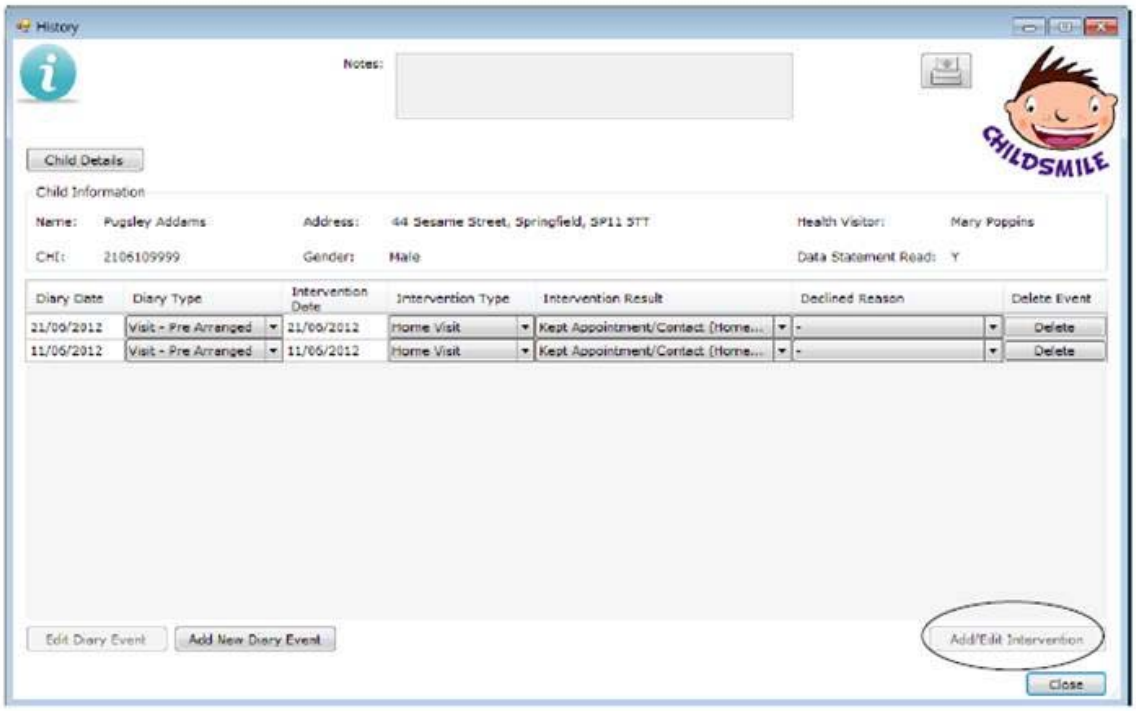
When a problem is entered for the first time, the professional code and problem status code must be entered
Subsequent pre-printed problems must have status updated in the problem status column

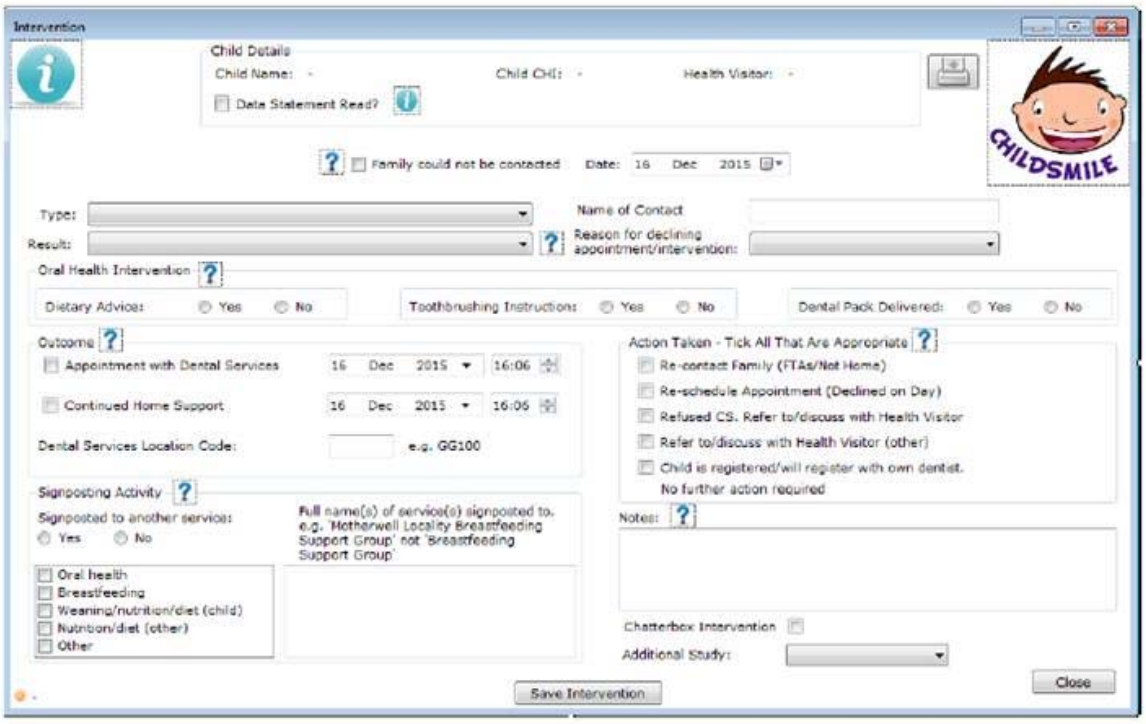
Problem Status Code
0 Referred
1 Problem ongoing
(#) 2 No longer has problem
(#) 3 Amended problem (must add new problem)
4 No information available
(#) 5 Problem/Code incorrectly recorded
6 Discharged due to DNA

N.B. SYMBOL (#) INDICATES USE OF THIS CODE WILL CLOSE A PROBLEM

HALL-LMC6-6 (PP06 form 17) — Version 1.6.2 2 March 2011

Appendix 16- Health Informatics Centre form for the Dental Health Support Worker intervention





Appendix 17- GP17 form for dental remuneration (MIDAS data)

NHS GENERAL DENTAL SERVICES REGISTRATION AND CLAIM FORM
TO BE COMPLETED BY THE DENTIST IN BLOCK CAPITALS USING BLACK INK
GP17 (06/13)

Part 1 PATIENT'S INFORMATION
SURNAME
FORENAME
D.O.B. SEX
CHI NUMBER
PREVIOUS SURNAME
ADDRESS
POSTCODE

Part 2 DENTIST'S INFORMATION
DENTIST'S NAME AND ADDRESS (STAMP)
Date of Registration/Acceptance for Treatment
Date of Completion of Treatment
BPE/CPITN Upper Lower
I claim payment under Special Needs – item 41(B) and 45(C)*

Part 3 PATIENT'S CLAIM DETAILS
Teeth present
Shade appropriate teeth for each item to be claimed
NON-TOOTH SPECIFIC ITEMS
Examination 1(A)
Examination 1(B)
Scale and polish 10(A)
Periodontal 10(B)
Special trays – upper 27(E)
Special trays – lower 27(E)
Small radiograph
Assessment and advice 47(A)
Radiographs available
Models available
Referral (no. of claims) 46(G)*
Trauma*
*Supporting observations are required
OTHER TREATMENTS
(Free replacements. Put X in box A) A
Total amount claimed £

Part 4 DENTIST'S DECLARATION
I declare that the information I have given on this form is correct and complete. I understand that if it is not action may be taken against me. I claim payment of fees due to me for the work carried out in accordance with the NHS (General Dental Services) (Scotland) Regulations.
Where treatment less than that necessary to secure and maintain oral health has been provided, this is because:
The patient refused the treatment and I have provided the care and treatment the patient was willing to undergo.
The patient has failed to complete the treatment. Incomplete treatment is noted in the observations box overleaf.*
Dentist's signature
Date

01020102

DRAFT

PATIENT'S DECLARATION ON ACCEPTANCE
(to be completed and signed by, or on behalf of the patient)
PLEASE USE BLACK INK
GP17 (06/13)

Part 4a
I wish to be treated by this dentist under the NHS (General Dental Service) (Scotland) Regulations and, if invited by the Scottish Dental Reference Service, will attend for an examination by another dentist.
I declare that the information I have given on this form is correct and complete. I understand that if it is not, appropriate action may be taken. I confirm proper entitlement to exemption or remission. To enable the NHS to check I have a valid exemption/remission and for the purposes of prevention, detection and investigation of crime, I understand that my data will be shared with the Common Services Agency, the NHS Business Services Authority, the Department for Work and Pensions, HM Revenue & Customs and Local Authorities.
I wish to be registered/continue to be registered with this dentist
I am registered with another dentist at this practice
I am registered with another dentist at another practice
I do not wish to be registered with any dentist
I wish to be treated by this dentist as a referred patient

Part 4b I HAVE TO PAY NHS CHARGES
I am liable for the NHS charge and may have to pay the full amount prior to treatment
I am named on a current HC3 for partial help with NHS charges
I am the patient I am the patient's parent, guardian or carer
Name in Block Capitals (if not patient)
Signature
Date

Part 4c I DO NOT HAVE TO PAY NHS CHARGES BECAUSE
I am under 16 years of age
I am aged 16 and in full-time education
I am expecting a baby
I have had a baby in the last 12 months
I AM INCLUDED IN AN AWARD OF:
Income Related Employment Support Allowance*
Income Support*
Income-based Job Seekers Allowance*
Box not to be used
Pension Credit guarantee credit*
I/My partner is entitled to, or named on, a valid NHS Tax Credit Exemption Certificate*
*Print the name of the person who gets the benefit/credit
D.O.B. or National Insurance No.
I am named on a current HC2 for full help with NHS charges
Evidence not produced
I am the patient I am the patient's parent, guardian or carer
Name in Block Capitals (if not patient)
Signature
Date

Part 5 DENTIST'S REQUEST FOR PRIOR APPROVAL
I have examined the patient and seek prior approval to carry out the treatment detailed at Part 3 which I consider necessary
Dentist's signature
Date
Prior Approval Authorised

Part 6 DENTIST'S OBSERVATIONS

Part 7 PATIENT'S DECLARATION ON COMPLETION
(to be completed and signed by, or on behalf of the patient)
I confirm that I have had all the treatment that I am willing to have and, if invited by the Scottish Dental Reference Service, will attend for an examination by another dentist.
If you previously completed Part 4b but your circumstances have since changed and you do not now have to pay NHS charges please complete below:
On when the charge was made,
I was included in an award of one of the benefits/tax credits indicated at Part 4c or named on a current NHS charges certificate which is indicated at Part 4b or 4c.
Print the name of the person who gets the benefit/credit
D.O.B. or National Insurance No.
I have paid or will pay the dentist (if you do not have to pay enter 00.00) £
I declare that the information I have given on this form is correct and complete. I understand that if it is not, appropriate action may be taken. I confirm proper entitlement to exemption or remission. To enable the NHS to check I have a valid exemption/remission and for the purposes of prevention, detection and investigation of crime, I understand that my data will be shared with the Common Services Agency, the NHS Business Services Authority, the Department for Work and Pensions, HM Revenue & Customs and Local Authorities.
I will pay the cost of the dental treatment if I am later found not to be entitled. In addition, a statutory penalty may be payable.
I am the patient I am the patient's parent, guardian or carer
Name in Block Capitals (if not patient)
Signature
Date

DRAFT

Appendix 18: Univariable and multivariable regressions of factors associated with health visitor referral through the Childsmile referral pathway

Regression model for HV referral (yes + refused) vs no referral				
	Univariable logistic regression		Multivariable logistic regression	
Explanatory Variable	**Unadjusted OR [95% CI]**	**p-value**	**Adjusted OR [95% CI]**	**p-value**
Health Board				
AA	1 [Ref]		1 [Ref]	
B	0.48 [0.42, 0.53]	*<0.001*	0.54 [0.48, 0.61]	*<0.001*
F	0.13 [0.12, 0.16]	*<0.001*	0.14 [0.12, 0.17]	*<0.001*
GGC	1.03 [0.97, 1.10]	*0.30*	1.11 [1.02, 1.19]	*0.02*
H	0.41 [0.39, 0.45]	*<0.001*	0.45 [0.41, 0.50]	*<0.001*
La	0.83 [0.78, 0.88]	*<0.001*	0.90 [0.84, 0.96]	*0.002*
G	0.23 [0.20, 0.27]	*<0.001*	0.24 [0.21, 0.28]	*<0.001*
L	0.46 [0.42, 0.50]	*<0.001*	0.43 [0.40, 0.47]	*<0.001*
T	0.70 [0.60, 0.90]	*<0.001*	0.08 [0.06, 0.09]	*<0.001*
FV	0.20 [0.15, 0.26]	*<0.001*	0.21 [0.15, 0.30]	*<0.001*
D&G	0.23 [0.19, 0.27]	*<0.001*	0.22 [0.18, 0.26]	*<0.001*
ISL	0.09 [0.06, 0.12]	*<0.001*	0.11 [0.08, 0.16]	*<0.001*
p-value	*<0.001*			*<0.001*
c-index	0.67 [0.66, 0.67]			
National SIMD				
1 (most deprived)	2.03 [1.90, 2.17]	*<0.001*	1.54 [1.43, 1.65]	*<0.001*
2	1.34 [1.25, 1.43]	*<0.001*	1.21 [1.12, 1.31]	*<0.001*
3	1.11 [1.04, 1.20]	*0.004*	1.15 [1.06, 1.24]	*0.001*
4	0.97 [0.90, 1.04]	*0.38*	1.08 [0.99, 1.17]	*0.06*
5 (least deprived)	1 [Ref]		1 [Ref]	
p-value	*<0.001*			*<0.001*
c-index	0.58 [0.57, 0.58]			
Local SIMD			NOT ENTERED INTO THE MODEL	
1 (most deprived)	1.62 [1.52, 1.73]	*<0.001*		
2	1.34 [1.25, 1.43]	*<0.001*		
3	1.24 [1.16, 1.33]	*<0.001*		
4	1.14 [1.06, 1.22]	*<0.001*		
5 (least deprived)	1 [Ref]			
p-value	*<0.001*			
c-index	0.55 [0.54, 0.55]			
Urban-rural Classification				
Large urban area	2.42 [2.19, 2.68]	*<0.001*	1.16 [1.02, 1.32]	*0.02*
Other urban area	2.26 [2.04, 2.51]	*<0.001*	1.40 [1.24, 1.58]	*<0.001*
Accessible small town	1.48 [1.32, 1.67]	*<0.001*	0.87 [0.75, 0.99]	*0.04*
Remote small town	1.77 [1.55, 2.02]	*<0.001*	1.52 [1.32, 1.75]	*<0.001*
Accessible rural	1.32 [1.18, 1.49]	*<0.001*	1.01 [0.88, 1.15]	*0.91*
Remote rural	1 [Ref]		1 [Ref]	
p-value	*<0.001*			*<0.001*
c-index	0.56 [0.56, 0.57]			

Infant feeding				
Breast	1 [Ref]		1 [Ref]	
Mixed	1.02 [0.94, 1.10]	*0.66*	0.95 [0.87, 1.03]	*0.20*
Bottle	1.36 [1.30, 1.43]	*<0.001*	1.06 [1.01. 1.12]	*0.02*
p-value	*<0.001*			*0.003*
c-index	0.53 [0.53, 0.54]			
Smoking				
No	1 [Ref]		1 [Ref]	
Yes	1.22 [1.15, 1.29]	*<0.001*	1.06 [0.99, 1.13]	*0.10*
Missing	0.78 [0.75, 0.82]	*<0.001*	0.86 [0.82, 0.91]	*<0.001*
p-value	*<0.001*			*<0.001*
c-index	0.53 [0.53, 0.54]			
HPI at 6-8 weeks				
Core	1 [Ref]		1 [Ref]	
Additional	1.07 [1.03, 1.11]	*0.002*	1.32 [1.26, 1.38]	*<0.001*
Intensive	1.71 [1.53, 1.91]	*<0.001*	1.58 [1.39, 1.78]	*<0.001*
p-value	*<0.001*			*<0.001*
c-index	0.52 [0.51, 0.52]			
Level of Risk			NOT ENTERED INTO THE MODEL	
No risk factors	1 [Ref]			
1 risk factor	1.46 [1.40, 1.52]	*<0.001*		
2 risk factors	1.80 [1.68, 1.93]	*<0.001*		
High risk	2.45 [1.99, 3.01]	*<0.001*		
p-value	*<0.001*			
c-index	0.56 [0.55, 0.56]			
		p-value for multivariable model		*<0.001*
		c-index for multivariable model		0.70 [0.70, 0.70]

Appendix 19: Univariable logistic regression of association between level of risk and health visitor referral through the Childsmile referral pathway

Regression model for number of risk factors associated with child being identified for referral by health visitor (yes+ refused versus no referral)

Area	N identified as at risk by health visitors/total N in risk category	% identified as at risk by health visitors	Unadjusted OR [95% CI]	p-value
Scotland				
No risk factors	7196/33485	21.49	1 [Ref]	
1 risk factor only	5423/18986	28.56	1.46 [1.40, 1.52]	*<0.001*
2 risk factors	1418/4289	33.06	1.80 [1.68, 1.93]	*<0.001*
High risk (3 or more)	150/374	40.11	2.45 [1.99, 3.01]	*<0.001*
			p-value	*<0.001*
			c-index	0.56 [0.55, 0.56]
NHS Ayrshire & Arran				
No risk factors	1266/4042	31.32	1 [Ref]	
1 risk factor only	1134/2875	39.44	1.43 [1.30, 1.58]	*<0.001*
2 risk factors	301/639	47.10	1.95 [1.65, 2.31]	*<0.001*
High risk (3 or more)	27/50	54.0	2.57 [1.47, 4.50]	*0.001*
			p-value	*<0.001*
			c-index	0.56 [0.55, 0.57]
NHS Borders				
No risk factors	304/1242	24.48	1 [Ref]	
1 risk factor only	124/381	32.55	1.33 [1.05, 1.69]	0.02
2 risk factors	16/52	30.77	1.26 [0.71, 2.23]	0.44
High risk (3 or more)	*	*	4.09 [0.57, 29.12]	0.16
			p-value	*0.06*
			c-index	0.53 [0.50, 0.56]
NHS Fife				
No risk factors	105/1880	5.59	1 [Ref]	
1 risk factor only	80/1010	7.92	1.45 [1.08, 1.97]	*0.02*
2 risk factors	29/178	16.29	3.29 [2.11, 5.13]	*<0.001*
High risk (3 or more)	*	*	*	*
			p-value	*<0.001*
			c-index	0.58 [0.54, 0.62]
NHS Greater Glasgow & Clyde				
No risk factors	1527/4870	31.36	1 [Ref]	
1 risk factor only	1828/4527	40.38	1.48 [1.36, 1.61]	*<0.001*
2 risk factors	561/1360	41.25	1.54 [1.36, 1.74]	*<0.001*
High risk (3 or more)	89/182	48.90	2.10 [1.56, 2.82]	*<0.001*
			p-value	*<0.001*
			c-index	0.55 [0.54, 0.56]
NHS Highland				
No risk factors	579/3483	16.62	1 [Ref]	
1 risk factor only	282/1183	23.84	1.57 [1.34, 1.84]	*<0.001*
2 risk factors	47/159	29.56	2.11 [1.48, 2.99]	*<0.001*
High risk (3 or more)	*	*	2.01 [0.39, 10.37]	*0.41*
			p-value	*<0.001*

			c-index	0.55 [0.53, 0.58]
NHS Lanarkshire				
No risk factors	2150/6883	31.24	1 [Ref]	
1 risk factor only	1225/3832	31.97	1.03 [0.95, 1.13]	*0.44*
2 risk factors	276/845	32.66	1.07 [0.92, 1.24]	*0.40*
High risk (3 or more)	13/37	35.14	1.19 [0.61, 2.35]	*0.61*
			p-value	*0.73*
			c-index	0.51 [0.49, 0.52]
NHS Grampian				
No risk factors	163/1530	10.65	1 [Ref]	
1 risk factor only	82/622	13.18	1.27 [0.96, 1.69]	*0.95*
2 risk factors	13/90	14.44	1.42 [0.77, 2.61]	*0.26*
High risk (3 or more)	*	*	2.80 [0.29, 27.03]	*0.38*
			p-value	*0.24*
			c-index	0.53 [0.49, 0.57]
NHS Lothian				
No risk factors	857/4750	18.04	1 [Ref]	
1 risk factor only	533/2290	23.28	1.38 [1.22, 1.56]	*<0.001*
2 risk factors	143/521	27.45	1.72 [1.40, 2.11]	*<0.001*
High risk (3 or more)	12/42	28.57	1.82 [0.93, 3.56]	*0.08*
			p-value	*<0.001*
			c-index	0.55 [0.53, 0.56]
NHS Tayside				
No risk factors	112/2703	4.14	1 [Ref]	
1 risk factor only	48/1464	3.28	0.78 [0.56, 1.11]	*0.17*
2 risk factors	18/327	5.50	1.35 [0.81, 2.25]	*0.25*
High risk (3 or more)	*	*	2.31[0.70, 7.70]	*0.17*
			p-value	*0.11*
			c-index	0.54 [0.50, 0.58]
NHS Forth Valley				
No risk factors	36/414	8.70	1 [Ref]	
1 risk factor only	19/145	13.10	1.58 [0.88, 2.86]	*0.13*
2 risk factors	*	*	1.05 [0.13, 8.44]	*0.96*
High risk (3 or more)	0	0	-	-
			p-value	*0.31*
			c-index	0.55 [0.47, 0.63]
NHS Dumfries & Galloway				
No risk factors	70/857	8.19	1 [Ref]	
1 risk factor only	62/355	17.50	2.38 [1.65, 3.44]	*<0.001*
2 risk factors	12/71	16.90	2.29 [1.17, 4.46]	*0.20*
High risk (3 or more)	*	*	1.61 [0.20,13.24]	*0.66*
			p-value	*<0.001*
			c-index	0.60 [0.55, 0.65]
Islands				
No risk factors	27/527	5.12	1 [Ref]	

1 risk factor only	6/178	3.37	0.65 [0.26, 1.60]	*0.34*
2 risk factors	*	*	0.98 [0.13, 7.56]	*0.98*
High risk (3 or more)	0	0	-	-
			p-value	*0.64*
			c-index	0.54 [0.44, 0.63]

*some N undisclosed due to small numbers meaning there is a risk of identification of individuals

Appendix 20: Multivariable regression within health boards of factors associated with health visitor referral through the Childsmile referral pathway

National SIMD, level of risk and urban/rural classification were not entered into these models. All variables that remained in the final models are shown in the tables.

NHS Ayrshire & Arran	Multivariable logistic regression: identified as 'at risk' by health visitor	
Explanatory Variable	**Adjusted OR [95% CI]**	**p-value**
Local SIMD		
1 (most deprived)	2.18 [1.84, 2.57]	
2	2.13 [1.79, 2.53]	*<0.001*
3	1.62 [1.36, 1.93]	*<0.001*
4	1.18 [0.98, 1.41]	*<0.001*
5 (least deprived)	1 [Ref]	*0.08*
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	1.14 [0.90, 1.44]	*0.27*
Bottle	1.22 [1.07, 1.40]	*0.004*
p-value		*0.01*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.47 [1.33, 1.63]	*<0.001*
Intensive	2.74 [2.06, 3.65]	*<0.001*
p-value		*<0.001*
	p-value for model	*<0.001*
	c-index for model	0.62 [0.61, 0.63]
NHS Borders		
Infant feeding		
Breast	1 [Ref]	
Mixed	0.99 [0.65, 1.50]	*0.96*
Bottle	1.77 [1.38, 2.29]	*<0.001*
p-value		*<0.001*
Smoking		
No	1 [Ref]	
Yes	1.03 [0.74, 1.45]	*0.85*
Missing	0.64 [0.47, 0.87]	*0.005*
p-value		*0.02*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.68 [1.35, 2.09]	*<0.001*

Intensive	3.95 [1.29, 12.03]	*0.02*
p-value		*<0.001*
	p-value for model	*<0.001*
	c-index for model	0.61 [0.58, 0.64]
NHS Fife		
Local SIMD		
1 (most deprived)	3.12 [1.83, 5.33]	*<0.001*
2	1.63 [0.91, 2.93]	*0.10*
3	1.85 [1.03, 3.31]	*0.04*
4	2.07 [1.13, 3.78]	*0.02*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Smoking		
No	1 [Ref]	
Yes	1.50 [0.99, 2.25]	*0.05*
Missing	0.82 [0.60, 1.12]	*0.21*
p-value		*0.02*
	p-value for model	*<0.001*
	c-index for model	0.62 [0.58, 0.65]
NHS Greater Glasgow & Clyde		
Local SIMD		
1 (most deprived)	2.87 [2.44, 3.36]	*<0.001*
2	2.37 [2.02, 2.78]	*<0.001*
3	1.92 [1.64, 2.26]	*<0.001*
4	1.81 [1.54, 2.12]	*<0.001*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	0.76 [0.65, 0.90]	*0.001*
Bottle	0.82 [0.74, 0.92]	*0.001*
p-value		*0.001*
Smoking		
No	1 [Ref]	
Yes	1.02 [0.89, 1.17]	*0.77*
Missing	0.79 [0.71, 0.88]	*<0.001*
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.15 [1.05, 1.26]	*0.004*
Intensive	1.07 [0.88, 1.30]	*0.49*
p-value		*0.02*

	p-value for model	*<0.001*
	c-index for model	0.60 [0.59, 0.61]
NHS Highland		
Local SIMD		
1 (most deprived)	3.43 [2.65, 4.44]	*<0.001*
2	1.86 [1.41, 2.45]	*<0.001*
3	1.93 [1.44, 2.60]	*<0.001*
4	1.83 [1.38, 2.43]	*<0.001*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	0.81 [0.60, 1.10]	*0.18*
Bottle	1.31 [1.10, 1.55]	*0.002*
p-value		*<0.001*
Smoking		
No	1 [Ref]	
Yes	0.23 [0.94, 1.58]	*0.14*
Missing	0.75 [0.62, 0.91]	*0.004*
p-value		*0.002*
	p-value for model	*<0.001*
	c-index for model	0.63 [0.61, 0.65]
NHS Lanarkshire		
Local SIMD		
1 (most deprived)	0.80 [0.70, 0.90]	*<0.001*
2	0.69 [0.61, 0.79]	*<0.001*
3	0.48 [0.68, 0.88]	*<0.001*
4	0.78 [0.68, 0.89]	*<0.001*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Smoking		
No	1 [Ref]	
Yes	1.11 [0.99, 1.25]	*0.07*
Missing	0.78 [0.71, 0.87]	*<0.001*
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.44 [1.32, 1.57]	*<0.001*
Intensive	1.41 [0.90, 2.21]	*0.13*
	1 [Ref]	
p-value	0.80 [0.70, 0.90]	*<0.001*
	p-value for model	*<0.001*
	c-index for model	0.56 [0.55, 0.58]

NHS Lothian		
Local SIMD		
1 (most deprived)	1.07 [0.88, 1.29]	*0.50*
2	0.87 [0.72, 1.06]	*0.17*
3	0.87 [0.72, 1.06]	*0.18*
4	0.79 [0.64, 0.96]	*0.02*
5 (least deprived)	1 [Ref]	
p-value		*0.006*
Infant feeding		
Breast	1 [Ref]	
Mixed	1.29 [1.08, 1.54]	*0.005*
Bottle	1.11 [0.97, 1.27]	*0.12*
p-value		*0.02*
Smoking		
No	1 [Ref]	
Yes	1.28 [1.07, 1.53]	*0.007*
Missing	0.95 [0.83, 1.09]	*0.47*
p-value		*0.01*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	3.15 [1.27, 7.85]	*0.01*
Intensive	4.68 [1.82, 12.02]	*0.001*
p-value		*<0.001*
	p-value for model	*<0.001*
	c-index for model	*0.56 [0.54, 0.57]*
NHS Tayside		
	NOT INCLUDED IN FINAL STEP	
Local SIMD		
Infant feeding	NOT INCLUDED IN FINAL STEP	
Smoking		
No	1 [Ref]	
Yes	1.20 [0.75, 1.94]	*0.45*
Missing	1.63 [1.18, 2.25]	*0.003*
p-value		*0.01*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.17 [0.86, 1.60]	*0.32*
Intensive	2.91 [1.52, 5.54]	*0.001*
p-value		
	p-value for model	*0.005*

	c-index for model	0.58 [0.54, 0.63]
NHS Dumfries & Galloway		
Local SIMD		
1 (most deprived)	2.46 [1.35, 4.49]	
2	2.27 [1.19, 4.34]	*0.003*
3	1.43 [0.72, 2.84]	*0.01*
4	2.04 [1.03, 4.04]	*0.31*
5 (least deprived)	1 [Ref]	*0.04*
p-value		*0.03*
Infant feeding		
Breast	1 [Ref]	
Mixed	1.82 [0.86, 3.85]	*0.12*
Bottle	1.85 [1.14, 3.00]	*0.01*
p-value		*0.04*
	p-value for model	*<0.001*
	c-index for model	0.61 [0.56, 0.65]
Islands		
Local SIMD		
1 (most deprived)	4.21 [1.32, 13.47]	*0.02*
2	1.29 [0.34, 4.91]	*0.71*
3	2.15 [0.63, 7.31]	*0.22*
4	0.96 [0.25, 3.64]	*0.95*
5 (least deprived)	1 [Ref]	
p-value		*0.02*
	p-value for model	*<0.001*
	c-index for model	0.65 [0.55, 0.75]

Appendix 21: Univariable and multivariable regressions of factors associated with referral by any pathway

Regression model for in HIC vs not in HIC				
	Univariable logistic regression		**Multivariable logistic regression**	
Explanatory Variable	**Unadjusted OR [95% CI]**	**p-value**	**Adjusted OR [95% CI]**	**p-value**
Health Board				
AA	1 [Ref]		1 [Ref]	
B	0.53 [0.47,0.60]	*<0.001*	0.59 [0.52, 0.68]	*<0.001*
F	0.16 [0.13, 0.19]	*<0.001*	0.18 [0.15, 0.21]	*<0.001*
GGC	2.12 [1.99, 2.26]	*<0.001*	2.47 [2.26, 2.70]	*<0.001*
H	1.36 [1.25, 1.47]	*<0.001*	1.44 [1.30, 1.59]	*<0.001*
La	3.62 [3.40, 3.86]	*<0.001*	4.35 [4.05, 4.68]	*<0.001*
G	0.02 [0.01, 0.03]	*<0.001*	0.02 [0.01, 0.03]	*<0.001*
L	0.002 [0.00, 0.01]	*<0.001*	0.002 [0.001, 0.005]	*<0.001*
T	0.04 [0.03, 0.05]	*<0.001*	0.04 [0.03, 0.05]	*<0.001*
FV	0.03 [0.01, 0.06]	*<0.001*	0.04 [0.02, 0.11]	*<0.001*
D&G	0.22 [0.18, 0.28]	*<0.001*	0.20 [0.16, 0.25]	*<0.001*
ISL	0.01 [0.004, 0.04]	*<0.001*	0.01 [0.004, 0.04]	*<0.001*
p-value	*<0.001*			*<0.001*
c-index	0.80 [0.80, 0.81]			
National SIMD				
1 (most deprived)	3.17 [2.96, 3.41]	*<0.001*	2.12 [1.94, 2.31]	*<0.001*
2	2.15 [2.00. 2.32]	*<0.001*	1.60 [1.47, 1.75]	*<0.001*
3	1.78 [1.66, 1.92]	*<0.001*	1.44 [1.32, 1.58]	*<0.001*
4	1.28 [1.18, 1.38]	*<0.001*	1.24 [1.13, 1.36]	*<0.001*
5 (least deprived)	1 [Ref]		1 [Ref]	
p-value	*<0.001*			*<0.001*
c-index	0.61 [0.60, 0.61]			
Local SIMD			NOT ENTERED INTO THE MODEL	
1 (most deprived)	1.64 [1.55, 1.75]	*<0.001*		
2	1.48 [1.38, 1.57]	*<0.001*		
3	1.27 [1.19, 1.36]	*<0.001*		
4	1.14 [1.07, 1.22]	*<0.001*		
5 (least deprived)	1 [Ref]			
p-value	*<0.001*			
c-index	0.61 [0.60, 0.61]			
Urban-rural Classification				
Large urban area	2.42 [2.20, 2.67]	*<0.001*	1.07 [0.93, 1.22]	*0.36*
Other urban area	1.73 [1.57, 1.91]	*<0.001*	1.14 [1.01, 1.29]	*0.03*
Accessible small town	2.10 [1.88, 2.34]	*<0.001*	1.79 [1.56, 2.07]	*<0.001*
Remote small town	2.70 [2.38, 3.05]	*<0.001*	2.67 [2.33, 3.06]	*<0.001*
Accessible rural	1.35 [1.21, 1.51]	*<0.001*	1.26 [1.10, 1.44]	*0.001*
Remote rural	1 [Ref]		1 [Ref]	
p-value	*<0.001*			*<0.001*
c-index	0.57 [0.56, 0.57]			

Infant feeding				
Breast	1 [Ref]		1 [Ref]	
Mixed	1.05 [0.97, 1.14]	*0.20*	1.04 [0.95, 1.14]	*0.43*
Bottle	1.58 [1.51, 1.66]	*<0.001*	1.06 [1.00, 1.13]	*0.04*
p-value	*<0.001*			*0.11*
c-index	0.55 [0.54, 0.55]			
Smoking				
No	1 [Ref]		1 [Ref]	
Yes	1.18 [1.12, 1.25]	*<0.001*	0.95 [0.89, 1.02]	*0.19*
Missing	0.82 [0.78, 0.85]	*<0.001*	0.95 [0.90, 1.01]	*0.07*
p-value	*<0.001*			*0.13*
c-index	0.53 [0.52, 0.53]			
HPI at 6-8 weeks				
Core	1 [Ref]		1 [Ref]	
Additional	0.59 [0.57, 0.61]	*<0.001*	1.26 [1.20, 1.32]	*<0.001*
Intensive	0.96 [0.86, 1.08]	*0.48*	1.52 [1.32, 1.75]	*<0.001*
p-value	*<0.001*			*<0.001*
c-index	0.56 [0.56, 0.57]			
Level of risk			NOT ENTERED INTO THE MODEL	
No risk factors	1 [Ref]			
1 risk factor only	1.65 [1.60, 1.70]	*<0.001*		
2 risk factors	2.31 [2.20, 2.43]	*<0.001*		
High risk (3 or more)	2.83 [2.47, 3.24]	*<0.001*		
p-value	*<0.001*			
c-index	0.56 [0.55, 0.56]			
		p-value for multivariable model		*<0.001*
		c-index for multivariable model		0.83 [0.82, 0.83]

Appendix 22: Univariable logistic regression of association between level of risk and referral by any pathway

Regression model for number of risk factors associated with child being in HIC				
Area	**N in HIC/total N in risk category**	**% in HIC**	**Unadjusted OR [95% CI]**	**p-value**
Scotland				
No risk factors			1 [Ref]	
1 risk factor only			1.65 [1.60, 1.70]	*<0.001*
2 risk factors			2.31 [2.20, 2.43]	*<0.001*
High risk (3 or more)			2.83 [2.47, 3.24]	*<0.001*
			p-value	*<0.001*
			c-index	0.56 [0.55, 0.56]
NHS Ayrshire & Arran				
No risk factors	954/4042	23.60	1 [Ref]	
1 risk factor only	784/2875	27.27	1.21 [1.09, 1.35]	*0.001*
2 risk factors	201/639	31.46	1.49 [1.24, 1.78]	*<0.001*
High risk (3 or more)	19/50	38.00	1.98 [1.12, 3.53]	*0.02*
			p-value	*<0.001*
			c-index	0.53 [0.52, 0.55
NHS Borders				
No risk factors	222/1547	14.35	1 [Ref]	
1 risk factor only	92/505	18.22	1.33 [1.02, 1.74]	0.04
2 risk factors	*	*	1.41 [0.76, 2.63]	0.28
High risk (3 or more)	*	*	5.97 [0.84, 42.59]	0.08
			p-value	*0.047*
			c-index	0.53 [0.50, 0.57]
NHS Fife				
No risk factors	206/5053	10.03	1 [Ref]	
1 risk factor only	198/2722	7.27	1.85 [1.51, 2.26]	*<0.001*
2 risk factors	63/536	11.75	3.13 [2.33, 4.22]	*<0.001*
High risk (3 or more)	*	*	2.21 [0.80, 6.31]	*0.13*
			p-value	*<0.001*
			c-index	0.60 [0.57, 0.63]
NHS Greater Glasgow & Clyde				
No risk factors	4145/12250	33.84	1 [Ref]	
1 risk factor only	5070/11146	45.49	1.63 [1.55, 1.72]	*<0.001*
2 risk factors	1865/3566	52.30	2.14 [1.99, 2.31]	*<0.001*
High risk (3 or more)	265/461	57.48	2.64 [2.19, 3.19]	*<0.001*
			p-value	*<0.001*
			c-index	0.58 [0.57, 0.59]
NHS Highland				
No risk factors	1053/4125	25.53	1 [Ref]	
1 risk factor only	507/1445	35.09	1.58 [1.39, 1.79]	*<0.001*
2 risk factors	83/190	43.68	2.26 [1.69, 3.04]	*<0.001*
High risk (3 or more)	*	*	8.75 [1.76, 43.43]	*0.008*
			p-value	*<0.001*
			c-index	0.56 [0.54, 0.57]
NHS Lanarkshire				
No risk factors	3809/6883	55.34	1 [Ref]	

1 risk factor only	2170/3832	56.63	1.05 [0.97, 1.14]	*0.20*
2 risk factors	457/845	54.08	0.95 [0.82, 1.10]	*0.49*
High risk (3 or more)	18/37	48.65	0.77 [0.40, 1.46]	*0.42*
			p-value	*0.34*
			c-index	0.50 [0.49, 0.51]
NHS Dumfries & Galloway				
No risk factors	212/1876	11.30	1 [Ref]	
1 risk factor only	150/803	18.68	1.80 [1.44, 2.26]	*<0.001*
2 risk factors	46/170	27.06	2.91 [2.02, 4.20]	*<0.001*
High risk (3 or more)	8/24	33.33	3.93 [1.66, 9.28]	*0.002*
			p-value	*<0.001*
			c-index	0.59 [0.56, 0.62]
NHS Tayside				
No risk factors	37/5036	0.73	1 [Ref]	
1 risk factor only	58/2810	2.06	2.85 [1.88, 4.31]	*<0.001*
2 risk factors	26/701	3.71	5.20 [3.13, 8.65]	*<0.001*
High risk (3 or more)	6/74	8.11	11.92 [4.87, 29.18]	*<0.001*
			p-value	*<0.001*
			c-index	0.67 [0.62, 0.72]

*some N undisclosed due to small numbers meaning there is a risk of identification of individuals

Appendix 23: Multivariable regression within health boards of factors associated with referral by any pathway

National SIMD, level of risk and urban/rural classification were not entered into these models. All variables that remained in the final models are shown in the tables.

NHS Ayrshire & Arran	Multivariable logistic regression: in HIC/not	
Explanatory Variable	**Adjusted OR [95% CI]**	**p-value**
Local SIMD		
1 (most deprived)	1.81 [1.50, 2.18]	*<0.001*
2	1.86 [1.54, 2.25]	*<0.001*
3	1.60 [1.32, 1.95]	*<0.001*
4	1.22, 0.99, 1.49]	*0.06*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	1.35 [1.05, 1.73]	*0.02*
Bottle	1.16 [1.00, 1.35]	*0.048*
p-value		*0.04*
Smoking		
No	1 [Ref]	
Yes	0.69 [0.58, 0.82]	*<0.001*
Missing	0.85 [0.75, 0.96]	*0.009*
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.60 [1.43, 1.79]	*<0.001*
Intensive	2.89 [2.17, 3.84]	*<0.001*
p-value		*<0.001*
	p-value for model	*<0.001*
	c-index for model	*<0.001*
NHS Borders		
Infant feeding		
Breast	1 [Ref]	
Mixed	1.31 [0.84, 2.03]	*0.23*
Bottle	1.80 [1.35, 2.39]	*<0.001*
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.60 [1.26, 2.04]	*<0.001*
Intensive	2.65 [0.80, 8.76]	*0.11*

p-value		
	p-value for model	*<0.001*
	c-index for model	0.60 [0.56, 0.63]
NHS Fife		
Local SIMD		
1 (most deprived)	6.80 [4.11, 11.26]	*<0.001*
2	4.88 [2.91, 8.17]	*<0.001*
3	3.27 [1.92, 5.58]	*<0.001*
4	2.49 [1.41, 4.41]	*0.002*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	0.95 [0.60, 1.52]	*0.84*
Bottle	1.43 [1.09, 1.87]	*0.009*
p-value		*0.009*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.94 [1.59, 2.37]	*<0.001*
Intensive	2.50 [1.59, 3.95]	*<0.001*
p-value		*<0.001*
	p-value for model	*<0.001*
	c-index for model	0.69 [0.67, 0.71]
NHS GGC		
Local SIMD		
1 (most deprived)	2.94 [2.66, 3.23]	*<0.001*
2	1.98 [1.80, 2.18]	*<0.001*
3	1.65 [1.50, 1.81]	*<0.001*
4	1.33 [1.21, 1.47]	*<0.001*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	1.03 [0.93, 1.14]	*0.53*
Bottle	0.88 [0.82, 0.94]	*<0.001*
p-value		*<0.001*
Smoking		
No	1 [Ref]	
Yes	1.11 [1.02, 1.21]	*0.01*
Missing	0.96 [0.89, 1.03]	*0.22*

p-value		*0.01*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.22 [1.15, 1.29]	*<0.001*
Intensive	1.20 [1.07, 1.36]	*0.003*
p-value		
	p-value for model	*<0.001*
	c-index for model	0.61 [0.60, 0.62]
NHS Highland		
Local SIMD		
1 (most deprived)	3.05 [2.51, 3.71]	*<0.001*
2	1.95 [1.58, 2.40]	*<0.001*
3	1.52 [1.22, 1.90]	*<0.001*
4	1.57 [1.27, 1.95]	*<0.001*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	1.11 [0.88, 1.39]	*0.39*
Bottle	1.44 [1.25, 1.65]	*<0.001*
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.24 [1.08, 1.43]	*0.003*
Intensive	1.48 [0.85, 2.58]	*0.17*
p-value		*0.006*
	p-value for model	*<0.001*
	c-index for model	0.61 [0.60, 0.62]
NHS Lanarkshire		
Local SIMD		
1 (most deprived)	1.21 [1.08, 1.37]	*0.002*
2	1.30 [1.15, 1.47]	*<0.001*
3	1.14 [1.01, 1.29]	*0.04*
4	1.02 [0.90, 1.16]	*0.72*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.13 [1.04, 1.23]	*0.004*
Intensive	0.76 [0.49, 1.17]	*0.21*

p-value		*0.006*
	p-value for model	*0.17*
	c-index for model	0.53 [0.52, 0.54]
NHS Tayside		
Local SIMD		
1 (most deprived)	5.79 [2.09, 16.02]	*0.001*
2	3.53 [1.23, 10.13]	*0.02*
3	2.14 [0.70, 6.52]	*0.18*
4	1.40 [0.42, 4.67]	*0.59*
5 (least deprived)	1 [Ref]	
p-value		*<0.001*
Infant feeding		
Breast	1 [Ref]	
Mixed	0.83 [0.32, 2.14]	*0.71*
Bottle	1.67 [0.97, 2.87]	*0.07*
p-value		*0.06*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	2.56 [1.62, 4.06]	*<0.001*
Intensive	8.19 [4.44, 15.13]	*<0.001*
p-value		*<0.001*
	p-value for model	*<0.001*
	c-index for model	0.76 [0.72, 0.80]
NHS Dumfries & Galloway		
Local SIMD		
1 (most deprived)	1.77 [1.24, 2.58]	*0.002*
2	1.58 [1.06, 2.36]	*0.03*
3	1.34 [0.89, 2.01]	*0.16*
4	1.58 [1.05, 2.38]	*0.03*
5 (least deprived)	1 [Ref]	
p-value		*0.03*
Smoking		
No	1 [Ref]	
Yes	2.87 [2.19, 3.76]	*<0.001*
Missing	1.18 [0.86, 1.60]	*0.30*
p-value		*<0.001*
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.61 [1.10, 2.36]	*0.02*
Intensive	1.74 [1.04, 2.93]	*0.04*
p-value		*0.04*

p-value for model	*<0.001*
c-index for model	0.62 [0.59, 0.65]

Appendix 24: Example of local referral form

Parent's consent for Oral Health Support Worker Visit

Birth pack sticker to be placed here:

OR please complete below:

Child's name:.....

Child's CHI number:.....

Child's Address:.....

Contact telephone number:.....

Parent's names:.....

Health Visitor's name:.....

Main language spoken in the house:.....

Interpreter required: Yes/No (delete as appropriate)

Parent's signature of agreement of OHSW visit:.....

Date of Referral:.....

Dogs in household: Yes/No (delete as appropriate) Number:...Friendly: Yes/No

Any other relevant information before visit:.....

.....

Appendix 25: Univariable and multivariable regressions of factors associated with 'dosage'

Regression model for 'dosage' 1 vs >1 successful				
	Univariable logistic regression		Multivariable logistic regression	
Explanatory Variable	**Unadjusted OR [95% CI]**	**p-value**	**Adjusted OR [95% CI]**	**p-value**
Health Board				
AA	1 [Ref]		1 [Ref]	
B	4.63 [3.33, 6.44]	*<0.001*	6.91 [4.84, 9.87]	*<0.001*
F	5.41 [4.11, 7.12]	*<0.001*	5.33 [4.02, 7.06]	*<0.001*
GGC	0.45 [0.37, 0.55]	*<0.001*	0.45 [0.34, 0.58]	*<0.001*
H	0.81 [0.63, 1.04]	*0.10*	1.83 [1.32, 2.54]	*<0.001*
La	0.26 [0.20, 0.32]	*<0.001*	0.30 [0.23, 0.39]	*<0.001*
G	1.21 [0.57, 2.59]	*0.62*	2.03 [0.93, 4.45]	*0.08*
L	1.34 [0.39, 4.59]	*0.64*	1.45 [0.41, 5.10]	*0.57*
T	5.66 [3.56, 9.02]	*<0.001*	4.35 [2.62, 7.21]	*<0.001*
FV	0.65 [0.09, 5.03]	*0.68*	0.48 [0.06, 3.80]	*0.48*
D&G	0.81 [0.54, 1.21]	*0.30*	0.87 [0.57, 1.32]	*0.51*
ISL	1.59 [0.46, 5.53]	*0.46*	3.29 [0.88, 12.30]	*0.08*
p-value	*<0.001*		*<0.001*	
c-index	0.40 [0.38, 0.42]			
National SIMD				
1 (most deprived)	2.09 [1.57, 2.78]	*<0.001*	1.86 [1.36, 2.55]	*<0.001*
2	1.71 [1.26, 2.31]	*0.001*	1.53 [1.11, 2.13]	*0.01*
3	1.49 [1.09, 2.05]	*0.01*	1.23 [0.87, 1.73]	*0.24*
4	1.40 [1.00, 1.95]	*0.05*	1.11 [0.77, 1.60]	*0.57*
5 (least deprived)	1 [Ref]		1 [Ref]	
p-value	*<0.001*		*<0.001*	
c-index	*0.45 [0.43, 0.46]*			
Local SIMD			NOT ENTERED INTO THE MODEL	
1 (most deprived)	2.32 [1.83, 2.94]	*<0.001*		
2	1.56 [1.21, 2.00]	*0.001*		
3	1.28 [0.98, 1.67]	*0.07*		
4	1.14 [0.86, 1.50]	*0.36*		
5 (least deprived)	1 [Ref]			
p-value	*<0.001*			
c-index	0.42 [0.40, 0.43]			
Urban-rural Classification				
Large urban area	0.42 [0.31, 0.55]	*<0.001*	1.35 [0.88, 2.06]	*0.17*
Other urban area	0.83 [0.63, 1.11]	*0.21*	1.47 [1.01, 2.15]	*0.04*
Accessible small town	0.58 [0.41, 0.82]	*0.002*	1.13 [0.73, 1.75]	*0.58*
Remote small town	0.31 [0.20, 0.49]	*<0.001*	0.28 [0.17, 0.45]	*<0.001*
Accessible rural	0.56 [0.39, 0.80]	*0.002*	1.06 [0.69, 1.63]	*0.78*
Remote rural	1 [Ref]		1 [Ref]	

p-value	*<0.001*		*<0.001*	
c-index	0.56 [0.54, 0.57]			
Infant feeding			NOT KEPT IN FINAL MODEL	
Breast	1 [Ref]			
Mixed	1.01 [0.77, 1.32]	*0.95*		
Bottle	1.38 [1.17, 1.62]	*<0.001*		
p-value	*<0.001*			
c-index	0.53 [0.51, 0.55]			
Smoking			NOT KEPT IN FINAL MODEL	
No	1 [Ref]			
Yes	1.32 [1.13, 1.55]	*0.001*		
Missing	1.10 [0.94, 1.27]	*0.23*		
p-value	*0.003*			
c-index	0.52 [0.50, 0.53]			
HPI at 6-8 weeks				
Core	1 [Ref]		1 [Ref]	
Additional	1.48 [1.30, 1.68]	*<0.001*	1.30 [1.13, 1.50]	*<0.001*
Intensive	4.42 [3.60, 5.44]	*<0.001*	3.73 [2.97, 4.70]	*<0.001*
p-value	*<0.001*		<0.001	
c-index	0.59 [0.57, 0.60]			
Level of risk			NOT ENTERED INTO THE MODEL	
No risk factors	1 [Ref]			
1 risk factor	1.30 [1.14, 0.19]			
2 risk factors	1.94 [1.64, 2.30]			
High risk	2.48 [1.69, 3.62]			
p-value	*<0.001*			
c-index	0.56 [0.55, 0.58]			
		p-value for multivariable model		*<0.001*
		c-index for multivariable model		*0.73 [0.72, 0.75]*

Appendix 26: Univariable logistic regression of association between level of risk and 'dosage'

Regression model for number of risk factors associated with dosage (success)				
Area	**N identified as at risk by health visitors/total N in risk category**	**% identified as at risk by health visitors**	**Unadjusted OR [95% CI]**	**p-value**
Scotland				
No risk factors	442/8544	5.17	1 [Ref]	
1 risk factor only	487/7341	6.63	1.30 [1.14, 1.49]	*<0.001*
2 risk factors	214/2238	9.56	1.84 [1.64, 2.30]	*<0.001*
High risk (3 or more)	32/269	11.90	2.48 [1.69, 3.62]	*<0.001*
			p-value	*<0.001*
			c-index	0.56 [0.55, 0.58]
NHS Ayrshire & Arran				
No risk factors	52/694	7.49	1 [Ref]	
1 risk factor only	67/595	11.26	1.57 [1.07, 2.29]	*0.02*
2 risk factors	28/150	18.67	2.83 [1.72, 4.67]	*<0.001*
High risk (3 or more)	6/14	42.86	9.26 [3.10, 27.70]	*<0.001*
			p-value	*<0.001*
			c-index	0.61 [0.55, 0.65]
NHS Greater Glasgow & Clyde				
No risk factors	115/3363	3.42	1 [Ref]	
1 risk factor only	207/4181	4.95	1.47 [1.17, 1.86]	*0.001*
2 risk factors	126/1529	8.24	2.54 [1.96, 3.29]	<0.001
High risk (3 or more)	20/220	9.09	2.82 [1.72, 4.64]	<0.001
			p-value	*<0.001*
			c-index	0.59 [0.57, 0.62]
NHS Highland				
No risk factors	55/854	6.44	1 [Ref]	
1 risk factor only	50/411	12.17	2.01 [1.35, 3.01]	*0.001*
2 risk factors	10/66	15.15	2.59 [1.26, 5.36]	*0.01*
High risk (3 or more)	*	*	2.91 [0.33, 25.30]	*0.33*
			p-value	*0.002*
			c-index	0.59 [0.54, 0.65]

*some N undisclosed due to small numbers meaning there is a risk of identification of individuals

Appendix 27: Multivariable regression within health boards of factors associated with 'dosage'

National SIMD, level of risk and urban/rural classification were not entered into these models. All variables that remained in the final models are shown in the tables.

NHS Ayrshire & Arran	Multivariable logistic regression: dosage	
Explanatory Variable	**Adjusted OR [95% CI]**	**p-value**
Local SIMD		
1 (most deprived)	3.92 [1.54, 9.98]	*0.004*
2	2.94 [1.12, 7.68]	*0.03*
3	3.05 [1.15, 8.12]	*0.03*
4	1.22 [0.40, 3.74]	*0.73*
5 (least deprived)	1 [Ref]	
p-value	0.002	
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.45 [0.99, 2.10]	*0.05*
Intensive	5.63 [3.22, 9.87]	*<0.001*
p-value	<0.001	
p-value for model		*<0.001*
c-index for model		0.67 [0.63, 0.72]
NHS Highland		
Smoking		
No	1 [Ref]	
Yes	1.77 [0.98, 3.20]	*0.06*
Missing	1.77 [1.12, 2.82]	*0.02*
p-value	0.02	
HPI at 6-8 weeks		
Core	1 [Ref]	
Additional	1.02 [0.65, 1.61]	*0.92*
Intensive	4.06 [1.52, 10.87]	*0.005*
p-value	0.02	
p-value for model		*<0.001*
c-index for model		0.58 [0.52, 0.64]
NHS GGC		
Local SIMD		
1 (most deprived)	2.43 [1.52, 3.89]	*<0.001*
2	1.78 [1.10, 2.90]	*0.02*
3	1.45 [0.87, 2.40]	*0.15*
4	1.21 [0.71, 2.06]	*0.49*
5 (least deprived)	1 [Ref]	
p-value	<0.001	

Infant feeding			
Breast	1 [Ref]		
Mixed	0.62 [0.40, 0.97]		*0.04*
Bottle	1.00 [0.77, 1.30]		*0.97*
p-value	0.07		
HPI at 6-8 weeks			
Core	1 [Ref]		
Additional	1.34 [1.06, 1.70]		*0.01*
Intensive	3.86 [2.83, 5.26]		*<0.001*
p-value	<0.001		
	p-value for model		*<0.001*
	c-index for model		0.65 [0.62, 0.68]
NHS Lanarkshire			
HPI at 6-8 weeks			
Core	1 [Ref]		
Additional	1.54 [1.10, 2.17]		*0.01*
Intensive	5.16 [1.78, 14.95]		*0.003*
p-value	0.001		
	p-value for model		*<0.001*
	c-index for model		0.56 [0.51, 0.61]