The prevalence and determinants of cardiometabolic disease among forensic patients in secure settings.

by

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Forensic Mental Health (MPhil)

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> My literature review is partially comprised of a review paper that I contributed to and published in the Journal of Forensic Psychiatry & Psychology. The results from this paper are contained in part in Chapter 2 - Systematic Review. Acknowledgement of the work of the other authors of this paper has been made at the beginning of the chapter as well as in my Acknowledgements section. A copy of the original published paper has been included in the Appendix section.

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ABSTRACT

The aim of this study was to estimate the prevalence and identify potential determinants of cardiometabolic disease (CMD) in people with psychotic disorders in secure settings and compare these to people with psychotic disorders in the community.

A systematic review of the literature was undertaken to determine existing rates of CMD indicators in people with psychotic disorders in secure settings. Data from a comprehensive health and well-being survey, the Forensic Mental Health Patient Survey (FMHPS), were obtained to determine the prevalence and determinants of CMD indicators in a sample of forensic patients. Findings were directly compared to a sample of people with psychotic disorders living in the community using data from the second Australian National Survey of High Impact Psychosis (SHIP).

The weighted pooled prevalence rates from the reviewed studies were hypertension 25.0% (N=857, 95% CI 22.1-27.9), dyslipidaemia 29.2% (N=1,135, 95% CI 26.6-31.9), diabetes 11.2% (N=2,582, 95% CI 9.9-12.4), being overweight or obese 72.4% (N=840, 95% CI 69.4-75.5), cardiovascular disease 15.6% (N=1,047, 95% CI 13.4-17.8) and metabolic syndrome 23.5% (N=1,390, 95% CI 21.3-25.7). The prevalence of CMD indicators in the reviewed studies were predominantly higher compared to the general population.

When directly compared, the forensic patient sample were older, more likely to be male, and more likely to be of Aboriginal and/or Torres Strait Islander background, than the community-based psychosis sample. The former also had higher rates of polypharmacy, clozapine prescribing, physical activity, and food consumption. However, on multivariate analysis, the forensic patients had a lower prevalence of hypertension (OR 0.36, 95% CI 0.23-0.57) and metabolic syndrome (OR 0.41, 95% CI 0.25-0.67) compared to the community-based psychosis sample.

There are clearly important differences in the sociodemographic characteristics, treatment needs and lifestyle practices of forensic patients in secure settings and there may be aspects of secure care that actually reduce CMD risk, however the resultant impact on CMD prevalence is complex. Forensic patients in secure settings require early detection and assertive treatment of CMD

indicators and further research to assess the feasibility and effectiveness of these interventions in secure settings is required.

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CHAPTER 1 – INTRODUCTION

1.1 Background

Non-communicable or chronic diseases such as coronary heart disease and cerebrovascular disease are the leading causes of death worldwide (World Health Organization, 2020). Sociodemographic, physiological, environmental, and behavioural factors contribute to the risk of these conditions. Metabolic syndrome and its components, which include central obesity, insulin resistance, type II diabetes mellitus, hypertension, and dyslipidaemia, represent key risk factors for cardiovascular disease. The increased prevalence of metabolic syndrome in people with psychotic disorders compared to the general population is well established. In 2005, the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) study of schizophrenia treatment estimated the prevalence of metabolic syndrome to be 40.9% in 689 subjects with schizophrenia compared to 23.7% of the general population in the United States (McEvoy et al., 2005).

People with mental illness are approximately three times more likely to die from heart disease and stroke compared to the general population (Osborn et al., 2007). Among adults with schizophrenia in the United States, cardiovascular disease accounts for approximately one-third of all natural deaths and is the leading cause of mortality (403.2 per 100,000 person-years) (Olfson, Gerhard, Huang, Crystal, & Stroup, 2015). In particular, people with schizophrenia have on average a reduced life expectancy of 18.7 years less for men and 16.3 years less for women than the general population (Laursen, 2011).

Whilst cardiometabolic disease (CMD) in people with psychotic disorders who live in the community has been widely studied, less is known about the prevalence and determinants of CMD in forensic patients and those with psychotic disorders in criminal justice settings. Whilst forensic patients typically receive psychiatric treatment for psychotic disorders such as schizophrenia, other mental disorders, such as bipolar and related disorders, personality disorders and neurocognitive disorders can be present at varying rates.

Forensic patients often follow a pathway of long-term detention and treatment, under Mental Health legislation, in a variety of secure settings and typically progress through lowering levels of

security and restrictions, which include custodial settings, secure mental health facilities and conditional community care. In the United Kingdom, 23.5% of forensic patients in high secure units are hospitalised for more than 10 years (Duke, Furtade, Guo, & Völlm, 2018). Differences between forensic mental health systems, including budgetary and expenditure factors, exist internationally, as well as amongst jurisdictions nationally. These are often due to differences in policy initiatives, legal systems and socioeconomic and demographic characteristics, and in turn impact on health determinants and outcomes (Hanley & Ross, 2013).

Forensic patients and other mentally ill offenders, in particular those with psychotic disorders, in secure settings are arguably doubly disadvantaged with regard to their risk of developing CMD due to their complex treatment needs and the restrictive environments in which they reside. For example, treatment with higher doses of antipsychotic medication and polypharmacy is common, and the frequent use of clozapine (Stone-Brown et al., 2016), a well-established risk factor for CMD, is typical for this group (Rummel-Kluge et al., 2010). Motivation and capacity to make healthy lifestyle choices as prevention for CMD are often diminished in this population (Haw & Stubbs, 2011) and opportunities for physical activity in secure settings can be highly restricted.

Whilst forensic patients account for relatively small proportions of people treated by mental health services, there are significant resource and financial implications associated with their care. For example, in the United Kingdom the cost of treating a forensic patient in a medium secure hospital is £170,000 per annum per patient; and forensic mental health services accounted for 10% of the national mental health and 1% of the National Health Service budgets (Duke et al., 2018). Australian forensic mental health services spend an estimated $1200 per patient day (Productivity Commission, Mental Health, Inquiry Report).

To date, research on the cardiometabolic health of people with psychotic disorders in secure settings have been limited to single-centre, self-report-based prevalence studies conducted predominantly in Europe and North America. Furthermore, this cohort have not been compared or matched against larger population-based samples of people with psychotic disorders to assess whether differences in prevalence or determinants exist. New South Wales has the largest group of forensic patients in Australasia, therefore it is anticipated that this study will be the most comprehensive analysis of CMD in forensic patients conducted in the region.

Improving the physical health of people with mental illness was identified by the Council of Australian Governments (COAG) as one of eleven performance indicators in The Roadmap for National Mental Health Reform 2012–22. The Roadmap Vision identified people with mental illness and comorbid physical conditions, such as diabetes, coronary heart disease and stroke as a National Health Priority Area. Forensic and correctional mental health services have a duty of care to provide forensic inpatients and incarcerated mentally ill offenders with a level of healthcare that is comparable, if not superior, to the treatment of chronic diseases in the general population (United Nations, 2015). Currently, there is an absence of evidence on the prevalence and determinants of CMD indicators of people with psychotic disorders in secure settings to inform clinical services on policy development and allocation of resources. The results of this study will provide a scientific framework for evidence-based interventions to be tested, developed, and used for advances in the management of CMD indicators in Australia and internationally. Ultimately, this is integral to ensuring that mortality and morbidity related to CMD indicators in this cohort are reduced.

1.2 Aims and overview of the study

This study aims to determine whether the prevalence of CMD indicators and their determinants are different in people with psychotic disorders who reside in secure settings compared to those in the community; and recommend future practice and research implications relating to the assessment and management of CMD indicators in people with psychotic disorders in secure settings. This study was structured into two phases.

The aim of the first phase of the study was to undertake a systematic review of research conducted to date in order to establish the prevalence of CMD indicators in people with psychotic disorders in secure settings. Where possible, weighted pooled prevalence findings for hypertension, dyslipidaemia, diabetes, weight-related problems, cardiovascular (CVD) and metabolic syndrome were calculated.

The second phase of the study consisted of analysis of data from the NSW Forensic Mental Health Patient Survey (Dean, Lewandowski & Korobanova, 2018), a cross-sectional health and wellbeing survey of forensic patients in secure care, designed in part to produce measures of the prevalence

of CMD indicators and their determinants. The survey instrument used was an amended version of that developed for the second Australian National Survey of High Impact Psychosis (SHIP) (Morgan et al., 2012), which was the first population-based psychosis prevalence study to detail the cardiometabolic health of people suffering psychotic disorders in the community. This phase of the study aimed to determine whether differences between the two samples existed (i.e. the Forensic and community samples) in relation to CMD indicator prevalence, as well as the role of potential CMD determinants and potential explanatory factors.

1.3 Terminology

The term *'forensic patient'* in this study is used to describe a person who receives a verdict from the court in relation to a mental illness defense or is found unfit or mentally incompetent to be tried for an offence. They are often detained under Mental Health legislation in secure mental health facilities and in some jurisdictions may spend time in custodial settings. Within mental health services, they are most commonly diagnosed with psychotic disorders and have risk management and criminogenic needs.

The term *'secure setting'* in this study refers to institutions where mentally ill offenders are detained involuntarily under Mental Health or criminal legislation. They include correctional centres and/or specialist forensic mental health facilities with increased levels of security and restrictions compared to general mental health facilities.

The term *"cardiometabolic disease (CMD) indicators"* in this study is used as an umbrella term for a group of conditions associated with cardiovascular and cerebrovascular diseases and include hypertension, dyslipidaemia, diabetes, weight related problems, cardiovascular disease, and metabolic syndrome.

The term *"metabolic syndrome"* in this study was defined by the harmonised criteria developed by the International Diabetes Federation (IDF) Task Force on Epidemiology and Prevention and related expert organisations (Alberti et al., 2009). However, an internationally accepted and recognised diagnostic criteria does not currently exist; and this was illustrated in the systematic review where the methods used to define the criteria for metabolic syndrome differed across studies. There is also controversy regarding the validity of metabolic syndrome as a discrete disorder with an

underlying pathogenesis of insulin resistance, or whether it is a cluster of risk factors for other disorders, such as cardiovascular disease and type II diabetes (Kassi, Pervanidou, Kaltsas & Chrousos, 2011). It was included in this study to highlight the potential burden of comorbid disease in the study group.

CHAPTER 2 – SYSTEMATIC REVIEW OF THE PREVALENCE OF CARDIOMETABOLIC DISEASE IN PEOPLE WITH PSYCHOTIC DISORDERS IN SECURE SETTINGS

Acknowledgment

This literature review is partially comprised of a review paper that I contributed to, along with Professor Kimberlie Dean and Dr Tobias Mackinnon, and published in the Journal of Forensic Psychiatry & Psychology. The results from this paper are contained in part in this chapter. A copy of the original published paper has been included in the Appendix section. The Version of Record of this manuscript has been published and is available in the Journal of Forensic Psychiatry & Psychology, 16 December 2020, http://www.tandfonline.com, doi.org/10.1080/14789949.2020.1859588.

2.1 Introduction

People with psychotic disorders have an increased prevalence of CMD, compared to the general population. Furthermore, forensic patients, and mentally ill offenders with psychotic disorders more broadly, have unique treatment needs and are often admitted to secure mental health facilities or detained in custodial centres for extended periods of time. Less is known about the prevalence of CMD in people with psychotic disorders in secure settings.

The review aimed to:

1. Identify all available studies relating to the prevalence of CMD indicators in people with psychotic disorders in secure settings.
2. Summarise and where possible present results of weighted pooled prevalence data on hypertension, dyslipidaemia, diabetes, weight-related problems, cardiovascular (CVD) and metabolic syndrome in the included studies.
3. Provide a descriptive analysis and critical appraisal of the quality of evidence in the included studies.

2.2 Methods

Search criteria

A PRISMA guided systematic search was conducted (Moher, Liberati, Tetzlaff & Altman, 2009). Searches were performed on MEDLINE, EMBASE, PsycINFO, CINCH (Australian Criminology Database) and NCJRS (National Criminal Justice Reference Service) from inception until May 2019 for articles written in English or translated into English. The key search terms were "metabolic syndrome", "cardiovascular disease", "schizophrenia", "forensic psychiatry". Additional key search terms used in criminology and justice databases were "psychosis", "forensic" and "hospital". Search strings were used to combine each key search term. Each key search term included up to 24 synonyms, which were used to combine MeSH terms. Other data sources included Google Scholar, hand searches and reference list reviews. Duplicate studies were removed from the combined search results and titles and abstracts were screened according to the eligibility criteria. The full text of eligible studies were independently assessed and discrepancies were discussed to determine which studies were included for review.

Studies were included in the review if:

1. They were cross-sectional, case-control or cohort in design. Baseline data reported for intervention studies were also included. Case studies, case series and qualitative studies were excluded, and conference abstracts and posters were also excluded unless sufficient summary data was available.
2. The majority of individuals in the study were diagnosed with psychotic disorders included in the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) classification of schizophrenia spectrum and other psychotic disorders; and classified as forensic patients or mentally ill offenders. Studies of male and female adults were included.
3. They were conducted in secure (low, medium, or high) mental health facilities or custodial centres. Samples from acute general psychiatric inpatient hospitals, long-stay civil mental health rehabilitation units and police cells were excluded.
4. They reported prevalence data for at least one of the CMD indicators considered, including hypertension, diabetes, dyslipidaemia, weight related problems, CVD and metabolic syndrome. Studies which used prescribed treatment as a proxy for a CMD indicator diagnosis were also eligible. Sample size data was also required for each study to conduct

weighted pooled analyses. Studies were excluded if only mean data, rather than prevalence rates, or mortality data were reported.

Data extraction

Data was extracted on items which included study method, sample age distribution, sample sex distribution, sample size, clinical setting, and country. The type of CMD indicators included and the details of psychiatric diagnoses were also recorded. Summary data was collected on the prevalence of each reported CMD indicator, including raw numbers and percentages. Where available, information related to the method used to measure and define CMD indicators was recorded for further sub-group analysis.

Data Analysis

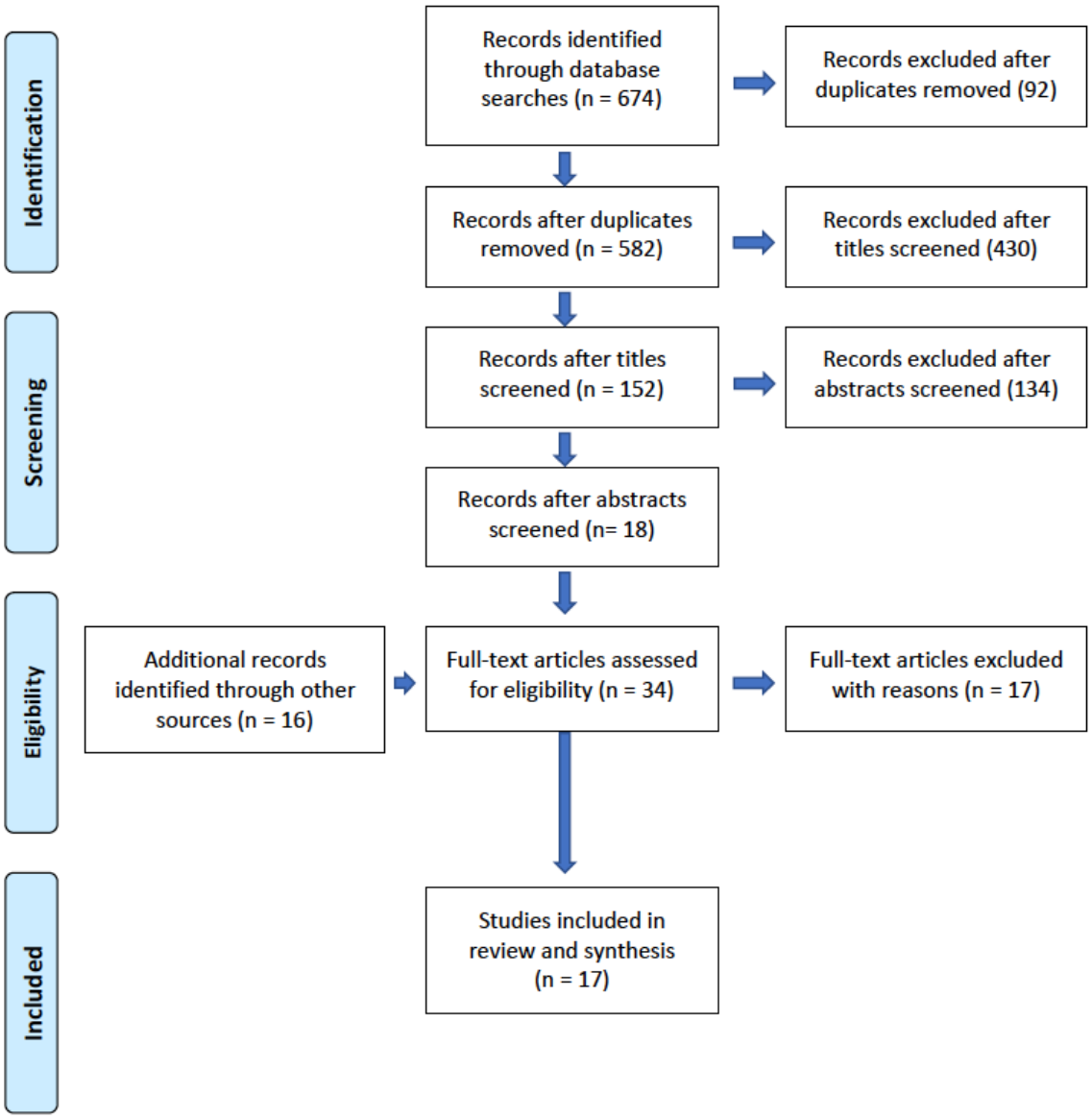
Prevalence data for each CMD indicator were weighted according to sample size from each individual study to calculate a weighted average prevalence of data across the studies. Where possible sub-group analyses, within each CMD indicator category, were conducted based on the type of diagnostic criteria used. Confidence intervals for each weighted pooled prevalence estimate were calculated from the standard error of each proportion using the normal approximation to the binomial.

2.3 Results

Study selection

Database searches identified 674 studies. After 92 duplicate studies were removed the remaining 582 studies were screened for eligibility. Of these, 430 studies were excluded following title screen and a further 134 studies were excluded after abstracts were screened. Eighteen eligible articles were identified through database searches and a further 16 studies were identified through searches of other data sources including Google Scholar, hand searches and reference lists. Of the 34 articles submitted for full-text assessment, 17 studies did not meet the inclusion criteria (page 6) and were excluded. Seventeen studies were determined to be eligible and comprised the final sample (Figure 1).

Figure 1. Study flow diagram



Study characteristics (Table 1)

Country and clinical setting

Of the 17 studies determined to be eligible, five studies were conducted in the United Kingdom, four in the United States of America, two in Finland, two in New Zealand and one in each of Australia, Canada, Ireland and Norway. Thirteen studies were conducted in secure mental health facilities and four studies were conducted in custodial centres.

Participants

Eleven studies included both male and female participants; male participants accounted for 68% to 89% of the samples in those studies, where the proportion was known. The remaining six studies included only male participants. In 11 studies the mean or median age of the study sample was between 30-39 years and in three studies the mean or median age was between 40-49 years. One study included two study groups, one of which had a mean age between 30-39 years and the other between 40-49 years. One study did not include the mean or median age of the sample. Eleven of the studies specified diagnoses of psychotic disorders and related conditions, and where the proportions were known, they accounted for 44% to 100% of the samples. Of the remaining studies where details of psychiatric diagnoses were not specified, participants were either described as either 'violent psychiatric patients', 'mentally disordered offenders', having serious mental disorders or receiving antipsychotic medication.

Study design

Nine studies were conducted as retrospective file reviews or audits and five studies as cross-sectional surveys. Other study designs included two intervention studies and one case-control study. Six studies had a sample size of less than 100 participants, with the smallest sample including only 13 participants. Ten studies had sample sizes between 100 and 500 participants. The largest study had 838 participants. In the study by Puzzo, Gable and Cohen (2017), a discrepancy in sample size was identified within the study (479 vs 500); taking a conservative approach, the smaller sample size was relied on when conducting analyses. Within some studies the sample sizes varied according to which CMD indicator was measured. Where possible sub-groups within the same study were combined to calculate the total prevalence of each CMD indicator.

Table 1. Summary of eligible studies included in review

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Cormac et al. (2005)	United Kingdom	Cross-sectional survey and review of case notes between November 2000 and March 2001	248	Mean age 39	Male 214/248 (86%) Female 34/248 (14%)	Secure mental health facility	Schizophrenia 131/248 (53%); personality disorder 119/248 (48%)
Hefazi et al. (2015)	United States of America	Review of medical records as of July 2014	149	Mean age 49	Male	Custodial centre	Prescribed antipsychotics for at least 6 months
Hillbrand et al. (1995)	United States of America	Retrospective review of medical records during 2-year period	106	Mean age 33-34	Male	Secure mental health facility	Violent psychiatric patients
Hilton et al. (2015)	Canada	Review of medical records on admission and discharge	122	Mean age 35.1	Male	Secure mental health facility	Schizophrenia 47%; personality disorder 12%; mood disorder 8%

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Huthwaite et al. (2017)	New Zealand	Cross-sectional survey; review of clinical records and patient interviews between March 2014 and March 2015	51 (forensic – 30 rehabilitation – 21)	Mean age 38	Male 40/51 (78%) Female 11/51 (22%)	Secure mental health facility	Schizophrenia 78%; schizoaffective disorder 12%; bipolar affective disorder 4%; psychotic disorder NOS 2% Total schizophrenia & related psychosis 92%
Ivbijaro et al. (2008)	United Kingdom	Audit; retrospective data collection from case notes for one-year period	56	Unknown	Male	Secure mental health facility	Mentally disordered offenders
Long et al. (2014)	United Kingdom	Three-year retrospective survey using electronic patient records	351	Mean age 38.12	Male 239/351 (68%) Female 112/351 (32%)	Secure mental health facility	Schizophrenia & related psychosis 53%; personality disorder 12%
MacFarlane et al. (2004)	United Kingdom	Cross-sectional survey; point prevalence measured on one day in September 2001	408	Approximately 90% of sample was under <60	Male 89% Female 11%	Secure mental health facility	Approximately 70% of sample severe mental illness; 25% personality disorder

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Mat et al. (2015)	Ireland	Data collected on admission and during admission	76	Mean age 36.3	Male 67/76 (88%) Female 9/76 (12%)	Secure mental health facility	Schizophrenia 83%
Ojala et al. (2008)	Finland	Retrospective review of medical records of patients from January 2002 and May 2002	221	Median age 41	Male 89% Female 11%	Secure mental health facility	Prescribed antipsychotic medication for at least 6 months (schizophrenia & related psychosis 92%)
Paavola et al. (2002)	Finland	Retrospective case-control study; review of medical records from January 1996 and May 1999	385	Mean age 36.8	Male	Secure mental health facility	Schizophrenia & related psychosis 44%; personality disorder 30%
Prebble et al. (2011)	New Zealand	Baseline measures of healthy living program intervention study	16 (program A – 7; program B – 9)	Mean age: Group A – 47 Group B – 36.5	Group A: Male 5/7 (71%) Female 2/7 (29%) Group B: Male 8/9 (89%) Female 1/9 (11%)	Secure mental health facility	Group A: schizophrenia 5/7 (71%); intellectual disability 2/7 (29%) Group B: schizophrenia 6/9 (33%); remainder had either delusional disorder, bipolar affective disorder, or personality disorder Total schizophrenia & related psychosis 69%

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Puzzo et al. (2017)	United Kingdom	Service evaluation; data collected from June to August 2015	479	Mean age 30-39	Male 418/479 (87%) Female 61/479 (13%)	Secure mental health facility	In two groups with diabetes 63% & 78% had schizophrenia respectively
Reeves et al. (2017)	United States of America	Retrospective chart review from 2005 until 2013	838	Mean age 44.6 (of those with metabolic syndrome)	Male & Female	Custodial centre	Psychotic spectrum disorder & prescribed antipsychotic medication for at least 6 months (schizophrenia 311; schizoaffective disorder 396; psychotic disorder NOS 131) Total schizophrenia & related psychosis 100%
Sazhin & Reznik (2008)	Australia	Retrospective review of medical records from July 2003 and January 2006	48	Average age 35.5	Male	Custodial centre	Major mental illness 44/48 (92%) (schizophrenia, schizophreniform psychosis, delusional disorder 39, schizoaffective disorder 7, manic psychosis 1)
Tetlie et al. (2008)	Norway	Baseline and follow up measures of an exercise intervention study	15 – baseline 13 – follow up	Mean age 32.5	Male 10 Female 3 Unknown 2	Secure mental health facility	Severe mental disorders

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Wolff et al. (2012)	United States of America	Self-report survey conducted between June 2009 and August 2009	Weight measured – 303 Prescribed medication for diabetes, heart disease, hypertension, or high cholesterol – 291	Mean age (of whole sample with and without serious mental disorder): Male 33.8 Female 36.5	Weight measured: Male 261/303 (86%) Female 42/303 (14%) Prescribed medication for diabetes, heart disease, hypertension, or high cholesterol: Male 251/291 (87%) Female 40/291 (14%)	Custodial centre	Serious mental disorder (schizophrenia or bipolar affective disorder)

CMD indicator prevalence rates

Hypertension

The internationally accepted diagnostic criteria for hypertension is outlined in Table 2. The prevalence of hypertension was reported in five studies (Table 3). The weighted pooled prevalence of hypertension across all studies was 25.0% (N=857, 95% CI 22.1-27.9).

Table 2. World Health Organization definition of hypertension (2019)

Hypertension is diagnosed if, when it is measured on two different days, the systolic blood pressure readings on both days is ≥140 mm Hg and/or the diastolic blood pressure readings on both days is ≥90 mm Hg.

Table 3. Summary of studies measuring the prevalence of hypertension

Study	**Diagnostic criteria**	**Sample size (n)**	**Prevalence (%)**
Cormac et al. (2005)	At risk due to hypertension	248	42.7
Ivbijaro et al. (2008)	Hypertension	56	12.5
Long et al. (2014)	Prescribed antihypertensive medication	351	12.7
Ojala et al. (2008)	BP >130/85 mm Hg or prescribed antihypertensive medication	195	28.2
Prebble et al. (2011)	DBP > 90 mm Hg	7	28.6

The method of determining the presence of hypertension differed amongst the studies. Two studies (Long, Rowell, Gayton, Hodgson, & Dolley, 2014; Ojala et al., 2008) used prescriptions of antihypertensive medication as a proxy for hypertension diagnosis. Although this was likely to have over-estimated the prevalence of hypertension due to antihypertensive medications having more than one clinical indication, it is also possible to have underestimated the prevalence due to the exclusion of individuals with untreated hypertension. When these studies were removed from the weighted analysis, the weighted prevalence of the remaining studies increased to 36.9% (N=311, 95% CI 31.6-42.3), indicating that the underestimating effect was perhaps stronger.

The weighted pooled analysis was strongly influenced by the study by Cormac, Ferriter, Benning, & Saul (2005), which reported the highest prevalence of hypertension (42.7% in 248 inpatients). In this study blood pressure was measured only once and the diagnostic criteria for those who were "at risk due to hypertension" was not specified, which may have over-estimated the prevalence of hypertension.

Dyslipidaemia

The internationally accepted diagnostic criteria for lipid disorders are outlined in Table 4. The prevalence of dyslipidaemia was reported in eight studies (Table 5). The weighted pooled prevalence of dyslipidaemia across all studies was 29.2% (N=1,135, 95% CI 26.6-31.9).

Table 4. National Cholesterol Education Program Adult Treatment Panel III classification of lipid disorders (National Heart, Lung, and Blood Institute, 2002)

Lipid disorder	Normal		Borderline high		High	
Total cholesterol	<200 mg/dL	<5.2 mmol/L	200-239 mg/dL	5.2-6.1 mmol/L	≥240 mg/dL	≥6.2 mmol/L
LDL-C	<100 mg/dL	<2.6 mmol/L	100-159 mg/dL	2.6-4.0 mmol/L	≥160 mg/dL	≥4.1 mmol/L
HDL-C	<40 mg/dL	<1.0 mmol/L	40-59 mg/dL	1.0-1.5 mmol/L	≥60 mg/dL	≥1.6 mmol/L
Triglycerides	<150 mg/dL	<1.7 mmol/L	150-199 mg/dL	1.7-2.2 mmol/L	≥200 mg/dL	≥2.3 mmol/L

LDL-C = Low density lipoprotein cholesterol; HDL-C = High density lipoprotein cholesterol

Table 5. Summary of studies measuring the prevalence of dyslipidaemia

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Hillbrand et al. (1995)	Serum cholesterol >200mg/dl	106	34.0
Huthwaite et al. (2017)	Prescribed statin	51	14.0
Long et al. (2014)	Serum cholesterol >5.0mmol/L or prescribed treatment for hyperlipidaemia	351	46.2
Ojala et al. (2008)	Serum triglycerides >1.7mmol/l or prescribed treatment hypertriglyceridaemia Serum HDL-C <1.0mmol/l for males; <1.3mmol/l for females	194	52.4 – abnormal triglycerides or treatment for hypertriglyceridaemia 43.7 – abnormal HDL-C
Paavola et al. (2002)	Prescribed cholesterol-lowering medication	385	2.6
Prebble et al. (2011)	Hyperlipidaemia	16	37.5
Sazhin & Reznik (2008)	Cholesterol >5.1mmol/L Triglycerides >1.7mmol/L	17	52.9 – abnormal cholesterol 47.1 – abnormal triglycerides
Tetlie et al. (2008)	Abnormal reference range of cholesterol and triglycerides	15	0

HDL-C = High density lipoprotein cholesterol

The approach to determining the presence of dyslipidaemia amongst the studies varied, with differences in the definitions/types of dyslipidaemia included as well as the source of information relied upon, typically either biochemistry results and/or prescriptions of medications used to treat

dyslipidaemia. Four studies (Hillbrand, Spitz, & Foster, 1995; Long et al., 2014; Paavola, Repo-Tiihonen, & Tiihonen, 2002; Sazhin & Reznik, 2008) measured the prevalence of abnormal serum cholesterol, three studies (Ojala et al., 2008; Sazhin & Reznik, 2008; Tetlie, Eik-Nes, Palmstierna, Callaghan, & Nottestad, 2008) measured abnormal serum triglycerides, one study (Ojala et al., 2008) measured abnormal serum high-density lipoprotein cholesterol (HDL-C) and four studies (Huthwaite, Elmslie, Every-Palmer, Grant, & Romans, 2017; Long et al., 2014; Ojala et al., 2008; Paavola et al., 2002) measured the prevalence of patients prescribed medication used to treat dyslipidaemia. In studies where more than one approach was used for the same sample the highest reported prevalence was included in the weighted pooled analysis.

Ojala et al. (2008) found the prevalence of high serum triglyceride levels or being prescribed medication for hypertriglyceridaemia to be 52.4% in 221 inpatients of a secure mental health facility in Finland in 2002. Surprisingly, Paavola et al. (2002) found that only 8 out of 385 (2.6%) inpatients in the same secure mental health facility in Finland were prescribed cholesterol lowering medication between 1996-1999. This wide variation in prevalence between these two studies from the same hospital may have reflected a change in prescribing practices between time periods.

In studies with smaller sample sizes, Prebble et al. (2011) found the point prevalence of hyperlipidaemia in two groups to be 5 out of 7 patients and 1 out of 9 patients; and Tetlie et al. (2008) found no cases of high cholesterol or high triglycerides in 15 inpatients of a secure mental health facility The highest prevalence of high cholesterol (52.9%) was found in a study conducted in a prison hospital (Sazhin & Reznik, 2008) with a sample size of 17.

Diabetes

The internationally accepted diagnostic criteria for diabetes is outlined in Table 6. The prevalence of diabetes was reported in 12 studies (Table 7). The weighted pooled prevalence of diabetes across all studies was 11.3% (N=2,561, 95% CI 10.0-12.5).

Table 6. International Diabetes Federation (IDF) modified diagnostic criteria for diabetes (2019)

Classification	Diagnostic criteria
Diabetes Should be diagnosed if one or more of the following criteria are met.	FPG ≥7.0 mmol/L (126mg/dL) Two-hour plasma glucose after 75g oral glucose load (OGTT) ≥11.1 mmol/L (200 mg/dL) HbA1c ≥48 mmol/mol (equivalent to 6.5%) Random plasma glucose (in the presence of symptoms of hyperglyecaemia) >11.1 mmol/mol (200 mg/dL)
Impaired glucose tolerance (IGT) Should be diagnosed if both of the following criteria are met	FPG <7.0 mmol/L (126mg/dL) Two-hour plasma glucose after 75g oral glucose load (OGTT) ≥7.8 and <11.1 mmol/L (200 mg/dL)
Impaired fasting glucose (IFG) Should be diagnosed if the first or both of the following are met	FPG 6.1-6.9 mmol/L (126 mg/dL) Two-hour plasma glucose after 75g oral glucose load (OGTT) <7.8 mmol/L (200 mg/dL)

FPG = Fasting plasma glucose; OGTT = Oral glucose tolerance test

Table 7. Summary of studies measuring the prevalence of diabetes

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Cormac et al. (2005)	Diabetes and metabolic illness	248	9.0
Huthwaite et al. (2017)	Diabetes	51	3.9
Ivbijaro et al. (2008)	Diabetes mellitus	56	17.9
Long et al. (2014)	Type II diabetes mellitus	351	10.0
MacFarlane et al. (2004)	Type II diabetes mellitus	408	8.6
Mat et al. (2015)	Type II diabetes mellitus	76	15.8
Ojala et al. (2008)	Impaired glucose regulation (IGR); defined as fBGL >6.1mmol/l or diabetes treatment	187	30.6
Paavola et al. (2002)	Prescribed medication for diabetes	385	1.8
Prebble et al. (2011)	Diabetes	16	25.0
Puzzo et al. (2017)	Type II diabetes mellitus	479	18.4
Tetlie et al. (2008)	Abnormal reference range of glucose	13	0.0
Wolff et al. (2012)	Prescribed medication for diabetes	291	5.3

fBGL = Fasting blood glucose level

The summary data used to measure diabetes and related conditions differed amongst the studies. Eight studies (Cormac et al., 2005; Huthwaite et al., 2017; Ivbijaro, Kolkiewicz, McGee, & Gikunoo, 2008; Long et al., 2014; MacFarlane, Gill, Finnegan, & Pinkney, 2004; Mat et al., 2015; Prebble et al., 2011; Puzzo et al., 2017) measured the prevalence of a diagnosis of type II diabetes mellitus from medical records and self-report, two studies (Paavola et al., 2002; Wolff, Shi, Fabrikant, & Schumann, 2012) measured the prevalence of patients prescribed medication used to treat diabetes; and two studies (Ojala et al., 2008; Tetlie et al., 2008) measured the prevalence of other abnormal glucose states (impaired glucose regulation and abnormal reference range of glucose). Of the studies which measured a recorded diagnosis of type II diabetes mellitus, the weighted pooled prevalence of diabetes was 12.4% (N=1,685, 95% CI 10.8-14.0).

The highest prevalence of diabetes (30.6%) was reported in a study by Ojala et al. (2008), which included both impaired glucose regulation (IGR) or prescriptions for diabetes medication in determining the diagnosis. IGR is a pre-diabetic state and affects a greater proportion of the population than diabetes mellitus. Additionally, oral hypoglycaemic medications such as metformin may have been prescribed for indications other than diabetes, such as for weight loss. Therefore, both these factors are likely to have over-estimated the prevalence in this study compared to the other studies.

A very low prevalence (1.8%) was found in a study by Paavola et al. (2002), which measured the prevalence of prescriptions for diabetes medication in a secure mental health facility in Finland. The reason for this considerably lower prevalence compared to other studies in the review could not be fully elucidated from the article, however a possible explanation may have been a preference for non-pharmacological or alternative prescribing practices for diabetes in the service where the study was conducted.

Weight-related problems

The internationally accepted classification criteria for Body Mass Index are outlined in Table 8. The prevalence of weight-related problems was reported in nine studies (Table 9). The weighted pooled prevalence of weight-related problems across the studies was 61.1% (N=1,389, 95% CI 58.5-63.7).

Table 8. World Health Organization classification of Body Mass Index (BMI) (2020)

Classification	BMI (kg/m²)
Healthy weight	18.5 – 24.9
Overweight	25.0 – 29.9
Obesity class I	30.0 – 34.9
Obesity class II	35.0 – 39.9
Obesity class III	≥40.0 or more

Table 9. Summary of studies measuring the prevalence of weight-related problems

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Cormac et al. (2005)	Obese (BMI > 30) Waist size that required an intervention to reduce health risk (>102cm in men)	248	Male & female: Obese – 41.1 Waist circumference – 55.6 Male: Obese – 36.0 Waist circumference – 53.0 Female: Obese – 75.0 Waist circumference – 76.0
Hilton et al. (2015)	BMI (Health Canada classification, 2003)	122	Overweight – 34.0 Obese I – 19.0 Obese II – 11.0 Obese III – 5.0 Total – 69.0
Huthwaite et al. (2017)	BMI (WHO classification)	51	Overweight – 20.0 Obese I – 28.0 Obese II – 20.0 Obese III – 26.0 Total – 94.0
Long et al. (2014)	BMI (WHO classification, 1995)	351 NB: total sample size (351); total number of serial BMI measurements (761)	Male & female: Overweight – 34.3 Obese I – 23.0 Obese II – 7.2 Obese III – 1.8 Total – 66.0 Male: Overweight – 35.4 Obese I – 20.5 Obese II – 7.0 Obese III – 2.0 Female: Overweight – 32.4 Obese I – 28.0 Obese II – 7.5 Obese III – 1.6

Mat et al. (2015)	Obese (BMI > 30)	76	75.0
Ojala et al. (2008)	BMI >30 (WHO classification, 1999)	195	38.6
Sazhin & Reznik (2008)	Weight (kg)	30	>90kg – 50.0 >100kg – 23.0
Tetlie et al. (2008)	BMI	13	Overweight – 67.0 BMI>30 – 54.0
Wolff et al. (2012)	BMI Overweight (BMI 25-29.9) Obese (BMI > 30)	303	Male & female: Overweight – 42.6 Obese – 35.3 Total – 77.9 Male: Overweight – 43.2 Obese – 34.2 Total – 77.4 Female: Overweight – 37.5 Obese – 42.5 Total – 80.0

BMI = Body mass index; WHO = World Health Organization

The diagnostic criteria for weight-related problems differed amongst the studies. Eight studies (Cormac et al., 2005; Hilton et al., 2015; Huthwaite et al., 2017; Long et al., 2014; Mat et al., 2015; Ojala et al., 2008; Tetlie et al., 2008; Wolff et al., 2012) measured the prevalence of having a BMI of 30 and above (obese and above); the weighted pooled prevalence in these studies was 39.8% (N=1,359, 95% CI 37.2-42.4). Five of these studies (Hilton et al., 2015; Huthwaite et al., 2017; Long et al., 2014; Tetlie et al., 2008; Wolff et al., 2012) also measured the prevalence of having a BMI of 25 and above (overweight and above); and the weighted pooled prevalence in these studies was 72.4% (N=840, 95% CI 69.4-75.5).

In the three studies (Cormac et al., 2005; Long et al., 2014; Wolff et al., 2012) which compared the categories of obesity in males and females, males had higher rates of being overweight whereas females had higher rates of being obese. Females had higher overall rates of abnormal BMI. Long et al. (2014) suggested that women may be more susceptible to weight gain on antipsychotic medications such as clozapine and had lower levels of physical activity compared to men.

Cormac et al. (2005) found the prevalence of having a waist circumference that "required an intervention to reduce health risk" in males was 53% and in females 76%. In a prison hospital in Australia, Sazhin and Reznik (2008) found 50% of male inmates weighed over 90kg and 23% weighed over 100kg.

Cardiovascular disease

The internationally accepted definition of cardiovascular diseases is outlined in Table 10. The prevalence of cardiovascular disease (CVD) was reported in six studies (Table 11). The weighted pooled prevalence of CVD across all studies was 15.6% (N=1,047, 95% CI 13.4-17.8).

Table 10. World Health Organization definition of cardiovascular diseases (CVDs) (2017)

A group of disorders of the heart and blood vessels including:
Coronary heart disease
Cerebrovascular disease
Peripheral arterial disease
Rheumatic heart disease
Congenital heart disease
Deep vein thrombosis and pulmonary embolism
Cardiomyopathies
Cardiac arrhythmias

Table 11. Summary of studies measuring the prevalence of cardiovascular disease

Study	**Diagnostic criteria**	**Sample size (n)**	**Prevalence (%)**
Cormac et al. (2005)	Cardiovascular disease	248	11.0
Huthwaite et al. (2017)	Cardiovascular condition	51	9.8
Ivbijaro et al. (2008)	Coronary heart disease (CHD) Stroke & transient ischaemic attacks (TIA)	56	7.1 – CHD 1.8 – stroke & TIA
Paavola et al. (2002)	Prescribed medications for cardiovascular diseases (β-adrenergic blocking agents, nitrates, ACE-inhibitors, acetylsalicylic acid, calcium channel-blocking drugs, diuretics)	385	15.8
Prebble et al. (2011)	Cardiac conditions	16	18.8
Wolff et al. (2012)	Prescribed medication for heart disease, hypertension, or high cholesterol	291	Male & female: All weights – 21.6 Male: Healthy weight – 6.0 Overweight – 22.8 Obese – 32.0

		Female: Healthy weight – 12.5 Overweight/obese – 21.9

ACE = angiotensin-converting enzyme

The diagnostic criteria for CVDs encompass a variety of cardiac, neurological, and vascular conditions and no studies had diagnostic criteria that were directly comparable. Two studies (Paavola et al., 2002; Wolff et al., 2012) used prescribed medication to treat CVD as a proxy for diagnosis. Because medications for hypertension or dyslipidaemia often have multiple clinical indications, these studies are likely to have overestimated the true prevalence of prescribing for CVD in their samples, but again underestimation may have also resulted due to the loss of individuals with untreated disease. When these studies were removed from the weighted pooled analysis across all studies, the weighted pooled prevalence of the four remaining studies (Cormac et al., 2005; Huthwaite et al., 2017; Ivbijaro et al., 2008; Prebble et al., 2011), which measured the prevalence of CVD related diagnoses was 10.5% (N=371, 95% CI 7.5-13.7).

Wolff et al. (2012) reported the prevalence of inmates with serious mental disorder in the healthy weight, overweight and obese weight ranges, who were prescribed medication for either heart disease, hypertension, or high cholesterol. The combined total prevalence was 21.6%, however medication prescribed for other indications such as hypertension and high cholesterol were also included.

Metabolic syndrome

The internationally accepted diagnostic criteria for metabolic syndrome is outlined in Table 12. The prevalence of metabolic syndrome (MS) was reported in five studies (Table 13). The weighted pooled prevalence of MS across all studies was 23.5% (N=1,390, 95% CI 21.3-25.7).

Table 12. American Heart Association criteria for the clinical diagnosis of the metabolic syndrome (Alberti et al., 2009)

Three out of the following 5 measures	
Measure	**Categorical cut points**
Elevated waist circumference	Population and country-specific definitions
Elevated triglycerides; or drug treatment for elevated triglycerides	≥ 150 mg/dL (1.7 mmol/L)
Reduced HDL cholesterol; or drug treatment for reduced HDL	< 40 mg/dL (1.0 mmol/L) in males < 50 mg/dL (1.3 mmol/L) in females
Elevated blood pressure; or antihypertensive drug treatment of previously diagnosed hypertension	Systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg
Elevated fasting glucose; or drug treatment for elevated glucose	≥ 100 mg/dL (5.6 mmol/L)

HDL = High density lipoprotein; BP = Blood pressure

Table 13. Summary of studies measuring the prevalence of metabolic syndrome

Study	**Diagnostic criteria**	**Sample size (n)**	**Prevalence (%)**
Hefazi et al. (2015)	At least three of the following: - BMI >30 - Triglycerides >150 mg/dL - HDL-C <40 mg/dL - BP >130/85 mm Hg - HbA1c >6%	149	42.3
Hilton et al. (2015)	All the following: - BMI >25 - BP >130 mmHg - Waist circumference >102 cm	106	22.0
Mat et al. (2015)	Not defined	76	57.9
Ojala et al. (2008)	At least three of the following: - BMI >30 - fBGL >6.1mmol/l or on diabetes treatment - Triglycerides >1.70 mmol/l or on hypertriglyceridaemia treatment - HDL-C <1.00 mmol/l for males; <1.30 mmol/l for females - BP >130/85 mm Hg or on antihypertensive treatment	221	33.0
Reeves et al. (2017)	At least three of the following: - BMI >25 - Prescription for lipid modifying agent - Prescription for antihypertensive - Prescription for a diabetic medication	838	14.7

BMI = Body mass index; HDL-C = High density lipoprotein cholesterol; BP = Blood pressure; HbA1c = Glycated haemogloblin; fBGL = Fasting blood glucose level

The method used to define the criteria for MS differed across studies. Of the three studies (Hefazi, Johnson, & Chen-Peng, 2015; Hilton, Ham, Lang, & Harris, 2015; Ojala et al., 2008) which utilised biochemistry results and physical observations to determine the presence of MS, the weighted pooled prevalence of MS was 33.5% (N=476, 95% CI 29.2-37.7).

Whilst the method used to define and measure MS for the study (Mat et al., 2015) with the highest prevalence (57.9%) was not available, the two studies (Hefazi et al., 2015; Ojala et al., 2008) with the next highest prevalence of MS used the greatest number of parameters to diagnose MS, resulting in lower diagnostic thresholds compared to the other studies.

The study by Reeves, Tamburello, and DeBilio (2017), which had the largest sample size (838 participants) of all studies included in the review, found the lowest prevalence of MS (14.7%). This study used prescriptions of medications used to treat dyslipidaemia, hypertension, and diabetes as parameters for MS diagnosis. By selecting only participants with treated components of MS this approach is likely to have under-estimated the true prevalence of MS.

2.4 Discussion

This systematic review of CMD indicators in people with psychotic disorders in secure settings identified 17 eligible studies, conducted across eight countries, and included a total of 7851 patients. The majority of included studies were conducted as file reviews or surveys of between 100 and 500 participants in secure psychiatric hospitals, in either the United Kingdom or the United States of America. Participants were predominantly men with a mean age between 30-39 years. The majority of excluded studies were conducted in settings such as acute inpatient units where admissions are typically shorter or from civil mental health rehabilitation units which are less physically restrictive environments.

Overall, a substantial burden of CMD risk was identified, with weighted pooled prevalence rates identified of 25.0% for hypertension (95% CI 22.1-27.9), 29.2% for dyslipidaemia (95% CI 26.6-31.9), 11.2% for diabetes (95% CI 9.9-12.4), 72.4% for being overweight or obese (95% CI 69.4-75.5), 15.6% for cardiovascular disease (95% CI 13.4-17.8) and 23.5% for metabolic syndrome (95% CI 21.3-25.7). There was, however, considerable methodological variation noted between

the reviewed studies, particularly with regard to the methods for ascertaining the presence of CMD indicators.

Main findings

The weight pooled prevalence rates for each CMD indicator from the current study varied in comparison to established prevalence rates in the general population and the wider population of people with psychotic disorders, although variations may be influenced to some extent by differences in the methodologies employed.

According to the World Health Organization (2021), the global prevalence of CMDs, in adults across all age ranges, was estimated to be 39% for raised cholesterol in 2008, 40% for hypertension in 2008, and 39% and 13% for being overweight and obese respectively in 2016. The International Diabetes Federation estimated the global prevalence for diabetes as 9.3% (2019).

Age specific rates of CMDs in the general population were reported by the Australian Institute of Health and Welfare (2019). The prevalence of diabetes (11.2% reviewed studies vs 4.5% AIHW) and cardiovascular disease (15.6% vs 3.0%) obtained from the reviewed studies was higher than the general population aged 45-54 (2017-18). The prevalence of being overweight or obese from the reviewed studies was similar (72.4% vs 74.0%) compared to the general population aged 45-54, but marginally higher (72.4% vs 68.7%) when compared to the 35-44 age group (2017-18). The prevalence of hypertension obtained from the reviewed studies was similar (25.0% vs 24.4%) compared to the general population aged 45-54, but higher (25.0% vs 16.1%) when compared to the 35-44 age group (2014-15). The prevalence of dyslipidaemia obtained from the reviewed studies was lower (29.2% vs 59.2%) compared to the general population aged 35-44 (2011-12). One reason for the lower rate of dyslipidaemia in the reviewed studies may have been because data was not available to aggregate all types of lipid disorders; whereas the AIHW result was an aggregate of abnormal total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides and people taking lipid-modifying medication.

While the prevalence of several of the CMD indicators for the reviewed studies was higher than reported in general population studies, the extent to which they are comparable to other non-forensic samples of individuals with psychotic disorders must be considered. In large international

systematic review of patients with schizophrenia (n=185,606), Vancampfort et al. (2013) found the prevalence of cardio-metabolic abnormalities in people with schizophrenia to be 36.3% for hypertension, 34.5% for hypertriglyceridaemia, 37.5% for low HDL cholesterol, 31.1% for metabolic syndrome and 9.0% for diabetes. In comparison, the weighted pooled prevalence rates in the reviewed studies were lower for hypertension (25.0%), dyslipidaemia (29.2%) and metabolic syndrome (23.5%) and comparable for diabetes (11.2%).

Overall, the prevalence rates of CMD indicators in people with psychotic disorders in secure settings were generally higher compared to the general population and either similar or lower when compared to people with psychotic disorders in the community.

Between study heterogeneity

Considerable variation in study design and methodology was identified across the studies included in the review. In particular, the methods of determining the presence of CMD indicators, both the definitions and data sources used, varied considerably. For example, some studies used the results of one-off testing to diagnose the presence of hypertension or diabetes while others relied on self-reported information on diagnosis of hypertension. In a number of cases, perhaps due to the convenience of data access, records of prescriptions of medication were used as a proxy for the presence of CMD indicators (e.g. antihypertensive, hypoglycaemic medication). This method may have underestimated CMD indicator frequency if participants in the sample with the disease were treated with non-pharmacological interventions or were untreated. The latter may be a particular problem for individuals in settings with limited access to healthcare treatment, such as in custodial centres. Alternatively, in some circumstances, studies relied on prescription information and were likely to have overestimated CMD indicator frequency because the medications in question had more than one indication (e.g. antihypertensive medication).

Differences in approaches to sampling may also have given rise to variation in reported prevalence rates across studies. In studies where individual recruitment following the ascertainment of informed consent was required, participation bias may have resulted in those with more severe psychotic disorders, and perhaps a higher risk of CMD, being excluded from the sample. Whilst the objective of this review was to identify CMD indicators in people with psychotic disorders, sample diagnostic heterogeneity may have had an impact on reported CMD indicator prevalence

rates. Samples with other diagnostic groups represented in substantial numbers, including intellectual disability and personality disorder, may have had quite different levels of CMD indicators, given the likely differences in psychotropic prescribing patterns.

Although most studies used point prevalence as a measure of disease frequency, the timing of data collection and the relevant period did vary. Consequently, it was difficult to distinguish between longstanding, recent and new cases of CMD indicators and thus to directly compare summary data across studies.

Strengths and limitations

This is the first systematic review of the prevalence of CMD indicators in people with psychotic disorders in secure settings. It was possible to calculate weighted pooled prevalence rates for a wide range of CMD indicators, including in some cases within key study subgroups. A combination of both health and criminal justice databases were searched and the primary electronic search was augmented by including other data sources. While the ability to validly summarise prevalence data by meta-analyses was limited by the extent of methodological heterogeneity identified, the key sources of variability were recorded and considered, and analyses were undertaken within more homogeneous study subgroups where possible.

2.5 Conclusion

This first phase of the study measured the prevalence of CMD indicators in the existing literature. It also revealed that methodological heterogeneity limited direct comparison of prevalence rates between the reviewed studies. To address these concerns the second phase of the study, which consisted of the NSW Forensic Mental Health Patient Survey (Dean et al., 2018), aimed to measure the prevalence and determinants of CMD indicators in a large cohort of forensic patients and mentally ill offenders using rigorous sampling and methodological approaches, with standardised methods to determine the presence of indicators so that robust comparisons could be made. Potential differences in risk factors associated with CMD in people with psychotic disorders in secure settings could then be compared to those with psychotic disorders in the community using the second Australian National Survey of High Impact Psychosis (SHIP) (Morgan et al., 2012) to determine whether differences between the two samples existed.

CHAPTER 3 – METHODS

3.1 Study design

The second phase of this study comprised analysis of data from a cross-sectional survey of forensic patients and comparison of the survey sample with a control group.

The Forensic Mental Health Patient Survey (FMHPS) data was analysed to determine the prevalence of CMD indicators and sociodemographic, clinical and lifestyle factors in a sample of forensic patients.

A comparison of these results was made with the second Australian National Survey of High Impact Psychosis (SHIP) to identify differences between the two samples using a case-control study design. Multivariate analytic techniques were then used to estimate associations of selected demographic, clinical and lifestyle factors, as potential explanatory factors, between cases of CMD indicators across both the FMHPS and SHIP samples.

3.2 Measures

Forensic Mental Health Patient Survey (FMHPS)

The FMHPS was a comprehensive health and well-being survey conducted by the Justice Health and Forensic Mental Health Network in 2016-17. With permission obtained from the SHIP research group, the FMHPS was in part adapted from components of the SHIP schedule to enable direct comparisons between the two samples.

Setting

The FMHPS was conducted across a high secure hospital and adult custodial settings in New South Wales, which included the Forensic Hospital, Long Bay Hospital Mental Health Unit, and other adult correctional centres. The Forensic Hospital is a 126-bed high secure mental health facility which accommodates male and female adults and adolescents, predominantly with severe mental illness, who are detained under Mental Health legislation and require secure mental health care. The Long Bay Hospital Mental Health Unit is a 40-bed mental health facility located within

a maximum-security correctional centre. It accommodates predominantly adult male inmates in custodial settings who require involuntary treatment for severe mental illness.

Selection criteria and recruitment

The eligibility criteria for the survey included male and female adult forensic patients in the Forensic Hospital, Long Bay Hospital Mental Health Unit or adult correctional centres; correctional and civil patients transferred to the Forensic Hospital for involuntary mental health treatment; and individuals subject to Forensic Community Treatment Orders located in adult correctional centres. Individuals were approached by trained staff to obtain consent. Individuals determined to be either too mentally unwell, cognitively impaired, or too high a risk to participate in the FMHPS interview were not approached for a face-to-face interview and were instead placed in the FMHPS file review group. The total population from which the sample was derived at the time of the survey was 263 individuals.

Sample

One hundred and sixty four individuals were approached to participate in the face-to-face interview and 96 consented (response rate 58.5%); file review data was collected on a further 42 individuals. In total, data was obtained from 138 patients (52.5% of total source population).

Data collection

Data collection was conducted over a 12-month period between 2016-17 by trained forensic mental health clinicians, including by the author this study. The FMHPS comprised of a structured face-to-face interview, which included standardised questions on several sociodemographic, physical health and mental health measures. Data collectors also rated psychopathology of the participant based on mental state examination during the interview. Physical health measurements and pathology investigations were performed. Trained clinical staff and data collectors were responsible for referring patients to the relevant health clinic or clinical team when medical conditions were identified. Permission was approved to collect data from non-participants for the purpose of the FMHPS file review group where existing data was available and formed part of routine clinical care. File review of clinical records included paper and electronic records. Where there was amalgamation of variables, the presence or absence of the amalgamated variable was satisfied if data from at least one of the variable datasets was

available. Missing data included responses of "don't know" and "declined", and when amalgamation of variables occurred, the outcome was reported as missing when all the variables were missing.

Survey of High Impact Psychosis (SHIP)

The second Australian National Survey of High Impact Psychosis (Morgan et al., 2012) was a large epidemiological survey funded by the Australian Government Department of Health and Ageing and conducted in 2010-11. The SHIP described the profile of people living with psychosis in communities across a catchment area of over 1.5 million people. Male and female adults (18-64 years) in contact with public mental health services and non-government organisations across five Australian states were screened for psychosis (n=7955) and randomly selected for interview (n=1825). People considered too mentally unwell or unable to provide consent were excluded. The SHIP comprised of a semi-structured clinical research interview and physical examination conducted by trained staff using standardised procedures. It included a comprehensive schedule of health and well-being modules, including sociodemographic, service use, physical and mental health, and psychopathology measures.

3.3 Procedure

Classification of CMD indicator diagnoses

As evidenced in the literature review, considerable methodological variations for defining the presence of CMD indicators exist, including as result of changing thresholds, cut-offs and definitions which vary according to different standards or sources. Previous studies have either used a single measure or combination of measures, such as a positive history, thresholds reached on investigations or prescribed medication for the health problem, to classify CMD indicator diagnoses. Each of these methods has strengths and weaknesses when identifying cases for investigation. To reduce selection bias and ensure the cases were representative of the population of interest all three measures were used to classify CMD indicators in this study.

History of CMD diagnosis

Selected CMD indicators in both the FMHPS and SHIP were identified using self-declared diagnosis. Participants were asked whether they had a lifetime or present diagnosis of each of the

CMD indicators. In the FMHPS file review group this information was obtained from the clinical records.

Investigations

Participants from both the FMHPS and SHIP samples underwent physical health assessments which included measurements of height, weight, waist circumference and systolic and diastolic blood pressures. Pathology was collected for lipid profile and fasting blood glucose levels. In the FMHPS file review group this information was obtained from the clinical records where available.

Treatment used for CMD indicators

Participants from both the FMHPS and SHIP samples were asked whether they were currently taking medication used to treat CMD indicators. Additionally, currently prescribed medication lists were obtained and cross-referenced. When medications had more than one indication, the primary indication was considered and dealt with in individual analyses of CMD indicator prevalence.

Amalgamated criteria for CMD indicators

Measures relating to the history, investigations, and treatment of CMD indicators were amalgamated to determine the presence of the indicator. Participants were determined to have either the presence or absence of a CMD indicator diagnosis if data from at least one of these measures was available. Where required, datasets from the SHIP which did not originally use all available measures relating to CMD indicator classification were expanded to enable direct comparison to the FMHPS sample. Where possible face-to-face and file review data were both used for the FMHPS sample.

CMD indicators

Hypertension

Hypertension was classified in the FMHPS and SHIP samples based on self-declared diagnosis of high blood pressure, prescription of medication used to treat hypertension and systolic and diastolic blood pressure measurements. In the FMHPS, blood pressure measurements were obtained from the face-to-face group only (n=96). The International Diabetes Federation (IDF) definition (International Diabetes Federation, 2006) of at-risk hypertension (systolic blood pressure ≥ 130 mmHg and/or a diastolic pressure ≥ 85 mmHg) was used in both FMHPS and

SHIP samples. Whilst the majority of antihypertensive medication prescribed also had additional indications, such as arrhythmia and ischaemic heart disease, their primary indication was for hypertension and therefore included in analysis.

Dyslipidaemia

Dyslipidaemia was classified in the FMHPS and SHIP samples based on self-declared diagnosis of high cholesterol, prescription of medication used to treat abnormal lipids and results on fasting lipid biochemistry. The thresholds for abnormal lipid results used in both FMHPS and SHIP samples were total cholesterol ≥ 5.5 mmol/l, triglycerides ≥ 1.7 mmol/l and HDL-C < 1.0 mmol/l for men and < 1.3 mmol/l for women.

Diabetes

Diabetes was classified in the FMHPS and SHIP samples based on self-declared diagnosis of diabetes (type 1 or type 2), prescription of medication used to treat diabetes or hyperglycaemia and plasma glucose levels suggestive of hyperglycaemia. The IDF definition for "at-risk" diabetes (fasting blood glucose ≥ 5.6 mmol/l) was used in the SHIP (International Diabetes Federation., 2006); whereas in the FMHPS pre-diabetes was defined as fasting blood glucose ≥ 6.1mmol/l and non-fasting blood glucose ≥ 7.8mmol/l. Due to the limited availability of fasting blood glucose, non-fasting results were used for classification in the FMHPS sample. HBA1c (glycated haemoglobin) was not collected in the SHIP and therefore excluded from classification.

Weight related problems

Weight related problems were classified in the FMHPS and SHIP samples based on prescription of medication used for weight management and measurements of body mass index and abdominal obesity. A self-declared history of weight related problems was not included in the FMHPS and SHIP.

BMI was categorised according to WHO criteria (World Health Organization., 1995) as underweight (BMI < 18.5), normal weight (BMI 18.50–24.99), overweight (BMI 25.00–29.99) or obese (BMI ≥ 30). A BMI of obese or above was used in the classification of weight related problems. Abdominal obesity was defined as a waist circumference ≥ 94 cm for men and ≥ 80 cm

for women. In the FMHPS, measurements of BMI and waist circumference were obtained from the face-to-face group only.

Whilst metformin is often prescribed in clinical practice for antipsychotic-induced weight management, it was excluded from this classification due to its primary indication being for type 2 diabetes mellitus. Other medications identified for weight management included phentermine and bupropion, which were included for classification.

Cardiovascular disease

Cardiovascular disease was classified in the FMHPS and SHIP based on self-declared history of stroke, heart attack, angina or other heart diseases such as arrhythmias. Prescription of medication used to treat cardiovascular disease was also used. Thirty of the 48 medications used to treat stroke, heart attack, angina or other heart diseases were primarily indicated for the treatment of hypertension and therefore not included in the classification of cardiovascular disease.

Metabolic syndrome

Metabolic syndrome was defined by the harmonised criteria developed by the IDF Task Force on Epidemiology and Prevention and related expert organisations (Alberti et al., 2009) and was used in both FMHPS and SHIP samples. The criteria for metabolic syndrome required three of the following five risk factors to make the diagnosis:

1. Abdominal obesity defined as at-risk waist circumference
2. At-risk diastolic and/or systolic blood pressure
3. At-risk levels of fasting blood glucose
4. At-risk levels of triglycerides
5. At-risk levels of high-density lipoprotein (HDL) cholesterol

Participants receiving medications for hypertension, hyperlipidaemia or hyperglycaemia were also considered to meet the relevant criterion. Waist circumference measurements were not obtained in the FMHPS file review group (n=42) and therefore only the face-to-face group (n=96) was used in this analysis.

Selection and classification of sociodemographic, clinical and lifestyle factors for analysis

A series of factors were identified that were either known to contribute to CMH indicator risk and were unique to the treatment needs of forensic patients and/or the environment of secure mental health facilities or correctional centres. They were broadly categorised into sociodemographic, clinical and lifestyle domains. Selected factors needed to be available and common to both the FMHPS and SHIP datasets to enable direct comparison. To enhance the statistical power for regression analysis variables were converted to dichotomous variables, where possible, and cut-offs for each variable were chosen that were clinically relevant.

Sociodemographic factors

Participants aged 65 years and above were excluded from the SHIP and occurred in only a small number (n=4) of the FMHPS sample; therefore age was categorised into stratums of 34 years and under and 35 years and above. Mean age was also calculated. Ethnicity was reported based on Aboriginal and/or Torres Strait Islander status due to Indigenous Australians having higher rates of cardiometabolic disease compared to non-Indigenous Australians (Australian Institute of Health and Welfare, 2020) and being over-represented in the New South Wales criminal justice system (Weatherburn & Holmes, 2017). Education was divided into participants who completed secondary school and those who had not. Accommodation and employment status for both samples (in the 12 months prior to entering custody or hospital for the FMHPS sample and at interview for the SHIP sample) were described. The legal status and location of participants in the FMHPS sample were also described.

Clinical factors

Diagnosis of mental disorders in the FMHPS was based on self-declared, symptom screening or treating clinician diagnosis from clinical records. The SHIP used a semi-structured clinical interview, the Diagnostic Interview for Psychosis (DIP), and incorporated classification systems such as the International Classification of Diseases, tenth revision 10 (ICD-10) and Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV). These were broadly categorised into psychotic disorders (Table 14). Other psychiatric diagnoses including neurodevelopmental disorders, bipolar and related disorders, depressive disorders, and neurocognitive disorders were described.

Table 14. Diagnoses included under psychotic disorders according to FMHPS and SHIP

FMHPS	SHIP
Schizophrenia	Schizophrenia
Schizophreniform disorder	Schizoaffective disorder
Schizoaffective disorder	Bipolar, mania
Delusional disorder	Depressive psychosis
Substance/medication-induced psychotic disorder	Delusional disorder and other non-organic psychosis
Brief psychotic disorder	
Psychotic disorder due to another medical condition	
Other schizophrenia spectrum and other psychotic disorder	

Psychopathology of the participants in both surveys was rated during interviews based on mental state examination. For the FMHPS file review group ratings were based on the participant's last recorded mental state examination in the clinical records. The symptoms selected and included for analysis were chosen because they were more likely to impact on the long-term functioning and mental stability of the participant. Symptom categories were broadly grouped into negative symptoms, behaviour and affect changes and speech changes (Table 15). Symptom categories were rated as present if the participant was rated as positive for at least one symptom in the category. Insight into the need for treatment was also analysed.

Table 15. Rated symptoms according to symptom category

Negative symptoms	Behaviour and affect changes	Speech changes
Restricted affect*	Blunted affect	Negative formal thought disorder
Poverty of speech	Inappropriate affect	Positive formal thought disorder
Diminished sense of purpose	Agitated activity/behaviour	Speech difficult to understand
	Catatonia	Incoherence of speech
	Bizarre behaviour	Pressured speech

*also included in behaviour and affect changes category in the SHIP

Medication lists were obtained in the FMHPS by reviewing medication charts from the clinical records. In the SHIP study the participants brought their medications or list of medications with them to the interview. As needed or pro re nata (PRN) medication was not included in the analysis. Antipsychotic prescribing was analysed in terms of whether the participant was prescribed any antipsychotic, the class of antipsychotic and number of antipsychotics prescribed (polypharmacy). Due to clozapine's association with cardiometabolic risks (Rummel-Kluge et al., 2010), clozapine was individually selected for analysis. Side effects and impairment due to medication were described.

Lifestyle factors

Levels of physical activity were rated in terms of the frequency in which the participant performed at least ten minutes of walking, moderate activity, and vigorous activity per day. Responses were categorised into participants who walked at least seven days a week and/or performed moderate or vigorous activity at least one day a week. Patterns and attitudes to physical activity were also described.

Nutrition was rated in terms of consumption of vegetable and fruit servings per day, frequency of added salt, meals and snacks consumption per day and breakfast consumption days per week. Buy-up items and sugary drink consumption from the FMHPS sample were described.

3.4 Data analysis

A primary analysis involved the amalgamation of available diagnostic measures used to determine the prevalence of each CMD indicator across the separate FMHPS and SHIP datasets. Prevalence data for sociodemographic, clinical and lifestyle factors were similarly analysed for each dataset, with recoding completed, where required, to obtain categorical and dichotomous predictor variables. A comparison of prevalence results was undertaken to determine if the difference in independent proportions between the FMHPS and SHIP samples were statistically significant (unadjusted). Odds ratios with 95% confidence intervals (CI) were calculated for the prevalence of the amalgamated criteria for each CMD indicator and sociodemographic, clinical and lifestyle factors selected for regression analysis.

A secondary analysis tested the differences between each CMD indicator with regard to the selected predictor variables (i.e. demographic, clinical and lifestyle factors). Binary logistic regression was used to adjust for the effects of demographic and selected covariates. Because of the inclusion of multiple selected predictor variables and potential for some factors to have positive associations with each CMD indicator, and some factors to have negative associations, a stepped approach of adjusted analysis for each CMD indicator was conducted. For each amalgamated CMD indicator prevalence, the unadjusted odds ratio for cases in the FMHPS sample (versus the SHIP sample) were reported again for the purpose of providing a baseline reference. Four consecutive stepped adjustments were then conducted, each progressively

included additional selected factors (in the groupings presented in Table 27), whilst retaining statistically significant factors from the previous adjusted analysis.

Analyses were performed using the IBM Statistical Package for the Social Sciences (SPSS) software, Version 26.0 (IBM Corp. in Armonk, NY).

3.5 Ethics

The FMHPS study was approved by the Justice Health and Forensic Mental Health Human Research Ethics Committee (HREC) (Ref: G365/14), the Aboriginal Health and Medical Research Council HREC (Ref: 1080/15) and the Corrective Services New South Wales Ethics Committee (Ref: D15/227697) under the umbrella Network Patient Health Survey (NPHS) study. An Aboriginal Health Research Consultation Group was established to engage in consultation and review of the FMHPS.

Datasets obtained from the SHIP research group were previously approved by human research ethics committees at each of the seven study sites (Morgan et al., 2012).

CHAPTER 4 – RESULTS

4.1 Comparison of sociodemographic factors between the FMHPS and SHIP samples

Table 16 outlines the key sociodemographic factors in the FMHPS and SHIP samples. The overwhelming majority of the FMPHS sample were male (89.9%); whereas in the SHIP sample the prevalence of male participants (59.6%) was marginally higher than for female participants (40.4%). The mean age of the FMHPS sample was 43.7 year (SD 11.4 years) compared to the 38.4 years (SD 11.2 years) in the SHIP sample; and the proportion of participants aged 35 years and older was higher in the FMHPS sample (79.7% vs 57.6%). Aboriginal and/or Torres Strait Islander participants were 4.5 times more likely to be represented in the FMHPS sample compared to the SHIP sample (19.0% vs. 4.9%). In the FMHPS sample 75.4% of participants were born in Australia compared to 82.2% in the SHIP sample.

Table 16. Prevalence and odds ratios for demographic factors in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Sex^			
Female	14/138 (10.1)	738/1825 (40.4)	1.00 (reference)
Male	124/138 (89.9)	1087/1825 (59.6)	**6.01 (3.43-10.53)
Age^			
34 years and under	28/138 (20.3)	773/1825 (42.4)	1.00 (reference)
35 years and above	110/138 (79.7)	1052/1825 (57.6)	**2.89 (1.89-4.42)
Ethnicity^			
Non-Aboriginal and/or Torres Strait Islander	111/137 (81.0)	1735/1825 (95.1)	1.00 (reference)
Aboriginal and/or Torres Strait Islander	26/137 (19.0)	90/1825 (4.9)	**4.52 (2.80-7.27)
Education Completed year 12 or equivalent of last year of secondary school	30/129 (23.3)	574/1802 (31.9)	
Employment Paid employment in the 12 months prior to enter custody/hospital or interview	52/132 (39.4)	596/1825 (32.7)	
Housing Homelessness in the 12 months prior to entering custody/hospital or interview	25/129 (19.4)	159/1824 (8.7)	

**p<.001, ^selected factor for regression analysis

The prevalence of year 12 completion in the FMHPS sample was lower than the SHIP sample (23.3% vs. 31.9%), however paid employment in the 12 months prior to entering custody/hospital or interview was higher in the FMHPS sample (39.4% vs. 32.7%). Homelessness in the 12 months prior to entering custody/hospital or interview was higher in the FMHPS sample (19.4% vs. 8.7%).

The legal status of participants from the FMHPS sample included those who had been found not guilty by reason of mental illness (60.9%) and unfit to stand trial (17.4%); or were correctional patients (12.3%) and civil patients (6.5%). The location of participants from the FMHPS sample were 84.1% in secure hospital and 15.9% in correctional centres.

4.2 Comparison of cardiometabolic disease (CMD) indicators between the FMHPS and SHIP samples

The individual measures used for each CMD indicator and their amalgamated prevalence in the FMHPS and SHIP samples are reported in Tables 17 to 22. Where relevant, the prevalence of measures derived specifically from history, investigations, or treatment of CMD indicators are also reported.

Hypertension

The prevalence of being prescribed medication to treat hypertension was twice as common in the FMHPS sample compared to the SHIP sample (23.0% vs 11.2%), while the prevalence of having at-risk hypertension on blood pressure measurement was almost half in the FMHPS sample compared to the SHIP sample (27.7% vs 48.8%) (Table 17). Overall, the amalgamated prevalence of hypertension was lower in the FMHPS sample compared to the SHIP sample (31.6% vs. 55.2%) and the difference was statistically significant ($x2=27.842$, $df=1$, $p<.001$).

Table 17. Prevalence of measures used in the amalgamated criteria for hypertension in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Self-declared or file review history of high blood pressure	19/127 (15.0)	352/1775 (19.8)	
At-risk hypertension on blood pressure measurement	13/47 (27.7)	861/1766 (48.8)	
Prescribed medication to treat hypertension	31/135 (23.0)	190/1695 (11.2)	
Met amalgamated criteria for hypertension	42/133 (31.6)	1006/1822 (55.2)	*0.37 (0.26-0.55)

*p<.001

Dyslipidaemia

In the FMHPS, 35.6% of the sample were prescribed medication used to treat high cholesterol compared to 12.4% in the SHIP sample (Table 18). The rates of having a history of high cholesterol and abnormal lipid biochemistry were also both higher in the FMHPS sample. The amalgamated prevalence of dyslipidaemia was marginally higher in the FMHPS sample compared to the SHIP sample (69.3% vs. 64.8%), although the difference was not statistically significant (x2=1.169, df=1, p=.280).

Table 18. Prevalence of measures used in the amalgamated criteria for dyslipidaemia in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Self-declared or file review history of high cholesterol	53/128 (41.4)	535/1713 (31.2)	
Abnormal results on fasting lipid biochemistry	26/62 (41.9)	460/1391 (33.1)	
Prescribed medication to treat high cholesterol	48/135 (35.6)	211/1695 (12.4)	
Met amalgamated criteria for dyslipidaemia	95/137 (69.3)	1177/1817 (64.8)	*1.23 (0.85-1.79)

* p=.280

Diabetes

In the FMHPS, 28.3% of the sample were prescribed medication used to treat diabetes compared to 8.1% in the SHIP sample (Table 19). The prevalence of participants with abnormal plasma glucose levels was lower in the FMHPS sample (21.1% vs 28.6%). The amalgamated prevalence of diabetes was marginally higher in the FMHPS sample compared to the SHIP sample (36.2% vs. 33.2%), although the difference was not statistically significant (x2=0.496, df=1, p=.481).

Table 19. Prevalence of measures used in the amalgamated criteria for diabetes in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Self-declared or file review history of diabetes	23/130 (17.7)	374/1793 (20.9)	
Abnormal plasma glucose level	15/71 (21.1)	397/1387 (28.6)	
Prescribed medication to treat diabetes	39/135 (28.9)	148/1695 (8.7)	
Met amalgamated criteria for diabetes	50/138 (36.2)	606/1820 (33.3)	*1.14 (0.79-1.63)

* p=.481

Weight related problems

The prevalence of measures used for weight related problems, including BMI in the obese range and abdominal obesity on waist circumference, as well as the amalgamated prevalence of weight related problems, were almost identical across both samples (Table 20).

Table 20. Prevalence of measures used in the amalgamated criteria for weight related problems in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Body mass index (BMI ≥ 30)	35/76 (46.1)	823/1774 (46.4)	
Abdominal obesity (waist circumference)	61/74 (82.4)	1450/1763 (82.2)	
Prescribed medication for weight management	0/135 (0.0)	5/1695 (0.3)	
Met amalgamated criteria for weight related problems	63/78 (80.8)	1460/1784 (81.8)	*0.93 (0.52-1.66)

*p=.811

Cardiovascular disease

Participants in the FMHPS sample were twice as likely to be prescribed medication used to treat cardiovascular disease compared to the SHIP sample (10.4% vs 4.2%) (Table 21). Additionally, the prevalence of having a history of cardiovascular disease was also higher in the FMHPS sample (20.5% vs 13.1%). The amalgamated prevalence of cardiovascular disease was therefore higher in the FMHPS sample compared to the SHIP sample (23.2% vs. 14.9%) and the difference was statistically significant ($x2=6.769$, $df=1$, $p=.009$).

Table 21. Prevalence of measures used in the amalgamated criteria for cardiovascular disease in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Self-declared or file review history of stroke, heart attack, angina or other heart diseases	26/127 (20.5)	238/1811 (13.1)	
Prescribed medication to treat cardiovascular disease	14/135 (10.4)	72/1695 (4.2)	
Met amalgamated criteria for cardiovascular disease	32/138 (23.2)	271/1821 (14.9)	*1.73 (1.14-2.62)

*p=.009

Metabolic syndrome

The prevalence of metabolic syndrome, as originally defined in the SHIP, was lower in the FMHPS sample compared to the SHIP sample (39.4% vs 43.0%) (Table 22). When self-declared and file review histories of CMD indicators were included in the criteria, the prevalence of metabolic syndrome was 43.8% and 53.8% in the FMHPS and SHIP samples respectively, although the difference was not statistically significant (x2=3.694, df=1, p=.055). Measurements of waist circumference were not obtained in the FMHPS file review group (n=42) and therefore only the face-to-face group (n=96) in the FMHPS sample was used to measure metabolic syndrome.

Table 22. Prevalence of amalgamated criteria for metabolic syndrome in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Metabolic syndrome according to SHIP criteria (IDF 2009)	37/94 (39.4)	775/1804 (43.0)	
Metabolic syndrome according to SHIP criteria (IDF 2009)* with self-declared or file review history of hypertension, dyslipidaemia, and diabetes	42/96 (43.8)	979/1820 (53.8)	*0.67 (0.44-1.01)

* p=.055

4.3 Comparison of clinical and lifestyle factors between the FMHPS and SHIP samples

Clinical factors

Diagnosis

Psychotic disorders were the predominant diagnostic category in both samples, however the prevalence of participants without a diagnosis of a primary psychotic disorder was higher in the FMHPS sample (13.1% vs 4.7%) (Table 23). The next most common mental health diagnosis listed for the FMHPS sample were depressive disorders 10.2%, neurodevelopmental disorders 10.2%, neurocognitive disorders 8.8% and bipolar affective disorders 4.4%.

Symptoms

Participants from the FMHPS sample were three times more likely (OR 3.00, 95% CI 1.93-4.64) than those in the SHIP sample to have a lack of insight into the need for medication and/or treatment. However, compared to the SHIP sample, participants from the FMHPS sample had fewer negative symptoms (54.1% vs 64.4%) and fewer speech changes (30.1% vs 39.1%). There was no difference in the prevalence of behaviour and affect changes between samples.

Table 23. Prevalence and odds ratios for diagnosis and symptom related clinical factors in the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Psychotic disorder^			
Yes	119/137 (86.9)	1740/1825 (95.3)	1.00 (reference)
No	18/137 (13.1)	85/1825 (4.7)	**3.10 (1.80-5.32)
Insight into ceasing medication^			
Present	72/104 (69.2)	1589/1825 (87.1)	1.00 (reference)
Not present	32/104 (30.8)	236/1825 (12.9)	**3.00 (1.93-4.64)
Negative symptoms			
Present	73/135 (54.1)	1176/1825 (64.4)	
Not present	62/135 (45.9)	649/1825 (35.6)	
Behaviour and affect changes			
Present	81/135 (60.0)	1095/1825 (60.0)	
Not present	54/135 (40.0)	730/1095 (40.0)	
Speech changes			
Present	41/136 (30.1)	713/1825 (39.1)	
Not present	95/136 (69.9)	1112/1825 (60.9)	

**p<.001, ^selected factor for regression analysis

Medication

The proportion of participants prescribed antipsychotic medication was similar between the two samples (Table 24). However, antipsychotic polypharmacy (i.e. prescribed two or more antipsychotics) was more than three times (OR 3.18, 95% CI 2.19-4.63) higher in the FMHPS sample compared to the SHIP sample; and clozapine prescribing was nearly four times more likely (OR 3.78, 95% CI 2.59-5.51).

Participants prescribed only atypical antipsychotics (second generation) dominated the FMHPS sample to a slightly greater extent than the SHIP sample (99.2% vs 90.7%). Typical antipsychotics (first generation) were more common in the SHIP sample (6.6% vs 18.7%).

Table 24. Prevalence and odds ratios for medication related clinical factors for the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Prescribed antipsychotic medication			
No	14/135 (10.4)	207/1697 (12.2)	
Yes	121/135 (89.6)	1490/1697 (87.8)	
Polypharmacy^			
One antipsychotic	55/121 (45.5)	1082/1490 (72.6)	1.00 (reference)
Two or more antipsychotics	66/121 (54.5)	408/1490 (27.4)	**3.18 (2.19-4.63)
Prescribed clozapine^			
Other antipsychotic	62/121 (51.2)	1190/1490 (79.9)	1.00 (reference)
Clozapine	59/121 (48.8)	300/1490 (20.1)	**3.78 (2.59-5.51)
Antipsychotic class			
Typical	8/121 (6.6%)	278/1490 (18.7%)	
Atypical	120/121 (99.2%)	1351/1490 (90.7%)	

**p<.001, ^selected factor for regression analysis

Weight gain as a side effect of psychotropic medication was reported in 36.2% and 37.5% of the FMHPS and SHIP samples respectively; with a reported mean weight gain in the last six months of 8.5kg (SD = 6.3kg) in the FMHPS sample and 9.4kg (SD = 7.1kg) in the SHIP sample.

Lifestyle factors

Physical activity

Participants in the FMHPS sample were more than twice as likely as the SHIP sample to engage in walking, moderate activity, and vigorous activity per week (Table 25). Participants who completed at least one day per week of vigorous activity were reported in 38.5% and 20.4% of the FMHPS and SHIP samples respectively.

Table 25. Prevalence and odds ratios for physical activity related lifestyle factors for the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Walking			
Walks less than 7 days per week	37/91 (40.7)	1099/1819 (60.4)	
Walks 7 days per week	54/91 (59.3)	720/1819 (39.6)	
Moderate activity			
No days per week	45/91 (49.5)	1255/1819 (69.0)	
At least 1 day per week	46/91 (50.5)	564/1819 (31.0)	
Vigorous activity^			
No days per week	56/91 (61.5)	1448/1820 (79.6)	1.00 (reference)
At least 1 day per week	35/91 (38.5)	372/1820 (20.4)	**2.43 (1.57-3.77)

**p<.001, ^selected factor for regression analysis

Participants considered they were doing enough physical activity in 46.9% of the FMHPS sample compared to 36.1% of the SHIP sample. In the FMHPS sample, 50.0% of participants reported being less physically active since coming into custody or hospital, whilst 29.2% reported similar rates of physical activity and 14.6% reported being more physically active.

Nutrition

Participants from the FMHPS sample reported eating more meals and snacks each day in the last four weeks compared to the SHIP sample (56.2% vs 42.0%) (Table 26). Participants from the FMHPS sample also reported eating breakfast more frequently than the SHIP sample (88.8% vs 51.7%). Participants from both samples reported similar rates of vegetable and fruit consumption per day and added salt in their diet in the last four weeks.

Table 26. Prevalence and odds ratios for nutrition related lifestyle factors for the FMHPS and SHIP samples.

Variable	FMHPS n/N (%)	SHIP n/N (%)	Unadjusted OR (95% CI)
Meals and snacks^			
3 or less per day	39/89 (43.8)	1051/1811 (58.0)	1.00 (reference)
4 or more per day	50/89 (56.2)	760/1811 (42.0)	*1.77 (1.15-2.72)
Breakfast			
3 or less days per week	10/89 (11.2)	877/1816 (48.3)	
4 or more days per week	79/89 (88.8)	939/1816 (51.7)	
Vegetables serves			
1 or less per day	45/89 (50.6)	887/1808 (49.1)	
2 or more per day	44/89 (49.4)	921/1808 (50.9)	
Fruit serves			
1 or less per day	64/88 (72.7)	1297/1808 (71.7)	
2 or more per day	24/88 (27.3)	511/1808 (28.3)	
Salt added			
Never or rarely	41/89 (46.1)	902/1810 (49.8)	
Sometimes or usually	48/89 (53.9)	908/1810 (50.2)	

*p<.05, ^selected factor for regression analysis

The FMHPS sample identified food and drink items purchased from the 'buy-up' system or hospital kiosk. The most common items included chips, chocolate, hot chips, lollies, biscuits, noodles, tuna, and soft drink. In the FMHPS sample, 49.0% of participants reported drinking sugary drinks each day.

4.4 Multivariate analysis of CMD indicators across the FMHPS and SHIP samples, including consideration of selected demographic, clinical and lifestyle factors

A selection of nine key demographic, clinical and lifestyle factors that were considered potential determinants and explanatory factors of CMD risk specific to secure settings were identified (Table 27). Each factor was previously found to differ significantly between the FMHPS and SHIP samples.

Table 27. Selected demographic, clinical and lifestyle factors for multiple regression analysis

Demographic	**Clinical**	**Lifestyle**
Male sex	Psychotic disorder	Vigorous activity at least one day per week
Aged 35 years and above	Insight not present	Four or more meals and snacks per day
Aboriginal and/or Torres Strait Islander	Polypharmacy	
	Clozapine	

Age (those 35 years and above) was found to have a positive association with all CMD indicators on multivariate analysis and the effect remained statistically significant when adjusted for all other demographic, clinical and lifestyle factors. All other associations between covariates and CMD indicators on multivariate analysis are described below under each CMD indicator analysis.

Hypertension

Participants from the FMHPS sample were approximately three times less likely (OR 0.37, 95% CI 0.26-0.55) to have hypertension compared to the SHIP sample on unadjusted analysis (Table 28). This measure remained the same and statistically significant (OR 0.36, 95% CI 0.23-0.57) when adjusted for all other factors, including sex and age. In the final multivariate model, male participants were 1.3 times more likely to have hypertension compared to female participants. There were no other selected factors, aside from age, that had a statistically significant effect on the prevalence of hypertension in the final model.

Table 28. Adjusted odds ratios for hypertension by selected demographic, clinical and lifestyle factors

1: adjusted for demographic factors (sex, age, ethnicity)
2: adjusted for statistically significant factors from adjustment 1 and clinical factors (psychotic disorder and insight)
3: adjusted for statistically significant factors from adjustment 2 and clinical factors (polypharmacy, clozapine)
4: adjusted for statistically significant factors from adjustment 3 and lifestyle factors (vigorous activity and meals and snacks)
^ FMHPS file review group not included in analysis

Variable	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)[1]**	**Adjusted OR (95% CI)[2]**	**Adjusted OR (95% CI)[3]**	**^Adjusted OR (95% CI)[4]**
FMHPS sample	**0.37 (0.26-0.55)	**0.28 (0.19-0.41)	**0.25 (0.16-0.40)	**0.23 (0.15-0.36)	**0.36 (0.23-0.57)
Male		*1.36 (1.12-1.65)	*1.35 (1.12-1.64)	*1.35 (1.09-1.66)	*1.33 (1.09-1.61)
Aged 35 years and above		**1.97 (1.63-2.37)	**1.95 (1.62-2.36)	**1.82 (1.48-2.24)	**1.88 (1.55-2.27)
Aboriginal and/or Torres Strait Islander		1.42 (0.95-2.12)			
Psychotic disorder			1.03 (0.65-1.65)		
Insight not present			1.17 (0.87-1.57)		
Polypharmacy				1.06 (0.84-1.32)	
Clozapine				1.20 (0.93-1.54)	
Vigorous activity at least one day per week					0.86 (0.69-1.08)
Four or more meals and snacks per day					0.91 (0.75-1.10)

*p<.05, **p<.001

Dyslipidaemia

Whilst there was no overall statistically significant difference in the prevalence of dyslipidaemia cases between the FMHPS and SHIP samples (OR 1.23, 95% CI 0.85-1.79), adjusted analysis did reveal significant differences, of both positive and negative associations, in some selected factors (Table 29).

When adjusted for demographics, not having insight into the need for treatment initially showed a negative association with dyslipidaemia, however it was no longer significant when this factor was further adjusted for polypharmacy and clozapine. In the final multivariate model,

participants prescribed clozapine and those who had four or more meals and snacks per day were 1.8 times and 1.4 times more likely to have dyslipidaemia respectively. In contrast, participants who completed vigorous activity one day or more per week were 0.7 times less likely to have dyslipidaemia.

Table 29. Adjusted odds ratios for dyslipidaemia by selected demographic, clinical and lifestyle factors

1: adjusted for demographic factors (sex, age, ethnicity)
2: adjusted for statistically significant factors from adjustment 1 and clinical factors (psychotic disorder and insight)
3: adjusted for statistically significant factors from adjustment 2 and clinical factors (polypharmacy, clozapine)
4: adjusted for statistically significant factors from adjustment 3 and lifestyle factors (vigorous activity and meals and snacks)
^ FMHPS file review group not included in analysis

Variable	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)[1]**	**Adjusted OR (95% CI)[2]**	**Adjusted OR (95% CI)[3]**	**^Adjusted OR (95% CI)[4]**
FMHPS sample	1.23 (0.85-1.79)	1.09 (0.74-1.62)	1.36 (0.86-2.14)	0.93 (0.57-1.52)	1.00 (0.59-1.69)
Male		1.07 (0.88-1.30)			
Aged 35 years and above		**1.76 (1.46-2.13)	**1.76 (1.45-2.13)	**1.70 (1.37-2.11)	**1.55 (1.24-1.93)
Aboriginal and/or Torres Strait Islander		0.97 (0.65-1.45)			
Psychotic disorder			0.86 (0.53-1.40)		
Insight not present			*0.71 (0.53-0.95)	0.85 (0.56-1.31)	
Polypharmacy				1.26 (0.99-1.61)	
Clozapine				**1.81 (1.36-2.40)	**1.78 (1.33-2.37)
Vigorous activity at least one day per week					*0.69 (0.53-0.90)
Four or more meals and snacks per day					*1.37 (1.10-1.71)

*p<.05, **p<.001

Diabetes

When adjusted for demographic and selected clinical factors (psychotic disorder and insight), being of Aboriginal and/or Torres Strait Islander background was associated with an increased

risk of diabetes (Table 30). However, significance was lost when this factor was further adjusted for polypharmacy and clozapine. Clozapine treatment and having four or more meals per day were also associated with an increased risk of diabetes when adjusted for all other selected factors in the final model.

Table 30. Adjusted odds ratios for diabetes by selected demographic, clinical and lifestyle factors

1: adjusted for demographic factors (sex, age, ethnicity)
2: adjusted for statistically significant factors from adjustment 1 and clinical factors (psychotic disorder and insight)
3: adjusted for statistically significant factors from adjustment 2 and clinical factors (polypharmacy, clozapine)
4: adjusted for statistically significant factors from adjustment 3 and lifestyle factors (vigorous activity and meals and snacks)
^ FMHPS file review group not included in analysis

Variable	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)[1]**	**Adjusted OR (95% CI)[2]**	**Adjusted OR (95% CI)[3]**	**^Adjusted OR (95% CI)[4]**
FMHPS sample	1.14 (0.79-1.63)	0.84 (0.58-1.23)	1.02 (0.67-1.56)	0.67 (0.44-1.01)	0.92 (0.56-1.52)
Male		1.14 (0.94-1.40)			
Aged 35 years and above		**2.28 (1.86-2.79)	**2.24 (1.82-2.74)	**2.30 (1.84-2.89)	**2.20 (1.75-2.77)
Aboriginal and/or Torres Strait Islander		*1.64 (1.11-2.44)	*1.67 (1.12-2.51)	1.51 (0.97-2.35)	
Psychotic disorder			1.55 (0.92-2.61)		
Insight not present			1.03 (0.76-1.40)		
Polypharmacy				1.17 (0.92-1.48)	
Clozapine				**2.60 (2.02-3.33)	**2.56 (1.98-3.32)
Vigorous activity at least one day per week					0.78 (0.59-1.04)
Four or more meals and snacks per day					*1.34 (1.07-1.67)

*p<.05, **p<.001

Weight related problems

Whilst there was no overall statistically significant difference in the cases of weight related problems between the FMHPS and SHIP samples (OR 0.93, 95% CI 0.52-1.66), adjusted

analysis did reveal significant differences, of both positive and negative associations, in some selected factors (Table 31).

In the final multivariate model, participants prescribed polypharmacy and clozapine were 1.5 times and 2.0 times more likely to have weight related problems respectively. In contrast, male participants were approximately two-thirds less likely (OR 0.28, 95% CI 0.19-0.41) to have weight related problems compared to female participants.

When adjusted for demographics, not having insight into the need for treatment initially showed a negative association with weight related problems, however significance was lost when this factor was further adjusted for polypharmacy and clozapine.

Table 31. Adjusted odds ratios for weight related problems by selected demographic, clinical and lifestyle factors
1: adjusted for demographic factors (sex, age, ethnicity)
2: adjusted for statistically significant factors from adjustment 1 and clinical factors (psychotic disorder and insight)
3: adjusted for statistically significant factors from adjustment 2 and clinical factors (polypharmacy, clozapine)
4: adjusted for statistically significant factors from adjustment 3 and lifestyle factors (vigorous activity and meals and snacks)
^ FMHPS file review group not included in analysis

Variable	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)[1]**	**Adjusted OR (95% CI)[2]**	**Adjusted OR (95% CI)[3]**	**^Adjusted OR (95% CI)[4]**
FMHPS sample	0.93 (0.52-1.66)	1.05 (0.58-1.91)	1.13 (0.57-2.23)	0.66 (0.33-1.33)	0.74 (0.38-1.43)
Male		**0.33 (0.25-0.45)	**0.32 (0.24-0.43)	**0.27 (0.19-0.40)	**0.28 (0.19-0.41)
Aged 35 years and above		**2.22 (1.74-2.84)	** 2.22 (1.74-2.85)	**2.01 (1.51-2.68)	**1.90 (1.43-2.54)
Aboriginal and/or Torres Strait Islander		1.02 (0.59-1.79)			
Psychotic disorder			1.25 (0.69-2.27)		
Insight not present			*0.60 (0.41-0.87)	0.91 (0.50-1.66)	
Polypharmacy				*1.50 (1.08-2.10)	*1.47 (1.05-2.04)
Clozapine				*1.98 (1.34-2.94)	*1.97 (1.33-2.92)
Vigorous activity at least one day per week					0.78 (0.56-1.09)

Four or more meals and snacks per day					1.24 (0.92-1.67)

*p<.05, **p<.001

Cardiovascular disease

The statistically significant increased likelihood (OR 1.73, 95% CI 1.14-2.62) of having cardiovascular disease in the FMHPS sample compared to the SHIP sample, on unadjusted analysis, was lost when adjusted for demographic factors and subsequent clinical and lifestyle factors (Table 32). The adjusted analysis did however reveal significant differences, of both positive and negative associations, in some selected factors. In the final multivariate model, Aboriginal and/or Torres Strait Islander participants were more than twice as likely (OR 2.23, 95% CI 1.39-3.56) to have cardiovascular disease compared to non-Aboriginal and/or Torres Strait Islander participants. Whereas participants who engaged in vigorous activity one day or more per week were approximately one-third less likely to have cardiovascular disease, compared to participants who did not.

Table 32. Adjusted odds ratios for cardiovascular disease by selected demographic, clinical and lifestyle factors

1: adjusted for demographic factors (sex, age, ethnicity)
2: adjusted for statistically significant factors from adjustment 1 and clinical factors (psychotic disorder and insight)
3: adjusted for statistically significant factors from adjustment 2 and clinical factors (polypharmacy, clozapine)
4: adjusted for statistically significant factors from adjustment 3 and lifestyle factors (vigorous activity and meals and snacks)
^ FMHPS file review group not included in analysis

Variable	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)[1]**	**Adjusted OR (95% CI)[2]**	**Adjusted OR (95% CI)[3]**	**^Adjusted OR (95% CI)[4]**
FMHPS sample	*1.73 (1.14-2.62)	1.17 (0.75-1.83)	1.03 (0.61-1.72)	0.95 (0.57-1.57)	1.64 (0.97-2.78)
Male		1.03 (0.79-1.34)			
Aged 35 years and above		**3.59 (2.64-4.90)	**3.49 (2.56-4.76)	**3.67 (2.60-5.17)	**3.37 (2.47-4.60)
Aboriginal and/or Torres Strait Islander		**2.39 (1.53-3.74)	**2.49 (1.58-3.94)	**2.71 (1.66-4.42)	*2.23 (1.39-3.56)
Psychotic disorder			0.93 (0.51-1.68)		
Insight not present			1.42 (0.98-2.06)		
Polypharmacy				1.21 (0.89-1.63)	

Clozapine	1.02 (0.73-1.42)	
Vigorous activity at least one day per week		*0.68 (0.47-0.98)
Four or more meals and snacks per day		0.78 (0.60-1.01)

*p<.05, **p<.001

Metabolic syndrome

There was no significant difference between the FMHPS and SHIP samples for cases of metabolic syndrome in the unadjusted analysis. However, in the final multivariate model, participants from the FMHPS were 0.4 times less likely compared to the SHIP sample to have metabolic syndrome. Adjusted analysis also revealed significant differences, of both positive and negative associations, in some selected factors (Table 33).

Participants prescribed clozapine and those who had four or more meals and snacks per day were 2.4 times and 1.4 times more likely to have metabolic syndrome respectively. In contrast, participants who completed vigorous activity one day or more per week were 0.6 times less likely to have metabolic syndrome.

Table 33. Adjusted odds ratios for metabolic syndrome by selected demographic, clinical and lifestyle factors

1: adjusted for demographic factors (sex, age, ethnicity)
2: adjusted for statistically significant factors from adjustment 1 and clinical factors (psychotic disorder and insight)
3: adjusted for statistically significant factors from adjustment 2 and clinical factors (polypharmacy, clozapine)
4: adjusted for statistically significant factors from adjustment 3 and lifestyle factors (vigorous activity and meals and snacks)
^ FMHPS file review group not included in analysis

Variable	**Unadjusted OR (95% CI)**	**Adjusted OR (95% CI)[1]**	**Adjusted OR (95% CI)[2]**	**Adjusted OR (95% CI)[3]**	**^Adjusted OR (95% CI)[4]**
FMHPS sample	0.67 (0.44-1.01)	*0.56 (0.37-0.87)	0.65 (0.40-1.05)	**0.35 (0.22-0.57)	**0.41 (0.25-0.67)
Male		0.96 (0.79-1.16)			
Aged 35 years and above		**2.48 (2.05-2.99)	**2.48 (2.05-2.99)	**2.48 (2.05-2.99)	**2.23 (1.80-2.76)
Aboriginal and/or Torres Strait Islander		1.16 (0.77-1.74)			

Psychotic disorder	1.15 (0.72-1.86)		
Insight not present	0.78 (0.58-1.05)		
Polypharmacy		1.15 (0.91-1.45)	
Clozapine		**2.46 (1.87-3.23)	**2.37 (1.80-3.12)
Vigorous activity at least one day per week			**0.58 (0.44-0.75)
Four or more meals and snacks per day			*1.36 (1.10-1.69)

*p<.05, **p<.001

CHAPTER 5 – DISCUSSION

Cardiometabolic disease is highly prevalent in people with psychotic disorders and contributes significantly to their morbidity and mortality. Due to the complex treatment needs and the restrictive environments in which forensic patients and other mentally ill offenders reside, people with psychotic disorders in secure settings were hypothesised to have even higher rates of CMD indicators compared to people with psychotic disorders in the community.

This study included the first systematic review of the literature on the prevalence of CMD indicators in people with psychotic disorders in secure settings; and the first study to identify and directly compare the prevalence and determinants of CMD indicators in people with psychotic disorders in secure settings and the community.

In the first phase of this study, a systematic review of the literature was conducted to determine what was known about the prevalence of CMD indicators in people with psychotic disorders in secure settings.

In the second phase of the study a cross-sectional survey, the FMHPS, was conducted on a population of 138 forensic mental health patients residing in secure settings in New South Wales. The aim was to establish the prevalence of CMD indicators in a sample of forensic patients and mentally ill offenders in secure settings. The FMHPS was one of the largest and most comprehensive health and well-being surveys of forensic patients in Australasia and was adapted to include items that would enable measurement of CMD indicators with accuracy. The inclusion of the FMHPS file review group enabled the research to include those clinically unwell participants, who are relatively common in high secure settings, but who are ordinarily excluded in research studies. The FMHPS was adapted from the SHIP study, a national population-based psychosis prevalence study of people with psychosis living in the community in Australia (Morgan et al., 2012).

The prevalence of CMD indicators in the FMHPS sample, along with demographic, clinical and lifestyle factors widely known to influence CMD prevalence and likely to differ between forensic

and community settings for those with psychosis, were compared across the two samples. Multivariate analysis was undertaken to determine the extent to which any CMD indicator differences between the two samples (or lack of differences) could be attributed to differences in the prevalence of a range of demographic, clinical and lifestyle factors.

5.1 Main findings

Systematic review

The systematic review examined 17 studies from eight countries, including data on a total sample of 7851 participants. The weighted pooled prevalence of CMD indicators in people with psychotic disorders in secure settings were calculated. As expected, the weight pooled prevalence of CMD indicators from the reviewed studies were higher compared to the general population. However, in comparison to community-based psychosis samples the prevalence of CMD indicators from the reviewed studies were either similar (i.e. diabetes) or lower (i.e. hypertension, dyslipidaemia and metabolic syndrome).

Due to inadequate measures of classifying CMD indicator diagnoses in the reviewed studies, the second phase of this study, which consisted of a cross-sectional survey, the FMHPS, was designed to incorporate the broadest and most comprehensive set of available measures to mitigate errors in diagnosis classification. These measures included history of CMD diagnosis, investigations and physical testing and treatment used for CMD indicators.

The weighted pooled prevalence of CMD indicators from the reviewed studies were consistently lower compared to the amalgamated prevalence for CMD indicators in the FMHPS. However, the FMHPS used "at-risk" states for hypertension, diabetes, and metabolic syndrome, which may have over-estimated prevalence rates in comparison to the reviewed studies. Additionally, the criteria for weight related problems in the reviewed studies did not include abdominal obesity according to waist circumference, which likely under-estimated the prevalence compared to the FMHPS sample.

CMD indicator prevalence between the FMPHS and SHIP samples

The results of the comparative analysis were not completely in line with the original hypotheses of the study, since overall, it was expected that the demographic profile, treatment context and secure

setting of the FMHPS sample, would give rise to elevated rates of CMD indicators compared to the community-based psychosis sample. Instead, either no difference or a reduced prevalence in the FMHPS group was found.

The prevalence of two CMD indicators (i.e. hypertension and metabolic syndrome) were found to be significantly lower in the FMHPS sample compared to the SHIP sample. Interestingly, these results paralleled the findings of hypertension and metabolic syndrome prevalence in the reviewed studies when they were compared to community-based psychosis samples.

The amalgamated prevalence of hypertension in the FMHPS sample was 31.6% compared to 55.2% in the SHIP sample. Hypertension was the only condition to have a statistically significant difference across both samples on both unadjusted (OR 0.37, 95% CI 0.26-0.55) and adjusted analysis (OR 0.36, 95% CI 0.23-0.57). Of note, in the FMHPS sample, the prevalence of hypertension on physical testing was almost half that reported in the SHIP sample (27.7% vs. 48.8%). Whilst more participants were prescribed antihypertensive treatment in the FMHPS sample (23.0% vs. 11.2%) and thus more likely to have normalised blood pressure on physical testing, the effect this may have had on reducing the overall rate of hypertension in the FMHPS sample was accounted for by the inclusion of treated status as a variable in the amalgamated criteria.

The prevalence of metabolic syndrome in both samples was reported according to the original criteria used in the SHIP study and was found to be slightly lower in the FMHPS sample (39.4% vs. 43.0%). When self-declared or file review diagnoses were added to the criteria, as expected, the prevalence increased across both samples (43.8% vs. 53.8%) but the apparent difference remained. When adjusted for all selected potential explanatory factors, the difference between the two samples was statistically significant (OR 0.41, 95% CI 0.25-0.67). Given the amalgamated prevalence of dyslipidaemia, diabetes and weight related problems in both samples were similar, the lower prevalence of hypertension in the FMHPS sample likely accounted for most of the difference seen.

Of the six CMD indicators compared, only the amalgamated prevalence of cardiovascular disease was higher (23.2% vs 14.9%) and statistically significant (OR 1.73, 95% CI 1.14-2.62) in the

FMHPS sample compared to the SHIP sample on unadjusted analysis. Statistical significance was lost following adjusted analysis (OR 1.64, 95% CI 0.97-2.78), however it revealed that completing vigorous activity at least one day per week, which was more common in the FMHPS sample, had a significant and negative association (OR 0.68, 95% CI 0.47-0.98) with cardiovascular disease risk.

Whilst the amalgamated prevalence of the remaining CMD indicators, (i.e. dyslipidaemia, diabetes and weight related problems) were similar between samples and no significant differences were found on either unadjusted or adjusted analysis, the effect of the determinants and explanatory factors on overall risk were found to be more complex. Multivariate analysis of each CMD indicator demonstrated that several the selected factors were found to have either a significantly positive or negative association with certain CMD indicator risk, and when analysed together were likely to have had a bi-directional effect, removing any resultant net overall association with a particular sample.

For example, the amalgamated prevalence of dyslipidaemia between the FMHPS and SHIP samples was 69.3% and 64.8% respectively; and the overall adjusted odds of having dyslipidaemia was the same in both samples (OR 1.00, 95% CI 0.59-1.69). However, being prescribed clozapine (OR 1.78, 95% CI 1.33-2.37) and having four or more meals and snacks per day (OR 1.37, 95% CI 1.10-1.71) both had significant and positive associations with dyslipidaemia risk; whilst completing vigorous activity at least one day per week (OR 0.69, 95% CI 0.53-0.90) had a significant and negative association with dyslipidaemia risk. All three of these factors were significantly more common in the FMHPS sample. A similar bi-directional effect for the same factors was observed in the adjusted analysis for metabolic syndrome and diabetes, although the negative association of completing vigorous activity at least one day per week (OR .78, 95% CI 0.59-1.04) on diabetes was not statistically significant.

The amalgamated prevalence of weight related problems between the FMHPS and SHIP samples was almost identical (80.8% vs. 81.8%), however a similar bi-directional effect was again observed for selected factors that were significantly more common in the FMHPS sample compared to the SHIP sample. As expected, being prescribed two or more antipsychotics (OR 1.47, 95% CI 1.05-2.04) and clozapine (OR 1.97, 95% CI 1.33-2.92) both had significant positive associations with the risk of weight related problems. Conversely, male participants had a significant negative

association (OR 0.28, 95% CI 0.19-0.41), which is likely to have off-set any resultant difference between the samples. Again, all three of these factors were significantly more common in the FMHPS sample.

Overall, prescribing of medication used to treat CMD indicators such as hypertension, dyslipidaemia, diabetes, and cardiovascular disease was higher in the FMHPS sample. This was likely to have been an effect of participants in hospital or institutional settings being more routinely screened for health problems that uncover unknown or asymptomatic risk or disease, which in turn leads to increased access to treatment compared to people with psychosis in community settings, who may be poorer users of primary care.

Of note, participants in the FMHPS sample were three times more likely to be prescribed medication used to treat diabetes compared to the SHIP sample (28.9 % vs 8.7%). However, metformin is also typically prescribed for antipsychotic-induced weight gain (de Silva et al., 2016); and therefore, this additional indication may have over-estimated the prevalence of diabetes in the FMHPS sample.

Demographic, clinical and lifestyle factors in relation to CMD indicators between the FMPHS and SHIP samples

Being aged 35 years or older was the only selected potential explanatory factor that was a statistically significant predictor of all CMD indicators, even following adjusted analysis. Older participants were shown to have increased odds of meeting criteria for all CMD indicators. This was consistent with the known age-related prevalence of metabolic syndrome and its components in the general population (Hildrum, 2007). Participants in the FMHPS sample were almost three times as likely than the SHIP sample to be aged 35 years and above (OR 2.89, 95% CI 1.89-4.42).

Compared to female participants, male participants across both FMHPS and SHIP samples had lower odds of having weight related problems (OR 0.28, 95% CI 0.19-0.41). This finding was consistent with higher rates of obesity and overall abnormal BMI found in women in the reviewed studies (Cormac et al., 2005; Long et al., 2014; Wolff et al., 2012). Male participants were more likely than female participants to have hypertension, which was consistent with rates of hypertension in the general population. For example, in Australia, 25% of men in the general

population have been reported to have hypertension, compared to 20% of women (Australian Institute of Health and Welfare, 20120). This was of relevance for the FMHPS sample, which was overwhelmingly represented by men compared to the SHIP sample (89.9% vs 59.6%), and consistent with overall rates of male incarceration.

Aboriginal and/or Torres Strait Islander participants were more likely to suffer from cardiovascular disease than non-Aboriginal and/or Torres Strait Islander participants (OR 2.23, 95% CI 1.39-3.56). This was consistent with reported rates of cardiovascular disease between Indigenous Australians and Non-Indigenous Australians in the general population (4.7% vs. 3.5%) (Australian Institute of Health and Welfare, 2020). This was of significance for the FMHPS sample, where there was an over-representation of Aboriginal and/or Torres Strait Islander participants (19.0% vs. 4.9%); and consistent with rates of Indigenous over-incarceration across Australia (Weatherburn & Holmes, 2017).

Participants who completed at least one day of vigorous activity per week were almost half as likely to have metabolic syndrome compared to participants who did no days of vigorous activity (OR 0.58 95% CI 0.44-0.75). Participants in the FMHPS sample were more likely to engage in all types of physical activity on a more frequent basis compared to the SHIP sample. Secure settings are likely to have bi-directional effects on physical activity. On one hand, correctional centres are highly restrictive environments with limitations on the time an inmate can spend out of their cell; but on the other hand, exercise and physical activity are a valued and adaptive coping strategy for many people detained in secure settings, as it often functions as a means of enhancing social interaction and as an activity to pass time. The FMHPS sample were predominantly located in a secure hospital setting, where compared to correctional centres, there are no lock-in periods, and furthermore exercise is routinely encouraged and often included in some rehabilitation programs (Prebble, 2011).

Whilst vigorous activity was negatively associated with the prevalence of metabolic syndrome, consuming at least four or more meals and snacks per day was associated with approximately 1.4 times the odds of having metabolic syndrome. Participants from the FMHPS sample were found to eat more meals and snacks, including breakfast, compared to community controls (OR 1.77, 95% CI 1.15-2.72). The presence of highly structured and consistent meal services available in

secure hospital settings could explain the difference in levels of food consumption compared to people with psychotic disorders living in the community, where support for food preparation may not be available for those who require it. In custodial settings, high levels of boredom also potentially lead to snacking and over-eating.

Clozapine is a well-established treatment for violence and aggression in forensic populations; Patchen et al also argues that it is under-utilised in forensic populations due to its clinical and cost-saving benefits (2018). The proportion of participants prescribed clozapine in the FMHPS was significantly higher than the SHIP sample (OR 3.78 95% CI 2.59-5.51). Furthermore, participants prescribed clozapine were 2.4 times likely to have metabolic syndrome compared to those prescribed other antipsychotics.

Polypharmacy is often relied on by prescribers to meet the complex treatment and risk management needs of forensic patients. Farrell and Brink (2020) measured the rate of antipsychotic polypharmacy in a sample (N=142) of forensic inpatients to be 54.93%. The FMHPS sample had twice the rate of polypharmacy compared to the SHIP sample (54.5% vs. 27.4%). Participants across both samples who were prescribed two or more antipsychotics, compared to those prescribed only one antipsychotic, were 1.5 times more likely of having weight related problems, even when adjusted for all other selected factors.

Interestingly, despite the FMHPS sample having high rates of clozapine and polypharmacy prescribing, which are known risk factors for CMD indicators and shown to be so in this study, the overall prevalence of metabolic syndrome was higher in the SHIP sample. This suggests that the effects of clozapine and polypharmacy on CMD risk may have been mitigated by other explanatory factors such as physical activity and early access to CMD treatments.

5.2 Limitations

The most significant limitation identified in the systematic review was methodological heterogeneity in the classification of CMD indicator diagnoses. For example, the frequent use of single measures to diagnose CMD indicators likely lead to the under-estimation of CMD indicator prevalence where this occurred. This also impacted on the extent to which data across studies could be directly compared and included for the weighted pooled prevalence of CMD indicators.

Due to the nature of mentally ill offending in forensic patients, it was expected that the FMHPS sample would contain participants predominantly diagnosed with psychotic disorders. Whilst psychotic disorders were represented at high rates in both samples, in the FMHPS sample the prevalence was slightly less (86.9% vs 95.3%). The differences in the mental health profile of the two samples should be considered when generalising the findings from this study. There were periods of time between data collection for the SHIP (2010-11) and FMHPS (2016-17), as well as the subsequent analysis of results, which should be considered when applying the findings of this study to contemporary populations.

There was a lack of statistical power to include additional explanatory factors, such as antipsychotic class, secondary mental health conditions and nutrition related variables in the multiple regression analysis. Several variables and measurements were not obtained from the FMHPS file review group (n=42). For example, weight and height measurements were not available and therefore only the face-to-face group (n=96) were used to measure and analyse weight related problems and metabolic syndrome. Additionally, data on lifestyle factors such as physical activity and nutrition were not obtained for the file review group.

The use of stepwise regression was helpful in identifying which explanatory variables to select for adjusted analysis, however this type of analysis may have limited the accurate identification of statistically significant and non-significant explanatory variables (Smith, 2018).

The prescription of atypical antipsychotics was so ubiquitous in the FMHPS sample that distinct differences compared to those prescribed only typical antipsychotics were unable to be elicited from regression analysis. There was insufficient data available for smoking history in the FMHPS sample, which would have been relevant as a risk factor for cardiovascular disease. Current smoking status in the FMHPS sample was not collected due to smoking being prohibited in the study settings at the time of the survey.

Due to differences in sociodemographic and lifestyle factors, the prevalence and determinants of CMD indicators for forensic patients and mentally ill offenders identified in this study are likely to differ when compared to similar populations in low and middle income countries. Furthermore,

the recommended practice implications of this study will be limited by budgetary and health expenditure factors in different jurisdictions.

5.3 Future directions

Implications for practice

Clinical services for people with psychotic disorders in secure settings should embed within core clinical practice integrated care models for the early detection and assertive treatment of cardiometabolic conditions. A number of models have been developed in general mental health services (Lambert et al., 2020) and other specialty mental health populations. For example, the Healthy Active Lives (HeAL) consensus statement (International Physical Health in Youth, 2013), provide a set of standards and approaches used to detect and treat physical illnesses, particularly CMD indicators, in young people with psychotic disorders. Patients should have access to multidisciplinary services, which include allied health, primary care, and specialist medical services, where a collaborative approach for the management of cardiometabolic conditions takes place. This study highlighted that certain demographic groups are at increased risk of CMD and may benefit from targeted programs. These include weight related problems in females, hypertension in males and cardiovascular disease in Aboriginal and/or Torres Strait Islander people. Culturally sensitive programs that target health promotion and CMD interventions for Aboriginal and/or Torres Strait Islander people may be effective (Huffman & Galloway, 2010).

This study further contributes to the evidence that exercise and physical activity are an effective intervention for reducing CMD risk in forensic settings (Tetlie et al., 2008). Whilst formal exercise groups are part of many therapeutic programs in secure hospitals and some custodial settings, they should be embedded within standard programs for people with psychotic disorders in secure settings. Opportunities to engage and promote exercise to patients with psychotic disorders is a relative strength of the institutional setting compared to the community setting. Clinical services should routinely recruit dedicated staff, such as health and fitness officers in custodial settings or exercise physiologists in secure mental health facilities; and ensure there is available and appropriate equipment and facilities to promote exercise and physical activity.

Clinical services have a duty of care to ensure meals served in institutional settings meet nutrition standards of the local jurisdiction. This study highlighted that "over-nutrition" (NSW Agency for

Clinical Innovation, 2013) in secure settings is associated with increased CMD risk. Education focusing on portion sizes and meal frequency should be incorporated into healthy lifestyle and cooking programs. The availability of unhealthy snacks that may lead to over-eating should be restricted and balanced with appropriate food options. Additionally, training to build the confidence and knowledge of staff to provide evidence-based nutrition advice and practical assistance has been identified as a need in forensic rehabilitation settings (Forsyth, Elmslie & Ross, 2012).

There were higher rates of prescribing overall in the FMPHS sample for medications used to treat CMD indicators and psychotropics prescribed for mental illness. Whilst early detection and access to pharmacological treatment for CMD indicators was considered a relative strength in the FMHPS sample, they were also more likely to be prescribed clozapine and/or two or more antipsychotics; both of which are risk factors for CMD. To date, there are no published interventions on reducing antipsychotic prescribing in forensic populations for the purpose of mitigating cardiometabolic risk, however quality improvement programs have been successful in sustained reductions in high-dose and polypharmacy prescribing in psychiatric intensive care units in the United Kingdom (Mace & Taylor, 2015). There is also evidence that quetiapine prescribing can be safely and effectively reduced in custodial settings, through changes in prescribing formularies and organisational guidelines and policy, for the purpose of minimising misuse and metabolic risks (Reeves, 2012; Tamburello, Lieberman, Baum & Reeves, 2012). Therefore, prescribers in secure settings should be supported by guidelines and quality improvement programs to assist in rationalising antipsychotic prescribing, in balance with non-pharmacological risk management strategies, where benefits are not observed.

Implications for research

Whilst a community-based psychosis sample was chosen for initial comparative analysis, future research comparing forensic patients and mentally ill offenders in secure settings to people with psychotic disorders in general adult inpatient settings may offer further opportunities to identify factors associated with secure settings, such as high levels of physical restrictions and long-term institutional care, that impact on CMD risk.

Future research is required to evaluate potential interventions for the prevention and treatment of CMD indicators in secure settings. Implementing multidisciplinary interventions in secure hospitals and in particular custodial settings can be challenging and therefore interventions should be initially piloted for feasibility. The effectiveness of behavioural and environmental interventions in secure settings and changes in psychotropic prescribing practices on CMD risk in forensic populations should be evaluated through controlled trials.

5.4 Conclusion

People with severe mental illness have poor physical health profiles, in particular cardiometabolic diseases. Forensic patients and other mentally ill offenders with psychotic disorders in secure settings have complex treatment and risk management needs and are detained in highly restrictive environments. It was hypothesised that people with psychotic disorders in secure settings would have higher rates of CMD indicators, even above others with severe mental illnesses outside secure settings.

Methodological differences in study design meant that the pooled prevalence of CMD indicators from the reviewed studies in the existing literature were lower compared to the FMHPS sample. Future studies measuring the prevalence of CMD indicators in mental health populations should develop dedicated methodologies for measuring and classifying CMD indicator diagnoses to overcome these differences.

Surprisingly, the prevalence of CMD indicators in the FMHPS sample, whilst higher compared to equivalent measures in the general population, were found to be either lower (i.e. hypertension and metabolic syndrome) or similar to those found in the comparison SHIP sample. What differed significantly, were the rates of potential explanatory factors and CMD determinants between the samples. For example, whilst higher rates of clozapine and antipsychotic polypharmacy prescribing were expected and subsequently demonstrated in the FMHPS sample, it was surprising to find that participants in this sample also had higher levels of physical activity despite being in secure settings, and that food consumption was problematic rather than a strength. A stepped approach to multivariate analysis revealed that explanatory factors relevant to secure settings did not simply have a uni-directional impact on CMD risk, as initially hypothesised, but rather that these factors could have either a positive or negative association with certain CMD indicator risk. Whilst this

bi-directional effect, where one factor could mitigate the effect of another factor, may not have proved there was an overall difference in CMD indicator prevalence between the two samples, it did highlight more nuanced aspects in relation to the strengths and weaknesses that the secure setting had in relation to CMD risk, which importantly could be targets for intervention.

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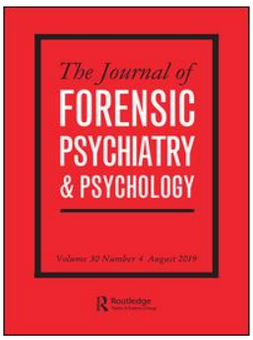

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The prevalence of cardiometabolic disease in people with psychotic disorders in secure settings – a systematic review

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ABSTRACT

The aim of this review was to estimate the prevalence of cardiometabolic disease indicators in people with psychotic disorders in secure settings. A PRISMA guided systematic search and appraisal was conducted for studies of metabolic disease indicators in samples of adult male and female inpatients in secure psychiatric hospitals and inmates in custodial centres with diagnoses of psychotic disorders. Seventeen studies were selected for review. An ability to validly summarise and compare prevalence data across studies were limited by the extent of methodological heterogeneity. The weighted pooled prevalence rates were determined to be: metabolic syndrome 23.5% (N = 1,390, 95% CI 21.3, 25.7), diabetes 11.2% (N = 2,582, 95% CI 9.9, 12.4), dyslipidaemia 29.2% (N = 1,135, 95% CI 26.6, 31.9), hypertension 25.0% (N = 857, 95% CI 22.1, 27.9), being overweight or obese 72.4% (N = 840, 95% CI 69.4, 75.5) and cardiovascular disease 15.6% (N = 1,047, 95% CI 13.4, 17.8). The prevalence of CMD indicators in people with psychotic disorders in secure settings were predominantly higher compared to the general population and either similar or lower compared to people with psychotic disorders in the community.

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KEYWORDS 'Metabolic syndrome'; 'cardiovascular disease'; 'schizophrenia'; 'forensic psychiatry'

Introduction

Background

Cardiovascular diseases such as coronary heart disease and cerebrovascular disease are the leading causes of death worldwide (World Health Organization, 2018). Metabolic syndrome (MS) and its components, which include central obesity, insulin resistance, type II diabetes mellitus, hypertension and dyslipidaemia, represent key risk factors for cardiovascular disease.

The increased prevalence of MS in people with psychotic disorders compared to the general population is well established. In 2005, the Clinical

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Antipsychotic Trials of Intervention Effectiveness (CATIE) study of schizophrenia treatment estimated the prevalence of MS to be 40.9% in 689 subjects with schizophrenia compared to 23.7% of the general population in the United States (McEvoy et al., 2005). In the second Australian National Survey of High Impact Psychosis (SHIP), 54.8% of 1,825 people who screened positive for psychosis met the criteria for MS (Galletly et al., 2012).

People with mental illness are approximately three times more likely to die from heart disease and stroke compared to the general population (Osborn et al., 2007). Among adults with schizophrenia in the United States, cardiovascular disease accounts for approximately one-third of all natural deaths and is the leading cause of mortality (403.2 per 100,000 person-years) (Olfson et al., 2015). In particular, people with schizophrenia have on average a reduced life expectancy of 18.7 years less for men and 16.3 years less for women than the general population (Laursen, 2011).

Whilst cardiometabolic disease (CMD) in people with psychotic disorders who live in the community has been widely studied, less is known about the prevalence and determinants of CMD in forensic patients and those with psychotic disorders in criminal justice settings. One of the main subgroups of forensic patients includes those whom the court has found not guilty by reason of mental illness or unfit to be tried for an offence. They are often detained under Mental Health legislation in secure psychiatric hospitals for long-term treatment and, in some jurisdictions may spend time in custodial settings. They are most commonly diagnosed with psychotic disorders.

Forensic patients and other mentally ill offenders in secure settings are arguably doubly disadvantaged with regard to their risk of developing CMD due to their unique treatment needs and the restrictive environments in which they reside. For example, treatment with higher doses of antipsychotic medication and polypharmacy is common, and the frequent use of clozapine (Stone-Brown et al., 2016), a well-established risk factor for CMD, is typical for this group (Rummel-Kluge et al., 2010). Motivation and capacity to make healthy lifestyle choices as prevention for CMD are often diminished in this population (Haw & Stubbs, 2011) and opportunities for physical activity in secure psychiatric hospitals and custodial centres are often highly restricted.

The aim of the current study was to undertake a systematic review of research conducted to date in order to establish the prevalence of CMD in people with psychotic disorders in secure settings. Where possible, we also aimed to establish weighted pooled prevalence data for metabolic syndrome, diabetes, dyslipidaemia, hypertension, weight-related problems and cardiovascular (CVD).

Methods

Search criteria

A PRISMA guided systematic search was conducted (Moher et al., 2009). We searched MEDLINE, EMBASE, PsycINFO, CINCH (Australian Criminology Database) and NCJRS (National Criminal Justice Reference Service) from inception until May 2019 for articles written in English or translated into English. The key search terms were 'metabolic syndrome', 'cardiovascular disease', 'schizophrenia', 'forensic psychiatry'. Additional key search terms used in criminology and justice databases were 'psychosis', 'forensic' and 'hospital'. Search strings were used to combine each key search term. Each key search term included up to 24 synonyms, which were used to combine MeSH terms. Other data sources included Google Scholar, hand searches and reference list reviews. Duplicate studies were removed from the combined search results and titles and abstracts were screened by TM according to the eligibility criteria. The full-text of eligible studies were independently assessed by TM and KD and discrepancies were discussed to determine which studies were included for review.

Studies were included in the review if:

(1) They were cross-sectional, case-control or cohort in design. Baseline data reported for intervention studies were also included. Case studies, case series and qualitative studies were excluded and conference abstracts and posters were also excluded unless sufficient summary data were available.
(2) The majority of individuals in the study were diagnosed with psychotic disorders included in the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition (DSM-5) classification of schizophrenia spectrum and other psychotic disorders; and classified as forensic patients or mentally ill offenders. Studies of male and female adults were included.
(3) They were conducted in secure (low, medium or high) psychiatric hospitals or custodial centres. Samples from acute general psychiatric inpatient hospitals, long-stay civil psychiatric rehabilitation units and police cells were excluded.
(4) They reported prevalence data for at least one of the CMD indicators considered, including: metabolic syndrome, diabetes, dyslipidaemia, hypertension, weight-related problems and CVD. Studies which used prescribed treatment as a proxy for a CMD indicator diagnosis were also eligible. Sample size data were also required for each study in order to conduct weighted pooled analyses. Studies were excluded if only mean data, rather than prevalence rates, or mortality data were reported.

Data extraction

Data extraction was conducted by TM. Data items included study method, sample age distribution, sample sex distribution, sample size, clinical setting and country. The type of CMD indicators included and the details of psychiatric diagnosis were also recorded. Summary data were collected on the prevalence of each reported CMD indicator, including raw numbers and percentages. Where available, information related to the method used to measure and define CMD indicators was recorded for further sub-group analysis.

Data analysis

Prevalence data for each CMD indicator were weighted according to sample size from each individual study to calculate a weighted average prevalence of data across the studies. Where possible sub-group analyses, within each CMD indicator category, were conducted based on the type of diagnostic criteria used. Confidence intervals for each weighted pooled prevalence estimate were calculated from the standard error of each proportion using the normal approximation to the binomial.

Results

Study selection

Database searches identified 674 studies. After 92 duplicate studies were removed the remaining 582 studies were screened for eligibility. Of these, 430 studies were excluded following title screen and a further 134 studies were excluded after abstracts were screened. Eighteen eligible articles were identified through database searches and a further 16 studies were identified through searches of other data sources including Google Scholar, hand searches and reference lists. Of the 34 articles submitted for full-text assessment, 17 studies were determined to be eligible and comprised the final sample (Figure 1).

Study characteristics (Table 1*)*

Country and clinical setting

Of the 17 studies determined to be eligible, five studies were conducted in the United Kingdom, four in the United States of America, two in Finland, two in New Zealand and one in each of Australia, Canada, Ireland and Norway. Thirteen studies were conducted in secure psychiatric hospitals and four studies were conducted in custodial centres.

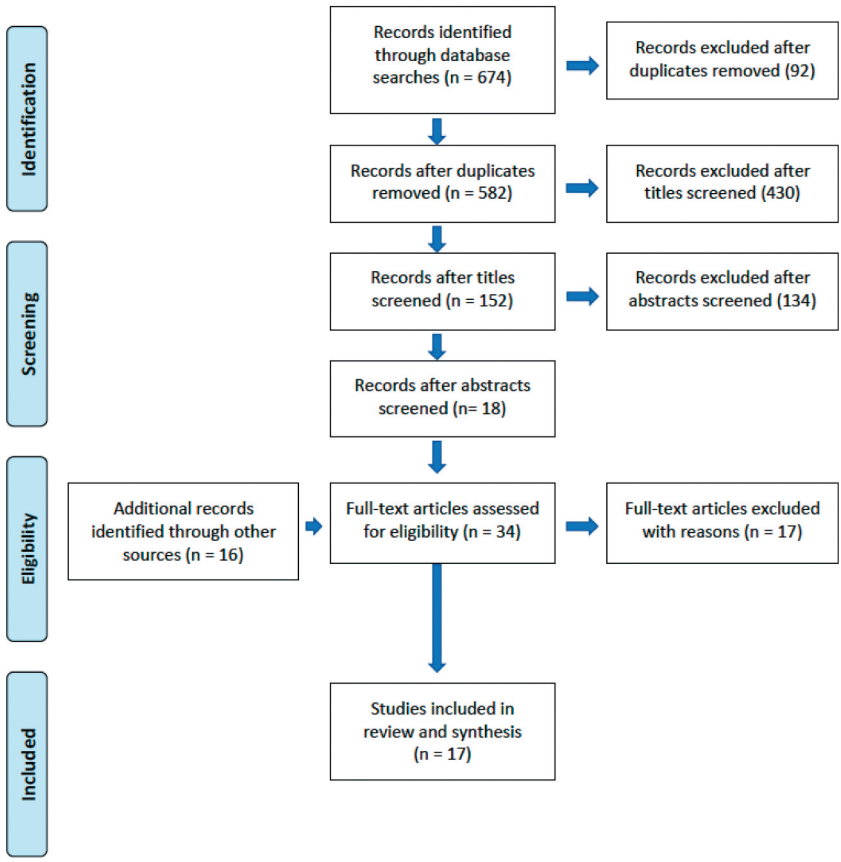

Figure 1. Study flow diagram.

Participants

Eleven studies included both male and female participants; male participants accounted for 68% to 89% of the samples in those studies, where the proportion was known. The remaining six studies included only male participants. In 11 studies the mean or median age of the study sample was between 30 and 39 years and in three studies the mean or median age was between 40 and 49 years. One study included two study groups, one of which had a mean age between 30 and 39 years and the other between 40 and 49 years. One study did not include the mean or median age of the sample. Eleven of the studies specified diagnoses of psychotic disorders and related conditions, and, where the proportions were known, they accounted for 44% to 100% of the samples. Of the remaining studies where details of psychiatric diagnoses were not specified, participants were either described as either 'violent psychiatric patients', 'mentally disordered offenders', having serious mental disorders or receiving antipsychotic medication.

Table 1. Summary of eligible studies included in review.

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Cormac et al. (2005)	United Kingdom	Cross-sectional survey and review of case notes between November 2000 and March 2001	248	Mean age 39	Male 214/248 (86%) Female 34/248 (14%)	Secure psychiatric hospital	Schizophrenia 131/248 (53%); personality disorder 119/248 (48%)
Hefazi et al. (2015)	United States of America	Review of medical records as of July 2014	149	Mean age 49	Male	Custodial centre	Prescribed antipsychotics for at least 6 months
Hillbrand et al. (1995)	United States of America	Retrospective review of medical records during 2-year period	106	Mean age 33–34	Male	Secure psychiatric hospital	Violent psychiatric patients
Hilton et al. (2015)	Canada	Review of medical records on admission and discharge	122	Mean age 35.1	Male	Secure psychiatric hospital	Schizophrenia 47%; personality disorder 12%; mood disorder 8%
Huthwaite et al. (2017)	New Zealand	Cross-sectional survey; review of clinical records and patient interviews between March 2014 and March 2015	51 (forensic – 30 rehabilitation – 21)	Mean age 38	Male 40/51 (78%) Female 11/51 (22%)	Secure psychiatric hospital	Schizophrenia 78%; schizoaffective disorder 12%; bipolar affective disorder 4%; psychotic disorder NOS 2% Total schizophrenia & related psychosis 92%

(*Continued*)

Table 1. (Continued).

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Ivbijaro et al. (2008)	United Kingdom	Audit; retrospective data collection from case notes for one-year period	56	Unknown	Male	Secure psychiatric hospital	Mentally disordered offenders
Long et al. (2014)	United Kingdom	Three-year retrospective survey using electronic patient records	351	Mean age 38.12	Male 239/351 (68%) Female 112/351 (32%)	Secure psychiatric hospital	Schizophrenia & related psychosis 53%; personality disorder 12%
MacFarlane et al. (2004)	United Kingdom	Cross-sectional survey; point prevalence measured on one day in September 2001	408	Approximately 90% of sample was under <60	Male 89% Female 11%	Secure psychiatric hospital	Approximately 70% of sample severe mental illness; 25% personality disorder
Mat et al. (2015)	Ireland	Data collected on admission and during admission	76	Mean age 36.3	Male 67/76 (88%) Female 9/76 (12%)	Secure psychiatric hospital	Schizophrenia 82.9%
Ojala et al. (2008)	Finland	Retrospective review of medical records of patients from January 2002 and May 2002	221	Median age 41	Male 89% Female 11%	Secure psychiatric hospital	Prescribed antipsychotic medication for at least 6 months (schizophrenia & related psychosis 92%)

(*Continued*)

Table 1. (Continued).

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Paavola et al. (2002)	Finland	Retrospective case-control study; review of medical records from January 1996 and May 1999	385	Mean age 36.8	Male	Secure psychiatric hospital	Schizophrenia & related psychosis 44%; personality disorder 30%
Prebble et al. (2011)	New Zealand	Baseline measures of healthy living program intervention study	16 (program A – 7; program B – 9)	Mean age: Group A – 47 Group B – 36.5	Group A: Male 5/7 (71%) Female 2/7 (29%) Group B: Male 8/9 (89%) Female 1/9 (11%)	Secure psychiatric hospital	Group A: schizophrenia 5/7 (71%); intellectual disability 2/7 (29%) Group B: schizophrenia 6/9 (33%); remainder had either delusional disorder, bipolar affective disorder or personality disorder Total schizophrenia & related psychosis 69%
Puzzo et al. (2017)	United Kingdom	Service evaluation; data collected from June to August 2015	479	Mean age 30–39	Male 418/479 (87%) Female 61/479 (13%)	Secure psychiatric hospital	In two groups with diabetes 63% & 77.5% had schizophrenia respectively

(*Continued*)

Table 1. (Continued).

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Reeves et al. (2017)	United States of America	Retrospective chart review from 2005 until 2013	838	Mean age 44.6 (of those with metabolic syndrome)	Male & Female	Custodial centres	Psychotic spectrum disorder & prescribed antipsychotic medication for at least 6 months (schizophrenia 311; schizoaffective disorder 396; psychotic disorder NOS 131)
Sazhin and Reznik (2008)	Australia	Retrospective review of medical records from July 2003 and January 2006	48	Average age 35.5	Male	Custodial centre	Total schizophrenia & related psychosis 100% Major mental illness 44/48 (92%) (schizophrenia, schizophreniform psychosis, delusional disorder 39, schizoaffective disorder 7, manic psychosis 1)
Tetlie et al. (2008)	Norway	Baseline and follow up measures of an exercise intervention study	15 – baseline 13 – follow up	Mean age 32.5	Male 10 Female 3 Unknown 2	Secure psychiatric hospital	Severe mental disorders

(*Continued*)

Table 1. (Continued).

Study	Country	Study design & data collection method	Sample size (n)	Participant age	Participant sex	Clinical setting	Psychiatric diagnoses (% of sample)
Wolff et al. (2012)	United States of America	Self-report survey conducted between June 2009 and August 2009	Weight measured – 303 Prescribed medication for diabetes, heart disease, hypertension or high cholesterol – 291	Mean age (of whole sample with and without serious mental disorder): Male 33.8 Female 36.5	Weight measured: Male 261/303 (86%) Female 42/303 (14%) Prescribed medication for diabetes, heart disease, hypertension or high cholesterol: Male 251/291 (87%) Female 40/291 (14%)	Custodial centre	Serious mental disorder (schizophrenia or bipolar affective disorder)

Study design

Nine studies were conducted as retrospective file reviews or audits and five studies as cross-sectional surveys. Other study designs included two intervention studies and one case–control study. Six studies had a sample size of less than 100 participants, with the smallest sample including only 13 participants. Ten studies had sample sizes between 100 and 500 participants. The largest study had 838 participants. In the study by Puzzo et al. (2017), a discrepancy in sample size was identified within the study (479 vs 500); taking a conservative approach, we relied on the smaller sample size when conducting analyses. Within some studies the sample sizes varied according to which CMD indicator was measured. Where possible subgroups within the same study were combined to calculate the total prevalence of each CMD indicator.

CMD Indicator prevalence rates

Metabolic syndrome

The internationally accepted diagnostic criteria for metabolic syndrome is outlined in Table 2. The prevalence of metabolic syndrome (MS) was reported in five studies (Table 3). The weighted pooled prevalence of MS across all studies was 23.5% (N = 1,390, 95% CI 21.3, 25.7).

The method used to define the criteria for MS differed across studies. Of the three studies (Hefazi et al., 2015; Hilton et al., 2015; Ojala et al., 2008) which utilised biochemistry results and physical observations to determine the presence of MS, the weighted pooled prevalence of MS was 33.5% (N = 476, 95% CI 29.2, 37.7).

Whilst the method used to define and measure MS for the study (Mat et al., 2015) with the highest prevalence (57.9%) was not available the two studies

Table 2. American Heart Association criteria for the clinical diagnosis of the metabolic syndrome (Alberti et al., 2009).

Three out of the following 5 measures	
Measure	Categorical cut points
Elevated waist circumference	Population and country-specific definitions
Elevated triglycerides; or drug treatment for elevated triglycerides	≥ 150 mg/dL (1.7 mmol/L)
Reduced HDL cholesterol; or drug treatment for reduced HDL	< 40 mg/dL (1.0 mmol/L) in males < 50 mg/dL (1.3 mmol/L) in females
Elevated blood pressure; or antihypertensive drug treatment of previously diagnosed hypertension	Systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg
Elevated fasting glucose; or drug treatment for elevated glucose	≥ 100 mg/dL (5.6 mmol/L)

HDL = High density lipoprotein; BP = Blood pressure

Table 3. Summary of studies measuring the prevalence of metabolic syndrome.

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Hefazi et al. (2015)	At least three of the following: • BMI >30 • Triglycerides >150 mg/dL • HDL-C < 40 mg/dL • BP >130/85 mm Hg • HbA1c >6%	149	42.3
Hilton et al. (2015)	All of the following: • BMI >25 • BP >130 mmHg • Waist circumference >102 cm	106	22
Mat et al. (2015)	Not defined	76	57.9
Ojala et al. (2008)	At least three of the following: • BMI >30 • fBGL >6.1 mmol/l or on diabetes treatment • Triglycerides >1.70 mmol/l or on hypertriglyceridaemia treatment • HDL-C < 1.00 mmol/l for males; <1.30 mmol/l for females • BP >130/85 mm Hg or on antihypertensive treatment	221	33
Reeves et al. (2017)	At least three of the following: • BMI >25 • Prescription for lipid-modifying agent • Prescription for antihypertensive • Prescription for a diabetic medication	838	14.7

BMI = Body mass index; HDL-C = High density lipoprotein cholesterol; BP = Blood pressure; HbA1c = Glycated haemoglobin; fBGL = Fasting blood glucose level

(Hefazi et al., 2015; Ojala et al., 2008) with the next highest prevalence of MS used the greatest number of parameters to diagnose MS, resulting in lower diagnostic thresholds compared to the other studies.

The study by Reeves et al. (2017), which had the largest sample size (838 participants) of all studies included in the review, found the lowest prevalence of MS (14.7%). This study used prescriptions of medications used to treat dyslipidaemia, hypertension and diabetes as parameters for MS diagnosis. By selecting only participants with treated components of MS this approach is likely to have under-estimated the true prevalence of MS.

Diabetes

The internationally accepted diagnostic criteria for diabetes is outlined in Table 4. The prevalence of diabetes was reported in 12 studies (Table 5). The weighted pooled prevalence of diabetes across all studies was 11.3% (N = 2,561, 95% CI 10.0, 12.5).

The summary data used to measure diabetes and related conditions differed amongst the studies. Eight studies (Cormac et al., 2005; Huthwaite et al., 2017; Ivbijaro et al., 2008; Long et al., 2014; MacFarlane et al., 2004; Mat et al., 2015; Prebble et al., 2011; Puzzo et al., 2017) measured the prevalence

Table 4. International Diabetes Federation (IDF) modified diagnostic criteria for diabetes (International Diabetes Federation, 2019).

Classification	Diagnostic criteria
Diabetes	FPG ≥7.0 mmol/L (126 mg/dL)
Should be diagnosed if one or more of the following criteria are met.	Two-hour plasma glucose after 75 g oral glucose load (OGTT) ≥11.1 mmol/L (200 mg/dL)
	HbA1c ≥48 mmol/mol (equivalent to 6.5%)
	Random plasma glucose (in the presence of symptoms of hyperglyecaemia) >11.1 mmol/mol (200 mg/dL)
Impaired glucose tolerance (IGT)	FPG <7.0 mmol/L (126 mg/dL)
Should be diagnosed if both of the following criteria are met	Two-hour plasma glucose after 75 g oral glucose load (OGTT) ≥7.8 and <11.1 mmol/L (200 mg/dL)
Impaired fasting glucose (IFG)	FPG 6.1–6.9 mmol/L (126 mg/dL)
Should be diagnosed if the first or both of the following are met	Two-hour plasma glucose after 75 g oral glucose load (OGTT) <7.8 mmol/L (200 mg/dL)

FPG = Fasting plasma glucose; OGTT = Oral glucose tolerance test

Table 5. Summary of studies measuring the prevalence of diabetes.

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Cormac et al. (2005)	Diabetes and metabolic illness	248	9
Huthwaite et al. (2017)	Diabetes	51	3.9
Ivbijaro et al. (2008)	Diabetes mellitus	56	17.9
Long et al. (2014)	Type II diabetes mellitus	351	10
MacFarlane et al. (2004)	Type II diabetes mellitus	408	8.6
Mat et al. (2015)	Type II diabetes mellitus	76	15.8
Ojala et al. (2008)	Impaired glucose regulation (IGR); defined as fBGL >6.1 mmol/l or diabetes treatment	187	30.6
Paavola et al. (2002)	Prescribed medication for diabetes	385	1.8
Prebble et al. (2011)	Diabetes	16	25
Puzzo et al. (2017)	Type II diabetes mellitus	479	18.4
Tetlie et al. (2008)	Abnormal reference range of glucose	13	0
Wolff et al. (2012)	Prescribed medication for diabetes	291	5.3

fBGL = Fasting blood glucose level

of a diagnosis of type II diabetes mellitus from medical records and self-report, two studies (Paavola et al., 2002; Wolff et al., 2012) measured the prevalence of patients prescribed medication used to treat diabetes; and two studies (Ojala et al., 2008; Tetlie et al., 2008) measured the prevalence of other abnormal glucose states (impaired glucose regulation and abnormal reference range of glucose). Of the studies which measured a recorded diagnosis of type II diabetes mellitus, the weighted pooled prevalence of diabetes was 12.4% (N = 1,685, 95% CI 10.8, 14.0).

The highest prevalence of diabetes (30.6%) was reported in a study by Ojala et al. (2008), which included both impaired glucose regulation (IGR) or prescriptions for diabetes medication in determining the diagnosis. IGR is a pre-diabetic state and affects a greater proportion of the population than diabetes mellitus. Additionally, oral hypoglycaemic medications such as

metformin may have been prescribed for indications other than diabetes, such as for weight loss. Therefore, both these factors are likely to have overestimated the prevalence in this study compared to the other studies.

A very low prevalence (1.8%) was found in a study by Paavola et al. (2002), which measured the prevalence of prescriptions for diabetes medication in a secure psychiatric hospital in Finland.

Dyslipidaemia

The internationally accepted diagnostic criteria for lipid disorders are outlined in Table 6. The prevalence of dyslipidaemia was reported in eight studies (Table 7). The weighted pooled prevalence of dyslipidaemia across all studies was 29.2% (N = 1,135, 95% CI 26.6, 31.9).

The approach to determining the presence of dyslipidaemia amongst the studies varied, with differences in the definitions/types of dyslipidaemia included as well as the source of information relied upon, typically either biochemistry results and/or prescriptions of medications used to treat dyslipidaemia. Four studies (Hillbrand et al., 1995; Long et al., 2014; Paavola et al., 2002; Sazhin & Reznik, 2008) measured the prevalence of abnormal serum cholesterol, three studies (Ojala et al., 2008; Sazhin & Reznik, 2008; Tetlie et al., 2008) measured abnormal serum triglycerides, one study (Ojala et al., 2008) measured abnormal serum high-density lipoprotein cholesterol (HDL-C) and four studies (Huthwaite et al., 2017; Long et al., 2014; Ojala et al., 2008; Paavola et al., 2002) measured the prevalence of patients prescribed medication used to treat dyslipidaemia. In studies where more than one approach was used for the same sample the highest reported prevalence was included in the weighted pooled analysis.

Ojala et al. (2008) found the prevalence of high serum triglyceride levels or being prescribed medication for hypertriglyceridaemia to be 52.4% in 221 inpatients of a secure psychiatric hospital in Finland in 2002. Surprisingly, Paavola et al. (2002) found that only 8 out of 385 (2.6%) inpatients in the same secure psychiatric hospital in Finland were prescribed cholesterol lowering medication between 1996 and 1999. This wide variation in prevalence between these two studies from the same hospital may have reflected a change in prescribing practices between time periods.

In studies with smaller sample sizes, Prebble et al. (2011) found the point prevalence of hyperlipidaemia in two groups to be 5 out of 7 and 1 out of 9; and Tetlie et al. (2008) found no cases of high cholesterol or high triglycerides in 15 inpatients of a secure hospital. The highest prevalence of high cholesterol (52.9%) was found in a study conducted in a prison hospital (Sazhin & Reznik, 2008) with a sample size of 17.

Table 6. National Cholesterol Education Program Adult Treatment Panel III classification of lipid disorders (National Heart, Lung and Blood Institute, 2002).

Lipid disorder	Normal		Borderline high		High	
Total cholesterol	<200 mg/dL	<5.2 mmol/L	200–239 mg/dL	5.2–6.1 mmol/L	≥240 mg/dL	≥6.2 mmol/L
LDL-C	<100 mg/dL	<2.6 mmol/L	100–159 mg/dL	2.6–4.0 mmol/L	≥160 mg/dL	≥4.1 mmol/L
HDL-C	<40 mg/dL	<1.0 mmol/L	40–59 mg/dL	1.0–1.5 mmol/L	≥60 mg/dL	≥1.6 mmol/L
Triglycerides	<150 mg/dL	<1.7 mmol/L	150–199 mg/dL	1.7–2.2 mmol/L	≥200 mg/dL	≥2.3 mmol/L

LDL-C = Low density lipoprotein cholesterol; HDL-C = High density lipoprotein cholesterol

Table 7. Summary of studies measuring the prevalence of dyslipidaemia.

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Hillbrand et al. (1995)	Serum cholesterol >200 mg/dl	106	34
Huthwaite et al. (2017)	Prescribed statin	51	14
Long et al. (2014)	Serum cholesterol >5.0 mmol/L or prescribed treatment for hyperlipidaemia	351	46.2
Ojala et al. (2008)	Serum triglycerides >1.7 mmol/l or prescribed treatment hypertriglyceridaemia	194	52.4 – abnormal triglycerides or treatment for hypertriglyceridaemia
	Serum HDL-C < 1.0 mmol/l for males; <1.3 mmol/l for females		43.7 – abnormal HDL-C
Paavola et al. (2002)	Prescribed cholesterol-lowering medication	385	2.6
Prebble et al. (2011)	Hyperlipidaemia	16	37.5
Sazhin and Reznik (2008)	Cholesterol >5.1 mmol/L	17	52.9 – abnormal cholesterol
	Triglycerides >1.7 mmol/L		47.1 – abnormal triglycerides
Tetlie et al. (2008)	Abnormal reference range of cholesterol and triglycerides	15	0

HDL-C = High density lipoprotein cholesterol

Table 8. World Health Organization definition of hypertension (World Health Organization, 2019).

Hypertension is diagnosed if, when it is measured on two different days, the systolic blood pressure readings on both days is ≥140 mm Hg and/or the diastolic blood pressure readings on both days is ≥90 mm Hg.

Table 9. Summary of studies measuring the prevalence of hypertension.

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Cormac et al. (2005)	At risk due to hypertension	248	42.7
Ivbijaro et al. (2008)	Hypertension	56	12.5
Long et al. (2014)	Prescribed antihypertensive medication	351	12.7
Ojala et al. (2008)	BP >130/85 mm Hg or prescribed antihypertensive medication	195	28.2
Prebble et al. (2011)	DBP > 90 mm Hg	7	28.6

Hypertension

The internationally accepted diagnostic criteria for hypertension is outlined in Table 8. The prevalence of hypertension was reported in five studies (Table 9). The weighted pooled prevalence of hypertension across all studies was 25.0% (N = 857, 95% CI 22.1, 27.9).

The method of determining the presence of hypertension differed amongst the studies. Two studies (Long et al., 2014; Ojala et al., 2008) used prescriptions of antihypertensive medication as a proxy for hypertension diagnosis. Although this was likely to have over-estimated the prevalence of hypertension due to antihypertensive medications having more than one clinical indication, it is also possible to have underestimated the prevalence due to the exclusion of individuals with untreated hypertension. When these studies were removed from the weighted analysis, the weighted prevalence of the remaining studies increased to 36.9% (N = 311, 95% CI 31.6, 42.3), indicating that the underestimating effect was perhaps stronger.

The weighted pooled analysis was strongly influenced by the study by Cormac et al. (2005), which reported the highest prevalence of hypertension (42.7% in 248 inpatients). In this study blood pressure was measured only once and the diagnostic criteria for those who were 'at risk due to hypertension' was not specified, which may have over-estimated the prevalence of hypertension.

Weight-related problems

The internationally accepted classification criteria for Body Mass Index is outlined in Table 10. The prevalence of weight-related problems was reported in nine studies (Table 11). The weighted pooled prevalence of weight-related problems across the studies was 61.1% (N = 1,389, 95% CI 58.5, 63.7).

Table 10. World Health Organization classification of Body Mass Index (BMI) (2020).

Classification	BMI (kg/m^2)
Healthy weight	18.5–24.9
Overweight	25–29.9
Obesity class I	30–34.9
Obesity class II	35–39.9
Obesity class III	≥40 or more

The diagnostic criteria for weight-related problems differed amongst the studies. Eight studies (Cormac et al., 2005; Hilton et al., 2015; Huthwaite et al., 2017; Long et al., 2014; Mat et al., 2015; Ojala et al., 2008; Tetlie et al., 2008; Wolff et al., 2012) measured the prevalence of having a BMI of 30 and above (obese and above); the weighted pooled prevalence in these studies was 39.8% (N = 1,359, 95% CI 37.2, 42.4). Five of these studies (Hilton et al., 2015; Huthwaite et al., 2017; Long et al., 2014; Tetlie et al., 2008; Wolff et al., 2012) also measured the prevalence of having a BMI of 25 and above (overweight and above); and the weighted pooled prevalence in these studies was 72.4% (N = 840, 95% CI 69.4, 75.5).

In the three studies (Cormac et al., 2005; Long et al., 2014; Wolff et al., 2012) which compared the categories of obesity in males and females, males had higher rates of being overweight whereas females had higher rates of being obese. Females had higher overall rates of abnormal BMI. Long et al. (2014) suggested that women may be more susceptible to weight gain on antipsychotic medications such as clozapine and had lower levels of physical activity compared to men.

Cormac et al. (2005) found the prevalence of having a waist circumference that 'required an intervention to reduce health risk' in males was 53% and in females 76%. In a prison hospital in Australia, Sazhin and Reznik (2008) found 50% of male inmates weighed over 90 kg and 23% weighed over 100 kg.

Cardiovascular disease

The internationally accepted definition of cardiovascular diseases is outlined in Table 12. The prevalence of cardiovascular disease (CVD) was reported in six studies (Table 13). The weighted pooled prevalence of CVD across all studies was 15.6% (N = 1,047, 95% CI 13.4, 17.8).

The diagnostic criteria for CVDs encompass a variety of cardiac, neurological and vascular conditions and no studies had diagnostic criteria that were directly comparable. Two studies (Paavola et al., 2002; Wolff et al., 2012) used prescribed medication to treat CVD as a proxy for diagnosis. Because medications for hypertension or dyslipidaemia often have multiple clinical indications, these studies are likely to have overestimated the true prevalence of prescribing for CVD in their samples, but again underestimation may have also resulted due to

Table 11. Summary of studies measuring the prevalence of weight-related problems.

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Cormac et al. (2005)	Obese (BMI > 30) Waist size that required an intervention to reduce health risk (>102 cm in men)	248	Male & female: Obese – 41.1 Waist circumference – 55.6 Male: Obese – 36 Waist circumference – 53 Female: Obese – 75 Waist circumference – 76
Hilton et al. (2015)	BMI (Health Canada classification, 2003)	122	Overweight – 34 Obese I – 19 Obese II – 11 Obese III – 5 Total – 69
Huthwaite et al. (2017)	BMI (WHO classification)	51	Overweight – 20 Obese I – 28 Obese II – 20 Obese III – 26 Total – 94
Long et al. (2014)	BMI (WHO classification, 1995)	351 NB: total sample size (351); total number of serial BMI measurements (761)	Male & female: Overweight – 34.3 Obese I – 23 Obese II – 7.2 Obese III – 1.8 Total – 66 Male: Overweight – 35.4 Obese I – 20.5 Obese II – 7 Obese III – 2 Female: Overweight – 32.4 Obese I – 28 Obese II – 7.5 Obese III – 1.6
Mat et al. (2015)	Obese (BMI > 30)	76	75
Ojala et al. (2008)	BMI >30 (WHO classification, 1999)	195	38.6
Sazhin and Reznik (2008)	Weight (kg)	30	>90 kg – 50 >100 kg – 23
Tetlie et al. (2008)	BMI	13	Overweight – 67 BMI>30 – 54
Wolff et al. (2012)	BMI Overweight (BMI 25–29.9) Obese (BMI > 30)	303	Male & female: Overweight – 42.6 Obese – 35.3 Total – 77.9 Male: Overweight – 43.2 Obese – 34.2 Total – 77.4 Female: Overweight – 37.5 Obese – 42.5 Total – 80

BMI = Body mass index; WHO = World Health Organization

Table 12. World Health Organization definition of cardiovascular diseases (CVDs) (World Health Organization, 2017).

A group of disorders of the heart and blood vessels including:
Coronary heart disease
Cerebrovascular disease
Peripheral arterial disease
Rheumatic heart disease
Congenital heart disease
Deep vein thrombosis and pulmonary embolism
Cardiomyopathies
Cardiac arrhythmias

Table 13. Summary of studies measuring the prevalence of cardiovascular disease.

Study	Diagnostic criteria	Sample size (n)	Prevalence (%)
Cormac et al. (2005)	Cardiovascular disease	248	11
Huthwaite et al. (2017)	Cardiovascular condition	51	9.8
Ivbijaro et al. (2008)	Coronary heart disease (CHD) Stroke & transient ischaemic attacks (TIA)	56	7.1 – CHD 1.8 – stroke & TIA
Paavola et al. (2002)	Prescribed medications for cardiovascular diseases (β-adrenergic blocking agents, nitrates, ACE-inhibitors, acetylsalicylic acid, calcium channel-blocking drugs, diuretics)	385	15.8
Prebble et al. (2011)	Cardiac conditions	16	18.8
Wolff et al. (2012)	Prescribed medication for heart disease, hypertension or high cholesterol	291	Male & female: All weights – 21.6 Male: Healthy weight – 6 Overweight – 22.8 Obese – 32 Female: Healthy weight – 12.5 Overweight/obese – 21.9

ACE = angiotensin-converting enzyme

the loss of individuals with untreated disease. When these studies were removed from the weighted pooled analysis across all studies, the weighted pooled prevalence of the four remaining studies (Cormac et al., 2005; Huthwaite et al., 2017; Ivbijaro et al., 2008; Prebble et al., 2011), which measured the prevalence of CVD related diagnoses was 10.5% (N = 371, 95% CI 7.5, 13.7).

Wolff et al. (2012) reported the prevalence of inmates with serious mental disorder in the healthy weight, overweight and obese weight ranges, who were prescribed medication for either heart disease, hypertension or high cholesterol. The combined total prevalence was 21.6%, however medication

prescribed for other indications such as hypertension and high cholesterol were also included.

Discussion

This systematic review of CMD in people with psychotic disorders in secure settings identified 17 eligible studies, conducted across eight countries and included a total of 7851 patients. The majority of included studies were conducted as file reviews or surveys of between 100 and 500 participants in secure psychiatric hospitals, in either the United Kingdom or the United States of America. Participants were predominantly men with a mean age between 30 and 39 years. Overall, a substantial burden of CMD risk was identified, with weighted pooled prevalence rates of 23.5% identified for metabolic syndrome (95% CI 21.3, 25.7), 11.2% for diabetes (95% CI 9.9, 12.4), 29.2% for dyslipidaemia (95% CI 26.6, 31.9), 25.0% for hypertension (95% CI 22.1, 27.9), 72.4% for being overweight or obese (95% CI 69.4, 75.5) and 15.6% for the presence of cardiovascular disease (95% CI 13.4, 17.8). There was, however, considerable methodological variation noted between the reviewed studies, particularly with regard to the methods for ascertaining the presence of CMD indicators.

Main findings:

The weight pooled prevalence rates for each CMD indicator from the current study varied in comparison to established prevalence rates in the general population and the wider population of people with psychotic disorders, although variations may be influenced to some extent by differences in the methodologies employed.

According to the World Health Organization, the global prevalence of CMDs, in adults across all age ranges, was estimated to be 39% for raised cholesterol (2020), 24.1% and 20.1% for hypertension in men and women, respectively (2017), 39% and 13% for being overweight and obese, respectively (2020c). The International Diabetes Federation estimated the global prevalence for diabetes as 9.3% (International Diabetes Federation, 2019).

Age-specific rates of CMDs in the general population were reported by the Australian Institute of Health and Welfare (2019). The prevalence of diabetes (11.2% current study vs 4.5% AIHW) and cardiovascular disease (15.6% vs 3.0%) obtained from the reviewed studies was higher than the general population aged 45–54 (2017–18). The prevalence of being overweight or obese from the reviewed studies was similar (72.4% vs 74.0%) compared to the general population aged 45–54, but marginally higher (72.4% vs 68.7%) when compared to the 35–44 age group (2017–18). The prevalence of hypertension obtained from the reviewed studies was similar (25.0% vs 24.4%) compared to the general population aged 45–54, but higher (25.0% vs 16.1%) when compared to the 35–44 age group (2014–

15). The prevalence of dyslipidaemia obtained from the reviewed studies was lower (29.2% vs 59.2%) compared to the general population aged 35–44 (2011–12). One reason for the lower rate of dyslipidaemia in the reviewed studies may have been because data were not available to aggregate all types of lipid disorders.

While the prevalence of several of the metabolic indicators for the reviewed studies was higher than reported in general population studies, the extent to which they are comparable to other non-forensic samples of individuals with psychotic disorders must be considered. In large international systematic review of patients with schizophrenia (n = 185,606), Vancampfort et al. (2013) found the prevalence of cardio-metabolic abnormalities in people with schizophrenia to be 36.3% for hypertension, 34.5% for hypertriglyceridaemia, 37.5% for low HDL cholesterol, 31.1% for metabolic syndrome and 9.0% for diabetes. In comparison, the weighted pooled prevalence rates in the reviewed studies were lower for hypertension (25.0%), dyslipidaemia (29.2%) and metabolic syndrome (23.5%) and comparable for diabetes (11.2%).

Overall, the prevalence rates of CMD indicators in people with psychotic disorders in secure settings were generally higher compared to the general population and either similar or lower when compared to people with psychotic disorders in the community.

Between study heterogeneity

Considerable variation in study design and methodology was identified across the studies included in the review. In particular, the methods of determining the presence of CMD indicators, both the definitions and data sources used, varied considerably. For example, some studies used the results of one-off testing to diagnose the presence of hypertension or diabetes while others relied on self-reported information on diagnosis of hypertension. In a number of cases, perhaps due to the convenience of data access, records of prescriptions of medication were used as a proxy for the presence of CMD indicators (e.g., antihypertensive, hypoglycaemic medication). This method may have underestimated CMD indicator frequency if participants in the sample with the disease were treated with non-pharmacological interventions or were untreated. The latter may be a particular problem for individuals in settings with limited access to healthcare treatment, such as in custodial centres. Alternatively, in some circumstances, studies relied on prescription information and were likely to have overestimated CMD indicator frequency because the medications in question had more than one indication (e.g., antihypertensive medication).

Differences in approaches to sampling may also have given rise to variation in reported prevalence rates across studies. In studies where individual recruitment following the ascertainment of informed consent was required,

participation bias may have resulted in those with more severe psychotic disorders, and perhaps a higher risk of CMD, being excluded from the sample. Whilst the objective of this review was to identify CMD indicators in people with psychotic disorders, sample diagnostic heterogeneity may have had an impact on reported CMD indicator prevalence rates. Samples with other diagnostic groups represented in substantial numbers, including intellectual disability and personality disorder, may have had quite different levels of CMD indicators, given the likely differences in psychotropic prescribing patterns.

Although most studies used point prevalence as a measure of disease frequency, the timing of data collection and the relevant period did vary. Consequently, it was difficult to distinguish between longstanding, recent and new cases of CMD and thus to directly compare summary data across studies.

Strengths and limitations

This is the first systematic review of the prevalence of CMD indicators in people with psychotic disorders in secure settings. It was possible to calculate weighted pooled prevalence rates for a wide range of CMD indicators, including in some cases within key study subgroups. A combination of both health and criminal justice databases were searched and the primary electronic search was augmented by including other data sources. While the ability to validly summarise prevalence data across studies was limited by the extent of methodological heterogeneity identified, the key sources of variability were recorded and considered, and analyses were undertaken within more homogeneous study subgroups where possible.

Conclusion

People with psychotic disorders are known to suffer a high burden of cardiometabolic disease, arguably a key reason for the reduced life expectancy seen amongst those with severe mental illnesses. The burden of CMD may be even greater in particular subgroups of psychotic disorders, including amongst forensic patients in secure psychiatric hospitals and mentally ill offenders in custodial centres, given their unique treatment needs and restrictive environments. The objective of this study was to systematically review the studies conducted to date with prevalence rates of metabolic syndrome, diabetes, dyslipidaemia, hypertension, weight-related problems and CVD in this cohort of patients. The prevalence rates of CMD indicators in the reviewed studies were often higher than the general population of the same age, except in the case of dyslipidaemia. However, when compared to studies of people with psychotic disorders in the community, the prevalence rates of CMD indicators in the reviewed studies were lower for metabolic syndrome, hypertension, dyslipidaemia, similar for cardiovascular disease and

being overweight or obese, and mixed for diabetes. Methodological heterogeneity limited direct comparison of prevalence rates between the reviewed studies.

Practice implications of these findings for forensic and custodial services should include primary prevention strategies such as adherence of menu items and dietary options to regulatory health standards and opportunities for physical activity and programs which encourage more active lifestyles. Interventions should be adapted from international best practice in other mental health settings and populations, such as detailed in the Healthy Active Lives (HeAL) consensus statement (International Physical Health in Youth (iphYs) working group, 2013), which are a set of standards and approaches used to detect and treat physical illnesses, particularly CMD indicators, in young people with psychotic disorders.

Future research should focus on establishing the prevalence of CMD indicators using rigorous sampling and methodological approaches, with standardised methods to determine the presence of indicators so that robust comparisons can be made, and on testing the impact of any adapted interventions to reduce CMD risk in secure settings. Potential differences in risk factors associated with CMD in people with psychotic disorders in secure settings, such as treatment needs and antipsychotic prescribing practices, should be compared to those with psychotic disorders in the community in order to identify the key targets for intervention. Longitudinal studies should also be undertaken to determine the incidence and outcomes of CMD in people with psychotic disorders in secure settings.

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Forensic Mental Health Patient Survey

FRONT SHEET	Start Date: ____/____/20____	Finish Date: ____/____/20____

RECORD ANSWERS FOR QUESTIONS 0.01 TO 0.07 FOR EVERYONE, INCLUDING NON-PARTICIPANTS (THOSE WHO REFUSED OR WERE NOT ABLE TO PARTICIPATE)

0.01 MIN/MRN/AUID Number	☐☐☐☐☐☐☐☐
0.02 Participant Reference Code (for data entry only)	☐☐☐☐☐☐
0.03 Interviewer Name	_____
0.04 Date of interview/contact DD/MM/YY	☐☐/☐☐/☐☐
0.05 Sex 0 = Male 1 = Female	☐
0.06 Date of Birth DD/MM/YY	☐☐/☐☐/☐☐
0.07 Reason for not conducting interview 0 = Conducted interview 1 = Poor comprehension &/or use of English (English not first language) 2 = Language disorder (inc dysphasia, autistic spectrum) 3 = Incoherent speech from any cause 4 = Poverty of content or too little speech 5 = Disturbance of consciousness 6 = Unable to give informed consent (inc Intellectual handicap) 7 = Refused 8 = Too acutely unwell 9 = Other reasons [specify……..…]	☐ _____

PARTICIPANT INFORMATION
FOR THE FOLLOWING ITEMS, USE INFORMATION AVAILABLE IN THE FILE NOTES.

0.08 Current legal status – collect from file/notes 1 = Unfit 2 = Not Guilty By Reason of Mental Illness 3 = Correctional (under MHA) Patients 4 = Civil 5 = Other specify [……] 8 = Don't know	☐ _____
0.09 Date of index offence - collect from file/notes DD/MM/YY	☐☐/☐☐/☐☐
0.10 Date of coming into custody DD/MM/YY	☐☐/☐☐/☐☐
0.11 Current Location (ward, wing) 1 = Forensic Hospital Specify Unit: …….. 2 = Long Bay Hospital Specify Unit: …….. 3 = MRRC Specify Block/Pod: …… 4 = Other Correctional Centre (MSPC, Wellington, Parklea, Goulburn, Cessnock, Emu, OMPC, MUL) Specify Unit: …….. 8 = NK	☐ _____

0.12 Admission date to LBH/FH DD/MM/YY		☐☐/☐☐/☐☐
0.13 Current Diagnoses as in the File/Notes		
	0.13.01 DIAGNOSIS #1	_____
	0.13.02 DIAGNOSIS #2	_____
	0.13.03 DIAGNOSIS #3	_____
	0.13.04 DIAGNOSIS #4	_____
	0.13.05 DIAGNOSIS #5	_____
	0.13.06 DIAGNOSIS #6	_____
0.14 Current Medications as in the File/Notes **Please record all medications for physical and mental health. If more than 6 medications, please record the rest in the space provided at the end of the survey.**		☐ TICK IF MORE THAN 6 DRUGS PRESCRIBED
	DRUG CODE SEE APPENDIX #3 777 = Drug not on list 888 = Drug not identifiable	**For each drug, please indicate whether it is regular or PRN.**

	DRUG NAME	**DRUG CODE**	**TYPE OF USE**
0.14.01 DRUG #1		☐☐☐	☐ REGULAR ☐ PRN
0.14.02 DRUG #2		☐☐☐	☐ REGULAR ☐ PRN
0.14.03 DRUG #3		☐☐☐	☐ REGULAR ☐ PRN
0.14.04 DRUG #4		☐☐☐	☐ REGULAR ☐ PRN
0.14.05 DRUG #5		☐☐☐	☐ REGULAR ☐ PRN
0.14.06 DRUG #6		☐☐☐	☐ REGULAR ☐ PRN

0.15 Physical Health Check 0 = No 1 = Yes 9 = Refused	☐
0.16 Blood Sample 0 = No [specify……..] 1 = Yes	☐ _____
0.17 Urine Sample 0 = No [specify……..] 1 = Yes	☐ _____
0.18 Referral Made 0 = No 1 = Yes	☐

1 GENERAL INFORMATION

1.01 Reported age (DIP 1.01; SHIP 1.01) ☐☐

- **What was your age last birthday?**

  88 = Don't Know (DK)

1.02 Country of birth (DIP 1.02, SHIP 1.02, NPHS 1.02 ☐☐☐☐

- **What country were you born in?**

  [If not Australia record……]

  1101 = Australia → **SKIP TO 1.05**
  SEE APPENDIX #1 FOR COUNTRY CODING
  8888 = DK
  9999 = Declined to respond (Declined)

1.03 Age at immigration (DIP 1.03, SHIP 1.03 ☐☐

- **What age were you when you arrived in Australia?**

  00 = < 1 year of age
  88 = DK
  99 = Declined

1.04 Current residency status (SHIP 1.04) ☐

- **What is your current residency status?**

  1 = Has permanent residency – permanent visa
  2 = Has permanent residency – Australian citizen
  3 = Has temporary residency
  4 = Is in the country illegally
  8 = Doesn't know if has permanent or temporary residency
  9 = Declined

1.05 State of birth (SHIP 1.06) ☐☐

- **Which State or Territory of Australia were you born in?** (DO NOT ADMINISTER IF NOT BORN IN AUSTRALIA AS PER 1.02; CODE **09**)

  01 = ACT
  02 = NSW
  03 = NT
  04 = QLD
  05 = SA
  06 = TAS
  07 = VIC
  08 = WA
  09 = Not born in Australia
  88 = DK
  99 = Declined

1.06 Aboriginal/Torres Strait Islander descent (DIP 1.04, SHIP 1.07, NPHS 1.07) ☐

- **Are you of Aboriginal or Torres Straits Islander descent?**

  0 = No → **SKIP TO 1.09**
  1 = Yes, Aboriginal
  2 = Yes, Torres Strait Islander
  3 = Yes, both Aboriginal and Torres Strait Islander
  8 = DK
  9 = Declined

1.07 Aboriginal country or people (NPHS 12.01) ☐

- **Do you identify with a particular Aboriginal country or people?**

  0 = No
  1 = Yes
  9 = Declined

1.08 Aboriginal languages (NPHS 12.06) ▪ **Do you speak any Aboriginal languages?** 0 = No 1 = Yes, some words 2 = Yes, well 9 = Declined	☐
1.09 Language other than English spoken (DIP 1.05, SHIP 1.08, NPHS 1.06) ▪ **Did you speak a language other than English as your first language at home?** 0 = No 1 = Yes [specify…….] 9 = Declined	☐ _____
1.10 Present relationship status (DIP 1.06, SHIP 1.09, NPHS 1.09) ▪ **What is your current marital status?** 0 = Single, never married 1 = Married 2 = De facto 3 = Separated 4 = Divorced 5 = Widowed 9 = Declined	☐
1.11 Present relationship status (DIP 1.06, SHIP, NPHS) ▪ **In the 12 months prior to coming into custody or hospital, were you living with a partner (de facto)?** 0 = No 1 = Yes 9 = Declined	☐
1.12 Mother's Birth Country (NPHS 1.04) ▪ **In which country was your mother born?** [If not Australia record……] 1101 = Australia 8888 = DK SEE APPENDIX #1 FOR COUNTRY CODING	☐☐☐☐
1.13 Father's Birth Country (NPHS 1.05) ▪ **In which country was your father born?** [If not Australia record……] 1101 = Australia SEE APPENDIX #1 FOR COUNTRY CODING 8888 = DK 9999 = Declined	☐☐☐☐
1.14 Most recent postcode (NPHS 1.08) ▪ **In which postcode did you spend most time in the 12 months prior to coming into custody/hospital?** ASK FOR SUBURB AND STATE IF POSTCODE UNKNOWN, SPELL IF UNCLEAR 8888 = DK 9999 = Declined	POSTCODE ☐☐☐☐ SUBURB: _____ STATE: ☐☐☐

27 NUTRITION

27.01. Snacks (NNS1, SHIP 16.01)

- **The next few questions are about what you eat and drink.**
- **In the last 4 weeks including snacks, how many times did you usually have something to eat in a day including evenings?**

01 - 30 Range
88 = DK/can't remember
99 = Declined

☐☐

27.02. Breakfast (NNS 2, SHIP 16.02

- **In the last 4 weeks how many days per week did you usually have something to eat for breakfast?** (MEASURED IN TIMES PER WEEK)

0 - 7 Range
8 = DK/can't remember
9 = Declined

☐ TIMES PER WEEK

27.03 Vegetables consumed (NNS 5, SHIP 16.04, NPHS 8.02)

- **In the last 4 weeks how many serves of vegetables did you usually eat each day including fresh, frozen and tinned vegetables? (CARD)**

(1 SERVE = 1/2 CUP COOKED VEGETABLES OR 1 CUP OF SALAD VEGETABLES)

0 = Does not eat vegetables
1 = 1 serve or less
2 = 2-3 serves
3 = 4-5 serves
4 = 6 serves or more
8 = DK/can't remember
9 = Declined

☐

27.04 Fruit consumed (NNS 6, SHIP 16.05, NPHS 8.01)

- **In the last 4 weeks how many serves of fruit did you usually eat each day including fresh, dried, frozen and tinned fruit? (CARD)**

(1 SERVE = 1 MEDIUM PIECE OR 2 SMALL PIECES OF FRUIT OR 1 CUP OF DICED PIECES)

0 = Does not eat fruit
1 = 1 serve or less
2 = 2-3 serves
3 = 4-5 serves
4 = 6 serves or more
8 = DK/can't remember
9 = Declined

☐

27.05. Salt added to food (NHS 2001 q304, SHIP 16.06)

- **In the last 4 weeks how often did you add salt to your food after it is cooked? (CARD)**

0 = Never
1 = Rarely
2 = Sometimes
3 = Usually
8 = DK/can't remember
9 = Declined

☐

27.06 Buy Up (NPHS 8.04) ▪ **Name the most common food items you purchase from the buy-up list or at the kiosk** (IF IN THE FORENSIC HOSPITAL). 0 = Never purchase from buy up list or the kiosk 1 = Do not have access to the buy up list on the kiosk 2 = Do not have funds to purchase from the buy up list or the kiosk 9 = Declined	☐
27.06.01 Item 1	_____
27.06.02 Item 2	_____
27.06.03 Item 3	_____
27.07 Caffeine consumption ▪ **In the last 4 weeks how many caffeinated drinks (including tea, coffee, and soft drinks like energy drinks or Coca Cola) did you have per day?** 00 = None 01 – 30 Range 88 = DK/can't remember 99 = Declined	☐☐
27.08 Sugar drinks consumption ▪ **In the last 4 weeks how many of sugary drinks (including Coca Cola, Fanta, Sprite, energy drinks) did you have per day?** ▪ APPROXIMATE AMOUNTS TO LITRES IF THE RESPONDENT PROVIDES ALTERNATIVE (e.g., if they say they drink 1.5L bottle, record as 1.5 litres). 00.0 = None 00.1 – 15.0 Litres Range 88.8 = DK/can't remember 99.9 = Declined	☐☐.☐ LITRES

Continue on next page

28 PHYSICAL ACTIVITY

28.01 Level of activity prior to custody/hospital (NPHS 5.01)

- **In the 12 months before you came into custody/hospital, would you describe yourself as:**

  0 = Not at all physically active
  1 = Not very physically active
  2 = Fairly physically active
  3 = Very physically active
  9 = Declined

☐

28.02 Change in level of activity since coming into custody/hospital (NPHS 5.02)

- **Compared with before you came into custody/hospital, would you say that you are now:**

  1 = Less active
  2 = About the same
  3 = More active
  9 = Declined

☐

28. 03 Vigorous Activity (days) (IPAQ 1, NS CC41, SHIP 17.01)

- **I am now going to ask you questions about the kinds of physical activities you do as part of your everyday life and the time you spend doing these activities.**
- **During the <u>last 7 days</u>, on how many days did you do VIGOROUS physical activity like heavy lifting, digging, or running?**
- Did it take hard physical effort & make you breathe much harder than usual?
- Did you do (*insert name of exercise/activity*) for at least 10 minutes at a time?

  0 - 7 Range days out of the week
  9 = Declined

Vigorous activity includes: Jogging, running, fast bicycling, circuit weight training, jump rope, swimming.
Note: Each activity must be for at least 10 minutes duration

☐ DAYS/WK

28.04 Moderate activity (days) (IPAQ 3, NS CC42, SHIP 17.03)

- **During the <u>last 7 days</u>, on how many days did you do MODERATE physical activity like carrying light loads, jogging, or team sports (e.g., volleyball)?**
-
- Did they take moderate physical effort & make you breathe somewhat harder than usual?
- Did you do (*insert name of exercise/activity)* for at least 10 minutes at a time?

  0 - 7 Range days out of the week
  9 = Declined

Moderate activity includes: leisurely bicycling, general garden maintenance, jogging, playing volleyball/basketball/badminton/cricket
Note: Each activity must be for at least 10 minutes duration

☐ DAYS/WK

28.05 Walking (days) (IPAQ 5, NS CC40, SHIP 17.05) ▪ **During the last 7 days, on how many days did you walk for at least 10 minutes at a time? This includes walking to and from locations within prison/hospital, doing laps around prison/hospital, doing laps in the courtyard, walking on the treadmill.** 0 - 7 Range days out of the week 9 = Declined **Note:** Each period of walking must be for at least 10 minutes duration	☐ DAYS/WK
28.06 Considers doing enough physical activity (SHIP 17.08) ▪ **Do you consider you are doing enough physical activity?** 0 = No 1 = Yes 8 = DK 9 = Declined	☐

Continue on next page

29 PHYSICAL HEALTH & METABOLIC MEASURES

29.01 Medical history (NS CC1, SHIP 18.12, NPHS 6.01.02)

- **I am going to read you a list of health problems. Please tell me if you have ever been told by a doctor you have any of the following (CARD)**
  - ***IF YES*:** do you have it at the moment?
  - ***IF YES*:** have you taken prescribed medication for it in the last month?

L = Lifetime
P = Present
M = Currently taking medication

0 = No
1 = Yes
8 = DK
9 = Declined

29.01.01 Arthritis	☐ L	☐ P	☐ M
29.01.02 Asthma	☐ L	☐ P	☐ M
29.01.03 Epilepsy/seizures	☐ L	☐ P	☐ M
29.01.04 Stroke/TIA	☐ L	☐ P	☐ M
29.01.05 Heart attack	☐ L	☐ P	☐ M
29.01.06 Angina/chest pain	☐ L	☐ P	☐ M
29.01.07 Other heart disease e.g. arrhythmias [specify ……]	☐ L	☐ P	☐ M
29.01.08 Hepatitis A	☐ L	☐ P	☐ M
29.01.09 Hepatitis B	☐ L	☐ P	☐ M
29.01.10 Hepatitis C	☐ L	☐ P	☐ M
29.01.11 Other liver disease [specify……..……..]	☐ L	☐ P	☐ M
29.01.12 Chronic Kidney disease	☐ L	☐ P	☐ M
29.01.13 Anaemia	☐ L	☐ P	☐ M
29.01.14 Memory problems	☐ L	☐ P	☐ M
29.01.15 Respiratory problems (incl Chronic Obstructive Pulmonary Disease (COPD))	☐ L	☐ P	☐ M
29.01.16 Parkinson's	☐ L	☐ P	☐ M
29.01.17 Frequent or severe headaches/migraines	☐ L	☐ P	☐ M
29.01.18 Eating disorders such as anorexia or bulimia	☐ L	☐ P	☐ M
29.01.19 Chronic back neck or other pain	☐ L	☐ P	☐ M
29.01.20 Allergies [specify ……..……..……]	☐ L	☐ P	☐ M

CONTINUED FROM PREVIOUS PAGE	L = Lifetime P = Present M = Currently taking medication 0 = No 1 = Yes 8 = DK 9 = Declined		
29.01.21 Cancer/ tumours [specify ……..……]	☐ L	☐ P	☐ M
29.01.22 Diabetes (ADMINISTER DIABETES SECTION)	☐ L	☐ P	☐ M
29.01.23 High Cholesterol	☐ L	☐ P	☐ M
29.01.24 Congenital disorders/syndromes [specify……..……]	☐ L	☐ P	☐ M
29.01.25 **If female**: Gynaecological problems 9 = NA	☐ L	☐ P	☐ M
29.01.26 **If male**: Prostate problems 9 = NA	☐ L	☐ P	☐ M
29.01.27 High blood pressure/hypertension	☐ L	☐ P	☐ M
29.01.28 Other [specify……]	☐ L	☐ P	☐ M
29.01.29 Other [specify……..……]	☐ L	☐ P	☐ M
29.01.30 Other [specify……..]	☐ L	☐ P	☐ M

If subject identified suffering from diabetes at the time of the assessment, administer the next part → DIABETES
Otherwise SKIP TO MEN'S HEALTH (for men) & WOMEN'S HEALTH (for women)

DIABETES

29.02 Age at diagnosis of diabetes (NPHS 6.03.01)

- **I'm now going to ask you some questions about diabetes and blood sugar.**
- **How old were you when you were told that you had diabetes?**

00 = Never told
01 – 80 Range
88 = DK/can't remember
99 = Declined

☐☐ YEARS

29.03 Blood sugar tests in the last 12 months (SHIP 18.81, NPHS 6.03.02)

- **Excluding the blood sugar test given as part of this survey, have you had any blood sugar tests in the last 12 months?**

0 = No → **SKIP TO 29.05**
1 = Yes
8 = DK → **SKIP TO 29.05**
9 = Declined → **SKIP TO 29.05**

☐

33 BEHAVIOUR AND AFFECT

Rate the following Items on the basis of observation during the interview.

33.01 Agitated activity (OPCRIT 23) Restlessness / agitation (SCAN 22.015-22.016 (SHIP 20.84) ☐

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Excessive repetitive activity, such as fidgety restlessness, wringing of hands, pacing up and down, all usually accompanied by expression of mental anguish.

33.02 Catatonia (OPCRIT 18) Catatonic behaviour (SCAN 22.024 – 035 (SHIP 20.85) ☐

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Mannerisms *odd, idiosyncratic purposeful movements or actions, e.g. hopping, walking tiptoe, tapping foot 4 times before entering a doorway; may be suggestive of specific meaning or purpose.*
Stereotypies: *simple, repetitive movements, e.g. rocking, rubbing, nodding, swaying, feeling surfaces, which do not seem to have special significance.*
Posturing: *assumes and maintains for >10 minutes or hours at a time odd postures of parts of body which would be very difficult for most people to sustain for long periods.*
Catalepsy: *the muscles of a limb become fairly rigid, e.g. if an arm is raised by examiner into a certain position the patient will hold it for >15 seconds.*
Stupor: *total/nearly total lack of spontaneous movement & marked decrease of reactivity to the environment.*
Excitement: *bouts of uncontrollable, chaotic over activity, e.g. running about the room, jumping, perhaps shouting, may throw things or be aggressive during such episodes.*
Negativism: *motiveless resistance to instructions or attempts to move or examine patient; refusal to eat, drink or make eye contact.*
Verbigeration: *repetition of syllables, phrases or sentences, like a scratched record.*
Mutism: *verbally unresponsive or minimally responsive.*
Perseveration: *repeatedly reverts to the same topic in conversation, or persists with movement.*

33.03 Bizarre behaviour (OPCRIT 17) Bizarre behaviour (SCAN 22.043) Apparently hallucinating behaviour (SCAN 22.054) (SHIP 20.86) ☐

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Behaviour that is strange and incomprehensible. Includes behaviour which could be interpreted as response to auditory hallucinations or thought interference e.g. lips moving soundlessly; looks around as though voices might be calling, wears specially constructed hat to keep rays off. These signs do not necessarily indicate hallucinations and should not be regarded in themselves as evidence.
Do not rate: *Eccentricity determined by belonging to a social subgroup.*

33.04 Restricted affect (OPCRIT 32) Restricted affect (SCAN 20.089) (SHIP 20.87) ☐

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Respondent's emotional responses are restricted in range and at interview there is an impression of bland indifference or lack of contact (a 'glass wall').

- *A relatively expressionless face or unchanging facial expression*
- *Reduced expressive gestures when emotional material is discussed*
- *Diminished vocal inflection*

Note: *It is important to distinguish primary restricted affect from a guarded speaking style, which is caused by suspiciousness or a relatively normal reticence or shyness in an interview.*

33.05 Blunted affect (OPCRIT 33) Blunting or flattening of affect (SCAN 23.012) (SHIP 20.88) ☐

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Where the respondent's emotional responses are persistently flat and show a complete failure to resonate to external change. Includes flatness of affect, emotional indifference and apathy. A global diminution of emotional response.
Note: *The differences between restricted and blunted affect should be regarded as one of degree, with 'blunted' only being rated in extreme cases.*

33.06 Inappropriate affect (OPCRIT 34) Incongruity of affect (SCAN 23.013) (SHIP 20.89)

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Respondent's emotional responses are inappropriate to the circumstance, e.g., laughter when discussing painful or sad occurrences, fatuous giggling without apparent reason. The range of emotional expression is not necessarily diminished but the emotion expressed is not in keeping with that expected to accompany the concurrent thought process.
***Do not rate:** A simple failure to show emotion when expected (this is restricted or blunted affect)*

34 SPEECH

Rate the following Items on the basis of observation during the interview.

34.01 Pressure of speech (OPCRIT 30) Pressure of speech (SCAN 24.007) (SHIP 20.90)

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

This is a change from their usual speech. Much more talkative than usual or there seems to be undue pressure to get the words out; or feels under pressure to continue taking. Speaks too fast, too loud, and unnecessary words are added. Speech is spontaneous and there is difficulty in interrupting the respondent. This item includes manic types of speech disorder e.g. clang associations, punning and rhyming.

34.02 Speech difficult to understand (OPCRIT 26) Rambling speech (SCAN 24.017) (SHIP 20.91)

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

'Drivelling' or rambling on in a vague, muddled way, beginning more or less on the point but gradually wandering far from it. Speech lacks logical or understandable organisation. The overall effect after some time is of speech that is difficult to understand. Short sections of speech may appear within normal limits.
***Do not rate:** Dysarthria or speech impediment.*

34.03 Positive formal thought disorder (OPCRIT 28) Neologisms and idiosyncratic use of words or phrases (SCAN 24.021) Magical or markedly illogical thinking (SCAN 24.023) (SHIP 20.92)

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Respondent has fluent speech but tends to communicate poorly due to

- *Neologisms (made up words) e.g. Per-God, Per-the-devil, tarn-harn*
- *Bizarre use of words and phrases*
- *Derailments (totally unexpected shifts from topic to topic)*
- *Loosening of associations (lack of logical connection between parts of a sentence or between sentences)*

Make due allowance for lack of education or intelligence.
Example: "one is called Per-God and the other is called Per-the devil".

34.04 Incoherence of speech (OPCRIT 27) Incoherence of speech (SCAN 24.022) (SHIP 20.93)

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

This should only be rated for extreme forms of formal thought disorder. Normal grammatical sentence construction has broken down. Includes "word salad" (incoherent mixture of words and phrases). Always make due allowances for poor education, poor intelligence or poor grasp of the language. Always write down an example.

34.05 Negative formal thought disorder (OPCRIT 29) Blocking (SCAN 24.024) Poverty of content of speech (SCAN 24.025) Restricted quantity of speech (SCAN 24.026) (SHIP 20.94) ☐

0 = Not present
1 = Present
8 = Not able to rate due to insufficient information

Always write down an example. Rate any of the following:

Blocking: *a sudden interruption in a line of speech without recognisable reason, so that they stop in the middle of a sentence and cannot recapture the theme. Stops talking & then begins again on same or a different topic. It is not distraction, lapse of attention, or lack of understanding.*
Poverty of content of speech: *An adequate amount of speech or number of words (may talk freely) however little information is conveyed because of vagueness, repetitive, stereotypes, or cliché-ridden speech.(Only if severe)*
Restricted quantity of speech: *Repeatedly fails to answer, questions have to be repeated, & answers are restricted to the minimum (often one word, or telegrammatic style). Also rate if answers readily enough, but only with the minimum necessary number of words & does not use extra sentences or unprompted additional comments. Keeping a conversation going is extremely difficult.*

Do not rate: *Catatonic mutism*

35 NEGATIVE SYNDROME

Rate the following Items on the basis of observation during the interview.

35.01 Restricted affect (SCAN 20.089, Carpenter) (SHIP 21.01) ☐

Restricted affect refers to observed behaviours rather than subjective experience. Included in the rating is

- a relatively expressionless face, or unchanging facial expression
- reduced expressive gestures when emotional material is discussed
- diminished vocal inflection

0 =	**NONE** Spontaneous and widely ranging affect or decreased affect, so mild it is not confidently considered pathological
1 =	**MODERATE** Moderate decreased affect in relation to many topics, or severe decrease in some topics
2 =	**SEVERE** Severe decrease in relation to many topics, or very severe decrease in relation to some topics
8 =	Not able to rate due to insufficient information

35.02 Poverty of speech (SCAN 20.093, Carpenter) (SHIP 21.02) ☐

Poverty of speech refers to both the amount of speech and the amount of information conveyed, including that information that is volunteered and not absolutely required by a literal answer to a question.

0 =	**NONE** Speech normal in quantity and amount of information conveyed or decrease in quantity of speech or amount of information conveyed, so mild it is not confidently considered pathological
1 =	**MODERATE** Moderate decreased in quantity of speech or amount of information conveyed in relation to many topics, a severe decrease in relation to some topics
2 =	**SEVERE** Severe decrease in quantity of speech or amount of information conveyed in relation to many topics, or very severe decrease in relation to some topics
8 =	Not able to rate due to insufficient information

35.03 Diminished sense of purpose (SCAN 20/097, Carpenter) (SHIP 21.03)		☐
Diminished sense of purpose refers to an impairment in: ▪ the degree to which the person posits life goals ▪ the extent to which the person fails to initiate or sustain goal directed activity due to lack of interest ▪ the amount of time passed in inactivity		
0 =	**NONE** Normal motivation and goal directed activity either in relatively wide range of areas, or intensely in a narrow range or decreased motivation and goal directed activity, so mild it is not confidently considered pathological	
1 =	**MODERATE** Moderate decrease in range or intensity of motivation and goal directed activity	
2 =	**SEVERE** Severe decrease in range or intensity of motivation and goal directed activity	
8 =	Not able to rate due to insufficient information	

ADDITIONAL SECTION FOR MEDICATION RECORD

0.14 Current Medications as in the File/Notes

Please record all medications for physical and mental health. If more than 6 medications, please record the rest in the space provided at the end of the survey.

☐ TICK IF MORE THAN 6 DRUGS PRESCRIBED

DRUG CODE

SEE APPENDIX #3
777 = Drug not on list
888 = Drug not identifiable
999 = NA

For each drug, please indicate whether it is regular or PRN.

	DRUG NAME	DRUG CODE	TYPE OF USE
0.14.01 **DRUG #7**		☐☐☐	☐ REGULAR ☐ PRN
0.14.02 **DRUG #8**		☐☐☐	☐ REGULAR ☐ PRN
0.14.03 **DRUG #9**		☐☐☐	☐ REGULAR ☐ PRN
0.14.04 **DRUG #10**		☐☐☐	☐ REGULAR ☐ PRN
0.14.05 **DRUG #11**		☐☐☐	☐ REGULAR ☐ PRN
0.14.06 **DRUG #12**		☐☐☐	☐ REGULAR ☐ PRN
0.14.04 **DRUG #13**		☐☐☐	☐ REGULAR ☐ PRN
0.14.05 **DRUG #14**		☐☐☐	☐ REGULAR ☐ PRN
0.14.06 **DRUG #15**		☐☐☐	☐ REGULAR ☐ PRN
0.14.04 **DRUG #16**		☐☐☐	☐ REGULAR ☐ PRN
0.14.05 **DRUG #17**		☐☐☐	☐ REGULAR ☐ PRN
0.14.06 **DRUG #18**		☐☐☐	☐ REGULAR ☐ PRN

Participant Reference Code
(for data entry only)

Health
Justice Health & Forensic Mental Health Network

Clinical Assessment

Interviewer Name		Interview Date	

Section 1 – Physical Health Check & Visual Acuity

1. Blood pressure
[Please conduct 2 blood pressure measurements on the non-dominant arm]

Blood pressure (sitting)

Systolic / Diastolic

Blood pressure (standing)

Systolic / Diastolic

[Please include a decimal point for measurements below]

2. Height (no shoes) (cm) ☐☐☐.☐

3. Weight (no shoes, clothed) (kg) ☐☐☐.☐

4. Waist measurement (cm) ☐☐☐.☐

5. Hip measurement (cm) ☐☐☐.☐

6. Peak flow (Peak flow reading conducted standing)

LPM ☐☐☐

7. Do you currently wear glasses or contact lenses to correct, or partially correct your eyesight?

No → **Q9** ☐ 0
Yes ☐ 1

8. If **YES**, What sight problems do your glasses or contact lenses correct or partially correct?

Astigmatism ☐ 1
Short – sightedness ☐ 2
Long – sightedness ☐ 3
Don't Know ☐ 4
Other *(specify)* _____ ☐ 5

9. Snellen Chart

	Both eyes	
	No	**Yes**
Line 1	☐ 0	☐ 1
Line 2	☐ 0	☐ 1
Line 3	☐ 0	☐ 1
Line 4	☐ 0	☐ 1
Line 5	☐ 0	☐ 1
Line 6	☐ 0	☐ 1
Line 7	☐ 0	☐ 1
Line 8	☐ **0**	☐ **1**
Line 9	☐ 0	☐ 1
Line 10	☐ 0	☐ 1
Line 11	☐ 0	☐ 1

[Interviewer: Must be standing exactly 2.8 metres from chart.
If normally wears spectacles test to be performed with glasses on.
Note: one mistake on each line is acceptable. If, more than one mistake tick 'no'].

Clinical Assessment

Interviewer Name		Interview Date	

Section 2 - Pathology

1. Blood glucose results (mg/dl)

☐☐☐

2. Hours since last ate

1-2 hours ☐ 1
3-4 hours ☐ 2
More than 5 hours ago ☐ 3
Don't know ☐ 4

3. Urine sample taken

No → **Q5** ☐ 0
Yes ☐ 1

4. Urinalysis

No abnormalities detected	☐ NAD
* Appearance (Hazy, cloudy, clear)	
* Colour (straw to dark yellow)	
* pH	
* Specific Gravity	
Glucose (record + to ++++)	
Protein (record + to ++++)	
RBCs (BLO) Trace/small/moderate/large	
WBCs (LEU) (record + to +++)	

5. Blood sample taken

No → **Q6** ☐ 0
Yes ☐ 1

6. If no blood sample taken, why?

Could not find veins ☐ 1
Refused ☐ 2
Dislike of Needles ☐ 3
Concerned about DNA testing ☐ 4
Concerned about drug testing ☐ 5
Other *(specify)* _____ ☐ 6

Participant Reference Code
(for data entry only)

NSW GOVERNMENT Health
Justice Health & Forensic Mental Health Network

Tobacco Use & Lipid Profile – File Review

Interviewer Name		Interview Date	

36.1 Smoking (SHIP 20.68) Has the participant ever regularly smoked cigarettes, tobacco, cigars or a pipe? - 0 = No SKIP TO NEXT SECTION - 1 = Yes - 88 = DK	EVER ☐☐
36.2 Smoking: age started smoking (SHIP 20.68.01) At what age did they begin smoking regularly? - 01 – 80 Range - 88 = DK	AGE IN YEARS ☐☐
36.3 Smoking: heaviest amount used (SHIP 20.68.02) At their heaviest time of use how many were they smoking a day? - 01 – 80 Range - 88 = DK	# PER DAY ☐☐

PR01.1 Lipid profile: collection time and date - 0000 – 2400 Range - 1 – 31/1 – 12/2000 – 2017 Range	24 HOUR TIME ☐☐☐☐ DATE/MONTH/YEAR ☐☐/☐☐/☐☐☐☐
PR01.2 Lipid profile: fasting status - 0 = Non-fasting - 1 = Fasting - 88 = Unknown	☐☐
PR01.3 Lipid profile: Cholesterol (SHIP 33.05) - 0.1 – 9.9 Range	(mmol/L) ☐☐.☐
PR01.4 Lipid profile: Triglyceride (SHIP 33.06) - 0.1 – 9.9 Range	(mmol/L) ☐☐.☐
PR01.5 Lipid profile: HDL Cholesterol (SHIP 33.03) - 0.1 – 9.9 Range	(mmol/L) ☐☐.☐
PR01.6 Lipid profile: LDL Cholesterol (SHIP 33.04) - 0.1 – 9.9 Range	(mmol/L) ☐☐.☐