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Explorations of Head Injury, Trauma and Disabilities within Criminal Justice Settings, with consideration of Gender

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Foreword

The Major Research Project (MRP) initially proposed could not proceed due to restrictions on ethics procedures and participant research, as well as changes to the frontline services involved in the study, during the COVID-19 pandemic. The proposal had been approved by the University of Glasgow internal process and was at the point of progressing to ethics before aiming to undertake the study.

The analysis of existing data came from discussions with the research supervisor, Professor Tom McMillan. It was important to the research team that the new project remained within a similar field of research (prison studies) and answered an important question. The data was from previous studies supervised by Professor McMillan and being analysed as part of ongoing research on head injury among prisoners within the Scottish Prison Service.

Chapter One: Systematic Review

Prevalence of Intellectual Disability in Prison Populations:

A Systematic Review

Chapter word count: 6,584

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(Appendix 1.1: 84-86)

Abstract

Background: Intellectual disabilities (ID) are over-represented in prisons. Lack of screening means ID remains largely hidden within criminal justice systems. Accurate estimates of prevalence among prisoners can inform policy and planning of prison health services.

Aim: To systematically update Hellenbach et al.'s (2017) review to present current information of prevalence of ID within prisons.

Methods: ProQuest, CINAHL, MEDLINE, PsycINFO, ScienceDIRECT and Wiley Online Library databases were searched for studies published between August 2014 and June 2020 using relevant key words and subject headings.

Results: Six studies met inclusion/exclusion criteria. Considering bias, definitions of ID and measures for screening prevalence were evaluated. Overall estimates of ID prevalence are reported as 4-9%, from 7,872 prisoners from low risk of bias studies, across UK, Australian and Spanish prisons (four criminal justice systems).

Conclusion: The current review estimates ID from a large sample with overall low risk of bias however potential over-estimations of screening tools should be considered. Further, there is a need for research on ID to consistently include female prisoners and explore screening within the wider criminal justice system.

Keywords: intellectual disability, learning disability, prisoners, forensic mental health

Introduction

Although it is widely recognised that intellectual disabilities (ID) are over-represented in prisons (Sondenna, 2008; Hassiotis et al., 2011), it is also acknowledged that lack of screening of this population means that ID remains largely hidden within criminal justice systems. Furthermore, high prevalence of disability from other cause such as head injury (HI), mental health difficulties and substance use problems among the offending population complicates the picture, making the identification and assessment of ID more challenging and complex (Young et al., 2017).

Individuals with ID represent a vulnerable population, and in addition to impaired cognitive function, have coexisting physical and mental health difficulties and developmental disorders (Hellenbach et al., 2017). Fazel et al. (2008) report that victimisation and poor mental health are exacerbated by incarceration. HI is more common in prison populations compared to non-prison, and studies report an even greater risk among individuals with ID (Chester et al., 2017). Many prisoners report a history of multiple mild HI (Moynan &McMillan, 2018) and of the emotional, behavioural and cognitive impact including increased risk of reoffending (Williams et al., 2018). Literature on prisoners with ID suggests that they often find it difficult to cope with the prison regime due to impaired social adaptability resulting from cognitive, behavioural and communication problems (Dochery 2010; Boodle et al. 2014). A UK study of prison suicides found that 3% of prisoners who completed suicide had a primary diagnosis of ID (Shaw, Appleby, & Baker, 2003).

Despite differences in prevalence data, offenders with ID are generally thought to be significantly over-represented in all areas of the criminal justice system in all countries

where estimates are available (Boer et al., 2018). The prevalence of ID within the prison population is reported to be 7-10% worldwide (Hellenbach et al., 2017) compared to around 1% in the general population (McKenzie et al., 2016). However, studies are inconsistent because of a lack of consistency in conceptualising ID, use of different research designs and variations in criminal justice systems internationally (Hellenbach et al., 2017). Accurate estimates of prevalence among prisoners can be used to inform public policy and the planning of prison health services and is crucial due to the vulnerabilities associated with this group. Further, prison can offer a unique opportunity to assess and begin to meet the healthcare needs for those at greater risk, and who can be marginalized and have difficulties in accessing healthcare in the community (Fazel, 2008).

Definition of Intellectual Disability (ID)

A lack of consistency in definitions of ID across prison studies has been noted (Fazel et al., 2008). The recognition that IQ alone is not sufficient to diagnose ID, that ID are more marked at different ages and under different conditions, and that there can be identified causes of impaired cognition and function has led to a reconsideration of both incidence and prevalence (McKenzie et al., 2016). For the purpose of this review, ID is considered to be a lifelong condition that manifests during the developmental years (age<18years), characterised by IQ score below 70, with significant limitations in adaptive or social functioning. This reflects UK- and globally-recognised criteria for the diagnosis of ID (BPS, 2000; WHO, 2018).

Previous systematic reviews

In 2008, Fazel et al. completed a comprehensive review of studies published between January 1966 and June 2004, and included ten studies on the prevalence of ID, involving 11,969 prisoners. A further review by Hellenbach et al. (2017), of studies published between July 2004 and July 2014, systematically reviewed four studies on prevalence of ID and comorbidities, involving 4,653 prisoners. Fazel et al. (2008) found a prevalence of 0.5-1.5% among almost 12,000 prisoners however concluded that prevalence could not be accurately calculated due to the substantial heterogeneity of the population. Hellenbach et al. (2017) identified a higher prevalence of 7-10% through studies screening 4,653 prisoners, however findings were inconclusive due to the vast variations of methodologies. Both reviews concluded that further research is needed on prevalence of ID within prisons and highlighted the importance of up to date evidence for the appropriate care of offenders with ID. Therefore, as the prevalence findings in both reviews were inconclusive and new evidence is emerging in an ever-changing and currently relevant field, undertaking an updated review with a quality assessment tool to mitigate for heterogeneity, could make a key contribution to research and practice.

Aim

To systematically update Hellenbach et al.'s (2017) review in order to present current information including new data, new methods and new analyses (Garner et al., 2016) to facilitate decision making for stakeholders in planning services and informing of policy.

Research Questions

1. What is the prevalence of ID among prisoners?
2. Is there consistency in the definition of ID in prisoners?

3. Are there gender differences in prevalence of ID in prisoners?
4. What comorbidities, social and environmental factors related to prevalence, are reported?

Methods

In order to update the Hellenbach et al. (2017) review, only studies published between August 2014 and June 2020 were considered for inclusion in this systematic review. The review was conducted following Meta-analysis of Observational studies in Epidemiology guidelines (Stroup et al., 2000) and the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) (Moher et al., 2009). Cochrane guidelines for updating reviews were consulted (Cumpston & Chandler, 2019; Higgins et al., 2020).

Differences between previous review and current protocol

The update followed the protocol, and methods, of the 2017 review, while incorporating planned changes. The current review focuses on prevalence of ID and although evidence of comorbidities was considered, a decision was made to amend Hellenbach et al.'s (2017) inclusion criteria in order to extend consideration of evidence on ID prevalence. Hellenbach et al. (2017) did not include a quality appraisal, but this was included in the current review, to conform to guidance on risk of bias assessment, in line with PRISMA protocols (Cumpston & Chandler, 2019). Therefore, studies employing secondary data analyses were not excluded as per the criteria set out by Hellenbach et al. (2017) but the design rated within the quality assessment.

Search Strategy

The search strategy was developed from that documented in Hellenbach et al.'s (2017:

231-232) review, using a range of relevant database-specific subject headings and keywords; these were updated to take account of any changes to terms, in consultation with a librarian, to ensure the strategy remained appropriate (Garner et al., 2016). The search was carried out on the 29th June 2020 and used the same databases as the original review (ProQuest, CINAHL, MEDLINE, PsycINFO, ScienceDIRECT and Wiley Online Library). In addition, the Cochrane Database of Systematic Reviews and Google Scholar were also consulted. All databases were searched from the previous review date: 1st August 2014. Reference lists of key papers were also hand searched to trace any subsequent potentially relevant articles. The following search strategy was used in the PsycINFO database:

Line 1 Intellectual Disability

TI (intellect* disab* or mental* retard* or learning disorder* or learning disab*) or AB (intellect* disab* or mental* retard* or learning disorder* or learning disab*)
DE "learning disabilities" or "learning disorders" or "intellectual development disorder"

Line 2 Prisoners

TI (prison* or inmate* or sentenc* or remand* or detain* or felon*) OR AB (prison* or inmate* or sentenc* or remand* or detain* or felon*)

DE "prisoners"

Limits: all journals and English language only.

Selection Criteria

Articles were read and considered based on the inclusion and exclusion criteria from the previous review (Hellenbach et al.,2017: 232), with amendments detailed above:

Inclusion criteria:

- The study aimed to report prevalence of ID among detained prisoners;
- A peer-reviewed article or research report (published between August 2014 and June 2020);
- Published in English.

Exclusion criteria:

- Not using standardized and validated tools for testing of ID;
- Dissertations/theses, literature reviews, book chapters and case studies (and therefore not peer-reviewed articles or research reports).

Included studies were limited to English language in line with the previous criteria and because translation was not feasible for this review due to the financial and time limitations.

Search Results

Studies identified from searches were initially screened for eligibility by title and abstract. The full texts of these studies were then examined and the final six articles confirmed based on the selection criteria. The literature identification process is set out in Figure 1. Data were then extracted using a tool adapted for this review, based on the data collected

in the Hellenbach et al. (2017: 234-235) report (appendix 1.2), and summarised in table format (table 3). One person completed the search, screening and data extraction.

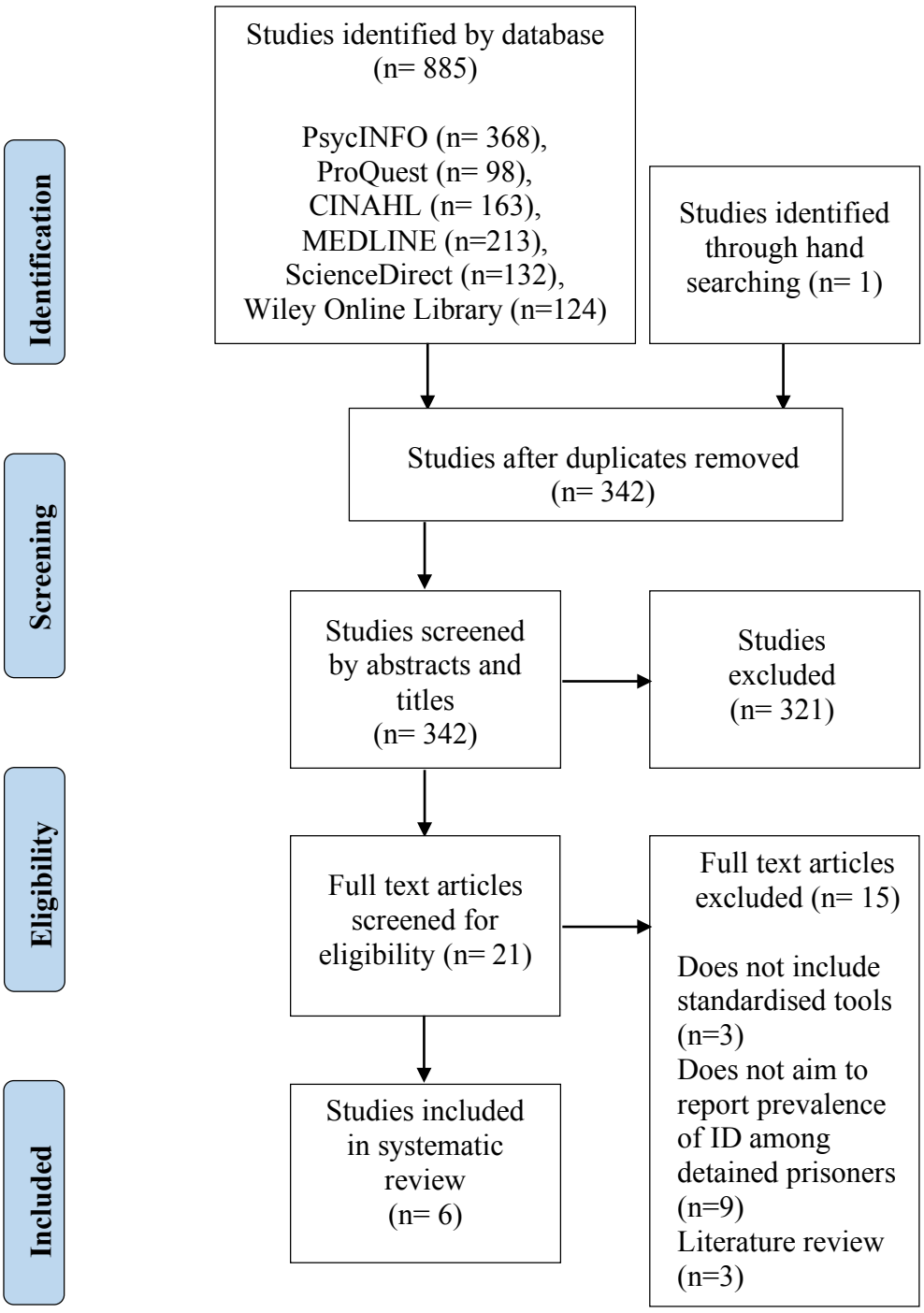

Figure 1. PRISMA Flow Diagram

Rating Risk of Bias

Articles selected for inclusion were systematically rated for methodological bias using a quality rating tool developed for this review (table 1), in line with The Cochrane Collaboration (Higgins et al., 2019) guidance on systematic reviews. The tool was derived from criteria set out in Sanderson et al (2007)'s paper on tools for epidemiological studies, and adapted by Moynan and McMillan's (2018) review on prevalence of head injury in prison populations. The tool was further adapted for this review with reference to the research questions. Domains were rated as 'high' or 'low' in risk of bias based on whether they met the specified criteria; domains not relevant to the study or not reported could be rated as 'not applicable' (N/A).

The writer initially rated each study on all domains; 50% of studies were then rated by a second reader, independently. The agreement on risk of bias ratings was 95% (20/21); the one discrepancy was resolved by discussion (Bhandari, 2015; selection bias rating).

Table 1: Risk of Bias Domains and Criteria

Domain		**Criteria**	
1.	Methods for selecting participants	i. ii.	Clear inclusion and exclusion criteria Sample representative of the larger prison population
2.	Methods for defining ID	i. ii.	Definition used for ID clearly stated ID definition includes IQ < 70
3.	Methods for measuring ID	i. ii.	Describes method of measuring ID Standardized & validated tool used
4.	Design specific bias	i.	Describes methods used to manage issues such as interviewer bias, recall bias, self-report
5.	Methods to control confounding	i.	Description of any other variables being assessed that may impact ID
6.	Statistical methods / analysis plan	i. ii. iii.	Statistical methods appropriate for analysing prevalence of ID Analysis plan appropriate to the design Effect sizes reported where appropriate
7.	Conflict of interest	i.	Declarations of conflict of interest made or funding sources identified where appropriate

Synthesis of results

The reviewed studies used varying methodologies to define and screen for ID, often in the context of different confounding factors such as offending characteristics, neurodevelopmental difficulties and environmental stressors. Given this heterogeneity, studies were analysed qualitatively, which models the approach taken by Hellenbach et al. (2017).

Results

Risk of bias (table 2)

None of the six studies had low risk of bias for all domains considered. Four studies were rated low risk of bias overall (Ali, 2016; Chaplin, 2017; Murphy, 2017; Young, 2017), and two were high risk of bias (Bhandari, 2015; Tort, 2016). Overall, risk of bias was low for selection bias; methods for defining and measuring ID; and for conflict of interest. It was high for design specific bias, and mixed for the other domains.

Table 2: Risk of bias ratings

Study - first author	**Selection bias**	**Methods for defining ID**	**Methods for measuring ID**	**Design specific bias**	**Methods to control confounding**	**Statistical methods & analysis plan**	**Conflict of interest**
1. Ali (2016)	LOW	HIGH	LOW	HIGH	HIGH	LOW	LOW
2. Bhandari (2015)	HIGH	LOW	LOW	HIGH	HIGH	HIGH	LOW
3. Chaplin (2017)	LOW	LOW	LOW	HIGH	LOW	HIGH	LOW
4. Murphy (2017)	LOW	LOW	LOW	HIGH	HIGH	LOW	LOW
5. Tort (2016)	LOW	LOW	LOW	HIGH	HIGH	HIGH	HIGH
6. Young (2017)	HIGH	LOW	LOW	HIGH	LOW	LOW	LOW

Study characteristics

The six included papers were all epidemiological studies on the prevalence of ID in 7,872 prisoners at one time point. All studies aimed to establish prevalence within a population of detainees, either as their primary aim or within the context of wider aims. Five of the considered studies used primary data from prisoners currently detained, whilst the other (Ali, 2016), analysed secondary data from a prison survey of all prisons in England and Wales. The samples covered three different countries and four different criminal justice systems (with Scotland having a devolved system from the UK). Three were from England & Wales, one from a prison in London (Chaplin, 2017), one from three London prisons (Murphy, 2017), one from all prisons across England & Wales (Ali, 2016); one from Scotland (Young, 2017); one from Australia (Bhandari, 2015); and one from Spain (Tort, 2016). Selection bias was overall low, with most studies representative of the wider population of convicted prisoners serving a prison sentence, employing randomised or stratified sampling methods (Ali, 2016; Chaplin, 2017; Murphy, 2017; Tort, 2016). The exceptions were Bhandari (2015) who chose to exclude prisoners currently on remand, as their study investigated prisoners soon-to-be-released, and Young (2017) who used convenience sampling. Ali (2016) and Bhandari (2015) sampled both males and females, whereas all other studies took place in male only prisons. Overall, bias was low for conflict of interest, with all but one study (Tort, 2016) including a statement of declaration.

1. *What is the prevalence of ID among prisoners?*

Prevalence estimates among the sampled populations varied. The highest rates were found by Bhandari (2015) and Young (2017) a high risk and low risk study respectively; both reporting prevalence of ID to be 9%. Lowest prevalence was 4% and was reported

by Tort (2016), a high bias study. In summary, low risk of bias studies (Ali, 2016; Chaplin, 2017; Murphy, 2017; Young, 2017) found prevalence to be 5-9% and high risk of bias studies (Bhandari, 2015; Tort, 2016) found prevalence to be 4-9%. All studies had low risk of bias for measuring ID, as all employed standardised psychometric testing to screen for ID. From all studies therefore, overall estimates for prevalence of ID are between 4 and 9% from 7,872 prisoners, with overall low risk of bias.

There was, however, inconsistency in distinguishing between borderline and mild ID with both low and high bias reports. Ali (2016) noted a distinction could not be made because of the lack of adaptive information. Tort (2016) was the only study reporting different prevalence rates for mild and borderline (4% were identified as mild ID with IQ<70 and 11% with borderline intelligence with IQ<80), with high risk of bias.

2. *Is there consistency in the definition of ID in prisoners?*

All studies set out to identify or screen for ID, rather than diagnose individuals. Therefore, the research designs did not fully include the 3-point diagnostic test and so bias was not rated against this. Indeed, no author included a measure of adaptive function, and limited developmental history, with all studies using intelligence as the measure of ID. In almost all articles, ID was defined as an individual having an IQ< 70 and rated low bias. The exception was Ali (2016) who screened for IQ using a score on the Quick Test with an equivalent of IQ≤65 together with self-reported poor educational attainment. Therefore, there was consistency across studies with regards defining ID by general intellect below 70, with overall low risk of bias.

Prisoners were screened for ID using a variety of measures, with some also including

educational attainment and/or history of previous diagnoses. Risk of bias was low for measuring ID as all studies employed a standardised validated screening tool to measure ID. Low bias studies used the Learning Disability Screening Questionnaire (LDSQ) (Chaplin, 2017; Murphy, 2017; Young, 2017) to ascertain IQ or the Quick Test (Ali, 2016). High bias studies used the TONI II Test (Tort, 2016) and the Hayes Ability Screening Index (HASI) (Bhandari, 2015). Chaplin (2017) also employed clinical interview and case note review to assess intelligence while Ali (2016) and Bhandari (2015) included interviews for information on education and health background.

3. *Are there gender differences in prevalence of ID in prisoners?*

Only two studies, one low bias (Ali, 2016) and one high bias (Bhandari, 2015) sampled female prisoners as well as male. In the Ali (2016) study, the sample was made up of 2,145 (77%) males and 655 (23%) females, and of those identified as meeting the criteria for ID, 74% were male compared to 26% female, with low bias (Ali, 2016). In the Bhandari (2015) study, 97% of those with ID were male compared to 3% female, with high bias, however no information is given on the gender proportions of the overall sample and therefore it is unclear whether ID was or was not more prevalent in males.

4. *What comorbidities, social and environmental factors related to prevalence, are reported?*

The included studies measured and reported a variety of different coexisting health conditions affecting people with ID. A low risk of bias study (Young, 2017) found over-representation of neurodevelopmental disorders among prisoners with ID, with 40% of participants who screened positive for ID also meeting criteria for ADHD. Another low risk of bias study found a significant association between prevalence of ID and looked

after experiences in childhood; 49% of prisoners identified as likely to have an ID were in institutions as children and 44% were in local authority care (Ali, 2016). They also found significant differences in school background, with prisoners with ID more likely to have had disruptions in education either by dropping out or expulsion.

Perhaps most notable, is the association found with regards remand and sentencing. One study (Ali, 2016), with low risk of bias, found that prisoners with ID were more likely to be on remand than to be detained, and similarly prisoners without ID were more likely to be convicted and sentenced.

Table 3: Summary of studies

Study	Study aims	Design	Definition & Assessment of ID	Sample	Limitations	Key findings
1. Ali (2016) UK	To examine prevalence of ID in context of social, environmental & contextual risk factors among prisoners; secondary aim to explore difference in prevalence of prisoners on remand with ID	Cross-sectional design Secondary data from National Prison Survey (1997) of interviews conducted by lay interviewers, with some participants self-administering if deemed capable	Score ≤ 25 on the Quick Test (equivalent to IQ of ≤65) combined with low education Attainment Assessed by Quick test & follow up clinical interview	N=3142; random sampling from a survey of all prisoners in England & Wales using proportionate sampling fraction so all had equal chance of selection (excluding non-English speaking) Male & female sample	No adaptive function measure Risk of having been under-inclusive in screening for ID by lower than usual IQ threshold of 65 Data more than 20 years old	170 (5%; 95% CI [4.2, 5.8]) identified as meeting criteria for ID; 124 (74%) males & 45 (26%) females
2. Bhandari (2015) Australia	To examine prevalence of ID in soon-to-be-released prisoners in context of social circumstances, patterns of substance use and substance-related harm.	Cross-sectional design 60-90 minute interviews	Considered to have ID if screening positive on the HASI (score <85) and (i) attended a special school and/or (ii) had a diagnosis of ID from a healthcare professional. Assessed by HASI to ascertain IQ values	N=1279 prisoners from seven prisons across Queensland, Australia between August 2008 & July 2010 – included all prisoners expected to be released within 6 weeks of interview Male & female sample	No adaptive measure Exclusion of prisoners on remand No gender specific analysis	Mean HASI score 88.4; 316 (24%) participants scored <85. Of these, 108 (93%) attended a special school and 56 (49%) reported having been diagnosed with ID. Therefore, total of 115 (9%; 95% CI [7.0, 11.0])

						identified with ID; mean age 33 years, 97% male, 3% female; 32% indigenous
3. Chaplin (2017) England, UK	To identify prisoners with ID and compare characteristics with prisoners without neurodevelopmental disorders with regard to demographic profile, mental health, suicide risk and offences.	Cross-sectional design Interview-based	The LDSQ comprises seven items, score <46% indicates the presence of ID. Assessed by LDSQ, clinical interview & case note review	240 male prisoners in London C prison; included all current adult prisoners arriving between May 2012 & June 2013, with capacity for consent All male sample	No adaptive function measure	18 (7.5%; 95% CI [5.0, 11.0]) identified as meeting criteria for ID; of these, 16 (89%) also self-reported as having ID or learning difficulties; 94% aged 20-35; 6% 36+; 22% BME & 78% white
4. Murphy (2017) England, UK	To establish the number of prisoners identified as likely to have ID & feasibility of ID assessment in prisons	Cross-sectional design Interviews by prison staff trained in ID awareness and to administer tool	The LDSQ comprises seven items, score <46% indicates the presence of ID. Assessed by LDSQ only	2429 male prisoners from three English prisons – included every consenting new prisoner (within 72hrs) over 3-month period (excluding non-English speaking) All male sample	No adaptive measure Different approaches to screening by each prison Possible overestimate of ID	169 (7%; 95% CI [6.0, 8.0]) identified as meeting criteria for ID

5. Tort (2016) Spain	To determine the prevalence of ID; secondary aim to explore prevalence of ID in forensic psychiatric hospitals	Cross-sectional design Interviews	TONI II test and clinical interview Assessed by IQ<70 on TONI II test	398 male prisoners in Spanish prisons (Madrid, Cataluna & Aragon) by stratified random sampling; data collection between April 207 & June 2008 All male sample	No adaptive functioning measure	16 (4%; 95% CI [2.0, 6.0]) identified as meeting criteria for ID by IQ<70; increased to 11% with borderline intelligence (IQ<80)
6. Young (2017) Scotland, UK	A number of aims listed. Primary aim in relation to ID: to establish proportion of people with ID in UK prison sample, and proportion with ADHD, ASD & general ND.	Cross-sectional design	The LDSQ comprises seven items, <46% indicates the presence of ID. Assessed by LDSQ	390 male prisoners by opportunity sampling from prison in Scotland; serving sentence & on remand (excluding non-English speaking, severe mental ill health or severe learning difficulty); recruited over 18 month period (2011-2013) via prison staff & posters/leaflets All male sample	No adaptive functioning measure Limitation of self-report measure identifying false positives identified	35 (9 %; 95% CI [6.0, 12.0]) identified as meeting criteria for ID; mean age 30 (range 18-50 years)

[1]ADHD=Attention Deficit Hyperactive Disorder; [2]ASD=Autism Spectrum Disorder; [3]HASI=Hayes Ability Screening Index; [4]LDSQ= Learning Disability Screening Questionnaire; [5]ND=Neurodevelopmental Disorder; [6]TONI II=The Test of Nonverbal Intelligence 2nd edition

Discussion

There are relatively few published studies exploring the prevalence of ID among prison populations. In the recent review period, few new studies have been published and Hellenbach et al. (2017) found just four studies to review since the previous Fazel et al. (2008) report despite ID being a recognised and specific difficulty for this population. Of the six reviewed studies, four were low risk of bias (Ali, 2016; Chaplin, 2017; Murphy, 2017; Young, 2017) and findings can therefore be considered with overall low bias. The review therefore contributes to existing evidence of prevalence of ID.

Prevalence of ID among prisoners

Hellenbach et al., (2017) reported prevalence as 7-10% worldwide, from four studies and 4,653 prisoners sampled from four different countries (UK, Australia, Norway, Israel). This review has found similar figures of 4-9% from 7,872 prisoners, representative of three different countries (the UK including Scotland, England and Wales; Australia and Spain), and four distinct criminal justice systems, with low risk of bias. Although the previous review did not undertake quality rating, the analyses of included studies determined that methodologies were too varied to allow for a conclusive prevalence rate of ID among prisoners to be established. The current review has been met with similar limitations with regards the heterogeneity of study design and methods including lack of consistency defining and measuring ID.

Prevalence rates reported by Fazel et al. (2008) however are far more modest and this can be explained by the measures used by the reviewed studies. All ten studies used a standardised assessment measure for diagnosing ID, rather than a screening tool. Overall estimates were 0.5-1.5% from ten studies among 11,969 prisoners and five countries (UK,

New Zealand, USA, Australia and Dubai) however the reliability of the rating was debated due to the variation in definitions and procedures used across studies. Considering the inconclusive findings of the previous reviews, it could be concluded that the prevalence rates from the current review, with large sample size, across a similar number of countries, with overall low bias, offers a more reasonable current estimate of prevalence of ID.

Definition of ID in prisoners

The definition and assessment of ID in the current review was similar to the studies reviewed in Hellenbach et al., 2017, with a focus on intelligence. Much has been written about the limitations of screening tools due to the lack of full scale IQ, no adaptive function measure nor developmental history however this is balanced with the practicalities of these tools for efficiency and ease within the prison environment. Particularly given these tests can be undertaken without specific training, allowing for wider scale screening (Board et al., 2015). This is important given the hidden ID within this population and the opportunity to screen for ID within the prison setting (Fazel, 2008).

Fazel et al. (2008) chose to exclude studies that used screening without any clinical diagnostic assessment of ID for example, WAIS, which is widely used in clinical practice. They suggest that the comparatively high prevalence found in screening studies indicate that such results should not be used as a basis for estimating the prevalence of ID. Indeed, there is a risk that screening over-estimates rates and Hellenbach et al., (2017) identified this as a limitation. Still, Fazel et al. (2008) found no difference in prevalence rates between studies that used IQ as the sole criterion for a diagnosis of IQ, similar to the low

bias studies in this review, and those that used the full clinical criteria only.

Despite this, the Quick Test (Ammons & Ammons, 1962) was used by Ali (2016), a low bias study, to assess intellectual functioning and has been found to correlate well with the Wechsler Adult Intelligence Scale-Revised (WAIS-R) Full Scale IQ (Wechsler, 1981). Similarly, the LDSQ, used by three studies (Chaplin, 2017; Murphy, 2017; Young, 2017), has been reported to have good reliability and validity when compared with the Wechsler IQ tests (McKenzie et al., 2012), with over 80% specificity and sensitivity; it has also been validated for use within forensic settings (McKenzie et al., 2012).

Implications for Future Research

Gender differences in prevalence of ID in prisoners

With regards gender differences, results are limited due to the lack of studies reporting on female prisoners (Ali, 2016; Bhandari, 2015). Prison studies historically include male only samples however there is a need to screen female prisoners, due to their specific vulnerabilities and poorer outcomes in relation to multi-morbidities (McMillan et al., 2020, in preparation; Board et al., 2019). There is therefore a need for more studies on ID to include both male and female prisoners to allow for comparison between prevalence rates and information for services on the needs of female offenders specifically.

Comorbidities; social; environmental factors related to prevalence

The association of ID prevalence and prison remand found in Ali (2016)'s low risk of bias study was supported by a paper reviewed by Hellenbach et al., (2017). Hassiotis et al. (2011) also found an over-representation of prisoners with ID on remand in prison when compared with proportions of non-ID prisoners on remand. This trend is not fully

understood and studies suggest a number of possible hypotheses, for example, the effect of suggestibility and acquiescence bias (Clare & Gudjonsson, 1993). It may be that difficulties such as communication, adaptive and cognitive deficits, make people with ID more vulnerable to being misunderstood and misrepresented, and less aware or able to advocate for their legal rights, such as bail (Ali, 2016; Hassiotis et al. (2011). Indeed, studies suggest that individuals with ID are more vulnerable than non-disabled people, at each point within the criminal justice system, for example, police caution, interview, court and within all forensic settings including but not exclusive to prisons (Board et al., 2017). This perhaps has implications for criminal justice services, when considering the appropriate time to screen individuals involved in the system; screening in prison is potentially too late in order to ensure the appropriate adaptions and care is in place. There is therefore a need to explore this association further and the implications for practice.

Limitations

A limitation of this review is that one researcher made the decisions regarding the inclusion/exclusion criteria, conducted the searches and selected the studies. Furthermore, studies were limited to English language only. Decisions were based on updating the previous review, with a clear rationale for any changes, and a second rater consulted for the quality assessment, in order to mitigate these limitations as much as possible.

The use of screening tools to measure ID has been criticised due to the lack of full scale IQ and not providing diagnostic assessment, and therefore less accurate estimates of prevalence (Fazel et al., 2008). No articles were found to meet the inclusion criteria that employed a clinical measure of ID and therefore only studies using screening measures

could be reviewed, reflecting Hellenbach et al., (2017)'s findings.

Conclusions

The current review updates the existing evidence on prevalence of ID in prisoners, reviewing a greater number of studies and including a larger sample than the previous review, Hellenbach et al., (2017). In addition, due to the quality assessment undertaken in this review, findings can be considered with risk of bias. Therefore, low risk of bias studies suggest that prevalence is between 5 and 9% when identified by screening. However, the prevalence reported cannot be viewed without consideration of potential over-estimations of screening tools. Screening measures can be effective in practice in order to identify prisoners with ID and arguably are particularly useful for providing estimates of this specific population, due to the scope of the measures, requiring less time, less money and less training. Still, research of ID within prisons needs to include clinical diagnostic assessment with adaptive function and developmental assessments, in order to provide true estimates of prevalence. Further, there is a pressing need for research on ID to consistently include female prisoners, to provide estimates of prevalence and offer criminal justice services better understanding of the needs of this particularly vulnerable group within prisons.

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Chapter Two: Major Research Proposal Paper

(a) MRP Proposal

Head injury in Women with Trauma:

Knowledge and Practice within Criminal Justice Settings

Chapter word count: 4,553

Abstract

Background: There is increasing awareness of the high prevalence of Head Injury (HI) in prisoners, with studies on female prisoners highlighting an association with HI, trauma and domestic violence. This has implications for practitioners working with women involved in the criminal justice system.

Aims: To deliver evidence-based training on HI to frontline workers with women with trauma. Further, to improve knowledge of HI in services linked to criminal justice and facilitate application of that understanding.

Planned Methods: Approximately 40 staff across three women-only criminal justice services were to be asked to participate in a quantitative within-groups repeated measures study. Questionnaires and vignettes would evaluate knowledge, awareness, confidence and practice of workers, pre-intervention (T1), post-intervention (T2) and follow-up (T3). Interviews were to be undertaken with service managers on the impact of training and any issues arising. Reviews of assessment reports were to be completed in each service to determine the practice of staff in relation to HI.

Applications: Training workers about HI may improve practice by identifying HI, signposting women to support and adopting a more in depth understanding of women's offending behaviours. If change was evidenced, it was hoped that training could be rolled out to other community services.

Introduction

Prevalence of HI

There is growing awareness of head injury (HI) in prisoners and its consequences, increasing understanding of the high prevalence among female prisoners. Compared to an estimated 12% in the general population (Frost et al., 2013), meta-analyses estimate lifetime prevalence between 51% and 60% among the prison population (Farrer and Hedges, 2011; Shiroma et al., 2010). In female prisoners, varied estimates are reported (23-95%), still prevalence is recognised as high, whether by self-report (McGinley & McMillan, 2019) or records of hospital admission (McMillan et al., 2019). HI is associated with cognitive, emotional and personality changes, along with increased risk of reoffending (Williams et al., 2018).

Scottish context

Within Scotland, almost 25% of prisoners have experienced a hospitalised head injury (HHI); multiple incidences are more common in both male and female offenders than in the general population (McMillan et al., 2019) and prevalence of disability high (Crowe, 2018). Addressing the needs of people with HI in prison is a national priority in Scotland, for the NHS and Scottish Government (NPHN, 2016). Preliminary data from a recent study in Scottish prisons found a high prevalence of HI (90%) in women prisoners with a history of complex trauma (86%), (McMillan et al., in preparation).

Women and trauma

Research with female prisoners with HI is limited (McGinley & McMillan, 2019) but has highlighted the context of trauma and violence (Colantonio et al., 2014). A study of women in prisons in the EU found a history of domestic abuse to be common (Macdonald,

2013). Several studies report a direct link between intimate partner violence and HI, with domestic abuse being described a national health crisis (Zieman et al., 2017; Hunnicutt et al., 2017). Furthermore, women have described behavioural changes as the most severe effect of HI (Zieman et al., 2017). This has implications for practitioners working with women in criminal justice settings as relates to different support needs (McGinley & McMillan, 2019).

Frontline services

Training is acknowledged as an urgent need in criminal justice services to help staff understand the complex histories of female offenders and the impact on their emotional wellbeing and behaviour (Macdonald, 2013), and apply this understanding to practice. There is a lack of evidence-based training available in this area informing knowledge and practice. De Mora (2019) found no information on HI recorded in Criminal Justice Social Work reports despite a high prevalence of HI in the cases they were seeing.

Objectives

The present study aimed to improve knowledge, awareness and confidence of workers in frontline services working with women with HI and trauma, by means of delivering an evidence-based training package. The hope was by increasing understanding of HI, there would be a change in practice to identifying signs of HI and signposting women to the right support.

Aims and hypotheses

Aims

1. To describe workers' current knowledge and understanding of head injury in women with trauma.

2. To deliver and evaluate a single training session for workers about women with HI to improve:

- Knowledge
- Awareness
- Confidence
- Practice.

Hypotheses

1. Workers' current knowledge of HI and application to practice does not reflect the prevalence of HI among female offenders.

2. A single training session on HI will improve workers':

- Knowledge
- Awareness
- Confidence
- Practice.

Plan of Investigation

Participants

Male and female workers aged 18 and over were to be recruited from staff teams in three community justice services.

Inclusion and Exclusion Criteria

The sample was to include paid and unpaid staff from three services who work directly with female offenders. All staff within the services were to be invited to participate. Staff who were due to leave before completion of the project were to be excluded, due to the follow up element of the study.

Recruitment Sites

The three study sites had confirmed interest (Tomorrow's Women, the 218 Service and the Willow Service). **Tomorrow's Women** and **218** are both community justice services in Glasgow for female offenders; for women leaving prison or as an alternative to custody. Tomorrow's Women is a service within Glasgow City Health and Social Care Partnership (GCHSCP) whereas 218 is a project of Turning Point Scotland, a third sector organisation. **Willow** is a partnership between NHS Lothian, City of Edinburgh Council and Sacro to address social, health and welfare needs of female offenders.

All sites are women-only, for women with complex needs involved in the criminal justice system; all involve community and prison work. The services are multi-disciplinary, including psychology, social work, nursing, support workers and volunteers. Tomorrow's Women has a current staff team of approximately 10; 218 approximately 30; and Willow approximately 20. Although the teams range in backgrounds and expertise, the plan was not to offer different training. Initial discussions with services suggested professional staff do not feel well trained nor experienced in the research area.

Planned Recruitment Procedures

The researcher planned to speak with managers of each service to confirm dates and participants. The researcher was due to attend team meetings to meet potential participants and introduce the study. Managers had agreed to then invite their entire staff team to participate by means of the Participant Information Sheet. Managers had intimated the training could fit within Continual Professional Development (CPD), which could provide an incentive to participate, give credibility to the training and alleviate issues regarding time commitment. Written informed consent was to be sought from all staff participating in the intervention.

Planned Measures (see appendices 2.4:126 - 2.11:130)

Interviews with service managers planned to be undertaken within each service, pre-training and at follow up, comprising 5 questions related to prevalence of HI, practice within the service and any issues responding to HI.

Vignettes were to be administered as an open-ended measure of knowledge, with response sheet. It was planned to repeat the same vignette at each time point for within-group comparison. Vignettes have been used as a measure of knowledge of HI in several studies, with different groups: prison population (Buchan, 2018); general practitioners (Mackenzie & McMillan, 2005); students (Gunstad & Suhr, 2002) and the general population (Mulhern & McMillan, 2006) and found to be effective in detecting change (Buchan, 2018). The vignette developed for this study takes less than five minutes to complete and each response was to be scored based on a scoring format.

The Common Misconceptions about Traumatic Brain Injury questionnaire (CM-TBI) [O'Rourke, Linden & Lohan, 2017] is a 20-item standardised questionnaire used to evaluate knowledge about HI, showing good internal consistency at .84 using Cronbach's alpha. It takes less than 5 minutes to complete, administered at each time point.

The Knowledge about Head Injury in Offenders questionnaire (modified from McMillan, 2019) is a 12-item questionnaire developed for a study on prison staff's knowledge of HI and was modified for the present study. It takes less than 5 minutes to complete, administered at each time point.

Likert scales were developed and coded for awareness, confidence and practice. They take a minute to complete, administered at each time point. An additional *Likert scale* planned to be administered at T2 for feedback, to evaluate the intervention, taking a minute to complete.

Review of assessment reports planned to be undertaken to explore current practice and application of knowledge following training in HI. Anecdotal evidence indicates women in prison do not get input in relation to HI. Discussions with managers suggested HI is not routinely asked about nor recorded in assessment reports despite recent research reporting high prevalence in the population, including disabling HI (McMillan et al., in preparation). A review of ten reports were to be undertaken in each service pre-training and follow up. Reports are held electronically on web based case management systems - the NHS system, EMIS Web and the Social Work system, CareFirst (see section 5. Ethics).

A summary of measures planned for each stage of the study is given in Table 1. It was estimated completion of the measures would take 10 minutes at each time point and the interviews would have taken no more than 10-15 minutes. A longer follow-up time was sacrificed in an effort to retain participants and achieve sample size, power and internal validity.

Table 1: Summary of Data Collection for Study Design

Stage	**Measures**
T1: Pre-training	1. Interview with service managers 2. Descriptive measures: • Background Information questionnaire (age, gender, job role…) 3. Knowledge based measures: • Vignette • Common Misconceptions about Traumatic Brain Injury (CM-TBI) questionnaire • Knowledge about Head Injury in Offenders questionnaire 4. Awareness, confidence and practice measure: • Likert scale 5. Review of assessment report
T2: Post-training	1. Knowledge based measures: • Vignette • Common Misconceptions about Traumatic Brain Injury • (CM-TBI) questionnaire • Knowledge about Head Injury in Offenders questionnaire 2. Awareness, confidence and practice measure: • Likert scale
T3: Follow up; 2 weeks post-training	1. Knowledge based measures: • Vignette • Common Misconceptions about Traumatic Brain Injury (CM-TBI) questionnaire • Knowledge about Head Injury in Offenders questionnaire 2. Awareness, confidence and practice measure: • Likert scale 3. Evaluation of intervention measure: • 5 point Likert scale feedback form 4. Review of assessment reports 5. Interview with service managers

Outcome measures:

Knowledge of HI in women with trauma and its sequelae; **Awareness** of the prevalence of HI in women with trauma and relevance to their practice; **Confidence** asking about HI and working with women who may have experienced HI; **Practice** in relation to women who may have suffered HI.

Training Package

It was estimated that the single training event would be 40/45 minutes, involving a PowerPoint presentation, with visual aid (3D human brain model) and time for questions and discussion. The planned content of the training presentation was: prevalence of HI among the prison population, specifically women; recent evidence-based research on the relationship between HI and trauma; symptoms of HI; recognising HI; working with someone with a HI and supports available; challenges and opportunities for services.

Planned Design

The project was designed as a pre-post quantitative study with follow-up using a within-subjects repeated measures design.

Planned Research Procedure

1. Contact relevant services to establish interest.
2. Adapt / develop questionnaires and Likert scales.
3. Contact services to formally arrange dates for training, interviews, follow-up.
4. Develop training informed by literature.
5. Obtain written informed consent from participants.
6. Undertake review of assessment reports in each service.

7. Interview manager from each service.
8. Deliver training to each service, with pre- and post- measures (time point 1 and 2).
9. Attend all services for follow up (time point 3).
10. Undertake review of assessment reports in each service.
11. Interview manager from each service.

To enhance participation and increase likelihood a priori G*Power sample size was met, the researcher planned to administer pre- and post- measures at the training session. The researcher then planned to attend team meetings at time point 3 to facilitate data collection, and arrange alternative dates if participants were unavailable.

Data Analysis Plan

Demographic information was to be collected and displayed graphically, in table format, to characterise the sample. This includes age, gender, job role, frequency of contact with women with trauma as well as information on any previous training on HI.

H1

Workers' current knowledge of HI and application to practice does not reflect the prevalence of HI among female offenders.

The pre-intervention interviews with managers and the reviews of assessment reports from each service, were to be summarised in table format, to illustrate current knowledge and practice. The aim was to review 10 reports from each service from the one month period prior to training, in order to gain an overview of prevalence and practice in relation to HI. The managers' responses and the reviewing of reports both aimed to identify a

number of themes in relation to the understanding of HI and application to practice within the services (i.e. current prevalence of HI within the service, was HI screened for, was it identified, what if any actions were undertaken). This was to enable the exploration of practice knowledge and whether this reflects prevalence of HI among female offenders reported by current research literature.

H2

A single training session on HI will improve workers':

- *Knowledge*
- *Awareness*
- *Confidence*
- *Practice.*

Univariate analysis was to be used to investigate within-group differences across each time point to assess for change. For each outcome measure (knowledge, awareness, confidence, practice), difference scores were to be calculated pre- and post- intervention (T1 and T2), and pre- intervention and follow up (T1 and T3), from the questionnaire data, Likert scales and Vignette scores. This would therefore indicate whether there had been significant improvement following intervention.

Where appropriate, tests of normality would determine if data met parametric assumptions using the Shapiro-Wilk statistic (>.05). Data from the Likert scales (5 levels) and questionnaires (2 levels: true/false) would be non-parametric. Tests were therefore planned to investigate whether there was a significant difference between the mean scores for T1 and T2, and T1 and T3, for each outcome measure. A t-test for related samples was to be used for continuous data (vignette scores), or Wilcoxon signed-rank test if non-

parametric, while Chi-square test for independence and Fisher's exact test were to be used for categorical data (Likert scales, questionnaires). This design allowed for testing of effect over time (Pallant, 2016). Effect sizes would also be reported for each statistic to describe the strength of association. All analyses were to be conducted using IBM SPSS version 26.

The above statistical analyses were to be supplemented by pre- and post- comparison (T1 and T3) of themes drawn from the interviews with managers and reviews of assessment reports. The aim was to complete both measures pre- and post- training to give opportunity to explore and demonstrate any changes in practice following the intervention. It was intended that 10 reports pre-training and 10 reports in the follow up period from each service would be reviewed (60 reports in total) to provide an overview for comparison. These themes would be summarised in table format.

Brief Critical Appraisal of Planned Methods

One challenge of the proposed methods is the reliance on self-report. Effort was made to incorporate a variety of different measures in order to ensure validity and reliability of assessment, however response styles have been found to impact a participant's score on measures such as Likert scales and vignettes whereby individual differences determine the response rather than the content of the question (von Davier et al., 2018). Indeed, the study proposes a mix of measures. Some validated (CM-TBI), some used in previous studies and modified for this project to capture the particular staffing group (Knowledge of HI Questionnaire), and some developed for this project. Vignettes have been found to be effective in detecting limited knowledge and change in knowledge, by previous studies (Buchan, 2018). There is still potential risk that the tools would not be sensitive to find

effect however this risk would be minimised by the inclusion of case report reviews and therefore not solely reliant on self-report. If no lack of knowledge was demonstrated by the measures, the reports would demonstrate whether attention was given to HI and any change following intervention. Furthermore, evaluating the effectiveness of the tools would be out with the scope of the project and potentially another study in itself.

In further appraising the methodology, the study design was limited by the absence of a control group; the same researcher administering all measures and intervention was an additional potential weakness. This lack of blinding (including to baseline measures and hypotheses) may have introduced bias to the study which would therefore need to be considered when evaluating any findings, and designing future studies.

Lack of detail on the homogeneity of the sample may be a limitation. It was planned that the training would not be adapted for different professionals based on anecdotal evidence from managers; their view being that staff do not have understanding of HI and this is evidenced in their practice. Still, this is supported by De Mora's (2019) recent work with Criminal Justice Social Workers and her findings that despite being professional staff, they did not have an understanding of HI and were not recording information on HI in CJSW reports despite a high prevalence of HI in the cases they were seeing. This is essentially an expert standard of evidence, a level used within The Matrix (NHS Education for Scotland, 2015) evidence tables, for example. Further, the within-subjects design allowed for differences between staff knowledge at baseline.

The interviews with managers and reviews of reports were incorporated into the procedure in order to allow for a fuller understanding of practice and prevalence of HI

within services, and to provide a tangible measure of practice change following intervention. Further, in order to gain insight into any difficulties that services may be facing in relation to supporting individuals with HI and trauma; this was a unique and timely opportunity that had been created due to the relationships forged with the services for the project. However, this was perhaps a limitation to the design as analysis was based on the researcher's interpretations and conclusions rather than on validated qualitative methods. This decision was made due to time constraints and a focus on the quantitative measures of the study. Still, it was important to include both of these methods in the design due to the opportunity for preliminary evidence that would potentially inform future interventions.

Justification of Sample Size

No study on training workers on HI within criminal justice settings was identified. Buchan (2018) assessed knowledge of HI in prisoners following a psychoeducation programme using similar methods and was helpful in estimating sample size. Buchan (2018) reports large sized effects for knowledge of HI, in favour of the intervention. Using the same parameters as this study, taking power of .80 and medium-large effect size (d_z=0.50) with $p<.05$ (two-tailed) (Cohen, 1992; Lakens, 2017), the required sample size estimated using a priori G*Power analysis for a paired samples t-test was **34** (Version 3.1 Faul et al., 2009).

The proposed sample were staff recruited by managers who had shown initial engagement. The researcher had been invited to attend team meetings, giving access to participants and potential for recruiting large numbers quickly. **34** was therefore

considered feasible. Given the pre-post design, a decision was made to aim for **40** participants to account for attrition.

Setting and Equipment

The study was due to take place at three training sites. Equipment planned included information sheets, consent forms, Powerpoint presentation, IT equipment, laptop, handouts and measures.

Health and Safety Issues

Researcher Safety Issues

GG&C lone working policy was to be followed. Risk to the researcher's safety was thought to be minimal as the project involved seeing staff in their places of work.

Participant Safety Issues

Recruitment did not include service users therefore was unlikely to cause harm. The training topic was unlikely to be distressing because participants were dealing with trauma on a daily basis. There may have been survivors of trauma within staff teams; care would be taken to ensure the information sheet informed participants of the subject matter and re-iterated at the beginning of the training, as well as opportunity to withdraw consent at any point.

Appropriate referral information was to be provided to each service, such as Headway, Community Treatment Centre for Brain Injury in Glasgow, Community Rehabilitation and Brain Injury Service (CRABIS) in Lothian, and Inverclyde Community Rehabilitation Team, to ensure workers were equipped with resources.

Ethics

Informed consent was to be sought to ensure participants understand completion was voluntary. Once collected, measures would be stored in a locked filing cabinet, accessed only by the primary researcher. A locked bag was to be provided by the university for secure transportation from services and the questionnaires anonymised using participant ID numbers.

Ethical approval was to be sought from a number of sources, including NHS Research Ethics Committee (REC), NHS Research and Development (R&D) for NHS GG&C and NHS Lothian, and management within each service. As the project involves accessing patient records, Caldicott Guardian approval was also to be sought, as well as approval from Glasgow City Health and Social Care Partnership (GCHSCP) Ethics for accessing CareFirst, in line with the procedure for external research involving Social Work Service. All data collected for the project was to be anonymised and stored confidentially in line with NHS and University of Glasgow guidelines, adhering to GDPR.

The process of seeking ethical approval had begun, and the project had been granted approval to proceed to the NHS and GCHSCP processes.

Financial Issues

Project costs included printing and photocopying materials such as information sheets, measures and training resources. Additional costs proposed included travel to and from the training sites.

Planned Timetable

- March 2020: Application to Ethics
- February – March 2020: Design training package
- April – May 2020: Deliver training package; data collection (time points 1 & 2)
- April – May 2020: Data collection follow up (time point 3)
- May 2020: Data analyses
- June – July 2020: Write up
- July 2020: Final submission

Practical Applications

Training frontline workers on HI may improve practice by identifying signs of HI, signposting women to support and adopting greater understanding of women's offending behaviours. If change was evidenced, it was hoped the training could be rolled out to other frontline staff and services similar to those represented within this preliminary study. In addition, the study highlighted a need for controlled research on HI in women with trauma, building on some of the design weaknesses reflected in this project such as potential for bias; it was hoped that the current study would inform future research in this important but under-represented area, and instigate a momentum for further projects and further evidence-based training. Furthermore, the research study formed part of a wider Scottish government funded programme and so findings were to be fed back to the government, with the potential to contribute to service development and inform policy change.

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Chapter Two: Major Research Proposal Paper

(b) Secondary Analysis Project

Gender Differences in Disability in Prisoners, with and without Head Injury

Chapter word count: 4,546

Prepared in accordance with the International Journal of Forensic Mental Health (Appendix 1.1: 84-86)

Plain Language Summary

Disability in Prisoners with and without Head Injury

Title: Gender Differences in Disability in Prisoners, with and without Head Injury

Background: Addressing the needs of people with HI in prison is a national priority in Scotland, for the NHS and Scottish Government. The rates of HI are higher in prisons compared to the general population. Almost 25% of prisoners have experienced a hospitalised HI and incidences of multiple HI are more common in both male and female offenders than in non-prison populations (Moynan & McMillan, 2018). The impact of HI can include cognitive, emotional and personality changes, along with increased risk of reoffending and long-standing disability (Williams et al., 2018). Females have been found to have worse disability outcomes in general and also from HI, however this has not been investigated within prison populations despite the high prevalence of HI (McGinlay & McMillan, 2019).

Aims and questions: This study explores gender differences in disability associated with HI and from any cause, among prisoners in Scotland. It is predicted that gender would have an impact on different disability outcomes among Scottish prison populations, with females showing higher rates of disability and recovering less well after HI than males.

Methods: Data on 200 prisoners across six Scottish prisons was analysed for outcomes related to HI, gender and disability. Anxiety, depression and substance

use were also analysed as it was thought that they might also have an impact on recovery.

Main findings and conclusions: Gender was associated with disability from any cause, with females experiencing poorer outcomes, but no gender differences were found with disability associated with HI. Overall, psychological distress was associated with more severe disability, and substance use with disability from any cause but only in males. Findings from investigations of disability from any cause informs research on HI given the high numbers reporting HI as a causal factor. Further research into HI, disability and mood, and mediators of female disability, would be important.

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Abstract

Background: Although studies report a high prevalence of HI within prisons, evidence has not extended to associated disability. Non-prison studies identify gender differences in disability outcomes and there is concern that women prisoners recover less well after HI.

Aim: To explore gender differences in disability, associated with HI or from any cause, in prisoners in Scotland.

Methods: Secondary data on 200 prisoners across six Scottish prisons was analysed for outcomes related to HI, gender, disability, and covariates (anxiety, depression, substance use) using ordinal logistic regressions.

Results: Gender was associated with disability from any cause, with females experiencing poorer outcomes on the Glasgow Outcome at Discharge Scale. No gender differences were found with disability associated with HI. Overall, psychological distress was associated with more severe disability, and substance use with disability from any cause in males.

Conclusions: Investigations of disability from any cause informs research on HI given the high numbers reporting HI as a causal factor. Female prisoners have poorer disability outcomes, from any cause, highlighting gender difference in recovery. Further research into HI, disability, mood, and mediators of female disability, is important.

Introduction

There is growing interest and concern regarding the prevalence of head injury (HI) in prisoners (NPHN, 2016). Within Scotland, hospitalised HI is significantly more prevalent in prison than in general populations; almost 25% of prisoners have experienced a hospitalised HI and incidences of multiple HI are more common in male and female offenders (Moynan & McMillan, 2018; McMillan et al., 2019). Addressing the needs of people with HI in prison is a national priority in Scotland for the NHS and Scottish Government (NPHN, 2016).

HI is associated with cognitive, emotional and personality changes, and increased risk of reoffending (Williams et al., 2018). It is linked to long-standing disability in everyday life and estimates suggest that several million people are living with HI-related disability worldwide (Stochetti & Zanier, 2016). Although numerous studies report high prevalence of HI within prisons, research has not extended to disability among this population (Moynan & McMillan, 2018; McGinlay & McMillan, 2019). For example, Colantonio et al. (2014) found gender differences related to offending and early life experiences but did not assess disability. Non-prison studies have found that severe HI commonly results in persisting disability (Whitnall et al, 2006) and greater disability has been reported in women (Holbrook et al., 2001) highlighting a need to consider gender differences after HI in prisoners.

This study therefore explores gender differences in disability associated with HI and from any cause; it hypothesises that female prisoners with HI will have greater disability than male prisoners with HI.

Methods

Anonymised secondary data on 200 prisoners (101 female, 99 male; age 21-73) from two studies across six Scottish prisons was collated into one database. This was checked independently by two researchers to allow coding differences to be cross-referenced and harmonised. The data comprises self-report measures of HI and HI-related disability with measures of psychological distress, offending characteristics and demographics.

Procedure

Participants were recruited from HMPs Greenock, Cornton Vale, Edinburgh and Polmont for female prisoners, and HMPs Low Moss and Shotts for male prisoners. The sample included prisoners fluent in English, deemed to have capacity to give consent and complete the measures and not judged by prison staff to be a risk to researchers.

Approvals

Ethical approval was given by NHS Research Ethics Committee (REC), NHS Research and Development (R&D), and the Scottish Prison Service (SPS) for the original studies. Approval for access to the data was obtained from the relevant NHS R&D departments and authorised by the sponsor (appendix 2.13).

Primary Outcome Measures:

1. Head Injury

The Ohio State University Traumatic Brain Injury-Identification Method (OSU TBI-ID, Bogner & Corrigan, 2009) assesses cause and severity of single-event and multiple HI by structured interview. It is practical for use in Scottish prisons, and has good test-retest

reliability (r>0.6) and large effect sizes (R^2 >0.36) for outcomes in US prison studies (Bogner & Corrigan, 2009).

The OSU-TBI defines HI as injury to the head or neck resulting in alteration in consciousness; being dazed, having a memory gap or a loss of consciousness (LOC). Mild HI is categorised as no, or <30 minutes LOC; moderate as LOC 30 minutes–24 hours; and severe as LOC >24 hours. Multiple HI is defined as 'two or more TBIs close together, including a period of time when they experienced multiple blows to the head even if apparently without effect'. Age at first HI is also assessed; first injury before age 15 has poorer outcomes (McGinlay & McMillan, 2019).

2. Disability

The Glasgow Outcome at Discharge Scale (GODS; McMillan et al., 2013) assesses disability following HI across several domains including activities of everyday living, relationships and independence. The GODS was developed from the Glasgow Outcome Scale-Extended (GOS-E; Wilson et al., 1998); the latter is for use with people with HI living in the community and the GODS is validated for people in an institution and was adapted for the prison environment. The GODS has good predictive validity (r= 0.51), high inter-rater reliability (98%; McMillan et al., 2013) and been used successfully in prison studies (McGinlay & McMillan, 2019; Crowe, 2018).

Secondary Outcome Measures:

1. Mood

Psychological distress such as anxiety and depression has been linked to poorer disability outcomes (McMillan et al., 2012). The Hospital Anxiety and Depression Scale (HADS)

assesses symptoms of anxiety and depression, with scores ≥11 considered to indicate clinical abnormality (Zigmond & Snaith, 1983), with good reliability and validity for assessing distress in a HI population (Whelan-Goodinson et al., 2009).

2. Problematic Substance Use

Substance use predicts poorer outcomes related to HI including increased disability, worse prognosis and delayed recovery (Graham & Cardon, 2008). Previous problematic substance use was assessed as part of a self-report questionnaire.

Data Analysis

Univariate analysis established between-group differences. Measures of central tendency (median, range) and frequency (percentages) are used to present demographic data. Where appropriate, data were assessed for normality using the Shapiro-Wilk test. With the exception of age, demographic data did not meet assumptions for parametric testing. An independent t-test examined age differences, and Mann-Whitney U test examined other between-group differences for continuous demographic and background variables; chi-square and Fisher's exact test examined between-group differences for categorical variables.

Multivariate regression models further investigated variables found to be significantly different in univariate analysis, controlling for mood (anxiety and depression) and previous problematic substance abuse, as it was hypothesised that these factors could affect disability outcome. The outcome variable (GODS disability outcomes) is measured on an ordinal scale, and therefore ordered logistic regressions were used. Multicollinearity tests investigated correlations between the predictors in the final model.

All statistical analyses were completed using IBM SPSS version 26.

Defining Head Injury

HI is most often mild and with good rates of recovery; however, risk of disability is higher following moderate-severe HI (Carroll et al, 2004) and multiple-mild HI (McGinlay & McMillan, 2019). Furthermore, research with prisoners has found high prevalence of multiple HI, related to higher rates of disability (McGinlay & McMillan, 2019); the sample was therefore grouped by history of HI likely to have persistent effects (HI Group), or no significant HI (NoS-HI Group).

The HI Group included individuals with mod-severe HI and/or multiple HI, as defined by Bogner & Corrigan (2009) as likely to have persisting effects and who should be referred for specialist clinical assessment. The NoS-HI group comprised those with no HI, or mild HI with no multiple, as considered likely to recover (Bogner & Corrigan, 2009).

Results

Demographics (table 1)

There was no significant difference between females and males for age ($t(198)=.21$, $p=.84$, $d= 0.03$), years of education (U=4623, z=-.933, p=.35, r=.07) nor school type ($x^2 =.962$, p=.62, phi=.07); 97% of participants self-identified as white.

Table 1: Demographics (n=200)

	Female	Male	Total
Gender, N (%)	101 (51)	99 (49)	200 (100)
Age in years, *Md*; range (IQR)	34; 20-73 (11)	35; 21-58 (16)	36; 20-73 (13)
Ethnicity, N (%)			
White	99 (98)	95 (96)	194 (97)
Mixed or multiple	1 (1)	0	1 (.5)
Asian	1 (1)	2 (2)	3 (1.5)
Other	0	2 (2)	2 (1)
Years education, *Md*; range (IQR)	11; 0-20 (1.75)	11; 0-16 (2)	11; 0-20 (2)
School type, N (%)[1]			
Main stream	45 (45)	47 (48)	92 (46)
Main stream with 1:1 support	16 (16)	11 (11)	27 (14)
Specialist education	39 (39)	40 (40)	79 (40)

Missing [1]N=2 (1%)

Head Injury (table 2)

Median age at first HI was 12years (IQR=13) for females, and 10years (IQR=9) for males; there was no significant difference between gender and age at first HI (U=3895.0, z=-.77, p=.44, r=.06), or HI/NoS-HI group, (x^2=.24, p=.62, phi=.05). As HI grouping is hypothesised as a predictor of disability, this will be explored further in multivariate analysis.

Table 2: Head Injury History by Gender; N (%)

Group	Female	Male[1]	Total
HI	70 (69)	72 (74)	142 (71)
No HI	31 (31)	26 (27)	57 (29)

Missing [1]N=1 (1%)

Disability (table 3)

The GODS categorises disability from HI or from any cause. 8% of participants attributed any disability to effects of HI (11% of females, 6% males); 36% to other illness/injury (51% of females, 21% males); and 18% to a mix of HI and other factors (31% of females,

4% males). Overall, 30% were moderate-severely disabled by HI (33% of females; 26% of males). Females were more severely disabled from HI than males (F=24.84, p<.01, Cramer's V= .35).

66% reported moderate-severe disability from any cause, with 82% of females compared to 52% of males. Females were more severely disabled than males (F=36.77, p<.01, Cramer's V= .43) and those in the HI group were more severely disabled from any cause than those in the NoS-HI group (F=53.29, p<.01, Cramer's V= .54).

Table 3: Disability from HI and any cause (GODS) by Gender; N (%)

Disability Outcome	**Female**	**Male**	**Total**
GODS HI cause[1]			
Lower Severely Disabled	0	0	0
Upper Severely Disabled	3 (3)	1 (1)	4 (2)
Lower Moderately Disabled	14 (14)	11 (11)	25 (13)
Upper Moderately Disabled	16 (16)	14 (14)	30 (15)
Lower 'Good Recovery'	15 (15)	27 (27)	42 (21)
Upper 'Good Recovery'	31 (31)	44 (44)	75 (38)
GODS any cause[2]			
Lower Severely Disabled	23 (23)	5 (5)	28 (14)
Upper Severely Disabled	16 (16)	7 (7)	23 (12)
Lower Moderately Disabled	19 (19)	13 (13)	32 (16)
Upper Moderately Disabled	24 (24)	23 (23)	47 (24)
Lower 'Good Recovery'	6 (6)	22 (22)	28 (14)
Upper 'Good Recovery'	9 (9)	29 (29)	38 (19)

Unclear[1] Female N=7(7%), Total N=7(3.5%); Missing[2]N=4 (2%)

Mood and substance use (table 4)

Significantly more females than males self-reported clinical anxiety (x^2 =22.18, p<.01, phi=.34) or depression (x^2 =10.56, p<.01, phi=.24) on the HADS. HI/NoS-HI group self-ratings did not differ for clinical anxiety (x^2=1.19, p=.27, phi=.09) or depression (x^2 =.20,

p=.65, phi=.04). Clinical anxiety was more common in those disabled by HI (x^2 =9.34, p<.01, phi=.22) or from any cause (x^2 =53.04, p<.01, phi=.52).

Most participants reported previous problematic substance use (83%) and no significant difference was found for gender (x^2=.00, p=1.0, phi=.005). More participants in the HI than NoS-HI group reported previous use (x^2 =21.69, p=<.01, phi= .345). Substance use was associated with disability from HI (F=18.03, p<.01, Cramer's V= .31) or from any cause (F=16.10, p<.01, Cramer's V=.27).

Table 4: Mood & Problematic Substance Use by Gender & HI, N (%)

Participants reporting dep/ anx/sub use	**Clinical Depression**		**Clinical Anxiety**		**Problematic Substance Use**	
	Yes	No	Yes	No	Yes	No
Female	36(36)	63(64)	71(72)	28(28)	84(83)	17(17)
Male	15(15)	84(85)	37(37)	62(63)	82(83)	17(17)
Total Gender	51(26)	147(74)	108(54)	90(45)	166(83)	34(17)
HI	38(27)	102(73)	80(57)	60(43)	126(91)	12(9)
No HI	13(23)	44(77)	27(47)	30(53)	39(65)	21(35)
Total HI/No HI	51(26)	146(74)	107(54)	90(46)	165(83)	33(17)

Multivariate Analysis: Associations between HI, Gender and Disability

Regression models further explore whether gender and HI/NoS-HI group predicts disability outcome using variables that significantly differed in univariate analyses. As GODS ratings are ordinal, they violate key assumptions of linear and logistic regression; therefore, an ordered logistic model was employed. Multicollinearity was assessed (appendix 2.14) showing no significant correlations between variables and a forced-entry approach employed, whereby all covariates (anxiety, depression, substance use) were entered simultaneously and modelled with the two disability outcomes: disability

associated with HI and disability from any cause, with HI Group (HI/NoS-HI) as a predictor (tables 5 & 6). Gender was a predictor in models that included females and males together; separate stratified models were also run for females only and males only. For disability associated with HI, only data from participants with HI were modelled.

Post-hoc analyses confirmed that assumptions were met overall and the models a good fit (appendix 2.15). The proportional odds assumption was violated for disability from any cause by gender; logistic regressions were therefore carried out with dichotomous variables to assess this further (appendix 2.16). The Pearson or Deviance goodness-of-fit tests indicated the models were a good fit to the observed data (>.05), and the final models significantly predicted the outcome variables over and above the intercept-only model (<.05).

Disability associated with HI (table 5)

Main effects

In this model, only those in the HI group were included. An estimated 17% (pseudo R^2=.17) of variance in disability outcomes is explained by gender, anxiety, depression and substance use with only the mood variables being significant. Clinical anxiety was associated with greater odds of severe disability (OR 2.25), holding gender, depression and substance use constant. Clinical depression was also associated with greater odds of severe disability (OR 2.84), holding gender, anxiety and substance use constant.

Interactions with gender

Interactions between gender and anxiety, depression and substance use were all non-significant.

Table 5: Ordered Logistic Regression of Predictors of Disability associated with HI, by GODS

Outcome: GODS HI cause?	**Female** N=61			**Male** N=72			**Total Gender**[3] N=133			Gender Interaction p[4]
	OR[1]	95% CI[2]	*p*	OR	95% CI	*p*	OR	95% CI	*P*	
Gender							1.08	.54, 2.16	.82	
HADS-Anxiety	4.35	1.25, 15.21	.02	1.70	.69, 4.19	.25	2.25	1.09, 4.61	.03	.50
HADS-Depression	1.39	.51, 3.78	.52	7.59	2.15, 26.87	.002	2.84	1.32, 6.09	.007	.10
Substance Use	5.27	.80, 34.64	.08	1.83	.41, 8.15	.43	2.72	.85, 8.70	.09	.54
Pseudo R^2	*.17*			*.16*			*.17*			

[1]OR=Odds ratio reported by Exp(B); [2]CI=Confidence interval; [3]Female gender is coded as the predictor in the combined sample; [4]The absence of significant interaction means the gender-stratified results should be interpreted with caution.

Disability from any cause (table 6):

Main effects: An estimated 32% (pseudo R^2=.32) of variance in disability is explained by gender, HI, anxiety, depression and substance use. A significant main effect with gender and disability from any cause was found: females have higher odds than males, (OR 3.18) of reporting severe disability from any cause. Clinical anxiety was associated with greater odds of severe disability (OR 3.78), holding gender, HI, depression and substance use constant. HI group and depression were not significant factors in this model.

Interactions with gender: A significant interaction was found between substance use, gender and disability from any cause ($p<.001$); substance use was associated with more severe disability in males only, (OR 5.13). Other interactions were non-significant.

Table 6: Ordered Logistic Regression of Predictors of Disability from Any Cause, by GODS

Outcome: GODS any cause?	**Female** N=95			**Male** N=95			**Total Gender**[3] N=190			Gender Interaction p[4]
	OR[1]	95% CI[2]	*p*	OR	95% CI	*p*	OR	95% CI	*p*	
Gender							3.18	1.79, 5.65	<.01	
HI/ NoS-HI Group	1.95	.83, 4.60	.13	1.60	.66, 3.91	.30	1.60	.87, 2.94	.13	.60
HADS-Anxiety	3.56	1.46, 8.70	.01	4.95	2.13, 11.51	<.01	3.78	2.07, 6.89	<.01	.59
HADS-Depression	1.54	.71, 3.34	.28	1.45	.50, 4.20	.49	1.45	.78, 2.70	.25	.79
Substance Use	.38	.12, 1.16	.09	5.13	1.62, 16.27	.007	1.57	.74, 3.33	.24	<.001
Pseudo R^2	*.14*			*.26*			*.32*			

[1]OR=Odds ratio reported by Exp(B); [2]CI=Confidence interval; [3]Female gender is coded as the predictor in the combined sample; [4]The absence of significant interaction means the gender-stratified results for HI group, anxiety and depression should be interpreted with caution.

Discussion

HI and gender differences

It was predicted that females in prison populations would have poorer outcomes from HI than males. Females were more severely disabled than males from any cause, experiencing poorer outcomes on the GODS, but no gender differences were found for disability associated with HI. This does not support the hypothesis that females recover less well than males, after HI. However, the findings from disability from any cause may

inform HI research given the high prevalence of prisoners reporting HI as a causal factor in their disability.

Mood and substance use

Overall, psychological distress was associated with more severe disability, related to HI and any cause. Individuals with clinical anxiety and depression were more likely to report disability from HI and this was particularly the case for females. This perhaps suggests gender differences in impact of mood on recovery from HI. Abnormal mood has been linked to poorer disability outcomes after HI (McMillan et al., 2012). Although a predictor of more severe disability, this could also result from HI or an independent factor associated with disability or indeed a general effect of stress associated with the experience of prison. Depression and anxiety are typical features of the sequelae of symptoms following HI (Whelan-Goodinson et al, 2009) and common in prisoners in general, with poorer mental health outcomes than the wider population (Fazel et al., 2016). Women are recognised as a particularly vulnerable group within prisons, with higher prevalence of mental health conditions and trauma (Fazel et al., 2016).

Previous problematic substance use (drug and alcohol use) was associated with gender and disability from any cause, with males with past substance use reporting more severe disability. Although not associated with disability from HI, this can still inform understanding of HI-related disability and supports previous findings that past substance use predicts poorer disability outcomes including worse prognosis and delayed recovery (Graham & Cardon, 2008).

Strengths and Limitations

The current study reports on a large data sample of its kind, with 49/51% gender split and is representative of the wider prison population within Scotland. HI research and prison studies most often include male only participants (Ma, 2019) and this study is therefore unique and important in its contribution to research on females and on gender differences. The gender-stratified models however had relatively low sample size and therefore low statistical power; and so, the significant effects may need to be interpreted with caution and investigated further with a larger sample for reliability and reproducibility of findings.

The data were based on self-report measures, an efficient and largely non-intrusive tool however response styles can impact a participant's score on such measures whereby individual differences determine the response rather than the content of the question (von Davier et al., 2018). Recall can further impact on responses (McGinley & McMillan, 2019). A mix of measures were used to hopefully mitigate limitations and increase validity. Further, the data lacks detail on multi-morbidities such as chronic health conditions and trauma, both important considerations due to the impact on disability outcomes related to HI (McMillan et al., in prep). Multi-morbidity in women prisoners raises concern of poorer outcomes (Crowe, 2018).

Conclusions

Findings from investigations of disability from any cause informs research on HI given the high numbers reporting HI as a causal factor. Female prisoners have poorer disability outcomes, from any cause, highlighting gender differences in recovery. Mood is associated with more severe disability from HI and any cause, also predicting poorer

outcomes in females. The present findings contribute to current literature on HI especially given the sample size and unique explorations in relation to gender. These findings provide support for further investigations of gender differences in HI and disability within prison populations specifically of mood; future research should attempt to explore the associations found in the study, in order to further understand the direction of the relationship between HI, disability and mood and thus inform interventions and training. It would also be important to investigate mediators of disability outcomes specifically among female prisoners given the evidence for poorer recovery.

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Appendices

Appendix 1.1 Instructions for Authors for Int Journal of Forensic Mental Health

International Journal of Forensic Mental Health – Instructions for Authors

Thank you for choosing to submit your paper to the *International Journal of Forensic Mental Health*. These instructions will ensure our editorial team has everything required so your paper can move smoothly through peer review, production, and publication. Please take the time to read and follow them as closely as possible, as doing so will ensure your paper matches the journal's requirements. For general guidance on the publication process at Taylor & Francis please visit our Author Services website.

SCHOLARONE MANUSCRIPTS™

Submission Portal. The *International Journal of Forensic Mental Health* uses the ScholarOne Manuscripts (previously Manuscript Central) submission portal to peer review submissions. Please read the guide for ScholarOne authors before making a submission. Complete guidelines for preparing and submitting your manuscript to this journal are provided below.

For ScholarOne Manuscripts technical support: http://scholarone.com/services/support/.

For any other requests:

Dr. Tonia L. Nicholls, Editor-in-Chief
Associate Professor, University of British Columbia
Distinguished Scientist, Forensic Psychiatric Services Commission, BC Mental Health and Substance Use Services
tnicholls@forensic.bc.ca

Plagiarism. Please note that the *International Journal of Forensic Mental Health* uses CrossCheck™ software to screen papers for unoriginal material, simultaneous submission and multiple publication. By submitting your paper to the *International Journal of Forensic Mental Health,* you are agreeing to any necessary originality checks your paper may have to undergo during the peer review and production processes.

MANUSCRIPT PREPARATION

Prepare your manuscript according to the *Publication Manual of the American Psychological Association (6th Edition)*. Manuscripts should be copyedited in accordance with Chapter 3 of the Publication Manual relating to unbiased language. We recommend the use of the *APA Checklist for Manuscript* Submission to help you prepare and review prior to submission.

Each manuscript must be accompanied by a statement that it has not been published elsewhere and that it has not been submitted simultaneously for publication elsewhere. Authors are

additionally responsible for obtaining the relevant ethical approvals from relevant institutions, or should be able to provide us with an ethics waiver from their institution (i.e., in case the project is exempt from full ethics review). Authors are responsible for obtaining permission to reproduce copyrighted material from other sources and are required to sign an agreement for the transfer of copyright to the publisher. As an author, you are required to secure permissions if you want to reproduce any figure, table, or extract from the text of another source. This applies to direct reproduction as well as "derivative reproduction" (where you have created a new figure or table which derives substantially from a copyrighted source). All accepted manuscripts, artwork, and photographs become the property of the publisher.

Types of Submissions
The *IJFMH* accepts a variety of submissions, relevant to the field of forensic mental health (e.g., criminal responsibility, competency or fitness to stand trial, risk assessment, family violence, and treatment of forensic clients, diversion, correctional mental health, mental health tribunals, intellectual disabilities and violence). Examples: Original experiments (qualitative and quantitative), systematic reviews and meta-analyses, narrative reviews, case studies, program evaluations.

Formatting
- All parts of the manuscript should be typewritten (Times New Roman, 12 pt.), double spaced, with margins of at least one inch on all sides.
- Pages should be numbered consecutively throughout the paper.
- Authors should also supply a shortened version of the title suitable for the running head, not exceeding 50 character spaces.

Abstract
Each article should be summarized in an abstract of not more than 150 words. Avoid abbreviations, diagrams, and reference to the text in the abstract.

Authorship Affiliations
Each author should be listed with his or her primary departmental affiliation and institution name, and city/state/country (where applicable). The corresponding author(s) should be clearly noted.

No authorship or otherwise identifying information should be included in the abstract, body of the manuscript, or reference list. Rather authorship can be conveyed on a separate title page (consistent with the APA Publication Manual 6th Ed.) and (if applicable) in an accompanying cover letter.

Additional Considerations
Funding. All sources of funding and potential conflicts of interest should be noted in the admission portal and (if applicable) in an accompanying cover letter.

Keywords. A maximum of 5 keywords, relevant to your manuscript, will also be required.

References. References, citations, and general style of manuscripts should be prepared in accordance with the *APA Publication Manual, 6th Edition*. Cite in the text by author and date (Smith, 1983) and include an alphabetical list at the end of the article. Each in-text reference should be included in the reference list; each reference in the reference list should appear in the text of the manuscript. Please also be sure to include DOIs.

Examples:

- Journal Article:
  Tsai, M., & Wagner, N.N. (1978). Therapy groups for women sexually molested as children. *Archives of Sexual Behaviour*, 7(6), 417-427. doi: 10.1037/0096-3445.134.2.258

- Authored Book:
  Millman, M. (1980). *Such a pretty face*. New York: W.W. Norton.

- Chapter in an Edited Book:
  Hartley, J.T., & Walsh, D.A. (1980). Contemporary issues in adult development of learning. In I.W. Poon (ed.). *Ageing in the 1980s* (pp. 239-252). Washington, DC: American Psychological Association.

Illustrations

Illustrations submitted (line drawings, halftones, photos, photomicrographs, etc.) should be clean originals or digital files. Digital files are recommended for highest quality reproduction and should follow these guidelines:

- 300 dpi or higher
- Sized to fit on journal page
- EPS, TIFF, or PSD format only
- Submitted as separate files, not embedded in text files

Color Illustrations. Color art will be reproduced in color in the online publication at no additional cost to the author. Color illustrations will also be considered for print publication; however, the author will be required to bear the full cost involved in color art reproduction. Color reprints can only be ordered if print reproduction costs are paid.
Print Reproduction: $900 for the first page of color; $450 per page for the next three pages of color. A custom quote will be provided for articles with more than four pages of color. Art not supplied at a minimum of 300 dpi will not be considered for print.

Tables and Figures. Tables and figures (illustrations) should not be embedded in the text, but should be included as separate sheets or files. A short descriptive title should appear above each table with a clear legend and any footnotes suitably identified below. All units must be included. Figures should be completely labeled, taking into account necessary size reduction. Captions should be typed, double-spaced, on a separate sheet. Refer to the APA Publication Manual, 6th Ed. for guidance and examples.

Full guidelines can be found at:

http://www.iafmhs.org/resources/Pictures/IJFMH%20-%20Info%20for%20Authors%20Final%20Jan%2025%2017.pdf

Appendix 1.2: Data Extraction for Analysis

Domain	
Study characteristics	a) First author b) Year of publication c) Country of publication
Study aims	a) Prevalence of ID b) Secondary aims c) Gender noted in aims
Design	a) Type of design e.g. cross-sectional study b) Type of procedure e.g. surveys, interviews
Definition & assessment of ID	a) Detail of how ID is defined including measure of IQ (<70?) b) Standardised tools to measure ID c) Any additional measures used d) Developmental assessment e) Adaptive & social functioning assessment
Sample	a) Total N (%) b) Prison sample / recruited from c) Sampling method d) Gender of sample
Limitations	a) Design limitations b) Limitations related to definition & measures of ID c) Sampling limitations
Key findings	a) Prevalence rates of ID, N (%) e) Gender split

Appendix 1.3: Risk of bias results from second rater

Study	Selection bias	Methods for defining ID	Methods for measuring ID	Design specific bias	Methods to control confounding	Statistical methods & analysis plan	Conflict of interest
1. Ali (2016)	LOW	HIGH	LOW	HIGH	HIGH	LOW	LOW
2. Bhandari (2015)	LOW	LOW	LOW	HIGH	HIGH	HIGH	LOW
3. Chaplin (2017)	LOW	LOW	LOW	HIGH	LOW	HIGH	LOW

Appendix 2.1: Proceed to ethics letter

University of Glasgow

Institute of Health & Wellbeing

Athena SWAN Gold Award

EC GENDER CHARTER

BC/LC

4th March 2020

Caroline Brodie
0106518B@student.gla.ac.uk

Dear Caroline,

Major Research Project Proposal

Head injury in women with trauma: knowledge and practice within criminal justice settings

The above project has been reviewed by your University Research Supervisor and by a member of staff not involved in your project, and has now been deemed fit to proceed to ethics.

Congratulations and good luck with the study.

Yours sincerely

Dr Breda Cullen
Senior Lecturer in Clinical Psychology
DClinPsy Research Director

Institute of Health and Wellbeing

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Tw: @DClinPsyGlasgow

The Queen's Anniversary Prizes
For Higher and Further Education
2013

Participant Information Sheet:
Head Injury in Women with Trauma

We are carrying out a study on knowledge of head injury in women. You are invited to take part. Before you decide, it is important that you understand why the research is being undertaken and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like further information. This project is part of a programme of research for people with head injury who may have been in contact with the criminal justice system. The research so far has led to the implementation of recommendations for services in Scotland.

What is the purpose of the study?
We are carrying out this current study to improve services for women who have experienced trauma and who may have had a head injury. The project will also contribute towards the researcher's fulfillment of their Doctorate in Clinical Psychology degree, undertaken at the University of Glasgow and within NHS Greater Glasgow & Clyde.

Why have I been chosen?
You have been chosen because you are currently working directly with women who have experienced trauma, and because your service is linked with the criminal justice system in Scotland.

Do I have to take part?
No, it is up to you to decide. There will be no consequences for you either way, except the time required to complete the study. You will be given this information sheet to keep and if you choose to take part you will be asked to sign a consent form. You can still withdraw from the study at any time and do not have to give a reason.

What do I have to do if I take part?
- Should you decide to take part, your participation from beginning to end will be approximately one month.
- You will be invited to attend a training session lasting approximately 45 minutes.
- You will be asked to complete short questionnaires before and after the session.
- 2-4 weeks after training, you will be asked to complete short questionnaires; the researcher will attend a team meeting at your place of work to facilitate this.

- If you are a manager of the service, you will also be invited to attend a short interview with the researcher before the training and 2-4 weeks after the training. Each interview will last no more than 15 minutes.

Where will the research take place?
All components of the research will be at your place of work, as agreed by your manager.

What are the possible disadvantages and risks of taking part?
We foresee no particular disadvantages to taking part and we do not anticipate the study to be distressing; you can choose to withdraw at any time.

What are the possible benefits of taking part?
We hope the training will contribute to awareness, knowledge and practice within your service. The information collected will give us a better understanding of head injury which may allow us to make recommendations for training and service needs across Scotland.

Will my taking part in this study be kept confidential?
All information collected about you during the research will be kept confidential, accessible only to the researchers. You will be identified by number only, not by your name. Any information about you will have your name removed so that you cannot be recognised by it.

What will happen to my data?
The University of Glasgow is responsible for looking after your information and using it properly. All paper forms will be destroyed after the study is concluded. We will retain an anonymised electronic record stored in the University department for a maximum of 10 years from the end of the study, in order to meet record keeping guidelines and for future research. Researchers from the University of Glasgow collect, store and process all personal information in compliance with the General Data Protection Regulation (GDPR, 2018).

What will happen to the results of the research study?
When the project is complete, the findings may be submitted for publication in peer reviewed academic journals. The results may be used in conference presentations and will be included in theses to fulfill the requirements of the Doctorate in Clinical Psychology. A summary of results will be provided to the National Prisoner Healthcare Network and to the Scottish Government. Participants and the services involved will also receive a summary of results. Publications arising from the research will not identify you.

Analysing the research data
Researchers occasionally need assistance to analyse the research data from specialist colleagues in Universities. If their assistance is required, then the data that is used will be

completely anonymised - all personal information that could identify research participants will be removed before it is passed on to the University for analysis.

Who is organising and funding the research?
The research project is organised and funded by the University of Glasgow. It is part of a larger research programme funded by the Scottish Government.

Who reviews the study?
Before the study is undertaken, the project will be fully reviewed by the University of Glasgow College of Medical Veterinary and Life Sciences.

Complaints process
You have the right to complain about your involvement in this study if you are not happy with it. If you have any complaints about any part of your involvement in this research study, these will be dealt with by the NHS complaints process.

Your rights
We need to manage your information in specific ways in order for the research to be reliable and accurate and so, your rights to access, change or move your information are limited. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally-identifiable information possible.

Contact for further information:
For any questions, please contact Caroline Brodie: c.brodie.1@research.gla.ac.uk.

What if there is a problem?
For any concerns about any aspect of the study, please contact Dr Karen McKeown: karen.mckeown@glasgow.ac.uk (0141 211 0354).

The researchers working on this study are:
- Caroline Brodie - Trainee Clinical Psychologist and researcher.
- Professor Tom McMillan - Clinical Neuropsychologist and Principal Investigator supervising this research.

Thank you for considering this request to take part in the study.

University of Glasgow | College of Medical, Veterinary & Life Sciences

NHS Greater Glasgow and Clyde

Centre Number:
Project Number:

Tittle of Project: Head Injury in Women with Trauma

Name of Researcher: Caroline Brodie

CONSENT FORM *Please initial box*

I confirm that I have read and understood the Participant Information sheet dated 23.02.2020.	☐
I confirm that I have red and understood the Privacy Notice dated 23.02.2020.	☐
I have had the opportunity to think about the information and ask questions, and understand the answers I have been given.	☐
I confirm that I agree to the way my data will be collected and processed and that data will be stored for up to 10 years in University archiving facilities in according with relevant Data Protection policies & regulations.	☐
I understand that all data and information I provide will be kept confidential and will be seen only by study researchers and regulators whose job it is to check the work of researchers.	☐
I agree that my name, contact details and data described in the information Sheet will be kept for the purposes of the research project.	☐
I understand that if I withdraw from the study, my data collected up to that point will be retained and used for the remainder of the study.	☐
I agree to take part in the study.	☐

_____ Name of participant	_____ Date	_____ Signature
_____ Name of person taking consent (if different from researcher)	_____ Date	_____ Signature
_____ Name of researcher	_____ Date	_____ Signature

1 copy for participant, 1 copy for researcher

Interview with Service Managers:
Head injury in Women with Trauma

1. Is Head Injury an issue in your service and in what way?

2. How often do service users present to your service with experience of Head Injury?

3. How do your staff respond to service users with experience of Head Injury?

4. What are the difficulties within your service in relation to responding to Head Injury?

5. Is there anything you would like to add?

Background Information Questionnaire:
Head injury in Women with Trauma

All questions are optional and confidential.
Not answering these questions will not affect your participation in the study.

Date of completion:

1. How old are you?

2. What is your gender?

3. How long have you worked in the current service?

4. What is your current job role?

5. What is your employment status? [e.g. full time, part time, voluntary]

6. How often do you have contact with women who may have experienced trauma? [e.g. daily, weekly]

7. Have you had any training about head injury/brain injury? Y / N
[please detail if yes]

Participant ID:

University of Glasgow | College of Medical, Veterinary & Life Sciences

NHS Greater Glasgow and Clyde

Vignette and Response Sheet:
Head injury in Women with Trauma

Lee-anne has been released from prison following a short sentence for theft. She has a history of domestic violence; she lived with her most recent partner for 5 years and experienced emotional and physical abuse since the beginning of the relationship.
Lee-anne describes controlling behaviours including her movements being restricted and monitored, and violence involving regular assaults and repeated hits to the head.

1. What key questions would help you to decide whether there is a likelihood of persisting effects of Head Injury on function?

2. What might be the potential issues in developing an intervention or management plan?

3. If you thought specialist input might be needed, where could you refer to or seek guidance from?

Participant ID:

Appendix 2.7: Vignette Scoring Guide

University of Glasgow | College of Medical, Veterinary & Life Sciences

NHS Greater Glasgow and Clyde

Vignette Scoring Guide

1. What key questions would help you to decide whether there is a likelihood of persisting effects of Head Injury on function?

   Asking about:
   Recent HI
   Loss of consciousness
   Previous HI
   Multiple HI
   Experiences of trauma

I point per answer. Maximum score = 5

2. What might be the potential issues in developing an intervention or management plan?

   Any mention of:
   Behavioural impact
   Cognitive impairment
   Emotional changes
   Specifying increase in offending behaviours
   Substance use

I point per answer. Maximum score = 5

3. If you thought specialist input might be needed, where could you refer to or seek guidance from?

   Appropriate neurorehabilitation services for the areas such as Headway, Community Treatment Centre for Brain Injury in Glasgow, Community Rehabilitation and Brain Injury Service (CRABIS) in Lothian, and Inverclyde Community Rehabilitation Team
   - For referral and/or consultation

I point per answer. Maximum score = 2 *TOTAL SCORE = /12*

Appendix 2.8: CM-TBI Questionnaire

University of Glasgow | College of Medical, Veterinary & Life Sciences

NHS Greater Glasgow and Clyde

Common Misconceptions about Traumatic Brain Injury (CM-TBI) Questionnaire:
Head injury in Women with Trauma

CM-TBI QUESTIONNAIRE

Please tick whether you think the following statements are true or false.
If uncertain please guess.

Date of completion:

	TRUE	FALSE
1. A head injury can cause brain damage even if the individual is not knocked unconscious		
2. Whiplash injuries can cause brain damage even if there is no direct blow to the head		
3. It is common for people with brain injuries to be easily angered		
4. It is common for personality to change after a brain injury		
5. Problems with speech, coordination, and walking can be caused by brain damage		
6. Problems with irritability and difficulties controlling anger are common in people who had a brain injury		
7. Most people with brain damage are not fully aware of its effect on their behaviour		
8. People who have survived a brain injury usually show a good understanding of their problems because they experience them every day		
9. Brain injuries often cause a person to feel depressed, sad, and hopeless		
10. It is common for people to experience changes in behaviour after a brain injury		
11. Sometimes a second blow to the head can help a person remember things that were forgotten		
12. Recovery from a brain injury is usually complete in about 5 months		
13. Once a person is able to walk again, his/her brain is almost fully recovered		

14. Once a person with a brain injury realises their degree of impairment they will always be aware of this		
15. A person who has a brain injury will be "just like new" in several months		
16. Asking people who were brain injured about their progress is the most accurate, informative way to find out how they have progressed		
17. It is good advice to remain completely inactive during recovery from a brain injury		
18. Once a person recovering from a brain injury feels "back to normal," the recovery process is complete		
19. How quickly a person recovers depends mainly on how hard they work at recovering		
20. The primary goal of brain injury rehabilitation is to increase physical abilities such as walking		

Linden et al. (2013)

Participant ID:

University of Glasgow | College of Medical, Veterinary & Life Sciences

NHS Greater Glasgow and Clyde

Knowledge about Head Injury in Women with Trauma Questionnaire:
Head injury in Women with Trauma

These questions pertain to knocks on the head that occurred many months or years ago. Tick true, false or don't know for each question below.

Completion date:

		True	False	Don't Know
1	About half of prisoners report a history of head injury			
2	A history of head injury is equally likely in male and female prisoners			
3	About half of head injury in female prisoners is a result of trauma			
4	Head injury is associated with increased risk of offending behaviour			
5	People with a history of head injury often have fits or seizures			
6	People with a history of head injury can often be identified by physical problems such as difficulty in walking or speech impediment			
7	Repeated mild head injuries have cumulating effects on memory			
8	Head injury in female prisoners is often associated with childhood abuse and domestic abuse			
9	People with past head injury are more likely to be challenging to services than people without			
10	A history of head injury is more often associated with conviction of a violent offence than of other offences			
11	The risk of having another head injury is greater if you have already had one			
12	Prisoners with past head injury are likely to have bleeding on the brain if hit on the head again			

Modified from The Knowledge about HI in Offenders questionnaire (McMillan, 2019).

Participant ID:

Appendix 2.10: Likert Scale: Knowledge, awareness & confidence

Please circle the most appropriate response.

	1 = Strongly Disagree	*2 = Somewhat Disagree*	*3 = Neither agree nor disagree*	*4 = Somewhat agree*	*5 = Strongly Agree*
1. I am aware of the link between trauma and head injury in women	1	2	3	4	5
2. I am aware of prevalence rates of head injury among women offenders	1	2	3	4	5
3. I understand the issues that women with head injury may present with	1	2	3	4	5
4. I feel confident to ask about head injury in my practice	1	2	3	4	5
5. I know how to identify someone who may have recently suffered head injury	1	2	3	4	5
6. If I assess someone with head injury in my normal practice, I feel confident offering support and referring to specialist services	1	2	3	4	5

Measures: Knowledge: qu's 3&5;
Awareness: qu's 1&2;
Confidence: qu's 4&6

Participant ID:

Appendix 2.11: Likert Scale: Training Feedback

Please circle the response that most closely fits with your experience of the training session.

	1 = Strongly Disagree	*2 = Somewhat Disagree*	*3 = Neither agree nor disagree*	*4 = Somewhat agree*	*5 = Strongly Agree*
1. The training met my expectations	1	2	3	4	5
2. The training is relevant to my current job role	1	2	3	4	5
3. The style of delivery was engaging	1	2	3	4	5
4. The training was delivered at the correct pace for my learning	1	2	3	4	5
5. The training is relevant to my continued professional development	1	2	3	4	5
6. Further training in this area would benefit my practice	1	2	3	4	5

Participant ID:

Appendix 2.12: MRP Proposal

Name of Assessment: Major Research Project (MRP)

Title of Project:

Head injury in Women with Trauma: Knowledge and Practice within Criminal Justice Settings

Matriculation Number:

Date of Submission: 23/02/20

Version Number: 1

Word Count: 3400

Abstract

Background: There is increasing awareness of the high prevalence of Head Injury (HI) in prisoners, with studies on female prisoners highlighting an association with HI, trauma and domestic violence. This has implications for practitioners working with women involved in the criminal justice system.

Aims: To deliver evidence-based training on HI to frontline workers with women with trauma. Further, to improve knowledge of HI in services linked to criminal justice and facilitate application of that understanding.

Methods: Approximately 40 staff across three women-only criminal justice services will be asked to participate in a quantitative within-groups repeated measures study. Questionnaires and vignettes will evaluate knowledge, awareness, confidence and practice of workers, pre-intervention (T1), post-intervention (T2) and follow-up (T3). Interviews will be undertaken with service managers on the impact of training and any issues arising. A review of assessment reports will be completed in each service to determine the practice of staff in relation to HI.

Applications: Training workers about HI may improve practice by identifying HI, signposting women to support and adopting a more in depth understanding of women's offending behaviours. If change is evidenced, it is hoped training can be rolled out to other community services.

Introduction

Prevalence of HI

There is growing awareness of head injury (HI) in prisoners and its consequences, increasing understanding of the high prevalence among female prisoners. Compared to an estimated 12% in the general population (Frost et al, 2013), meta-analyses estimate lifetime prevalence between 51% and 60% among the prison population (Farrer and Hedges, 2011; Shiroma et al, 2010). In female prisoners, varied estimates are reported (23-95%), still prevalence is recognised as high, whether by self-report (McGinley & McMillan, 2019) or records of hospital admission (McMillan et al 2019). HI is associated with cognitive, emotional and personality changes, along with increased risk of reoffending (Williams et al., 2018).

Scottish context

Within Scotland, almost 25% of prisoners have experienced a hospitalised head injury (HHI); multiple incidences are more common in both male and female offenders than in the general population (McMillan et al., 2019) and prevalence of disability high (Crowe 2018). Addressing the needs of people with HI in prison is a national priority in Scotland, for the NHS and Scottish Government (NPHN, 2016). Preliminary data from a recent study in Scottish prisons found a high prevalence of HI (90%) in women prisoners with a history of complex trauma (86%), (McMillan et al, in preparation).

Women and trauma

Research with female prisoners with HI is limited (McGinley and McMillan 2019) but has highlighted the context of trauma and violence (Colantonio et al., 2014). A study of women in prisons in the EU found a history of domestic abuse common (Macdonald,

2013). Several studies report a direct link between intimate partner violence and HI, with domestic abuse being described a national health crisis (Zieman et al., 2017; Hunnicutt et al., 2017). Furthermore, women have described behavioural changes as the most severe effect of HI (Zieman et al., 2017). This has implications for practitioners working with women in criminal justice settings as relates to different support needs (McGinley and McMillan 2019).

Frontline services

Training is acknowledged as an urgent need in criminal justice services to help staff understand the complex histories of female offenders and the impact on their emotional wellbeing and behaviour (Macdonald, 2013), and apply this understanding to practice. There is a lack of evidence-based training available in this area informing knowledge and practice. De Mora (2019) found no information on HI recorded in Criminal Justice Social Work reports despite a high prevalence of HI in the cases they were seeing.

Objectives

The present study aims to improve knowledge, awareness and confidence of workers in frontline services working with women with HI and trauma, by means of delivering an evidence-based training package. The hope is by increasing understanding of HI, there will be a change in practice to identifying signs of HI and signposting women to the right support.

Aims and hypotheses

Aims

1. To describe workers current knowledge and understanding of head injury in women with trauma.

2. To deliver and evaluate a single training session for workers about women with HI to improve:

- Knowledge
- Awareness
- Confidence
- Practice.

Hypotheses

1. Workers' current knowledge of HI and application to practice does not reflect the prevalence of HI among female offenders.

2. A single training session on HI will improve workers:

- Knowledge
- Awareness
- Confidence
- Practice.

Plan of Investigation

Participants

Male and female workers aged 18 and over will be recruited from staff teams in three community justice services.

Inclusion and Exclusion Criteria

The sample will include paid and unpaid staff from three services who work directly with female offenders. All staff within the services will be invited to participate. Staff who are leaving before completion of the project will be excluded, due to the follow up element of the study.

Recruitment Sites

The three study sites have confirmed interest (Tomorrow's Women, the 218 Service and the Willow Service). **Tomorrow's Women** and **218** are both community justice services for female offenders in Glasgow; for women leaving prison or an alternative to custody. Tomorrow's Women is within Glasgow City Health and Social Care Partnership (GCHSCP) whereas 218 is a project of Turning Point Scotland, a third sector organisation. **Willow** is a partnership between NHS Lothian, City of Edinburgh Council and Sacro to address social, health and welfare needs of female offenders.

All sites are women-only, for women with complex needs involved in the criminal justice system; all involve community and prison work. The services are multi-disciplinary, including psychology, social work, nursing, support workers and volunteers. Tomorrow's Women has a current staff team of approximately 10; 218 approximately 30; and Willow approximately 20. Although the teams range in backgrounds and expertise, the plan is not to offer different training. Initial discussions with services suggest professional staff do not feel well trained nor experienced in the research area.

Recruitment Procedures

The researcher will speak with managers of each service and confirm dates and participants. The researcher will attend team meetings to meet participants and introduce the study. Managers will invite their entire staff team to participate by means of the Participant Information Sheet. Managers have intimated the training could fit within Continual Professional Development (CPD), which could provide an incentive to participate, give credibility to the training and alleviate issues regarding time commitment. Written informed consent will be sought from all staff participating in the intervention.

Measures

Interviews with service managers will be undertaken within each service, pre-training and follow up, comprising 5 questions related to prevalence, practice within the service and any issues responding to HI.

Vignettes will be administered as an open-ended measure of knowledge, with response sheet. The same vignette will be repeated at each time point for within group comparison. Vignettes have been used as a measure of knowledge of HI in several studies, with different groups: prison population (Buchan, 2018); general practitioners (Mackenzie &McMillan, 2005); students (Gunstad & Suhr, 2002) and the general population (Mulhern & McMillan, 2006) and found to be effective in detecting change (Buchan, 2018). Vignettes in this study will take less than five minutes to complete and each response will be scored based on a scoring format.

The Common Misconceptions about Traumatic Brain Injury questionnaire (CM-TBI) [O'Rourke, Linden & Lohan, 2017] is a 20-item standardised questionnaire used to evaluate knowledge about HI, showing good internal consistency at 0.84 using Cronbach's alpha. It takes less than 5 minutes to complete, administered at each time point.

The Knowledge about Head Injury in Offenders questionnaire (modified from McMillan, 2019) is a 12-item questionnaire developed for a study on prison staff's knowledge of HI and has been modified for the present study. It takes less than 5 minutes to complete, administered at each time point.

Likert scales will be developed and coded for awareness, confidence and practice. It will take a minute to complete, administered at each time point. An additional *Likert scale* will be administered at T2 for feedback, to evaluate the intervention. It will take a minute to complete.

Review of assessment reports will be undertaken to explore current practice and application of knowledge following training in HI. Anecdotal evidence indicates women in prison do not get input in relation to HI. Discussions with managers suggest HI is not routinely asked about nor recorded in assessment reports despite recent research reporting high prevalence in the population, including disabling HI (McMillan et al, in preparation). A review of ten reports will be undertaken in each service pre-training and follow up. Reports are held electronically on web based case management systems - the NHS system, EMIS Web and the Social Work system, CareFirst (see section 5. Ethics).

A summary of measures completed at each stage of the study is given in Table 1. It is estimated completion of the measures will take 10 minutes at each time point and the single training event 40/45 minutes. Interviews will take no more than 10-15 minutes. A longer follow-up time has been sacrificed in an effort to retain participants and achieve sample size, power and internal validity.

Table 1: Summary of Data Collection for Study Design

Stage	**Measures**
Pre-training: T1	6. Interview with service managers 7. Descriptive measures: o Background Information questionnaire (age, gender, job role…) 8. Knowledge based measures: o Vignette o Common Misconceptions about Traumatic Brain Injury (CM-TBI) questionnaire o Knowledge about Head Injury in Offenders questionnaire 9. Awareness, confidence and practice measure: o Likert scale 10. Review of assessment report
Post-training: T1	3. Knowledge based measures: o Vignette o Common Misconceptions about Traumatic Brain Injury (CM-TBI) questionnaire o Knowledge about Head Injury in Offenders questionnaire 4. Awareness, confidence and practice measure: o Likert scale
Follow up: T3	6. Knowledge based measures: o Vignette o Common Misconceptions about Traumatic Brain Injury (CM-TBI) questionnaire o Knowledge about Head Injury in Offenders questionnaire 7. Awareness, confidence and practice measure: o Likert scale 8. Evaluation of intervention measure: o 5 point Likert scale feedback form 9. Review of assessment reports 10. Interview with service managers

Outcome measures:

Knowledge of HI in women with trauma and its sequelae; **Awareness** of the prevalence of HI in women with trauma and relevance to their practice; **Confidence** asking about HI and working with women who may have experienced HI; **Practice** in relation to women who may have suffered HI.

Design

The project is a pre-post quantitative study with follow-up using a within-subjects repeated measures design.

Research Procedure

12. Contact relevant services to establish interest.
13. Adapt / develop questionnaires and Likert scales.
14. Contact services to formally arrange dates for training, interviews, follow-up.
15. Develop training informed by literature.
16. Obtain written informed consent from participants.
17. Undertake review of assessment reports in each service.
18. Interview manager from each service.
19. Deliver training to each service, with pre- and post- measures (time point 1 and 2).
20. Attend all services for follow up (time point 3).
21. Undertake review of assessment reports in each service.
22. Interview manager from each service.

To enhance participation and increase likelihood a priori G*Power sample size will be met, the researcher will administer pre- and post- measures at the training session. The

researcher will attend team meetings at time point 3 to facilitate data collection, and arrange alternative dates if participants are unavailable.

Data Analysis

Demographic information will be collected and displayed graphically to characterise the sample.

H1

Interviews with managers and reviews of assessment reports will be summarised. A number of themes will be highlighted in relation to the understanding of HI and application to practice (i.e. was HI screened for, was it identified, were actions undertaken). This will enable the exploration of practice knowledge and whether this reflects prevalence of HI among female offenders reported by current research literature.

H2

For each outcome measure (knowledge, awareness, confidence, practice), difference scores will be calculated pre- and post- intervention (T1 and T2), and pre- intervention and follow up (T2 and T3), from the questionnaire data, Likert scale and Vignette scores.

Tests of normality will determine if data meets parametric assumptions. Data from the Likert scale and standardised questionnaire will be non-parametric. Primary analyses adopted will be a t-test for related samples (Wilcoxon signed-rank test if non-parametric). This design allows testing of effect over time (Pallant, 2016). All analyses will be conducted using SPSS.

This will be supplemented by pre- and post- comparison (T1 and T3) of themes drawn from the interviews with managers and reviews of assessment reports.

Justification of Sample Size

No study on training workers on HI within criminal justice settings was identified. Buchan (2018) assessed knowledge of HI in prisoners following a psychoeducation programme using similar methods and may be helpful in estimating sample size. Buchan (2018) reports large sized effects for knowledge of HI, in favour of the intervention. Using the same parameters as this study, taking power of 0.80 and medium effect size (0.50) with $p<0.05$ (Cohen, 1992), the sample size required using a priori G*Power analysis for a paired samples t-test is **34** (Version 3.1 Faul et al., 2009).

The sample are staff recruited by managers who have shown initial engagement. The researcher has been invited to attend team meetings, giving access to participants and potential for recruiting large numbers quickly. **34** is therefore considered feasible. Given the pre-post design, **40** participants will be aimed for to account for attrition.

Setting and Equipment

The study will take place at three training sites. Equipment will include information sheets, consent forms, Powerpoint presentation, IT equipment, laptop, handouts and measures.

Health and Safety Issues

Researcher Safety Issues

GG&C lone working policy will be followed. Risk to the researcher's safety is minimal as the project involves seeing staff in their places of work.

Participant Safety Issues

Recruitment does not include service users therefore is unlikely to cause harm. The training topic is unlikely to be distressing because participants are dealing with trauma on a daily basis. There may be survivors of trauma within staff teams; care will be taken to ensure the information sheet informs participants of the subject matter which will be re-iterated at the beginning of the training, as well as opportunity to withdraw consent at any point.

Appropriate referral information will be provided to each service, such as Headway, Community Treatment Centre for Brain Injury in Glasgow, Community Rehabilitation and Brain Injury Service (CRABIS) in Lothian, and Inverclyde Community Rehabilitation Team, to ensure workers are equipped with resources.

Ethics

Informed consent will be sought to ensure participants understand completion is voluntary. Once collected, measures will be stored in a locked filing cabinet, accessed only by the primary researcher. A locked bag will be provided by the university for secure transportation from services. The questionnaires will be anonymised using numerical rating scales. Ethical approval will be sought from a number of sources, including NHS Research Ethics Committee (REC), NHS Research and Design (R&D) for NHS GG&C

and NHS Lothian, and management within each service. As the project involves accessing patient records, Caldicott Guardian approval will also be sought, as well as approval from Glasgow City Health and Social Care Partnership (GCHSCP) Ethics for accessing CareFirst, in line with the procedure for external research involving Social Work Services. All data collected for the project will be anonymised and stored confidentially in line with NHS and University of Glasgow guidelines, adhering to GDPR.

Financial Issues

Project costs include printing and photocopying materials such as information sheets, measures and training resources. Additional costs will be incurred from travel to and from the training sites.

Timetable

- December 2019: Final proposal submitted to University for blind review
- February 2020: Application to Ethics
- February – March 2020: Design training package
- April – May 2020: Deliver training package; data collection (time points 1 & 2)
- April – May 2020: Data collection follow up (time point 3)
- May 2020: Data analyses
- June – July 2020: Write up
- July 2020: Final project submitted

Practical Applications

Training frontline workers on HI may improve practice by identifying signs of HI, signposting women to support and adopting greater understanding of women's offending behaviours. If change is evidenced, it is hoped the preliminary study can be rolled out to other staff and services, and be utilised as a resource for conferences and workshops. Furthermore, the research study forms part of a wider Scottish government funded programme and so findings will be fed back to the government, with the potential to help service development and inform policy change.

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Appendix 2.13: Ethics approval

From: Emma-Jane Gault <EmmaJane.Gault@glasgow.ac.uk>
Date: Friday, 18 September 2020 at 16:53
To: Tom Mcmillan <Thomas.McMillan@glasgow.ac.uk>
Subject: RE: Amy and Caroline

Dear Professor McMillan,
Thank you for your email.
The amendment forms were authorised on behalf of the Sponsor and you have R&D management approval from the relevant health boards, as follows:

Student name	CI	Replacement activity		R&D approval				
				NHS GG&C	NHS Lanarkshire	NHS Forth Valley	NHS Lothian	NHS Grampian
Amy Foreman & Caroline Brodie Original research plans abandoned due to COVID response prior to approval GN20MI088 (AF) & R&D number not yet assigned (CB)	Prof Tom McMillan	GN17MH52: secondary analysis of anonymised dataset. End of Study not yet submitted	AM04 new research team members	24/08/2020		Confirmed Letters of Access not required 08/09/2020	Letters of Access issued 04/09/2020	Not required, no Grampian data included
			AM05 revised study end date	24/08/2020		Acknowledgement 07/09/2020	Acknowledgement 03/09/2020	
		GN16MH50: secondary analysis of anonymised dataset. End of Study not yet submitted	AM04 new research team members	24/08/2020	Confirmed Letters of Access not required 27/08/2020			
			AM05 revised study end date	26/08/2020	Restart approval issued 31/08/2020			

Given that the work has already taken place, there is nothing further needed at this time in terms of sponsor approval.
However, the non-compliance has been logged with NHS GG&C R&D Governance and further guidance on required corrective and preventative actions will be provided in due course.

Best wishes,
Emma-Jane

Emma-Jane Gault
Research Governance Officer
University of Glasgow
Email emmajane.gault@glasgow.ac.uk

Appendix 2.14: Collinearity testing between predictor variables and disability outcomes to assess multicollinearity assumption for regression models

Dummy variable	Tolerance Values (>0.05)	
	Disability any cause	Disability HI cause?
Gender	.85	.85
HI Group	.90	.87 (HI only)
HADS – Depression	.86	.86
HADS – Anxiety	.79	.80
Substance Use	.88	.86

Appendix 2.15: Post hoc analyses showing fit for all regression models

Model	Proportional odds >.05	Pearson goodness-of-fit >.05	Deviance goodness-of-fit >.05	Final model fit <.05
Disability from any cause:				
Total gender	x^2= 110.67, p<.01	x^2= 118.21, p=.53	x^2= 106.48, p=.81	x^2=69.56, p<.01
Females	x^2= 25.83, p=.06	x^2= 66.47, p=.29	x^2= 59.25, p=.54	x^2=14.13, p=.007
Males	x^2= 21.02, p=.18	x^2= 29.03, p=.99	x^2= 33.63, p=.97	x^2= 27.57, p<.01
Disability from HI cause:				
Total gender	x^2= 10.57, p=.31	x^2= 66.23, p=.04	x^2= 45.17, p=.59	x^2= 23.27, p<.01
Females	x^2= 21.25, p=.13	x^2= 67.14, p<.01	x^2= 18.83, p=.60	x^2= 10.92, p=.012
Males	x^2= 9.78, p=.37	x^2= 20.70, p=.48	x^2= 20.69, p=.48	x^2= 11.80, p=.008

Appendix 2.16: Binomial logistic regressions on cumulative dichotomous dependent variables to further explore assumption of proportional odds (OR)

Disability associated with HI:

Independent variable	Odds Ratio, OR					
	Cat1	Cat2	Cat3	Cat4	Cat5	Cat6
Gender	.23	.28	.23	.38	.24	.32
Depression	.95	.73	.92	.83	.85	.63
Anxiety	.35	.40	.51	.30	.45	.30
Substance use	2.25	1.55	2.25	1.45	2.15	1.25

Disability from any cause:

Independent variable	Odds Ratio, OR					
	Cat1	Cat2	Cat3	Cat4	Cat5	Cat6
Gender	.24	.32	.23	.28	.34	.22
HI Group	.69	.34	.79	.54	.59	.43
Depression	.85	.63	.95	.73	.75	.54
Anxiety	.45	.32	.35	.40	.41	.40
Substance use	2.15	1.45	2.05	1.55	2.12	1.63