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Implementation of the Chronic Care Model for Diabetes Type 2 in Indonesia

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Abstract

Background and aim

Diabetes type 2 is a major public health concern worldwide. The increasing prevalence of diabetes globally requires countries to develop effective and accessible health care systems built around a strong primary care providing generalist care that is comprehensive and person-centred. The Chronic Care Model (CCM) is a well-known framework that originated in the United States of America (USA) and provides a framework for such care for people with diabetes and other long-term conditions (LTCs). Indonesia has recently implemented a universal health coverage scheme that provides a diabetes management model called *Prolanis*. Its elements are similar to that of the CCM (though no formal reference to the model has been documented) and very few studies have evaluated its implementation.

The PhD thesis aims to assess the appropriateness of the current model of diabetes care implemented in Indonesia with the CCM as a model of reference. In order to fulfil the aim of this thesis, the following objectives and research questions were formulated:

1. Systematic Review of primary care diabetes management models related to the CCM and applied in Southeast Asia
    a. What types of disease management models for diabetes have been tested or implemented in Southeast Asian countries?
    b. How are disease management models for diabetes implemented in Southeast Asian countries?
    c. How effective are disease management models for diabetes in Southeast Asian countries?
2. Determine the characteristics of the diabetes population in Indonesia
    a. what are the characteristics of individuals with and without diabetes?
    b. What are the characteristics of individuals with diabetes only and individuals with diabetes and comorbidities?
    c. What is the prevalence of diagnosed physical and mental comorbidities in individuals with diabetes?
    d. What is the relationship between diabetes and health care utilisation?

3. Explore the experiences of primary care doctors and patients in the implementation of Indonesia's diabetes management model, *Prolanis*
    a. How is *Prolanis* implemented in different primary care settings in Indonesia?
    b. What are the factors influencing the implementation of *Prolanis?*
    c. What are the perceived effects of implementing *Prolanis* in diabetes care provision?
4. Using the CCM as a reference model, how does the use of *Prolanis* in Indonesia address diabetes management, and how appropriate is it for the Indonesian diabetes population?

Methods

This thesis comprises of three studies, utilising multiple methods to answer the research aim: a systematic review on diabetes management models implemented in Southeast Asia; and epidemiological study of the population of people with diabetes in Indonesia; and a qualitative study exploring the experiences of primary care doctors and diabetes patients on Indonesia's diabetes management model.

The systematic review was conducted according to the PRISMA guideline. Eligibility screening was conducted on publications gathered from five databases (Medline, Embase, PsycInfo, CINAHL, and Web of Science). The epidemiological study used publicly available data from the Indonesian Family Life Survey wave 5 (IFLS 5). Analysis included multi-stage binary logistic regression analysis. The qualitative study involved in-depth semi-structures interviews with primary care doctors and patients with diabetes regarding their experience with *Prolanis*. Interviews were recorded and transcribed verbatim and thematic analysis carried out.

Key results

The systematic review identified a total of 18 studies, with 15 models of diabetes management studies from Indonesia, Malaysia, Singapore, the Philippines, and Thailand. Only five studies had a control group. Out of these five, only two were RCTs. The findings indicated that the CCM is not widely acknowledged, implemented,

or studied in Southeast Asia. Most models of diabetes management in Southeast Asia emphasised self-management support and the involvement of communities. Most studies reported favourable clinical and non-clinical outcomes and several qualitative studies reported improvements in patient's satisfaction, confidence, and ability to manage their diabetes after implementation of new models of diabetes care. However, quality appraisal concluded that the included studies were of low to moderate quality.

Secondary analysis of the IFLS 5 data was conducted on total of 31,866 participants; of these 31,089 participants did not have diagnosed diabetes (97.5%) and 777 (2.5%) had diagnosed type 2 diabetes. The findings revealed that the majority of people with diabetes in Indonesia have at least one comorbidity, mainly hypertension and high cholesterol. Further analysis showed that having diabetes was a strong predictor health care utilisation, however having one or more comorbidities did not reveal an increase of likelihood of health care utilisation compared to those with diabetes only. Health insurance was a stronger predictor of health care utilisation in the diabetes population.

A total of 18 primary care doctors and 18 patients were interviewed in the qualitative study. Analysis revealed that the implementation of *Prolanis* differed substantially between primary care practices. Implementation was greatly influenced by the practice setting and the social context of their patients. Group sessions and the involvement of communities in the delivery of care was seen as the highlight of successful *Prolanis* implementation. However, several issues were reported including lack of practice resources, fragmented care between primary and secondary care, and the lack of authority of primary care on comorbidities.

Conclusion

This thesis has highlighted a number of issues regarding the implementation of the CCM in diabetes management specifically in Indonesian primary care. The findings suggest that the variation of Indonesia's primary care practices and social contexts contributed greatly to the different ways in which *Prolanis* was implemented. Different from other evidence from Southeast Asian countries however, *Prolanis* has

been implemented into routine care, making the continuation of the programme more promising. The prevalence of comorbidities in people with diabetes, as well as other LTCs other than diabetes in Indonesia’s population in general, warrants the consideration of the expansion of *Prolanis* beyond diabetes care. The development of a high-quality primary care system with fully trained generalist doctors working in an integrated multidisciplinary team is essential to provide care that is comprehensive and person-centred.

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Author’s Declaration

I declare that I am the sole author of this thesis and was responsible for leading all aspects of this research, under supervision of Dr Barbara Nicholl, Professor Stewart Mercer, and Dr Sara Macdonald. A number of colleagues collaborated at various stages, and they are formally acknowledged below.

Systematic review

The search strategy for the systematic review was formulated after discussion with Paul Cannon, the college librarian for MVLS, University of Glasgow Library. I acted as first reviewer during all stages of the review, including eligibility screening, data extraction, quality appraisal and analysis. Dr Barbara Nicholl and Professor Stewart Mercer acted as second reviewers for eligibility screening, data extraction, and quality appraisal and supported my rationales in approaching analysis.

Epidemiology study

This study used secondary data from IFLS 5, by the RAND corporation which is publicly attainable online after registration. I performed data cleaning and all descriptive analysis and the logistic regression modelling. Dr Romi Hartarto assisted me with aspects of navigating the IFLS 5 data and the use of STATA software. Dr Barbara Nicholl supported me in the strategies of analysis using STATA software.

Qualitative study

Recruitment of doctor participants was supported by the administrative staff of the Department of Community and Family Medicine, Faculty of Medicine, Nursing, and Public Health, Universitas Gadjah Mada. Dr Rida Rizki Amalia and Dr Kirana Dyah Maharddhika transcribed the interviews. A professional translator was used to translate three doctor and three patient interviews for initial coding. I conducted initial coding with Professor Stewart Mercer and Professor Sara MacDonald. I coded and analysed the remaining transcripts and translated sections in writing that are relevant to present in this thesis, with the supervision of my supervisors.

Abbreviations / Definitions

Askes	-	Asuransi Kesehatan / public health insurance for government workers in Indonesia
BMI	-	Body Mass Index
BPJS-K	-	*Badan Pelaksana Jaminan Sosial Kesehatan* / Social Security Agency for Health in Indonesia
CAI	-	Computer Assisted Instruction
CASP	-	Critical Appraisal Skills Programme
CBIA -DM	-	Community-based interactive approach for diabetes mellitus
CCM	-	Chronic Care Model
DALY	-	Disability Adjusted Life Year
DSME/S	-	Diabetes self-management education and support
FPG	-	Fasting plasma glucose
GP	-	General Practitioner
IFLS	-	Indonesia Family Life Survey
JKN	-	*Jaminan Kesehatan Nasional* / Indonesia's national health insurance scheme
KAP	-	Knowledge, Attitude and Perception
LTC	-	Long-term condition
NP	-	Nurse practitioner
NR	-	Not reported
N/A	-	Not applicable
OR	-	Odds Ratio
PACIC	-	Patients' Assessment of Chronic Illness Care
Puskesmas	-	*Pusat Kesehatan Masyarakat* / Government-run community health centres in Indonesia
QoL	-	Quality of Life
RCT	-	Randomised Controlled Trial
SD	-	Standard Deviation
SMA	-	Shared Medical Appointment
UHC	-	Universal Health Care

USA - United States of America

WHO - World Health Organisation

95% CI - 95% Confidence Interval

Chapter 1 – Introduction

1.1. Overview

This PhD thesis sought to understand the current management of diabetes mellitus type 2 in primary care in Indonesia, and to provide suggestions for future service improvement. It achieved this through several studies that will be presented in this thesis individually, then discussed together in the final chapter.

This chapter provides an introduction towards the PhD thesis. It will first introduce diabetes as a complex disease and major public health concern, its approach to management, and the use of disease care models in diabetes management in primary care. It will then move on to the Indonesian context, the setting in which this PhD thesis focuses on, and introduce Indonesia's health system, the problem of diabetes in Indonesia, and Indonesia's diabetes management model: *Prolanis*. This chapter will end in the acknowledgement of a gap of knowledge that will be addressed as the basis of this thesis.

1.2. Diabetes

Diabetes is major public health concern worldwide. Within the last few decades, the prevalence of diabetes has increased significantly, affecting essentially all regions of the world, both developed and developing nations (Guariguata et al., 2014). The estimated prevalence of diabetes worldwide was 9.3% (463 million people) in 2019, and projected to rise to 10.9% (700 million) by 2045 (Saeedi et al., 2019). This is in part related to the increase of the aging population, economic development, and associated transitions in culture and unhealthy lifestyles (Zheng et al., 2018, Zimmet et al., 2014). Diabetes is a chronic, and incurable disease. It is extremely common for people with diabetes to have other long-term conditions (LTCs) as comorbidities (Iglay et al., 2016). These LTCs may emerge as a complication of diabetes itself, or as a separate condition not directly related to the pathophysiology of diabetes, thus it may occur before or after the clinical diagnosis of diabetes. With the increase of prevalence of diabetes, together with their resulting complications and/or comorbidities, it poses a prominent burden for health systems around the world (Gilmer et al., 2005).

1.2.1. Pathophysiology and mechanisms of diabetes

The World Health Organisation (WHO) (2020) defines diabetes as a group of metabolic disorders characterised by the presence of elevated blood glucose levels (hyperglycaemia) due to defects in insulin secretion, insulin action, or both. There are two main forms of diabetes: diabetes type 1 and diabetes type 2. Diabetes type 1 is caused by the destruction of pancreatic β-cells, resulting in absolute deficiency of insulin (Gan et al., 2012). This type of diabetes requires insulin replacement therapy for survival. Its frequency is low, relative to diabetes type 2, and most commonly diagnosed clinically during childhood and adolescence (Menke et al., 2013, Diaz-Valencia et al., 2015). Diabetes type 2 is characterised by relative insulin deficiency to a dysfunction of pancreatic β-cells and insulin resistance in target tissues (Rodriguez-Saldana, 2019). They are usually diagnosed in adulthood and unlike diabetes type 1, people with diabetes type 2 initially do not require insulin replacement therapy and can be managed by oral hypoglycaemic agents. However, loss of pancreatic β-cells function still occur progressively, despite medication, which can lead to the requirement of exogenous insulin (DeFronzo et al., 2013).

There are many factors which contribute to the pathophysiological pathway of glucose intolerance in the development of diabetes type 2 (Rodriguez-Saldana, 2019). Insulin resistance in muscle/liver and β-cell failure represent the core abnormality which initiate the disease (DeFronzo et al., 2013). Individuals with a genetic predisposition to diabetes type 2 inherit genes that make their tissues resistant to insulin (Ahlqvist et al., 2011, Groop and Lyssenko, 2008). In the liver, insulin resistance is manifested by two conditions: 1) the over production of glucose during the basal or fasting state despite the high circulation of insulin, and 2) impaired suppression of hepatic glucose production by insulin following a meal (DeFronzo et al., 1989, Groop et al., 1989). In the muscle, insulin resistance is manifested by impaired glucose uptake after ingestion of carbohydrates, resulting in hyperglycaemia following meals (postprandial hyperglycaemia) (Groop et al., 1989, Pendergrass et al., 2007). These insulin-resistant states place stress on pancreatic β-cells to increase insulin secretion to counter insulin resistance. As long as these cells are able to sufficiently secrete insulin, glucose levels remain normal. However, with time these cells begin to fail, and postprandial blood glucose levels and subsequently fasting blood glucose levels begin to rise, leading to the diagnosis of diabetes type 2 (DeFronzo et al., 2013, Weyer et al., 2001). The diagnosis of diabetes type 2 is based on values of blood glucose or glycated haemoglobin (HbA1c). Diagnostic cut-off values according to the World Health Organisation (Organization, 2020), are presented in Table 1.1.

Table 1.1 Diagnostic criteria for diabetes type 2, adapted from WHO

Measurement	**Diagnostic cut-off value**
Fasting venous or capillary blood glucose	≥7.0 mmol/L (126 mg/dL)
2-hout post-load venous blood glucose	≥11.1 mmol/L (200 mg/dL)
2-hour post-load capillary blood glucose	≥12.2 mmol/L (220mg/dL)
Random blood glucose	≥11.1 mmol/L (200 mg/dL)
HbA1c	6.5% (48 mmol/mol)

The diabetes epidemic relates particularly to diabetes type 2. Diabetes type 1 is genetically predisposed, associated with islet cell autoimmunity. Although diabetes type 2 does have genetic predispositions, which makes individuals susceptible to the disease, it is more commonly associated with its prime risk factors; obesity, and physical inactivity (DeFronzo et al., 2013, Chan et al., 1994, Patterson et al., 2018, Henson et al., 2016). These conditions increase insulin resistant states that contribute to placing even more stress on pancreatic ß-cells to secrete insulin (Defronzo et al., 1978, DeFronzo et al., 2013). Other modifiable risk factors include high cholesterol and smoking. High cholesterol level, mainly triglycerides, play an important role in the development of diabetes type 2 through changes in adipocyte metabolism which induce insulin resistance and impair ß-cell function (Bays et al., 2008). Smoking is strongly associated with both increased incidence and severity of diabetes type 2 (Willi et al., 2007). It contributes to the development of diabetes by insulin resistance as well as decreased insulin secretion due to pancreatic ß-cell damage by inflammatory and oxidative pathway mechanisms (Xie et al., 2009). These risk factors do not only contribute to the development of diabetes type 2. Once diabetes has been apparent, they continue to pose risk for future complications. This thesis focuses on diabetes type 2, and from this point forward will be referred to as diabetes.

1.2.2. Diabetes complications, comorbidities, and impact on health care

Diabetes poses great burden on health care, as many complications may occur if it is uncontrolled (Dall et al., 2010). These complications may arise as acute or chronic complications. Acute complications are known as diabetic emergencies, where either abnormally high or low levels of blood glucose can lead to life threatening conditions (Umpierrez and Korytkowski, 2016). Diabetic ketoacidosis and hyperglycaemic hyperosmolar states, two conditions that are characterised by uncontrolled hyperglycaemia may be induced by infections, intercurrent illnesses, psychological stress, and non-compliance with therapy. On the other end of the spectrum, hypoglycaemia, a condition of abnormally low blood glucose level, can be caused by loss of autonomic function of blood glucose control, or a side effect of therapy. These diabetic emergencies are associated with substantial morbidity and mortality (Kitabchi et al., 2009, Pasquel and Umpierrez, 2014, McCoy et al., 2012).

Chronic complications in diabetes occur as the disease progresses. They begin to develop even from the pre-diabetes state, then increase in prevalence as duration of diabetes increases, especially if blood glucose levels are not adequately controlled (Stratton et al., 2000, Tabák et al., 2009). Persistent exposure of tissues to high levels of glucose can lead to endothelial dysfunction of blood vessels, both in small (microvascular) and large (macrovascular) vessels (Fowler, 2008, Yan, 2014). Microvascular damage will further lead to tissue and organ damage, most commonly the kidneys (nephropathy), the eyes (retinopathy), and nerves of both peripheral (peripheral neuropathy) and central nervous system (autonomic neuropathy). Damage on the macrovascular level can lead to cardiovascular complications such as atherosclerosis, cardiomyopathy, myocardial infarction, and stroke (Shah and Brownlee, 2016, Yan, 2014, Fowler, 2008). These complications may be further accelerated with the presence of other factors, mainly hypertension, dyslipidaemia, and smoking (Adler et al., 2000, Adler et al., 2002).

Since chronic complications develop even before diabetes is apparent, it is common to detect complications even when a diagnosis of diabetes has only just been made. Neuropathy, retinopathy, microalbuminuria, and chronic heart disease are amongst some of the complications found at diagnosis (Spijkerman et al., 2003, Partanen et al., 1995, Martin et al., 2007). Developments in early diagnosis, and improved management of diabetes and its cardiovascular risk factors have decreased the incidence of these complications, especially in developed nations (Charlton et al., 2008, Gregg et al., 2016, Nathan, 2015). However, as people with diabetes now live longer, prevalence of complications such as chronic kidney disease and end-stage renal disease have been shown to be persistently high, particularly among older adults (Gregg et al., 2014, Gregg et al., 2016).

Aside from complications that directly arise from uncontrolled diabetes, several indirectly related health conditions may arise in people with diabetes, resulting in multimorbidity. Multimorbidity refers to the presence of two or more LTCs without an index disease, meanwhile comorbidity refers to the presence of an index disease with one or more LTC (van den Akker et al., 1996). In this thesis, diabetes is considered the index disease, therefore any other LTC present will be referred to as comorbidity. These include infectious diseases, and other LTCs such as musculoskeletal complaints, mental health problems, and cancers (Struijs et al., 2006, Roy and Lloyd, 2012, Merashli et al., 2015). Several aspects of immunity are altered in people with diabetes, and hyperglycaemic conditions are thought to increase the virulence of some pathogens (Casqueiro et al., 2012, Joshi et al., 1999). Urinary tract infection and pulmonary tuberculosis are two of the prominent infections to occur more frequently in people with diabetes (Pizzol et al., 2016, Hoepelman et al., 2003). Musculoskeletal complaints such as joint pains and fibromyalgia are also commonly found in people with diabetes (Yanmaz et al., 2012, Merashli et al., 2015). These complaints may not be life threatening, however, it can lead to significant pain and disability that is frequently unreported, thus inadequately treated (Merashli et al., 2015, Daousi et al., 2004). Mental health problems such as depression are more prevalent in people with diabetes compared to those without (Roy and Lloyd, 2012). The physiological changes that occur with diabetes, as well as the psychosocial burden of managing the disease, are considered to play a part in the concurrence of depressive symptoms and diabetes (Mezuk et al., 2008, Renn et al., 2011). Meanwhile, cancer is closely linked with diabetes as these two diseases share many risk factors, including ageing, smoking, and unhealthy lifestyle (Giovannucci et al., 2010, Patterson et al., 2018).

Comorbidities are frequently found in people with diabetes. They hold negative effects on mental health, quality of life, and increase frequency of health care visits (Salisbury et al., 2011, Fortin et al., 2004, Spangenberg et al., 2011). This leads to an increased burden of diabetes on health care costs (Williams et al., 2012, Pagano et al., 2016, Fisher et al., 2016, Alva et al., 2015). People with diabetes have a significantly higher health care expenditure in their lifetime than those without diabetes (Zhuo et al., 2014). The largest component of this cost is hospitalisations, followed by outpatient costs, with many direct costs associated with long-term complications (Ng et al., 2014, Alva et al., 2015, Pagano et al., 2016).

Living with diabetes means living with the daily routine of medications, adjustment of lifestyles, and monitoring possible complications. It demands a high commitment of life-long self-care from affected individuals in order to protect themselves from deterioration of health, and maintain a good quality of life. The intangible costs of pain, anxiety, and reduced quality of life from living with diabetes are difficult to quantify, and are often overlooked (Berry et al., 2015). Living with other LTCs (co-morbidities) adds to this burden. The presence of comorbidities has been found to have the largest impact on health-related quality of life, aside from social and environmental factors (Maddigan et al., 2006). The psychosocial challenges related to diabetes and its comorbidities, such as depression, anxiety, and disease-related distress are common (Tanenbaum et al., 2016, Bruno et al., 2019). These challenges shift the mindset of diabetes management from a single disease approach to a more integrated and holistic approach.

1.2.3. Diabetes management

The goal of diabetes management is to control blood glucose levels, prevent micro and macrovascular complications, and detect and manage early complications. This includes the use of various medications that aim to lower blood glucose, blood pressure, blood lipids, and medications that manage other cardiovascular risks (Home et al., 2008). This complex treatment regimen becomes a burden on the patient, as the patient is tasked with a myriad of self-care activities to maintain their health (Eton et al., 2012). Adding to this complexity is the commonly found comorbidity in people with diabetes (Struijs et al., 2006, Salisbury et al., 2011, Gruneir et al., 2016). Therefore, it often leads to psychosocial challenges for the patient (Stuckey et al., 2014). This burden is an important issue to address, as it can lead to a decrease of adherence with treatments and self-care (Vijan et al., 2005, Haynes et al., 2002).

The management approach of diabetes goes beyond pharmacological interventions, encouraging the patient to hold the most important role in the management of their condition. It should address various aspects of the patient's life, their biological, psychological, and social situations, aiming not only for improvements in their clinical markers, but also their overall quality of life (Brown et al., 2002). While doctors and health care professionals are experts in the disease and its care, it is ultimately the patients themselves that will manage their disease, incorporating it into their daily lives (Bodenheimer et al., 2002a). Traditional models of health care designed to address patients with acute conditions, with a disease-oriented approach would not be able to provide this. Primary care is the ideal setting in which to manage the bulk of people with diabetes, with its distinct attribute of person-centredness.

Person-centred care incorporates the patient's illness experience, their psychosocial context, and shared decision making between the practitioner and the patient (Stewart et al., 2013). Evidence of the success of a more patient-centred approach to care have been seen. A systematic review by Van Dam et al. concluded that care programmes that directly enhance patient participation, such as assistant-guided patient preparation for patient-provider encounters, patient empowering group education, group consultations, or automated telephone management with nurse support, were able to improve determinants of patient health behaviour, enhance self-management, and improve care outcomes (van Dam et al., 2003).

1.2.4. The Chronic Care model for diabetes

With its complex management, diabetes, as with other LTCs, is commonly managed via disease care models. The Chronic Care Model (CCM) by Wagner was developed in the United States of America as a response to the growing need for improvement in primary care to provide effective LTC care (Wagner et al., 1996a). The model derives from the notion that LTC care takes place within three overlapping galaxies: 1) the community, 2) the health care system, and 3) the provider organisation (Bodenheimer et al., 2002b). It is within this universe of care that the CCM identifies six essential elements: 1) community resources and policies, 2) health care organisation, 3) self-management support, 4), delivery system design, 5) decision support, and 6) clinical information systems. Improvements within these six elements are expected to produce productive interactions between prepared, proactive practice teams and informed, activated patients in order to improve clinical outcomes.

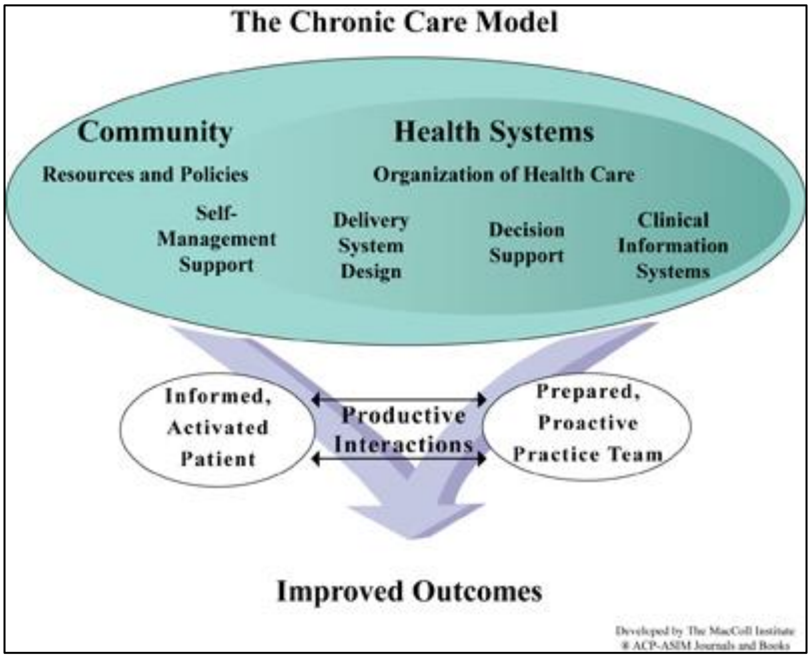

Figure 1.1. The Chronic Care Model from The MacColl Center for Health Care Innovation Source: (http://www.improvingchroniccare.org/index.php?p=Graphics&s=164)

The elements of CCM are not a precise method of health care delivery to be implemented exactly by health providers, rather a set of elements that guide the development of effective chronic care within their own contexts (Bodenheimer et al., 2002b). The element of community resources and policies describes an element of incorporating the community in the delivery of care. This can be in the form of exercise programs, senior centres, and self-help groups. Health care organisation addresses the need for reform in the provider's organisation where its structure, goals, values, and its relationships with stakeholders reflect its view in making LTC care a priority. Self-management support, an important element of LTC management, involves providers and patients working collaboratively in equipping patients and their families with the skills and confidence to manage their illness (Bodenheimer et al., 2002a). The element of delivery system design emphasises on the restructuring of the practice, where there is a clear division of acute care from the planned management of LTC care. This division often includes the formation of interprofessional practice teams to ensure appropriate care and follow up for LTCs (Grumbach and Bodenheimer, 2004). Decision support ensures evidence-based clinical practice through activities such as reinforcement of guidelines, specialist consultation without always needing a full referral. Meanwhile, clinical information systems through computerised information act as registries for patients, reminder systems, and feedback to clinicians on patient's progress. It is with a clear system in place that organisation and continuity of patient's care can be achieved.

CCM has been used extensively in the management of diabetes. A systematic review of diabetes management using CCM in USA's primary care settings revealed that organisational leaders initiated reorganisations at the system level, which has improved coordination of care (Stellefson et al., 2013). The use of registries and electronic medical records facilitated the establishment of patient-centred goals, the monitoring of patient progress, and used to identify gaps in care. Primary care physicians were trained to deliver care that is evidence based, and the provision of self-management education improved patient outcomes. This review also showed that implementation of CCM varies between settings. Not all studies addressed all six elements in its care. For example, community resources and policies were described in only seven of the 16 studies included in the review.

The six elements of CCM are interdependent, and build upon one another (Bodenheimer et al., 2002b). However, implementations of the model have seldom incorporated all of the elements. A more recent systematic review by Baptista et al in 2016 highlighted the variation in implementation (Baptista et al., 2016). The review further revealed that evidence of effectiveness varies between studies. Only half of the studies included showed significant improvements in clinical outcome such as HbA1c, blood pressure, and BMI, suggesting that greater benefits of CCM in diabetes management could be obtained through combining all six elements. However, no evidence has been established on whether any individual element is superior than the other, or whether one combination of elements has greater effects than other combinations. This seems to reflect on the nature of CCM, where all six elements are complementary with one another. Therefore, to reach the ultimate goal to achieve informed activated patients, working together with a prepared proactive practice team, all of the elements would need to be implemented. Although evidence of the use of CCM in diabetes management is available with a variety of implementation strategies and outcomes, these have been conducted in developed countries, mainly the USA and Europe.

Adaptations to the CCM have been made in several countries to develop distinct models of care, or for implementation of one or several components of the CCM into clinical practice. Two examples of established models based on the CCM are the House of Care model from NHS England, originally for people with diabetes and further developed to include people with multiple LTCs (Coulter et al., 2013), and the FildCare model from the Philippines for people with diabetes (Ku and Kegels, 2014b). The House of Care model includes all people with LTCs, not only those with single disease, and it provides an active role for patients to collaborate with healthcare professionals to create a personalised care plan for their condition. The model uses a whole-system approach in which care planning between the engaged and informed patient and committed healthcare professionals are carried out with the adjustments of organisational systems and processes, and involves community groups or services through local commissioning (Coulter et al., 2013). The FildCare model utilises community health workers in partnership with primary health care centres to monitor and improve diabetes care in the community (Ku and Kegels, 2014a). These two models are examples of how the CCM can be adapted into different contexts. The variability of its implementation provides the opportunity for different health systems to use CCM as a basis or guide to develop their own care model that suits the context of the people they serve. It is with this consideration that the CCM was chosen as the guiding model for the exploration of diabetes management in Indonesian primary care in this thesis.

1.3. Indonesian context

Indonesia consists of five main islands and hundreds of smaller islands within its territory. Figure 1.1 shows the map of Indonesia and its provinces. With over 250 million inhabitants across the archipelago, the population consists of more than 100 different ethnic and racial groups (Statistik, 2016). Javanese is the most common ethnicity (41.71%), followed by Sundanese, Malay, and Batak (Pitoyo and Triwahyudi, 2017). Although not a Muslim country, Muslims make up the majority of the population in terms of religious belief, followed by Christians (Catholic and Protestant), Hindus, Buddhists, and Confucianists. For administrative purposes, the country is divided into 34 provinces, with each province consisting of regencies and cities. The implementation of a decentralization law in 1999 resulted in local governments holding a greater role in the administration of their areas, including health care (Pudjirahardjo and Sopacua, 2006). This is to ensure a more effective and efficient administration of provinces, regencies, and cities. However, several issues remain centralized to the national government such as foreign policy, defence, and monetary policy. In regard to health care, prior to the implementation of a universal health coverage (UHC) scheme in 2014, local governments issued health benefits for the poor within their jurisdiction that were not covered by the national government.

Figure 1.2. Map of Indonesia. Source: Indonesia Demographic and Health Survey 2012

1.3.1. Indonesia's health system

Indonesia's health sector historically originated as a non-profit private sector during the Dutch colonial period (Agustina et al., 2019). After its independence in 1945, the Indonesian government began to shift health care towards the public-based sector. However, in 1965, as a new political power of the New Order came to power, the country focused on development through market-oriented economic growth. The country concentrated only on the welfare of its government workers, military personnel, and workers in the formal sector (full employment status), as they were considered integral to the development of the economy. Thus, public health insurance was limited to government workers through *Asuransi Kesehatan/Askes*, military personnel through *Asuransi Angkatan Bersenjata Republik Indonesia/Asabri*, and formal workers through *Jaminan Sosial Tenaga Kerja/Jamsostek*. Health care for the remaining population was left to the market through private insurance providers or out-of-pocket payment, with private health care services flourishing ever since it was permitted by the government in 1986 (Mahendradhata et al., 2017).

A political transformation in 1998 led to the decentralisation of the government in 1999 (Pudjirahardjo and Sopacua, 2006). This resulted in the reorganisation of the health system in which the Provincial Health Office and District Health Office are now authorised to formulate and implement policies regarding health development, health services, and health human resources within their area of jurisdiction (Mahendradhata et al., 2017). Regardless of this change, the government expanded its insurance scheme at the national level to target the poor through *Jaminan Kesehatan Masyarakat/Jamkesmas*, in 2008 (Pisani et al., 2017, Sparrow et al., 2013). Meanwhile, local governments also developed and implemented their own schemes in the form of poverty-targeted social health insurance, *Jaminan Kesehatan Daerah/Jamkesda* for those not included in the *Jamkesmas* scheme (Pisani et al., 2017).

In 2004, a National Social Security Law, *Sistem Jaminan Sosial Nasional/SJSN* was established (Arifianto, 2004a). This included a plan for universal health coverage that was finally implemented through the scheme *Jaminan Kesehatan Nasional/JKN* in 2014. With this scheme, all prior public insurance schemes merged into one single Social Security Agency for Health, *Badan Pelaksana Jaminan Sosial Kesehatan/BPJS-K* that delivers the national health insurance programme (Mboi, 2015). While the population previously insured through their respective public schemes were automatically transferred to the JKN scheme, the remaining population needed to enrol individually into the scheme and individually pay for their premiums. Prior to the implementation of JKN, only 49.5% of the country's population were insured through various public schemes (Statistics Indonesia (Badan Pusat Statistik - BPS) et al., 2013). With its implementation in January 2014, the JKN scheme resulted in about 75.9% of the population insured in 2018 (Agustina et al., 2019). The remaining population without insurance would access healthcare through their own out-of-pocket payments. Government health facilities at all levels (primary, secondary, and tertiary care) automatically serve the population through the JKN scheme. Private healthcare facilities have the option to be contracted by BPJS-K to serve patients within the JKN scheme, or they can opt out of the scheme entirely and only serve patients in a private capacity. Private healthcare care facilities not contracted by BPJS-K still thrive alongside the JKN scheme, especially in urban settings in Indonesia. This is more likely due to people's preference for accessing hospitals and specialist care directly by paying out-of-pocket, rather than being required to follow the referral procedure in the JKN scheme.

1.3.2. Indonesia's primary care

Indonesia's primary care is defined as "*services that are provided by a non-specialist health-care worker and accessible on a first point of contact basis*" (Mahendradhata et al., 2017). Primary care facilities comprise of government-run community health centres (*Pusat Kesehatan Masyarakat / Puskesmas*) (55.8%), private clinics (13.7%), and individual doctor practices (22.9%) (Claramita et al., 2017). Prior to JKN, primary care in Indonesia was considered irrelevant (Sista, 2010). For those with insurance, secondary and tertiary care was accessible directly, without prior contact to primary care. With the implementation of JKN, primary care now holds an important role. Insurance holders must opt into any primary care facility within their area of residence that are in contract with BPJS-K. Access to secondary and tertiary care must now be through their respective primary care provider (Mahendradhata et al., 2017). Patients outside the JKN scheme, however can still access any type of healthcare directly with out-of-pocket payments.

Puskesmas is the first contact care for outpatients in the community. It is situated at the regency level and supports a wider network of primary care services that reach the village level. Established in 1968, *Puskesmas* were tasked to offer multiple health services including curative, rehabilitative, preventive, and promotive services delivered within its area of jurisdiction and through outreach programmes in the community (Mahendradhata et al., 2017). However, due to the flourishing private sector, especially in urban areas of Indonesia, the role of the *Puskesmas* has somewhat shifted to low-quality, cheap health care for poorer communities (Reich and Takemi, 2016). Meanwhile, private primary care consists of private clinics and individual doctor practices (Claramita et al., 2017). Most operate on an independent basis. To be able to serve patients under the JKN scheme, practices would collaborate with BPJS-K through renewable contracts (Mahendradhata et al., 2017).

All primary care facilities serve the population through the JKN scheme with a monthly capitation payment system from BPJS-K (Mahendradhata et al., 2017). *Capitation* payment is calculated on the number of registered patients within the facility regardless of the number and type of health service provided. This capitation is then adjusted based on the fulfilment of service commitments that is evaluated every three months in the form of Commitment Based Partnership (*Kerjasama Berbasis Komitmen* / KBK) (Kesehatan, 2017). Target indicators of this evaluation are: 1) patient contact rate of ≥150 per 1000 patients; 2) ratio of non-specialistic referrals of <5%; and 3) ratio of contact of *Prolanis* (programme for chronic disease management targeting diabetes and hypertension) patients of ≥50%. *Prolanis* is a programme dedicated for diabetes and hypertension where patients need to be enrolled into this model of care in order to receive its services. The contact ratio of *Prolanis* patients is calculated based on actual attendance of *Prolanis* patients out of total patients enrolled. Practices are encouraged to reach the targets of these indicators through capitation adjustments. Capitation will be paid in full (100%) when all three of these indicators are met, while payment will be reduced to 95%, 92.5%, and 90% when only two, one, or none of the indicators are met respectively. Figure 1.3. summarises the capitation adjustment based on the three-month evaluation process.

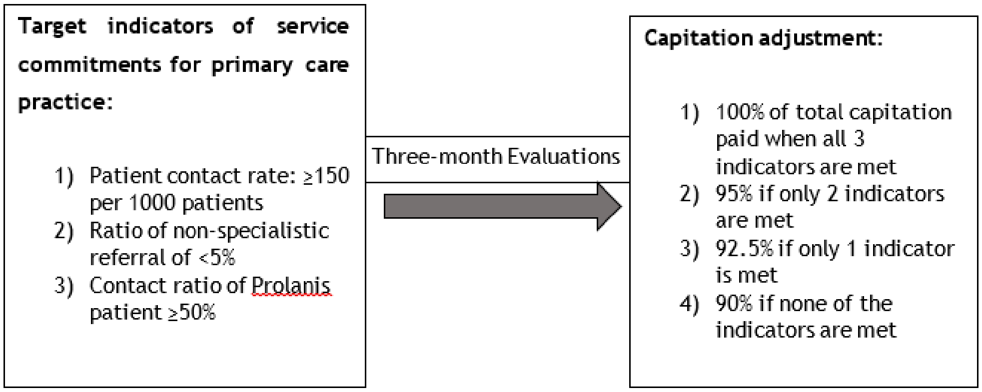

Figure 1.3. Summary of capitation adjustment for primary care practices based on service commitment evaluation

General practice is not yet a specialty in Indonesia, and doctors working in primary care are medical graduates, without additional training in the field of primary care (Claramita et al., 2011). Recently, further training in primary care has been introduced in the form of Family Medicine postgraduate courses and master's degree in Family Medicine offered by Universitas Gadjah Mada. A National Act in 2013 outlined the need to educate "primary care physicians" that will be equivalent to family medicine specialists, or general practitioners (GP) in other parts of the world. This resulted in the formation of an Indonesian National Board of Primary Care Physicians to formulate the standards and regulations in preparation of GP specialist training to be conducted in highly accredited medical faculties across the country (Claramita et al., 2017). While waiting for this specialist training to be established, Universitas Gadjah Mada have conducted postgraduate trainings in Family Medicine in affiliation with the District Health Office of the Special Region of Yogyakarta, Indonesia (Claramita et al., 2018). Although it was open for all practicing primary care doctors, the District Health Office specifically assigned primary care doctors employed in *Puskesmas* within their jurisdiction to attend the training.

1.3.3. Diabetes in Indonesia

Indonesia is no exception to the increased burden of diabetes. The Institute for Health Metrics and Evaluation (2017) revealed that diabetes has become one of the leading causes of Disability Adjusted Life Years (DALYs) in the country. From the year 2006 to 2016, the number of DALYs of diabetes increased by 54.9%, making it the third leading cause of DALYs in 2016. It was also the third leading cause of death in 2017, increasing by 50.1% from the year 2007, making it the third leading cause of death and disability combined. Being the fourth most populous country in the world with over 260 million people, Indonesia holds the number 7 rank in the top 10 countries for number of people with diabetes (20-79 years) in 2019, with 10.7 million people (Saeedi et al., 2019). This number is projected to increase to 16.6 million in 2045.

The International Diabetes Federation calculated Indonesia's diabetes prevalence (20-79 years) to be 6.2% in 2019 (Saeedi et al., 2019). The two countries with the highest numbers of people with diabetes are China with 12.4% in 2018 (Wang et al., 2021), and India with 8.9% in 2019 (Pradeepa and Mohan, 2021). This prevalence of diabetes in Indonesia (6.2%), compared to other populous low-middle income countries needs to be viewed with caution, as undiagnosed diabetes appears to be a prominent issue in Indonesia (Kemenkes, 2018). The Indonesian Ministry of Health, through its annual Basic Health Research presented two outlooks in calculating the prevalence of diabetes in the population of aged 15 and over (Kemenkes, 2018). One is the prevalence of doctor-diagnosed diabetes, and another as the prevalence of diabetes based on blood glucose examinations (using diagnosis cut-off from the American Diabetes Association and Indonesia's Endocrinologist Association). A difference was found between the two prevalences in this 2018 Basic Health Research Report. The prevalence of diabetes was found to be 2.0% (95% CI 2.0 to 2.1) when it has been diagnosed by a doctor. However, when blood glucose levels were measured during data collection, the prevalence increased to 10.9% (95% CI 10.5 to 11.2). This suggests that the majority of people with diabetes in Indonesia are not being diagnosed by health care professionals, which is highly likely to result in inadequate management and poor health outcomes.

Since the introduction of JKN, diabetes care has shifted from secondary care to primary care. Where previously the majority of the population paid out-of-pocket for health services, secondary care in hospitals, or specialists care was considered a better level of care compared to primary care (Mahendradhata et al., 2017). It is then unsurprising that the majority of diabetes patients received care from specialists in secondary care (Soewondo et al., 2010, Soewondo et al., 2013). Even when primary care was presented with diabetes patients, the role of the primary care doctor mainly focused on referring these patients to a higher level of care, whether to hospitals (Pranoto et al., 2015), or direct referral to specialists such as ophthalmologists (Adriono et al., 2011).

1.3.4. Indonesia's diabetes management model: Prolanis

The change in delivery of health care in Indonesia meant a significant shift of patients from secondary care to primary care. With JKN, Indonesia has implemented a diabetes and hypertension management model in primary care named *Prolanis* (Idris, 2014). Compared to similar industrialised countries such as China and India, Indonesia has accomplished a roll out of a nation-wide model of diabetes care, whereas reports in China and India have been mainly delivery of care models in project mode. These include The Chunampet Rural Diabetes Prevention Project implemented in rural parts of South India to provide comprehensive diabetes care and promote prevention of diabetes using telemedicine (Mohan et al., 2014); and a randomised controlled trial in Shanghai, China of an integrated intervention programme which included in-depth diabetes education, blood glucose monitoring, nutrition counselling, and meal plans (Sun et al., 2008). These studies resulted in favourable clinical outcomes such as improved HbA1c and blood pressure.

Indonesia's model of care was initially established for patients within *Askes* with the aim to reduce complications and referrals to secondary and tertiary care (Askes, 2012). However, no publicly available documentation is available on the development of the model, and the model was rolled over on to the JKN scheme under BPJS-K. Under Askes, the model was limited to patient registry and monthly consultation and medication. Under the new scheme, *Prolanis* has been expanded to include re-structuring of care delivery with Primary Care at the core. The model focuses heavily on diabetes patient registry, self-management support, community involvement through group activities, re-structuring of care delivery, and equipping primary care doctors with the appropriate skills to manage diabetes. Patients enrolled in Prolanis receive services such as monthly consultations, lab examinations, education sessions, group exercise, monthly medication prescription, home visits, and reminders via mobile text messaging (Kesehatan, 2014). Although no formal document explicitly mentions Wagner's Chronic Care Model in the development or publication of *Prolanis*, its components and emphasis mirror several components of the CCM. A summary of *Prolanis* Services based on the CCM can be viewed in Table 1.2. below.

Table 1.2. Prolanis services according to Wagner's Chronic Care Model

Element of the Chronic Care Model	Prolanis
Health care organisation	Part of primary care scoring system for contract renewal
Delivery system design	• Health consultation • Monthly prescriptions • Lab examination • Group education and exercises
Decision support	Training for doctors
Clinical information systems	Diabetes registry
Community resource and policies	Group education and exercises
Self-management support	

Implementing *Prolanis* does not bring direct financial benefit to primary care practices. Its financial benefit is seen in the form of reduced use of the capitation fund by the practices through a distinct medication procurement scheme. Medications for *Prolanis* patients are obtained from an affiliated pharmacy which they claim directly to BPJS-K, thus not reducing the capitation of the practice. Practices do not receive any additional funding for carrying out *Prolanis* unless they carry out two additional services: 1) lab examinations within the practice (not referring patients to an affiliated private lab); or; 2) formation of patient group/club for exercise and/or educations sessions. This additional payment is paid in the form of reimbursements for fees spent. The implementation of *Prolanis* is a pre-requisite for practices to be contracted by BPJS-K, as *Prolanis* attendance is one of the components of evaluation for capitation adjustment. Therefore even though there are no direct financial incentive, practices will still take part in implementing the programme.

While *Prolanis* attempts to provide a comprehensive management of diabetes in primary care,management of diabetes through a multidisciplinary primary care team is notextensively available. Screening such as eye examinations and feet examinations may be conducted in primary care, however there is no specific programme or guideline for those examinations. Referrals to secondary care are currently for diagnosis of an established complication, and not for screening purposes (Adriono et al., 2011).

Studies on *Prolanis* itself are limited, published studies are in Indonesian unaccredited journals, and some are in the form of undergraduate thesis or master's dissertation. BPJS-K claims that it carries out routine analysis or *Prolanis* patients' clinical outcomes, however these analyses are not publicly available. Published studies on *Prolanis* are small-scaled, poorly conducted, and focused only on one primary care setting (Ahmad et al., 2017, SARI, 2014, Purnamasari, 2017, Sitompul et al., 2016). Studies that were conducted during the early implementation of *Prolanis* reported that health professionals' understanding of the model was lacking, that there was no clear standard operating procedure to be used as guidance, and therefore not all practices implemented *Prolanis* in the same manner (Ramsar, 2017, Rosdiana et al., 2017, Sitompul et al., 2016). Evidence on whether *Prolanis* is being implemented as intended or meets the original aims is lacking.

1.4. Gap of knowledge

The evidence on the use of CCM in diabetes management have been mainly from developed countries. Evidence on its use in the context of a developing nation such Indonesia is severely lacking. Although Indonesia has its own diabetes management model, *Prolanis*, which contains elements of CCM, scientific evidence on its implementation is sparse. The absence of publicly available documentation on its development makes the development and use of a theory of change model for Prolanis unfeasible. Therefore, this PhD thesis was designed to address the gap of knowledge on the exploration of diabetes management in Indonesia, and how *Prolanis* is implemented in Indonesian primary care, its appropriateness to the population, and how it compares to Southeast Asian nations, using the CCM as a model of reference.

1.5. Chapter Summary

Diabetes is a major concern for health systems worldwide, including Indonesia. The complexity of diabetes drives the need for its management to be delivered in a comprehensive, and patient-centred manner. The use of diabetes management models, most notably those deriving from CCM have been implemented worldwide, although most published evidence has focused on developed countries. While the *Prolanis* model introduced in Indonesia has several components of the CCM model, robust evidence of its implementation was lacking when this thesis commenced. There was a need to examine how *Prolanis* was being implemented and whether it suited the contexts of Indonesia. Chapter 2 will outline the overall research aim of this thesis, together with the research questions that flow from this aim.

Chapter 2 – Aim and Objectives

2.1. Aim

This PhD thesis aimed to assess the appropriateness of the current model of diabetes care implemented in Indonesia, with the CCM as a model of reference.

2.2. Research Questions

In order to fulfil the aim of this thesis, the following objectives and research questions were formulated.

1. Systematic review of primary care diabetes management models related to the CCM and applied in Southeast Asia
    a. What types of disease management models for diabetes have been tested or implemented in Southeast Asian countries?
    b. How are disease management models for diabetes implemented in Southeast Asian countries?
    c. How effective are disease management models for diabetes in Southeast Asian countries?
2. Determine the characteristics of the diabetes population in Indonesia
    a. What are the characteristics of individuals with and without diabetes?
    b. What are the characteristics of individuals with diabetes only and individuals with diabetes and comorbidities?
    c. What is the prevalence of diagnosed physical and mental comorbidities in individuals with diabetes?
    d. What is the relationship between diabetes and health care utilisation?
3. Explore the experiences of primary care doctors and patients in the implementation of Indonesia's diabetes management model, *Prolanis*
    a. How is *Prolanis* implemented in different primary care settings in Indonesia?
    b. What are the factors influencing the implementation of *Prolanis?*
    c. What are the perceived effects of implementing *Prolanis* in diabetes care provision?

4. Using the CCM as a reference model, how does the use of *Prolanis* in Indonesia address diabetes management, and how appropriate is it for the Indonesian diabetes population?

Chapter 3 Chapter 3 – Methodology

3.1. Overview

This chapter addresses the research methodology considered and applied across the thesis. This thesis comprises of three studies, utilising multiple methods to answer the research aim: a systematic review on diabetes management models implemented in Southeast Asia, an epidemiological study of the population of people with diabetes in Indonesia, and a qualitative study exploring the experiences of primary care doctors and diabetes patients on Indonesia's diabetes management model.

Methodology refers to *"the rationale and the philosophical assumptions that underlie any natural, social or human science study"*, and method refers to the specific technique and procedure used to conduct the study that are determined by the methodology (McGregor and Murnane, 2010).Conducting a research study involves the consideration of three interconnecting components: philosophy; research design; and specific methods (Creswell and Creswell, 2017). This chapter will explain and discuss the philosophical foundation of this PhD thesis, which led to the selection of the most appropriate research design and research methods. Details of specific methods are given in the relevant chapters (systematic narrative review in Chapter 4, cross-sectional epidemiology study in Chapter 5, and qualitative in-depth interview in Chapter 6).

3.2. Methodological considerations

3.2.1. Philosophical Worldview

Creswell (Creswell and Creswell, 2017) highlighted four worldviews that are commonly held by researchers that lead to the application of quantitative, qualitative, or mixed method approaches. These are post-positivism, constructivism, transformative, and pragmatism. Post-positivism upholds a deterministic philosophy, whereby in order to understand the world, verification and testing of laws and theories are conducted. The researcher begins with a theory, then collects data using objective measurements and observation that will either support or refute the theory. The research design applied with a post-positivism lens is typically quantitative. On the other hand, constructivism seeks subjective meanings of experiences. These experiences are varied and multiple, which are dependent on social and historical contexts. Contrary to the post-positivism view, the constructivist inductively develops a theory or pattern of meaning from the data collected and adopts a qualitative approach.

While post-positivism and constructivism lead to two distinct approaches in research, quantitative and qualitative respectively, the transformative and pragmatic worldviews do not uphold one specific research approach. These two worldviews may apply a mixed-methods approach of both quantitative and qualitative positions to answer their inquiry. The difference between these two worldviews lies in the motivation of inquiry. The transformative worldview is motivated by a political agenda of social justice and human rights that focus on the needs of marginalised communities (Mertens, 2010). The issues of focus include empowerment, inequality, oppression, domination, suppression, and alienation. Meanwhile, pragmatism focuses on solutions to problems (Ormerod, 2006). It emphasises the research question and uses all relevant approaches to address and answer the question. Therefore, it leads to the application of multiple methods, different worldviews, and different assumptions with various forms of data collection and analysis.

3.2.2. Mixed method / Multiple method approach

Mixed method research is defined as "*the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study*" (Johnson and Onwuegbuzie, 2004). Without the restriction of a single approach to research, the mixed method approach utilises various methods to fully answer the research questions, especially when there are combinations of questions that need to be answered. The selection and application of both quantitative and qualitative methods must be carried out with careful consideration to justify their utility over a single method approach to answer the research question.

There are three core mixed methods designs: convergent; explanatory sequential; and exploratory sequential (Creswell and Creswell, 2017). These three designs differ in their approach to data collection, data analysis and integration, and interpretation. The convergent design collects quantitative and qualitative data in no particular order. The explanatory sequential design involves a sequence of data collection where quantitative data is first collected and analysed, for the findings to be used in the planning of the subsequent qualitative data collection. This design is used to have the qualitative findings explain further the results of the initial quantitative data collection. Meanwhile, the exploratory sequential design is the reverse of the explanatory sequential design. It starts with a qualitative data collection which is analysed and then used to build a quantitative instrument to be used in data collection. This design allows the quantitative data collecting instrument to be tailored to the individuals being studied. The integration of quantitative and qualitative components in both the explanatory and exploratory sequential designs may use a technique described as following a thread (Moran-Ellis et al., 2006).

A true mixed methods approach requires robust integration of findings from quantitative and qualitative data. Without such integration, the approach is called multi-method rather than mixed method, where the combination of any different methods contribute to the generation of conclusions (Hesse-Biber and Johnson, 2015). The integration of mixed methods findings can be achieved through several techniques such as triangulation, ‘following a thread’, and generating a mixed methods matrix (O’Cathain et al., 2010). In the process of triangulation, data are analysed separately, and then considerations are made on whether findings from each method confirm, complement, or contradict each other. ‘Following a thread’ refers to the technique of selecting questions or themes from one type of data and following it through another type of data. An example of this would be when findings from a qualitative interview generates a key theme, the researcher will then explore whether this theme can be followed through with findings from the quantitative data and aid in its interpretation. Meanwhile, the mixed methods matrix uses a matrix to directly compare quantitative and qualitative data collected from the same cases.

The use of a mixed methods approach is considered beneficial in supporting the evidence for the conclusion through the integration of both quantitative and qualitative findings (O’Cathain et al., 2010). Narration from qualitative data can be used to add context and meaning to numbers and statistical tests in quantitative analysis, while, numbers can be used to add precision to the context and story of the qualitative study (Johnson and Onwuegbuzie, 2004). However, it can be difficult to carry out a mixed methods approach due to time constraints and the need for a research team that has both quantitative and qualitative expertise.

This PhD thesis used a pragmatic lens to guide the choice of approach implemented. The research query started with a problem of diabetes management in primary care in Indonesia. As previously outlined in Chapter 1, primary care has only been recently given the role of diabetes management in Indonesia's new JKN scheme. There is little information on the development of the diabetes management programme, *Prolanis*, its appropriateness to Indonesia's population with diabetes, or how it is implemented. In order to address these issues, a single method of investigation was considered insufficient. Multiple approaches were deemed necessary to address the overall aim of the thesis, and a systematic review, an epidemiological study, and a qualitative study were planned. The multiple approaches used in this thesis do not follow a sequential manner, rather all studies are independent of one another and the results of each study are incorporated in the General Discussion Chapter (Chapter 7) to address the overall research aim. Findings from the multiple methods used are combined to allow conclusions to be drawn. The rationale of the use of different methods in the three studies in this thesis will be further elaborated in the next section.

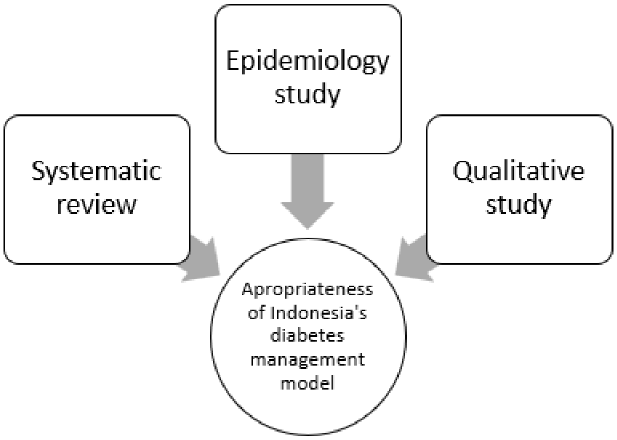

Figure 3.1. Approach used to answer the overall research aim

3.3. Systematic Review

The first study in this thesis was a systematic review of literature, to review diabetes management models in Southeast Asia. The review sought to identify, appraise, and synthesise empirical evidence to be compared with Indonesia's diabetes management model. The geographical region of Southeast Asia was used as a limit to provide contextual comparison with Indonesia. The similarities in health systems and cultural contexts between Southeast Asian nations and Indonesia will provide a more appropriate and relevant comparison. The objective of the systematic review was to identify the types of diabetes management models implemented in Southeast Asia, how they are implemented, and how effective they are. The breadth of this objective led to the option of a mixed method review.

A mixed methods systematic review combines studies from different research paradigms of both quantitative and qualitative to generate evidence. The inclusion of diverse types of research maximises the findings in order to inform policy and practice (Pearson et al., 2015). The conduct of a mixed methods systematic review can be based on three general frameworks: segregated, integrated, or contingent (Sandelowski et al., 2006). The segregated framework maintains a clear distinction between quantitative and qualitative evidence, conducting individual synthesis of each category of evidence before a final synthesis which combines the two. The integrated framework directly combines both forms of data to be synthesised into one single mixed methods synthesis. Meanwhile, the contingent framework involves two or more syntheses of the data in a sequential manner, using either integrated and/or segregated synthesis to generate a subsequent synthesis until the final result answers the objective of the review. The use of these frameworks depends on the studies found and the data being analysed. The specific methods used in this thesis are described in detail in Chapter 4.

3.4. Epidemiology of diabetes in Indonesia study

An epidemiological study was used to answer the second aim of the thesis: to determine the characteristics of the people with diabetes in Indonesia. Epidemiology is defined by Porta as "the study of the occurrence and distribution of health-related states or events in specified populations, including the study of the determinants influencing such states, and the application of this knowledge to control health problems" (Porta, 2014). The rationale for an epidemiology study in this thesis was to provide information on the distribution, determinants and frequency of diabetes along with its comorbidities in the Indonesian population, something that has not been conducted before. This information was used to discuss the landscape of the diabetes population in Indonesia, and to consider whether the current diabetes programme is appropriate.

There are two main types of epidemiological study, observational, and experimental (Bonita et al., 2006). An observational study measures various variables without any intervention from the investigator, which are then examined and presented in a descriptive and analytical manner. Meanwhile, experimental studies involve an intervention which aims to alter a determinant of disease such as an exposure or behaviour, or to change the progress of disease with treatment. The aim in this thesis was to undertake an observational epidemiological study to provide a descriptive and analytical analysis of the condition of the diabetes population in Indonesia.

The three most common types of observational epidemiology are cross-sectional, cohort, and case-control (Mann, 2003). Cross-sectional studies are used to measure the prevalence of disease, which is the number of cases within a population at a given point in time (Porta, 2014). Because cross-sectional data are gathered in only one point in time, differentiation between cause and effect cannot be determined. This type of observational study can be used to identify associations that can be further investigated through cohort or experimental studies. Cohort studies are used to determine incidence, causes, and prognosis. Incidence refers to the new number of cases within a population in a specified period of time (Porta, 2014). Data of events are gathered in chronological order, therefore can be used to distinguish between cause and effect. This is because cohorts measure potential causes before the occurrence of outcome. With data from cohort studies, risk factors can be analysed, and relative risk can be calculated. Meanwhile, case-control studies compare groups in a retrospective manner. A group of people with the outcome of interest are matched and compared with a control group which consists of people that do not have the outcome of interest. It seeks to identify possible predictors of outcome and is most suitable for rare diseases. Since data are collected retrospectively, predictors cannot be calculated in terms of relative risk, rather odds ratios.

Sources of data for epidemiological studies can be through primary or secondary data collection (Bonita et al., 2006). Primary data collection refers to data gathered directly by the researchers themselves to answer their research questions. Meanwhile, secondary data uses existing data that have already been gathered, usually by large government institutions or health care facilities to be analysed further according to the researchers' interest. The use of secondary data has become increasingly common in epidemiology and public health research. This is due to the widely increasing availability of data regarding health. Many countries routinely collect national health data that can be readily used by researchers to analyse outcomes of interests that will take up too many resources if conducted as primary research (Boslaugh, 2007). However, analysis of secondary data is limited to the data available, its completeness, and its quality. Therefore, utilisation of secondary data must acknowledge the process of primary data collection, its purpose, who collected them, the information collected, its time frame, its methodology, and its data management (Johnston, 2017).

For this study, data were first sought from the Ministry of Health of the Republic of Indonesia to obtain data from the routinely collected Basic Health Research (*Riskesdas*). However, the request for said data was denied, citing lack of novelty (letter of rejection in Appendix A). An appeal was sought via email to the Ministry which was not granted and no further communication was received from the Ministry. Therefore, this thesis used publicly attainable data instead from the Indonesian Family Life Survey (IFLS) by the RAND corporation, allowing a cross-sectional secondary data analysis of the diabetes population in Indonesia. Ensuring that the thesis could still deliver a comprehensive examination of the current epidemiology of diabetes in Indonesia. The specific research methods regarding this data and the analyses conducted are presented in detail in Chapter 5.

3.5. Qualitative study

The qualitative component of this thesis was conducted to address the third aim of the thesis: exploring the experiences of primary care doctors and patients in the implementation of Indonesia's diabetes management model, *Prolanis*. A qualitative study was conducted to provide a story on how *Prolanis* is being implemented, its perceived effects, and factors that influenced its implementation.

The use of qualitative methods is directed to provide an in-depth and interpreted understanding of research participants regarding their social circumstances, experiences, perspectives and histories (Ritchie et al., 2013). In order to achieve this, the methods used include: observation, focus groups, in-depth individual interviews, and analysis of documents and texts. Focus groups and in-depth interviews are two of the most common methods used in qualitative research. Focus groups rely on group discussion and dynamics to identify perceptions, thoughts, impressions of a select group of people regarding a specific topic of investigation (Kitzinger, 1995). With group processes, it helps people explore and clarify views which can deepen insights from the respondents' own circumstances (Ritchie et al., 2013). This is most useful in research where the group process will illuminate the research topic, providing an opportunity to explore how people think about the topic, how opinions emerge through conversation with others. In-depth interviews view the person being interviewed as an individual expert. Therefore, it enables people to talk in more detail about their personal feelings, opinions, and experiences to provide insight into how they interpret their world. This is most suitable for research that requires an understanding towards complex systems, processes, or experiences due to the depth of focus.

Sampling methods in qualitative studies vary greatly from quantitative studies. While quantitative studies use probability sampling, intended to be statistically representative, qualitative studies do not. The selection of sample in a qualitative study is conducted deliberately to reflect specific features within the sampled population (Ritchie et al., 2013). The main sampling approaches for qualitative studies include purposive sampling, theoretical sampling, and convenience sampling.

Purposive sampling refers to the selection of samples based on their particular characteristics that will enable detailed exploration and understanding of the topic being studied (Patton, 2007). These criteria are determined from the beginning of the study to yield the type of sample composition that suits the study's aim and coverage. Theoretical sampling is similar to purposive sampling but selects samples on the basis of their potential to contribute to the development and testing of theoretical constructs (Draucker et al., 2007). This is often conducted in an iterative manner, whereby the researcher selects an initial sample, analyses the data, and then selects further samples to refine theories or categories that have emerged from previous samples. Convenience sampling however does not refer to any clear sampling strategy and instead samples are chosen based on ease of access (Ritchie et al., 2013).

There is a diverse range of analytical approaches in qualitative studies including grounded theory, interpretative phenomenological analysis, narrative analysis, content analysis, and thematic analysis. Thematic analysis is seen as a foundational method for qualitative analysis (Braun and Clarke, 2006). It is a method to analyse and report patterns or themes within data. Themes capture important features of the data in relation to the research question that represent a patterned response or meaning within the whole data set. This can be done in two ways, inductive or theoretical thematic analysis. In inductive approaches, the themes are generated from the data themselves, while in theoretical approaches, themes are predetermined based on the researcher's theoretical interest.

This thesis attempts to answer the question of implementation of *Prolanis* in Indonesia using in-depth interviews with primary care doctors and patients. A maximum variation purposive sampling method was used to capture the variety of primary care practices in Indonesia, from the type of primary care practice, and urban rural settings. With maximum variation, a deliberate strategy was used to include samples which vary from one another (Ritchie et al., 2013). Interview data were analysed using inductive thematic analysis to provide a story on how doctors and patients experienced *Prolanis*. The specific research methods used for this study are presented in Chapter 6.

3.6. Chapter summary

Several methods were used to meet the overall aims of this thesis. These were chosen to provide an exploration of *Prolanis* implementation, its comparison to Southeast Asian nations, and its appropriateness for the diabetes population in Indonesia. The approaches used started with a systematic review of diabetes management programmes in Southeast Asia. This provided contextually relevant empirical evidence to be compared with and discussed in the context of Indonesia's *Prolanis*. The epidemiological approach used secondary analysis of health data to provide information on the characteristics of Indonesia's diabetes population. Meanwhile the qualitative study using in-depth interviews provided meaningful insight on the experiences of doctor and patients in the current implementation of *Prolanis*. The three following chapters will further describe the specific methods used in each study, along with its findings.

Chapter 4 – Diabetes Management Models in Southeast Asia: A Systematic Review

4.1. Overview

This chapter presents a systematic review of diabetes management models in Southeast Asia. There have been previous systematic reviews on the implementation of chronic disease management models in diabetes type 2 care, but these have focused on studies conducted in western countries, principally the USA, but also Europe, United Kingdom, and Australia. The lack of studies originating from Asia, and Southeast Asia specifically, begs the question on whether disease management models specific for diabetes type 2 have been tested or implemented in the region. Although the existing systematic reviews on chronic disease management models, and diabetes type 2 management models are useful as a foundation and comparison to the Indonesian context, this study sought to retrieve and analyse studies that have been specifically conducted in Southeast Asia, for a more appropriate and relevant comparison. There was not enough internationally published research in Indonesia to conduct a systematic review just in this country. The findings of this systematic review will be used as a source of discussion and reflection of Indonesia’s own attempt at implementing a disease management model for diabetes type 2. This systematic review was registered in Prospero (registration number CRD42017073967).

4.2. Aim and Research Questions

This study addresses the first aim of the PhD, which is to systematically review published evidence of disease management models for diabetes type 2 in Southeast Asia. The research questions being addressed are:

1. What type of disease management models for diabetes type 2 have been tested in Southeast Asia?
2. How are disease management models for diabetes type 2 implemented in Southeast Asia?

3. How effective are disease management models for diabetes type 2 in Southeast Asia?
4. What are the barriers and facilitators of the implementation of disease management models for diabetes type 2 in Southeast Asia?

4.3. Methods

The methodological considerations related to this systematic review are described in detail in chapter 3.

4.3.1. Identification of relevant studies

This systematic review followed a protocol of systematically selecting and reviewing studies according to the PRISMA guideline (Moher et al., 2015). Eligibility screening of studies through title, abstract, and full text were conducted from studies that have been gathered from five databases (Medline, Embase, PsycInfo, CINAHL, and Web of Science). Reference screening was also conducted for included studies to identify additional studies that may not have been obtained from the database search.

The search strategy used the following concept filters: 1) diabetes type 2; 2) primary care; and 3) disease management. Selected subject headings were combined with key words relating to the three main concept filters to create a search strategy for each database used for the search. The formulised search strategy was then reviewed and discussed by all three reviewers: Aghnaa Gayatri (AG), Dr Barbara Nicholl (BN), and Professor Stewart Mercer (SM). An additional review and discussion of the search strategy was carried out with the College of MVLS librarian to ensure thoroughness of the search. The complete search terms used for each database are presented in Appendix B.

The yielded results from the five databases used were exported into a bibliographical software EndNote for duplication detection (Bramer et al., 2016, Hupe, 2019). After de-duplication, the final reference list was exported into a systematic review assistance software, DistillerSR (2011) for additional de-duplication and selection of studies. Identification of studies from databases and de-duplication was conducted by one reviewer, AG.

4.3.2. Selection of studies

This review followed a systematic screening process of selecting studies from title, abstract, through to the full text. Inclusion and exclusion criteria were formulated to determine eligible studies to be reviewed. These criteria were chosen to aid the selection of studies that were directly relevant to the research aim and objectives, with specific criteria regarding the study design, population, intervention, and setting.

Only studies published in peer-reviewed journals and that examined the testing or implementation of a chronic disease management model for diabetes type 2 were included. Diabetes management interventions had to include elements of the CCM. These were defined as the organization of health care, self-management support, decision support, delivery system design, clinical information systems, and community resources and policies. Studies on drug trials or specific pharmacotherapy interventions for diabetes were excluded. Only studies addressing diabetes type 2 in the adult population were included, thus excluding studies on diabetes type 1, gestational diabetes, pre-diabetes or impaired fasting glucose states, studies in children or adolescent population, and studies that addressed chronic disease management not specifically conducted for diabetes type 2. Quantitative, qualitative, and mixed-method studies were included. Quantitative studies included randomized and non-randomized controlled trials of interventions on diabetes type 2 management in the primary care setting, either from the organizational and management of practice, service delivery, or direct intervention with patients. Studies using qualitative methods included studies involving primary or secondary analysis of qualitative data describing the implementation of a disease management model for diabetes type 2. Articles of descriptive case studies, literature or systematic reviews, meta-analysis, commentary or opinion studies with no research component were excluded. Systematic reviews were not included as they are considered as secondary sources. Any systematic reviews found were checked to ensure appropriate primary studies were included in the current review. Grey literature such as reports, working papers, government documents, evaluation were not included since these studies may have no research component, and/or not peer reviewed. Studies that examined the implementation of diabetes type 2 management models in secondary or tertiary care setting, or specialized diabetes clinics were also excluded. Studies were only included if published in English. A summary of the inclusion and exclusion criteria is presented in Table 4.1.

Table 4.1. Inclusion and exclusion criteria

Inclusion	Exclusion
• Peer-reviewed journals • CCM element: o Organization of health care o Self-management support o Decision support o Delivery system design o Clinical information systems o Community resources and policies • Diabetes type 2 • Primary care setting • Adult population • Original research • Conducted in Southeast Asia • Quantitative studies • Qualitative studies • Mixed-methods studies • English language • Full text available	• Drug trials or specific pharmacotherapy interventions • Diabetes type 1 • Children or adolescent population • Gestational diabetes • Pre-diabetes or impaired fasting glucose states • Conference proceedings • Editorials • Research protocols • Descriptive case studies • Literature or systematic reviews • Commentary or opinion studies • Secondary or tertiary care setting • Specialised diabetes clinics • Not English language • Full text unavailable

Screening of included studies in this review follows the PRISMA guideline, applying title, abstract, and full text screening. An additional country screening was applied after abstract screening and before full text screening for practical reasons to allow a more efficient full text screening process. All screening of studies was carried out using the systematic review software, DistillerSR. References were first selected based on title by AG. A form consisting of selection questions were then applied to screen the abstracts, this was carried out by two reviewers, AG and BN or SM. Any conflicts that arose at this stage resulted in the conflicted studies being included in the next stage of screening. After abstract screening, country screening was done by one reviewer, AG. This process looked at the full text of studies and screened for studies that were not conducted in Southeast Asia, which were then excluded. A full text screening was then carried out for the remaining references using a selection form. This was carried out by two reviewers, AG and BN or SM. At this stage, any conflicts that arose were discussed with a third reviewer (BN or SM) to decide on inclusion/exclusion. The selection forms used for abstract and full text screening are available in Appendix C.

A flowchart of the selection process is presented in Figure 4.1. The final database search used for the review was conducted on the 4th of June 2017. A total of 14,319 references were obtained through the five database searches. After de-duplication, 4,154 references were removed, and a total of 10,165 references were confirmed for title screening. A total of 8,443 references were excluded from the title alone, mostly due to having titles that explicitly stated either diabetes type 1, gestational diabetes or pre-diabetes, specific pharmacotherapy trials, or conducted in children or adolescent population. This resulted in 1,722 references going through to abstract screening stage. The abstract screening process resulted in 1,095 studies excluded and 627 studies remaining for the next stage. Excluded studies were due to studies that were conducted in countries outside of Southeast Asia, conference proceedings, editorials/opinion studies, case studies or reviews, and prevention/screening programmes. Country screening before the full-text screening was carried out to exclude studies that were not set in Southeast Asia. This resulted in 589 studies excluded and a total of 38 studies to be screened in full text. In the full text screening stage, 22 studies were excluded due to: no CCM element in its query (n=10), not set in primary care (n=3), being only conference proceedings (n=6), not diabetes type 2 (n=1), and full text not available after library request (n=2). Out of the two articles that were not available, AG was only able to contact the author of one of the articles. However, they were not able to provide the full text of their paper in English, as it was in Thai language. This resulted in 16 studies that were eligible for extraction and synthesis. Additional reference screening of these 16 studies resulted in an additional of two studies being identified and included after full text screening by two reviewers, AG and BN or SM. Thus, a final total of 18 studies were included for quality appraisal, extraction, and synthesis.

Since the database search on the 4th of June 2017, an updated search of the databases was conducted on the 29th of May 2018 which did not result in the identification of any new studies to be included in this review.

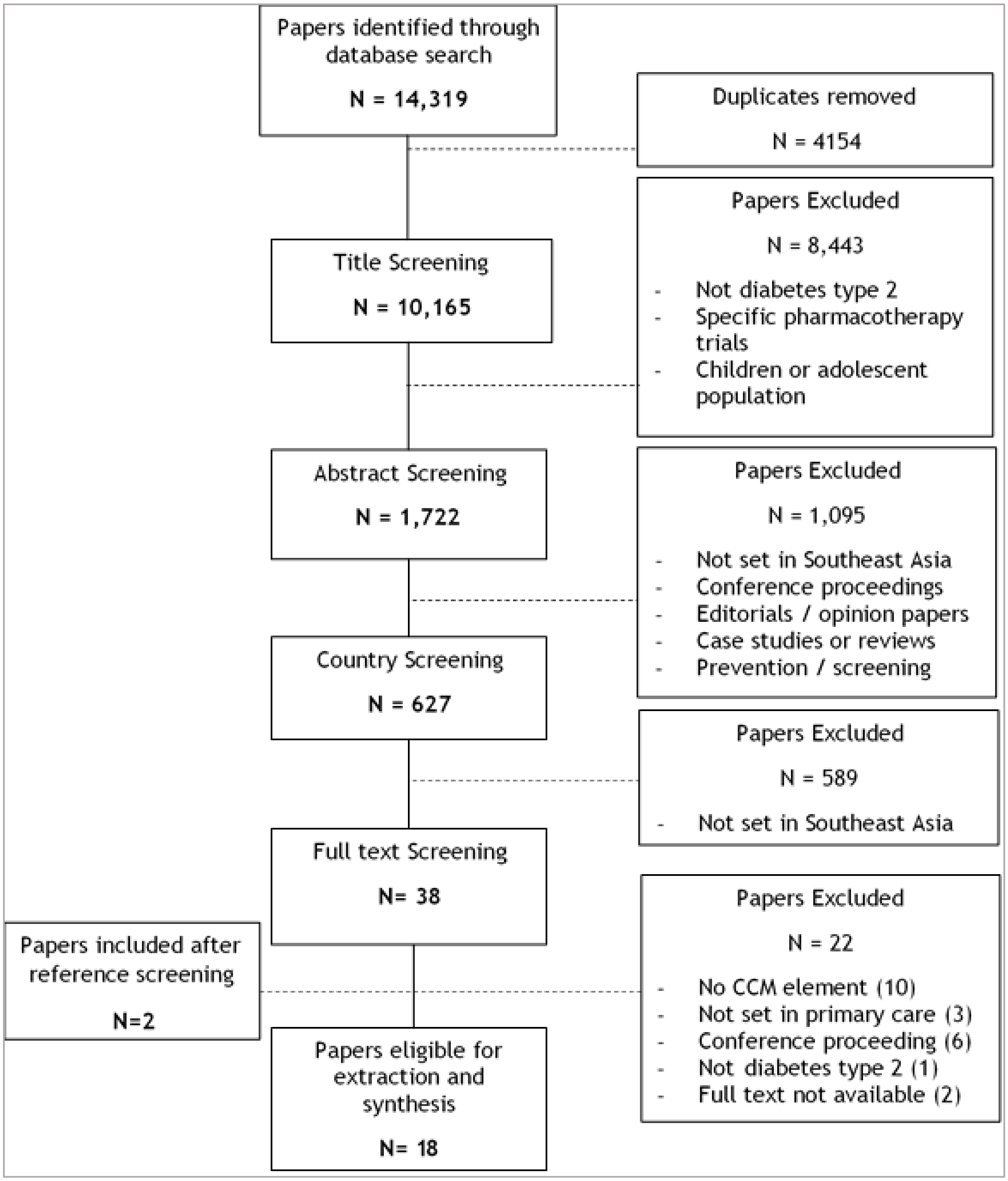

Figure 4.1. Flowchart of selection process of studies, adapted from the PRISMA flowchart (Moher et al., 2015).

4.3.3. Quality appraisal

This systematic review of publications on diabetes type 2 management models in Southeast Asia includes issues of both implementation and effectiveness. Such interventions are often complex (with more than one intervention component) rather than more straightforward interventions such as drug trials. Complex interventions generally involve multiple interacting components which are often programmatic and highly dependent on the context in which they are being implemented (Greenhalgh, 2014, Rychetnik et al., 2002). An intervention might also be considered complex when there are a range of behaviours targeted; the number of groups, settings, or levels targeted; or there is a flexibility in the delivery or component of the intervention (Skivington et al., 2021). Therefore, when attempting to assess the quality of such studies, one cannot simply assess methodological quality and risk to bias. For complex interventions, in order to assess transferability, information is also needed on the intervention itself, the evaluation of context in which it is applied in, and the interaction between intervention and context (Rychetnik et al., 2002). Other elements of complex interventions include the development, refinement, and testing of programme theory, engagement of stakeholders, identification of key uncertainties, refinement of intervention, and economic considerations (Skivington et al., 2021). These aspects, which are central to understanding complex interventions, are lacking from traditional appraisal criteria or tools.

There is no gold-standard tool to appraise study quality (Katrak et al., 2004). The extent of bias affecting the results of a study also cannot be determined in absolute terms (Higgins and Altman, 2008). Commonly followed guidelines on the reporting of clinical trials, observational studies, or qualitative studies are merely checklists to guide the reporting of a study (Booth et al., 2014, Knottnerus and Tugwell, 2008, Moher et al., 2001), where no judgement on quality is assessed. Established quality appraisal tools that assess methodological aspects to detect bias are mostly design-specific (Higgins et al., 2011, Sterne et al., 2016), making it difficult for a review with high heterogeneity, such as this review, to compare study quality between the included studies. A quality appraisal tool by the Effective Public Health Practice Project (EPHPP) (Thomas et al., 2008) was developed to evaluate a range of designs in observational quantitative studies with a single tool. However, the components relating to complex interventions are still lacking.

Quality indicators in qualitative studies differ to that of quantitative studies. The ability of quantitative and qualitative studies to ensure the validity and reliability of their findings are fundamentally different due to their differing nature of enquiry (Mays and Pope, 1995). The three criteria argued to be the foundation of good qualitative health research include interpretation of subjective meaning, description of social context, and attention to lay knowledge (Popay et al., 1998). These criteria can be examined in the theoretical basis, sampling strategy, scope of data collection, description of data collected, and concern with generalizability or typicality of a qualitative study. A variety of appraisal tools for qualitative studies are available that differ in the criteria being used to guide the appraisal process (Hannes et al., 2010). A Framework for Qualitative Evaluation designed by the UK Cabinet Office (Spencer et al., 2003) focuses on assessing methods that are used in government-based evaluations, while a more generic tool such as the Critical Appraisal Skills Programme (CASP) can be applied in generally all methods of qualitative method (Nadelson and Nadelson, 2014).

Judgement on the quality of included studies in this review did not result in exclusion of studies considered of low quality. A meta-analysis was not carried out since included studies were highly heterogeneous, i.e., they consisted of various interventions and outcome measures which could not be pooled together for analysis. Considerations were made regarding the purpose of this review and the variety of critical appraisal tools available. This review appraised the quality of included studies using a set of criteria that have been adapted from the EPHPP for quantitative studies, and the CASP for qualitative studies, adjusted to the nature of the included studies and the objectives of this review. These criteria were not used as a rating scale to determine quality of studies included in a quantitative manner. However, they were used to inform a general conclusion on the quality of studies, ranging from low, moderate, to high quality. Additional component of complexity that were added in the appraisal were that of context. Other elements of complexity were not included as most included studies in the review were testing an intervention in a single research setting. The forms for quality appraisal are presented in Appendix D. Quality assessment of included studies were conducted by two reviewers: AG and BN or SM, and any conflicts were discussed with a third reviewer BN or SM.

4.3.4. Data extraction and synthesis

Data of included studies were extracted using a data extraction form that was created to address the objectives of this review. The data extraction form is shown in Appendix E. Data extraction was conducted by two reviewers: AG and BN or SM. Any conflicts were discussed with a third reviewer, BN or SM.

Due to the diversity of studies included in this review, of both quantitative and qualitative studies, a mixed-methods synthesis was conducted. A segregated framework analysis was chosen which maintained a clear distinction between quantitative and qualitative evidence extracted from the included studies. This evidence was utilised to analyse this systematic review in relation to the objectives. Descriptions of the intervention or models of diabetes management that were implemented in the included studies are presented in relation to the CCM. Comparison and contrasts between models were made to assess effectiveness, as well as its facilitators and barriers to implementation.

4.4. Findings

4.4.1. General description of included studies

Table 4.2 provides a summary of the general description of the included 18 studies. The studies were conducted in five different countries in Southeast Asia: three from Indonesia (Hartayu et al., 2012a, Hartayu et al., 2012b, Widyahening et al., 2014), two from Malaysia (Ismail et al., 2013, Lee et al., 2016), four from the Philippines (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015, Paz-Pacheco et al., 2017), one from Singapore (Goh et al., 2015), and eight from Thailand (Prueksaritanond et al., 2004, Chaiopanont, 2008, Chaveepojnkamjorn et al., 2009, Sukwatjanee et al., 2011, Mekwiwatanawong et al., 2013, Jiamjarasrangsi et al., 2014, Susilparat et al., 2014, Jaipakdee et al., 2015). Although no time limit was employed in the database search process, the studies obtained were fairly recent, with the oldest study published in 2004 (Prueksaritanond et al., 2004), while the most recent was published in 2017 (Paz-Pacheco et al., 2017). The settings in which the studies described their study were variable. Six studies were set in urban settings (Ismail et al., 2013, Chaveepojnkamjorn et al., 2009, Mekwiwatanawong et al., 2013, Jaipakdee et al., 2015, Jiamjarasrangsi et al., 2014, Lee et al., 2016), two in rural settings (Prueksaritanond et al., 2004, Chaiopanont, 2008), and three in both urban and rural settings (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015). Meanwhile, seven studies did not specify their urban/rural setting (Hartayu et al., 2012b, Hartayu et al., 2012a, Widyahening et al., 2014, Paz-Pacheco et al., 2017, Goh et al., 2015, Sukwatjanee et al., 2011, Susilparat et al., 2014).

A mixture of study designs was used in the studies that were included. Most of the studies used a quantitative approach. In studies that assessed outcomes of interventions, a randomized controlled trial (Jaipakdee et al., 2015, Chaveepojnkamjorn et al., 2009, Ismail et al., 2013, Paz-Pacheco et al., 2017), or quasi-experimental (Hartayu et al., 2012b, Hartayu et al., 2012a, Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015, Prueksaritanond et al., 2004, Chaiopanont, 2008, Sukwatjanee et al., 2011, Susilparat et al., 2014) design was used. Observational cross-sectional design was used in studies that surveyed patients' or physicians' views on a model that had already been implemented (Mekwiwatanawong et al., 2013, Jiamjarasrangsi et al., 2014, Goh et al., 2015, Widyahening et al., 2014). There was only one study who used a purely qualitative approach (Lee et al., 2016), where views of patients and health care professionals were explored on a patient decision aid for insulin initiation in type 2 diabetes in Malaysia. Two studies incorporated a qualitative component alongside their quantitative study, assessing the implementation of a self-help group for rural Thai elders, and a diabetes self-management programme with computer assisted instruction in Thailand (Sukwatjanee et al., 2011, Jaipakdee et al., 2015).

The studies included in the review were assessed as being of low or moderate quality. Studies rated low on quality were due to methodological flaws that could have influenced the credibility of their findings. These flaws were mainly relating to sampling, data collection, and analysis methods. Those rated as moderate on quality had no major methodological flaws, but lacked information on context, rigour of analysis, and overstating their overall conclusion based on their results.

Table 4.2. General description of included studies

No	Author, year	Country	Objectives	Setting	Design	Quality
1	Hartayu et al., 2012 (Hartayu et al., 2012a)	Indonesia	To improve outcome measures by using the Community-based interactive approach for diabetes mellitus (CBIA-DM).	NR*	Quantitative: Quasi-experimental (three-group before-after intervention)	Low
2	Hartayu et al., 2012 (Hartayu et al., 2012b)	Indonesia	Improving of Type 2 Diabetic Patients' Knowledge, Attitude and Practice Towards Diabetes Self-care by Implementing CBIA-DM	NR*	Quantitative Quasi-experimental (three-group before-after intervention)	Low
3	Widyahening et al., 2014 (Widyahening et al., 2014)	Indonesia	To explore the degree of general practitioners' awareness of agreement with, adoption of and adherence to the type 2 diabetes mellitus guidelines in Indonesia, and identify associated physicians' characteristics	NR*	Quantitative Cross-sectional survey	Low
4	Ismail et al., 2013 (Ismail et al., 2013)	Malaysia	To determine the difference in diabetes control between patients who undertake SMBG and those who have their blood glucose level monitored in public health clinics	Urban	Quantitative: Randomised controlled trial	Low
5	Lee et al., 2015 (Lee et al., 2016)	Malaysia	To explore patients' and health-care professionals' views on the content and format of a patient decision aid on insulin initiation	Urban	Qualitative In-depth interview and focus group discussion	Low
6	Ku & Kegels, 2014a (Ku and Kegels, 2014a)	Philippines	To investigate the effects of implementing a context-adapted diabetes self-management education and support (DSME/S) project based on chronic care models in the Philippines, on knowledge, attitudes, self-management practices, adiposity/obesity and glycaemia of people with diabetes	Urban and rural	Quantitative Quasi-experimental (one group before-after intervention)	Moderate
7	Ku & Kegels, 2014b (Ku and Kegels, 2014b)	Philippines	To examine the effects of integrating the selected chronic care elements in the local	Urban and rural	Quantitative	Moderate

No	Author, year	Country	Objectives	Setting	Design	Quality
			health systems on health care workers' knowledge and skills in primary diabetes care and on the glycemia of people with diabetes.		Quasi-experimental (two groups before-after intervention)	
8	Ku & Kegels, 2015 (Ku and Kegels, 2015)	Philippines	To investigate the effects of implementing elements of a context-adapted chronic disease care model (CACCM) in two local government primary health care units of a non-highly urbanized city and a rural municipality in the Philippines on Patients' Assessment of Chronic Illness Care (PACIC) and glycaemic control (HbA1c) of people with diabetes	Urban and rural	Quantitative Quasi-experimental (one group before-after intervention)	Low
9	Paz-Pacheco et al., 2017 (Paz-Pacheco et al., 2017)	Philippines	To assess the effectiveness of a community-based DSME program in improving anthropometric, biochemical, and health behaviour outcomes among persons with diabetes	NR*	Quantitative (Quasi experimental)	Low
10	Goh et.al, 2015 (Goh et al., 2015)	Singapore	1. To assess iDAT app usage in patients with type 2 diabetes 2. Identify and characterize short-term (8week) trajectories of use of the iDAT app among patients with type 2 diabetes mellitus 3. Identify patient characteristics associated with different trajectories	NR*	Quantitative Longitudinal (cohort?)	Low
11	Prueksaritanond et.al, 2004 (Prueksaritanond et al., 2004)	Thailand	To evaluate the efficacy of patient-centered clinical care on type 2 diabetes	Rural	Quantitative Quasi experimental (one group before-after intervention)	Low
12	Chaiopanont, S., 2008 (Chaiopanont, 2008)	Thailand	To evaluate the hypoglycemic effect of SKT1 (Somporn Kantaradusdi -Triamchaisri technique 1) on type 2 diabetic patients at	Rural	Quantitative	Low

No	Author, year	Country	Objectives	Setting	Design	Quality
			Wat Khae Nok Primary health care center in Nonthaburi province, Thailand		Quasi experimental (one group before-after intervention)	
13	Chaveepojnkamjorn et.al, 2009 (Chaveepojnkamjorn et al., 2009)	Thailand	To determine the effects of a Self-help group by comparing the patients' quality of life using the same indicators with patients undergoing standard care at a primary level	Urban	Quantitative Randomised controlled trial	Moderate
14	Sukwatjanee et.al, 2011 (Sukwatjanee et al., 2011)	Thailand	To gain a better understanding of the process and perceived benefits for rural Thai elders, with T2D, participating in a self-help group on diabetes. (a) Explore the elders' perspectives with respect to how taking part in a self-help group on diabetes affected their self-care ability and Quality of life (QOL) (b) Compare the elders' self-efficacy and QOL scores, and blood glucose levels, before and after participation in a self-help group on diabetes	NR*	Mixed-methods One group before-after intervention (quasi-experimental) Observation of group process	Moderate
15	Mekwiwatanawong et.al, 2013 (Mekwiwatanawong et al., 2013)	Thailand	To compare the difference in outcomes among persons with diabetes receiving care at three primary care settings	Urban	Quantitative Cross-sectional (descriptive-comparative)	Moderate
16	Jiamjarasrangsi et.al, 2014 (Jiamjarasrangsi et al., 2014)	Thailand	To assess the progress of CCM implementation on system-wide to improve type 2 diabetes care in a developing country. Specifically, this study aims at surveying the extent to which type 2 diabetes patients report having received CCM-based services in different types of health care facilities throughout Bangkok	Urban	Quantitative Cross-sectional	Moderate

No	Author, year	Country	Objectives	Setting	Design	Quality
17	Susilparat et al., 2014 (Susilparat et al., 2014)	Thailand	To study outcomes of the specific health care services that providing health education in parallel with counselling by Islamic leader during Ramadan	NR*	Quantitative quasi-experimental (two groups before-after intervention)	Low
18	Jaipakdee et.al, 2015 (Jaipakdee et al., 2015)	Thailand	1. To compare HbA1c level, health behaviour, depression, and quality of life between people with diabetes receiving a diabetes self-management program with computer assisted instruction, and those receiving routine care. 2. To assess the benefits, flexibility, barriers, satisfaction, and impact of DSMS program	Urban	Mixed methods Cluster RCT Focus group discussion	Low

*NR = Not Reported

4.4.2. Disease management models for diabetes and its implementation

There was a total of 15 models of diabetes management in the 18 studies included in this review; a summary of the models can be viewed in Table 4.3. Only two studies specifically mentioned the CCM as the basis of their models, one in the Philippines (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015), and another in Thailand (Jiamjarasrangsi et al., 2014). Although other models did not specifically mention the CCM, their models or interventions included elements of CCM. Thirteen of the models included elements of self-management support (Jaipakdee et al., 2015, Susilparat et al., 2014, Jiamjarasrangsi et al., 2014, Sukwatjanee et al., 2011, Chaiopanont, 2008, Chaveepojnkamjorn et al., 2009, Prueksaritanond et al., 2004, Goh et al., 2015, Paz-Pacheco et al., 2017, Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015, Hartayu et al., 2012b, Hartayu et al., 2012a, Ismail et al., 2013, Mekwiwatanawong et al., 2013). Two models were solely on decision support, in the form of a guideline for the management of diabetes for physicians (Widyahening et al., 2014), and patient decision aid for insulin initiation (Lee et al., 2016). One study focused on the elements of organisation of health care and delivery system design, in addition to self-management support, evaluating three types of care models in a primary care setting (Mekwiwatanawong et al., 2013).

Models that consisted of an element of self-management support used either separate individual/group approach, or a combination of both. Models that delivered self-management support in the form of group education sessions by health professionals were: community-based interactive group model by Hartayu (Hartayu et al., 2012b, Hartayu et al., 2012a); diabetes care education and local meditation exercise by Chaiopanont (Chaiopanont, 2008); contextual model for Muslims during Ramadan (Susilparat et al., 2014); and diabetes self-management support with computer-assisted instruction (CAI) (Jaipakdee et al., 2015). Three models also delivered self-management support in group format, however they were led and conducted by peers, not by the health care professionals. These were: diabetes self-management education (DSME) with peer educators by Paz-Pacheco (2017); self-help group on diabetes by Chaveepojnkamjorn (Chaveepojnkamjorn et al., 2009); and self-help group on diabetes for rural Thai elders by Sukwatjanee (Sukwatjanee et al., 2011).

The study by Mekwiwatanawong evaluated three types of care models that delivered self-management support through individual consultations (Mekwiwatanawong et al., 2013), while the FilDCare model from the Philippines by Ku and Kegels delivered self-management supported individually in clinical and community settings (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015). Another model on self-management support that targeted individual patients was specifically to monitor the use of a smartphone app to monitor diet and exercise (Goh et al., 2015). The models by Ismail and Prueksaritanond incorporated both individual and group approaches in delivering self-management support(Ismail et al., 2013, Prueksaritanond et al., 2004). Most models on self-management support alone were short-term, with the intervention carried out within several weeks, and assessment carried out up until six months post-intervention at most. A summary of the implementation characteristics of the included studies can be viewed in table 4.4.

The primary care practices in which the interventions were implemented ranged from public primary care centres (Ismail et al., 2013, Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015, Paz-Pacheco et al., 2017, Goh et al., 2015, Chaiopanont, 2008, Chaveepojnkamjorn et al., 2009, Sukwatjanee et al., 2011, Mekwiwatanawong et al., 2013, Jaipakdee et al., 2015, Jiamjarasrangsi et al., 2014, Susilparat et al., 2014), community setting (Hartayu et al., 2012b, Hartayu et al., 2012a), and primary care (outpatient care) units of hospitals (Prueksaritanond et al., 2004, Chaveepojnkamjorn et al., 2009, Sukwatjanee et al., 2011). Almost all models targeting patients had a participant demographic in the older age group, with a mean age of approximately 50 years. The self-help group model by Sukwatjanee (2013) specifically targeted elderly Thai population, with a mean age of 66.5 years. Meanwhile, the diet and exercise smartphone app by Goh (2015) and the self-help group model by Chaveepojnkamjorn (2009) recruited patients with a mean age of 48.2, and 48.9 years respectively. Most studies also had a majority of female participants, with some having more than a 70% female study population (Paz-Pacheco et al., 2017, Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015). Information regarding race or ethnicity were extracted, however only studies conducted in Malaysia and Singapore (3 studies) had this information (ethnicity of Malay, Indian, and Chinese). Thus, ethnicity was not included in the comparison of all studies included.

Not all studies from the studies included in this review described their intervention or model in detail. Therefore, not all studies can be compared in terms of model implementation. Most models were carried out as interventions directly targeted at patients, be it through modified individual consultations or group education or support sessions. One study that looked at the use of a diabetes management guideline in Indonesia, solely targeted primary care physicians (Widyahening et al., 2014), and another looked at patients as well as physicians' views on the use of a patient decision aid for insulin initiation (Lee et al., 2016). Studies that described a more comprehensive model implemented in routine care will be highlighted below.

First-Line Diabetes Care (FiLDCare) Project (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015)

The FiLdCare project is a context-adapted CCM implemented in the Philippines. This model was created to integrate care for patients with chronic conditions (including type 2 diabetes) with other primary care activities. It implemented the CCM elements of health care organisation by creating a chronic care team, delivery system design by redistributing chronic care tasks, decision support by training health care workers, and self-management support services for patients.

This model started off by creating a chronic care team, composed of municipal/city health officers (MHO/CHO), nurses, midwives, and community-based health workers. Clinical consultations were conducted by MHO/CHO, self-management education activities by MHO/CHO or nurses, and self-management support activities reassigned to midwives and community-based health workers. All health care workers received further training on diabetes management based on their respective roles. The training took a holistic approach to managing diabetes, focusing on the biopsychosocial approach, active listening, patient and family empowerment, and social mobilisation. The delivery of care consisted of one-on-one diabetes self-management education during regular clinic consultations, at least once every three months. This was followed by community-based diabetes self-management support by midwives or community-based health workers through home visits or in the community health stations.

Patient-centered care model in Thailand (Prueksaritanond et al., 2004)

This model incorporated patient-centred care, combining an individual and group approach. In the initial visit, a patient-patient, patient-physician, and patient-health care team were established. Individual visits were conducted to assess fasting plasma glucose (FPG) levels, medication changes, and counselling when necessary. The group process comprised of six to ten patients per visit. It emphasised exploration, assessment, and analysis of the clinical nature of diabetes within the group, comorbidities, patients' ideas, feelings, expectation and function, drug compliance, and eating and exercise behaviours. Nutrition and exercise education workshops were conducted by a nutritionist and physical therapist. Patients were advised to take notes and self-record diaries two days per week. Nutritional, exercise, and self-care activities were assessed at every appointment.

Three models of primary care delivery in Thailand (Mekwiwatanawong et al., 2013)

The study by Mekwiwatanawong (2013) assessed and compared the outcomes of diabetes care in three primary care practice models that emphasised the role of nurse practitioners (NP) in diabetes care. NPs in Thailand are nurses that went through four months of training after two years of clinical practice as a registered nurse (RN). The training programme was developed to ensure universal coverage amid severe physician shortage. The NPs were expected to work in primary care units to provide integrated services which include health promotion, disease prevention, disease detection, diagnose and treatment of common health problems, management of chronic conditions, and care of terminally ill patients.

The models of primary care with NPs were: 1) health centres without physicians; 2) health centres with physicians on rotation; and 3) upgraded health centres with a full-time family medicine or general practice physician (GP). The first model was implemented in a small community health centre which served up to 5,000 people at the sub-district and village level. It consisted of one NP or one registered nurse (RN) and one to two community health workers. The second model was in a large community health centre covering 5,000-10,000 people which consisted of one or two NPs and two to four community health workers with a rotating physician. The third model was referred to as a Community Medical Unit covering 10,000-15,000 people. It consisted of at least one physician, two to three NPs, and four to six community health workers. All three models provided five specific aspects of diabetes care: screening and diagnosis, pharmacological treatment, follow-up and evaluation of treatment outcomes, complication screening, and education for self-care and lifestyle adjustment.

The comprehensive care management project for type 2 diabetes and related conditions in Thailand (Jiamjarasrangsi et al., 2014)

This project was based on the CCM, driven via the country's universal coverage health insurance scheme. Top up money was offered to contracted primary care units for activities of 1) diabetes education for high-risk individuals; 2) self-management support for patients with diabetes; and 3) regular monitoring and follow-up of glycemic control status, mouth hygiene, and diabetes complications. No further elaboration of how these activities were carried out was described.

Contextual education for self-management for Muslims during Ramadan in Thailand (Susilparat et al., 2014)

This model was developed and implemented specifically during the fasting period in the month of Ramadan in a primary care unit. This model emphasised on a holistic strategy to suit patients' lifestyles, cultures and religious beliefs to prevent severe complications during Ramadan. It consisted of diabetes self-management education and medical nutrition therapy that were delivered in parallel with Islamic principles. This education session was delivered in a group format by a physician and an Islamic leader. This model also included individual appointments for the adjustment of medication and dosage during the fasting period according to a guideline developed by the Thai Muslim Medical Association.

Self-management support programme with computer-assisted instruction (CAI) in Thailand (Jaipakdee et al., 2015)

This model focused on the use of CAI for the delivery of self-management support in a group setting provided by trained nurses in primary care. Three nurses in each primary care unit were trained in a two-day intensive course. The CAI consisted of two components: 1) the disease process of diabetes; and 2) skill learning on management, lifestyle changes, and psychological support. It included video lessons, stories, graphics, animated images, interviews and demonstrations. This session was conducted once every six months for three hours.

Table 4.3. Disease management models for diabetes in Southeast Asia

No.	Author, Year	Country	Description of care model	CCM element
1.	Hartayu et al., 2012 (Hartayu et al., 2012a) Hartayu et al., 2012 (Hartayu et al., 2012b)	Indonesia	Community-based interactive approach in the form of small-group problem-based intensive discussions followed by individual assessment with a facilitator present	Self-management support Community resources
2.	Widyahening et al., 2014 (Widyahening et al., 2014)	Indonesia	Type 2 diabetes guideline from the consensus on the Management of Type 2 Diabetes Mellitus 2011 of the Indonesian Society of Endocrinology	Decision support
3.	Ismail et al., 2013 (Ismail et al., 2013)	Malaysia	Additional appointments for self-measurement of blood glucose (SMBG), SMBG practice, and a two-day class that included practical demonstrations of SMBG	Self-management support
4.	Lee et al., 2015 (Lee et al., 2016)	Malaysia	Patient decision aid for insulin initiation	Decision support
5.	Ku & Kegels, 2014a (Ku and Kegels, 2014a) Ku & Kegels, 2014b Ku & Kegels, 2015	Philippines	First-Line Diabetes Care (FiLDCare) Project: Creation of First-Line Chronic Care Team (FLCCT), with task shifting from physician/nurse to midwife/community health worker: 1. One-on-one diabetes self-management education (DSME) during consultations by health care professional (Ku & Kegels, 2014a) 2. Community-based diabetes self-management support (DSMS) by community health workers 3. Training workshop for health workers (Ku & Kegels, 2014b)	Self-management support Community resources Health care organisation Delivery system design Decision support
6.	Paz-Pacheco et al., 2017 (7)	Philippines	Diabetes self-management education (DSME) conducted with peer educators in community (village) setting	Self-management support Community resources
7.	Goh et.al, 2015 (Goh et al., 2015)	Singapore	Smartphone app to monitor diet and exercise	Self-management support

No.	Author, Year	Country	Description of care model	CCM element
8.	Prueksaritanond et.al, 2004 (Prueksaritanond et al., 2004)	Thailand	Program consisting of six interconnecting components of patient-centred care: 1. Establishing patient-patient, patient-physician, patient-health care team relationship 2. Group process 3. Counselling and management of psychological and social behavior 4. Goal setting of fasting plasma glucose level 5. Nutrition and exercise education workshops 6. Self-record of food diaries, self-care, nutritional and exercise assessment	Delivery system design Self-management support
9.	Chaiopanont, S., 2008 (Chaiopanont, 2008)	Thailand	Diabetes care education and practice of a local form of a sitting-breathing-meditation exercise, SKT1	Self-management support
10.	Chaveepojnkamjorn et.al, 2009 (Chaveepojnkamjorn et al., 2009)	Thailand	Self-help group on diabetes type 2	Self-management support
11.	Sukwatjanee et.al, 2011 (Sukwatjanee et al., 2011)	Thailand	Self-help group in diabetes for rural Thai elders	Self-management support Community resources
12.	Mekwiwatanawong et.al, 2013 (Mekwiwatanawong et al., 2013)	Thailand	Models of care emphasizing on the role of nurse practitioners (NP) 1. Nurse practitioner without a physician (NP) 2. Nurse practitioner – physician part-time model (NP-MDp) 3. Nurse practitioner and physician full-time model (NP-MDf)	Health care organisation Delivery system design Self-management support
13.	Jiamjarasrangsia et.al, 2014 (Jiamjarasrangsi et al., 2014)	Thailand	CCM-based comprehensive diabetes management	Health care organisation Delivery system design Self-management support
14.	Susilparat et al., 2014 (Susilparat et al., 2014)	Thailand	Contextual education for self-management and medication adjustments for Muslims during Ramadan	Self-management support Decision support
15.	Jaipakdee et.al, 2015 (Jaipakdee et al., 2015)	Thailand	Diabetes self-management support programme equipped with a computer-assisted instruction (CAI)	Self-management support Decision support

Table 4.4. Implementation method of diabetes management models

No.	Author, Year	Country	Model of care	Setting	Target population	Sample size (N)	Demographic Characteristics	Study duration	Approach
1.	Hartayu et al., 2012 (Hartayu et al., 2012a)	Indonesia	Community-based interactive group session	Community setting	Patients	- Control group I: 30 - Control group II: 30 - Intervention group: 30	• Mean age of intervention group 55.3 years • Females in intervention group 43%	6 months (but intervention delivered once)	Group
	Hartayu et al., 2012 (Hartayu et al., 2012b)	Indonesia	Community-based interactive group session	Community setting	Patients	- Control group I: 30 - Control group II: 30 - Intervention group: 30	• Mean age of intervention group 55.3 years • Females in intervention group 57%	NR*	Group
2.	Widyahening et al., 2014 (Widyahening et al., 2014)	Indonesia	Guideline implementation in diabetes management	Primary care	Physicians	• 399	• Mean age N/A • Female participants 68%	NR*	Individual
3.	Ismail et al., 2013 (Ismail et al., 2013)	Malaysia	Additional appointments for SMBG and group classes	Public community health centres	Patients	- Control group:47 • Intervention group: 58	• Mean age of intervention group 54.0 years • Females in intervention group 53.4%	6 months	Individual and group
4.	Lee et al., 2015 (Lee et al., 2016)	Malaysia	Patient decision aid for insulin initiation	University based primary	Patients and health care professionals	General practitioners (n=2)	NR*	12 months	Individual

No.	Author, Year	Country	Model of care	Setting	Target population	Sample size (N)	Demographic Characteristics	Study duration	Approach
				clinic, public health care clinic, private GP		Medical officers (n=7) Diabetes nurses (n=3) Pharmacists (n=1) Patients (n=18)			
5.	Ku & Kegels, 2014a (Ku and Kegels, 2014a) Ku & Kegels, 2014b Ku & Kegels, 2015	Philippines	FiLDCare programme	Public primary care centers	Patients and health care professionals	203 patients 125 health care professionals	• Mean age of patient participants 57.1 • Female patient participants in study 74.4%	12 months	Individual
6.	Paz-Pacheco et al., 2017 (7)	Philippines	DSME with peer educators in group format	Public primary care community setting	Patients	Control group: 70 Intervention group: 85	• Mean age of intervention group 57.6 years • Females in intervention group 71%	6 months (intervention delivered once a week for four weeks)	Group
7.	Goh et.al, 2015 (Goh et al., 2015)	Singapore	Smartphone app to monitor diet and exercise	Public primary care clinic	Patients	84 patients	• Mean age of participants 48.2 years • Female participants 49%	2 months	Individual
8.	Prueksaritanond et.al, 2004	Thailand	Patient-centered care programme	Family Medicine department,	Patients	78 patients	• Mean age of participants 57.2 years	One year	Individual and group

No.	Author, Year	Country	Model of care	Setting	Target population	Sample size (N)	Demographic Characteristics	Study duration	Approach
	(Prueksaritanond et al., 2004)			University hospital outpatient clinic		•	• Female participants 68.0%		
9.	Chaiopanont, S., 2008 (Chaiopanont, 2008)	Thailand	Diabetes care education in group format	Primary health care centre	Patients	• 50 patients	• Median age of participants 63.1 years • Female participants 78%	Two weeks	Group
10.	Chaveepojnkamjorn et.al, 2009 (Chaveepojnkamjorn et al., 2009)	Thailand	Self-help group on diabetes	Primary health care centre and community hospital	Patients	• Control group: 84 • Intervention group: 80	• Mean age of intervention group 48.9 years • Females in intervention group 78.1%	6 months (programme carried out for 4 months)	Group
11.	Sukwatjanee et.al, 2011 (Sukwatjanee et al., 2011)	Thailand	Self-help group on diabetes for rural elders	Community health centre and community hospital	Patients	20 patients	• Mean age of participants 66.5 years • Female participants 85%	6 months	Group
12.	Mekwiwatanawong et.al, 2013 (Mekwiwatanawong et al., 2013)	Thailand	NP focused models	Primary care centres	Patients	• 300	• Mean age of participants 60.7 years • Female participants 73%	NR*	Individual

No.	Author, Year	Country	Model of care	Setting	Target population	Sample size (N)	Demographic Characteristics	Study duration	Approach
13.	Jiamjarasrangsia et.al, 2014 (Jiamjarasrangsi et al., 2014)	Thailand	CCM-based comprehensive care management model	Public hospitals, public health care centres, private hospitals	Patients	• 1000	• Mean age of participants 62.1 years • Female participants 69.0%	NR*	Not specified
14.	Susilparat et al., 2014 (Susilparat et al., 2014)	Thailand	Contextual model for Muslims during Ramadan	Primary care centre	Patients	• Control group: 31 • Intervention group: 62	• Mean age of intervention group 56.3 years • Females in intervention group 69.4%	Two months (intervention delivered once, in the first month)	Group
15.	Jaipakdee et.al, 2015 (Jaipakdee et al., 2015)	Thailand	Diabetes self-management support program with CAI	Public health centres	Patients and nurses	• Control group: 200 • Intervention group: 203	• Mean age in intervention group 61.1 years • Females in intervention group 76.4%	6 months	Group

*NR = Not Reported

4.4.4. Effectiveness of diabetes management models

Effectiveness of management models was reported either quantitatively or qualitatively. A summary of studies that reported on quantitative outcomes of their models are presented in Table 4.5. Quantitative effects on patients were based on clinical measures such as FPG, HbA1c, blood pressure, and lipid profiles. Other outcome measures included Knowledge, Attitude and Perception (KAP) scores of self-management, self-management behaviour, quality of life, and patient satisfaction. Studies that evaluated their model from the health care professionals' perspective measured awareness, agreement, adoption, and adherence with guidelines (Widyahening et al., 2014), and difference in knowledge and self-assessment of skills before and after implementation of the model (Ku and Kegels, 2014b). Meta-analysis was not carried out due to the heterogeneity of the studies included in this review. Sample sizes varied between studies, ranging from 20 patients at the least, and 1000 patients in a cross-sectional study. Findings of effectiveness may need to be viewed with caution, as most of the intervention studies were quasi-experimental before-after studies, and only two RCTs. Only few studies reported their sample size calculation which may indicate that these studies were not properly powered. Follow-up period were also relatively short, ranging from two weeks (Chaiopanont, 2008) to one year (Prueksaritanond et al., 2004, Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015). Furthermore, the percentage of dropouts seem to increase the longer studies were conducted, with the most at 57.7% in a study that was implemented for one year (Prueksaritanond et al., 2004).

Of the six models that delivered group diabetes education classes delivered by health professionals (Ismail et al., 2013, Prueksaritanond et al., 2004, Chaiopanont, 2008, Susilparat et al., 2014, Jaipakdee et al., 2015, Hartayu et al., 2012b, Hartayu et al., 2012a), five studies reported clinical outcomes. Three of the five models reported favourable outcomes, with significant improvements in HbA1c, and FPG between baseline and at either six months or one year post-implementation (Ismail et al., 2013, Prueksaritanond et al., 2004, Jaipakdee et al., 2015). The model by Ismail with additional appointments for self-monitoring of blood glucose in addition to group classes reported another significant improvement on triglyceride level(Ismail et al., 2013), and the model by Prueksaritanond which incorporated both individual and group approaches to diabetes education also reported improvement in HDL-cholesterol (Prueksaritanond et al., 2004). One model of diabetes care education by Chaiopanont reported significant improvement in post-prandial glucose levels (Chaiopanont, 2008). However, this was only measured from baseline and two weeks post intervention. Meanwhile, the contextual diabetes education group model specific for Muslims during Ramadan did not show any significant difference in outcome measures between intervention and control group eight weeks post-intervention (Susilparat et al., 2014).

Aside from clinical outcomes, several of the aforementioned studies reported non-clinical outcome measures. The community-based interactive group sessions reported in two studies by Hartayu, showed increased KAP scores of self-management, and quality of life after implementation(Hartayu et al., 2012b, Hartayu et al., 2012a). The model of self-management support with CAI by Jaipakdee also reported improvement in quality of life, alongside improvement in clinical outcomes and health behavior scores (Jaipakdee et al., 2015). Eating and exercise behaviours were also reported to improve after the implementation of the model by Prueksaritanond (Prueksaritanond et al., 2004).

Models on self-management support with peer educators or in the form of self-help groups also reported favourable outcomes. Although the models that implemented diabetes self-management education with peer educators measured several clinical and non-clinical outcomes, significant improvement was only found on HbA1c six months post-intervention (Paz-Pacheco et al., 2017). The self-help group by Chaveepojnkamjorn reported significant and consistent increase in quality-of-life score at three months and six months post-intervention (Chaveepojnkamjorn et al., 2009). Meanwhile, the self-help group specific for rural elders reported significant improvement in both clinical and non-clinical outcomes, reporting improvement in FPG, quality of life, and self-efficacy (ability to perform self-care activities) six months post-intervention (Sukwatjanee et al., 2011). Another measure of outcome in another model of self-management support was the trajectory of smartphone app usage to monitor diet and exercise. This study by Goh revealed that the majority of the participants included only used the app during the first two weeks of recruitment (Goh et al., 2015).

Another assessment of the effectiveness of self-management support was in the evaluation of three types of delivery models as reported in the study by Mekwiwatanawong. When compared cross-sectionally between patients receiving care in the NP (nurse practitioner only), NP-MDp (nurse practitioner and part time physician), and NP-MDf (nurse practitioner and full-time physician) models, both clinical and non-clinical measures were assessed. No significant difference was found between patients in the three models in their fasting plasma glucose. Self-care ability, satisfaction with care, and quality of life ratings were also variable between its individual components, thus it cannot be determined for certain if any of the three models were superior. This may be due to the insufficient samples achieved, which was less than the sample size calculated in their methods.

The FilDCare model implemented in the Philippines was the only model that assessed both health care practitioners and patients. Health care practitioners made self-assessments towards their knowledge and skills before and after their training. The findings reported improvement on both knowledge and skills, with specific mention of improvement in community health workers. The model's clinical effects on patients were shown as significant improvements on HbA1c, waist circumference, and weigh-height ratio one-year post-implementation. It also reported improvements in the patients' diabetes knowledge test and improvements in the attitude and perceptions of perceived ability to control blood glucose, and to adhere to diet and exercise. This was further supported with findings of an increase in adherence to medications and exercise. The result of the Patient Assessment of Care for Chronic Conditions (PACIC) evaluation which measured specific actions or qualities of care in line with the CCM were significantly higher post-implementation, except in one element, which was for delivery system design.

The system-wide approach to diabetes management implemented in Bangkok, Thailand cannot be evaluated for its effectiveness as the study by Jiamjarasrangsi merely reported on a cross-sectional survey of PACIC and measurement of clinical outcomes in three different health care settings i.e., public hospitals, public health centres, and private hospitals. Their findings showed that PACIC scores were significantly higher in public health facilities compared to private, which suggests that services delivered in public health facilities may be more in line with the CCM than that in private hospitals. However, whether their services resulted in better clinical outcomes are questionable, since the clinical results did not differ between the two public health facilities and the private hospitals.

The model assessed by Widyahening (Widyahening et al., 2014), which was solely on the use of a diabetes care guideline by The Indonesian Society of Endocrinologists in Indonesia revealed that primary care physicians may not necessarily implement the recommendations set in the guideline. This study reported that although the majority of participants in the study were aware of the individual recommendations published in the guideline, not all recommendations were adopted or adhered to.

Four studies included in this review reported a qualitative component alongside their quantitative inquiry. However, only two studies reported their qualitative methods. The study by Sukwatjanee which assessed the implementation of a self-help group on diabetes specific for rural Thai elders, reported that the group felt benefits from obtaining culturally sensitive knowledge, social support, sense of empowerment, and self-efficacy. These benefits were perceived to increase their self-care ability and their quality of life. Studies by Hartayu and Ku & Kegel reported their findings of interviews of their participants without reporting a clear qualitative method. However, the findings by Hartayu resonated with the findings of Sukwatjanee, where participants enjoyed discussions within a group setting, and reported improved confidence in self-care and a desire for a self-help club. Meanwhile, the findings of Ku & Kegel revealed how self-management education and support in the clinic and in the community apparently made patients more activated and informed regarding their diabetes and its management.

The study by Lee which evaluated the model of patient decision aid for insulin initiation was the only purely qualitative study included in this review. Although they did not report the perceived effects of the model towards patients or health care professionals, several issues were revealed in its implementation. This was also the case with the qualitative findings from the study by Jaipakdee on diabetes self-management support with CAI. Their findings on barriers and facilitators of implementation, together with issues of implementation found by Lee and other studies will be presented in the next section.

Table 4.5. Quantitative outcome of diabetes management models, quantitative studies

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Study Design	Outcome measures	Assessment method	Outcome
1.	Hartayu et al., 2012 (Hartayu et al., 2012a)	Indonesia	Community-based interactive group sessions	- Control group I: 30 - Control group II: 30 - Intervention group: 30	0	Quasi-experimental (Before-after study)	Knowledge, attitude and Practice (KAP) of self-management score	Comparison of KAP score at baseline, one month, three months, and six months after intervention	Increase of KAP of self-care with implementation of model
2.	Hartayu et al., 2012 (Hartayu et al., 2012b)					Quasi-experimental (Before-after study)	Quality of life (QoL) profile	Comparison of QoL profile at baseline, one month, three months, and six months after intervention	Increase of QoL with implementation of model
3.	Widyahening et al., 2014 (Widyahening et al., 2014)	Indonesia	Guideline implementation in diabetes management	399 primary care physicians	N/A*	Cross-sectional survey	Awareness, agreement, adoption, adherence of guideline	Outcome measures were measured using a questionnaire specifically developed for the study	High awareness was not associated with adoption or adherence to guideline recommendations
4.	Ismail et al., 2013 (Ismail et al., 2013)	Malaysia	Additional appointments for SMBG and group classes	- Control group:47 - Intervention group: 58	5.7	RCT	HbA1c, lipid profile serum creatinine, anthropometric measures, blood pressure	Outcome measures compared between baseline and at six months	Significant improvement only found on HbA1c and triglyceride level

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Study Design	Outcome measures	Assessment method	Outcome
5.	Ku & Kegels, 2014a (Ku and Kegels, 2014a)	Philippines	FiLD Care programme	203 patients	19.2	Quasi experimental (Before-after study)	HbA1c Anthropometric measures Diabetes knowledge score, attitude and perceptions on diabetes and self-management	Outcome measures measured at baseline and post implementation (one year)	Improvements found on HbA1c and waist-hip ratio post implementation. Improvements on a few elements of attitude and perceptions
6.	Ku & Kegels, 2014b(Ku and Kegels, 2014b)			125 health care professionals	15	Quasi experimental (before-after study)	Knowledge and self-assessment of skills of health care workers, HbA1c, anthropometric measures	Health care worker outcomes measured at pre- and post-training. Patient outcomes measured at baseline and post-implementation (one year)	Improvement found on all health worker outcomes, especially in community health workers. Overall improvement on patient outcomes only found for HbA1c and waist-hip ratio
7.	Ku & Kegels, 2015(Ku and Kegels, 2015)			203 patients	19.2	Quasi experimental (before-after study)	PACIC rating, HbA1c	Outcome measures measured at baseline and one year after full implementation	Improvement in overall PACIC rating and HbA1c after implementation
8.	Paz-Pacheco et al., 2017 (Paz-Pacheco et al., 2017)	Philippines	DSME with peer educators in group format	- Control group: 70 - Intervention group: 85	20	Quasi experimental (before-after study)	Anthropometric measures FPG, HbA1c	Outcome measures measured at	Significant and consistent improvement only found for

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Study Design	Outcome measures	Assessment method	Outcome
							Total cholesterol, LDL, HDL Health behaviour Medication usage	baseline, three and six months	HbA1c in the intervention group
9.	Goh et.al, 2015 (Goh et al., 2015)	Singapore	Smartphone app to monitor diet and exercise	84 patients	N/A	Cohort	App usage characteristics	App usage assessed within eight weeks	A large proportion of patients were minimal users, with very few intermittent-waning users and consistent users.
10.	Prueksaritanond et.al, 2004 (Prueksaritanond et al., 2004)	Thailand	Patient-centred care programme	78 patients	57.7	Quasi experimental (before-after study)	FPG, HbA1c, lipid profile, eating and exercise behaviours, symptoms of diabetes, medication usage, satisfaction	Outcome measures measured at baseline and post intervention (one year)	Improvements found in FPG, HbA1c, eating and exercise behaviour, and HDL-cholesterol
11.	Chaiopanont, S., 2008 (Chaiopanont, 2008)	Thailand	Diabetes care education in group format	50 patients	0	Quasi experimental (before-after study)	PPG, blood pressure	Outcome measures measured at baseline and post intervention (two weeks)	Significant and consistent improvement in PPG levels

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Study Design	Outcome measures	Assessment method	Outcome
12.	Chaveepojnkamjorn et.al, 2009 (Chaveepojnkamjorn et al., 2009)	Thailand	Self-help group on diabetes	- Control group: 84 - Intervention group: 80	11.0	RCT	QoL score	Measured at baseline, 12 weeks, and 24 weeks	Significant and consistent increase in QoL score in intervention group
13.	Mekwiwatanawong et.al, 2013 (Mekwiwatanawong et al., 2013)	Thailand	NP focused models	300	N/A	Cross sectional	FPG, Diabetes Self-care ability, patient's satisfaction, QoL	Measured once as cross-sectional data. Comparison made between participants in NP, NP-MDp, and NP-MDf models	No significant difference in glycaemic control and patient satisfaction across three models of care. Significant higher level of quality of life in the full Nurse Practitioner Model
14.	Sukwatjanee	Thailand	Self-help group on diabetes for rural Thai elders	20 patients	0	Quasi experimental (before-after study)	FPG, QoL, self-efficacy	Measured at baseline and six months after intervention	Significant improvement in FPG, QoL, and self-efficacy after intervention
15.	Jiamjarasrangsi et.al, 2014 (Jiamjarasrangsi et al., 2014)	Thailand	CCM-based comprehensive care management model	1000	N/A*	Cross sectional	PACIC score, self-management score, BMI, FPG, HbA1c	Measured once as cross-sectional data. Comparison made between participants in public hospitals, public health	PACIC scores were significantly higher in public health facilities compared to private. Diabetes outcomes showed no significant differences

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Study Design	Outcome measures	Assessment method	Outcome
								centres, and private hospitals	between the public and private health facilities
15.	Susilparat et al., 2014 (Susilparat et al., 2014)	Thailand	Contextual model for Muslims during Ramadan	- Control group: 31 - Intervention group: 62	3.2	Quasi experimental (before-after study)	Anthropometric measures, blood pressure, FPG	Measured at baseline, and two weeks after Ramadan (8 weeks interval)	No significant difference in outcome measures between intervention and control groups.
16.	Jaipakdee et.al, 2015 (Jaipakdee et al., 2015)	Thailand	Diabetes self-management support program with CAI	- Control group: 200 - Intervention group: 203	6.2	Cluster RCT	FPG, HbA1c, Health behaviour, depression (PHQ-9), QoL	Measured at baseline, three months, and six months	Improvement in HbA1c, FPG, health behaviour score, and quality of life in intervention group

**N/A = Not Applicable*

Table 4.6. Effect of models on HbA1c

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Outcome measures	Assessment method	Outcome
4.	Ismail et al., 2013 (Ismail et al., 2013)	Malaysia	Additional appointments for SMBG and group classes	- Control group:47 - Intervention group: 58	5.7	HbA1c, lipid profile serum creatinine, anthropometric measures, blood pressure	Outcome measures compared between baseline and at six months	Significant improvement only found on HbA1c and triglyceride level
5.	Ku & Kegels, 2014a (Ku and Kegels, 2014a) Ku & Kegels, 2014b(Ku and Kegels, 2014b) Ku & Kegels, 2015(Ku and Kegels, 2015)	Philippines	FiLD Care programme	203 patients	19.2	HbA1c Anthropometric measures Diabetes knowledge score, attitude and perceptions on diabetes and self-management	Outcome measures measured at baseline and post implementation (one year)	Improvements found on HbA1c and waist-hip ratio post implementation. Improvements on a few elements of attitude and perceptions
8.	Paz-Pacheco et al., 2017 (Paz-Pacheco et al., 2017)	Philippines	DSME with peer educators in group format	- Control group: 70 - Intervention group: 85	20	Anthropometric measures FPG, HbA1c Total cholesterol, LDL, HDL Health behaviour measures Medication usage	Outcome measures measured at baseline, three and six months	Significant and consistent improvement only found for HbA1c in the intervention group
10.	Prueksaritanond et.al, 2004 (Prueksaritanond et al., 2004)	Thailand	Patient-centred care programme	78 patients	57.7	FPG, HbA1c, lipid profile, eating and exercise behaviours, symptoms of diabetes, medication usage, satisfaction	Outcome measures measured at baseline and post intervention (one year)	Improvements found in FPG, HbA1c, eating and exercise behaviour, and HDL-cholesterol
14.	Jiamjarasrangsi et.al, 2014 (Jiamjarasrangsi et al., 2014)	Thailand	CCM-based comprehensive care	1000	N/A*	PACIC score, self-management score, BMI, FPG, HbA1c	Measured once as cross-sectional data. Comparison made between	PACIC scores were significantly higher in public health facilities

No.	Author, Year	Country	Model of care	Sample size (N)	Drop-out rate (%)	Outcome measures	Assessment method	Outcome
			management model				participants in public hospitals, public health centres, and private hospitals	compared to private. Diabetes outcomes showed no significant differences between the public and private health facilities
16.	Jaipakdee et.al, 2015 (Jaipakdee et al., 2015)	Thailand	Diabetes self-management support program with CAI	- Control group: 200 - Intervention group: 203	6.2	FPG, HbA1c, Health behaviour, depression (PHQ-9), QoL	Measured at baseline, three months, and six months	Improvement in HbA1c, FPG, health behaviour score, and quality of life in intervention group

4.4.5. Barriers and Facilitators in implementation of models

The majority of the models included in this review were interventionsin research settings . Therefore, not all models have a detailed evaluation of the possibility of the model being implemented into routine care. The study by Jaipakdee was the only study to specifically report barriers and facilitators in the implementation of their model based on findings from their interviews with nurses that delivered the model (Jaipakdee et al., 2015). However, several characteristics of the other models and reports on how they were carried out provided insights into possible barriers and facilitators of implementation into routine care. A summary of barriers and facilitators of the implementation of diabetes management models within the studies included is presented in Table 4.7.

Table 4.7. Facilitators and Barriers of implementation

Facilitators	Barriers
• Patient involvement • Availability of local venues and local communities • Consideration for patient's well-being • Good relationship and teamwork between health care worker and patients • Local government support • Support from staff and health care workers	• Lack of consideration for patients' need • Inadequate staff and resources • Lack of budget

Not all studies described the development of their model. Several studies mentioned the involvement of communities in first developing the contents of their diabetes education modules. The community-based interactive group approach by Hartayu specifically mentioned that the educational materials were developed through focus group discussions with diabetic patients (Hartayu et al., 2012b, Hartayu et al., 2012a). This enabled them to formulate an education package that suited the needs of patients. The diabetes education model by Chaiopanont incorporated a local form of a sitting breathing meditation exercise, *Somporn Kantaradusdi-Triamchaisri* technique (Chaveepojnkamjorn et al., 2009). This can be seen as their attempt to make diabetes management culturally acceptable. Cultural acceptability is seen as an important aspect when providing self-management support. Models that emphasised the formation of self-help groups for diabetes patients or training peers for peer education sessions revealed their models were considered as success due to their programme being in coherence with their communities cultural values and beliefs (Paz-Pacheco et al., 2017, Chaveepojnkamjorn et al., 2009, Sukwatjanee et al., 2011). Furthermore, sessions for these self-help groups were conducted within the community, which provided ease of access.

The awareness of patients' needs, and shared decision making is important in order to provide patient-centred care, something that might not be commonly acknowledged in Malaysia. The use of a patient decision aid in the model by Lee revealed that there was a mismatch between patients' needs and health care professionals' perceptions of patient needs (Lee et al., 2016). Health care professionals felt that information on patient decision aids should focus on treatment (in this case, insulin) and its benefits, while patients wanted more practical information and on the effects on their physical, psychological, and social selves before they decided on treatment. Therefore, these concerns question the effectiveness of the patient decision aid used in the model. Meanwhile, the self-management support model by Jaipakdee revealed that their model's consideration for patients' well-being, and good relationship between health care workers and patients was seen is an important facilitator to their success and willingness to continue the model in their practice (Jaipakdee et al., 2015).

The FilDCare model was the only model included in this study that incorporated most of the elements of CCM (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015). Their reorganisation of health care and shifting of tasks between health care workers meant that services could be delivered both in the clinic and community. Ku & Kegel revealed that this was possible due to the support of local government which enabled existing local resources of community health workers to be incorporated into diabetes management. It was also revealed that with full support of the local government, health care workers have continued delivering the model in their routine care, even after the project ended. Although this seems promising, it needs to be taken into consideration that there may be instances where shortages in staff and resources may act as barriers on continuation of such elaborate models. Even a small scaled self-management support model such as the model by Jaipakdee was in the end not continued by all the participating practices, citing inadequate staff and lack of budget (Jaipakdee et al., 2015).

4.5. Discussion

4.5.1. Summary of main findings

This review identified a total of 18 studies, with 15 models of diabetes management studies from Indonesia, Malaysia, Singapore, the Philippines, and Thailand. The studies were fairly recent, predominantly quasi-experimental before-after studies with only five studies having control groups. Out of these five studies, only two were in the form of an RCT. Sample sizes were variable in the included studies, ranging from 20 patients in a quasi-experimental study to 1000 in a nation-wide cross-sectional study. Quality appraisal concluded that the included studies were of low to moderate quality.

Only two of the models specifically mentioned CCM as the basis of their model. However, the other studies were still included due to models having at least one element of CCM. Out of all the CMM elements, self-management support was the most common element emphasised in the models included, implemented exclusively or together with other elements of CCM. Self-management support services were either individual or group diabetes education and support, or a combination of the two. Group sessions ranged from health professional led sessions, or peer led. These self-management support services were commonly combined with the use of community resources. These included enabling community health workers to follow-up patients in their homes or involving communities in the formation and delivery of self-management support sessions. Involvement of the community and incorporating local values were considered relevant to the provision of culturally sensitive education and support.

The element of ‘health care organisation’ was included in only three models, and this was accompanied by ‘delivery system design’. The formation of a designated First

Line Chronic Care Team for diabetes in the Philippines was the most notable form of health care organisation. This included task shifting from physician/nurse to midwife/community health workers. The notion of task shifting is similar to that conducted in Thailand, where trained nurse practitioners were deemed capable to provide diabetes services in primary care, either alone or alongside physicians. The nationwide CCM-based comprehensive diabetes management model in Thailand, although mentioned to include multiple elements of CCM such as health care organisation, delivery system design, and self-management support, was sadly not described in detail in the included study.

Decision support was another element that the models implemented in included studies focused on. Two of the models focused on the use of a diabetes management guideline, one as a recommendation from the Indonesian Society of Endocrinologists, and another from the Thai Muslim Medical Association for diabetes management in Ramadan specifically. Other models provided further training of health care workers for decision support in preparation of the delivery of their self-management support services. One model in Malaysia used a patient decision aid for insulin initiation which was used by both doctors and patients in their consultations. The element of ‘clinical information systems’ was not mentioned in any of the models included in this review.

Effects of diabetes management models on both clinical and non-clinical outcome measures were found to be favourable in some studies, especially improvements in fasting plasma glucose and HbA1c. However, these findings should be interpreted with some caution as the study designs and quality of reporting of these studies may indicate possible risk of bias. Other studies included in this review showed no significant improvement in clinical outcomes post-intervention. Non-clinical benefits of diabetes management models found in this review included the increase of knowledge, awareness, attitude, and practice of self-management activities in patients. However, lasting effects have yet to be proven, since most studies had a relatively short duration of follow-up (mostly one year). However, unquantifiable effects should also be taken into account when considering the effectiveness of implemented models. Several qualitative studies reported the benefits of self-management support, either in the form of group or individual sessions, in their confidence and ability to manage their diabetes.

The involvement of patients and the community was considered important in several studies for their model to be accepted by the patients. Together with availability of local venues within the community, self-management services could be easily accessed by patients. For models to be maintained however, they needed more than just a positive relationship between health care professionals and patients. Local government support, and strong team support between staff and health care professionals were deemed necessary. Without this, in addition to inadequate staff and resources, and lack of budget, models were not continued beyond the scope of research purposes.

4.5.2. Comparison with other reviews

This review shows that CCM has not been widely adapted in the region of Southeast Asia. CCM elements can be broadly grouped into two aspects, the health system and the community (Wagner et al., 1996b). Models in Southeast Asia focused more on the community aspect, and less on the health system. This can be seen by studies focusing on single interventions on self-management support, without the consideration of a model of care for diabetes. This differs greatly from other parts of the world, such as Europe and the USA, where chronic care models have been widely implemented and reviewed (Stellefson et al., 2013, Bongaerts et al., 2017, Baptista et al., 2016, Yeoh et al., 2018). However, due to the multiple elements of CCM, these reviews also found varying degrees of implementation of individual components in the models studied. A common limitation between these systematic reviews and our systematic review is that many studies did not provide sufficient detail on the intensity of specific components of the CCM implemented. Discrepancies in delivery of models, content, and outcomes made it difficult to make a detailed comparison between models across studies. Furthermore, unclear descriptions of what usual diabetes care entailed, compared with the models being studied complicated the appraisal of the implementation of newer models of diabetes care.

Diabetes management models in this review showed varying degrees of effectiveness when it comes to clinical outcomes such as HbA1c, blood pressure, lipid profiles, and anthropometric measures (BMI, body weight). This is similar to what was found in the meta-analyses by Elissen et.al (2013) and Bongaerts et.al (2017). Although these two studies presented positive effects of CCM on clinical outcomes, they both highlighted the need to take caution in not overinterpreting the results. This is due to the quality of studies and the small number of RCTs that could be included for meta-analysis. In addition to these meta-analyses, a systematic review by Baptista et.al (2016) showed that the use of isolated, individual components of CCM did not seem to be enough to improve clinical outcomes. This may also be the case in the current review, where most models were implementing individual components of CCM and rather than combinations. It seems that this may be a common problem even in Europe, as the recent meta-analysis conducted in Europe showed, studies which evaluated the implementation of all six CCM components simultaneously are lacking (Bongaerts et al., 2017). This clearly warrants further research on whether the CCM must be implemented in its entirety in order to be effective in improving clinical outcomes.

Although clinical effectiveness may be variable in the implementation of CCM, other non-clinical benefits have been found in the implementation of CCM in diabetes management. In a recent systematic review by Yeoh et.al Yeoh et al. (2018), the implementation of the CCM in primary care was considered beneficial in enhancing patients' quality of life, and alleviating social burden when multiple components of CCM are implemented in a single model. This further emphasise the importance of the implementation and integration of multiple components of CCM within a model.

A systematic review by Kadu & Stolee (2015) on facilitators and barriers to implementing CCM in primary care emphasised the importance of tailoring models to the local context for the process to be successful, and to ensure sustainability. The inner setting of the organisation, the process of implementation, and the characteristics of the individual providers are themes that emerged that could either be facilitators or barriers in the implementation of the CCM. As with the systematic review by Yeoh et.al (2018), limitations in clinical information systems, linking with the community, health professionals working in isolation with low motivation and insufficient knowledge, and patients who are difficult to motivate could be significant barriers in implementing the CCM. These arguments resonate with the findings of our systematic review.

4.5.3. Strengths and limitations

This systematic review on the implementation of diabetes management models was exclusively conducted in Southeast Asia. This review retrieved literature from five databases, to ensure the inclusion of as many studies as possible. However, the review had some limitations. This systematic review did not thoroughly consider complexity of the interventions carried out in the included studies. Though context (urban vs rural) was considered, other elements of complexity such as programme theory, stakeholders, key uncertainties, intervention refinement, and economic considerations were not explored. Studies that were published in language other than English were not included. Since the review focused on the region of Southeast Asia, there were several studies excluded based on language. This may have impacted on the conclusion of this review. The relatively low quality of studies included in this review suggests that more robust studies are needed to evaluate the implementation of diabetes management models in the Southeast Asia region. This would be highly beneficial when developing and implementing models of diabetes management in Southeast Asian countries, as references within the same context would provide more relevant comparisons.

4.6. Chapter summary

This chapter presented the first study of this PhD - a systematic review of diabetes management models in Southeast Asia. Most of the findings of this review were similar to those of previous systematic reviews that mostly included studies from Europe and the USA. However, this review showed that the CCM is not yet widely acknowledged, implemented, or studied in Southeast Asia, and the evidence-base for effectiveness is limited.

The findings of this systematic review highlighted the need to evaluate the implementation of Indonesia’s own diabetes management model, something that has not been extensively studied and published before. This chapter will be followed by a quantitative analysis of the epidemiology of the people with diabetes in Indonesia to provide a contextual picture, and the experiences of both doctors and patients in the implementation of Indonesia’s diabetes management model *Prolanis*. Findings from these studies will be incorporated with the findings of this systematic review to underpin a comprehensive discussion of the implementation of a diabetes management model in Indonesia.

Chapter 5 - Epidemiology of Diabetes in Indonesia

5.1. Overview

This chapter is based on a quantitative analysis of secondary data from the Indonesian Family Life Survey (IFLS), a survey conducted by the RAND corporation, RAND is an American non-profit global policy think tank, and the survey was conducted in partnership with several Indonesian institutions. The IFLS is a longitudinal survey on socioeconomic and health indicators, providing data representing around 83% of the country's population (Strauss et al., 2016), and is discussed further in section 5.3.1. below.

To date, there have been no published studies on the epidemiology of people with diabetes in Indonesia in relation to comorbidities and health care utilisation. Therefore, this chapter characterises people with diabetes in Indonesia, including reported comorbidities of LTCs, and analyses its association with health care utilisation. These findings will be discussed with other relevant studies in relation to the study aim. The reporting of this epidemiology study follows the STROBE reporting guideline on cross sectional studies, with the checklist available in Appendix F.

5.2. Aim and Research Questions

The aim of this study was to address the second aim of this PhD: to determine the characteristics of the people with diabetes in Indonesia. The specific research questions addressed were:

1. What are the characteristics (sociodemographic and health-related) of individuals with diabetes and without diabetes?
2. What are the characteristics (sociodemographic and health-related) of individuals within the diabetes population, with and without comorbidities?
3. What is the prevalence of physical and mental comorbidities in individuals with diabetes and without diabetes?

4. What is the relationship between diabetes, with and without comorbidity, and health care utilisation?

5.3. Research Hypotheses

The research hypothesis for this epidemiology study are:

1. Individuals with diabetes are more likely to have poorer health-related characteristics than individuals without diabetes.
2. Individuals with diabetes and comorbidities are more likely to have poorer health-related characteristics than those with diabetes only.
3. People with diabetes are more likely to utilise healthcare than those without
4. People with diabetes and comorbidities are more likely to utilise healthcare than those with only diabetes.

5.4. Methods

The methodological considerations related to this quantitative study are described in detail in Chapter 3.

5.4.1. The Indonesia Family Life Survey

The Indonesia Family Life Survey (IFLS) is a continuing longitudinal survey on socioeconomic status and health conditions (Strauss et al., 2016). The survey collects data from individuals, their families, their households, the communities in which they live, and the health and education facilities they use. It was first started in 1993, sampling households that represented approximately 83% of the Indonesian population from 13 of the nation's then 26 provinces. Selection of the provinces for the survey was mainly based on economic reasons, bearing in mind the size and terrain of the country. The included provinces were four provinces in Sumatra (North Sumatra, West Sumatra, South Sumatra, and Lampung), all five of the provinces in Java (DKI Jakarta, West Java, Central Java, DI Yogyakarta, and East Java), and four provinces representing the remaining major island groups (Bali, West Nusa Tenggara, South Kalimantan, and South Sulawesi). Smaller island groups with significantly lower population density were not included in the survey, accounting for approximately 17% of the population not represented in IFLS.

The first wave of the survey (IFLS 1) in 1993 covered 7,224 households (33,081 individuals). Four years later, the same participants were re-interviewed for IFLS 2 in 1997. IFLS 3 was fielded in 2000 with the full sample. In late 2007 and early 2008, the same households from 1993 and their split-offs (household members that have left and formed a separate household) were interviewed again for IFLS 4. IFLS 5, the latest wave, was fielded in 2014-2015. This study used data from the most recent IFLS 5 to provide the most up to date information on the diabetes population in Indonesia. Ethical approval was not sought for this study as the dataset were publicly available to obtain, were anonymised, and it was no possible to identify individual participants from the data available.

5.4.2. Study design and population

This study applied a cross-sectional analysis using data from IFLS 5. Although earlier waves of the IFLS study were available, comparability of the datasets was limited and would not have allowed a complete longitudinal analysis. This was due to differences in the questionnaire used for IFLS 4 and IFLS 5. In IFLS 4, there were 11 other LTCs aside from diabetes. However, in IFLS 5, there were 19 other LTCs. Combining these two datasets to conduct a cohort analysis of diabetes in relation to comorbidities (which includes comorbidity count) would introduce measurement bias. Furthermore, between IFLS 4 and IFLS 5, there were a large amount of people lost to follow up and a large number of new participants included. It was unknown how these changes were planned or implemented. The dataset provided non-identifiable data on individuals, their families, and households regarding their socioeconomic status and health conditions. These data are publicly available and was retrieved from the RAND Corporation's website upon registration (https://www.rand.org/well-being/social-and-behavioral-policy/data/FLS/IFLS/access.html).

The IFLS 5 data were collected between September 2014 and March 2015. The target population consisted of the original households from IFLS 1 and additional households from IFLS 2 – 4. IFLS 5 dataset included 52,587 individuals. This was larger than the previous waves due to inclusion of household members in previous waves that had left and formed their own households.

Data of IFLS were collected by trained interviewers who visited each household and attempted to conduct interviews with every individual age 11 years and older, living in that household, to complete the questionnaire. The questionnaire of IFLS 5 was divided into books and further subdivided into topical modules or sections. A total of 10 books were used to collect data in the household. Books 3A and 3B were used to collect individual-level data from adult participants. Book 3A asked all household members aged 15 years and over regarding their sociodemographic, economic, and subjective opinions on social matters. Book 3B collected retrospective information regarding the participant's health. A proxy book was used to collect data on individuals who could not be interviewed in person, thus represented by another household member. It contained shortened versions of most of the sections included in books 3A and 3B.

IFLS 5 as a whole consists of 151 datasets according to the book or topical modules or sections that the questionnaire addressed. The datasets used for the current study were: sociodemographic characteristics of participants, health insurance status, LTCs, health-related characteristics, and utilisation of outpatient and inpatient care. Data were excluded for participants under the age of 18 years old, resulting in 33,880 adult participants eligible for inclusion in this study. The other datasets of interest were then merged. Since this study analysed data in relation to diabetes, participants that had missing data on self-reported diabetes diagnosis were excluded (n=2014, 5.9%). This resulted in a total of 31,866 participants who were included in this study.

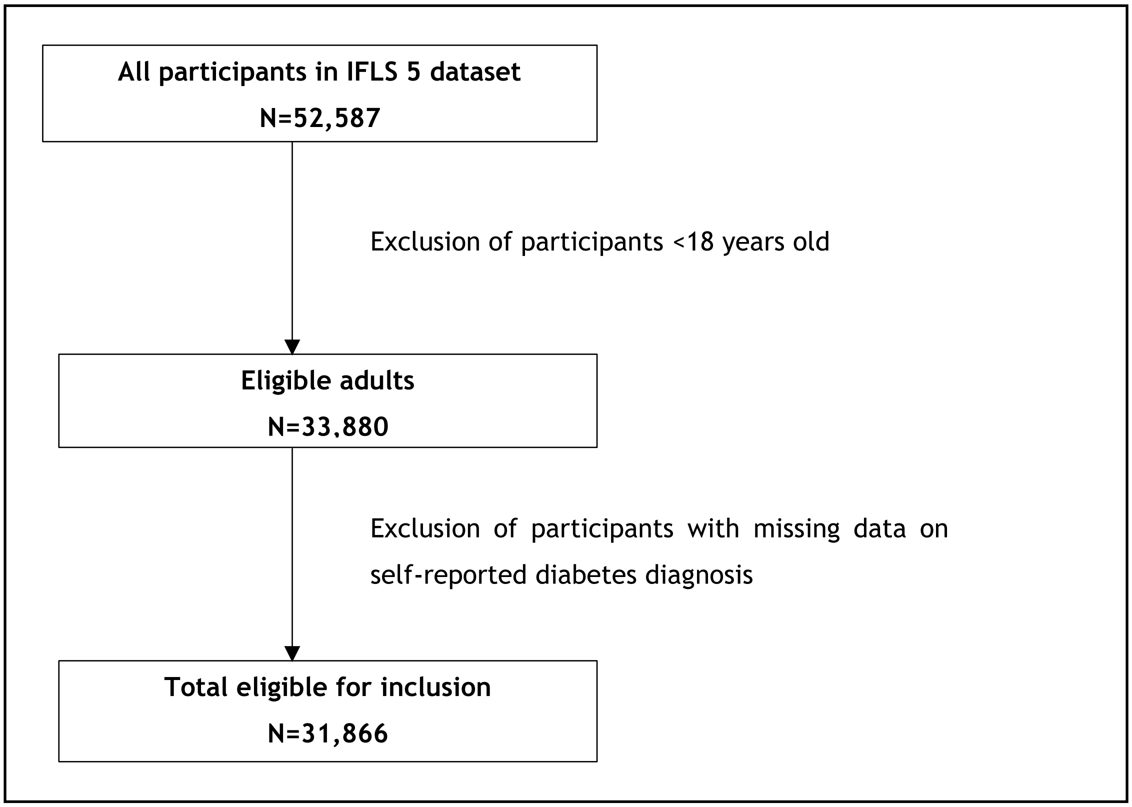

Figure 5.1. Flow chart of number of participants included in study

5.4.3. Study variables

5.4.3.1. Sociodemographic characteristics

Sociodemographic characteristics included participants' sex, age, marital status, education, ethnicity, religion, and residential area. The variable of age was grouped into three categories: 18-35 years, 36-55 years, ≥56 years. This grouping was used to identify groups as younger adults, middle-aged adults, and older adults. The cut-off of 56 years and above for older adults was due to the consideration of elderly as being relatively younger in Indonesia compared to more developed parts of the world (Arifianto, 2004b, Cao and Rammohan, 2016). Since there are several ethnic groups in Indonesia, for the purpose of this study, ethnicity was grouped based on the three most common ethnicities, resulting in four categories: Javanese, Sundanese, Minang, and others. Similarly, religion was also grouped based on the most common religions: Islam, Christian, Hindu, and other. The variable of residential area was defined as whether the participant lived in an urban or rural area. This was stratified from the outset, prior to data collection of IFLS, based on the 1993 National Socioeconomic Census.

An additional variable of health insurance status was included and was further grouped into three categories for the purpose of the analysis: no insurance, government insurance, and private insurance. Government insurance included health insurance of government employees (including police and military), labour force insurance, and government insurance for the poor. Meanwhile, private insurance included medical expenditure reimbursement from employer, employer provided clinic, private health insurance, and savings-related insurance. Differences between government and private insurance have been elaborated in Chapter 1.

5.4.3.2. Health related characteristics

Health related characteristics are the variables that depict the health status of the individuals in this study. The variables used were LTCs, smoking habit, falls (within the last two years), and number of self-reported acute complaints (in the last four weeks). The LTCs available in the dataset were self-reported information on diagnosis by a health care professional of: glaucoma, memory impairment, psychiatric disease, digestive disease, renal disease, high cholesterol, arthritis, cancer, stroke, liver disease, heart disease, lung disease, asthma, tuberculosis, hypertension, hearing impairment, brain damage, learning disability, and autism. The questionnaire used to collect the variables of LTCs are available in Appendix F. Classification of participants into diabetes only and diabetes plus comorbidities group were made when individuals with diabetes did not have any other LTC, or when individuals with diabetes had ≥1 LTCs.

5.4.3.3. Health care utilisation

The main outcome of interest was self-reported utilisation of health care. Utilisation of health care was obtained using two variables: outpatient care, and hospital admission. Outpatient care was defined as any care received by the participant in both primary and secondary care settings; in a clinic, community health centers (*Puskesmas)*, private doctor, or outpatient clinics at the hospital within the last four weeks. Hospital admission was defined as any hospital admissions that occurred within the last 12 months. There was no differentiation of hospital admissions into emergency and elective admissions. Length of hospital stay was also not available. Reasons for hospital admission were further specified in those that answered “yes” to a hospital admission; these were sickness, accident, giving birth, operation, and other.

5.4.4. Statistical analysis

5.4.4.1. Missing data

The percentage of missing data in these datasets varied. Several variables e.g. subjective economic status, subjective health rating, and screening on depression had missing data up to 8.5% from the included study population. This was due to a large number of interviews being conducted by a proxy (a family or household member) of the study participant. The use of a proxy meant that several variables relevant to the study, that required subjective answers, were unavailable and were therefore not included in this analysis. These included health measurements which included height and weight measurements that could be used to assess body mass index (BMI) and obesity.Missing data in the variables included in this study are considered as missing at random. These missing data in the original IFLS 5 dataset were distinguished between system missing data, where data were properly absent due to skip patterns in the questionnaire, or data missing due to error in interview. The IFLS 5 guidebook also pointed out that there are times where valid answers were categorised differently when the participant refused to answer the question, or the participant did not know the answer (Strauss et al., 2016). For the purpose of this analysis, when data was categorised as the participant refusing to answer or not knowing the answer, it was then considered as missing data. The number and percentage of missing data for each variable are pointed out in each of the descriptive analysis tables in the Results section below. Individuals with missing data on diabetes diagnosis were not included in the study population.

5.4.4.2. Descriptive analysis

Statistical analysis was carried out after thorough data cleaning. Descriptive analysis described the sociodemographic, and health-related characteristics in both the overall study population and the participants with diabetes. Analysis is reported as means (for continuous variables), or number and percentages (for categorical variables) for each variable considered. Values of means are presented up to two decimal points, while percentages are presented up to one decimal point or up to two when below 0.1%. The variables were found to be normally distributed, and t-test or chi square tests were used to test differences in characteristics between the diabetes and group without diabetes in the overall study population, and between diabetes only and diabetes plus comorbidities in the diabetes population. A p-value of <0.05 was considered as statistically significant.

5.4.4.3. Regression analysis

A multi-stage binary logistic regression analysis was carried out to answer research question 4; to determine the relationship between having diabetes, with and without LTCs, and health care utilisation. The analysis was conducted in the two study populations of interest (whole population and diabetes only population). For the whole population, the independent variable used was presence of diabetes and LTCs; no diabetes, diabetes only, and diabetes plus comorbidities. For the diabetes population, the independent variable was the presence of ≥1 LTC; diabetes only, diabetes plus comorbidities. The dependent or outcome variables for all regression analysis were occurrence of outpatient visits and hospital admissions. The logistic regression carried out used a complete case analysis, omitting participants with missing data.

An unadjusted (crude) Odds Ratio (OR) was first obtained, looking at the relationship between the independent variable and dependent variable alone. The OR represent the odds that an outcome will occur (healthcare utilisation: outpation visit or hospital admission) given a particular exposure (independent or predictor variables). Diabetes status, presence of LTC, sociodemographic and health-related variables were all analysed univariably to look at their individual association with outpatient visits and hospital admissions. A stepwise approach to adjustment for sociodemographic and heath related characteristics was then used to produce two models: 1) adjustment for sociodemographic variables (age, sex, marital status, education, ethnicity, religion, residential area, and health insurance status); 2) as in model 1 with additional adjustment for health-related characteristics (smoking habit, occurrence of falls, and number of acute complaints). This was repeated to analyse the two study populations of interest. Results are presented in the form of OR and 95% Confidence Interval (95% CI), with values up to two decimal points. All statistical analyses were carried out using STATA version 16.0 (StataCorp, 2007).

5.5. Findings

5.5.1. Characteristics of individuals in overall study population

A total of 31,866 participants with complete diabetes data were analysed; 31,089 participants without diabetes (97.5%) and 777 (2.5%) with diabetes. Table 5.1. shows the individual level sociodemographic characteristics of the overall study population, of those without diabetes, and of those with diabetes. The mean age for the overall population was 40.05 years (SD 15.39), while the mean age for those with diabetes was 53.49 years (SD 12.56). Individuals with diabetes were more likely to be female, married, have primary or secondary education, of Javanese ethnicity, Muslim, living in an urban area, and have government insurance.

Compared to those with missing data on diabetes, the mean age between those with missing diabetes data was similar to the overall study population (with complete diabetes data), with a mean age of 39.74 (SD 14.91) and 40.05 (SD 15.39) for those with missing diabetes data and for the overall study population respectively. However, all other sociodemographic characteristics between the two groups showed statistically significant difference (p-value <0.001). Those with missing data were more likely to be male, while the overall study population had a larger proportion of female. A much larger proportion of those with missing data lived in urban area (75.3%) compared to the overall study population (59.2%). The most striking difference in characteristics between the two groups is health insurance status. All of those with missing data on diabetes also had missing data on health insurance status, meanwhile in the overall study population, there were only 28 with missing data. The sociodemographic characteristics of those with missing diabetes data compared to the overall study population with complete diabetes data are presented in Table 5.2.

Table 5.1. Sociodemographic and economic characteristics of individuals in study population (N(%))

Characteristics	**Missing N(%)**	**Overall N = 31,866**	**No Diabetes N = 31,089**	**Diabetes N= 777**	**p-value***
Age					
Mean (S.D)	0	40.05 (15.39)	39.72 (15.31)	53.49 (12.56)	<0.001
		N(%)	**N(%)**	**N(%)**	
18-35 years		14,791 (46.4)	14,715 (47.3)	76 (9.8)	<0.001
36-55 years		11,743 (36.9)	11,399 (36.7)	344 (44.3)	
≥56 years		5,332 (16.7)	4,975 (16.0)	357 (45.9)	
Sex	0				
Male		15,149 (47.5)	14,789 (47.6)	360 (46.3)	0.495
Female		16,717 (52.5)	16,300 (52.4)	417 (53.7)	
Marital status	0				
Married		24,273 (76.2)	23,642 (76.0)	631 (81.2)	
Never married		4,442 (13.9)	4,428 (14.2)	14 (1.8)	<0.001
Separated/widowed		3151 (9.9)	3,019 (9.7)	132 (17.0)	
Education	0				
No school		1,925 (6.0)	1,874 (6.0)	51 (6.6)	
Primary level		10,058 (31.6)	9,774 (31.4)	284 (36.6)	<0.001
Secondary level		15,340 (48.1)	15,033 (48.4)	307 (39.5)	
Higher education		4,543 (14.3)	4,408 (14.2)	135 (17.4)	
Ethnicity	0				
Javanese		14,037 (44.1)	13,645 (43.9)	392 (50.5)	
Sundanese		3,821 (12.0)	3,741 (12.0)	80 (10.3)	0.004
Minang		1,703 (5.3)	1,669 (5.4)	34 (4.4)	
Others		12,305 (38.6)	12,034 (38.7)	271 (34.9)	
Religion	0				
Islam		28,567 (89.6)	27,880 (89.7)	687 (88.4)	
Christian		1,663 (5.2)	1,619 (5.2)	44 (5.7)	
Hindu		1,559 (4.9)	1520 (4.9)	39 (5.0)	0.002
Other		77 (0.2)	70 (0.2)	7 (0.9)	
Residential area	0				
Urban		18,852 (59.2)	18,272 (58.8)	580 (74.6)	
Rural		13,014 (40.8)	12,817 (41.2)	197 (25.4)	<0.001
Health Insurance	28 (0.09)				
No insurance		16,324 (51.3)	16,017 (51.6)	307 (39.7)	
Government insurance		13,381 (42.0)	12,972 (41.8)	409 (52.9)	<0.001
Private insurance		2,133 (6.7)	2,076 (6.7)	57 (7.4)	

* P-value represents difference in values between no diabetes and diabetes group

Table 5.2. Characteristics of population with missing diabetes data compared to the overall study population

Characteristics	**Missing (N%)**	**Missing diabetes data N = 2,014**	**Overall study population* N = 31,866**	**P-value****
Age	0			
Mean (S.D)		39.74 (14.91)	40.05 (15.39)	
		N(%)		
18-35 years		937 (46.5)	14,791 (46.4)	0.618
36-55 years		756 (37.6)	11,743 (36.9)	
≥56 years		321 (15.9)	5,332 (16.7)	
Sex	0			
Male		1,152 (57.1)	15,149 (47.5)	<0.001
Female		862 (42.9)	16,717 (52.5)	
Marital status	0			
Married		1,428 (70.9)	24,273 (76.2)	<0.001
Never married		383 (19.0)	4,442 (13.9)	
Separated/widowed		203 (10.1)	3151 (9.9)	
Education	0			
No school		136 (6.8)	1,925 (6.0)	<0.001
Primary level		450 (22.4)	10,058 (31.6)	
Secondary level		956 (47.4)	15,340 (48.1)	
Higher education		472 (23.4)	4,543 (14.3)	
Ethnicity	0			
Javanese		749 (37.2)	14,037 (44.1)	<0.001
Sundanese		356 (17.7)	3,821 (12.0)	
Minang		161 (8.0)	1,703 (5.3)	
Others		748 (37.1)	12,305 (38.6)	
Religion	0			
Islam		1,753 (87.0)	28,567 (89.6)	<0.001
Christian		134 (6.7)	1,663 (5.2)	
Hindu		101 (5.0)	1,559 (4.9)	
Other		26 (1.3)	77 (0.2)	
Residential area	0			
Urban		1,515 (75.3)	18,852 (59.2)	<0.001
Rural		499 (24.7)	13,014 (40.8)	
Health Insurance	2,042	All missing		
No insurance	(0.09)	-	16,324 (51.3)	
Government insurance		-	13,381 (42.0)	
Private insurance		-	2,133 (6.7)	

*Study population with complete diabetes data to be analysed in this study

**P-value represents difference in values between no diabetes and diabetes group

Table 5.3. shows the health-related characteristics and health care utilisation of the study population. The majority of individuals with diabetes had never smoked (63.1%). However, the percentage of those who had stopped smoking in the group with diabetes was significantly higher than in those without diabetes (12.0% and 5.0%, respectively). The number of acute complaints within the last four weeks in the group with diabetes was also statistically higher than the group without diabetes, with a mean of 3.46 (SD 2.38) compared to a mean of 2.80 (SD 2.23). Individuals in the group with diabetes reported more outpatient care (n=314, 40.7%) than the group without diabetes (18.1%) within the last month. The proportion reporting hospital admissions was also higher in the group with diabetes compared to the group without diabetes within the last year, 13.6% and 5.0% respectively. Reasons for hospital admissions were mostly for sickness in both groups (58.1%) in the group with diabetes and in the group without diabetes (42.8%).

Table 5.3. Health related characteristics and health care utilisation of individuals in study population (Number (%))

Characteristics	**Missing N(%)**	**Overall N = 31,866 N(%)**	**No Diabetes N = 31,089 N(%)**	**Diabetes N = 777 N(%)**	**p-value***
Smoking habit	0				
Never smoked		19,640 (61.6)	19,150 (61.6)	490 (63.1)	
Current smoker		10,388 (33.2)	10,399 (33.4)	189 (24.3)	<0.001
Previous smoker		1,638 (5.1)	1540 (5.0)	98 (12.6)	
Falls (within the last 2 years)	15 (0.05)				0.022
Yes		4,788 (15.0)	4,649 (15.0)	139 (17.9)	
No		27,063 (85.0)	26,427 (85.0)	636 (82.1)	
Acute complaints	15 (0.05)				
Mean (S.D)		2.82 (2.24)	2.80 (2.23)	3.46 (2.38)	<0.001
Outpatient care (within last 4 weeks)	34 (0.1)				
Yes		5,950 (18.7)	5,636 (18.1)	314 (40.7)	<0.001
No		25,882 (81.3)	25,424 (81.9)	458 (59.3)	
Hospital admissions (within the last 12 months)	34 (0.1)	1,592 (5.0)	1,487 (4.8)	105 (13.6)	
Yes		30,240 (95.0)	29,573 (95.2)	667 (86.4)	<0.001
No					
Reason for admission		N=1,592	N=1,487	N=105	
Sickness		698 (43.8)	637 (42.8)	61 (58.1)	
Accident		87 (5.5)	83 (5.6)	4 (3.8)	
Giving birth		421 (26.4)	418 (28.1)	3 (2.9)	
Operation		156 (9.8)	141 (9.5)	15 (14.3)	<0.001
Other		230 (14.4)	208 (14.0)	22 (21.0)	

* P-value represents difference in values between no diabetes and diabetes group

5.5.2. Characteristics of individuals in the population with diabetes

Within the diabetes population, the individuals were then grouped into those with diabetes only, and diabetes plus comorbidities. 73.6% (n=572) of the diabetes population reported one or more LTCs. Table 5.4. shows the sociodemographic characteristics of individuals in the overall diabetes population, those with diabetes only, and those with diabetes plus comorbidities. Individuals with diabetes that had comorbidities were older than those without (50.7% and 32.7% in the ≥56 age group respectively). The majority of individuals in the diabetes only group were male (58.5%), while this was not the case with individuals with diabetes plus comorbidities, with 58.0% female. There were no statistically significant differences in other sociodemographic and economic characteristics between the groups with diabetes. Most individuals in both groups had health insurance, mostly government insurance.

For health-related characteristics, shown in Table 5.5., more than half of the overall diabetes population never smoked (63.1%), this was also the case in both the diabetes only group, and those with LTCs (56.1%, 65.6%). However, there was a higher percentage of current smokers in the diabetes only group compared to diabetes plus comorbidities (37.1%, n= 76 to 19.8%, n= 113). The percentage of previous smokers was lower in the diabetes only group (6.8%, n=14), compared to diabetes plus comorbidities (14.7%, n= 84). A statistically significant difference was noted in the number of acute complaints reported in the last four weeks between the two groups. Those with diabetes plus comorbidities reported a mean of 3.7 (S.D 2.4) complaints compared to those with diabetes only (mean 2.8, S.D 2.1). There were no statistically significant differences between occurrence of falls within the last two years. Less than half of the individuals in both diabetes groups reported that they received outpatient care within the last four weeks, with 36.3% in the diabetes only group and 42.3% in the diabetes plus comorbidities group (non-significant). Hospital admissions in the last 12 months were 11.8% in the group with diabetes and 14.3% in the diabetes plus comorbidities group (non-significant).

Table 5.4. sociodemographic and economic characteristic of individuals in diabetes population (N (%))

Characteristics	Missing N(%)	Overall 777	Diabetes Only 205	Diabetes plus comorbidities 572	p-value*
Age	0				
Mean (S.D)		53.5 (12.6)	50.0 (12.9)	54.8 (12.2)	<0.001
		N(%)	N(%)	N(%)	
18-35		76 (9.8)	31 (15.1)	45 (7.9)	<0.001
36-55		344 (44.3)	107 (52.2)	237 (41.4)	
≥56		357 (45.9)	67 (32.7)	290 (50.7)	
Sex	0				
Male		360 (46.3)	120 (58.5)	240 (42.0)	<0.001
Female		417 (53.7)	85 (41.5)	332 (58.0)	
Marital status	0				
Married		631 (81.2)	176 (85.9)	455 (79.5)	0.103
Never married		14 (1.8)	4 (2.0)	10 (1.7)	
Separated /widowed		132 (17,0)	25 (12.2)	107 (18.7)	
Education	0				
No school		51 (6.6)	13 (6.3)	38 (6.6)	0.195
Primary level		284 (36.6)	63 (30.7)	221 (38.6)	
Secondary level		307 (39.5)	92 (44.9)	215 (37.6)	
Higher education		135 (17.4)	37 (18.0)	98 (17.1)	
Ethnicity	0				
Javanese		392 (50.5)	103 (50.2)	289 (50.5)	0.618
Sundanese		80 (10.3)	18 (8.8)	62 (10.8)	
Minang		34 (4.4)	7 (3.4)	27 (4.7)	
Others		271 (34.9)	77 (37.6)	194 (33.9)	
Religion	0				
Islam		687 (88.4)	184 (89.8)	503 (87.9)	0.695
Christian		44 (5.7)	9 (4.4)	35 (6.1)	
Hindu		39 (5.0)	11 (5.4)	28 (4.9)	
Other		7 (0.9)	1 (0.5)	6 (1.0)	
Residential area	0				
Urban		580 (74.6)	154 (75.1)	426 (74.5)	0.855
Rural		197 (25.4)	51 (24.9)	146 (25.5)	
Health Insurance	4 (0.5)				0.930
No insurance		307 (39.7)	82 (40.2)	225 (39.5)	
Govt insurance		409 (52.9)	106 (52.0)	303 (53.3)	
Private insurance		57 (7.4)	16 (7.8)	41 (7.2)	

*P-value represents difference in values between diabetes only group and diabetes plus comorbidities group.

Table 5.5. Health related characteristics and health care utilisation of individuals in diabetes population (N (%))

Characteristics	Missing N(%)	Overall N=777 N(%)	Diabetes Only N=205 N(%)	Diabetes plus comorbidities N=572 N(%)	p-value*
Smoking habit	0				
Never smoked		490 (63.1)	115 (56.1)	375 (65.6)	<0.001
Current smoker		189 (24.3)	76 (37.1)	113 (19.8)	
Previous smoker		98 (12.6)	14 (6.8)	84 (14.7)	
Falls (within the last 2 years)	2 (0.3)				0.007
Yes		139 (17.9)	24 (11.8)	115 (20.1)	
No		636 (82.1)	180 (88.2)	456 (79.9)	
Acute complaints	2 (0.3)				
Mean (S.D)		3.5 (2.4)	2.8 (2.1)	3.7 (2.4)	<0.001
Outpatient care (within last 4 weeks)	5 (0.6)				
Yes		314 (40.7)	74 (36.3)	240 (42.3)	0.136
No		458 (59.3)	130 (63.7)	328 (57.7)	
Hospital admissions (within the last 12 months)	5 (0.6)				
Yes		105 (13.6)	24 (11.8)	81 (14.3)	0.372
No		667 (86.4)	180 (88.2)	487 (85.7)	
Reason for admission		N=105	N=24	N=81	
Sickness		61 (58.1)	16 (66.7)	45 (55.6)	0.201
Accident		4 (3.8)	0	4 (4.9)	
Giving birth		3 (2.9)	2 (8.3)	1 (1.2)	
Operation		15 (14.3)	3 (12.5)	12 (14.8)	
Other		22 (21.0)	3 (12.5)	19 (23.5)	

*P-value represents difference in values between diabetes only group and diabetes plus comorbidities group.

5.5.3. Prevalence of physical and mental health comorbidities

With information on other LTCs, we mapped out the type and number of morbidities (other than diabetes) in the overall study population, comparing between those with and without diabetes (Table 5.6). Since included participants were those with complete information on LTC data, there were no missing values in this particular analysis. The diabetes population had a higher number of additional LTCs with a mean of 1.60 (SD 1.51) compared to the LTC count in those without diabetes (mean 0.55, SD 0.89). The number of individuals reporting two or more conditions in the group with diabetes was significantly higher, with a cumulative percentage of 44.1% (n=343), compared to those without diabetes (cumulative percentage 12.3%, n=3,833).

In the overall study population, the most common LTC reported by individuals was hypertension (13.1%). This was also the case in individuals with diabetes, with 44.5% (n=346) of individuals reporting that they had hypertension. However, the most commonly reported LTC in those without diabetes was digestive disease (12.8%, n=3,973), followed by hypertension (12.3%, n=3,821). The other most common LTCs reported in the group with diabetes were high cholesterol (27.0%, n=210), vision impairment (20.6%, n=160), digestive disease (16.0%, n=124), and arthritis (14.4%, n=112).

Table 5.6. Prevalence of reported diagnosed morbidities in individuals in study population (Number (%))

LTC*	**Overall 31,866**	**No Diabetes 31089**	**Diabetes 777**	**p-value****
Mean number (S.D)	0.58 (0.92)	0.55 (0.89)	1.60 (1.51)	<0.001
none	19,887 (62.4)	19,682 (63.3)	205 (26.4)	<0.001
1 LTC	7,803 (24.5)	7,574 (24.4)	229 (29.5)	
2 LTCs	2,696 (8.5)	2,531 (8.1)	165 (21.2)	
3 LTCs	977 (3.1)	889 (2.9)	88 (11.3)	
4 LTCs	346 (1.1)	298 (1.0)	48 (6.2)	
5 LTCs	105 (0.3)	76 (0.2)	29 (3.7)	
6 LTCs	34 (0.1)	28 (0.1)	6 (0.8)	
7 LTCs	13 (0.0)	8 (0.0)	5 (0.6)	
8 LTCs	5 (0.0)	3 (0.0)	2 (0.3)	
Hypertension	4,167 (13.1)	3,821 (12.3)	346 (44.5)	<0.001
Digestive disease	4,097 (12.9)	3,973 (12.8)	124 (16.0)	0.009
Vision impairment	2,619 (8.2)	2,459 (7.9)	160 (20.6)	<0.001
Arthritis	1,724 (5.4)	1,612 (5.2)	112 (14.4)	<0.001
High cholesterol	1,393 (4.4)	1,183 (3.8)	210 (27.0)	<0.001
Asthma	911 (2.9)	882 (2.8)	29 (3.7)	0.139
Lung disease	569 (1.8)	545 (1.8)	24 (3.1)	0.005
Heart disease	552 (1.7)	491 (1.6)	61 (7.9)	<0.001
Renal disease	451 (1.4)	415 (1.3)	36 (4.6)	<0.001
Hearing impairment	402 (1.3)	379 (1.2)	23 (3.0)	<0.001
Stroke	308 (1.0)	264 (0.8)	44 (5.7)	<0.001
Tuberculosis	316 (1.0)	288 (0.9)	28 (3.6)	<0.001
Liver disease	316 (1.0)	294 (0.9)	22 (2.8)	<0.001
Cancer	208 (0.7)	197 (0.6)	11 (1.4)	0.007
Memory impairment	86 (0.3)	78 (0.3)	8 (1.0)	<0.001
Psychiatric disease	93 (0.3)	89 (0.3)	4 (0.5)	0.243
Brain damage	110 (0.3)	106 (0.3)	4 (0.5)	0.414
Learning disability	43 (0.1)	42 (0.1)	1 (0.1)	0.962
Autism	5 (0.02)	5 (0.02)	0	0.724

*The order of conditions listed follows the order of highest to lowest prevalence in the overall population.
**P-value represents difference in values between no diabetes and diabetes groups.

5.5.4. Logistic regression models for health care utilisation

5.5.4.1. Logistic regression models for health care utilisation in overall study population

Outpatient visits within the last four weeks

Table 5.7. presents the logistic regression models for the association between diabetes groups within the overall study population and outpatient visits within the last four weeks. The crude (unadjusted) OR for having an outpatient visit for people with diabetes is 2.5 (95%CI 1.93, 4.32) compared to not having diabetes. This increased in those with diabetes and comorbidities, OR 3.30 (95% CI 2.79, 3.91). Univariate analysis showed that outpatient visits were more likely in older individuals (>56 age group), females, separated/widowed marital status, had insurance (both government and private), previous smokers, and having a fall within the last two years. These results are presented in full in Appendix G.

Having diabetes and having diabetes plus comorbidities was the strongest predictors of having an outpatient visit within the last four weeks in both models of adjustments (adjustment for sociodemographic factors model 1; and adjustment for sociodemographic factors and health-related characteristics in model 2). After adjusting for all sociodemographic and health-related characteristics, the odds of having an outpatient visit in those with diabetes only was 2.55 (95%CI 1.89, 3.44) compared to those without diabetes. However, the odds did not follow an exposure-response relationship where having ≥1 LTCs resulted in an OR of 2.22 (95% CI 1.85, 2.66). However, the overlapping of confidence intervals between the two indicates that there is no statistical significance of OR difference between having diabetes only and having ≥1 LTCs for outpatient visit. Several sociodemographic and health-related characteristics were significantly associated with outpatient visits in the final model. These characteristics were: older age (age (≥56 years), female, having education (primary, secondary, and higher education), Hindu, having insurance (government, and private), previous smoker, having a fall within the last two years, and the number of acute complaints.

Table 5.7. Logistic regression models for outpatient visit in overall study population

Predictor variables	**Unadjusted OR (95% CI)**		**Model 1***		**Model 2****	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Presence of diabetes (and other morbidity)						
No diabetes	1.00		1.00		1.00	
Diabetes only	2.57 (1.93, 3.42)	<0.001	2.45 (1.83, 3.28)	<0.001	2.55 (1.89, 3.44)	<0.001
Diabetes +†	3.30 (2.79, 3.91)	<0.001	2.69 (2.25, 3.20)	<0.001	2.22 (1.85, 2.66)	<0.001
Age						
18-35			1.00		1.00	
36-55			0.98 (0.92, 1.06)	0.693	1.00 (0.93, 1.07)	0.958
≥56			1.48 (1.34, 1.63)	<0.001	1.48 (1.33, 1.63)	<0.001
Sex						
Male			1.00		1.00	
Female			1.90 (1.79, 2.02)	<0.001	1.51 (1.38, 1.66)	<0.001
Marital status						
Married			1.00		1.00	
Never married			0.64 (0.58, 0.71)	<0.001	0.61 (0.55, 0.68)	<0.001
Separated/widowed			0.94 (0.85, 1.05)	0.259	0.94 (0.84, 1.04)	0.229
Education						
No school			1.00		1.00	
Primary level			1.16 (1.02, 1.32)	0.022	1.12 (098, 1.28)	0.087
Secondary level			1.22 (1.07, 1.40)	0.004	1.19 (1.04, 1.37)	0.013
Higher education			1.32 (1.13, 1.53)	<0.001	1.27 (1.09, 1.49)	0.003
Ethnicity						
Javanese			1.00		1.00	
Sundanese			1.00 (0.91, 1.10)	0.952	0.89 (0.81, 0.97)	0.013
Minang			0.70 (0.61, 0.81)	<0.001	0.67 (0.58, 0.78)	<0.001
Others			0.92 (0.86, 0.98)	0.013	0.86 (0.80, 0.92)	<0.001
Religion						
Islam			1.00		1.00	
Christian			1.06 (0.93, 1.20)	0.420	1.06 (0.93, 1.21)	0.384
Hindu			1.48 (1.30, 1.68)	<0.001	1.59 (1.40, 1.82)	<0.001
Other			0.51 (0.25, 1.04)	0.066	0.65 (0.32, 1.33)	0.238

Predictor variables	**Unadjusted OR (95% CI)**		**Model 1***		**Model 2****	
	OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**	**OR (95% CI)**	**p-value**
Residential area						
Urban			1.00		1.00	
Rural			1.00 (0.94, 1.06)	0.999	1.04 (0.98, 1.11)	0.189
Insurance type						
No insurance			1.00		1.00	
Government insurance			1.27 (1.19, 1.35)	<0.001	1.24 (1.16, 1.32)	<0.001
Private insurance			1.59 (1.42, 1.79)	<0.001	1.56 (1.38, 1.75)	<0.001
Smoking habit						
Never smoked					1.00	
Current smoker					0.68 (0.61, 0.75)	<0.001
Previous smoker					1.29 (1.12, 1.48)	<0.001
Falls (within last 2 years)						
No					1.00	
Yes					1.13 (1.05, 1.23)	0.002
Number of acute complaints (in last 4 weeks)					1.24 (1.22, 1.26)	<0.001

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type, smoking habit, falls, number of acute complaints.

†Diabetes plus comorbidities

Hospital admission within the last 12 months

Table 5.8. shows the logistic regression models for hospital admission within the last year in the overall study population. The presence of diabetes was found to be strongly associated with having a hospital admission in the unadjusted and both adjusted models. After adjusting for all sociodemographic, economic, and health related characteristics, the odds of having a hospital admission in the last year in those with diabetes was 2.80 times higher (95% CI 1.80, 4.36) than those without diabetes. However, the odds did not increase with having ≥1 LTCs, OR 2.45 (95% CI 1.89, 3.17) compared to not having diabetes after adjustment for all variables. Another strong association of hospital admission was sex, where females were 1.99 times more likely (95%CI 1.68, 2.36) to have a hospital admission compared to males, after adjusting for all variables. Having insurance also had a strong association; having government insurance had an increased odds of 2.09 times (95%CI 1.87, 2.35)

of having a hospital admission and having private insurance had an OR of 2.98 (95%CI 2.48, 3.58) compared to those without insurance, after adjusting for all other variables.

Table 5.8. Logistic regression models for hospital admissions in whole population

Predictor variables	**Unadjusted**		**Model 1***		**Model 2****	
	OR (95% (CI)	**p-value**	**OR* (95% CI)**	**p-value**	**OR (95% (CI)**	**p-value**
Presence of diabetes (and other morbidity)						
No diabetes	1.00		1.00		1.00	
Diabetes only	2.65 (1.73, 4.07)	<0.001	2.76 (1.78, 4.29)	<0.001	2.80 (1.80, 4.36)	<0.001
Diabetes +†	3.31 (2.60, 4.21)	<0.001	2.81 (2.18, 3.62)	<0.001	2.45 (1.89, 3.17)	<0.001
Age						
18-35			1.00		1.00	
36-55			0.56 (0.50, 0.64)	<0.001	0.57 (0.50, 0.64)	<0.001
≥56			1.11 (0.93, 1.31)	0.248	1.03 (0.87, 1.23)	0.726
Sex						
Male			1.00		1.00	
Female			2.34 (2.08, 2.62)	<0.001	1.99 (1.68, 2.36)	<0.001
Marital status						
Married			1.00		1.00	
Never married			0.50 (0.42, 0.61)	<0.001	0.49 (0.41, 0.60)	<0.001
Separated/widowed			0.94 (0.78, 1.12)	0.475	0.94 (0.78, 1.13)	0.494
Education						
No school			1.00		1.00	
Primary level			1.21 (0.94, 1.55)	0.139	1.19 (0.92, 1.53)	0.179
Secondary level			1.37 (1.06, 1.77)	0.018	1.33 (1.02, 1.72)	0.033
Higher education			1.59 (1.20, 2.11)	0.001	1.49 (1.13, 1.98)	0.005
Ethnicity						
Javanese			1.00		1.00	
Sundanese			0.96 (0.81, 1.13)	0.619	0.93 (0.79, 1.10)	0.401
Minang			1.09 (0.87, 1.36)	0.443	1.09 (0.87, 1.35)	0.462
Others			0.97 (0.86, 1.10)	0.670	0.96 (0.85, 1.08)	0.473
Religion						
Islam			1.00		1.00	
Christian			1.13 (0.90, 1.41)	0.303	1.12 (0.89, 1.40)	0.344
Hindu			1.21 (0.96, 1.53)	0.110	1.22 (0.97, 1.54)	0.093
Other			0.96 (0.34, 2.67)	0.933	1.05 (0.38, 2.95)	0.920
Residential area						
Urban			1.00		1.00	
Rural			0.90 (0.80, 1.00)	0.057	0.92 (0.82, 1.03)	0.133

Predictor variables	**Unadjusted**		**Model 1***		**Model 2****	
	OR (95% (CI)	**p-value**	**OR* (95% CI)**	**p-value**	**OR (95% (CI)**	**p-value**
Insurance type						
No insurance			1.00		1.00	
Government insurance			2.14 (1.91, 2.40)	<0.001	2.09 (1.87, 2.35)	<0.001
Private insurance			3.05 (2.54, 3.66)	<0.001	2.98 (2.48, 3.58)	<0.001
Smoking habit						
Never smoked					1.00	
Current smoker					0.66 (0.55, 0.81)	<0.001
Previous smoker					1.76 (1.40, 2.22)	<0.001
Falls (within last 2 years)						
No					1.00	
Yes					1.32 (1.15, 1.50)	<0.001
Number of acute complaints (in last 4 weeks)					1.07 (1.05, 1.10)	<0.001

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type, smoking habit, falls, number of acute complaints.

†Diabetes plus comorbidities

5.5.4.2. Logistic regression models for health care utilisation in diabetes population

Outpatients visit within the last four weeks

Table 5.9. shows the logistic regression models for outpatient visit within the last four weeks in the diabetes population. Having ≥1 LTCs alongside diabetes was not a strong predictor of having had an outpatient visit in any of the three models. After adjusting for all other variables, having diabetes and comorbidities did not suggest an association with outpatient visit with an OR of 1.04 (95%CI 0.72, 1.49). This also occurred in the ORs of all other variables, except having Hindu as a religion and the number of acute complaints within the last four weeks. After adjusting for all other variables, having Hindu as a religion was shown to be 2.31 times (95%CI 1.09 to 4.89) more likely to have received outpatient care in the last four weeks compared to being Muslim. Additionally, an increase of every acute complaint resulted in being 1.10 times (95%CI 1.03, 1.18) more likely to have received outpatient care compared to not having any acute complaints.

Table 5.9. Logistic regression models for outpatient visit in the diabetes population

Predictor variables	Unadjusted OR (95% (CI)		Model 1*		Model 2**	
	OR (95% (CI)	p-value	OR (95% CI)	p-value	OR (95% (CI)	p-value
Presence of other LTCs						
Diabetes only	1.00		1.00		1.00	
Diabetes + †	1.29 (0.92, 1.79)	0.136	1.16 (0.82, 1.64)	0.413	1.04 (0.72, 1.49)	0.847
Age						
18-35			1.00		1.00	
36-55			1.11 (0.64, 1.92)	0.713	1.16 (0.66, 2.05)	0.603
≥56			1.51 (0.85, 2.67)	0.162	1.55 (0.86, 2.82)	0.147
Sex						
Male			1.00		1.00	
Female			1.86 (1.33, 2.61)	<0.001	1.55 (0.97, 2.47)	0.067
Marital status						
Married			1.00		1.00	
Never married			0.36 (0.91, 1.40)	0.140	0.34 (0.83, 1.37)	0.129
Separated/widowed			0.79 (0.51, 1.23)	0.295	0.78 (0.50, 1.22)	0.275
Education						
No school			1.00		1.00	
Primary level			0.70 (0.37, 1.31)	0.265	0.73 (0.39, 1.38)	0.330
Secondary level			0.70 (0.37, 1.34)	0.282	0.73 (0.38, 1.40)	0.339
Higher education			0.63 (0.30, 1.29)	0.205	0.66 (0.32, 1.37)	0.261
Ethnicity						
Javanese			1.00		1.00	
Sundanese			0.95 (0.57, 1.57)	0.835	0.89 (0.53, 1.50)	0.666
Minang			0.59 (0.27, 1.30)	0.190	0.57 (0.26, 1.26)	0.166
Others			1.07 (0.75, 1.51)	0.714	1.00 (0.71, 1.44)	0.959
Religion						
Islam			1.00		1.00	
Christian			0.52 (0.24, 1.09)	0.082	0.53 (0.25, 1.12)	0.096
Hindu			2.23 (1.06, 4.69)	0.034	2.31 (1.09, 4.89)	0.029
Other			0.25 (0.03, 2.18)	0.209	0.28 (0.03, 2.48)	0.252
Residential area						
Urban			1.00		1.00	
Rural			1.34 (0.94, 1.92)	0.104	1.31 (0.92, 1.88)	0.137

Predictor variables	Unadjusted OR (95% (CI)		Model 1*		Model 2**	
	OR (95% (CI)	p-value	OR (95% CI)	p-value	OR (95% (CI)	p-value
Insurance type						
No insurance			1.00		1.00	
Government insurance			1.25 (0.90, 1.73)	0.185	1.22 (0.87, 1.69)	0.248
Private insurance			1.45 (0.77, 2.71)	0.247	1.48 (0.79, 2.79)	0.221
Smoking habit						
Never smoked					1.00	
Current smoker					0.67 (0.40, 1.11)	0.117
Previous smoker					1.02 (0.59, 1.77)	0.948
Falls (within last 2 years)						
No					1.00	
Yes					0.85 (0.57, 1.28)	0.442
Number of acute complaints (in last 4 weeks)					1.10 (1.03, 1.18)	0.004

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type, smoking habit, falls, number of acute complaints.

†Diabetes plus comorbidities

Hospital admission within the last 12 months

Table 5.10. shows the logistic regression models for hospital admission within the last year in the diabetes population. From the regression models, it cannot be determined with certainty whether having diabetes and comorbidities are associated with hospital admission. After accounting for all other variables, in model 2, the OR for having a hospital admission for those with ≥1 LTCs was 0.81 (95% CI 0.47 to 1.39) compared to having diabetes only. However, as with outpatient visits above, the confidence interval includes 1. The association between having health insurance and hospital admission before adjusted for other variables resulted in an OR of 2.27 (95%CI 1.40 to 3.64) for government insurance and OR of 1.76 (95%CI 0.75 to 4.10) for private insurance, compared to those without insurance. After adjusting for all other variables, only variables of insurance status and occurrence of falls had a significantly increased odds of having a hospital admission. Having government insurance had an OR of 2.34 (95%CI 1.39 to 3.92), and having private insurance had an OR of 2.60 (95%CI 1.03 to 6.59), compared to those without insurance. An

occurrence of falls within the last two years increased the odds of having hospital admission with an OR of 1.90 (95%CI 1.13 to 3.19) compared to not experiencing any falls.

Table 5.10. Logistic regression models for hospital admissions in the diabetes population

Predictor variables	Unadjusted		Model 1*		Model 2**	
	OR (95% (CI)	p-value	OR (95% CI)	p-value	OR (95% (CI)	p-value
Presence of other LCTs						
Diabetes only	1.00		1.00		1.00	
Diabetes + comorbidity	1.25 (0.77, 2.03)	0.373	0.99 (0.59,1.65)	0.957	0.81 (0.47, 1.39)	0.444
Age						
18-35			1.00		1.00	
36-55			0.62 (0.29, 1.34)	0.227	0.63 (0.29, 1.40)	0.261
≥56			1.04 (0.48, 2.28)	0.914	0.95 (0.42, 2.16)	0.905
Sex						
Male			1.00		1.00	
Female			2.31 (1.39, 3.83)	0.001	1.79 (0.89, 3.58)	0.101
Marital status						
Married			1.00		1.00	
Never married			0.43 (0.52, 3.58)	0.435	0.35 (0.04, 2.98)	0.336
Separated/widowed			0.99 (0.56, 1.75)	0.971	0.96 (0.54, 1.72)	0.893
Education						
No school			1.00		1.00	
Primary level			1.16 (0.49, 2.74)	0.736	1.16 (0.48, 2.78)	0.747
Secondary level			0.82 (0.33, 2.01)	0.662	0.77 (0.31, 1.92)	0.574
Higher education			0.81 (0.29, 2.23)	0.679	0.72 (0.25, 2.05)	0.534
Ethnicity						
Javanese			1.00		1.00	
Sundanese			1.68 (0.87, 3.27)	0.124	1.71 (0.87, 3.37)	0.123
Minang			1.16 (0.41, 3.22)	0.783	1.01 (0.38, 3.18)	0.851
Others			1.19 (0.72, 1.98)	0.490	1.13 (0.68, 1.89)	0.630
Religion						
Islam			1.00		1.00	
Christian			1.16 (0.42, 3.18)	0.775	1.19 (0.43, 3.32)	0.741
Hindu			0.98 (0.34, 2.84)	0.987	0.99 (0.34, 2.88)	0.987
Other			1.00		1.00	
Residential area						
Urban			1.00		1.00	
Rural			1.10 (0.66, 1.84)	0.721	1.16 (0.68, 1.95)	0.590

Predictor variables	Unadjusted		Model 1*		Model 2**	
	OR (95% (CI)	p-value	OR (95% CI)	p-value	OR (95% (CI)	p-value
Insurance type						
No insurance	1.00		1.00		1.00	
Government insurance	2.27 (1.40,3.64)	0.001	2.51 (1.51, 4.18)	<0.001	2.34 (1.39, 3.92)	0.001
Private insurance	1.76 (0.75,4.10)	0.192	2.50 (1.00, 6.26)	0.050	2.60 (1.03, 6.59)	0.043
Smoking habit						
Never smoked					1.00	
Current smoker					0.37 (0.15, 0.92)	0.032
Previous smoker					1.58 (0.75, 3.32)	0.230
Falls (within last 2 years)						
No					1.00	
Yes					1.90 (1.13, 3.19)	0.016
Number of acute complaints (in last 4 weeks)					1.05 (0.96, 1.16)	0.290

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type, smoking habit, falls, number of acute complaints.

5.6. Discussion

5.6.1. Summary of main findings

This epidemiology study was an observational cross-sectional study, using secondary data from IFLS 5 to explore the characteristics of the diabetes population in Indonesia. The data suggest that the diabetes population were relatively older, majority female, married, reside mainly in urban areas, and have government insurance. They also had more acute complaints, outpatient care, and hospital admission, compared to those without diabetes. The majority of people with diabetes had at least one comorbidity, with hypertension and high cholesterol as the two leading LTCs reported. People with diabetes and comorbidity were found to be older, mostly female, and reported more acute complaints than those with diabetes alone. Having diabetes had a strong association of health care utilisation in the form of outpatient care and hospitalisation. However, having comorbidity did not show an increased association towards health care utilisation than those with diabetes only. Having health insurance had a stronger association with health care utilisation in the diabetes population.

5.6.2. Comparison with other literature

The prevalence of diabetes in this study is similar to that of the prevalence of diabetes from Indonesia's Basic Health Research in 2018, of 2.0% (Kemenkes, 2018). This seems low when compared to other countries, such as the USA and the UK, and China and India (Saeedi et al., 2019). However, the Indonesian prevalence in this study was based on diagnosed diabetes. Meanwhile, further information on diabetes prevalence in Indonesia's Basic Health Research in 2018 revealed that when samples had their blood glucose examined, the prevalence of diabetes rose to 10.9%. This suggests that currently, there is a large proportion of the diabetes population that are undiagnosed, therefore not receiving care for their diabetes.

The findings in relation to the descriptive characteristics of the diabetes population in Indonesia were similar to the report of Indonesia's National Basic Health Research Report in 2018 (Kemenkes, 2018) and the DiabCare Asia 2012 study (Cholil et al., 2019). The higher number of acute complaints in the diabetes population compared to those without diabetes is reasonable, as progression of the disease leads to microvascular and macrovascular complications which may present as both acute and chronic symptoms (Fowler, 2008). Furthermore, individuals with diabetes are more prone to infections, as a constant hyperglycemic state may alter immune responses (Casqueiro et al., 2012). The higher number of outpatient care and hospital admissions in the diabetes population compared to those without diabetes are also expected. People with diabetes require ongoing contact with health care, and it is common for people with diabetes to be more frequently admitted to hospital than those without (Müller et al., 2015). A study from Sweden (Sabale et al., 2015) revealed that health care utilisation, and subsequently health care costs, peaked in the first year after the diagnosis of diabetes. It decreased in the second year, and steadily increased in subsequent years. It must be noted that at the time when this data was collected, Indonesia had not yet rolled out the universal health coverage scheme, *Jaminan Kesehatan Nasional* (JKN) nation-wide, therefore diabetes is most likely to be treated at secondary care at the time. This may explain the higher number of hospital admissions, as a regular source of primary care decreases the likelihood of hospital admission in diabetes patients (Wolters et al., 2017).

This study revealed that most people with diabetes have at least one comorbidity, and more people with multiple comorbidities compared to those without diabetes. Hypertension and high cholesterol were the two most common LTCs reported. This finding is similar in a study by Cholil (2019) where hypertension and dyslipidaemia was prevalent in Indonesia's diabetes population (Cholil et al., 2019). Even though hypertension and high cholesterol may be considered as a risk factor of diabetes, rather than a comorbidity, the findings suggest that these two conditions are prevalent and important to merit as a comorbidity to be addressed in the management of diabetes. This finding also adds to prior studies that revealed similar conditions in other diabetes populations in Switzerland and the Netherlands, where the majority of the diabetes population had at least one comorbidity (Struijs et al., 2006, Huber et al., 2014, Luijks et al., 2012), and almost all participants with diabetes had at least one comorbidity in an elderly diabetes population in Canada (Gruneir et al., 2016, Fisher et al., 2016). This finding adds to existing epidemiological information on the diabetes population in Indonesia with regard to comorbidities. Studies conducted in Indonesia have so far mostly focused on complications that occur with diabetes, mainly neuropathy and retinopathy (Cholil et al., 2019, Soewondo et al., 2010, Adriono et al., 2011, Arisandi et al., 2016, Soewondo et al., 2013) rather than comorbidities.

The increase of health care utilisation was apparent in the diabetes population when compared to those without diabetes. However, the findings in this study showed no additional effect of comorbidity on utilisation. This is contradictory to other studies where more comorbidities resulted in an increased use of health care (Struijs et al., 2006, Fisher et al., 2016, Gruneir et al., 2016). One speculation for this may be due to diabetes itself increasing healthcare utilisation, regardless of comorbidities. Another speculation may be related to access of health care. The findings of this study showed a strong association between having health insurance, be it government or private, in health care utilisation, especially in hospital admission. Adjusting for sociodemographic characteristics, including health insurance resulted in a decrease of effect of comorbidities on both outpatient care and hospital admission. Thus, it may suggest that health insurance has a stronger influence on health care utilisation.

This is supported by several studies, whereby by having insurance, people are more likely to utilise health care (Müller et al., 2015, Bakar and Samsudin, 2016, Dror et al., 2005). As the data used for this study was collected in the transitional period of Indonesia's universal health coverage scheme, it is plausible that the scheme had not completely rolled out, with around half of the population still not having insurance. Discussion on health care utilisation in the diabetes population in accordance with Indonesia's universal health coverage scheme will be elaborated further in the general discussion chapter (Chapter 7).

5.6.4. Strengths and limitations

This is the first study to date that has looked at the epidemiology of the diabetes population in Indonesia in relation to comorbidity and impact on health care utilisation. Meanwhile, previous work on diabetes in Indonesia have been focused on complications of diabetes. This study used participant data to determine the impact of diabetes and comorbidities on health utilisation using multi-stage binary logistic regression models.

This study used a national dataset, which claims to represent at least 80% of the Indonesian population (Strauss et al., 2016). The first wave of the IFLS (in 1993) represented approximately 83% of Indonesian population which were concentrated in 13 of the nation's then 26 provinces. In 2014 (when IFLS 5 was fielded), data were obtained from the same households, including their split-offs (household members that have left and formed separate households), which would mean an increase in participants (33,801 participants in 1993 and 52,587 participants in 2014). However, since the original participants were from the most populated provinces at the time, this may shift in 2014, where smaller island groups may have increased in population. Therefore, representativeness of the dataset towards the Indonesian population may be overestimated in IFLS 5. The findings also revealed that there were only 16.7% of the study population that were aged 56 or older, meanwhile the average life expectancy in Indonesia in 2015 was 70.84 years (Maryani and Kristiana, 2018) Even though the findings can be broadly generalised to the Indonesian adult population, particularly in terms of gender, age, rural/urban demographic, and ethnicity, prevalence data may not be accurate. However, the associations found would still be valid.

Due to the nature of a secondary analysis, this study was only able to analyse available data from the retrieved dataset. Therefore, only a limited list of LTCs were available to be included in the analysis. There were 2,014 individuals with missing data on diabetes that were excluded from analysis. Analysis on missing data showed that there were sociodemographic differences between those with missing data and the overall population used for analysis. This may have an impact on the results. It was also found that those with missing diabetes data had missing data on health insurance status. One reason for this might be that since health data were collected as a different questionnaire book to sociodemographic data, those with missing data may have not completed book 3B on health. A large number of missing data of up to 8.5% for several variables led to the decision to exclude these variables from analysis. These include variables on health measurement to assess BMI, indicators of socio-economic deprivation which may provide further insight into the diabetes population. This also included an important condition that is closely associated with diabetes, depression, was available in the dataset as screening questions, but not a clinical diagnosis. Although this could still be included as part of the analysis, the large number of missing data of this variable warranted its exclusion. It was decided that this variable would be excluded as it would have resulted in a large proportion of participants being excluded.

This study used a dataset with relatively limited information on health and its determinants. As self-reported data, it’s possible that individuals may not accurately recall past experiences. This may be more problematic when individuals need a proxy to answer the survey, where the proxy may not be able to accurately report the individual’s condition and their healthcare utilisation. Initially, data was sought from the Indonesian Ministry of Health’s Basic Health Research programme, which has more extensive data on health indicators of the country’s population. Its data collection is conducted every five years, in accordance with the national census, at the population level. It was collected in the form of self-reported health measures through interview, and measurements and examinations of specific clinical indicators, such as BMI, blood pressure, and blood glucose level, amongst other indicators. This data would better represent Indonesia’s diabetes population.

However, the request for this data was denied, stating lack of novelty and excessive data request. The letter of rejection is available in Appendix A.

A small sample size of the population with diabetes may have impacted the findings of this study (N=777). It cannot be concluded for certain the impact of comorbidities on health care utilisation in the population with diabetes. Higher levels of comorbidity might have impacted on this, however this was not carried out due to the small sample size. Furthermore, certain clusters of LTCs may have impacted health care utilisation, however this was not conducted as this was out-with the scope of this study. This may serve as further motive for future research to analyse a wider, nation-wide dataset to further examine the effect of comorbidities in the diabetes population.

5.7. Chapter summary

This chapter has presented the findings of the second study of this PhD, to determine the characteristics of Indonesia’s diabetes population using publicly available data from the IFLS.

Most of the findings of this study were expected based on the international literature. However, the characteristics of the diabetes population, and the increase of health care utilisation in the diabetes population is important information to explicitly have for Indonesia in order to ensure that a diabetes management programme fits the context of its population. The additional burden of comorbidity for the health care system merits further investigation, as this study found no additional effect of comorbidity in health care utilisation. Many factors may play a role in this finding. It might be possible that individual characteristics of participants further determines their utilisation of health care, characteristics and circumstances that may not be identified in a quantitative manner.

Determining the characteristics of the diabetes population is essential to providing optimal health care. The findings of this study will be further discussed on whether Indonesia’s approach to diabetes management meets the conditions of its population. This work leads to the next chapter of this thesis, where findings from qualitative interviews of primary care doctors and patients helped the findings of this quantitative study.

Chapter 6 – Experiences of Doctors and Patients with *Prolanis*

6.1. Overview

This chapter presents the results of the qualitative interviews conducted with doctors and patients in all three types of primary care in Indonesia regarding their experience with Indonesia's diabetes management model, *Prolanis*. To date, there have been no published studies on the implementation of *Prolanis* in all three types of primary care in Indonesia. This study will reveal important information that arise from both doctors' and patients' perspective in how diabetes is being managed in primary care. These findings will be discussed with other relevant studies and reflected towards the study aim.

6.2. Aim and Research Questions

This chapter aims to answer the third aim of this thesis, which is to explore experiences of patients and primary care doctors in the implementation of Indonesia's diabetes management model *Prolanis*. The specific research questions addressed were:

a. How is *Prolanis* implemented in different primary care settings in Indonesia?
b. What are the factors influencing the implementation of *Prolanis*?
c. What are the perceived effects of implementing *Prolanis* in diabetes care provision?

6.3. Methods

The methodological considerations related to this study are described in detail in Chapter 3. This qualitative study used in-depth semi-structured interviews with primary care doctors and patients with diabetes regarding their experience with *Prolanis*. Ethical approval for this study was granted by MVLS Ethics Committee, University of Glasgow, and the Medical and Health Research Ethics Committee of Faculty of Medicine Universitas Gadjah Mada – Dr. Sardjito General Hospital.

Permission to conduct the study was granted by the District Health Office of the Special Region of Yogyakarta. Approval letters from the Ethics Committees and the District health office can be viewed in Appendix H.

6.3.1. Sampling of practices

The study was conducted in the province of the Special Region of Yogyakarta, Indonesia. The province is located in the island of Java, the most developed region of the country. It is made up of both urban and rural districts. Gathering data from this province was considered appropriate to compare urban rural differences in a relatively similar cultural setting.

A purposive sampling approach was taken on the basis of maximum variation sampling (Patton, 2007). Doctors and patients were identified and approached based on the setting and type of primary care. The setting of practice was differentiated between urban and rural setting. The three types of primary care being carried out in Indonesia are Individual Doctor Practice, government-run community health centres (*Puskesmas)*, and private primary care clinics. Three participants were selected to be interviewed in each category, aiming for a total of 18 doctors and 18 patients.

Table 6.1. Sampling frame for participants

Setting	**Participants**					
	Patients			**Doctors**		
	Individual doctor practice	***Puskesmas***	**Primary care clinic**	**Individual doctor practice**	***Puskesmas***	**Primary care clinic**
Urban	3	3	3	3	3	3
Rural	3	3	3	3	3	3

6.3.2. Recruitment of participants

Recruitment of participants was carried out using a pragmatic approach. Potential doctor participants were identified from a registry of primary care physicians affiliated with the Department of Family and Community Medicine, Universitas Gadjah Mada, and selected based on the type and setting of practice. Patient participants were identified from the *Prolanis* patient registry of the participating practices, with the permission of the practice and the District Health Office. Patient participants were selected at random from these registries, with one participant from each practice who were willing to participate when contacted.

Doctor and patients were recruited via phone call to inquire their availability to participate in the study. Once they have verbally agreed, a packet of Participant Information Sheet and Informed Consent form was either e-mailed or given directly before the date of the interview. ID numbers of participants were allocated based on the participant type, setting and type of practice, and order of interview.

6.3.3. Data collection

Doctor participants were interviewed in person at their primary care practice. Patients were interviewed either at their primary care practice during their monthly *Prolanis* session or at their homes, depending on their preference. Most patients were interviewed alone, but two male patients were interviewed with their wife present. Two separate topic guides for doctor and patient interviews were developed to guide the interviews and address the aims of this study (Appendix I). The topic guides were developed based on the elements of the CCM to frame most of the questions. Additional questions were also incorporated to address how *Prolanis* is implemented, and barriers and facilitators of implementing *Prolanis* in practice. The topic guide for doctors was tested out informally on a few clinical doctors that were not part of the study. The interviews were conducted using the language of *Bahasa Indonesia*. All interviews took place between August and October 2018. AG conducted all interviews. The interviewer revealed her background as an academic and a GP to the doctors interviewed. This would allow doctors to openly discuss their experiences directly without having to explain terminologies or jargon commonly used in practice. However, this may lead to the drawing of conclusions regarding doctor’s opinions without probing further on their answers. The interviewer did not reveal her background as a GP to patient participants, only as a researcher. This was an effort to avoid patients being uneasy when speaking about their care experience.

6.3.4. Data analysis

Interviews were recorded and transcribed verbatim. Transcriptions of interviews were conducted by a third party. The transcripts were thoroughly checked against the recordings and pseudo-anonymised by AG. Three doctor and three patient interview transcripts were fully translated into English by a professional translator to be used in generating initial codes involving three researchers, AG, Professor Stewart Mercer (SWM), and Dr Sara Macdonald (SM). SWM is an academic GP and a mixed-methods researcher with extensive international experience of primary care. SM is a non-clinical senior lecturer in primary care and a sociologist with extensive experience in qualitative research. All three researchers first read and coded a transcript independently, then met together in a coding clinic session per transcript to discuss and synchronize codes assigned to the transcripts. This was carried out iteratively as interviews were being conducted. A total of six coding clinic sessions were conducted to formulate, adjust, and finalise a final thematic framework to be used to analyse the remaining untranslated transcripts. Transcripts that were not fully translated in English were analysed independently by AG. Whenever coding was not clear, or new themes emerged during this analysis, discussions were held again with SWM and SM. These remaining transcripts were translated (albeit by reading), and sections that were deemed most relevant were translated in writing to be presented in this chapter.

Analysis of transcribed interviews was conducted using thematic analysis (Braun and Clarke, 2006). The process of coding and categorization of codes in the interview transcripts led to the determination of themes and subthemes reflected in the data. One thematic framework was produced, capturing the themes across doctor and patient interviews. Although doctor and patient interviews were analysed separately, due to the overlap of themes generated between the two participant groups, the findings are presented together. This is intended to minimize repetition and provide adequate comparison between the experiences of doctors and patients across themes. Data handling and management was conducted with the aid of NVIVO11 qualitative data analysis software (Bazeley and Jackson, 2013).

6.4. Findings

6.4.1. Participant characteristics

A total of 18 primary care doctors and 18 patients were interviewed for this study. Table 1 shows the characteristics of the doctors, while the characteristics of the patients are shown on Table 2.

Nine doctors were interviewed from each of the rural and urban sites, with six each from individual doctor practices community health centers (*Puskesmas*), and private primary care clinic. The age of doctors interviewed ranged from 29 - 72 years old (mean of 41 years), which reflected on their experience as a practicing doctor (mean of 14.1 years practicing) and implementation of diabetes services through *Prolanis*. *Prolanis* was formally established as part of the universal health coverage (UHC) scheme in 2014. Prior to that, an older version of *Prolanis* was already implemented as part of the insurance scheme for government workers or civil servants (ASKES) before UHC was rolled out. Half of the doctors (n=9) interviewed had only implemented *Prolanis* for three years. Meanwhile, there were a number of doctors (n=3) that had been implementing *Prolanis* since ASKES. The doctors, although all practicing in primary care, ranged from having no exposure to further training in primary care (n=6), having postgraduate training (n=7), and having a Master's degree in Family Medicine (n=5).

The 18 patients interviewed were relatively older adults, ranging from 48 to 84 years old (mean of 63 years). There was a wide range of educational background reported, from only completing primary school (n=1), junior high school (n=5), or high school (n=3), to having an undergraduate diploma (n=5), Bachelor's degree (n=3), or a Master's degree (n=1). Years diagnosed with diabetes also varied, ranging from two to 20 years (mean duration = 9.4 years). The majority of patients were newly enrolled in *Prolanis* under the BPJS scheme (n=15), thus making their experience in *Prolanis* of only 4 years at the most. Those who were in *Prolanis* for more than 4 years (n=3) were patients in a primary care practice that previously provided services to patients under ASKES.

Table 6.2. Doctor participants' characteristics

Participant ID	**Sex**	**Age**	**Setting**	**Primary Care Type**	**Years in practice**	**Years implementing *Prolanis***	**Exposure to specific Family Medicine education**
DR101	M	45	Rural	Individual Doctor Practice	19	3	MSc in Family Medicine
DR102	F	46	Rural	Individual Doctor Practice	19	3	MSc in Family Medicine
DR103	M	47	Rural	Individual Doctor Practice	20	2	MSc in Family Medicine
DR201	M	45	Rural	Community Health Centre	18	3	Training*
DR202	F	37	Rural	Community Health Centre	13	3	Training*
DR203	F	42	Rural	Community Health Centre	18	3	MSc in Family Medicine
DR301	M	28	Rural	Private Clinic	2	1	None
DR302	F	28	Rural	Private Clinic	3	2	None
DR303	F	48	Rural	Private Clinic	21	3	Training*
DU101	F	73	Urban	Individual Doctor Practice	40	8 (4 with Askes)**	Training*
DU102	M	32	Urban	Individual Doctor Practice	6	6 (2 with Askes)**	None
DU103	M	44	Urban	Individual Doctor Practice	15	3	Training*
DU201	F	45	Urban	Community Health Centre	18	3	Training*
DU202	M	32	Urban	Community Health Centre	7	3	None
DU203	F	35	Urban	Community Health Centre	9	2	MSc in Family Medicine
DU301	F	29	Urban	Private Clinic	3	1	None
DU302	M	36	Urban	Private Clinic	6	1	None
DU303	F	41	Urban	Private Clinic	17	8 (4 with Askes)**	Training*

*Training in Family Medicine conducted by Universitas Gadjah Mada, in affiliation with the District Health Office of the Special Region of Yogyakarta, Indonesia.
**4 years of *Prolanis* under BPJS scheme, and previously under Askes (government employee insurance scheme)

Table 6.3. Patient participants' characteristics

Participant ID	**Sex**	**Age**	**Setting**	**Primary Care Type**	**Highest level of education**	**Years diagnosed with diabetes**	**Years in *Prolanis***
PR101	F	63	Rural	Individual Doctor Practice	Junior high	3	3
PR102	M	65	Rural	Individual Doctor Practice	Junior high	9	3
PR103	M	67	Rural	Individual Doctor Practice	Junior high	15	2
PR201	M	48	Rural	Community Health Centre	Primary	11	1
PR202	F	59	Rural	Community Health Centre	Bachelor’s degree	9	1
PR203	F	53	Rural	Community Health Centre	High School	3	1
PR301	M	53	Rural	Private Clinic	Junior high	13	1
PR302	F	52	Rural	Private Clinic	Junior high	2	1*
PR303	M	75	Rural	Private Clinic	Undergraduate diploma	4	4
PU101	M	84	Urban	Individual Doctor Practice	Undergraduate diploma	20	5**
PU102	M	66	Urban	Individual Doctor Practice	High school	13	6**
PU103	F	59	Urban	Individual Doctor Practice	Undergraduate diploma	5	3
PU201	M	56	Urban	Community Health Centre	Master’s degree	8	3
PU202	F	60	Urban	Community Health Centre	Undergraduate diploma	15	3
PU203	F	63	Urban	Community Health Centre	High School	12	4
PU301	F	56	Urban	Private Clinic	Bachelor’s degree	2	2
PU302	F	69	Urban	Private Clinic	Bachelor & professional degree	9	1
PU303	M	77	Urban	Private Clinic	Undergraduate diploma	17	8**

*dropped out of *Prolanis* after one year of participation

**4 years of *Prolanis* under BPJS scheme, and previously under Askes as a government employee

6.4.2. Thematic analysis

This study aimed to explore the experiences of doctors and patients in the implementation of *Prolanis*. To provide a coherent and comprehensive picture of these experiences, the themes reflect the factors that influenced implementation. A breakdown of the thematic framework is presented in Table 6.4. below. The main themes that arose throughout the interviews were contextual, system, process, and outcome factors. The contextual theme highlights factors that provided a picture of the context in which the participants have been in, this included the subthemes of patient health beliefs, family support, social relationship, and access to practice. The theme of system factors included subthemes that described systemic factors of the health care system and practice that affected the delivery of Prolanis, this included regulations/policy, funding/financial issues, staffing support, and primary-secondary care interface. Process factors includes the subthemes that illustrated the factors that arose in the process in which *Prolanis* was implemented in various settings, this included service provision, recruitment/navigation to care, motivation, continuity, drug availability, competence, and comorbidity. The theme of outcome describes experiences of participants regarding their perceived outcomes of *Prolanis*, which includes the subthemes of self-management, the group role, and clinical outcome. The findings will be presented in this order as to create a systematic flow in the depiction of the participants' experiences.

Most themes and subthemes applied to both doctor and patient interviews. However, the depth with which the experiences were recounted differed between the two groups of participants. In some themes, the patients' experiences were more elaborate and painted a clearer picture, while it was only acknowledged in passing in the doctor interviews. The opposite can be found on some other themes. Several quotes will be presented to illustrate this.

Table 6.4. Thematic framework

Main Theme	Sub-theme
Contextual Factors	Patient health beliefs
	Family support
	Social relationship
	Access to practice
System factors	Regulations/policy
	Funding/financial issues
	Staffing support
	Primary-secondary care interface
Process factors	Service provision
	Recruitment/pathways to care
	Motivation
	Continuity
	Drug availability
	Competence
	Comorbidity
Outcome factors	Self-management
	The group role
	Clinical outcome

Contextual factors

The contextual factors characterise the setting and context that influenced the participants' experiences in *Prolanis*. The subthemes within this theme mainly derived from the patient interviews, however several doctors' experiences echoed those of the patients.

a. Patient Health Beliefs

Patients shared beliefs about diabetes and their experiences when they were first diagnosed with the disease. The quotes below depict patients presenting with fear and worry upon being first diagnosed.

When patients were asked about how they were first diagnosed with diabetes and consequently enrolled in *Prolanis*, almost all patients revealed their fear upon first finding out about their diagnosis. Most patients believed that diabetes is an inherited disease.

> *"I didn't know then. I didn't even like sweets. Well probably (they say) if we have parents with the sugar (disease), their children will too. Yeah maybe it's because of my eating habits, but then I don't think my eating habits were (the problem). The whole family got it, my brother*

> *died recently, because of diabetes, then me, then my younger siblings, number five and six, they all got the sugar (disease). So that means it's from my father, he had the sugar disease." (PU202, patient, urban, Puskesmas)*

Patients without a family history therefore questioned the origins of the disease.

> *"I was really stressed, you know. I don't have sugar (disease) inheritance, my father and mother don't. I was actually taking care of my husband's grandfather, how come now I got it. I was stressed out, I really was, and I feel so down. So, I came here (clinic), I was scared of my kidneys, it was scary. So, I got in Prolanis. (PU301, patient, urban, primary care clinic)*

Some patients also revealed that they felt alone and ashamed following diagnosis. They understood that diabetes could not be cured and felt frustrated.

> *"I was scared. I was ashamed, (so) I kept it to myself. Why is my illness like this, they say there's no cure. It was frustrating you see" (PR203, patient, rural, Puskesmas)*

b. Family Support

The role of family was mentioned by several participants, both doctors and patients, in the management of diabetes, and implementation of *Prolanis*. Several male patients specifically mentioned the role of their wives in their diabetes care. Whether it was reminding them to control their diet or accompanying them every month to their *Prolanis* services.

> *"It's not like I'm spoiled or anything, but when I eat, I ask her to get the rice (meal) for me. Because she knows (the portion size), if it's me, I take what I want. If she gives me that much, then that's it, I don't take more food." (PU303, patient, urban, primary care clinic)*
>
> *"When I go to get my medicine (consultations), I go with her (wife), haha" (PR103, patient, rural, individual doctor practice)*

Doctors mentioned that they usually have family members come in with the patient during consultations. Patients' self-management was often challenged because they lacked family support:

> *"There are many Prolanis participants who live alone, (because) their children no longer live with them. Then they will come, not in the set schedule. Sometimes, they don't know when to take their medicine." (DR301, doctor, rural, primary care clinic)*

> *"I once called the patient's daughter to come in, 'are you okay with having your Mum (her disease) not controlled?' 'well no' (she said). So yeah, those things we also have to think about. (The patient) being old, having a strict diet would not work, so I was like "she needs shots (insulin), you need to watch out for her, if she doesn't (take the insulin shots) it will be high (glucose level)." (DU101, doctor, urban, individual doctor practice).*

c. Social relationship

The interviews were conducted in selected practices in both urban and rural sites. Differences in the nature of the community within these two settings played a role in deciding the type of service the practice applies in the implementation of *Prolanis*. Most rural and community centre based practices opt to conduct a one-day *Prolanis* group service where patients come on a designated day of the month to carry out consultations, attend a group education class and obtain their monthly prescriptions. This model was designed to offer continuity and therefore improve adherence

> *"We came to this format [Prolanis day for all sevices] because (some) people live quite far off, so they come in together, we treat them together. There are patients who live far away, so every time (Prolanis day), we see at least six people or (they come in) one car, and they will always come (together), so yeah." (DR201, doctor, rural, Puskesmas)*
>
> *"We used to have it on the 16th of every month, but then we moved it to the second Saturday of the month. Saturdays there's no school [no work as well], so they will have someone take them here, because it's the weekend. So, we make it that way" (DR302, rural, primary care clinic)*

This was not the case in urban sites, where there was no mention of a collective community within their patient group. Practices tend to opt for individual consultations and education appointments. They felt that they gave the patients freedom to come for their monthly consultations individually at a time that suited them. Even if practices did have a separate group session for exercise or education, they felt that not many people attended those sessions.

> *"We don't do any special day because from the beginning they (the patients) are enrolled in Prolanis at different times, they'll say that they're used to come in at the beginning of the month, in the middle of the month. It's hard to make them come together in one specific time" (DU301, urban, primary care clinic)*

It emerged that the social relationship between the practice and patient were important for patients, especially in rural sites when describing how they came to be enrolled in *Prolanis*. Since they are well acquainted with their doctors, they were more willing to be enrolled in *Prolanis* as they were personally close with the doctor. Meanwhile, there were no mention of this personal bond between patient and doctor from patients in urban sites.

> *"Yes, well Mrs [the doctor] lives near me, she's just like my sister. Whenever she comes by my house, she's like 'come on Mam, join the group, no need to overthink, you will meet lots of friends there', that kind of encouragement from her, it motivated me." (PR203, patient, rural, Puskesmas)*
>
> *"I like it here, because Mr [the doctor] when he doesn't see me, or it's been a while that I haven't gone to him, he will come and ask why I don't come in, let's check your sugar. He's a nice doctor." (PR103, patient, rural, Individual doctor practice)*

d. Access to care

With the implementation of universal coverage, access to primary care, and consequently *Prolanis* has been easier. Some doctors found that with this scheme, people are becoming more aware and less afraid of coming in to see their doctors. This was also true for diabetes patients. Several doctors noted that they motivated patients to come in and enrol for the programme as it is "free" and would alleviate their burden of continuously paying for their own medications.

> *"They need the family doctor. So, they will come routinely to their family doctor. Those without insurance and not in Prolanis, sometimes when they feel better, they don't come anymore (because of money). Although we know they have to be routinely managed, so Prolanis is much easier." (DR101, doctor, rural, individual doctor practice)*
>
> *"I paid whenever I come. Then the doctor told me that having the sugar disease, it cannot be cured, only controlled, and the sugar disease has effects everywhere. If it's not controlled, it can get to other organs, you see. So, I was advised to find KIS [insurance], then I went to social services for it. Three months and then it was approved, my primary care facility was here, so I now come here." (PR301, patient, rural, primary care clinic)*

The different forms of primary care have differing issues of access. Community health centres (*Puskesmas*) have their own jurisdiction, which make them have a definite area of work where they can carry out programs, and their patients mostly live within their jurisdiction area. This makes their practice more accessible to their patients. This is not the case for individual doctor practices and primary care clinics. These types of practices had patients register to their practices on their own. This resulted in practices having patients from many areas, not necessarily near the practice, as people are free to choose their own primary care practice.

> *"I have patients from near here, then it increases from word of mouth I suppose, those who live far away. You know they have it (primary care practice) as well, but I don't know, their family is here, so their family registered them to me. Before then they were general patients (paying out of pocket), but then they used BPJS then enrolled with me." (DU303, doctor, urban, primary care clinic)*

Being in *Prolanis* and having their diabetes treated at a primary care facility was considered beneficial by patients, especially in rural areas. Most patients in rural sites previously had their diabetes treated at a hospital, which is considerably farther away from their homes compared to their primary care practices.

> *"I like it here, I used to go [hospital] which is far. When I go here, it is much closer to my house. If there is anything, I would come here. Before when I had my feet treated, I had to go to hospital, then I was referred back here (Puskesmas). Now I'm all stable here. Praise the Lord, I just come here." (PR203, patient, rural, Puskesmas)*
>
> *"Here is much closer, I like it here. If I had to go to the hospital, it takes time, energy, resources. If [I] don't have any transportation it's hard, because it's about 27km from home to the hospital. But I had to go, it was troublesome. If it's here, it's only how many, only about 500m, so it's close right, it's nice here. (PR102, patient, rural, individual doctor practice)*

With physical access being mentioned as an important issue in the implementation of *Prolanis*, as mentioned above. For rural sites, the problem lies in the geographical area of the rural sites being studied. The terrain is mountainous, with no public transportation within villages. Patients that have difficulty to reach the practice on their own will rely on their children for transport. One patient specifically mentioned this as the reason she didn't regularly come in for *Prolanis* sessions and was eventually removed from the programme.

> *"Yes (my son) takes me there (clinic). He's the only one available, the other one he works in the city." (PR302, patient, rural, primary care clinic)*
>
> *"What happens if he can't take you?" (Interviewer)*

> *"Well I didn't go. If I had to walk, that far, I would pass out when I get there. (PR302, patient, rural, primary care clinic)*

System Factors

The theme of system factors presents the experiences relating to the system of care itself which influences the way practices implement *Prolanis*. Participants discussed regulations, financial issues, staffing support, and the complex nature of the primary-secondary care relationship. This theme mostly applied to doctor interviews. However, there were a few patients that can be quoted in regard to their opinion on the systems of how *Prolanis* is being implemented that they have found to affect them.

a. Regulations/policy

The regulations surrounding the initial implementation of *Prolanis* was not something that most doctors discussed in detail. Issues on regulation seemed to arise during the implementation itself. However, one doctor shared her experience of establishing *Prolanis*, because she has only implemented it for one year prior to the interview. She found the lack of set guidelines or clear documents on how to implement the programme challenging when her practice was implementing *Prolanis*. Little support was given by BPJS-K. She relied on experiences of other clinics and doctors that have already been implementing *Prolanis*.

> *"So, there was no guide in implementing Prolanis. When we started our contract (with BPJS), we were just told that there's this programme for diabetes and hypertension, here are the forms (for us to fill in for patients to enroll). Well they have this brochure, but it was confusing with all the forms. There was a time where we gave them the forms of patients (to be enrolled), and we were rejected. Turns out there were two forms that needed to be filled out. So, there's no clear information on the whole package, what to do, like how to run it. We get information only when we ask, so we have to be active ourselves. I suppose it's not a problem if you're a seasoned player and have been doing this for a while. At first, we asked BPJS directly, now we ask other clinics who have been doing this longer to tell us what to do." (DU301, doctor, urban, primary care clinic)*

In its course of implementation, all doctors found the Commitment Based Partnership (Kerjasama Berbasis Komitmen / KBK) greatly influenced their approach in implementing *Prolanis*. In the period when the interviews were conducted, the one aspect of the scoring system that concerns them the most is where practices must meet the requirement of a minimum of 50% contact rate for *Prolanis* patients. Some doctors felt that with the need to achieve this, they would only recruit patients that would most likely adhere to the program. This resulted in several diabetes patients not being included in *Prolanis*.

> *"Not everyone who has diabetes are enrolled in Prolanis. Because if they come this month, and they don't come back the next month, our clinic's score will be bad. So, it's better not to enroll them if we don't know (whether they will come regularly) yet." (DU302, doctor, urban, primary care clinic).*
>
> *"If we don't meet their cut off rate (for Prolanis), we get punished by having our capitation reduced. See that's the dilemma for us to increase our Prolanis patients, for us to control them is quite hard. The hard thing for our type of primary care practice, is that our patients are everywhere, different to Puskesmas where they have their own jurisdiction area, so they are automatically in charge of their area. I don't have a designated area of my own, and there's a Puskesmas here as well, I have patients from different districts that are registered with my practice, that's the hard part. If they don't come regularly, I wouldn't dare enroll them in Prolanis" (DU103, doctor, urban, individual doctor practice).*
>
> *"Yes, well I pick out the ones that we enroll (in Prolanis), so that I don't get a bad score you see. So, we don't really compete in the numbers (patients enrolled). Because if we enroll them, then they drop out, it will burden us." (DU101, doctor, urban, individual doctor practice).*

Some doctors did not limit their recruitment because of this regulation. Instead they made it easier for patients enrolled in their *Prolanis;* they hoped patients will be disciplined and attend the practice for their sessions. However, they do realise that eventually, it is the patients themselves that decide whether they want to be in *Prolanis*.

> *"Some clinics have a high turnout rate probably because they enroll only about 30 patients, and they select those who are 'diligent', so they come regularly. We don't do that, we enroll anyone diagnosed (with diabetes), if there's a new one, we enroll them, and yes some of them don't turn up, and then we get a low score. But that's the thing, I instruct all personnel to get on board and deal with this, I make sure that my team catch up to them and have them monitored. Then when we have those that are truly hard and not wanting to come, we then give them the option to leave the program, because we don't deal with patients that don't want to be controlled, and it's bad for our evaluation. And so some do prefer to be taken out of the program, with many reasons." (DR303, doctor, rural, primary care clinic).*
>
> *"This Prolanis is a good thing, but when practices are burdened with the requirement that the contact rate for Prolanis must be in this*

> *percentage, then there would be efforts to make our patients come regularly. But the thing is, we can't force them when that doesn't happen." (DR202, doctor, rural, Puskesmas)*

Several doctors also expressed their frustration with BPJS-K and the lack of incentive for performing well with *Prolanis*. Instead, balance of reward and punishment is non-existent, only punishment. This is in the form of deduction of capitation when they don't meet the criteria for *Prolanis* contact rate.

> *"If we don't get good Prolanis attendance, our score will be low from BPJS and they will reduce our capitation. So, it's just a punishment from them, no incentives. No, nothing for Prolanis, no appreciation. So here, we are paid our salary as a civil servant, other than that, nothing." (DU201, doctor, urban, Puskesmas)*

> *"There are lots of things that influence our implementation of Prolanis, but BPJS doesn't care. All they know is that 'Ha! You can't get your patients under control, so you're punished'. So, we get punished, a five (to) ten percent deduction, we just need to accept it, whatever that is." (DU103, doctor, urban, individual doctor practice)*

Doctors were also critical of the frequent changes in policy during the implementation of *Prolanis*. Doctors found that the changes made it hard for them to have a routine in care provision, which often resulted in complaints from patients. Changes were also often made at random times which was inconvenient.

> *"What makes it frustrating is how they (BPJS) change regulations. Sometimes this month they make this change, then in two months' time, they change it again. We just started to implement the previous change, then they change it again. Sometimes the patients complain to us, 'well last month it wasn't like this, doc'. (DR102, doctor, rural, Individual doctor practice)*

> *"It's very often that BPJS gives the Puskesmas information on a policy that clashes with the current condition. So, they don't have any sort of socialization with us, or the community, so it's us that's being pitted against the community. But when we complain they'll say that their resources are limited. 'We only have a few people that take care of everything here at BPJS' they'll say. And it's also often that the regulations that they make are just one-sided from BPJS, not accommodating our needs." (DR203, doctor, rural, Puskesmas)*

Patients were aware of these constant changes in policy, which resulted in changes in services. However, they felt that there is nothing they can do about it.

> *"Now there are a lot of reduction in services, such as the lab test. It would be much more satisfactory for us to have our blood drawn twice*

> *like before, the fasting one, and two hours after that. Now they only do it once. But we do realise that's just what the policy is now." (PU201, patient, urban, Puskesmas)*

> *"Previously we were given food during our lab checks, because we need to eat after our fasting (blood sugar test) one. But now they don't give us anymore, so we have to bring food ourselves from home. Probably because there's no funding. Well things like that, it's just what it is." (PR102, patient, rural, individual doctor practice)*

> *"I have always been referred to hospital A, but now they said I can't, and can only be referred to another hospital. Why do they do this? It was okay before, there were no problem, but now they change it. I can only oblige" (PU303, patient, doctor, primary care clinic).*

b. Funding/financial issues

Although not directly affecting direct monetary gains for the practice, *Prolanis* is beneficial for the practice. Previous funding mechanism on health care was a barrier for patients to access optimal care. Being in the UHC scheme, thus consequentially being enrolled in *Prolanis,* was considered a relief financially for some patients.

> *"For me, if a patient has diabetes, I would enroll them in Prolanis, and they will be considered a Prolanis patient, and they will be receiving regular medication. Then to those who don't have insurance, I would advise them to enroll in the national insurance scheme, then I would treat them. If not, it would be such a burden for them financially, so I would suggest them that." (DR101, Doctor, rural, individual doctor practice)*

> *"After I was hospitalized, I wanted to get a referral letter so it would be free, but I already have a letter from the hospital for my upcoming appointment. Then doctor ____ said "You've already been given a letter from the doctor at the hospital, so you don't need to get a referral from here, what were you sick with?". "sugar doctor" I said, then doctor _____ said "you know what, you should take part in Prolanis on the 3rd of every month, you will be required to provide a few documents, but that can be done later, it doesn't matter, but you should come here every month on the 3rd". So, I came to the Puskesmas on the 3rd of the next month, and I've been coming here once a month ever since." (PR201, patient, rural, Puskesmas)*

Being in *Prolanis* is considered to be especially beneficial financially for patients on insulin. Patients felt that being in *Prolanis* saved them from the financial burden of having to constantly spend money on insulin and needles.

> *"Praise the Lord, I get medication. If I had to pay for insulin, that's expensive." (PR103, patient, rural, individual doctor practice)*

> *"If I don't use KIS [national insurance] each needle is 200 (Indonesian Rupiah). You know one needle is only for one week. I use insulin twice a day, sometimes three times a day when my blood sugar is high, morning, day, night." (PR203, patient, rural, Puskesmas)*

The financial benefit of *Prolanis* mentioned before sometimes can be overshadowed by problems practices face in regard to claiming funds for reimbursement. Practices often relied on personal or practice funds to keep the programme running while reimbursements from BPJS can be delayed. This was felt particularly hard for individual doctor practices and private clinics where their main source of income is the capitation from BPJS-K, compared to Puskesmas who has the bulk of their budget from the government.

> *"The help (reimbursement) takes such a long time. So, I'm like, what do we do. 'Okay, we'll pitch in', So it's from the patient's contribution too." (DU101, doctor, urban, individual doctor practice)*
>
> *"For group education, we have to make additional expenses for the speaker and stuff. While we don't have that many Prolanis patients, sometimes our claim gets denied because they say that we don't have enough patients for it to be claimed. So, we just don't bother. We educate them personally when they come in for their monthly appointments anyway." (DU301, doctor, urban, primary care clinic)*
>
> *"The activities are all good, but all this time for the likes of education (group), the meeting gets funded by BPJS. Well hopefully it will continue to be funded, because there are rumours saying that it won't be funded anymore by BPJS. So, it's like saying that Prolanis patients are being forced to be independent. So, when they meet, they provide their own snacks, they pay their own instructors. If it does come to that, I've made plans from early on, I've put in this stuff in the Puskesmas budget plan for Puskesmas funding, so if it does stop, we'll still have backup." (DR203, Doctor, rural, Puskesmas)*

c. Staffing support

Staffing support plays an important role in determining the types of services being provided by practices. Puskesmas and established clinics have teams which coordinate the *Prolanis* programme, while most individual doctor practices do not.

> *"As an individual doctor practice, of course the practice team is limited. So, there's only one doctor (me), two admin staff, and one nurse. Of course, implementing Prolanis in my practice cannot be done as intensive as in Puskesmas. In Puskesmas they have teams, they have structured programs, theres the lab technicians, nutritionist, and they can easily have psychology counselling, or health promotion, they have a set of teams that's in charge of such programs. If you compare it to an individual doctor practice, we are our own managers, but the human resource is limited. Well that's in my practice anyway. My capitation is only for 1500 individuals, so to be hiring more personnel, that I can't afford with my current capitation." (DR101, doctor, rural, individual doctor practice)*

> *"So, like us, we have a team. It's all clear, there's Mrs ______ (other Puskesmas doctor), then there are village nurses that are usually in our village sites on other days, but for this activity (Prolanis day), they come and work with us here. It's so they can monitor as well, because once the patient goes back (home), they will go to our village sites for their problems and so our nurses will know. So yeah, there's a team, we have dieticians, nurses of course, then there are midwives as well. So, there's a team." (DR201, doctor, rural, Puskesmas)*

For patients being registered in a Puskesmas or a clinic, they feel engaged with the practice and have a good standing relationship with other staff of the practice. They feel that the doctor is there for consultations, but they also engage with the staff for group activities.

> *"It's not always him, when he's on leave, then I see doctor ______, either doctor ______ or doctor _______. But during the group sessions we receive explanations from other health care professionals from the Puskesmas." (PR201, patient, rural, Puskesmas)*
>
> *"If there are activities, I usually get reminders from the staff, that I should come to the clinic" (PR303, patient, rural, primary care clinic)*

d. Primary-secondary care interface

The primary-secondary care relationship within Indonesia's current universal coverage scheme is complex. Only since the UHC scheme in 2014 has primary care taken on care/management of chronic conditions such as diabetes. The historical over-reliance on secondary care is evident in the experiences and views of both doctors and patients in relation to their diabetes care. Doctors refer patients to secondary care in conditions such as uncontrolled diabetes, when additional drugs are needed that cannot be prescribed through primary care, and in cases with complications of diabetes.

> *"So, it's like this, if for instance we've done the maximum that we can do but it (blood glucose) doesn't go down, we're worried complications might arise. So, we refer them first, there might be additional therapy that the specialist will prescribe, because we've maxed out the medications and it still doesn't go down. Or we take a look at their lab results, if there's no improvement, or there's other findings such as hyperalbumin, or their HbA1c is always above the cutoff point. Those are the things that I refer for, I just give it to the specialists, rather than it leading to complications, right? (DU102, doctor, urban, individual doctor practice)*
>
> *"It's more on that, if their blood glucose is still in the hundreds, when we feel that insulin is better than oral, or there are other complaints like falls. We feel they need to have a further examination and stuff, we send them on those clinical indications, more examination, more*

> *competent (clinician), or better drugs. More on those reasons. (DU203, doctor, urban, Puskesmas)*

Problems that arise in referrals include the lack of system-regulated communication between primary and secondary care. Patients may be retained to receive care from secondary care for months without clear explanation from the specialists on the reasoning behind the decision.

> *"That's the thing, the communication between us, it's hard for them. In the form when they refer back to us, there's a section to write in the drugs et cetera, lots of hospitals don't fill that in and don't give us any feedback." (DU103, doctor, urban, individual doctor practice).*

> *"Here's the thing, that referring back thing, we have received patients being referred back (to primary care). But then I don't know, maybe the hospital forgot, or I don't know, sometimes we don't get them back. (DR302, doctor, rural, primary care clinic)*

Primary care doctors find ways to go around this by relying on patients to report back on the care they are receiving at the hospital, which was also stated by the patients.

> *"But when that doctor (specialist) don't refer the patients back to us because they still need treatment from the hospital, I will tell them (patients) what to do. I tell them to ask the doctor to write a letter to us. (DU303, doctor, urban, primary care clinic)*

> *"So, when I go to the hospital, they will prescribe me with medicines, then I will report back to my (primary care) doctor straight after." (PR103, patient, rural, individual doctor practice)*

Some doctors find that having good personal relationships with specialists allowed them to have more control of the care of their patients, and at times would only refer patients to specialists that understand the workings of *Prolanis* and BPJS.

> *"Because I often see the doctor. So, I just need to (refer) ________ (hospital) as I am close with the doctor. 'Later, if my Prolanis (participant) has any problem, I will send them directly to you. So, if I refer them to you, it means there's something wrong. So please, evaluate the medicine', 'Yes, Ok'." (DU201, doctor, urban, Puskesmas)*

> *"A not so nice experience was this, those specialists accuse us, primary care that manages these diabetes patients, 'because they handled them, we refer them back, they (patients) become uncontrolled and then complications arise'. But that's not right, because those that come to me after a referral, when I refer them again (to the specialist), they still get the same drugs. So now I have a doctor that is 'easy' on this referring back thing, in ____ hospital. 'ehm, once you've done the*

> *insulin initiation, please refer them back to me' 'oh yes, yes'. Then they (patients) will come back." (DU101, doctor, urban, individual doctor practice)*

Several patients interviewed had previously had their diabetes managed with outpatient care from specialists in hospitals. These were typically patients with ASKES (government worker insurance) where it was possible to directly receive care from specialists in the past. With the universal coverage scheme, they must abide by current regulations where they are to be primarily treated in primary care. It seemed that patients did not fully trust their primary care doctors and would rather be referred to secondary care.

> *"This is what I mean, truthfully, I'd rather go to the hospital, because they have all my medical record, they already know. And they have senior doctors at the hospital, like dr. _______ (a famous geriatrician), we used to go to him for everything. Now I don't know, I was a government worker, for so many years my salary was deducted (for health insurance), so what is it with BPJS." (PU303, patient, urban, primary care clinic)*

There were several patients who are enrolled in *Prolanis* but were also referred to secondary care regularly for other conditions. One patient in particular that received diabetes care from a specialist in secondary care seemed to be "lost" in the *Prolanis* programme. She attended primary care practice merely to ask for her referral letter, as all her medications were prescribed and provided by secondary care. She reported that receiving care from the specialist is enough and she no longer joins the weekly group exercise that her individual doctor practice holds for *Prolanis* patients.

> *"So, I come in, or sometimes my daughter does it, she asks for a referral letter for me to the hospital. I receive everything from the hospital, for my knees, for my sugar (diabetes), for my nerves."*
>
> *"The exercise? Well, I don't know, I don't really have time for that now, I go to the hospital" (PU103, patient, urban, individual doctor practice)*

Process Factors

The theme of process factors presents the experiences felt by participants regarding how *Prolanis* is being implemented in the practice. Doctors recalled their experiences in their actual implementation of *Prolanis* in their own practice, while patients recalled their experiences with the care that they have so far received with *Prolanis*.

a. Service provision

As briefly mentioned in several themes previously, the implementation of *Prolanis* varied between practices. Implementation was influenced by the contextual and system characteristics of the practice. The main, and mandatory service of *Prolanis* from BPJS-K were monthly consultations, prescription of medications, and laboratory examination of blood glucose. Monthly group education sessions, and group exercise sessions were not compulsory, and practices decided whether they were able to offer such sessions. Although different practices had their own unique ways of implementing *Prolanis*, the way practices provided *Prolanis* services can be broadly categorised into three main types: 1) a one day group service, where all *Prolanis* patients come in on a specific day of the month to take part in a group education session, whilst having their blood glucose checked, meet their primary care doctor for consultation, and obtain their monthly medications; 2) separate monthly individual appointments and blood glucose checks, with the addition of group education and/or exercise sessions that are usually held on the weekends; 3) monthly individual appointments and blood glucose checks without group educational sessions and exercise.

The first type of implementation was conducted in all *Puskesmas* that participated in the study, in both urban and rural settings. Several primary care clinics also implemented *Prolanis* in this manner, one in the urban setting, and all three clinics in the rural setting. The second type of implementation was conducted in several individual doctor practices, both in urban and rural settings, and in two urban primary care clinics. Meanwhile, the third type of implementation were conducted in two individual doctor practices (one in urban setting, and one in rural setting) with a small number of *Prolanis* patients.

b. Enrollment/pathways to care

The experience of primary care doctors in enrolling patients with *Prolanis* varied. These differences were influenced by the type of practice they work in, and their past affiliation with ASKES. Those with prior contracts with ASKES had a relatively seamless transition between ASKES *Prolanis* and the new *Prolanis* under BPJS-K, switching their already enrolled patients into the new programme, while still enrolling newly diagnosed diabetes patients through patient encounters. Most other practices simply advised their current diabetes patients to enrol in the programme, and have new patients enrolled as they come. For newly established practices without a regular diabetes patient registry, they enrolled patients incidentally during normal clinic sessions.

> *"I've been implementing Prolanis from the days of ASKES so it's just a continuation really, my patients are automatically enrolled (into the new Prolanis). Then I'll have the newly diagnosed ones, where I advise them to join (Prolanis)" (DU102, doctor, urban, individual doctor practice)*
>
> *"When I was asked to form Prolanis in the Puskesmas, initially I called up patients who had diabetes, we made a list of those patients, then we ask them for a day they can come in. We already formed a team then, so we agreed on the activity that we'll run, there's the team that sorted out the invitations, the room, everything." (DR202, doctor, urban, Puskemas)*
>
> *"Since we only recently came into contract with BPJS, with that commitment, we had to implement Prolanis. Then we started to try and identify those that can be enrolled as they come" (DU301, doctor, urban, primary care clinic)*

The patients interviewed had their own unique ways/routes of accessing their primary care facility and *Prolanis*. Patients who were retired government workers were often already enrolled in the previous *Prolanis* scheme, thus continuing into the new programme. When questioned on how they were first diagnosed with diabetes, many patients revealed that they were initially diagnosed and treated by either a specialist at a secondary care facility or a private practice outside the universal coverage scheme. They eventually made their way into a primary care facility within the scheme via two main pathways, either: 1) being referred back to primary care from their secondary care; or 2) self-referring to primary care due to financial circumstances. One patient in particular exemplified this through his experience, he was first admitted to hospital for his hyperglycemic state and was continually treated at the hospital as an outpatient once he was discharged. It was when he requested a referral letter from the *Puskesmas* that he was advised to join *Prolanis*.

> *"After I was hospitalized, I wanted to get a referral letter so it would be free, but I already have a letter from the hospital for my upcoming appointment. Then doctor ____ said "You've already been given a letter from the doctor at the hospital, so you don't need to get a referral from here, what were you sick with?". "sugar doctor" I said, then doctor _____ said "you know what, you should take part in Prolanis on the 3rd of every month, you will be required to provide a few documents, but that can be done later, it doesn't matter, but you should come here every month on the 3rd". So, I came to the Puskesmas on the 3rd of the next month, and I've been coming here once a month ever since." (PR201, patient, rural, Puskesmas)*

An example of a patient navigating their own path into primary care was a patient from an urban *Puskesmas*. She was first diagnosed with diabetes in a private practice. As she had to pay for consultations and medications, she managed to find out about the universal coverage scheme and enrolled to a *Puskesmas* near her house. It was at the *Puskesmas* that she was advised to register with the *Prolanis* programme.

> *"I had doctor _____, she was a Puskesmas doctor too I think, but I went to her (private practice) from a long time ago when my kids were little, so she's like our family doctor. She was the one that advised me to get BPJS and go to the Puskesmas to be treated. Because at her place I will get referred to that lab which is expensive, and I had to take regular medications that I buy myself. So, I said yes, and I went to the Puskesmas." (PU202, patient, urban, Puskesmas)*

It was also revealed that patients who were initially diagnosed and treated by specialists, were unaware that diabetes can be treated by a primary care doctor. Not many patients explicitly stated this, but this view on primary care was implied by many on their choice of first-line care.

> *"I was first told that I had the sugar disease at the hospital. Before I came (and treated) here, I usually get checked there" (PU101, patient, urban, individual doctor practice)*
>
> *"It was when suddenly I was very weak and I was having cold sweats, I didn't know, I thought I probably was just tired. So, I just rested in bed for a while. Then I went to this doctor, he was an internist. It was there I found out I had diabetes and he treated me." (PU303, patient, urban, primary care clinic)*

> *"I used to go to a doctor in the city to be treated (for diabetes). Then I had this wound on my foot, it was really scary. I went to the hospital to get it treated" (PR203, patient, rural, Puskesmas)*

c. Motivation

The motivation of primary care doctors in implementing *Prolanis* can be broadly categorised into two groups. Doctors personally committed and motivated to run *Prolanis* as they witness positive effects of *Prolanis* on their patients' wellbeing and clinical outcomes. While others viewed *Prolanis* as a programme imposed by BPJS and felt obliged to offer it.

> *"Before this, we do treat patients with diabetes. But it does seem different now with Prolanis. Beforehand, we give out medicines, and they come back to us, but they just don't seem to have their diabetes managed. It might be that we just didn't think of it, or we were just to focused on medications. But now having them educated, getting them together in a group to share experiences, it seems really good now. So, we try our best to carry out Prolanis." (DR303, doctor, rural, primary care clinic)*
>
> *"It's an obligation isn't it from BPJS, to have Prolanis, so we can be contracted by BPJS. So, we just do it." (DU302, doctor, urban, primary care clinic)*

For patients, being able to meet with their peers was a big motivation to attend *Prolanis* sessions. This was only felt by patients who were registered in practices that provide group sessions in their *Prolanis* service. Another motivation for patients to continually attend appointments was the experience that they felt in having their diabetes controlled. Several patients expressed how by being in *Prolanis*, they have come to understand their condition better, which resulted in them having more control over managing their condition.

> *"I just want to be healthy. So being healthy is not all about taking drugs, but the heart is also the cure. When I'm with my friends, especially since I don't have a husband anymore, I get tips from them, we share our stories, that's medicine too." (PR202, patient, rural, Puskesmas)*
>
> *"I have lots of things to do, well I'm busy too at home. But I really make the effort to go to the group exercise once a week, then the education session. I meet lots of people there. I'm really diligent with those, because it does make a difference, I do feel different, healthier." (PU101, patient, urban, individual doctor practice)*

d. Continuity

Continuity in the form of contact rate of *Prolanis* patients is one of the components in the primary care scoring system in BPJS. Most doctors intentionally educate and recruit patients into *Prolanis* with the consideration that they will continue to participate in the programme. *Puskesmas* and established primary care clinics usually have their own team of staff that ensure continuity in the care of *Prolanis* patients.

> *"We have 500 (patients). We employ 25 staff members to be in charge of 20 Prolanis patients (each). Now these staff members are nurses, midwives, nurse assistants, analysts, admins, all are involved. Because if only one person takes care of 500, that's just too much. So, they each have their group of patients, and at the end of the month we'll see those in their group, are they coming in regularly or not. If there's any problem, then they'll contact these patients via telephone, text messages, or they do home visits." (DR303, doctor, rural, primary care clinic)*

> *"At the beginning, we enrol everyone who has diabetes, and they come in individually for their consultations then again for group education classes. When they don't come, we try to contact them and reach out to them, why they don't come. Sometimes they just don't want to, then we just take them out. When we started having an allocated day for them to come in a group. They come in regularly. Maybe because it's a set day of the month, they only need to come in once a month, while before they had to come in several times." (DU203, doctor, urban, Puskesmas)*

> *"The staff gives us reminders, they text me when the next group session is. I don't hold a phone, but my son receives those text messages." (PR303, patient, rural, primary care clinic)*

Even though measures have been taken in ensuring continuity of care within *Prolanis*, patients dropping out of the programme does occur. The reasons behind these dropouts were variable, aside from transportation that has been explained in the theme of access to care in the previous section, several other issues have been noted to cause dropouts. These range from clinical issues, to practicality.

> *"Some that gets us in a pickle is this, they work, they have an eatery, or they have small children that are still in school. Now those are the people that's difficult to come in. and there's lots of people with small businesses too, like selling food and stuff, those are difficult as well. Well these are aside from the reasons where they're frail, old age, and*

> *it really depends on who can take them to come in really" (DU202, doctor, urban Puskesmas)*

> *"I was having a hard time attending the sessions because it was hard for me to go, I had no one to take me there. So, I didn't go" (PR302, patient, rural, primary care clinic)*

Another issue regarding continuity raised by doctors was when patients were referred to secondary care. When patients were treated as outpatients in hospital, the primary care facility only acted as a point of referral for these patients. There was no mention of patients still being assessed in their primary care practice, when they are in the care of specialists.

> *"But there must be information why they don't come for monthly Prolanis. Sometimes we try to find out. Oh, this one goes to hospital regularly because the specialist told them to go to hospital regularly. It can also be seen when they ask for referral, (they ask) for referral each month because the doctor told them so." (DR301, doctor, rural, primary care clinic)*

> *"I now get the drugs for my sugar (diabetes) from the hospital, and for my physiotherapy, so everything is at the hospital." (PU103. Patient, urban, individual doctor practice)*

e. Drug availability

The provision of care through *Prolanis* at times experienced setbacks due to the availability of pre-approved drugs within the programme. *Prolanis* was formulated in a way that patients would receive continuous medications in their diabetes management. However, throughout its time to date, there were instances where some drugs became unavailable, thus disrupting the adherence of medication. Even though this was considered as a separate issue between affiliated pharmacies that dispensed these drugs and BPJS (not with the practice itself), it was frequently mentioned by both doctors and patients when recalling their experiences with *Prolanis*. For doctors, the frequent unavailability of drugs caused concern, as they would have to find ways to ensure patients receive their medications. It was then common for patients to eventually buy branded (thus not covered by *Prolanis*) drugs themselves in order to stay on their medication.

> *"Yes, I sometimes give them some (prescribed medications) when that happens, for about 10 days. Because they will miss it if I don't." (DR103, doctor, rural, individual doctor practice)*

> *"I wish that the pharmacy provides all the medicines because they're already in affiliation, don't let the patients buy the medicine on their own. Just a few days ago, it was still happening. The medicine was unavailable, and the patient panicked a little "oh no, the medicine is not available, doctor?". Needs one more, then (he should) buy medicine, though it is cheap. Amlodipine, only for 30.000 (Indonesian Rupiah). But for them it is expensive." (DU201, doctor, urban, Puskesmas)*

> *"Sometimes I buy them myself, because we can still buy it ourselves, right? So, I buy them myself." (PU302, patient, urban, primary care clinic)*

Lack of access to drugs often necessitated referrals from primary to secondary care, and sometimes resulted in conflict between the two. The class of diabetes drugs that can be independently prescribed by primary care doctors were only biguanides and sulfonylureas. When a patient required other classes of drugs, they would need to first have a prescription of these drugs by a specialist before it can then continue to be prescribed by a primary care doctor.

> *"There are two possibilities of referral, they receive an additional oral antidiabetic drug, so three kinds, that there's that, straight to initiation of insulin. Those who are initiated on insulin, the next month or two, they should be referred back to us, so they can continue with us. That is the problem at the beginning, it's hard waiting for the specialist to realise that they need to refer them back to us. Then at the end I just chose to refer them to doctors who do care about referring patients back, because not all specialists want to refer back." (DU101, doctor, urban, individual doctor practice)*

> *"Back then during ASKES, we were able to initiate insulin, it was possible. But in this BPJS era, we can't, we have to refer them first. When we've maximised the drugs they can take, eventually we advise them on insulin. So yeah, we refer, then they get referred back and they can receive insulin from us." (DU102, doctor, urban, individual doctor practice)*

f. Competence

When asked how they felt about their competence in managing diabetes in the *Prolanis* programme, primary care doctors provided various responses. More experienced doctors felt that they were competent enough to provide more for their patients, beyond the restrictions that are imposed in *Prolanis*. As already stated in the previous section on drug availability, doctors felt that they were restricted in the control of patients' medications. They felt that they are competent enough to make changes in prescription and dosing, something that they currently cannot carry out.

> *"The truth is, us doctors in primary care have participated in many seminars, training, workshop, we follow the latest drugs, but we're locked with the drugs that are available in primary care. These drugs for chronic conditions, they're quite expensive and it's just not possible for us to take it out of our capitation. Meanwhile, if we prescribe secondary care drugs, because we do feel that we are capable, affiliated pharmacies will not dispense them, 'you're a primary care doctor, you can't prescribe specialists' medicines', we can't. There, so we must refer them first." (DU103, doctor, urban, individual doctor practice)*
>
> *"Yes, we are capable. There has been training. We can prescribe insulin, but the thing is, if there's no prescription form the specialist, they (patients) will have to pay for it. It's a burden for them, it's a pity" (DU302, doctor, urban, primary care clinic)*

It has been stated by BPJS that with the implementation of *Prolanis*, primary care doctors will be provided with additional training in the management of diabetes. How this is carried out is unclear, as there was striking variability in training provided by BPJS for the doctors interviewed. Several doctors mentioned that there have been workshops and training by BPJS since the implementation of *Prolanis*, but there were also those that had no recollection of ever being invited to such training. Those who did not receive additional training by BPJS relied on their own need to update their knowledge by participating in seminars on diabetes.

> *"The last time, hmmm, once this year. The previous year there was one in Semarang, but not all. I think only two Puskesmas or so from one region, this year was about diabetes, but I don't think that's purely from BPJS, together with a drug company, and that's only once. They say there is going to be three times, but it's just once now. There's no further follow up." (DR203, doctor, rural, Puskesmas)*
>
> *"No, not yet (BPJS seminars). But I do take part in seminars which are held everywhere." (DR301, doctor, rural, primary care clinic)*

When referring to doctor's competence, patients expressed satisfaction with the competence of their primary care doctors. However, they felt that when other problems arise, such as in the case of comorbidity, they preferred to be taken care of by a hospital specialist.

> *"So far, the doctors here are good, I mean, they treat the patients well. They are really patient, they form exercise groups, the regular aerobic exercises, and for the elderly. But I do need to go the hospital, because I'm old you see, I have lots of conditions" (PU303, patient, urban, primary care clinic)*

The impact of comorbidity on the management of diabetes will now be discussed in more detail.

g. Comorbidity

There seemed to be no specific acknowledgement by doctors of comorbidities in patients with diabetes. Doctors typically noted the comorbidity of hypertension and diabetes, while referring other diabetes-related comorbidities as complications. When these complications occur, they will refer these patients to secondary care as it is beyond the "competency of general doctors". Only when these patients are stable, are they returned to primary care to be continued on the medication initially prescribed by the specialist. This phenomenon was confirmed in the patient interviews. Patients with multiple conditions needed to go to specialists in addition to their monthly appointments in their primary care for *Prolanis*.

> *"So, patients that are not within our competency, we refer them to secondary care, to specialists. Then when they are stable, they will be returned to us for three months." (DU103, doctor, urban, individual doctor practice)*
>
> *"There are a few of our patients who has other morbidities such as heart disease, COPD. We still recruit these patients, as long as they're committed. Sometimes they do not come because they have to go to the hospital for those conditions, but they do come in for the group sessions" (DU202, doctor, urban, Puskesmas)*
>
> *"Every month I go to doctor _____ for my diabetes and have my lab checked. Then I had a stroke in 2011, so I was hospitalized and treated at the hospital. Now I still get treated by dr _____ at the hospital. So, I go there too." (PU102, patient, urban individual doctor practice)*

Outcome factors

The theme of outcome factors describes the experiences and views of doctors and patients in relation to the effects of *Prolanis* implementation. Much of the discussion centres on continuity of care and group sessions.

a. Self-management/adherence

An important outcome of *Prolanis* identified by both doctors and patients was the awareness and ability to self-manage diabetes. Doctors felt that *Prolanis* patients were more aware of their condition and more capable of self-management compared to those not enrolled in *Prolanis*.

> *"From what I see, they are different (compared to non Prolanis). They understand better on what's going on with their body. They know when to come into the clinic if anything is wrong, they know to have their condition controlled. They understand better now too." (DR302, doctor, rural, primary care clinic)*

> *"I have diabetes patients both with and without Prolanis. One patient without Prolanis, they come in whenever they want, usually when they don't feel well, and their blood sugar is quite high. I treat them the same, but it's hard getting them to adhere." (DR103, doctor, rural, individual doctor practice)*

> *"Certainly. They understand more how to be healthy. Those who used to drink sweet beverages, they don't do that anymore. The good point of Prolanis is that we discuss the disease frequently, so the patient understands it really well. They bear that in mind. Meanwhile, non-Prolanis patients only get little explanation, and then they go home, we treat other patients, and (when they come in) they see another doctor. So, they have different motivation. Sometimes, they don't take the medicine when they have a family gathering." (DU201, doctor, urban, Puskesmas)*

Most patients reported that they had become more aware and knowledgeable about diabetes and how to self-manage their condition after joining *Prolanis*. These were especially noticeable in patients that received group education sessions. Even though this was not the case in some of the patients from practices without group education sessions, some did reveal that they got to know their disease better because they met their doctors every month and receive regular education during consultations.

> *"I gained lots of new knowledge, not only about the sugar disease, what it is. But how it can later affect to other things, so the doctor gives us lots of useful information, like exercise. So, I know, oh I have to do this. I need to exercise, not only for my sugar level to be stable, but also for my other organs" (PU302, patient, urban, primary care clinic)*

In addition to the increase of awareness and knowledge regarding their diabetes, some patients felt that self-management was improved by sharing practical experiences with peers in the group sessions. Even though they were treated and informed of their condition by their doctors beforehand, several patients felt they were isolated and didn't know how to manage their disease well.

> *"In the past (when in the company), I used to forget (to take medicines). Now, since maybe I see them (the Prolanis group) every month, and every week we see each other for the exercise, I remember to take my medicines, I take them regularly now. (PU201, patient, urban, Puskesmas)*

> *"I was very afraid back then about my condition, I ate very little, I was very skinny. People scolded on me and told me to just eat. But now*

> *people say that I look much more radiant after joining Prolanis. I meet friends who tell my how they eat, how they cope. I feel so much more at ease." (PR202, patient, rural, Puskesmas)*

b. The role of the group

During interviews it emerged that group sessions were important when discussing the implementation of *Prolanis*. Some doctors felt that the group session provides a medium for patients to come together and share their experiences regarding their condition.

> *"With Prolanis, patients can meet each other, they can create friendships and share experiences. Usually they discuss their blood glucose 'what's your sugar level? Mine is this much'. So, there's a sense of competition to be healthy and who's in control. Then there's the sense of comradery that they live with the same disease." (DR202, doctor, rural, Puskesmas)*

Groups are led by patients in some practices, giving them the lead to arrange social gatherings and request particular education topics. The practice then serves as more of an advisory role to the group, providing the group with what the patients feel they need.

> *"Alhamdulillah (praise the Lord) my Prolanis (group) is really something, they really are a solid group. They don't mind pooling in their own money. So, like they have a good emotional bond between them, they have fun together. So, every year they do a picnic, they plan it themselves, it is really good, so they'll make a uniform, for us too even. Sometimes we chip in too from funds leftover from Prolanis. So, they have fun, we also feel great." (DR102, doctor, rural, individual doctor practice)*

An important part of having group sessions for patients was how it relieves the isolation of having diabetes. The sense that they are not alone, and they can meet lots of peers to help them cope with living with diabetes was felt by many patients and something that they are truly grateful for with the implementation of *Prolanis*.

> *"I was really lacking in confidence at first. I was really depressed. Why do I have this disease? Now with Prolanis, I have lots of friends that have the same disease. I don't feel so alone now." (PR203, patient, rural, Puskesmas)*

c. Clinical outcome

Few doctors focused on the clinical effects of the programme, and some reported that their patient's blood glucose levels were still variable. Indeed, some felt that patients who visit regularly, even if they're not in *Prolanis*, control their diabetes well. Therefore, they don't feel there has been any difference in clinical outcome between their *Prolanis* and non-*Prolanis* patients. Instead they focused on the increased routine consultations and follow-up in primary care. However, patients felt that they had significant improvements in their condition after joining *Prolanis*.

> *"I'm so happy. Alhamdulillah (Praise the Lord), after I join Prolanis, I feel healthier, my sugar levels are down. Well for the sugar level, it can't be stable, sometimes it goes up and down. Now is around 190, then 150. It's been like that for the past two years, around 190-150, sometimes up to 200, but that's only a few times." (PR201, patient, rural, Puskesmas)*

6.5. Discussion

6.5.1. Summary of main findings

A summary of findings is presented below in Figure 6.1. as a diagram from the analysis.

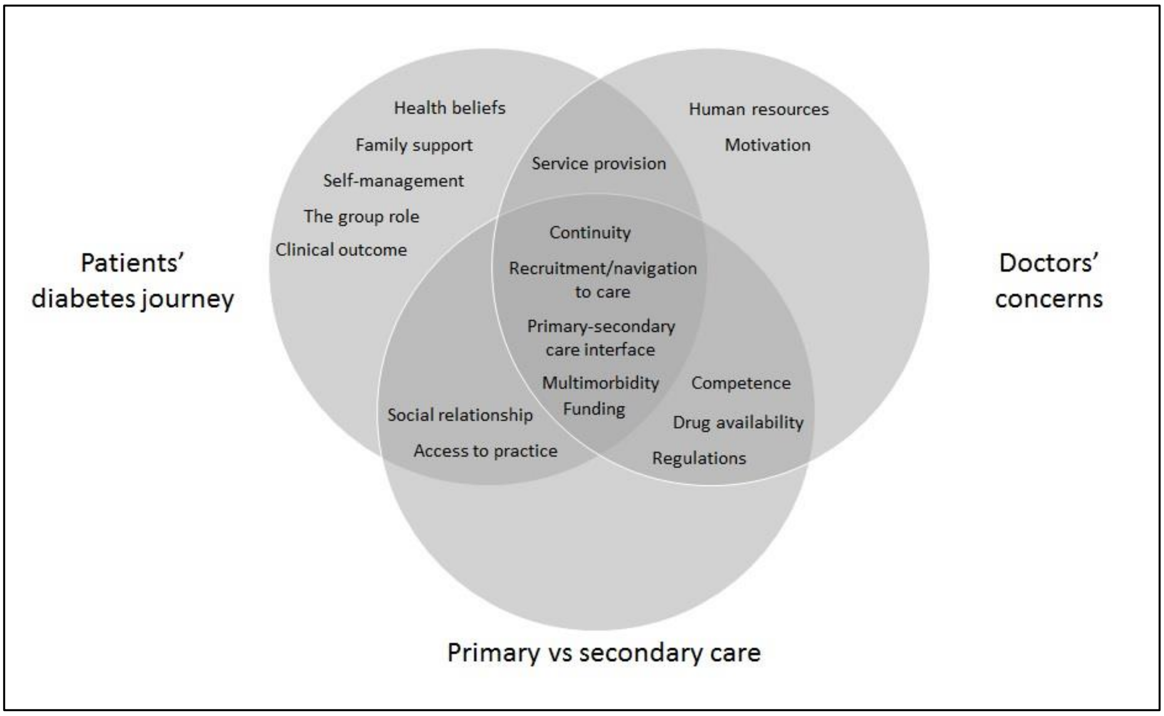

Figure 6.1. Summary of findings

The patients' diabetes journey

Patients recalled their diabetes journey by explaining how they were first diagnosed with diabetes. Most participants were first diagnosed due to hospitalisation, showing symptoms of hyperglycaemia, or by the presence of complication such as a foot ulcer. Following diagnosis, many patients recalled their prior beliefs about diabetes. Most believed that diabetes is hereditary. Patients who had family members with the disease felt like it was something they would inevitably have, while those who had no family members with diabetes felt confused as to why they were diagnosed with diabetes. Regardless of their belief as to the cause of diabetes, patients expressed their worry, fear, and shame when they were first diagnosed. Many of them felt alone, believing that because there is no cure to diabetes, they were helpless. For patients that had good family support, their family, particularly their wife or children, were important in helping them seek care and manage their disease. For those who live alone, this makes it more difficult. It seems to be for this reason that the group role was frequently mentioned by both patients and doctors as the highlight of their *Prolanis* implementation (if they have one). The formation of the group was initially to provide a platform for exercise and education sessions. Throughout its course, its role expanded much further into the social lives of the patients involved. Not only did it become a source of peer support in self-management, the group evolved into a community where patients arrange social activities outside the primary care's services. Patients felt they were no longer alone, they had peers that helped them make sense of the information they received from doctors, most of all, they no longer felt isolated. Their previous fear, worry, and shame of their diabetes seemed to be alleviated with the presence of this community. Regardless of the presence of a group however, all patients enrolled in *Prolanis* felt that they were much better off physically and were more capable to manage their diabetes.

Doctor's concerns

The interviews for this study were conducted at a time when the regulation regarding the practice scoring system with BPJS-K included a minimum of 50% contact rate of *Prolanis* patients. There were two main responses to this regulation by doctors: 1) finding ways to make sure patients were adhering to the programme; or 2) enrolling patients that were more likely to adhere to the programme. Doctors that were personally committed and motivated to run *Prolanis* found ways to implement it in ways that ensure continuity, be it by arranging a one-day service for *Prolanis* as a group, or by mobilising their staff to keep in close contact with the patients. Motivation may not be the only factor for this though, as practice size and the availability of staffing support play an important role in being able to carry out these arrangements. Doctors who may not be as motivated, or do not have the means to carry out additional measures to ensure continuity ended up only enrolling patients that would adhere to the programme. This would result in patients being deliberately left out. These experiences did not seem to differ between urban or rural settings. Regardless of their response to this regulation, most doctors felt that their work was not appreciated by BPJS-K. They would prefer a balanced reward and punishment system, where they would receive additional benefit from successful implementation of *Prolanis* and not only the punishment when they fail to do so. Encouragement such as this may make them more eager to carry out *Prolanis* better.

Primary versus secondary care

In a health system where previously, primary care has been side-lined, the shift of the bulk of diabetes care from secondary to primary care seemed to reveal tensions. From the patients' perspective, their initial views were mostly similar: that primary care cannot manage diabetes. This was shown by their choice of health care facility when they first showed symptoms, either hospitals or private practices of internists. They eventually made their way into the primary care of the JKN scheme by either being referred back to primary care from the hospital, or through the advice of their then doctor due to financial reasons. There were opposing reactions of patients about being treated in primary care: 1) realising the role of primary care and being content with their diabetes management, or 2) feeling discontent with care from primary care and preferring to be referred to secondary care. Those who preferred primary care were mostly patients in rural settings. It seemed that these patients had a stronger sense of connection with their primary care doctor or team. This is not the case for urban patients. They felt that specialists were better, that their care is more comprehensive when it is being treated in the hospital. When they had been exposed to secondary care, they felt reluctant to return to their primary care doctors. The current regulation seems to promote this view. Although *Prolanis* emphasises the role of primary care, current regulations on referral and drug availability seem to undermine its role. Patients with comorbidities or complications must be referred to secondary care. Even though several doctors (especially more experienced doctors that have exposure to further family practice training) felt that they were capable to manage these patients in their own settings, current regulations prevent them from prescribing the necessary medications without an initial prescription from a specialist. It is in this referral process that patients may either return to primary care with their newly formulated prescription or be retained in secondary care. There is no regulated format of communication between primary and secondary care, doctors reported that this meant they had to find their own way to maintain continuity with their patients. This was done by relying on patients to inform them directly on the care received in the hospital and asking to be referred back to primary care, or by choosing specific hospitals or specialists that will guarantee their patients' return.

6.5.2. Comparison with other literature

The findings of this study further add to existing qualitative evidence on how people with diabetes experience emotional distress. It was found to be common that patients with chronic conditions, such as diabetes hold feelings of isolation, loneliness, or frustration (Embuldeniya et al., 2013). A multinational qualitative study in 17 countries (Algeria, Canada, China, Denmark, France, Germany, India, Italy, Japan, Mexico, The Netherlands, Poland, Russia, Spain, Turkey, United Kingdom, United States of America) by Stuckey et. al (2014) found a general finding across countries on negative emotional reactions on diagnosis of diabetes such as fear, worry, depression, and hopelessness. Social stigma surrounding the disease may also elicit negative emotional reactions such as unwilling to disclose condition to other people, leading to further isolation (Browne et al., 2013, Stuckey et al., 2014, Kato et al., 2016). Similarly, Indonesian studies have also found experiences of emotional distress in diabetes patients, in parts of East Java (Arifin et al., 2020a, Arifin et al., 2020b) and Central Java (Pujilestari et al., 2014).

Emotional distress in diabetes patients prompts the need for social support, be it from family (Arifin et al., 2020a, Arifin et al., 2020b, Stuckey et al., 2014, Badriah et al., 2019) or from a wider social group such as peers (Embuldeniya et al., 2013, Joseph et al., 2001, Stuckey et al., 2014). A systematic review of qualitative studies on patient's and health care providers' perspectives on diabetes management by Sibounheuang et.al (2020) found that family involvement may act either as a facilitator or barrier in diabetes management. When family members are considered as a facilitator, they were seen to play a role in the support, motivation, and encouragement of patients in the management of their diabetes. A few studies also found that patients were more likely to follow recommendations in the presence of family support (Goetz et al., 2012, Held et al., 2010). However, family members may act as a barrier when their lifestyles are not in accordance with the needs of the patient to support their diabetes management. The role of peer support in the management of diabetes has been considered to improve health behaviours, across diverse settings (Fisher et al., 2017). A qualitative synthesis of peer support interventions in chronic disease management found that experiences of participants was largely positive (Embuldeniya et al., 2013). A sense of connection with one another facilitated the sharing of knowledge of disease and its management, and life experiences. This connection was found to have helped participants find meaning in life, become empowered, leading to adoption of a more active approach to health care.

The need for social support seems to be met by the provision of group services in *Prolanis* implementation in this study. Although it was not implemented by all healthcare providers, its impact seems profound, as it was the most talked about positive experience of *Prolanis* by both doctors and patients. One version of *Prolanis* implementation, in providing a one-day service for all diabetes patients, is considered as a form of shared medical appointment (SMA), where patients of the same condition come together to receive shared education and support from an interdisciplinary team (Edelman et al., 2015, Jaber et al., 2006). Visits such as this emphasise the role of patients as experts in their own circumstances and health professionals act as facilitators rather than an authoritative figure, supporting effective partnership between the two. This creates a safe environment in which to share experiences of illness and health to better inform, empower, and support patients (Batalden et al., 2016). Clinically shared medical appointment for patients with diabetes have been found to be effective in terms of reducing HbA1c and improved systolic blood pressure (Housden et al., 2013, Edelman et al., 2015). More recent systematic reviews have found that patients express positive experiences in patient-doctor dynamic, overall quality of care, quality of life, sense of community, patient empowerment, and efficiency besides favourable biophysical outcomes in SMAs, although these reviews were not exclusively on diabetes (Wadsworth et al., 2019, Kirsh et al., 2017). Views and experiences of those who dislike SMAs are poorly represented in current studies (Booth et al., 2015).

From the doctors' point of view, the findings of this study show variable attitudes towards the group format. Those who implemented it reported a great benefit to the group. However, those reluctant to carry it out cite concerns of resources as their main drawback. In almost all studies on SMAs, the SMAs are designed within a health care team, not individual doctors (Edelman et al., 2015, Wadsworth et al., 2019, Jaber et al., 2006, Kirsh et al., 2017, Housden et al., 2013). It is therefore understandable how individual doctor practices and newly established clinics in this study found it difficult to develop group visits.

SMAs are regarded as one of the innovations of a chronic disease management program within the framework of self-management support in the CCM. SMAs promote the formation of informed, activated patients (Batalden et al., 2016). However, to be truly successful, a prepared, proactive practice team must also be present. Not all primary care settings in the current study has access to a team, which has been revealed as one of the reasons group visits were not applied. This becomes a missed opportunity for these practices to reap the benefits of SMA in diabetes management. This is similar to a systematic review of facilitators and barriers of CCM implementation in primary care by Kadu & Stolee (2015), where implementation success was commonly related to the inner setting of the organization, the process of implementation, and characteristics of the individual health care providers (Kadu and Stolee, 2015). This further supports the view that multidisciplinary practice teams are key to CCM implementation (Grumbach and Bodenheimer, 2004).

The findings of this study illuminate the tension between primary and secondary care that affects the provision of diabetes care in Indonesia. Longstanding literature has highlighted the need of a shift of balance from secondary to primary care, especially in the management of LTCs such as diabetes (Coulter, 1995, Greenhalgh, 1994, Maier et al., 2008). However, barriers to the shift of diabetes management to primary care have been found to include lack of knowledge of primary care doctors (Haque et al., 2005, Larme and Pugh, 1998), lack of resources (Abdulhadi et al., 2013, Agarwal et al., 2008), lack of communication with specialists (Pooley et al., 2001), patient circumstances (Howard et al., 2006), and the presence of comorbidities (Crosson et al., 2010). Such barriers are reflected in this study. Attempts to overcome these barriers in developed nations such as Europe, include the utilisation of disease management models, emphasising patient-centredness, specific training for primary care doctors, and recognizing the primary care doctor’s role as coordinators of management models (Maier et al., 2008). The current study further highlights the need for specific training for primary care doctors to be able to take the role of coordinators in diabetes management. Without further training and acknowledgement of the role primary care doctors, even with the implementation a diabetes management model such as *Prolanis*, barriers in shifting diabetes management to primary care from secondary care remains evident.

6.5.3. Strengths and limitations

This qualitative study is the first study to date to qualitatively analyse the experiences of both primary care doctors and patients on the implementation of *Prolanis* in all three primary care types in Indonesia, in both urban and rural settings. The qualitative approach used not only provided information on the actual implementation of *Prolanis* from doctors perspective, but also considered the views of patients, which are essential to provide effective patient-centred care. The findings informed on various aspects that arise during *Prolanis* implementation, that would be difficult to quantify and analyse in an exclusively quantitative manner. However, for future research it would be useful to have access to quantitative data on Prolanis reach and outcomes in order to more fully understand how the programme works and for whom.

The in-depth interviews in this study were conducted with a range of doctors and patients in different settings, both rural and urban. This provides diverse experiences that reflects the nature of the Indonesian population. However, since this study was conducted in one province in the island of Java, generalization towards the overall Indonesian population should be conducted with caution. This warrants further research to be conducted in other parts of Indonesia, particularly outside the most populous island of Java, where it may provide different views, due to the diversity of cultural values and beliefs in different parts of Indonesia.

This study was conducted in a period of three months (August-October) in 2018 when *Prolanis,* under the new JKN scheme had only been implemented for less than four years. Therefore, it may be understandable that practices are still adapting and finding their way to incorporate *Prolanis* in their daily practice. Furthermore, the newly implemented JKN scheme may not have rolled out completely for all Indonesians, which may result in many people with diabetes that are still managed outside the system. Together with the excluded views of non-compliant patients in some practices, the perceived effects of *Prolanis* reported in this study may be biased. Further exploration later in the course of *Prolanis* implementation may reveal different experiences and attitudes toward diabetes management within the scope of the programme.

6.6. Chapter summary

This chapter has presented the findings of the third study of this PhD, exploring the experiences of patients and primary care doctors in the implementation of Indonesia's diabetes management model *Prolanis*.

The findings of this study have shed light on the different ways of implementing *Prolanis* in different primary care settings in Indonesia. The patient's diabetes journey and the concerns of doctors influenced the way diabetes management in primary care was viewed. This consequently affected the implementation considerations of *Prolanis* across different settings. Although the majority of experiences expressed on the outcomes of *Prolanis* were positive, further exploration is needed to see whether these favourable effects can be generalized towards the overall Indonesian population.

The CCM emphasises the establishment of informed, activated patients and prepared, proactive practice teams. This qualitative study has raised issues of primary and secondary care tensions and continuity of care in diabetes management in Indonesia, which may negatively impact on that goal. The findings from the systematic review and quantitative study in previous chapters will be incorporated with the findings from this study in the General Discussion chapter of this thesis. Further consideration will be presented regarding the current condition of Indonesia's diabetes management, reflecting it in relation to the CCM framework and the implications for future research and practice.

Chapter 7 – General Discussion

7.1. Overview

The aim of this thesis was to assess the appropriateness of the current model of diabetes care implemented in Indonesia. In order to answer this aim, several objectives and research questions were formulated:

1. Systematic Review of primary care diabetes management models applied in Southeast Asia
    a. What types of disease management models for diabetes have been tested or implemented in Southeast Asian countries?
    b. How are disease management models for diabetes implemented in Southeast Asian countries?
    c. How effective are disease management models for diabetes in Southeast Asian countries?
2. Determine the characteristics of the diabetes population in Indonesia
    a. What are the characteristics of individuals with diabetes and without diabetes?
    b. What are the characteristics of individuals with diabetes only and individuals with diabetes and comorbidities?
    c. What is the prevalence of diagnosed physical and mental comorbidities in individuals with diabetes?
    d. What is the relationship between diabetes and health care utilisation?
3. Explore the experiences of primary care doctors and patients in the implementation of Indonesia's diabetes management model, *Prolanis*
    a. How is *Prolanis* implemented in different primary care settings in Indonesia?
    b. What are the factors influencing the implementation of *Prolanis?*
    c. What are the perceived effects of implementing *Prolanis* in diabetes care provision?
4. Using the CCM as a reference model, how does the use of *Prolanis* in Indonesia address diabetes management, and how appropriate is it for the Indonesian diabetes population?

This thesis answered the above research questions through several methods: a systematic review, an epidemiological study, and a qualitative study. This chapter will summarise the main findings of the three studies before going on to provide a general discussion reflecting on the CCM. It will then be followed by the limitations of this thesis, implications of the findings for policy and practice, and future research, and end by drawing firm conclusions.

7.2. Summary of main findings in relation to the research questions

7.2.1. Review of primary care diabetes management models applied in Southeast Asia

CCM is not widely acknowledged, implemented, or studied in Southeast Asia. A total of 18 studies were included in the systematic review, with only two models of care (in four studies) that specifically drew on CCM. For example, the model implemented in the Philippines (Ku and Kegels, 2014a, Ku and Kegels, 2014b, Ku and Kegels, 2015) was the only model that explicitly stated the combination of multiple elements of CCM: health care organisation in the creation of a chronic care team; delivery system design by redistributing care tasks between multiple health professionals; decision support by training health care workers; and self-management support services for patients. Other models implemented elements of CCM without the specific reference to the CCM.

Most of the models from the studies identified emphasised self-management support, either individual or as a group. What stood out from the implementation of diabetes management models in Southeast Asia was the involvement of communities in the formation and delivery of self-management support sessions. The incorporation of local values was deemed relevant to provide culturally sensitive education and support. Decision support was implemented by applying guidelines or patient decision aids in practice and further training for health care workers in the preparation of the delivery of self-management support services. Three models implemented in the Philippines and Thailand combined CCM elements of health care organisation and delivery system design. The utilisation of other health care professionals beside doctors, such as nurses, midwives, community health workers highly supported the delivery of care to people with diabetes. However, inadequacy of staff and resources, with a lack of government and budgetary support, hindered the continuation of such models beyond the scope of research. The CCM element of clinical information systems was not mentioned in any of the models included in this review.

Both clinical and non-clinical outcome measures were used to gauge the effectiveness of diabetes management models. Most studies reported favourable outcomes in terms of fasting plasma glucose and HbA1c. Non-clinical effectiveness was reported as the increase of knowledge, awareness, attitude, and practice of self-management activities in patients. Several qualitative studies reporting improved patient's satisfaction, confidence, and ability to manage their diabetes. However, it is important to note that lasting effects of the use of these models cannot be determined, since almost all studies had a relatively short duration of follow-up, mostly of one year. Furthermore, these effects should be interpreted with some caution as the designs and quality of reporting of studies included in the review were often prone to bias, as studies included were of low or moderate quality studies based on appraisal.

7.2.2. Determining the characteristics of the diabetes population in Indonesia

The epidemiology of diabetes in Indonesia was analysed using publicly attainable secondary data from IFLS 5. The data was collected in the transition period of JKN implementation in 2014-2015. The data showed that people with diabetes were relatively older, were majority female, married, resided in urban areas and had government insurance. The analysis concurred with findings from previous studies that people with diabetes had more acute complaints, outpatient care, and hospital admissions compared to those without. The majority of people with diabetes were also found to have at least one comorbidity, mainly hypertension and high cholesterol. People with diabetes and comorbidities were relatively older and reported more acute complaints compared to those with diabetes only. Further analysis showed that having diabetes was a strong predictor of health care utilisation of both outpatient care and hospitalisation. However, having one or more comorbidities did not show an increased likelihood of health care utilisation when compared to those with diabetes only. Health insurance was a stronger predictor of health care utilisation in the diabetes population.

7.2.3. Exploring the experiences of primary care doctors and patients in the implementation of Indonesia's diabetes management model, Prolanis

The findings of the qualitative study revealed that there was no specific guideline in the implementation of *Prolanis* by BPJS-K. For doctors, the main elements of *Prolanis* were that diabetes patients were registered, received continuous care with their primary care provider, and received medication that was separate from the practice's capitation budget (calculated based on the overall number of patients registered in the practice). Group sessions in the form of exercise and/or education classes were optional, though recommended. It is for these reasons that implementation of *Prolanis* was variable between practices. Overall, there were three major types of implementation of *Prolanis* in Indonesian primary care: 1) one-day monthly service of all *Prolanis* activities conducted as a group; 2) a combination of group activities and individual appointments; and 3) individual appointments for patients without group activities.

Even within these three types of implementation, the way in which service was provided varied between practices. All *Puskesmas* (government-run community health centre) implemented a one-day *Prolanis* service. Doctors in Puskesmas favoured this type of implementation because they felt that it was more efficient and guaranteed attendance. This view was not shared by doctors in other primary care settings, especially in urban areas who felt it was difficult to implement *Prolanis* as a one-day service due to their lack of resource or individualistic nature of their patients. Patients that only received individual appointments didn't seem to express concern when asked about the possibility of missing out on group sessions. They felt that being in continuous contact with their doctor was enough to help them become more aware and knowledgeable in managing their diabetes. Frequent changes in regulations together with a lack of clarity from BPJS-K meant that practices drew on their own experiences of implementation together with the experience of other practices to guide and tailor their care provision of in a manner that suited their own practice system.

Implementation of *Prolanis* was greatly influenced by the practice setting and the social context of their patients. Provision of a collective group appointment for *Prolanis* patients were mainly chosen in *Puskesmas* settings and in rural primary care. Many doctors felt that this type of implementation ensured patient's adherence and continuity of care, as they had a support system and a close bond with their peers in the community. Furthermore, a strong sense of community within rural society seemed to be reflected in patients' relationship with the practice, where patients seemed to have a larger sense of trust and belonging to their primary care provider, compared to patients in urban settings. However, doctors did realise that this type of implementation was feasible only if they have the appropriate resources, to provide mass service. This was supported by views from doctors outside the *Puskesmas* setting, especially in individual practices. They reported that they were not capable to provide such service, opting for individual appointments and providing group exercise sessions outside clinic hours instead, or even forgoing group sessions all together. Together with challenges faced regarding the mostly individualistic nature of the urban society, many doctors in urban areas felt that it was better to allow patients attend individually, suiting their own schedules, rather than having a designated day of the month as a group. It was for this reason also that some doctors were reluctant to offer group exercise or education sessions, since patient attendance was poor.

Clinical outcomes following the implementation of *Prolanis* were variable, and it was unclear whether introducing *Prolanis* produced better clinical outcomes. Doctors reported improved continuity of care which in turn resulted in them feeling more involved and more in control of the patients' care even if patients received secondary care. This differed from patients not enrolled in *Prolanis* where their continuity of care relied heavily on the patients' own awareness to attend regularly. With continuity of care, both doctors and patients felt that adherence and self-management of diabetes was highly impacted from the implementation of *Prolanis*. Patients reported that their knowledge and awareness of diabetes were positively influenced following their enrolment in *Prolanis*. Continuity of care had improved their understanding of diabetes and this was particularly apparent in patients that received group exercise and/or education sessions. Peer support allowed them to enact practical lifestyle changes suited to their own context. Group sessions were highly valued and seen as a major benefit of *Prolanis*. The scoring system of practices by BPJS-K in regard to *Prolanis* patients' contact rate resulted in some practices only enrolling patients that they thought would be likely to adhere to the programme. Therefore, factors such as continuity of care and attendance may not have been so successful had *Prolanis* been applied to all diabetes patients within practices.

7.3. Reflections on the Chronic Care Model

CCM was developed to provide effective LTC care in primary care (Wagner et al., 1996a, Wagner, 1998). The six elements of the model were designed to result in patients that are informed and activated, and practice teams that are prepared and proactive (Bodenheimer et al., 2002b). Productive interactions between these patients and practice teams are expected to improved outcomes. This section will discuss how the findings of this thesis relates to the elements of the CCM.

Table 7.1 shows strengths and limitations of *Prolanis* in relation to the CCM. The findings of this thesis showed several limitations of *Prolanis,* particularly in the elements of health systems (health care organisation, delivery system design, decision support, and clinical information systems). However, it seems that the strength of *Prolanis* lay in the elements of community resource and policies, and self-management support.

Table 7.1. Reflecting Prolanis strengths and limitation on CCM

Element of the Chronic Care Model	**Prolanis**	
	Strength	**Limitation**
Health care organisation	Part of primary care scoring system	• Covering only patients under BPJS-K • Priority towards diabetes management more evident in practices with more resources
Delivery system design	Shared medical appointment Group education and exercise sessions	Not applicable to all types of practices
Decision support		• Lack of guideline on implementation • No formal training for practices to implement model
Clinical information systems		• Limited to patient registry • Not synchronised between primary-secondary care
Community resource and policies	• Collective nature of the rural community as an asset • Established community programme of *Puskesmas* as advantage	• Small practices may not be readily connected to their communities
Self-management support	• Utilising peer support in the form of group • Support from a multidisciplinary team (when available)	

7.3.1. Health care organisation

Health care organisation is reflected in the structure, goals, and values of the provider's organisation in making LTC care a priority (Bodenheimer et al., 2002b). Since *Prolanis* is a national program through BPJS-K, its implementation is only applicable for patients within the JKN scheme. Although practices encourage their patients to be enrolled in JKN, some patients continue to miss out on this programme. Analysis of the IFLS 5 data set outlined in chapter 5 found that only a little over 50% people with diabetes had government insurance, which would then be automatically transferred into the JKN scheme. Although a small number of those without government insurance had private insurance (7.4%), the remainder may have been missing out on optimum diabetes care through this programme.

How *Prolanis* is implemented is highly dependent on the structure of the primary care practice implementing them. *Puskesmas* and private clinics have more resources and are therefore more equipped to implement *Prolanis* than individual doctor practices. *Puskesmas* was already equipped with a multidisciplinary team from the government, and private practices could also equip their practice with additional resources. Meanwhile, individual doctor practices reported limitations in terms of how comprehensive they could be in implementing *Prolanis*. Individual practices rely mostly on one primary care doctor in diabetes management, and one approach may be to expand the deployment of nurses, who may be similarly effective. However, efforts to improve *Prolanis* care seems to be highly reliant on the motivation of the practice. Despite making *Prolanis* care part of the contract with GPs, in order to 'guarantee' its implementation, some practices only seemed to carry out the minimum required in order to not be financially penalised.

7.3.2. Delivery system design

Delivery system design in the CCM involves restructuring care where there is a clear division between acute care and the planned management of LTC care, which often involves the formation on inter-professional practice care teams (Grumbach and Bodenheimer, 2004). *Prolanis* emphasised self-management support through group education. This facilitated the inclusion of various health professionals in the management of diabetes. However, due to the different types of primary care practices in Indonesia, it seemed that to effectively implement *Prolanis*, only *Puskesmas* were readily equipped to achieve this. The availability of other health professionals varied between private practices, and individual doctor practices were mostly single practitioners. *Prolanis* therefore is implemented differently according to practice type.

There was no explicit protocol for implementation of *Prolanis*. Primary care practices appeared to be left to deliver *Prolanis* care in ways that suited the practice context. Moreover, care delivery was also influenced by characteristics of the patient population. *Puskesmas* delivered care included shared medical appointments, group education sessions, and involves multiple health professionals such as nurses, community workers, nutritionists, and psychologists. This type of care delivery was better suited to patients in rural settings and improved attendance. Meanwhile, a combination of single, individual appointments and group education and exercise sessions were preferred more in urban practices. Practices without additional health professionals usually relied on primary care doctors delivering education sessions. Some small private clinics and individual practices, with few diabetes patients, implemented the most minimal *Prolanis* service which involved individual appointments for patients without any group sessions.

Reflecting on the findings of the qualitative study, a standard implementation of *Prolanis* would be difficult to implement across all types of practice. This is due to the variety of practice types, which reflects their resources and types of patients. Therefore, the flexibility of *Prolanis* provides room for practices to implement it in the most appropriate manner for their practice, attempting to make *Prolanis* function as best as intended. However, the interviews also revealed that due to the absence of a specific guideline for implementation of *Prolanis,* new practices starting *Prolanis* have no guidance and had to rely on networking with other practices in order to deliver the programme in their own setting. Therefore, although flexibility is beneficial to tailor the implementation of *Prolanis* in order to provide the most benefit for patients in different settings, there should be an introductory guideline from BPJS-K for newly formed practices in order to guide the delivery of *Prolanis* and gain the most benefit.

7.3.3. Decision support

Decision support in the CCM emphasises on the availability of evidence-based practice through activities such as reinforcement of guidelines and specialist consultations without a full referral (Bodenheimer et al., 2002b). No evidence of decision support was found in the implementation of *Prolanis*. As already noted, implementation guidelines for Prolanis were lacking and indeed health professionals were not specifically trained to provide comprehensive care for diabetes. More experienced doctors or those with prior exposure of family medicine education were more motivated to implement *Prolanis* in a way that maximised the benefit. However, less experienced doctors reported their frustration in establishing *Prolanis* in the absence of a set protocol. They mainly relied on the experiences of other local practices to guide their implementation.

Prolanis also typically lacked access to specialist consultation without referrals to hospital. The programme was specifically designed for diabetes patients and therefore patients with complications or other comorbidities were usually referred to secondary care to be seen by specialists. This meant that often secondary care assumed responsibility for diabetes care as communication between primary and secondary care was fragmented. This is an important issue that needs to be addressed in the future, given that the analysis of the IFLS 5 data (chapter 5) concluded that most people with diabetes in Indonesia have at least one comorbidity. Therefore, primary care should be equipped with the skills and resources necessary to meet this need, in order to provide generalist care and reduce fragmentation of care, as well as containing costs.

7.3.4. Clinical information system

Prolanis has limited clinical information systems. Computerised data of diabetes patients within the programme was only used as a patient registry. This patient registry was then used to evaluate attendance of patients, and consequentially used as one of the measures of practice commitments to BPJS-K. It is regrettable that this system was not utilised further by practices to record patients' progress.

7.3.5. Community resources and policies

A highlight of *Prolanis* implementation was the activation of the community to provide inclusive care. The collective nature of the rural community was seen as an asset as it enabled the delivery of group programmes. Practices that had strong community connections were able to form patient groups and provided group education sessions and exercises. Such community focus was rarely found in urban practices. Therefore, *Puskesmas,* which already provides community health programmes, was most suited to the provision of *Prolanis* care.

The utilisation of communities in this way seems to be a common practice in the region of Southeast Asia. As the findings of the systematic review (Chapter 4) showed, patient involvement is seen as a facilitator when implementing new diabetes health models. This helps develop good relationships and teamwork between health care professionals and patients. Furthermore, the availability of local venues within local communities can provide ease of access to patients.

7.3.6. Self-management support

Self-management support for patients is a central element in CCM (Bodenheimer et al., 2002b). *Prolanis* implemented this element in the form of diabetes education services either individually or group sessions. Practices with multiple health professionals were able to provide education sessions that were more comprehensive, whereas practices that relied mostly on the primary care doctors may less able to do so. Patients rated the formation of *Prolanis* groups within practices highly. They felt that being able to share stories with their peers greatly increased their confidence in managing their diabetes.

7.4. Embedding CCM into the Indonesian context: implications for policy and practice

It is possible that how *Prolanis* is being carried out now, with the current regulation, may increase health inequalities. As was found in the interviews, patients that may not be adherent to the programme are usually not enrolled. These may include patients that are disadvantaged in the first place, such as those with harder access to healthcare practice, and those without insurance. At the time of data collection, the JKN scheme was relatively new (four years of implementation). Therefore, practices that had no experience of *Prolanis* during the *Askes* (insurance agency for government workers) period were still adapting to its implementation. BPJS-K automatically partners with *Puskesmas* and practices that previously served patients with *Askes* insurance. Therefore, these practices automatically had registered patients on the JKN scheme. This is not the case for newly affiliated practices. Practices receive patients through self-enrolment, and therefore may only serve a few diabetes patients, which may not warrant the provision of services such as group education sessions and exercise. Since *Prolanis* is only delivered to patients within this scheme, those without insurance are missing out. Our finding that almost 40% of the diabetes population had no insurance, reveals that there is a relatively large proportion of the diabetes population not receiving comprehensive diabetes care in the form of *Prolanis*. Further rolling out of the JKN scheme is needed to ensure that people with diabetes receive the care they need.

The implementation of *Prolanis* to provide comprehensive diabetes management in primary care is not without problems. Reflecting on the findings of the qualitative study, a standard implementation of *Prolanis* would be difficult to implement across all types of practice. This is due to the variety of practice types, which reflects their resources and types of patients. Therefore, the flexibility of *Prolanis* provides room for practices to implement it in the most appropriate manner for their practice, attempting to make *Prolanis* function as best as intended. However, the interviews also revealed that due to the absence of a specific guideline for implementation of *Prolanis,* new practices starting *Prolanis* have no guidance and have to rely on networking with other practices in order to deliver the programme in their own setting. Therefore, although flexibility is beneficial to tailor the implementation of *Prolanis* in order to provide the most benefit for patients in different settings, there should be a guide for practices to refer to when delivering *Prolanis*. The development of an introductory guideline is needed for newly formed practices to guide the delivery of *Prolanis* in their own setting.

With the current capitation-based payment for primary care practices, and the addition of only *Prolanis* group services reimbursements, it may be possible that these payment systems discourage practices to carry out *Prolanis* without any additional benefits. Furthermore, an expansion of *Prolanis* for diabetes including screening checks such as eye and foot checks is needed to make the programme more comprehensive. An adjustment of the payment system specifically for *Prolanis* may be warranted, such as a fee for service in addition of the capitation payment. This may add additional motivation for doctors to carry out *Prolanis* services when there are financial benefits for their efforts. To add to this, the current scoring system for *Prolanis* may also deter doctors from enrolling patients into the programme. This is due to scoring system being based on attendance rate of *Prolanis* patients. When attendance is low, thus having a low score on *Prolanis,* practices will be reprimanded by having their capitation deducted. An adjustment of this scoring system, looking more at the impact and reach of services rather than mere attendance may address this issue. This will need to be further explored from the perspectives of both doctors and BPJS-K.

Primary and secondary care integration is a crucial issue for effective diabetes care in Indonesia. The absence of effective communication flows between primary and secondary and vice versa leads to the loss of follow up of patients that are referred to hospitals. This is especially concerning when patients have multiple comorbidities, where they may be referred to many different specialists. It is challenging to maintain continuity of care for these patients as their primary care doctor no longer has an active coordinating role in the patient's care. It is equally difficult to provide comprehensive care in the presence of comorbidities, as even in the *Prolanis* programme, primary care does not have the authority to care for diabetes patients with comorbidities and patients will generally be referred to secondary care (as this study showed). This will lead to fragmented care with all the different specialists involved, leading to rising costs and polypharmacy. A recommendation from this research is to develop primary and secondary care integration to maintain continuity of care and to put the primary care doctors at the heart of generalist care.

One of the aims of CCM is to produce prepared, proactive practice teams. To achieve this, Indonesian primary care needs to be strengthened. Primary care doctors in Indonesia are mostly non-specialised doctors, that have not received post-graduate training in general practice and formal professional training in primary care is yet to be established in Indonesia at the time of data collection for this research. From the qualitative interviews, it was found that those that went on to do further training in family medicine showed a better understanding of the importance of diabetes management through *Prolanis*, while doctors with less experience carried out *Prolanis* for the mere purpose of practice obligation towards BPJS-K. This is also reflected on how doctors treat patients with diabetes and complications. Those with a lack of postgraduate training in primary care would consider diabetes complications or comorbidities as cases beyond their competency, thus directly referring them to secondary care. However, multimorbidity is now the norm for people with long-term conditions, including diabetes, and primary care doctors are best situated to manage these patients in a comprehensive manner (Mitchell and Bartell, 2021). The need for a more trained primary care doctor means that further training in primary care is essential for primary care to function in the current changing health demographics in Indonesia. The recognition of Family Medicine as a specialism and the roll out of the Family Medicine Specialist Programmes in several universities in Indonesia is a step forward in that direction. This is of great relevance as the increasing role of the primary care doctor is apparent in this JKN scheme.

In addition to the need for high quality primary care doctors, other high quality health professionals are needed in the management of diabetes care and other LTCs. The results presented in this thesis show that the existence of multidisciplinary primary care teams is required to provide comprehensive care. Practices that are equipped with multiple health professionals were more equipped to provide a variety of services, including group sessions. As such, this thesis recommends the need to encourage and support the formation of group practices with a diverse range of health professionals in primary care to optimise CCM delivery.

The epidemiology section of this thesis showed that the occurrence of two or more LTCs (multimorbidity) is a problem not only in the diabetes population, but for the whole population. This demands the expansion of *Prolanis* to provide service beyond diabetes management. Other LTCs should also be addressed and managed in a comprehensive and continuous manner in primary care. The expansion of the *Prolanis* model must be supported by clear guidelines and protocols to ensure proper implementation across practices and allowing for data collection of programme factors to allow for a full evaluation.

Based on this research, in order to embed CCM into Indonesian context in the form of *Prolanis*, five key recommendations on policy and practice emerged:

1. The further rolling out of the JKN scheme, adjustment of capitation payment and scoring system for primary care practices to facilitate wider inclusion of patients
2. The development of primary and secondary care integration to maintain continuity of care
3. The support of formal training for primary care doctors to provide comprehensive care
4. The encouragement and support of the formation of group practices with a diverse range of health professionals in primary care to optimise CCM delivery
5. Expansion of the *Prolanis* model must be supported by clear guidelines and protocols to ensure proper implementation across practices and allowing for data collection of programme factors to allow for a full evaluation

7.5. Study limitations

The lack of evidence available on Indonesia's diabetes management model *Prolanis* made it difficult for the thesis to apply an in-depth process evaluation of the model, addressing complexity and utilising a formal implementation theory. This thesis was initially formulated to use a mixed-methods approach. However, due the limitation on secondary data availability, a true mixed-method integration was not possible. Therefore, this thesis is considered as having taken a multi-method approach. Furthermore, the limitation of secondary data availability made our epidemiological analysis limited in terms of the sample size of the population and the available variables for analysed. Since the secondary data obtained was collected during the transition period of Indonesia's JKN scheme, the analysis may not reflect the current condition of Indonesia's population in terms of health insurance coverage. The qualitative aspect of this thesis was also limited to only one region of Indonesia albeit and area that covered 3,186 square kilometres. Indonesia is a vast and diverse country, therefore the findings in this thesis may not be generalisable to the whole population of Indonesia. However, many of the findings regarding the health care system may be relevant across the country, especially in terms of the primary and secondary care divide.

7.6. Future research directions

This thesis has presented new evidence on the exploration of the implementation of the CCM in Indonesian primary care. Although the findings of this thesis highlighted several aspects of its implementation and its suitability towards a general Indonesian context, further research should be conducted that takes a pan-Indonesian approach, addressing complexity and utilising theory of implementation. Such research would determine whether the CCM model can be applied across various settings in populations with a variety of sociocultural backgrounds. Furthermore, it was only possible to report the perceived effectiveness of *Prolanis,* and further quantitative evaluation is needed to determine the effectiveness of *Prolanis* and to conduct a full process evaluation of the model, exploring its complexity through an implementation science lens. In the longer term, the extension of the CCM to include all LTCs, in a manner that suits the Indonesian population, is the ultimate aim. This would entail further research on LTCs and multimorbidity in Indonesia and further expansion of

Prolanis beyond the management of diabetes. All three parts of this thesis will be written up for formal peer-reviewed publication.

7.7. Conclusions

This thesis has highlighted a number of issues regarding the implementation of the CCM in diabetes management specifically in Indonesian primary care. The lack of evidence regarding implementation of CCM in Indonesia provided the impetus for the exploration of whether Indonesia's current model of diabetes care, *Prolanis,* is appropriate to the Indonesian context. Several methods were used to achieve this aim: a systematic review on primary care diabetes management models in Southeast Asia; an epidemiological examination of secondary data to determine the characteristics of Indonesia's diabetes population; and a qualitative study to explore the experiences of primary care doctors and patients with *Prolanis.*

The findings of this thesis suggest that the implementation of *Prolanis* differed substantially between primary care practices. The variety of Indonesia's primary care practice and the social context of the population it serves greatly influenced implementation. Compared to evidence from Southeast Asian countries however, *Prolanis* is an example of a programme being implemented within routine care, not within research setting and thus the continuation of the programme seems likely. The prevalence of LTCs other than diabetes, and the finding that comorbidity is common in this population warrants consideration of the inclusion of additional conditions into *Prolanis* care, something that does not seem to have been considered in its implementation to date.

There are several implications from the findings of this thesis as regards the policy and practice of diabetes management and other LTCs in Indonesia's primary care. With the ambition of universal coverage through the JKN scheme, it is important that primary care in Indonesia receives the resources and policies to enhance its quality. It cannot be denied that the epidemiological transition will result in people needing more care for LTCs and multimorbidity. The development of a high-quality primary care system, led by fully-trained generalist doctors working as part of an integrated multidisciplinary team, with a functioning interface with secondary care, and providing a service that is person-centred, and which incorporates all the elements of comprehensive care (such as those in the CCM) will be an essential part of Indonesia's health system in the future.

Chapter 8 – Reflective Chapter

The choice of carrying out this particular topic for my PhD was based on a personal experience of my Father who has been living with diabetes for almost 20 years now. His work required him to relocate several times in multiple countries throughout his career. It was only when he retired that he has permanently lived in Jakarta, Indonesia. His experience of living with diabetes in Indonesia, compared to other countries, has made me curious about how Indonesia implements and improves its diabetes management programme. My background as an academic GP in Indonesia has also presented me with frequent encounters with diabetes patients. My personal, albeit short, experience with *Prolanis* itself has prompted me to pursue a PhD with a topic that is specifically related to this.

The initial phase of the PhD was quite a struggle, in regards to obtaining as much information as possible on *Prolanis*. There is very little evidence and formal documentation on the development of *Prolanis* to be referenced to build a strong foundation on what the programme entails, its development, its implementation process, and its outcomes. Most of the information on *Prolanis* was ascertained through conversations with colleagues and acquaintances. When I sought to dig deeper into *Prolanis* by contacting the insurance company, BPJS-K, this was met with hesitance, and several appointments were made and then cancelled on their part. My request if they could refer me to documents that I could use as reference were met with little acknowledgement. This was frustrating as this was supposed to be the foundation of my PhD. Discussions with my supervisors led me to be pragmatic in my PhD inquiry, considering the obstacles. Therefore, we agreed to conduct a project that may be descriptive in nature, however it provides a story of Indonesia's diabetes context, its current management programme in primary care, and how it compares to the CCM. None of this has been previously explored

My career as an academic GP in Indonesia was only in its beginning stages before I pursued the PhD. My experience in research was not extensive. Coming into the PhD, I knew I wanted to conduct a mixed-method study, for me to explore and develop my skills in different methodologies. My initial intention however needed adjustments along the PhD journey, and multi-method, rather than a pure mixed-method project was the most feasible approach for the PhD. Using a multi-method approach has been met with constant doubts along the way. The three studies of this thesis could be considered as stand-alone studies, and it was not until the end that I finally realised how it falls together into one cohesive story. The support of my supervisors tremendously helped me with this process.

Finishing the thesis during the pandemic brought along several challenges that I had to overcome, especially concerning my mental health. There was a period at the beginning of the pandemic where I was in Indonesia for a longer period than anticipated as I was not able to return to Glasgow due to flight restrictions. My conditions were not ideal to properly write and finish the thesis. Returning to Glasgow and being alone most of the time also affected my mental health. It was during the pandemic that I sought regular therapy sessions, and have continued to do so ever since. However, I am glad that I finally finished this thesis.

This PhD journey have been a tremendous learning experience for me as an academic. Primary Care and General Practice is still trying to gain spotlight in Indonesia. There are still very few academics in the field, and therefore not surprising that there is little quality evidence available on practice and service in Indonesian Primary Care. This PhD has made me more aware of this, and I plan to contribute further to the development of primary care in Indonesia.

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Appendices

Appendix A. Letter of rejection of request for *Riskesdas* data from Ministry of health, Republic of Indonesia

Appendix B. Search terms used for systematic review

Appendix C. Selection form for abstract and full text screening in systematic review

Appendix D. Quality appraisal forms for systematic review

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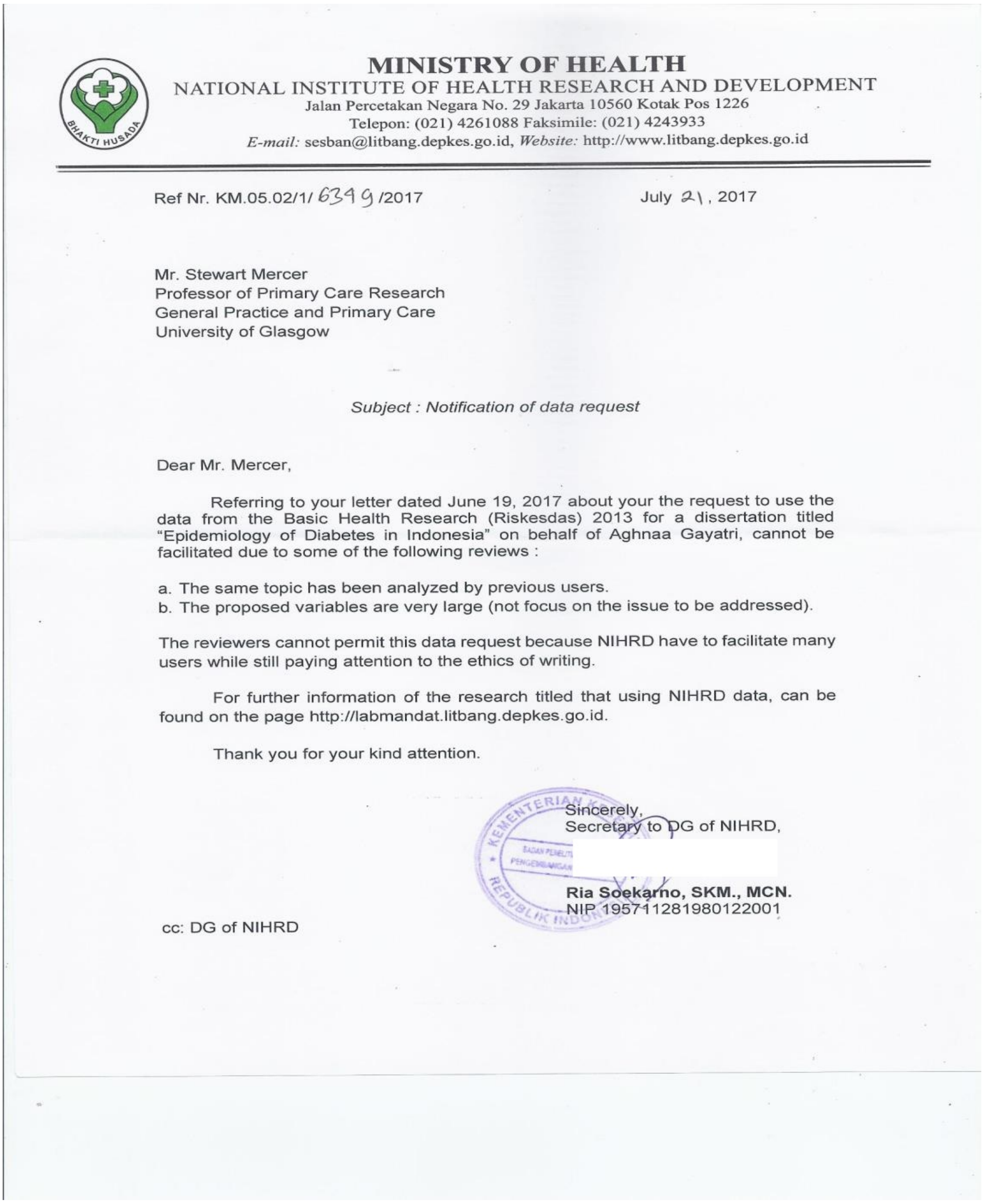
Appendix I. Approval letter from Ethics Committees and Health Offices in Indonesia

Appendix J. Topic Guide for Interviews

Appendix A. Letter of rejection of request for *Riskesdas* data from Ministry of health, Republic of Indonesia



MINISTRY OF HEALTH
NATIONAL INSTITUTE OF HEALTH RESEARCH AND DEVELOPMENT
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Ref Nr. KM.05.02/1/ 6349 /2017 July 21, 2017

Mr. Stewart Mercer
Professor of Primary Care Research
General Practice and Primary Care
University of Glasgow

Subject : Notification of data request

Dear Mr. Mercer,

Referring to your letter dated June 19, 2017 about your the request to use the data from the Basic Health Research (Riskesdas) 2013 for a dissertation titled "Epidemiology of Diabetes in Indonesia" on behalf of Aghnaa Gayatri, cannot be facilitated due to some of the following reviews :

a. The same topic has been analyzed by previous users.
b. The proposed variables are very large (not focus on the issue to be addressed).

The reviewers cannot permit this data request because NIHRD have to facilitate many users while still paying attention to the ethics of writing.

For further information of the research titled that using NIHRD data, can be found on the page http://labmandat.litbang.depkes.go.id.

Thank you for your kind attention.

Sincerely,
Secretary to DG of NIHRD,

[redacted]

Ria Soekarno, SKM., MCN.
NIP 195711281980122001

cc: DG of NIHRD

Appendix B. Search terms used for systematic review

1. Embase

No.	Term
1	Exp non insulin diabetes mellitus/
2	“diabetes type 2”
3	“diabetes type II”
4	T2DM
5	1 or 2 or 3 or 4
6	Exp primary medical care/
7	Exp community care/
8	Exp general practitioner/
9	Primary adj5 care
10	“family pract*”
11	“general pract*”
12	Community adj5 health
13	6 or 7 or 8 or 9 or 10 or 11 or 12
14	Exp health care delivery/
15	Exp disease management/
16	Exp health program/
17	Exp health service/
18	Care adj5 model*
19	Care adj5 program*
20	Care adj5 service*
21	Manag* adj5 model*
22	Manag* adj5 program*
23	Manag* adj5 service*
24	14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23
25	5 and 13 and 24

2. Medline

No.	Term
1	Diabetes mellitus, type 2/
2	“diabetes type II”
3	“diabetes type 2”
4	“T2DM”
5	1 or 2 or 3 or 4
6	Exp primary health care/
7	Exp general practice
8	General practitioners/
9	Physicians, family/
11	Physicians, primary care/
12	“general pract*”
13	“family pract*”
14	Primary adj5 care
15	Exp community health services
16	Community adj5 health
17	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16
18	Exp delivery of health care/
19	Disease management/
20	Exp patient care team/
21	Exp Patient care management/
22	Models, organizational/
23	Care adj5 model*
24	Care adj5 program*
25	Care adj5 service*
26	Manag* adj5 model*
27	Manag* adj5 program*
28	Manag* adj5 service*
29	18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
30	5 and 17 and 29

3. CINAHL

No.	Term
1	Diabetes mellitus, type 2/
2	“diabetes type 2”
3	“diabetes type II”
4	T2DM
5	1 or 2 or 3 or 4
6	Primary health care/
7	Physicians, family/
8	Community health centers/
9	Rural health centers/
10	“general pract*”
11	primary N5 care
12	“family pract*”
13	Community n5 health
14	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13
15	Patient care/
16	Disease management/
17	Exp health services/
18	Exp health services administration/
19	Care N5 model*
20	Care N5 program*
21	Care N5 service*
22	Manag* N5 model*
23	Manag* N5 program*
24	Manag* N5 service*
25	15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
	5 and 14 and 25

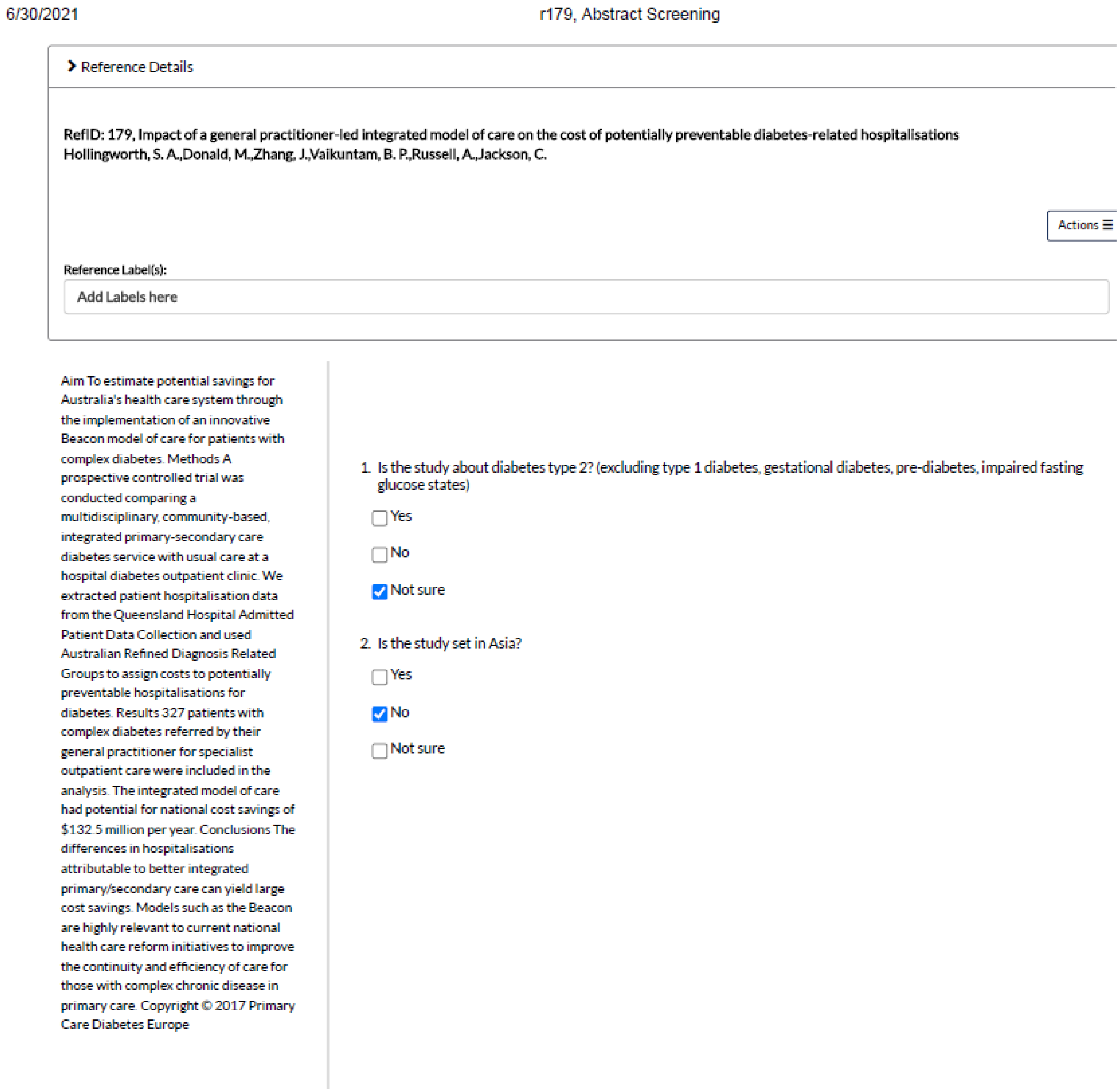
4. PsycInfo

No.	Term
1	Exp type 2 diabetes/
2	Diabetes type 2
3	Diabetes type II
4	T2DM
5	1 or 2 or 3 or 4
6	Primary health care/
7	General practitioners/
8	Family physicians/
9	Community health/
10	Family pract*
11	General pract*
12	Primary n5 care
13	Community n5 health
14	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13
15	Disease management/
16	Case management/
17	Exp health care services
18	Exp health care delivery
19	Care n5 model*
20	Care n5 program*
21	Care n5 service*
22	Manag* n5 model*
23	Manag* n5 program*
24	Manag* n5 service*
25	15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
	5 and 14 and 25

5. Web of Science

No.	**Term**
1	“diabetes type 2”
2	“diabetes type II”
3	T2DM
4	1 or 2 or 3
5	Primary near/5 care
6	“family pract*
7	“general pract*”
8	Community near/5 health
9	5 or 6 or 7 or 8
10	Care near/5 model*
11	Care near/5 program*
12	Care near/5 service*
13	Manag* near/5 program*
14	Manag* near/5 model*
15	Manag* near/5 service*
16	10 or 11 or 12 or 13 or 14 or 15
	4 and 9 and 16

Appendix C. Selection form for abstract and full text screening in systematic review



6/30/2021 r179, Abstract Screening

RefID: 179, Impact of a general practitioner-led integrated model of care on the cost of potentially preventable diabetes-related hospitalisations
Hollingworth, S. A.,Donald, M.,Zhang, J.,Vaikuntam, B. P.,Russell, A.,Jackson, C.

Reference Label(s):

Add Labels here

Aim To estimate potential savings for Australia's health care system through the implementation of an innovative Beacon model of care for patients with complex diabetes. Methods A prospective controlled trial was conducted comparing a multidisciplinary, community-based, integrated primary-secondary care diabetes service with usual care at a hospital diabetes outpatient clinic. We extracted patient hospitalisation data from the Queensland Hospital Admitted Patient Data Collection and used Australian Refined Diagnosis Related Groups to assign costs to potentially preventable hospitalisations for diabetes. Results 327 patients with complex diabetes referred by their general practitioner for specialist outpatient care were included in the analysis. The integrated model of care had potential for national cost savings of $132.5 million per year. Conclusions The differences in hospitalisations attributable to better integrated primary/secondary care can yield large cost savings. Models such as the Beacon are highly relevant to current national health care reform initiatives to improve the continuity and efficiency of care for those with complex chronic disease in primary care. Copyright © 2017 Primary Care Diabetes Europe

1. Is the study about diabetes type 2? (excluding type 1 diabetes, gestational diabetes, pre-diabetes, impaired fasting glucose states)

☐ Yes

☐ No

☑ Not sure

2. Is the study set in Asia?

☐ Yes

☑ No

☐ Not sure

1. Is the study about about diabetes type 2? (excluding diabetes type 1, gestational diabete, pre-diabetes, impaired fasting glucose states)

☑ Yes

☐ No

☐ Not sure

2. Is the study set in Southeast Asia (Indonesia, Malaysia, Thailand, Singapore, Vietnam, Myanmar, Philippines, Cambodia, Lao, Brunei Darussalam)?

☑ Yes

☐ No

☐ Not Sure

3. Is the paper an original published research of quantitative or qualitative design? (excluding protocols, commentaries, descriptive case studies, reviews, dissertation, conference proceedings)

☑ Yes (quantitative)

☐ Yes (qualitative)

☐ No

☐ Not sure

4. Does the study involve at least one element of chronic care management in adult patients with type 2 diabetes? (excluding drug trials or specific pharmacotherapy interventions)

☐ Organization of health care

☑ Self-management support

☐ Decision support

☐ Delivery system design

☐ Clinical information systems

☐ Community resources and policies

☐ None

☐ Not sure

5. Is the study set in primary care (including community) settings? (excluding secondary, tertiary care, and specialized diabetes clinics)

☑ Yes

☐ No

☐ Not sure

Appendix D. Quality appraisal forms for systematic review

Quality Appraisal for Qualitative Studies

RefID :

Appraiser / Date :

APPRAISAL COMPONENTS	YES	NO	CAN'T TELL	DESCRIPTION/COMMENTS
Was there a clear statement of the aims of the research?				
Is the qualitative methodology appropriate?				
Was the research design appropriate to address the aims of the research?				
Was the context clearly described?				
Was the sampling strategy clearly described and justified?				
Was the recruitment strategy appropriate to the aims of the research?				
Was the data collection method clearly described?				
Were the data collected in a way that addressed the research issue?				
Has the relationship between the researcher and participants been adequately considered?				
Were the procedures for data analysis clearly described and justified?				
Was the data analysis sufficiently rigorous?				
Is there a clear statement of findings?				
Were forms of original data presented to justify interpretation?				

APPRAISAL COMPONENTS	YES	NO	CAN'T TELL	DESCRIPTION/COMMENTS
Were generalisability towards existing knowledge or other populations or groups stated and discussed?				
Were there any conflict of interest that may affect the quality of the study?				
Overall Comments on quality				

Quality appraisal for Quantitative Studies

RefID :

Appraiser / Date :

APPRAISAL COMPONENTS	YES	NO	CAN'T TELL	N/A	DESCRIPTION/COMMENTS
Were the aims/objectives of the study clear?					
Sample					
Is there information on the context in which the intervention is carried out?					
Are the individuals selected to participate in the study likely to be representative of the target population?					
Was there a percentage of selected individuals that agreed to participate? (state percentage in comments)					
Study Design					
Was the study design appropriate for the stated aims?					
Was the study described as randomized?					
Was the method of randomization described?					
Was the randomization method appropriate?					
Confounders					
Were there important differences between groups prior to the intervention?					
Was there a clear statement of relevant confounders that were controlled?					
Blinding					

APPRAISAL COMPONENTS	YES	NO	CAN'T TELL	N/A	DESCRIPTION/COMMENTS
Was the outcome assessor aware of the intervention or exposure of participants?					
Were the study participants aware of the research question?					
Data collection methods					
Were data collection tools shown to be valid?					
Were data collection tools shown to be reliable?					
Withdrawals and drop-outs					
Was there a clear statement of percentage of participants completing the study? (state percentage)					
Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group?					
Intervention					
Was there sufficient explanation of the intervention or exposure being assessed?					
Was there a statement on the percentage of participants receiving the allocated intervention or exposure of interest?					
Was the duration of intervention sufficient?					
Analysis					
Are the statistical methods appropriate for the study design?					

APPRAISAL COMPONENTS	YES	NO	CAN'T TELL	N/A	DESCRIPTION/COMMENTS
Was the analysis performed by intervention allocation status (intention to treat), rather than the actual intervention received?					
Is it clear what was used to determine statistical significance and/or precision estimates? (e.g. p-values, confidence intervals?)					
Is there a comprehensive description of results?					
Discussion					
Were the authors' discussions and conclusions justified by the results?					
Has interactions between the intervention and the context been discussed?					
Overall comments on quality					

Appendix E. Data extraction form for systematic review

DATA EXTRACTION FORM

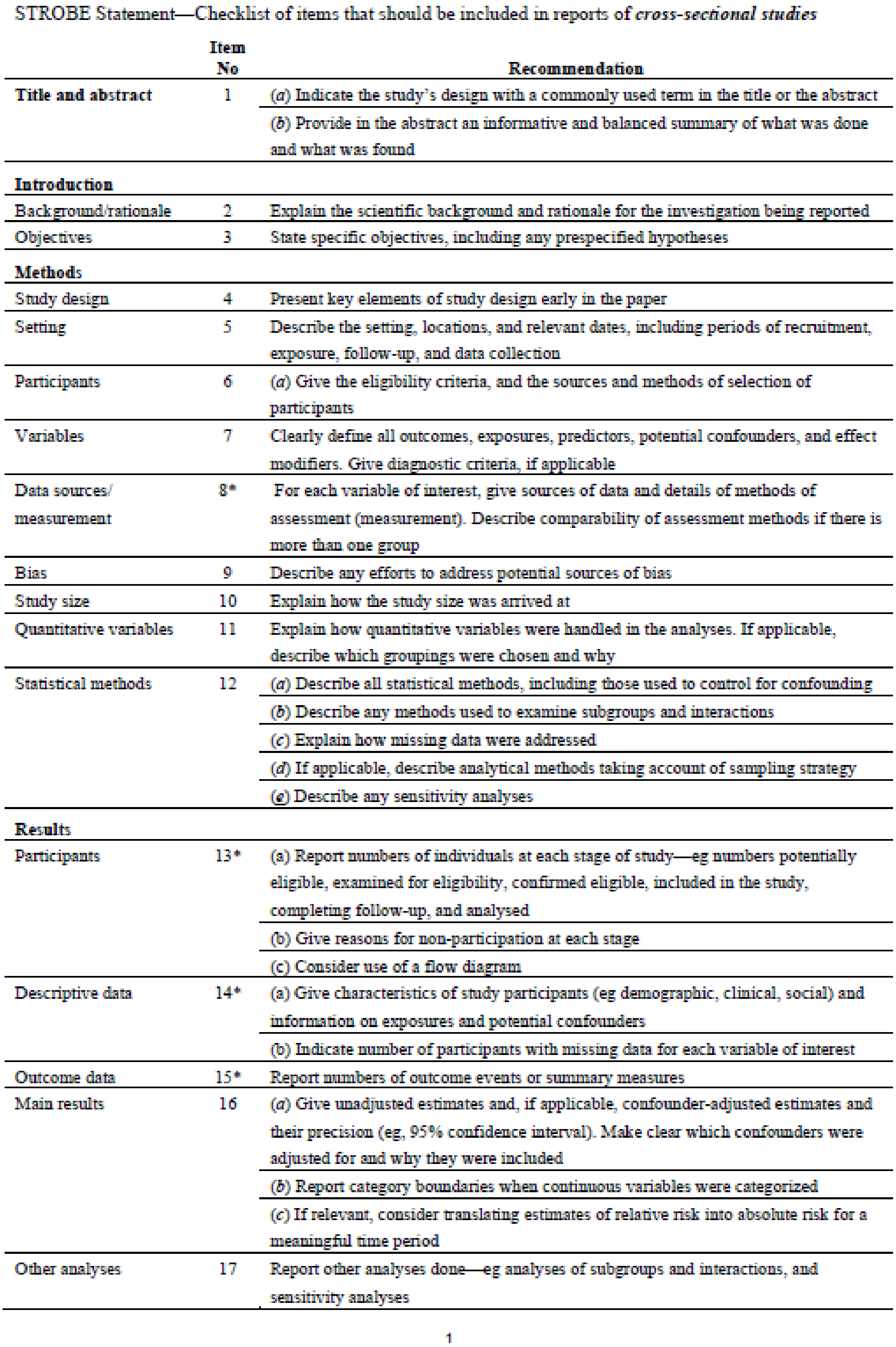
RefID :

Extractor / Date :

EXTRACTION FIELD		DESCRIPTION
BIBLIOGRAPHIC DETAILS		
Study Title		
Authors		
Journal, Vol, Issues, Page nos.		
STUDY DETAILS		
Year study conducted		
Country setting		
Setting of care (urban/rural, general practice/community)		
Research question or research objective(s)		
Study design		
Chronic Care Model element / Description of model or intervention		☐ Organization of healthcare: ☐ Decision support: ☐ Delivery system design: ☐ Self-management support: ☐ Community linkage: ☐ Clinical information system:
Participants		
Sampling approach		
Inclusion criteria		
Exclusion criteria		
Number of participants		
Patients	Age	
	Gender	
	Ethnicity	
	Socio-economic characteristics	

EXTRACTION FIELD		DESCRIPTION
	Co-morbidities mentioned	
Practitioners	Qualification	
	Age	
	Gender	
	Level of experience	
	Practice characteristics	
Quantitative studies		
Intervention		
Comparison group		
Timing of the intervention (e.g. Frequency, duration, etc.)		
Intervention Recipient (individual or group)		
Intervention Deliverer (individual or group)		
Data analysis approach		
Outcome(s)		
Conclusions		
Qualitative studies		
Data collection method		
Data analysis and interpretation approach		
Identified key themes		
Explanation of key themes		
Overall conclusion		
Recommendation		
Ethical Considerations		
Ethical approval		
How is the study funded? Are any conflicts of interest declared?		
Limitations		
Other Notes		

Appendix F. STROBE statement – Checklist of items that shouls be included in reports of cross-sectional studies



STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	**Recommendation**
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found
Introduction		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported
Objectives	3	State specific objectives, including any prespecified hypotheses
Methods		
Study design	4	Present key elements of study design early in the paper
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group
Bias	9	Describe any efforts to address potential sources of bias
Study size	10	Explain how the study size was arrived at
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding
		(*b*) Describe any methods used to examine subgroups and interactions
		(*c*) Explain how missing data were addressed
		(*d*) If applicable, describe analytical methods taking account of sampling strategy
		(*e*) Describe any sensitivity analyses
Results		
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
		(b) Give reasons for non-participation at each stage
		(c) Consider use of a flow diagram
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
		(b) Indicate number of participants with missing data for each variable of interest
Outcome data	15*	Report numbers of outcome events or summary measures
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
		(*b*) Report category boundaries when continuous variables were categorized
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses

1

Discussion		
Key results	18	Summarise key results with reference to study objectives
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
Generalisability	21	Discuss the generalisability (external validity) of the study results
Other information		
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

Appendix G. IFLS Questionnaire used to collect variables of LTCs

SECTION CD (CHRONIC CONDITIONS)

Now we would like to ask you about some health conditions that you may have been diagnosed with.

CD01. Did a doctor/paramedic/nurse/midwife ever diagnose you with […]?	CD02. Who first diagnose you with […]?	CD02a. When was the condition […] first diagnosed?	CD03.Does the condition limit the kind or amount of paid work you can do?
A. Physical disabilities ..... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
B. Brain damage .... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
C. Vision problem .... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
D. Hearing problem .... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
E. Speech impediment .... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
F. Mental retardation .... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
I. Autism .... 3. No ↓ 1. Yes →	1. Doctor 2. Paramedic 3. Nurse 4. Midwife	1. └┴┘ / └┴┴┴┘ Month / Year 2. Age: └┴┘ years 8. DON'T KNOW	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all

SECTION CD (CHRONIC CONDITIONS)

Now we would like to ask you about some chronic illnesses that you may have been diagnosed with.

CHRONIC CONDITIONS (CDTYPE)	CD05.	CD06.	CD07.	CD08.	CD09.	CD09a.	CD09b.	CD09c	CD10.
	Have a doctor/paramedic/nurse/ midwive ever told you that you had [....]	In which organ or part of the body have you or have you had cancer?	When was the condition [...] first diagnosed?	Who diagnosed the [...] condition?	In order to deal with [...] are you currently taking prescribed medication on a weekly basis?	Are you now taking the following treatments to treat [...] and its complications?	How many timesin the last 12 months have you had:	Have your care providers ever given you health education/advice on the following?	Does the condition limit the kind or amount of paid work you can do? **(SHOWCARD 18)**
A. Hypertension	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor ...... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No............... 3	|__| |__| |__|	1. |__|__|__|	|__| |__| |__| |__| |__|	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
B. Diabetes or high blood sugar	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor ...... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No......................	|__| |__| |__|	1. |__|__|__| 2. |__|__|__| 3. |__|__|__| 4. |__|__|__| 5. |__|__|__|	|__| |__| |__| |__| |__|	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
C. Tuberculosis (TBC)	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No......................	|__| |__| |__|			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
D. Asthma	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No............... 3	|__| |__| |__|			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
E. Other lung conditions	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No............... 3	|__| |__| |__|			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
F. Heart attack, coronary heart disease, angina, or other heart problems	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No............... 3	|__| |__| |__|		|__| |__| |__| |__| |__|	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
G. Liver	3. No ↓ 1. Yes→		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No............... 3	|__| |__| |__|			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all

SECTION CD (CHRONIC CONDITIONS)

CHRONIC CONDITIONS (CDTYPE)	CD05.	CD06.	CD07.	CD08.	CD09.	CD09a.	CD09b.	CD09c	CD10.
	Have a doctor/paramedic/nurse/ midwive ever told you that you had [….]	In which organ or part of the body have you or have you had cancer?	When was the condition […] first diagnosed?	Who diagnosed the […] condition?	In order to deal with […] are you currently taking prescribed medication on a weekly basis?	Are you now taking the following treatments to treat […] and its complications?	How many timesin the last 12 months have you had:	Have your care providers ever given you health education/advice on the following?	Does the condition limit the kind or amount of paid work you can do? (SHOWCARD 18)
H. Stroke	3. No ↓ 1. Yes→		1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No................ 3	☐ ☐ ☐		☐ ☐ ☐ ☐ ☐	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
I. Cancer or malignant tumor	3. No ↓ 1. Yes→	☐	1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No................ 3	☐ ☐ ☐			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
J. Arthritis/rheumatism	3. No ↓ 1. Yes→		1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No................ 3	☐ ☐ ☐			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
M. High Cholestero (Total or LDL)l	3. No ↓ 1. Yes→		1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐D☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No................ 3	☐ ☐ ☐		☐ ☐ ☐ ☐ ☐	1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
N. Prostate illness	3. No ↓ 1. Yes→		1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No................ 3	☐ ☐ ☐			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
O. Kidney disease (except for tumor or cancer)	3. No ↓ 1. Yes→		1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No......................	☐ ☐ ☐			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
P. Stomach or other digestive disease	3. No ↓ 1. Yes→		1. ☐☐ / ☐☐☐☐ Month / Year 2. Age: ☐☐ years 8. DON'T KNOW	Doctor .... 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No......................	☐ ☐ ☐			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all

SECTION CD (CHRONIC CONDITIONS)

CHRONIC CONDITIONS (CDTYPE)	CD05.	CD06.	CD07.	CD08.	CD09.	CD09a.	CD09b.	CD09c	CD10.
	Have a doctor/paramedic/nurse/ midwive ever told you that you had [….]	In which organ or part of the body have you or have you had cancer?	When was the condition […] first diagnosed?	Who diagnosed the […] condition?	In order to deal with […] are you currently taking prescribed medication on a weekly basis?	Are you now taking the following treatments to treat […] and its complications?	How many timesin the last 12 months have you had:	Have your care providers ever given you health education/advice on the following?	Does the condition limit the kind or amount of paid work you can do? **(SHOWCARD 18)**
Q. Emotional, nervous, or psychiatric problems	3. No ↓ 1. Yes➔		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor.............. 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No......................	|__| |__| |__|			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all
R. Memory-related disease	3. No ↓ 1. Yes➔		1. |__|__| / |__|__|__|__| Month / Year 2. Age: |__|__| years 8. DON'T KNOW	Doctor.............. 1 Paramedic .... 2 Nurse .... 3 Midwive........... 4	Yes .... 1 No......................	|__| |__| |__|			1. Yes, very much so 2. Yes, some degree 3. No, not much 4. No, not at all

Code for CD06 (Cancer)

A. Brain
B. Oral cavity
C. Larynx
D. Other pharynx
E. Thyroid
F. Lungs
G. Breast
H. Oesephagus
I. Stomach
J. Liver
K. Pancreas
L. Kidney
M. Prostate
N. Testicle
O. Ovary
P. Cervix
Q. Endometrium
R. Colon/Rectum
S. Bladder
T. Skin
U. Non Hodgkin lymphoma
X. Leukemia
V. Other, mention_____

NOTE for CD09a

1. Codes A, B,V and W is for all CDTYPE, codes C-K are for specific CDTYPE mentioned in the parentheses.
2. CD09b is for CDTYPE A and B only, need to block the other CDTYPE.
3. CD09b is for CDTYPE A,B,F,H and M only need to block the other CDTYPE.

Code for CD09a

A. Traditional medicine
B. Modern medicine
C. Insulin injection (CAPI: ONLY FOR CDTYPE B)
D. Chemotherapy (CAPI: ONLY FOR CDTYPE I)
E. Surgery (CAPI: ONLY FOR CDTYPE I)
F. Radiation therapy (CAPI: ONLY FOR CDTYPE I)
G. Physical therapy (CAPI: ONLY FOR CDTYPE H)
H. Occupational therapy(CAPI: ONLY FOR CDTYPE H)
I. Receiving psychiatric/psychological treatment (CAPI: ONLY FOR CDTYPE L)
J. Taking anti-depressant (CAPI: ONLY FOR CDTYPE L)
K. Taking tranquilizer/sleeping pills (CAPI: ONLY FOR CDTYPE L)
V. Other treatment
W. No treatment

Code for CD09b

1. Blood pressure test (CAPI: ONLY FOR CDTYPE A)
2. Blood glucose test (CAPI: ONLY FOR CDTYPE B)
3. Urine glucose test (CAPI: ONLY FOR CDTYPE B)
4. Fundus examination (CAPI: ONLY FOR CDTYPE B)
5. Micro-albuminuria test (CAPI: ONLY FOR CDTYPE B)

Code for CD09c

A. Weight control
B. Exercise
C. Diet
D. Smoking control
E. Foot self care (CAPI: ONLY FOR CDTYPE B)
W. None of the above

CD11.	Do you usually wear glasses or corrective lenses?	1. Yes 3. No
CD12.	Do you ever wear hearing aid?	1. Yes 3. No
CD13.	Do you use a walking cane/walker/other walking aids?	1. Walking cane 2. Walker 3. Manual wheelchair 4. Electric wheelchair 6. DO NOT USE WALKING AID

Appendix H. Full result of logistic regression models

Table 1. Logistic regression models for outpatient visit in overall study population

Predictor variables	Unadjusted OR (95% (CI)	Model 1 OR* (95% (CI)	Model 2 OR** (95% (CI)
Presence of diabetes (and other morbidity)			
No diabetes	1.00	1.00	1.00
Diabetes only	2.57 (1.93, 3.42)	2.45 (1.83, 3.28)	2.55 (1.89, 3.44)
Diabetes + comorbidities	3.30 (2.79, 3.91)	2.69 (2.25, 3.20)	2.22 (1.85, 2.66)
Age			
18-35	1.00	1.00	1.00
36-55	1.07 (1.01,1.14)	0.98 (0.92, 1.06)	1.00 (0.93, 1.07)
>56	1.57 (1.46,1.70)	1.48 (1.34, 1.63)	1.48 (1.33, 1.63)
Sex			
Male	1.00	1.00	1.00
Female	1.90 (1.79,2.02)	1.90 (1.79, 2.02)	1.51 (1.38, 1.66)
Marital status			
Married	1.00	1.00	1.00
Never married	0.56 (0.51,0.62)	0.64 (0.58, 0.71)	0.61 (0.55, 0.68)
Separated/widowed	1.26 (1.16,1.38)	0.94 (0.85, 1.05)	0.94 (0.84, 1.04)
Education			
No school	1.00	1.00	1.00
Primary level	0.92 (0.82,1.04)	1.16 (1.02, 1.32)	1.12 (098, 1.28)
Secondary level	0.83 (0.74,0.94)	1.22 (1.07, 1.40)	1.19 (1.04, 1.37)
Higher education	0.92 (0.81,1.05)	1.32 (1.13, 1.53)	1.27 (1.09, 1.49)
Ethnicity			
Javanese	1.00	1.00	1.00
Sundanese	1.02 (0.93,1.11)	1.00 (0.91, 1.10)	0.89 (0.81, 0.97)
Minang	0.72 (0.63,0.83)	0.70 (0.61, 0.81)	0.67 (0.58, 0.78)
Others	0.95 (0.89,1.01)	0.92 (0.86, 0.98)	0.86 (0.80, 0.92)
Religion			
Islam	1.00	1.00	1.00
Christian	1.07 (0.94,1.21)	1.06 (0.93, 1.20)	1.06 (0.93, 1.21)
Hindu	1.44 (1.28,1.63)	1.48 (1.30, 1.68)	1.59 (1.40, 1.82)
Other	0.59 (0.29,1.18)	0.51 (0.25, 1.04)	0.65 (0.32, 1.33)
Residential area			
Urban	1.00	1.00	1.00
Rural	0.95 (0.90,1.01)	1.00 (0.94, 1.06)	1.04 (0.98, 1.11)
Insurance type			
No insurance	1.00	1.00	1.00
Government insurance	1.31 (1.24,1.39)	1.27 (1.19, 1.35)	1.24 (1.16, 1.32)
Private insurance	1.48 (1.33,1.65)	1.59 (1.42, 1.79)	1.56 (1.38, 1.75)
Smoking habit			
Never smoked	1.00		1.00
Current smoker	0.48 (0.45, 0.52)		0.68 (0.61, 0.75)
Previous smoker	1.21(1.08, 1.36)		1.29 (1.12, 1.48)
Falls (within last 2 years)			
No	1.00		1.00
Yes	1.31 (1.21, 1.41)		1.13 (1.05, 1.23)
Number of acute complaints (in last 4 weeks)	1.24 (1.23, 1.26)		1.24 (1.22, 1.26)

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

Table 2. Logistic regression models for hospital admissions in overall study population

Predictor variables	Unadjusted OR (95% (CI)	Model 1 OR (95% CI)	Model 2 OR (95% (CI)
Presence of diabetes (and other morbidity)			
No diabetes	1.00	1.00	1.00
Diabetes only	2.65 (1.73, 4.07)	2.76 (1.78, 4.29)	2.80 (1.80, 4.36)
Diabetes + comorbidities	3.31 (2.60, 4.21)	2.81 (2.18, 3.62)	2.45 (1.89, 3.17)
Age			
18-35	1.00	1.00	1.00
36-55	0.64 (0.57, 0.72)	0.56 (0.50, 0.64)	0.57 (0.50, 0.64)
≥56	1.15 (1.01, 1.31)	1.11 (0.93, 1.31)	1.03 (0.87, 1.23)
Sex			
Male	1.00	1.00	1.00
Female	2.36 (2.12,2.64)	2.34 (2.08, 2.62)	1.99 (1.68, 2.36)
Marital status			
Married	1.00	1.00	1.00
Never married	0.56 (0.98,1.35)	0.50 (0.42, 0.61)	0.49 (0.41, 0.60)
Separated/widowed	1.49 (0.98,1.35)	0.94 (0.78, 1.12)	0.94 (0.78, 1.13)
Education			
No school	1.00	1.00	1.00
Primary level	1.00 (0.79,1.26)	1.21 (0.94, 1.55)	1.19 (0.92, 1.53)
Secondary level	1.15 (0.91,1.44)	1.37 (1.06, 1.77)	1.33 (1.02, 1.72)
Higher education	1.50 (1.17,1.92)	1.59 (1.20, 2.11)	1.49 (1.13, 1.98)
Ethnicity			
Javanese	1.00	1.00	1.00
Sundanese	1.01 (0.86,1.19)	0.96 (0.81, 1.13)	0.93 (0.79, 1.10)
Minang	1.21 (0.98,1.50)	1.09 (0.87, 1.36)	1.09 (0.87, 1.35)
Others	1.00 (0.89,1.11)	0.97 (0.86, 1.10)	0.96 (0.85, 1.08)
Religion			
Islam	1.00	1.00	1.00
Christian	1.16 (0.94,1.44)	1.13 (0.90, 1.41)	1.12 (0.89, 1.40)
Hindu	1.23 (0.99,1.53)	1.21 (0.96, 1.53)	1.22 (0.97, 1.54)
Other	1.06 (0.39,2.91)	0.96 (0.34, 2.67)	1.05 (0.38, 2.95)
Residential area			
Urban	1.00	1.00	1.00
Rural	0.76 (0.68,0.85)	0.90 (0.80, 1.00)	0.92 (0.82, 1.03)
Insurance type			
No insurance Government	1.00	1.00	1.00
insurance	2.23 (1.99,2.49)	2.14 (1.91, 2.40)	2.09 (1.87, 2.35)
Private insurance	3.06 (2.58,3.64)	3.05 (2.54, 3.66)	2.98 (2.48, 3.58)
Smoking habit			
Never smoked	1.00		1.00
Current smoker	0.36 (0.31, 0.41)		0.66 (0.55, 0.81)
Previous smoker	1.29 (1.07, 1.56)		1.76 (1.40, 2.22)
Falls (within last 2 years)			
No	1.00		1.00
Yes	1.39 (1.22, 1.58)		1.32 (1.15, 1.50)
Number of acute complaints (in last 4 weeks)	1.10 (1.08, 1.12)		1.07 (1.05, 1.10)

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

Table 3. Logistic regression models for outpatient visit in the diabetes population

Predictor variables	**Unadjusted OR (95% (CI)**	**Model 1 OR (95% CI)**	**Model 2 OR (95% (CI)**
Presence of other LTCs			
Diabetes only	1.00	1.00	1.00
Diabetes + comorbidities	1.29 (0.92, 1.79)	1.16 (0.82, 1.64)	1.04 (0.72, 1.49)
Age			
18-35	1.00	1.00	1.00
36-55	1.11 (0.66,1.86)	1.11 (0.64, 1.92)	1.16 (0.66, 2.05)
≥56	1.39 (0.83,2.32)	1.51 (0.85, 2.67)	1.55 (0.86, 2.82)
Sex			
Male	1.00	1.00	1.00
Female	1.83 (1.36,2.45)	1.86 (1.33, 2.61)	1.55 (0.97, 2.47)
Marital status			
Married	1.00	1.00	1.00
Never married	0.44 (0.12,1.63)	0.36 (0.91, 1.40)	0.34 (0.83, 1.37)
Separated/widowed	1.16 (0.79,1.69)	0.79 (0.51, 1.23)	0.78 (0.50, 1.22)
Education			
No school	1.00	1.00	1.00
Primary level	0.57 (0.31,1.04)	0.70 (0.37, 1.31)	0.73 (0.39, 1.38)
Secondary level	0.47 (0.26,0.86)	0.70 (0.37, 1.34)	0.73 (0.38, 1.40)
Higher education	0.41 (0.21,0.78)	0.63 (0.30, 1.29)	0.66 (0.32, 1.37)
Ethnicity			
Javanese	1.00	1.00	1.00
Sundanese	0.99 (0.60,1.62)	0.95 (0.57, 1.57)	0.89 (0.53, 1.50)
Minang	0.65 (0.30,1.39)	0.59 (0.27, 1.30)	0.57 (0.26, 1.26)
Others	1.11 (0.81,1.52)	1.07 (0.75, 1.51)	1.00 (0.71, 1.44)
Religion			
Islam	1.00	1.00	1.00
Christian	0.44 (0.21, 0.90)	0.52 (0.24, 1.09)	0.53 (0.25, 1.12)
Hindu	2.21 (1.13, 4.32)	2.23 (1.06, 4.69)	2.31 (1.09, 4.89)
Other	0.24 (0.03, 2.01)	0.25 (0.03, 2.18)	0.28 (0.03, 2.48)
Residential area			
Urban	1.00	1.00	1.00
Rural	1.35 (0.97,1.87)	1.34 (0.94, 1.92)	1.31 (0.92, 1.88)
Insurance type			
No insurance	1.00	1.00	1.00
Government insurance	1.14 (0.84,1.54)	1.25 (0.90, 1.73)	1.22 (0.87, 1.69)
Private insurance	1.06 (0.60,1.89)	1.45 (0.77, 2.71)	1.48 (0.79, 2.79)
Smoking habit			
Never smoked	1.00		1.00
Current smoker	0.48 (0.33, 0.69)		0.67 (0.40, 1.11)
Previous smoker	0.83 (0.53, 1.29)		1.02 (0.59, 1.77)
Falls (within last 2 years)			
No	1.00		1.00
Yes	0.90 (062, 1.32)		0.85 (0.57, 1.28)
Number of acute complaints (in last 4 weeks)	1.10 (1.04, 1.17)		1.10 (1.03, 1.18)

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

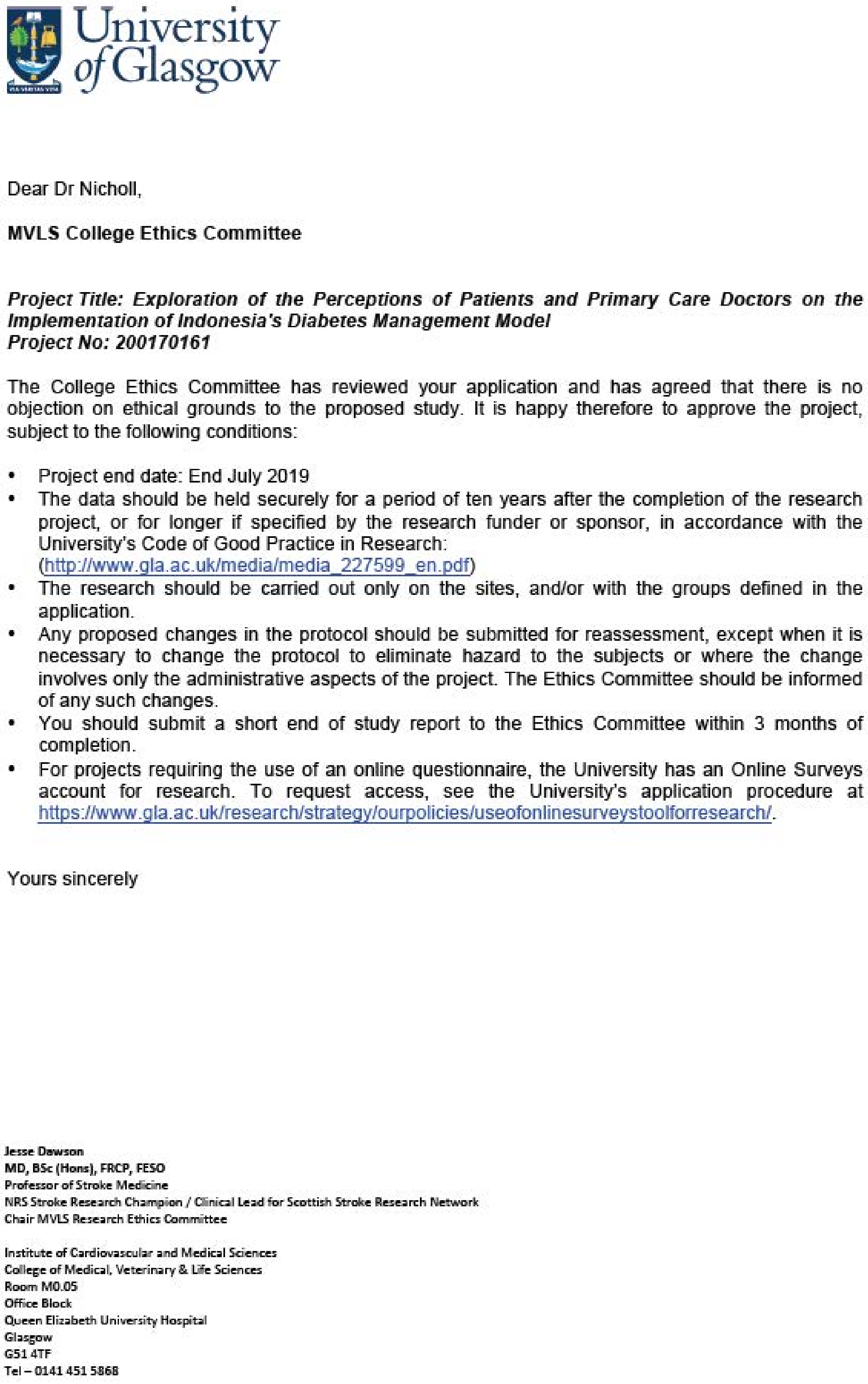
Table 4. Logistic regression models for hospital admissions in the diabetes population

	Unadjusted OR (95% (CI)	**Model 1 OR (95% (CI)**	**Model 2 OR (95% (CI)**
Presence of other LTCs			
Diabetes only	1.00	1.00	1.00
Diabetes +comorbidities	1.25 (0.77, 2.03)	0.99 (0.59,1.65)	0.81 (0.47, 1.39)
Age			
18-35	1.00	1.00	1.00
36-55	0.71 (0.34,1.46)	0.62 (0.29, 1.34)	0.63 (0.29, 1.40)
≥56	1.11 (0.55,2.23)	1.04 (0.48, 2.28)	0.95 (0.42, 2.16)
Sex			
Male	1.00	1.00	1.00
Female	2.30 (1.47,3.59)	2.31 (1.39, 3.83)	1.79 (0.89, 3.58)
Marital status			
Married	1.00	1.00	1.00
Never married	0.58 (0.07,4.51)	0.43 (0.52, 3.58)	0.35 (0.04, 2.98)
Separated/widowed	1.62 (0.99,2.66)	0.99 (0.56, 1.75)	0.96 (0.54, 1.72)
Education			
No school	1.00	1.00	1.00
Primary level	1.07 (0.47,2.41)	1.16 (0.49, 2.74)	1.16 (0.48, 2.78)
Secondary level	0.72 (0.31,1.65)	0.82 (0.33, 2.01)	0.77 (0.31, 1.92)
Higher education	0.64 (0.25,1.63)	0.81 (0.29, 2.23)	0.72 (0.25, 2.05)
Ethnicity			
Javanese	1.00	1.00	1.00
Sundanese	1.61 (0.85,3.03)	1.68 (0.87, 3.27)	1.71 (0.87, 3.37)
Minang	1.24 (0.46,3.37)	1.16 (0.41, 3.22)	1.01 (0.38, 3.18)
Others	1.08 (0.68,1.71)	1.19 (0.72, 1.98)	1.13 (0.68, 1.89)
Religion			
Islam	1.00	1.00	1.00
Christian	0.82 (0.31,2.12)	1.16 (0.42, 3.18)	1.19 (0.43, 3.32)
Hindu	0.94 (0.36,2.47)	0.98 (0.34, 2.84)	0.99 (0.34, 2.88)
Other	1.00	1.00	1.00
Residential area			
Urban	1.00	1.00	1.00
Rural	0.97 (0.60,1.56)	1.10 (0.66, 1.84)	1.16 (0.68, 1.95)
Insurance type			
No insurance	1.00	1.00	1.00
Government insurance	2.27 (1.40,3.64)	2.51 (1.51, 4.18)	2.34 (1.39, 3.92)
Private insurance	1.76 (0.75,4.10)	2.50 (1.00, 6.26)	2.60 (1.03, 6.59)
Smoking habit			
Never smoked	1.00		1.00
Current smoker	0.27 (0.13, 0.54)		0.37 (0.15, 0.92)
Previous smoker	1.18 (0.67, 2.08)		1.58 (0.75, 3.32)
Falls (within last 2 years)			
No	1.00		1.00
Yes	1.97 (1.23, 3.18)		1.90 (1.13, 3.19)
Number of acute complaints (in last 4 weeks)	1.09 (1.01, 1.19)		1.05 (0.96, 1.16)

*Adjustment for sociodemographic characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

**Adjustment for sociodemographic and health-related characteristics: age, sex, marital status, education, ethnicity, religion, residential area, insurance type.

Appendix I. Approval letter from Ethics Committees and Health Offices in Indonesia



University of Glasgow

Dear Dr Nicholl,

MVLS College Ethics Committee

Project Title: Exploration of the Perceptions of Patients and Primary Care Doctors on the Implementation of Indonesia's Diabetes Management Model
Project No: 200170161

The College Ethics Committee has reviewed your application and has agreed that there is no objection on ethical grounds to the proposed study. It is happy therefore to approve the project, subject to the following conditions:

- Project end date: End July 2019
- The data should be held securely for a period of ten years after the completion of the research project, or for longer if specified by the research funder or sponsor, in accordance with the University's Code of Good Practice in Research: (http://www.gla.ac.uk/media/media_227599_en.pdf)
- 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 change involves only the administrative aspects of the project. The Ethics Committee should be informed of any such changes.
- You should submit a short end of study report to the Ethics Committee within 3 months of completion.
- For projects requiring the use of an online questionnaire, the University has an Online Surveys account for research. To request access, see the University's application procedure at https://www.gla.ac.uk/research/strategy/ourpolicies/useofonlinesurveystoolforresearch/.

Yours sincerely

Jesse Dawson
MD, BSc (Hons), FRCP, FESO
Professor of Stroke Medicine
NRS Stroke Research Champion / Clinical Lead for Scottish Stroke Research Network
Chair MVLS Research Ethics Committee

Institute of Cardiovascular and Medical Sciences
College of Medical, Veterinary & Life Sciences
Room M0.05
Office Block
Queen Elizabeth University Hospital
Glasgow
G51 4TF
Tel – 0141 451 5868

MEDICAL AND HEALTH RESEARCH ETHICS COMMITTEE (MHREC)
FACULTY OF MEDICINE GADJAH MADA UNIVERSITY
– DR. SARDJITO GENERAL HOSPITAL

ETHICS COMMITTEE APPROVAL

Ref : KE/FK/0484 /EC/2018

Title of the Research Protocol	:	Exploration of the Perceptions of Patients and Primary Care Doctors on the Implementation of Indonesia's Diabetes Management Model, Prolanis
Documents Approved	:	1. Study Protocol versi 02 2018 2. Information for Subjects versi v1.1.2 12 Maret 2018 3. Informed consent form versi v1.1.2 12 Maret 2018
Principle Investigator	:	dr. Aghnaa Gayatri, M.Sc
Name of supervisor	:	1. Barbara Nicholl 2. Sara Macdonald 3. Stewart Mercer
Date of Approval	:	21 MAY 2018 (Valid for one year beginning from the date of approval)
Institution(s)/place(s) of research	:	Puskesmas, klinik pratama, praktek dokter keluarga

The Medical and Health Research Ethics Committee (MHREC) states that the above protocol meets the ethical principle outlined in the Declaration of Helsinki 2008 and therefore can be carried out.

The Medical and Health Research Ethics Committee (MHREC) has the right to monitor the research activities at any time.

The investigator(s) is/are obliged to submit:
☐ Progress report as a continuing review : Annually
☐ Report of any serious adverse events (SAE)
☑ Final report upon the completion of the study

Prof. dr. Madarina Julia, Sp.A(K)., MPH., Ph.D
Chairperson

dr. Shinta Prawitasari, M.Kes., Sp.OG(K)
Secretary

Attachments:
☐ Continuing review submission form (AF 4.3.01-014.2013-03)
☐ Serious adverse events (SAE) report form (AF 6.1.01- 019.2013-03)

Recognized by Forum for Ethical Review Committees in Asia and the Western Pacific (FERCAP)
18-May-18

PEMERINTAH KOTA YOGYAKARTA
DINAS KESEHATAN
JL. Kenari No.56 Yogyakarta Kode Pos 55165 Telp. (0274) 515865, 562682 Fax. (0274) 515869
EMAIL : kesehatan@jogjakota.go.id
HOT LINE SMS : 08122780001 HOTLINE EMAIL : upik@jogjakota.go.id
WEB SITE : www.jogjakota.go.id

Yogyakarta, 27 Juli 2018

Nomor : 070/ 9122
Sifat :
Lamp :
Hal : Rekomendasi Penelitian

Kepada Yth :
Kepala Dinas Penanaman Modal dan Perizinan Kota Yogyakarta
Di-
YOGYAKARTA

Berdasarkan surat dari Badan Kesatuan Bangsa dan Politik DIY, Nomor : 074/7590/Kesbangpol/2018, Tanggal 9 Juli 2018 perihal pada pokok surat.

Nama : dr. Aghnaa Gayatri, M.Sc
Pekerjaan : Dosen di Departemen Kedokteran Keluarga dan Komunitas FKKMK Universitas Gadjah Mada Yogyakarta
Alamat : Jl. Farmako Sekip Utara, Yogyakarta

Dengan ini kami sampaikan bahwa pada prinsipnya kami tidak berkeberatan dan memberikan rekomendasi penelitian dengan judul :

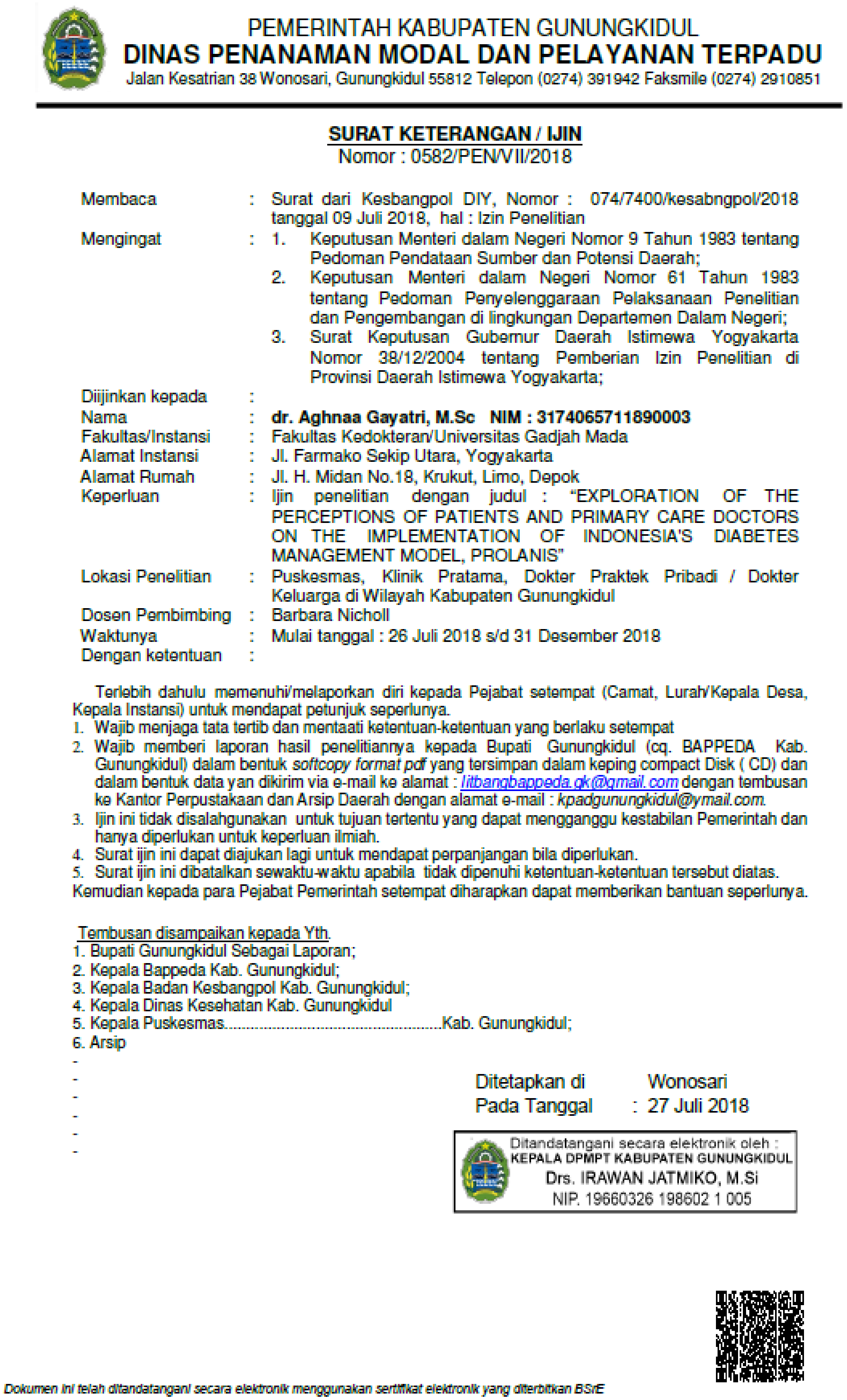
Exploration of the Perceptions of Patients and Primary Care Doctors on the Implementation of Indonesia's Diabetes Management Model, Prolanis

Demikian rekomendasi penelitian ini dibuat dengan ketentuan memenuhi persyaratan yang berlaku dan untuk dapat dipergunakan sebagaimana mestinya

a.n. Kepala
Sekretaris,

Agus Sudrajat,SKM, M.Kes
NIP 196505301988031006

Tembusan :
1. Kepala Bidang P2P
2. Kepala Puskesmas di Wilayah Kota Yogyakarta



PEMERINTAH KABUPATEN GUNUNGKIDUL
DINAS PENANAMAN MODAL DAN PELAYANAN TERPADU
Jalan Kesatrian 38 Wonosari, Gunungkidul 55812 Telepon (0274) 391942 Faksmile (0274) 2910851

SURAT KETERANGAN / IJIN
Nomor : 0582/PEN/VII/2018

Membaca : Surat dari Kesbangpol DIY, Nomor : 074/7400/kesabngpol/2018 tanggal 09 Juli 2018, hal : Izin Penelitian

Mengingat :
1. Keputusan Menteri dalam Negeri Nomor 9 Tahun 1983 tentang Pedoman Pendataan Sumber dan Potensi Daerah;
2. Keputusan Menteri dalam Negeri Nomor 61 Tahun 1983 tentang Pedoman Penyelenggaraan Pelaksanaan Penelitian dan Pengembangan di lingkungan Departemen Dalam Negeri;
3. Surat Keputusan Gubernur Daerah Istimewa Yogyakarta Nomor 38/12/2004 tentang Pemberian Izin Penelitian di Provinsi Daerah Istimewa Yogyakarta;

Diijinkan kepada :
Nama : **dr. Aghnaa Gayatri, M.Sc NIM : 3174065711890003**
Fakultas/Instansi : Fakultas Kedokteran/Universitas Gadjah Mada
Alamat Instansi : Jl. Farmako Sekip Utara, Yogyakarta
Alamat Rumah : Jl. H. Midan No.18, Krukut, Limo, Depok
Keperluan : Ijin penelitian dengan judul : "EXPLORATION OF THE PERCEPTIONS OF PATIENTS AND PRIMARY CARE DOCTORS ON THE IMPLEMENTATION OF INDONESIA'S DIABETES MANAGEMENT MODEL, PROLANIS"
Lokasi Penelitian : Puskesmas, Klinik Pratama, Dokter Praktek Pribadi / Dokter Keluarga di Wilayah Kabupaten Gunungkidul
Dosen Pembimbing : Barbara Nicholl
Waktunya : Mulai tanggal : 26 Juli 2018 s/d 31 Desember 2018
Dengan ketentuan :

Terlebih dahulu memenuhi/melaporkan diri kepada Pejabat setempat (Camat, Lurah/Kepala Desa, Kepala Instansi) untuk mendapat petunjuk seperlunya.

1. Wajib menjaga tata tertib dan mentaati ketentuan-ketentuan yang berlaku setempat
2. Wajib memberi laporan hasil penelitiannya kepada Bupati Gunungkidul (cq. BAPPEDA Kab. Gunungkidul) dalam bentuk *softcopy format pdf* yang tersimpan dalam keping compact Disk (CD) dan dalam bentuk data yan dikirim via e-mail ke alamat : *litbangbappeda.gk@gmail.com* dengan tembusan ke Kantor Perpustakaan dan Arsip Daerah dengan alamat e-mail : *kpadgunungkidul@ymail.com*.
3. Ijin ini tidak disalahgunakan untuk tujuan tertentu yang dapat mengganggu kestabilan Pemerintah dan hanya diperlukan untuk keperluan ilmiah.
4. Surat ijin ini dapat diajukan lagi untuk mendapat perpanjangan bila diperlukan.
5. Surat ijin ini dibatalkan sewaktu-waktu apabila tidak dipenuhi ketentuan-ketentuan tersebut diatas.

Kemudian kepada para Pejabat Pemerintah setempat diharapkan dapat memberikan bantuan seperlunya.

Tembusan disampaikan kepada Yth.
1. Bupati Gunungkidul Sebagai Laporan;
2. Kepala Bappeda Kab. Gunungkidul;
3. Kepala Badan Kesbangpol Kab. Gunungkidul;
4. Kepala Dinas Kesehatan Kab. Gunungkidul
5. Kepala Puskesmas..Kab. Gunungkidul;
6. Arsip

-
-
-
-
-
-

Ditetapkan di Wonosari
Pada Tanggal : 27 Juli 2018

Ditandatangani secara elektronik oleh :
KEPALA DPMPT KABUPATEN GUNUNGKIDUL
Drs. IRAWAN JATMIKO, M.Si
NIP. 19660326 198602 1 005

Dokumen ini telah ditandatangani secara elektronik menggunakan sertifikat elektronik yang diterbitkan BSrE

Appendix J. Topic Guide for Interviews

Topic Guide A (Doctors)

Introduction

- Thank the participant for agreeing to be interviewed for the study
- Recap participant information sheet, allow participants to ask questions
- Sign consent form (two copies: one for participant, one for researcher)
- Doctor background: age, duration of practice (overall, in current practice), additional training in diabetes care or general practice, duration of providing *Prolanis* care

Topics to be covered

Doctors' experience of:

- The implementation of *Prolanis* in their practice
- The types of services the primary care team provide for patients with diabetes
- The difference between *Prolanis* and their previous practice of diabetes care
- The involvement of community groups in diabetes care
- The provision of support for self-management
- The accessibility of evidence-based information necessary for diabetes care for the primary care team
- The storage and utilization of patient information in their diabetes care
- The organization of overall diabetes care (orientation, leadership of the organization)
- Challenges in diabetes care
- Opportunities for improvement in diabetes care
- The participants perception of *Prolanis* in general

Conclusion

- Sum up what has been discussed
- Ask if there is anything else the participant would like to mention
- Close the interview, thank the participant for their participation

Topic Guide B (Patients)

Introduction

- Thank the participant for agreeing to be interviewed for the study
- Recap participant information sheet, allow participants to ask questions
- Sign consent form (two copies: one for participant, one for researcher)
- Patient background: age, occupation, education, duration of diabetes, accompanying disease, medication being used, overall management and coping with diabetes

Topics to be covered

Patients' experience of:

- The types of services patients receive from the primary care team
- Noticeable differences between their current and previous diabetes care
- The involvement of community groups in diabetes care from the primary care team
- The provision of support from the primary care team for self-management
- The information provided by the primary care team regarding diabetes and its care
- The continuity of care from the primary care team
- The organization of overall diabetes care (making appointments, prescriptions, referrals, lab tests)
- Challenges in diabetes care
- Opportunities for improvement in diabetes care
- The participants perception of their diabetes care in general

Conclusion

- Sum up what has been discussed
- Ask if there is anything else the participant would like to mention
- Close the interview, thank the participant for their participation