Detection and treatment of mental illness among prison inmates:

A validation of mental health screening at intake to Correctional Service of Canada.

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Abstract

Mental health screening is frequently recommended to facilitate earlier detection of mental illness in prisons. For this goal to be achieved: (1) the screening process must be accurate; (2) appropriate follow-up treatment must be provided; (3) the treatment must lead to improved outcomes. The current thesis aimed to evaluate mental health screening in relation to these three criteria by studying 13, 281 prisoners admitted to Correctional Service of Canada. Screening achieved comparable accuracy to tools that have been studied internationally and many inmates received at least some treatment. However, interruptions in treatment were frequent and long-term treatment was rare. There was weak evidence that treatment led to reduced rates of institutional incidents of suicide, self-harm, victimization and violence. While screening remains widely endorsed, further study of its impacts is needed to maximize its value. This could include considering alternatives to screening itself, or as follow-up for those who screen positive.

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Table of contents

List of Tables

Introductory and discussion chapters

Chapter 5

Chapter 6

Chapter 7

Chapter 8

Chapter 9

Chapter 10

List of Figures

Introductory and discussion chapters

Chapter 5

Chapter 6

Chapter 7

Chapter 10

Chapter 1: Introduction

While many people with mental illness lead productive lives, others experience a range of adverse outcomes. Higher rates of criminal and violent behaviour, self-harm and suicide, and general mortality have been reported among persons with mental illness as compared to those without mental illness[1–8]. In the province of Ontario, a recent analysis reported that approximately 400,000 incident cases of mental illness contribute to over 600,000 health adjusted life years lost each year. The authors concluded that this burden is more than 1.5 times greater than that of all cancers and 7.5 times greater than that of infectious diseases[2]. A recent meta-analysis reported a median reduced life expectancy of approximately 10 years among persons with mental illness[8].

The burden of mental illness is particularly evident in jails and prisons. Globally, it is estimated that 3.7% of inmates have a current psychotic disorder, and 11.4% have a current diagnosis of major depression[9]. Similar rates have been observed in the most recent Canadian data; at intake to prison, current prevalence rates have been estimated at 3.3% for psychotic disorders, 16.9% for mood disorders (e.g. major depression and bipolar disorder) and 29.5% for anxiety disorders[10]. Comparatively, recent estimates of past year mood disorders and generalized anxiety disorder in the general population are 5.4% and 2.6% respectively in Canada[11]. Others have drawn a similar conclusion to these findings, that rates of mental illness are between two and four times higher among incarcerated individuals than the general public in Canada[12,13] and worldwide[9,14–16]. In a recent survey[17], correctional administrators ranked inmates with mental illness as being twice as disruptive (defined in terms of increased likelihood of self-harm, suicide, violence, victimization, escapes and disruptive behaviour) compared to other potentially challenging groups; namely gang members, ‘frequent fliers’ (inmates with 20 or more arrests in

the past 5 years) and inmates serving longer sentences. They were ranked as the highest risk to assault staff and to be victimized by other inmates, and second only to gang members in their risk of assaulting other inmates. These perceptions are supported by research that has found higher rates of institutional violent incidents, suicide attempts, self-harm and all-cause mortality among inmates with mental illness[18–35].

Beyond the empirical attention paid to the burden of mental illness in prisons, there has also been substantial attention drawn to sensational cases involving persons with mental illness. For example, the suicide of Ashley Smith in 2007 is frequently discussed to this day as an illustration of the challenges in responding to mental health needs of offenders. An inquest into Ashley's case led to 104 recommendations for change in Correctional Service of Canada (CSC), including of particular relevance to the current research, that "within 72 hours of admission to any penitentiary or treatment facility, all female inmates will be assessed by a psychologist to determine whether any mental health issues and/or self-injurious behaviours exist"[36]. Separate from this coroner's inquest into Ashley Smith's death, CSC made over 600 commitments between 2007 and 2013, many in response to other inquests or reports of the Office of the Correctional Investigator[37].

These past research findings and public attention highlight that detection and treatment remains a challenge both in the general population[38–40] and particularly in correctional institutions[41–45]. Only a quarter to half of inmates with a diagnosable mental illness receive treatment while incarcerated[46–49]. Higher rates of detection of psychotic disorders than mood disorders have been reported[45,46,48,50,51], although not all studies have observed this difference[47]. Inmates with prior psychiatric treatment may be more likely to receive services than those without a history[46,48,52]. A study in Quebec pre-trial jails found that 63% of inmates who had a

diagnosed mental illness in the five years prior to incarceration were receiving treatment[50]; a similar findings was reported in US jails where 70% of those with a prior diagnosis received treatment in jail[52]. A large epidemiological survey of inmates in American jails and prisons found that only half of all inmates who reported receiving medication in the community prior to their incarceration, continued to received medications while incarcerated[51]. In this study, inmates who were screened for mental or physical health needs were more likely to have medication continuity than those who did not report participating in screening.

Missed diagnoses often attract the greatest attention, as the proportion of people who are ill but not diagnosed is typically higher than the proportion of people who are apparently well but receive a diagnosis. However, in absolute terms there are typically more people diagnosed who should not be than missed cases, due to the fact that there are more persons who are not ill than who are ill[39]. Given that treatment can cause harm[53–56], ensuring that individuals stand to benefit from treatment to offset this harm is essential. Examples of harms of treatment that have been noted include side effects of medications[57] or symptom deterioration (which may be transient and short-term as in the case of trauma symptoms initially becoming worse during psychotherapy before resolving in the long-term)[56]. While focus on harms and inappropriate treatment are less common in correctional settings, there has been an increasing focus on over-prescribing of psychotropic medications in particular in recent years[58,59].

Correctly diagnosing the presence or absence of an illness is at the heart of the provision of all medical care. The United States' Institute of Medicine defined a diagnostic error as "the failure to (a) establish an accurate and timely explanation of the patient's health problem(s) or (b) communicate that explanation to the patient."[60(p3:4)] While not diagnostic in and of itself, mental health screening is a core component of correctional mental health strategies[61–65] to reduce the

duration of untreated mental illness. By contrast, enthusiasm for screening in community settings - in particular primary care - has waxed and waned over the past 20-25 years. As reviewed by Coyne and colleagues, in the late 1990s, screening was not recommended by organizations such as the United States Preventive Services Task Force (USPSTF) or the Canadian Task Force on the Periodic Health Examination (now known as the Canadian Task Force on Preventive Health Services)[66]. In the early 2000s, while some continued to argue that there was little evidence of benefits of screening[66,67], both the USPSTF[68–70] and Canadian Task Force on Preventive Health Services[71] recommended screening where appropriate resources were in place to provide follow-up. Around 2008 and onwards, enthusiasm for screening decreased based on re-appraisals of the literature that found weak[72–74] or no[75] evidence to support a net benefit of screening. In 2013, the Canadian Task Force on Preventive Health Services reversed its earlier recommendation to provide depression screening in primary care[73]. In other countries, such as the United Kingdom, the *National Institute for Health and Care Excellence* recommends screening only high risk individuals when depression is suspected[76]. This recommendation reflects the statistical phenomenon that the positive predictive value of a screening test (i.e. the likelihood that a referred individual in fact requires services) is related to the prevalence of the condition in the population, and thus screening is more likely to be clinically useful in settings where prevalence is higher[77,78].

However, in 2016, while acknowledging that direct evidence supporting the impact of screening is weak, the USPSTF maintained its earlier recommendations to screen for depression in community primary care settings[79]. The USPSTF recommendation is based on a broader interpretation of extant evidence, including indirect evidence that screening tools can identify depression, and that effective treatments for depression exist[80]. The USPSTF also took a broader

system of care approach, noting that "trials with additional supports may be interpreted as providing evidence for a complete system of care in which the sum is more important than the parts"[80(p49)].

These different interpretations of extant evidence highlight that decisions in health care and medicine are rarely made with perfect information[81]. Uncertainty about diagnosis, prognosis and treatment are common for clinicians responsible for planning the treatment of an individual client and for decision makers seeking to understand these factors at the population level. Potentially competing priorities of individuals, clinicians and policy makers, and tensions between values and evidence (i.e. despite evidence at a group level data showing little or no effect, it may be an important value to reduce suffering through early and individualized intervention) all contribute to the ongoing debate about the value of mental health screening. Resolving this debate requires more specific questions such as identifying whether there are specific conditions under which screening is a value added intervention, and identifying suitable screening tools. Addressing these (and related questions) will inform decision making regarding implementing, modifying or discontinuing a screening program. This thesis will examine three primary questions in order to evaluate current screening practice in Canadian prisons:

1. What is the accuracy of screening protocols to detect mental illness among inmates?
2. What is the relationship between follow-up treatment and screening results?
3. Are these services associated with rates of adverse outcomes such as self-harm, suicide, overdose, mortality, violence and victimization during incarceration?

1.1. Organization of the thesis

Chapter 2 reviews definitional issues related to the criminal justice system, screening, and mental illness. It establishes a framework to outline the criteria that an effective screening process must meet, and discusses challenges in defining screening and mental illness. Chapter 3

provides a literature review of the burden of mental illness, and possible impacts of screening to reduce this burden. The general methods for the primary studies are presented in Chapter 4. This includes descriptive statistics for the sample, and discussion of the data sources used throughout the primary research.

Chapters 5 through 10 address the three major research questions noted above. Chapters 5 and 6 address the first question. They examine the statistical accuracy of different screening tools or protocols through measures such as sensitivity, specificity, and positive and negative predictive values. Chapter 5 explores this question on an international scale through a systematic review of screening tools that have been validated in correctional settings. Chapter 6 focuses on the Canadian prison context. Beyond simply estimating statistical properties of screening, it also introduces the need to distinguish newly detected (i.e. incident) versus previously detected (i.e. prevalent) illness. Chapters 7 and 8 address the second major research question. In these chapters, I describe treatment patterns of inmates during their incarceration and how these are associated with screening. I explore differences in these relationships between demographic (e.g. race and sex) groups and regions of the prison service. The third question is addressed in Chapter 9, which examines whether treatment is associated with incident rates during incarceration. It will consider whether the effectiveness of treatment differs for those already known - and potentially more severe case - from the newly detected cases. To integrate the three questions, Chapter 10 applies a relatively novel medical decision making analytic technique to estimate the net benefit (or harm) of screening.

Chapter 11 builds on the work of Chapter 10 to continue integrating the findings across the entire thesis. It ties the findings together and proposes directions for future policy and research. In this Chapter, I compare different approaches for screening offenders with mental

illness. I conclude the chapter with a hypothesis generating model of potential alternatives to screening or responses to those screening positive, as well as a discussion of potential indicators that could be used by correctional administrators for routine outcome monitoring and quality improvement activities related to screening.

Chapter 2: Definitions

2.1. The Canadian correctional system

Terminology used by correctional researchers, front-line staff and policy makers may vary in their meanings across countries due to differences in how correctional services are organized. As the series of studies that follow were conducted in Canadian federal prisons, I define and use Canadian terminology for readers who are unfamiliar with this system. There are a number of other dispositions available to the criminal justice system for individuals who engage in criminal activity. In Canada, individuals awaiting trial for a criminal offence and those who are sentenced to a term of incarceration of less than two years serve their sentence in jails (which are managed under provincial or territorial jurisdiction). Furthermore, for individuals with mental illness, a range of alternatives exist earlier in the criminal justice process that seek to prevent further progression along the continuum of criminal justice services (i.e. to traditional criminal court, jail or prison) and divert the individual towards mental health services[82,83]. These include mental health courts and other dispositions to divert individuals from the justice to the civil/general mental health system, and findings of Not Criminally Responsible on Account of Mental Disorder (NCRMD) that lead the individual to the forensic mental health system[*]. Thus, the term 'offender with mental illness' is a heterogeneous label, and its definition may vary considerably across studies. The primary research reported in this thesis was conducted exclusively in the prison setting.

[*] An individual who is diverted to the forensic system is monitored by the Review Board in their province, which makes an initial decision whether to a) release the individual to the community either with conditions (i.e. conditional discharge) and a requirement for annual review; b) release to the community with no further supervision by the forensic system (i.e. absolute discharge) or; c) detain the individual in a forensic hospital (i.e. a secure hospital with locked units, and increased security similar to a jail or prison, but with more therapeutic programming/treatment). A detailed portrait of the characteristics of those found NCRMD and their outcomes is provided elsewhere[335–340].

Individuals convicted of a criminal offence and sentenced to two years or longer of incarceration serve their sentence in a prison. While incarcerated, federally-sentenced individuals are excluded from the *Canada Health Act.* Thus, the responsibility to provide health care services shifts from Health Canada and provincial health care systems to CSC[44]. As outlined in the *Corrections and Conditional Release Act*, CSC must provide all inmates with "essential health care" and "reasonable access to non-essential mental health care that will contribute to the inmate's rehabilitation and successful reintegration into the community"[84(sec86)].

2.2. Screening definitions, practices and approaches

In the most general sense, screening is an activity that seeks to identify previously unidentified illness or health needs. As defined in *A Dictionary of Epidemiology*, screening is

> The presumptive identification of unrecognized disease or defect by the application of tests, examinations, or other procedures which can be applied rapidly. Screening tests sort out apparently well persons who probably have a disease from those who probably do not. A screening test is not intended to be diagnostic. Persons with positive or suspicious findings must be referred to their physicians for diagnosis and necessary treatment[85(p257)].

Based on this definition, screening should be followed by additional steps to determine an individual's diagnosis and/or treatment needs. In the prison context, these steps have been described as triage and assessment[86]. A triage is intended to be a relatively brief clinical assessment in order to prioritize the urgency and severity of needs. For those assessed as having a need for treatment, a comprehensive mental health assessment should be undertaken to develop a treatment plan (e.g. goals of treatment, and the types of intervention that are most likely to

achieve these goals). However, it is unclear that these steps are always followed. For example a combined patient self-report screening tool and brief structured assessment tool to be administered by the clinician to those obtaining a positive screen was previously evaluated in community primary care[87]. Only 30% of positive screens were followed by the use of the structured assessment tool in a condition where the clinician was provided with prompts reminding them to use the tool; when no additional support was provided, the follow-up triage was only completed 5% of the time.

More recent definitions of screening have argued that these follow-up actions should be considered in the definition of screening. For example, Raffle and Gray[88] suggest that screening is not simply a test, but rather a process. They define this process to include the entire range of activities required to achieve symptom reduction. While this conflates screening, triage, assessment, and treatment, Raffle and Gray argue that treatment cannot occur without identification of the condition, but that there is little value identifying a condition if there are no plans to intervene. This observation speaks more to whether there is value to screen, rather than what screening is. Nonetheless, acknowledging that screening is part of a process highlights that screening occurs within a broader context in which factors beyond the test itself (e.g. who administers screening, where screening is completed, the policies for using and communicating screening results, the effectiveness of follow-up services, etc.) influence the impact of screening on outcomes. Furthermore, screening typically requires the informed consent of individuals in the target population. For individuals who refuse to complete a test, policy and practice may suggest or require further actions to be taken. For example, in correctional institutions, security staff play a key role in monitoring inmates for signs of mental illness and risk of suicide[89,90].

Closer monitoring of inmates who do not complete screening, and in particular those believed to be at higher risk, may be indicated through policy.

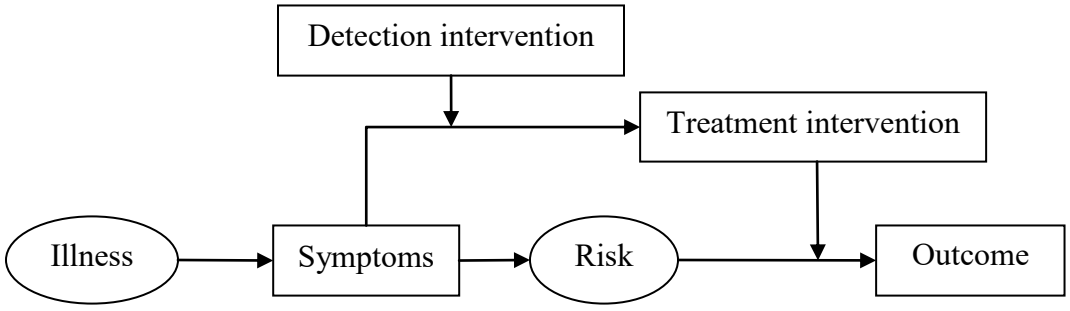
Second, the categories into which screening should sort individuals have been questioned. Historically (and as reflected in the *Dictionary of Epidemiology* definition above), screening should sort individuals solely on the basis of being sufficiently high risk of having the disorder to warrant further assessment[91]. Recent definitions have re-framed this sorting threshold based on whether the benefits of further intervention outweigh the harms[92,93]. Wald argues that revised definitions are redundant given that "all medical activity aims to do more good than harm"[92(p1)]. However, Harris and colleagues note "Our experience with multiple screening topics has taught us to focus on health outcomes rather than diseases or intermediate outcomes. The purpose of screening is to improve the length and/or quality of people's lives, not just to find abnormalities."[93(pp22-23)] Therefore, they use the term predictor of poor health to describe targets of screening. Screening results, illnesses and risk factors are all included within this category of predictors of poor health. Using this umbrella term of predictors of poor health is useful to inform research on screening tools, as it indicates the need to evaluate whether the screening result and/or the illness being screened for is a predictor of adverse outcomes.

Referring to predictors of poor health also suggests that a screening process can be useful even if it is not accurate in detecting a specific illness, as long as the screening result can predict other important adverse health outcomes. For example, if a screening process to detect inmates with major depression lacks sensitivity or specificity for diagnosing this condition, but identifies inmates who are at high risk of self-harm and suicide, this tool would likely be of interest to correctional institutions (although it may be necessary to change its' name and its' purpose should be clarified given that it lacks discriminant validity). This is consistent with findings that

screening tools which capture symptoms of distress are important predictors of morbidity and mortality[94,95]. It is also consistent with targeted and indicated prevention interventions that may rely on screening to identify at risk groups or individuals with prodromal symptoms to prevent the onset of illness[96,97].

Finally, considering screening results within a broader category of predictors of poor health is useful to conceptualize how screening results are used in practice, and their relationship with treatment. This conceptualization can frame discussions about the value of pursuing a more sensitive screening approach to increase detection of illness, or favouring a more specific screening to concentrate resources on the highest needs cases. In Figure 1, I offer a simplified schematic (i.e. ignoring numerous other confounding variables that could appear in the figure) of how screening and further assessment and treatment services are inter-related interventions. For this purpose, I adopt the definition of intervene from the *Merriam-Webster Dictionary*[98]: "to interfere with the outcome or course especially of a condition or process (as to prevent harm or improve functioning)".

Figure 1. Schematic of the relationship between mental health screening, interventions and outcomes.

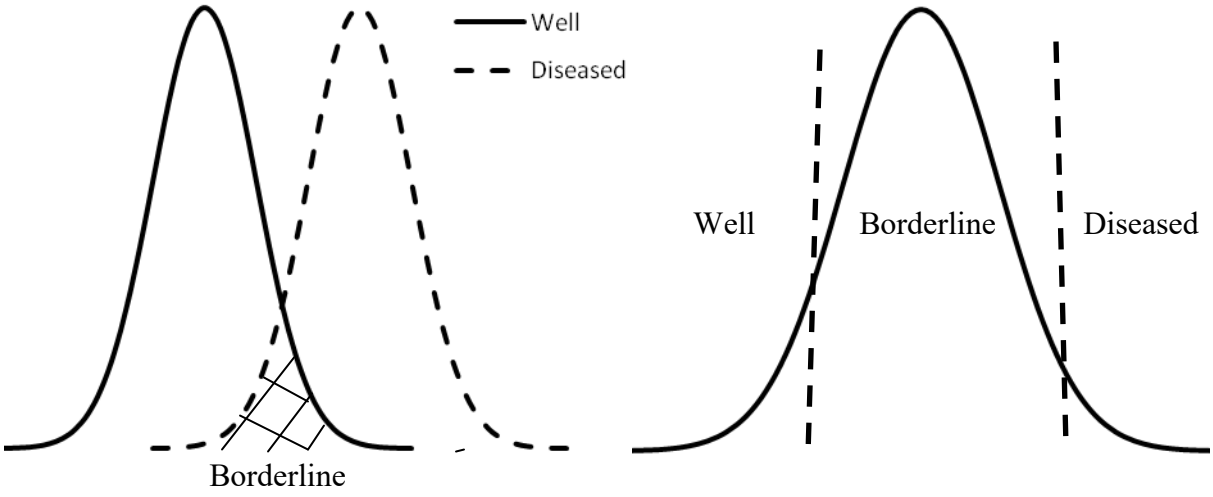


This figure posits that symptoms (or other markers detected through screening) reflect an underlying (but unobservable) illness. If screening is accurate, there will be a strong association

between illness and symptoms. These symptoms are presumed to be important in terms of increasing risk (again, an unobservable construct) of experiencing an outcome in the future (which could include continued symptoms, but could also consider other functional outcomes such as adverse behavioural outcomes such as violence, substance abuse or self-harm). The presence of symptoms also increases the likelihood that the individual will receive a treatment intervention, although this likelihood of receiving treatment is higher if the symptoms are detected or recognized than if they are not[99]. Thus detection interventions such as screening or surveillance can be considered to increase treatment uptake. The treatment intervention, in turn, can modify (ideally reduce) the individual's risk of experiencing the outcome. Intervention effects (especially when analyzed in RCTs) are often discussed as main effects in statistical models (i.e. treatment causes a better outcome), and usually followed by tests for effect modification to determine whether the effect of treatment varies within sub-groups of the population. However, conceptualizing an intervention as the effect modifier of an individual's risk is both consistent with practice and useful in terms of understanding when screening may be effective. This definition is also arguably more person-centred, by focusing on the needs and risk of the person rather than effect of treatment at a group level. If a person's risk is low, intervention is unlikely to influence the outcome; thus screening to improve detection is unlikely to offer a benefit. In the context of correctional interventions, the widely accepted risk-need-responsivity principles argue that intervening with someone of low risk and need may in fact increase their risk[100]. Extending these principles to mental health, unnecessary interventions may cause harms such as side effects[53,55–57], stigma[101–104] and time and monetary (e.g. lost income for time off work) costs of attending interventions.

As noted in the definition of screening, it is not diagnostic, but rather it is probabilistic. Wilson and Junger highlight the challenge of making dichotomized referral decisions due to what they refer to as 'borderline' cases[91]. They define borderline cases under two approaches – one that views this population as consisting of two sub-populations, and the other that views mental health symptoms as varying across a single population. Under the first perspective (see left hand side of Figure 2), it is assumed that there is a bimodal distribution of scores on the screening measure, where the healthy and diseased groups form truly distinct populations. In this case, the borderline group reflects the overlap in these distributions of healthy and diseased individuals. Specifically, this group includes healthy individuals scoring at the high range of the distribution of scores on the screening measure relative to other healthy individuals, and individuals who have disease but who score low on the screening measure relative to other individuals with disease. Alternatively, if the population is viewed as a single population, the borderline group represents the grey zone in between those who are clearly healthy or ill at the extremes of the distribution (see right hand side of Figure 2). These individuals might be thought of as having a moderate level of symptoms or impairment. In either case, policy must establish where the cut-off score should be set to best capture the group with disease (left side) or the group who would benefit most from treatment (right side). This question may be simplified if the follow-up to screening is not treated as a binary option to treat or not to treat, but rather to prioritize follow-up based on the individual's screening result and estimated level of risk.

Figure 2. Depiction of bimodal versus single population distribution conception of borderline cases.



2.3. Diagnostic error

These ideas of Wilson and Jungner about the 'borderline' group are at the heart of any debate about diagnostic error in mental health research and practice[60]. I recently authored a paper published in the *Journal of Correctional Health Care*[105] exploring the potential prevalence and causes of diagnostic error. In this section, I present a modified version of this article to summarize the relationship between screening and diagnostic error, and the need to consider diagnostic error in interpreting the results of research on mental health screening.

Defining and diagnosing mental illness is not a simple task. While the reliability and validity of psychiatric diagnosis have been debated over decades, the recent release of DSM-5 and ongoing revisions to the ICD-11 have re-invigorated debate about the classification of mental illness[106–113]. Others[109,114] have argued that the expansion of diagnostic criteria has reduced stigma for milder psychiatric conditions, while further increasing stigma towards the smaller group of individuals with the most severe mental illnesses. These arguments appear to be reflected in findings that individuals with mild to moderate symptom severity receive

disproportionately more services in community settings than those with severe mental illness[115,116].

Despite the high prevalence of mental illness in correctional settings, there remains a dearth of research regarding the reliability and validity of classification systems such as DSM among prison populations. Due to differences in the environment itself, and in the characteristics of the prison population, there may be factors associated with diagnostic error that are either magnified in a prison environment, or that are unique to this setting. A study in French prisons found that approximately 7-10% of inmates were diagnosed with a mental illness by one psychiatrist but not the second[117]. Thus, for every 1000 inmates, between 70 and 100 inmates' mental health status could differ depending on the clinician conducting their assessment. This may in fact be an under-estimate of the discrepancy of mental health classification; the clinicians in this study were both present to the same interview, and thus were working with the same information to arrive at their diagnosis. Other factors such as therapeutic alliance and dishonest responding from participants which clinicians believe contribute to poor reliability of psychiatric diagnosis[118], may result in worse agreement if assessments are done independently. Furthermore, the fact that both clinicians agree whether there is a diagnosis present does not indicate that this decision is in fact accurate. Discrepancies between clinicians could have important consequences for treatment in jails and prison, in light of the fact that correctional mental health providers could disagree with providers in the community, or with staff at other institutions for those inmates who transfer between institutions. In the context of CSC, mental health screening and assessment happens at a centralized intake site, but treatment is typically provided after the inmate is placed at the institution where they will serve their sentence.

Specific to research studies, estimates of undetected illness may be inflated by diagnostic error resulting from research diagnostic interviews that have been criticized for failing to distinguish psychiatric symptoms from normal reactions to stressors[119,120]. Considering functional impairment might address criticism that diagnosis is not necessary a good measure of need for care[121,122]. Recent studies have reported that between only 40-45% of those meeting criteria for mental illness had moderate to severe functional impairments[10,123]. Thus, approximately half of all inmates diagnosed using structured research interviews may require little or no treatment, which would suggest a lower than reported rate of untreated mental illness in correctional facilities, or a lower than reported rate of false negatives following administration of screening tools. The reliability and validity of these functional impairment assessments is unclear given that they are obtained from a research assistant who has a relatively brief opportunity to assess the individual's functioning, with no collateral information. For example, Bushnell and colleagues[124] found that in approximately a third of cases where general practitioners did not formally diagnose patients who met criteria for a mental disorder based on a research interview, they recognized symptoms but did not consider these to be sufficient to warrant a diagnosis or did not believe they caused significant impairment. In these cases - especially when the GP has regular contact with the patient - it is possible that the GP's assessment of functioning is more valid, as they may have a more complete picture of the patient's condition and its evolution over time. This can also avoid issues such as recall error that may be present in the administration of diagnostic interviews capturing symptoms over for example the past year, as is common in many diagnostic interviews (as seen in the Bushnell and colleagues study for example).

Diagnostic errors might be prevented through targeting their causes, although in the mental health context these have not been systematically studied. Nath and Marcus[125] outline a conceptual model that groups causes of diagnostic errors into patient, clinician and system factors. They also include interactions between patients and clinician (e.g. communication errors), patients and the system (e.g. navigation errors), and clinicians and the system (e.g. time constraints, caseloads, etc.) to highlight that errors often involve multiple levels.

Factors involving patients may include both malingering of psychiatric symptoms[126,127] or an unwillingness (or inability) to disclose symptoms[128,129]. The process of adapting to correctional environments, and adherence to the "inmate code" (e.g. trust nobody, serve your time quietly, etc.) may increase behaviours that work against disclosure of mental health symptoms and development of positive working relationships with clinicians[130,131]. Common characteristics among inmates may also increase the risk of diagnostic errors. For example, histories of trauma are highly common among inmate populations[132–134]. Individuals with traumatic histories may be more likely to present with physical health complaints with an ill-defined pathology, which may reflect unrecognized mental illness or psychological distress[135]. If misdiagnosed as a physical rather than mental health issue, this may lead to inappropriate treatments.

Inmates may also choose not to disclose mental health symptoms for various reasons, including avoiding looking weak for fear of victimization, a lack of access to services, negative prior experiences with service providers, and a preference to be self-reliant[128]. Inmates may also deny symptoms such as suicide ideation, potentially as a reflection of their preferences against available treatment options (e.g. observation cells)[129,136]. While these findings are not specific to screening - and inmate attitudes and preferences for screening have not been studied - some

evidence exists from (community) primary care settings that warrants consideration. For example, Wittkampf and colleagues[137] conducted qualitative interviews of the first 17 cases of major depressive disorder that were newly identified by screening. Participants were positive about screening and the fact that it drew attention to the symptoms that they experienced. However, they found the diagnosis and explanations of their symptoms unhelpful, and consequently many did not feel that treatment was appropriate for them. Participants reported particular concerns about stigma. They described their needs as being less severe than what they would consider to be diagnosable illness, and connected these symptoms to specific life events for which they required support (e.g. financial and family problems). Similar findings were reported among an elderly (aged 75 and older) population from an RCT of screening[138]. Of 121 positive screens, 101 accepted follow-up with a community psychiatric nurse as the initial step of a stepped-care intervention. Of this group, 23 initially accepted to participate in a coping with depression course, although ultimately only 5 participated. When these 23 participants were interviewed, similar themes emerged where participants recognized symptoms, but labelled these as less severe than 'depression'. This finding suggests potential discomfort with the labeling or medicalization of distress as illness. Respondents in these interviews also felt confident that they had developed effective personal coping styles to manage their symptoms, and reported low expectations that the program would help them.

At the clinician level, errors may stem from the use of heuristics by clinicians in situations where time or information are limited, the processes through which screening and assessment are conducted, interview style and training, and the availability of collateral information from previous treatment providers, family and other sources close to the individual[118,139,140]. Cognitive errors associated with the inappropriate use of heuristics such as

anchoring, confirmation bias, diagnosis momentum, and commission bias[139,140] may be especially prevalent in correctional settings where large numbers of inmates may need to be assessed, often in short time periods. To illustrate these errors, we adapt an example given by Crumlish and Kelly[140] to the correctional setting. An inmate is started on a medication at intake based on a perceived need to take at least some action despite an unclear psychopathology (i.e. commission bias) or based on a provisional diagnosis. As the inmate serves his or her sentence, this diagnosis may persist without further assessment to confirm it (i.e. diagnosis momentum). The persisting diagnosis may stem from anchoring (e.g. following a transfer from an intake institution to a regular institution to serve out the length of a sentence, a professional might be unwilling to adjust a diagnosis made by a colleague) or confirmation bias (e.g. improvement in symptoms and behaviour are attributed to the medication effectively managing symptoms rather than other possible explanations such as prior symptoms reflecting adjustment to prison[141], spontaneous remission[142] or the improvement reflecting regression to the mean on assessment instruments[143]).

System level factors may include policies that fail to account for situational stressors or the relationship between the assessor and the inmate. While admission to jail or prison is a highly stressful time, screening and assessment typically - as is the case in CSC - occur at this time. Thus, the potential for misdiagnosis or over-diagnosis may be especially high. While there are few studies exploring changes in mental health symptoms during the period of incarceration, for many inmates depressive and anxiety symptoms appear to decrease during the initial weeks of incarceration[141,144,145]. Conversely, Hart and colleagues[146] note that inmates may refuse to disclose information to correctional officers if they fail to build rapport and engage inmates in the process, and that correctional officers reported struggling with changing roles between a

security role and a "service-delivery" role. Given the important role of correctional officers in identifying inmates with mental illness, these challenges may be important contributing factors to misdiagnosis of inmates' mental health needs. These challenges are reflected in findings from Steadman and colleagues, where 26 of 33 inmates with mental illness who were missed by screening results reported different information to the correctional officer conducting screening and the research assistant administering a structured clinical interview (the SCID)[147].

Similar to the role conflict reported by correctional officers, given that correctional environments are primarily security oriented institutions, mental health staff may experience external pressures to provide treatment to individuals who do not meet diagnostic criteria[148–151]. These pressures were reflected in interviews with mental health professionals working in a US prison. In this study, Galanek[151] summarized a number of challenges reported by clinicians in terms of making diagnoses in prisons including: (1) working with individuals who have been historically labelled as 'behavioural' or 'troubled' cases, and experiences and/or perceptions that medications help manage this population by security officers; and (2) the impact of co-occurring personality disorders, substance abuse, and attempting to disentangle criminality from mental illness. A substantial challenge raised by staff in these interviews is that many inmates with the most severe mental illness do not access community mental health care, as they may not perceive a need for care. Galanek summarizes these comments by stating that "once in prison, the individual, who to that point had been seen as having a chaotic *life*, undergoes transformation to a mentally ill inmate"[151(p207)]. It is these perceptions that illness is untreated prior to incarceration that are a major contributor to calls for mental health screening. However, others have questioned these perceptions, suggesting that many inmates with mental illness do in fact access community services[152–154].

Taken in their entirety, these findings highlight the complex reasons why mental illness may go undetected in some cases, and why individuals not meeting diagnostic criteria may be treated in others. While it is clear that screening could assist with some causes of diagnostic errors (e.g. errors resulting from patient-system interactions such as lack of knowledge about navigating the system), screening will not address others such as patient unwillingness to disclose symptoms. It also seems possible that screening could magnify other causes of diagnostic errors. For example, errors related to clinician-system interactions such as resource constraints could be made worse due to the burden of false positive screening results. If this is the case, the reliance on heuristics by clinicians (such as the earlier example) would be increasingly necessary, and could potentially result in worse outcomes. While it is difficult to measure diagnostic errors in the context of mental health, an awareness of these challenges and issues in measuring mental illness is required when interpreting results of mental health screening research and practices.

Chapter 3: Literature Review

3.1. Mental illness and adverse behavioural and health outcomes

The burden of mental illness is substantial and its impacts are wide-ranging. The Global Burden of Disease study found that mental and substance use disorders are the leading cause of years lived with disability YLD), contributing to approximately 175 million YLD in 2010[155]. They accounted for approximately 7% of all disability adjusted life years lost (approximately 184 million DALY lost in 2010) and 8.6 million years of life lost prematurely. The World Economic Forum[156] estimated the global economic costs of mental illness at $2.5 trillion (US dollars) in 2010, and estimated this will increase to $6 trillion by 2030. In these estimates, mental illness was the leading cause of the economic burden of non-communicable diseases, with estimated costs that were slightly higher than those of cardiovascular disease, and greater than cancer, diabetes and chronic respiratory disease combined.

In correctional settings, mental health treatment is also motivated by safety considerations[148]. Thus, outcomes such as mortality (and in particular suicide), self-harm, victimization, and violence are often the focus of attention of correctional administrators, critics of current levels of care, and/or researchers[35]. While Alexander Jr argued that correctional mental health programs should be evaluated based on the extent to which they reduce symptoms and improve quality of life[157], only 14 of 25 studies in a prior systematic review on interventions for justice-involved persons with mental illness measured changes in these mental health outcomes[158].

3.1.1. Mental illness and health outcomes in correctional settings. Mental illness is associated with a range of adverse health behaviours. Higher rates of non-suicidal self-injury and suicide have consistently been reported among inmates with mental illness[18–21,159–161]. Power and

colleagues found that the most common motivation for non-suicidal self-injury in a prison context is to relieve feelings of distress[162,163]. Others, such as Dear[20] argue that distress is a necessary ingredient for self-injury in prison. While there is little debate about the relationship between mental health and self-harm, predicting and preventing self-harm is challenging. Since self-harm is a rare outcome, the majority of inmates with risk factors such as mental illness do not engage in self-harm. Most inmates who engage in self-harm in prisons, have a history of self-harm prior to their current incarceration[162–164]. These long-standing patterns of self-harm may be particularly challenging to intervene upon. However, a recent systematic review of interventions for self-harm suggests cognitive behavioural therapy and dialectical behavioural therapy are two approaches that appear to be effective at preventing recurrent self-harm among adults[165].

Studies on all-cause mortality in prisons have produced mixed results. For example Spaulding and colleagues[33] reported lower all-cause mortality rates as compared to the general population. However, they and Patterson[166], both found higher mortality rates for White inmates, and lower mortality rates for Black males. Patterson also found that despite differences in mortality rates that exist among the general population, there were no differences between racial groups in mortality while incarcerated. Conversely, a study of Aboriginal inmates in New South Wales (Australia) found a nearly five-fold increased mortality rate for incarcerated men and a 12.6 fold increase for women, relative to age and sex-specific annual mortality rates in the general population[167]. Increased mortality risk has also been noted following release from prison, especially in the first two to four weeks[32,33,168–170]. A recent study restricted to the population of community-living individuals with mental illness, reported an all-cause mortality rate that was twice as high for men with mental illness with a history of incarceration compared to those without a criminal history[171]. When this study was repeated with women, incarceration was

associated with a 1.3 fold increased mortality rate, although the confidence intervals of this estimate were wide (0.5 to 3.5) owing to a low incarceration rate among women[172]. However, in both of these prior studies psychiatric hospitalization could pre-date incarceration, limiting the ability to draw causal inferences. Therefore, it is unclear to what extent different justice contacts increase morbidity and mortality risk among individuals with mental illness.

3.1.2. Mental illness and violence. It is debated to what extent mental illness is a cause of violence[173–176], or whether higher rates of violent acts and other forms of misconduct in prisons[22–26,28,29,31] are confounded. Studies investigating criminal and violent behaviour in the community have led to three major conclusions which may extend to understanding violence by inmates with mental illness in prison: (1) general risk factors for criminal behaviour and violence are equally predictive in individuals with mental illness as in those without[176–178], although inmates with mental illness may have higher rates of these risk factors[25,178–183]; (2) mental illness may be a direct (i.e. causal) risk factor for subgroups of individuals (e.g. those with substance abuse[184–189], those with later-onset criminal behaviour[190], or those with specific symptoms[191–193]) or in certain situations (e.g. non-compliance with treatment, often tied to a lack of insight into one's illness[194–196]); (3) the percentage of violent and criminal behaviour directly attributable to mental illness is small[174,190,193,197–199].

Using meta-analysis, Bonta and colleagues[176,177] concluded that in general the same risk factors (e.g. early-onset crime, antisocial attitudes, antisocial personality, substance abuse, etc.) predicted repeat criminal activity among all offenders, regardless of whether they had a mental illness. However, there was the greatest variability in the estimates of the association for these mental health/clinical variables as compared to most other predictors of criminal behaviour. In other words, findings were inconsistent across the many studies that were included in the

systematic review. Thus, despite the fact that Bonta and colleagues' conclusions are generally accepted, there remains a continued effort to understand the circumstances when mental illness is a risk factor for crime. Douglas and colleagues argue that the question of whether mental illness is causally associated with violence is overly simplistic, and suggest the need to consider the "more complex and sophisticated question, 'What particular symptoms […], under which situational circumstances, and in combination with which personal or situational factors, are associated with increased or decreased risk of various kinds of violence?'"[175(p696)]. Similar views have been articulated by others[174,190] and reflect an interest in moving from simply predicting violence and criminal behaviour to understanding and preventing it[200].

Specific to the prison context, some authors have proposed that higher rates of violence are restricted to specific symptoms or sub-groups of inmates. Felson and colleagues[24] reported elevated risk of institutional incidents among those with psychotic and depressive symptoms, but not anxiety symptoms. However, other studies have found that depressive symptoms are associated only with self-harm, but not violence towards others or destruction of property[30]. Walters and Crawford[27] found that major mental illness was associated with increased risk of institutional violence only among those with a history of violence, whereas there was no association among those without a history. Others have found no association between symptoms (measured with the Brief Symptom Inventory [BSI]) and institutional misconduct after controlling for other risk factors for misconduct such as antisocial personality[34]. In my prior work examining the relationship between scores on the BSI and violence in the first six months of prison[201], distress was not associated with violence on its own. However, in combination with substance abuse and/or an earlier onset of criminal behaviour, there was evidence of increased risk of violence by inmates with mental health needs.

In sum, while it remains debated when, if and how mental illness is related to violent and criminal behaviour, there appears to be an opportunity to prevent at least some violence in prisons. This appears to be particularly relevant in terms of providing treatment for sub-groups of the inmate population with multiple co-occurring needs. While the potential benefits in terms of violence reduction may be much smaller than for improvements in health behaviours and outcomes, it remains an area of interest to correctional administrators and researchers to estimate potential reductions in violence through the provision of effective mental health services.

3.2. Impact of screening on mental health service use

There are two criteria that must be met for a screening tool to impact service use. First, the tools must be statistically accurate (i.e. have sufficiently high sensitivity and specificity, and positive and negative predictive values); second, screening must be able to identify treatable mental health needs earlier than they would otherwise be detected[88]. If screening cannot lead to earlier detection that, upon intervention, can slow or reverse the development of the condition, it is wasteful to divert resources that could otherwise be used to treat the disorder. As noted by Wilson and Jungner "screening is an admirable method of combating disease, since it should help detect it in its early stages and enable it to be treated adequately before it obtains a firm hold on the community."[91(p7)] This is in line with findings suggesting that early intervention for mental illness is associated with a better prognosis, such as greater symptom reductions, fewer relapses, and higher social functioning[202,203].

It is unclear to what extent mental health screening can capture individuals in a pre-symptomatic, or prodromal phase. Some have argued that since many inmates enter prison at an age where onset of mental illness is common[97,204–206], there would be value to screening for prodromal symptoms. However, more often, the benefits of screening have been implicitly

considered in terms of shortening the duration of untreated mental illness. Most screening tools comprise items that either capture current psychological distress (e.g. the Brief Symptom Inventory[207,208] asks about feelings in the past week such as feeling blue, keyed up, lonely, worthless, etc.), map onto diagnostic criteria (e.g. the Patient Health Questionnaire[209] explicitly includes the 9 criteria used for a diagnosis of depression), or inquire about previous mental health treatments or diagnoses (e.g. service utilization items are included in the Brief Jail Mental Health Screen [BJMHS][147] and the England Mental Health Screen [EMHS][210]). While such tools do not preclude detecting prodromal symptoms, they appear to reflect the perspective that pre-existing mental illness is being under-detected.

Specific to the prison context, there is a need to distinguish prevalent and incident mental illness, and the extent to which these illnesses are detected through routine practice, in order to inform both the value of screening, and the types of questions that should be asked. For example, if most cases of mental illness are diagnosed before intake to prison, this would suggest a need for better information sharing between health services in the community and prison, and less of a need for screening. Alternatively, it would suggest that screening could be done with relatively brief mental health history items, provided that inmates are willing to disclose this information. If mental illness develops during incarceration, this would suggest greater benefits of screening for either early warning signs or symptoms, but would also require that screening be done at later intervals during incarceration (ideally, corresponding to critical risk periods).

Based on existing data, it appears that a great deal of mental illness pre-dates incarceration. Mental health symptoms are reported by a majority of inmates upon admission to jails and prisons. For example, based on diagnostic interviews, a higher prevalence of mental illness is observed at intake to prison as compared to the general population[9,12,211], and many

individuals who are either receiving treatment in prison[154] or who meet diagnostic criteria based on research interviews[153,212] were receiving services in the community at some point prior to their incarceration. The limited body of evidence that has considered mental health longitudinally, has generally found high rates of remitting symptoms during early incarceration for men in particular[141]. Taylor and colleagues[144] conducted repeated assessments at one and four weeks following admission to a pre-trial jail using a number of measures including the Beck Depression Inventory, the Symptom Checklist (SCL-90) and the Comprehensive Psychological Rating Scale. Depending on the measure considered, approximately one-third to one-half of participants who exceeded the cut-off to be considered a case at intake, no longer exceeded the cut-off at follow-up. Hassan and colleagues found that while there were reductions in depressive symptoms among men who had been convicted, there were no differences for men awaiting trial. There was no change in symptoms for women, regardless of their legal status. Another study with women inmates, also found no significant differences in scores on the General Health Questionnaire-12 and the Hamilton Depression Scale over a 4 month follow-up interval[213]. Given that these studies typically reported that there was limited treatment available, they suggest that a sizeable number of inmates could end up receiving short-term mental health services following intake screening, despite the fact that in many cases these symptoms could resolve naturally.

While mental health often remains stable or improves throughout incarceration, it can deteriorate as well. Taylor and colleagues found that up to 10% of inmates who did not meet the criteria to be defined as a case at intake developed symptoms by the four week follow-up[144]. Furthermore, one older study[214] found increasing rates of anxiety among incarcerated individuals who were awaiting trial. All of these studies included inmates in pre-trial custody or serving

short-term jail sentences. Symptoms of mental illness may be more common in jail settings, given the uncertainty about the individual's legal situation and the potential unfamiliarity with routines in correctional institutions among those who are incarcerated for the first time. It is less clear what the incidence of new onset illness would be in a prison setting.

Mental health screening studies in general (i.e. in community settings) have been criticized for the inclusion of individuals with known illness in order to validate screening tests[215–217]. Given that a diagnosis of mental illness depends on either self-reported or observed symptoms[218], this may lead to over-estimating the potential yield of new cases that screening can identify. Furthermore, screening cannot lead to earlier initiation of treatment for those who are already receiving care prior to screening. In the prison context, there is a dearth of evidence examining the impact of screening on service use. In the lone study to provide a pre-post comparison, Pillai and colleagues[86] found that after implementing screening in New Zealand jails, there was a modest increase in the percentage of inmates receiving mental health services from 5.6% to 7.2% in the year after implementing screening. The authors note that when they extended their follow-up to 4 years post implementation that the proportion of inmates in treatment increased to 9.8%.

The introduction of screening in this case was part of a wider effort to introduce a standardized in-reach prison model of care, which had no additional funding attached to it. Given that only 25% of the population was screened, it is unclear to what extent screening alone contributed to the increase in service use versus other changes to the triage, assessment and intervention components of the model. The authors also note that despite the increase in treatment provision, the proportion of inmates receiving services remained below the estimated prevalence of illness of 15%, suggesting further room for improvement. Finally, while these

findings may suggest that screening may play a key role in increasing service use in the jail and prison context, they cannot speak to whether the newly detected cases are in fact appropriate as the data are population level rates. Addressing this question would require individual analyses matching service provision to screening results or a more detailed assessment of diagnosis and/or treatment needs.

Only one study in the prison context has both excluded already known illness, and explored the use of screening in a more preventative approach[97]. Of 2115 inmates screened, 616 (29%) obtained a positive screening result suggesting need for follow-up. After assessment, 94 inmates (4.4% of those screened) were identified as high risk of psychosis, and 24 (1.1% of all those screened) were already psychotic and thus referred to the usual mental health in-reach service. Only 52 (55% of the inmates offered the intervention or 2.5% of those screened) of the 94 identified as high risk and offered an intervention accepted it. The authors note evidence of symptom reduction for a sub-group of 20 participants who completed pre-post intervention measures of depression, anxiety and distress, and that the rates of return to prison were lower among the 52 treated individuals than re-offending rates for the entire prison population. While these are encouraging findings, the authors note that an RCT is required to demonstrate the value of the screening and intervention. It is highly likely that there are important selection biases at play, and it is unclear whether the 52 inmates who participated in the intervention would have come to the attention of treating clinicians even in the absence of screening. More broadly, it warrants consideration whether it is the most cost-effective use of clinical resources to screen all inmates and provide full assessments to almost a third of those screened, in order to ultimately treat 3.6% of those screened.

O'Neil and colleagues[219] provide similar data on outcomes following screening, as they report that 1109 referrals (18%) were generated during three years of screening with a variant of a screening tool used in the UK[210]. However, there is no indication that those with already known illness were excluded from the screening; 65% of these individuals (some of whom had multiple admissions during the three year study) had a psychiatric history that pre-dated incarceration that might have been identified even without screening. The authors do note that 349 individuals (5.6% of all intakes) were diverted from the prison system - highlighting the benefits of early detection - either to a forensic hospital or a community psychiatric hospital, whereas 748 (12.2%) were referred to either the prison GP or psychiatric team. While 82% of inmates had no needs identified by screening and case note review by the mental health in-reach team, the authors do not indicate the false positive referral rate at the screening stage. Nonetheless, they report a median 2 day delay from screening to psychiatric assessment, and median delays between 8 and 10 days to provision of treatment in the admitting prison, 24 days for treatment in other prisons, and 15-20 days for diversion to non-prison mental health services. These findings suggest the feasibility and sustainability of the model in this context, but do not provide a comparison of the effectiveness of the model relative to other case detection approaches.

Others have examined whether inmates identified by screening receive required follow-up, as a measure of whether correctional institutions can properly respond to positive screens. A study of over 2000 British prisoners found that 25% of inmates flagged with current suicide ideation, 22% with a history of self-harm, and 22% of inmates with a psychiatric history did not receive a follow-up assessment or treatment in the first month after completing screening[42]. While the authors note that some of these inmates may have received interventions that were not recorded on official records, these results highlight the challenges that prisons may face in

responding to growing numbers of inmates and high rates of endorsement of screening items. No data are provided regarding reasons why inmates may not have received services, but it is possible that follow-up was delayed as a result of competing priorities between assessing new intakes and providing treatment to those who were previously identified as having significant mental health needs. Furthermore, these results do not take into account the potential for false positive screening results, and therefore whether the lack of follow-up action was in fact appropriate.

Schilders and Ogloff[220] found similar results to the UK study in an Australian prison. The authors considered inmates with the two highest ratings of psychiatric needs used by the prison service, and found that 23% of severely/acutely ill inmates, and 19% of 'suspected and/or stable mentally ill inmates' were not receiving further follow-up after intake screening. However, they note that based on previous work the screening tool used has a false positive rate between 18 and 25%, and that the prevalence rate of mental illness is only comparable to studies using structured diagnostic interviews after adjustment for potential false positives. It is unknown whether those who did not receive service were false positives, as there was no independent measure of mental illness administered in this study to validate the screening results and classification.

While there is little research on the impact of screening in prisons, recent systematic reviews highlight the limited research evaluating the impact of screening in other contexts. A recent review by Thombs and colleagues reported that there are no studies of sufficient methodological rigour to support a benefit of screening for depression in primary care[75]. A recent updated systematic review by the USPTSF[80] identified only one new trial for the general adult population published since their last recommendation in 2009[79]. An older systematic review offers the lone meta-analysis of the impact of screening on detection and management of

depression by primary care physicians. This review found no overall effect of screening on recognition or treatment of depression[72]. However, when studies were divided by those which included the whole population versus those which pre-selected high risk populations, there was a small increased likelihood of detection and management of depression in the high-risk population group. The high-risk group was defined as RCTs for which screening results participants were only included in the trial if they scored above a cut-off score on the screening tool (which was administered by a researcher in the waiting room, and shared with the physician for those in the screening group and not shared for those in the treatment as usual group). Gilbody and colleagues speculated that this might be due to the fact that in a pre-selected population the prevalence of illness is high, and thus the likelihood that a patient with a high score has an illness is higher than in an unselected population with a lower prevalence. They suggest that understanding the thought processes involved in clinical decisions may inform how screening can add value in provision of mental health care.

Beyond understanding these thought processes, Wilson and Jungner[91] note that screening can become more efficient and economical and that it can become an accepted part of the care provided when it is a continuing process. They argue that one-time screening blitzes are less effective than if screening is offered as a matter of routine practice. Most of the studies in prior systematic reviews include one-off screening, often conducted by research assistants rather than staff members in the institution. Implementing screening requires buy-in from staff and integration within the existing care model. It is therefore unclear to what extent null or weak effects of screening are attributable to implementation issues versus limitations of screening.

3.3. Impact of screening on behavioural and health outcomes

Wilson and Jungner[91] argue that the most important criteria for justifying a screening tool is that an accepted treatment exists. They note, however, that it is often assumed as a matter of medical opinion or ethics that treatment successfully improves outlook, and that earlier intervention is of benefit. Two recent meta-analyses provide some evidence to suggest that interventions for individuals with mental illness can lead to improved mental health and behavioural outcomes during incarceration[221] and upon return to the community[158]. Furthermore, various standards, guidelines and strategies for mental health treatment[61,63,64] have been accepted and adopted within the mental health strategies of correctional systems[62]. Thus, the perception that effective treatment options exist, but are not being adequately applied has motivated the introduction of mental health screening in many correctional settings. However, no studies have evaluated whether screening in fact leads to improved outcomes among inmates with mental illness. There is relatively little evidence of the impact of screening on outcomes in the community. On the one hand, a number of effective psychotherapies[222,223], medications[224] and guidelines[76,225–235] are evidence-based responses for treating mental illness, and these could provide substantial return on investment if scaled up[40,80,236,237]. However, others have questioned whether these interventions will be effective when applied to individuals identified by screening who are likely to have less severe needs than clinical populations who are most commonly studied in randomized controlled trials[66,216,238].

In large part, the value of treatment following screening depends on the certainty and accuracy of the diagnosis. Screening tests for mental illness have consistently been reported to have positive predictive values between 25 and 40% (i.e. only 25-40% of those referred are in fact ill, whereas the majority are falsely referred), which leaves staff in a highly uncertain

position. This reflects the 'borderline' problem raised by Wilson and Jungner that was discussed previously in section 2.2. Hunink and colleagues describe three potential strategies that service providers may consider when faced with diagnostic uncertainty: (1) watchful waiting; (2) further diagnostic testing; or (3) initiating treatment[81]. The National Institute for Care and Excellence (NICE) in the United Kingdom recommend psychoeducation and watchful waiting (which they refer to as active monitoring) before offering or referring for further assessment in cases where "the presentation and history of a common mental disorder [i.e. major depression or anxiety disorders] suggest that it may be mild and self-limiting (that is, symptoms are improving), and the disorder is of recent onset."[76(p134)] In a correctional setting, watchful waiting may be a useful approach to integrate non-mental health professionals to contribute to the care of inmates. This role might be especially suitable for security staff who may be best suited for this task given their routine contact with inmates and skillsets[89,90]. Further diagnostic testing is the common approach within most models, where either a triage[239] or a full assessment (as in the case of CSC during the time when this thesis was completed, although recent changes have moved towards a triage function[240]) is completed following a positive screen. Moving directly to initiating treatment is rare in the context of mental health, but may be an appropriate approach if the harms of treatment are low, and its benefits are high. This is especially common in the context of preventative interventions for those at risk of developing an illness[96], which arguably reflect an approach that seeks to treat borderline cases to shift them towards the healthy end of the distribution and/or prevent movement into the ill distribution.

Medical decision making theories can be useful in this regard to understand how optimal treatment decisions can be made with incomplete and/or imprecise information. Among the more influential of these approaches is the threshold approach to medicine proposed by Pauker and

Kassirer[241,242]. In short, this approach argues that when faced with uncertainty, clinicians and patients (or policy makers at the population level) must weigh the accuracy of testing and the harms and benefits of treatment to decide the best course of action. They derived two thresholds based on these parameters - the first threshold is the point at which administration of further screening or diagnostic assessment is warranted, and the second threshold is the point at which treatment should be initiated. These thresholds capture the idea, that faced with uncertainty, the most likely outcome should inform decision making. In practical terms, the testing threshold captures the idea that for a person with a risk that is so low that even a positive test result would not increase their risk of illness to the point at which the benefits of treating the illness if it is in fact present outweigh the harms of treatment if the illness is not present, there is no value of further testing or assessment. In other words, the results of the testing would not change the decision whether to treat. In a similar vein, the treatment threshold represents the point at which a person's probability of having the illness is so high, that a negative screening result would not bring them below the point at which the harms of treating a non-ill individual outweigh the benefits of treating an ill individual. In this case, further testing would not change the decision to offer treatment, and thus it could be offered despite the lack of absolute certainty that the diagnosis is present. If screening is offered to an individual below the testing threshold, this could lead to over-treatment, whereas screening an individual above the treatment threshold might lead to withholding or delaying treatment.

3.4. Summary and research questions

Mental health needs of inmates have attracted considerable attention in recent years. Despite growing interest in screening prisoners for mental illness, the impact of screening remains unknown in practice. Given that the primary purpose of screening is to improve

outcomes for those affected by the disorder, it is critical to identify the extent to which screening reduces the rate of important incidents in prison such as violence and self-harm. Guided by the model presented previously in Figure 1, I will explore three aspects related to the value of screening: (1) the accuracy of screening (i.e. the relationship between illness and symptoms reported on screening); (2) the association between screening and service use; (3) the association between screening results, risk and institutional outcomes. The research questions in these three areas are outlined in Table 1.

Table 1. General and specific research questions.

General questions	**Specific research questions**
What is the accuracy of screening?	1) How do different screening protocols compare in their accuracy to detect mental illness? 2) How many inmates identified through screening are newly identified cases? 3) What are the needs of individuals who are identified by different screening protocols?
What is the impact of screening on service use?	1) How is service use associated with an inmate's screening result and mental health history? 2) Do these associations between screening results and service use vary based on demographic or regional characteristics?
What is the impact of service use on outcomes?	1) What is the impact of service use on health outcomes such as self-harm, overdose and mortality in prison? 2) What is the impact of service use on rates of violence in prison? 3) What is the impact of service use on rates of victimization in prison? 4) Does the impact of service use differ for individuals depending on the screening protocol that is required to detect them?

Chapter 4: General methods

The series of articles included in this thesis are based on a cohort of inmates who were admitted to Correctional Service of Canada (CSC) prisons between January 2012 and September 2014. In total there were 13,493 admissions to CSC during the study period. As there were only 8 inmates who had repeat admissions, only the first admission during the study period was included. Inmates who had screening results on file which were dated prior to their admission date (n = 4) were excluded. Furthermore, 200 (1.5%) inmates spent at least one day out of the prison on bail pending an appeal of their conviction or sentence. They were excluded from the sample, as we did not have access to the dates they left and re-entered (where applicable) the prison making their actual time at risk unknown. Therefore, in total 13,281 inmates were eligible for inclusion in the studies that follow. This cohort was followed up until (a) first release from prison (43.9%; n = 5830); (b) death (0.2%; n = 30); or (c) March 2015 (55.9%; n = 7,421), for a median follow-up of 15.9 months (range 0.03 to 38.4 months). Further details on exclusion criteria for specific analyses are provided in later sections. In this section, the research setting, data sources and descriptive characteristics for the full sample are provided.

4.1. Research setting

Individuals who receive a prison sentence of two years or longer following a criminal conviction are incarcerated in one of the 43 federal prisons managed by CSC. The majority of male inmates are initially admitted to a centralized reception institution in their respective region. Following the intake process, consisting of a range of assessments described in detail below, inmates are placed to their parent institution based on their rated security level, programming needs and other considerations. Owing to the small number of women prisoners, there is one institution for women in each region. Therefore, the intake assessment occurs in the institution

where the woman serves her sentence (unless she is transferred to another region). Two components of the intake process are relevant to the current research: (1) completion of mental health screening and (2) the Offender Intake Interview (OIA).

The initial introduction of computerized mental health screening in Canadian prisons was done in tandem with investments in dedicated teams of mental health professionals at intake institutions to offer follow-up for those who were referred following the screening stage, and with the introduction of additional primary mental health care resources in all prisons. In addition to these primary care teams, each of the five regions of CSC has a treatment centre, which is an accredited hospital that offers intensive mental health services for acute and chronic mental health conditions that require hospitalization. In between these treatment levels, intermediate mental health care units were implemented in 2015 to provide more intensive mental health services (i.e. 12 or 24 hour nursing coverage) for inmates whose mental health needs are more severe than what can be met through primary mental health care services, but are not so severe as to require hospitalization. While the overall mental health strategy has many parallels with other correctional jurisdictions, mental health screening within CSC is unique in three major ways: (1) it is computer administered; (2) it consists of multiple standardized measures, and is consequently substantially longer to complete; (3) it does not result in a dichotomous referral decision in its current form.

Mental health screening in CSC is done using a series of validated self-administered tests. CSC policy indicates that all inmates beginning a new sentence should be offered the screening within 14 days of admission. The inmate completes the series of tests on a computer, and a psychological testing assistant is present to assist with any issues using the system. Results are then reviewed by a mental health professional to determine what if any follow-up services will

be provided. The tests within the system, and the referral rules were updated following initial work to validate the screening. Two tests have been consistent in the screening battery since it was first implemented beginning in 2009 (measures are described in detail in Section 4.1.1): the Brief Symptom Inventory (BSI)[208] and the Depression Hopelessness Suicide Screening Form (DHS)[243]. Beginning in late 2012 a phased roll-out of a revision to the screening system began. At this time, the Paulhus Deception Scales were removed from the screening and two new standardized measures were added: the General Ability Measure for Adults (GAMA)[244] and the Adult Self-Report Screening Scale for Attention-Deficit Hyperactivity Disorder (ASRS)[245]. A series of nine mental health history questions were also added at this time. Three of these items are historical in nature: whether the inmate has ever been assessed for a mental illness, whether they have a history of self-injury, and whether they have been hospitalized for psychiatric reasons. The remaining six items capture both past and current information regarding psychiatric diagnosis, medication use and receipt of treatment for mental health needs in the months prior to arrest.

As originally implemented, an inmate was referred if they exceeded the cut-offs on either the BSI or the DHS. In total, there were 41 combinations of sub-scale and/or total scores (37 on the BSI and 4 on the DHS) that would lead to a referral. Consequently, the majority of inmates completing screening were referred for follow-up assessments[240]. In an initial validation of the computerized screening system, the sensitivity to detect inmates with mental health needs (as determined through a clinical assessment by a mental health professional who was not blind to screening results) was similar to that of the more promising brief screening tools at 76%, with a specificity of 65%[246]. A new scoring model was subsequently created (using this same dataset)[240], and implemented by CSC to better integrate the results of the multiple tests. This

scoring algorithm was developed using the Iterative Classification Tree methodology, which uses two cut-points – one to define low risk or low need and another to define high risk or low need individuals[247]. Groups for which the likelihood of requiring mental health service falls in between these two cut-off points are considered unclassified. Unclassified groups may best be thought of as moderate risk groups, given that approximately half of the inmates who were unclassified were clinically assessed as requiring further services[240]. Inmates who are flagged are offered follow-up assessment to determine the need for intervention. Furthermore, inmates who are screened out but for whom there are concerns noted by the mental health professional reviewing the results may also be referred for follow-up. As a matter of policy, CSC requires that a clinician conduct a minimum of a file review (although they may proceed directly to an assessment) for inmates in the unclassified group. At the outset of this study, the model had yet to be validated on a replication sample with a blinded outcome assessment, nor had it been evaluated in a setting where clinicians had to review unclassified cases and exercise judgment regarding these borderline cases. Therefore, the actual performance of the new model was unknown. Nonetheless, as 88% of all clinically-defined cases were either flagged (56%) or unclassified (32%), and 69% of non-cases were screened out (and only 5% were flagged), the potential for this new model to improve decision making was promising[240].

CSC's mental health screening is a routine part of the intake process. In fact, there are multiple intake screenings conducted, as inmates are seen by a nurse to assess their health care needs within 2 days (for a brief assessment to identify urgent needs) and within 14 days (for a more comprehensive health assessment[†]). Furthermore, a correctional officer assesses each inmate for risk of self-harm during the first 48 hours, and after every transfer to a new institution.

[†] This 14 day assessment was recently eliminated as the items were highly redundant with the questions asked in the computerized mental health screen, and it was administered within a similar timeframe.

Recent research[248] comparing the computerized screening and the two nursing assessments found that 56% of all files reviewed were screened out at all three stages. However, only 5% were identified by all 3 processes; 26% were identified by computerized screening but were screened out by at least one of the two nursing assessments, and 13% of inmates were identified by either or both of the nursing assessments but not by the computerized screening. It is unclear at this point what impact screening is having on inmates' access to mental health services. Furthermore, no research has examined whether the services received following screening have improved outcomes during incarceration.

4.1.1. Mental health screening tests. The BSI is a 53 item self-administered measure of distress. The respondent indicates the frequency at which they have experienced each of 53 symptoms of distress in the past 7 days on a scale from 0 (never) to 4 (always). Three overall distress scores and nine subscale scores are calculated by taking the average of the items relevant to that scale. The nine subscales are somatisation, obsessive-compulsive, interpersonal-sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Three overall distress scores reflect the overall rate of distress (the Global Severity Index), the number of symptoms endorsed (the Positive Symptom Total) and the intensity of endorsed symptoms (the Positive Symptom Distress Index). Among its desirable properties, the BSI has been shown to be highly predictive of cases of mental illness in a range of settings[208], including in discriminating between pre-trial inmates with and without psychotic disorders[249]. Nonetheless, there have been inconsistent findings regarding the factor structure of the BSI. While the tool generates nine subscale scores, only four - hostility, depression, anxiety and somatization have been consistently reproduced[250]. In a women's jail, Warren and colleagues reported that a single factor structure fit the data best[34], as the sub-scales were all highly correlated with one another

and with the Global Severity Index. In previous work with both men and women at intake to CSC[201], we observed similarly high correlations (i.e. *r*'s of .55 to .82 between the combinations of the 9 sub-scales and all sub-scales correlated at .74 or higher with the Global Severity Index), and therefore analyzed only Global Severity Index scores.

The DHS was developed and validated in Canadian prisons to address challenges implementing common depression screening tools with inmates (e.g. avoiding the use of terms such as guilt which have both legal and psychological meanings[251]). The scale comprises 39 true-false items, which produce subscale scores for depression and hopelessness and a total score. The DHS has high concurrent validity with the Beck Depression Inventory, the Beck Hopelessness Scale, and the Beck Scale for Suicide Ideation, and diagnoses of major depression[251,252] among prisoners. The DHS includes ten "critical items" that inquire about current suicide ideation, thoughts supportive of suicide, and historical suicide indicators. Two additional critical items inquire about a past diagnosis of depression and whether the inmate knows someone who has completed suicide. However, slightly more than half of all inmates endorsed one of these twelve critical items, and few offered incremental predictive validity in the prediction of incidents of self-injury or suicide attempts during the first 180 days following intake to prison[164]. Using a subset of five items reflecting more recent or frequent histories of self-harm and current suicide ideation, the referral rate would decrease to 17.7% of inmates endorsing at least one item. The sensitivity of 84.2% and specificity of 82.6% in this statistically selected model were comparable to or better than other screening tools for risk of suicide or self-injury.

The GAMA is a 66-item test consisting of entirely nonverbal content to minimize the effects of knowledge, verbal expression, and verbal communication and make the test more accessible across linguistic, cultural and educational backgrounds[244]. The test includes four item

types – matching, analogies, sequences and construction - and provides an age standardized estimate of IQ. A small pilot project conducted by CSC found high concordance between the GAMA and the Wechsler Adult Intelligence Scale (WAIS), with a correlation between the measures of 0.72[253] among a sample of male inmates.

The ASRS was developed by the World Health Organization (WHO) during the revision of the WHO Composite International Diagnostic Interview (CIDI). This symptom checklist consists of the 18 DSM-IV-TR criteria. The authors recommend using only the first six items for scoring the screener, as they outperformed the full scale in the prediction of ADHD in a community sample, with a total classification accuracy of 98%[245].

4.1.2. The Offender Intake Assessment. The OIA includes 100 yes/no indicator questions typically asked by a parole officer. These indicators are listed in a CSC research report along with the help messages provided to staff to structure the assessment process[254]. The items are grouped into seven domains (i.e. employment, marital/family, criminal associates, community functioning, substance abuse, personal/emotional and criminal attitudes), that are rated on a no-, low-, moderate-, or high-need scale (for domains such as employment there is also an asset rating). Specific to this study, we considered the domain ratings as confounders of associations between mental health and violent or self-harm incidents (Chapter 9) and as moderators of screening accuracy (Chapter 10).

4.1.3. Administrative data. In addition to information from the intake process, official prison record data were collected from two electronic systems: the Offender Management System and the Mental Health Tracking System. Data regarding institutional incidents of violence and self-harm, as well as sentence administration information (e.g. intake and release dates for calculating person time at risk) were extracted from the Offender Management System,

which is the primary record used by all prison staff. Categorization of incident codes is shown in Table 2. Previous work has shown high reliability in the coding of violent (kappa = 0.84)[201] and self-harm incidents (complete agreement)[164] based on file reviews.

Table 2. Categorization of incident codes.

Incident category	Included codes from Offender Management System
Violent	Murder
	Murder – inmate
	Murder - staff
	Hostage taking
	Hostage taking with sex assault
	Inmate fight
	Assault on inmate
	Assault on staff
	Assault on visitor
	Forcible confinement
	Forcible confinement with sex assault
	Sexual assault
Suicide attempts	Attempted suicide
Self-harm	Self inflicted injuries
Overdose	Overdose interrupted
Mortality	Suicide
	Death – natural cause
	Death – overdose
	Death – unknown causes
	Death – other

The Mental Health Tracking System is used exclusively by mental health professionals, for data reporting purposes on the number of referrals and mental health services provided to offenders. Initially, this system was implemented as a Microsoft Excel spreadsheet which staff used to enter each contact with an offender, including up to three service types that were provided as well as the outcome of the contact. In April 2012, staff transitioned to a web-based version of the tracking system, which captured similar information in a more user-friendly manner. Specifically, identifying information was imported directly to the system from the Offender Management System to reduce data entry errors, and services were entered using checkboxes instead of dropdown lists, which allowed staff to enter more than three service types.

Finally, staff no longer had to enter referral dates for each contact, instead entering each contact by first pulling up the referral. Data validation rules built into the system meant that there was no missing data, and that obvious data entry errors (e.g. a date that came after the date on which a contact was entered in the system) would be identified and corrected. Options for service types were highly similar between the two versions of the systems, and for the purpose of this study they were collapsed into the categories shown in Table 3.

Table 3. Categories of mental health services

Category	Codes (Excel)	Codes (Web)
MH assessment	Assessment: General mental health Assessment: Specialized mental health Follow-up for screening Psychiatric clinic Assessment: Neuropsychological Assessment: Transfer to treatment centre MH intake assessment: brief	Assessment: General mental health Assessment: Specialized mental health Assessment: Screening follow-up
MH Counseling	Counseling: Individual Counseling: Group Skills training	Counseling: Individual Counseling: Group Skills training Activities of daily living
Medication	Medication assessment or review	Psychiatric clinic Medication assessment or monitoring
Crisis intervention	Crisis intervention: suicide or Self-injury Assessment: suicide or self-injury Crisis intervention	Suicide or self-injury intervention Assessment: suicide or self-injury Crisis intervention (Not suicide or self-injury)
Reintegration	(Clinical) discharge planning Integration planning Accompaniment support	Accompaniment support Assessment: Discharge / Reintegration Referral forms/applications

4.2. Diagnosis of mental illness

For a random sample of male participants (n = 1072), a diagnostic interview was conducted by a trained research assistant who was not part of the institutional staff. A customized research version of the SCID for Axis I disorders was administered to assess for

current (within the last month) and lifetime psychotic disorders, mood disorders (i.e. major depression, bipolar disorder) and anxiety disorders (e.g. Post traumatic stress disorder [PTSD], generalized anxiety disorder, obsessive compulsive disorder, panic disorder and phobias) and substance abuse disorders. In addition, the borderline and antisocial personality disorder modules of the SCID-II were administered. The SCID is generally viewed as the gold standard for mental health diagnostic assessment in North America. As it has been used in past prevalence studies in Canadian prisons[1] and in most of the recent validation studies of mental health screening tools[147,255–258], the use of the SCID ensures comparability between our findings and past research. Previous studies have reported that the SCID has good inter-rater reliability (kappa values from .77 to .94 for PTSD, major mood and psychotic disorders), and test- retest reliability (kappa over a 7-10 day interval from .61 to 1.0)[259]. Prior to conducting interviews, all research assistants completed the SCID self-directed training using 8 DVDs available from the authors. This training also includes coding two videotaped interviews; the research coordinator reviewed all coding with the research assistants, and participated in an additional mock interview with each research assistant. Ongoing inter-rater reliability of interviews with the offenders participating in the study was not done.

4.3. Study sample

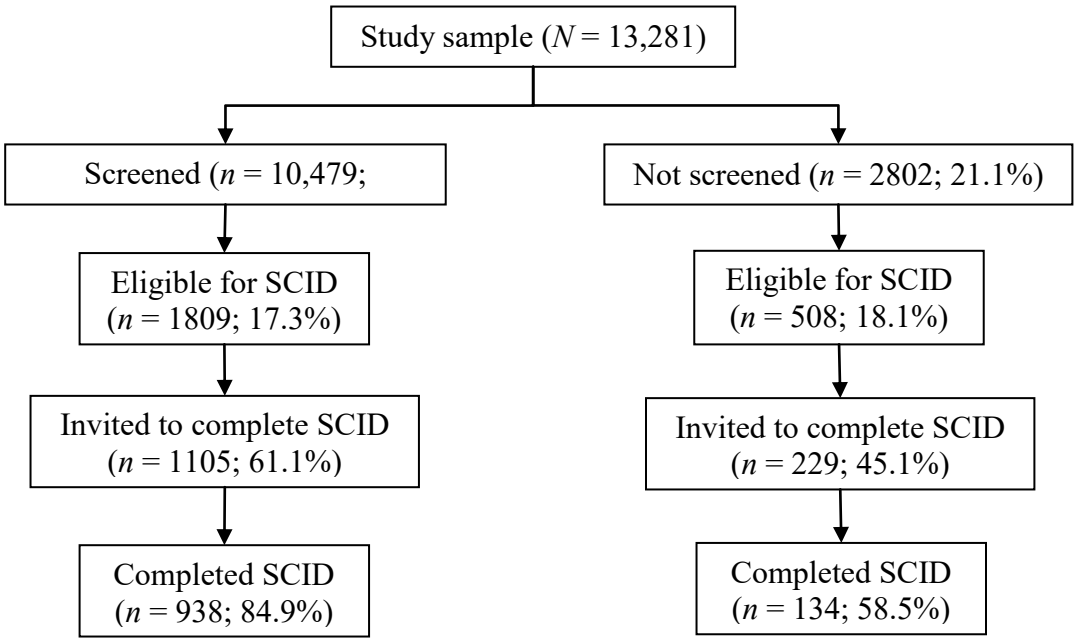
Figure 3 presents a flow-chart of eligible participants and completion rates for the various assessments. As seen in the figure, 10,479 (79.9%) of inmates completed mental health screening. Of the 10,479 who completed screening, 6726 (64.2%) completed the new version of screening, and 3753 (35.8%) completed the original version. A subset of inmates were eligible to participate in a diagnostic interview as part of a prevalence study that was conducted by CSC's

research branch[10,260] over the 33 months from which the current sample was drawn[‡]. The timing of this study was staggered across the 5 regions of CSC, as it was completed one region at a time. In total, 2137 inmates were admitted to CSC during the time period for which the prevalence study was being conducted in their respective regions (and thus were eligible to participate). Unsurprisingly, inmates were more likely to agree to complete the SCID if they completed screening than if they did not. Specifically, 84.9% of those who completed screening and were approached to complete the SCID agreed to participate, compared to 58.5% of those who did not complete screening. While missing data is often treated as a source of bias, in most analyses reported in this work, those who did not complete screening were considered as a separate group[§]. Statistical considerations (i.e. sufficient numbers of not screened inmates to compare differences between groups), prior evidence (i.e. not completing screening has been shown to be strongly predictive of risk[164]), and clinical or policy considerations (i.e. staff do not impute missing values, but rather incorporate this information into their decision making) were all taken into account in this decision to analyze the not screened individuals as a distinct group. Attempting to estimate bias associated with non-participation would have been an academic exercise with limited real world application; inmates have a right to refuse screening, and there are important reasons why an inmate would not be screened. Inmates who were not screened in this study are a distinct group, and there would likely be interest in generalizing their outcomes to inmates who are not screened in other samples.

[‡] The eligibility dates chosen for this study were intended to account for any potential cohort effects in terms of changes in availability of mental health services, or in population characteristics. It was anticipated that sensitivity and specificity of screening should not be affected by any such changes, but that impacts of screening on service use and outcomes could have changed over time had the analyses been restricted only to those with a completed diagnostic interview.

[§] The exception to this was that we did not investigate diagnoses among those who refused screening, since the use of the SCID in the current research was primarily to serve as a gold standard against which to validate screening tests. Furthermore, given the very low participation rate, it was likely that there would be strong participation biases that could not be measured, and the relatively small sample size would have yielded imprecise prevalence estimates for those who did have data

Figure 3. Participation rates in mental health screening and the diagnostic interview.



4.4. Descriptive statistics

In this section, descriptive statistics about the sample are provided, including their demographic characteristics, mental health and criminal justice histories. Substantive results corresponding to each of the research questions are provided in the articles beginning in chapter 6.

4.4.1 Demographic characteristics. The sample for this study consisted of 12,473 male (93.9%) and 808 (6.1%) female offenders. The average age was 35.5 (SD = 12.2), with a range from 18 to 85. Based on standardized self-report ethnic-racial groups used by Canadian federal government departments[261], the majority (*n* = 7674; 57.8%) of participants self-reported their race to be 'White'. Aboriginal ethnicity was reported by 3056 (23.0%) inmates [divided further as 2067 (15.6%) First Nations, 841 (6.3%) Métis and 148 (1.1%) Inuit]. A further 1280 (9.6%) reported 'Black', ‘Sub-Saharan African’ or ‘Caribbean’ ethnicity, and the remaining 1271 (9.6%) were distributed sparingly across numerous other categories of Asian, European and Latin origins. The 204 excluded participants (due primarily to releases on bail as discussed at the

beginning of Chapter 4, with 4 additional cases due to issues with incorrect dates) were slightly older (average age of 36.7), and with a slightly higher proportions of Black (11.7%) and other ethnicities (15.2%), with lower proportions of Aboriginal (16.7%) inmates. Women were also slightly more likely to be excluded from the study (7.1% of those excluded were women). While these differences may be of interest in terms of understanding characteristics of these inmates who have releases on bail, it is unlikely that their exclusion significantly biases the results given that they represent such a small proportion (1.5%) of the total population.

4.4.2. Mental health and criminal justice histories. Participants self-reported significant mental health and criminal justice histories as seen in Tables 4 and 5. Self-reported mental health history data was only available for those completing the new version of screening (n = 6726). As seen in the table, 25.1% reported a mental health diagnosis or taking a psychotropic medication at intake to CSC or having been hospitalized for a mental illness in the month prior to their current incarceration. Lifetime rates for these indicators were slightly higher, with 33.8% reporting lifetime diagnosis or treatment for a mental illness. The majority of participants had at least one prior court appearance (i.e. only 1831 [15.7% of those with data] had neither youth nor adult court appearances), of whom 44.4% had at least an appearance in youth court, and 80.1% had at least an appearance in adult court. These estimates are over-estimates of the proportions of inmates with criminal histories, as low risk inmates are eligible for a compressed version of the Offender Intake Assessment that does not include responses to the indicators used to obtain this information about criminal histories. Even if it were assumed that all of the 1619 participants with missing data on either or both of these indicators did not have a criminal history, this would increase the percentage of those without prior justice system involvement to 26%.

Table 4. Self-reported mental health diagnoses or treatment

	Current		
Lifetime	No	Yes	Total
No	4386	64	4450 (66.2%)
Yes	651	1625	2276 (33.8%)
Total	5037 (74.9%)	1689 (25.1%)	

Table 5. Prior youth and adult court criminal offences.

	Adult		
Youth	No	Yes	Total
No	1831	4654	6485 (55.6%)
Yes	484	4693	5177 (44.4%)
Total	2315 (19.9%)	9437 (80.1%)	

Chapter 5: Systematic review of screening tools in jails and prisons

Chapter summary. The first component of the proposed model (presented in Figure 1 in the introduction) for screening to have an impact is that screening is an effective intervention to increase detection of mental illness. This chapter reports a systematic review of the accuracy of screening tools that have been validated in a correctional setting. During the first year of my doctoral work, I published a systematic review of screening tools that have been validated in correctional institutions in *BMC Psychiatry*[262]. The final version of the original review can be obtained (open-access) at the following URL: https://bmcpsychiatry.biomedcentral.com/articles/10.1186/1471-244X-13-275

Contribution statement: Study retrieval and coding began following my acceptance in the doctoral program (but prior to beginning the program); study quality coding, data analysis, and report writing all took place while I was in the program. This work was done with my co-authors Drs. Colman, McKenzie and Simpson. I developed the research question and coding guide, coded all studies, performed the search and did initial title and abstract screening, analyzed the data and drafted the manuscript. My co-authors provided critical revisions to the study design and coding tool, coded one-third of included studies, and reviewed and approved the final manuscript as originally published. I subsequently updated the published review, including studies published since the earlier publication. In this chapter, I present an updated version of the systematic review, excluding some of the additional background from the original publication that is provided in the introductory chapters.

Once the decision is made to pursue screening to increase detection of mental illness, it is necessary to identify an appropriate test (or series of tests). Operationalizing what constitutes an appropriate test has proven more challenging than might be expected. Brooker et al[1] remarked that while screening tools have improved the identification of individuals with mental illness, they tend to screen in a large number of offenders without mental health needs (i.e., false positives). If false positive rates are too high, this may lead to an inefficient use of scarce mental health resources[2–4]. This may result in large numbers of offenders without mental health needs receiving mental health assessments, possibly delaying treatment for those of highest need. Tensions between accurately identifying needs versus provision of treatment are intensified in jails where there is less time to provide treatment than in prisons where inmates are serving long sentences.

Possible standards that administrators could attempt to achieve include: 1) maximizing detection of mental illness regardless of false positive rates; 2) maximizing detection of mental illness while maintaining the false positive rate below a threshold; 3) minimizing the number of false positives while maintaining the false negative rate below a threshold; 4) maximizing the overall accuracy with no priority given to either type of error. Major issues in choosing a standard are determining the most important mental health conditions to detect and what referral rate can be managed with local resources. In screening for rare but severe disorder (e.g. psychosis or suicidal ideation), a two-stage screening process might be appropriate. It may be tolerable to have a high false positive rate in the first stage, followed by secondary level triage to identify those in greatest need of service[5,6]. In community settings, this has been challenging, with lower needs individuals using disproportionately high levels of services[7,8]. To mitigate this potential concern, adding a minimal standard for specificity might be desirable.

Where resources are more limited, efficiency may be the primary consideration. Jurisdictions with long waitlists for treatment and/or short periods of time to offer treatment may be overburdened by a screening tool which refers many inmates who do not require services. In this case, a tool with high specificity and adequate sensitivity might be preferable. Alternatively, a tool with high overall accuracy might be an option. However, if the prevalence of disorder is very low, overall accuracy might be high, even if the tool identifies very few individuals with mental illness. For example, the Kessler-6 (K6), which has been widely adopted in community settings, had an overall correct classification rate of 92% at the optimal cut-off of 13. However, at this cut-off, the sensitivity was only 36%[9].

Methods

Since conducting an initial search in February 2012 of the *Medline* and *PsycINFO* databases[**], I have maintained daily e-mail updates in an effort to identify all studies published in English or French on mental health screening in correctional settings. Studies were reviewed against four inclusion and two exclusion criteria. Inclusion criteria included: (1) the sample consisted of people 18 years of age or older who were incarcerated following a charge or conviction for a criminal offence; (2) the paper examined a systematic screening process to detect potential mental illness; (3) the criterion measure was either a validated diagnostic tool or direct clinician assessment; and (4) sufficient data were available to calculate relevant statistics

[**] The search was conducted using the title and abstract fields, searching for terms that captured the activity of interest (i.e. screen*, assess*, identify* or triage), its focus (i.e. mental health, psychiatric, or mental disorder) and the setting (i.e. jail, prison*, offender). Terms within the three categories were joined using the OR operand and the three categories were joined using the AND operand. Searches using controlled vocabulary (i.e. MeSH terms) were judged ineffective based on very few screening studies being appropriately categorized. While the STARD guidelines recommend the use of sensitivity and specificity as a MeSH term, only 15 of the 24 studies originally identified using title and abstract searching were returned when using MeSH terms in a later search, and no new studies that met the inclusion criteria were identified. Subsequent systematic reviews by the National Institute for Care and Excellence in developing their clinical guideline for mental health justice involved populations[62] and by a group developing a new screening tool[23] identified a smaller range of tools, providing further support for the effectiveness of this search strategy.

to assess tool performance (i.e. sensitivity, specificity, negative/positive predictive value [NPV/PPV]). Exclusion criteria were: (1) screening for cognitive functioning, intellectual disability, substance abuse, personality disorder, suicide risk, or malingering of psychiatric symptoms; (2) screening in a forensic hospital setting in the context of a pre-trial assessment (e.g. competency to stand trial or criminal responsibility).

The original search identified 781 from PsycInfo and 404 from Medline. There were 946 unique results from this initial search after excluding 239 results returned from both databases. Following a review of titles and abstracts to exclude articles that obviously did not meet the research question, 107 articles remained for a complete review. Nine additional studies were identified from a review of the reference lists of these 107 articles, including one unpublished manuscript that was retrieved through a Google search[10]. One author was contacted to obtain the government report[11] containing the primary analyses that were subsequently presented in a peer reviewed manuscript[12]. Twenty-five additional studies[4,6,13–35] were identified through daily e-mail updates.

Given that this review was of a descriptive nature, we erred towards being over-inclusive when reviewing papers against the criteria. Twenty-nine articles met all inclusion and exclusion criteria and were included in the review (see Figure 1 for a flow-through of articles retrieved as part of this review). Four additional studies[4,11,36,37] had overlapping samples with included studies. These were used to extract additional information regarding the methods or to retrieve data from sub-group analyses. One study[38] reported independent samples to construct and validate the Referral Decision Scale (RDS); each of which was coded as a separate study (which we refer to as the construction and the validation samples).

Data was extracted using a tool developed in Microsoft Excel, which collected the information listed in Table 1. I coded all studies included in the review. The three co-authors of the original review each coded one-third of the studies retrieved following the original search.

Twenty-eight different screening tools had been validated for use in a correctional population - twenty-two from the original review and six from the updated search. Only six had replication studies confirming their performance in an independent sample [the Brief Jail Mental Health Screen (BJMHS)[3,5,39,40], the Correctional Mental Health Screen for Men (CMHS-M)[41,42], the Correctional Mental Health Screen for Women (CMHS-W)[41,42], the England Mental Health Screen (EMHS)[5,10,43], the Jail Screening Assessment Tool (JSAT)[11,12,40,44], and the Referral Decision Scales (RDS)[2,38,45–47].

Results

Study characteristics

The majority (*n* = 13; 54%) of the original research was conducted in the United States, and almost exclusively in jail settings (*n* = 18; 75%). The newly identified work was more diverse in terms of countries in which studies were conducted, including two from each of Australia (including one focused exclusively on Aboriginal offenders) and Canada, and one from each of Chile, the UK and the USA.

Using the QUADAS-2[48] tool to judge study quality, only one study[5]was rated as having both a low risk of bias and low concerns regarding applicability. Nine additional studies had low concerns regarding applicability, but had at least some concerns regarding potential bias. The remaining twenty studies had concerns of potential bias and applicability to the review topic. Study quality was generally improved in many of the newly identified studies with the exception that most continued to lack pre-specified cut-off scores[16–19,25]. QUADAS-2 ratings of all studies

included in this review -from both the original publication, and the updated search are presented in Table 2.

Common concerns with patient selection included sampling from populations with high rates of mental illness such as health care units and substance abuse programs[49–51], convenience sampling[19,47,52] and high refusal and/or drop-out rates[3,11,12,39,44,45]. In a number of studies[38,41,49] index tests were developed by statistically choosing a subset of items that performed best from a larger test battery, and in other studies[29,30], the index test was embedded within the diagnostic assessment (although two of the three tools - the CMHS and the RDS - had subsequent replication studies[2,42,45–47]). Three studies[41,42,53] received high risk of bias ratings for the administration of the index test due to not having a pre-specified threshold score, which may result in an over-estimation of test performance due to over-fitting[48]. A number of studies relied on chart information as a reference standard[46,50,54], which may result in misclassification. Flow and timing issues were due to the administration of the reference test predominantly[3,39,40], or exclusively[43,55] to those who screened positive, without weighting or other statistical adjustment as was done in two studies[2,5]. In other studies, the timing between the screening test and reference standard was lengthy (e.g. up to one month)[49], or the reference standard may have been known prior to screening[50,51].

Performance of screening tools

In this section, I summarize the performance of tools that have replication studies and appear most promising for use (all extracted data are provided in the Supplementary File S1). Second, I discuss some of the more promising tools that do not have replication studies, with the caveat that overly optimistic estimates of performance may be likely, especially for tools for which the cut-off scores were not established in advance[48]. Tools are ordered alphabetically, and

thus do not represent recommendations to favour any tool over the others given the limited body of evidence from which to base any recommendation.

Brief Jail Mental Health Screen. The BJMHS generally had a sensitivity of approximately 60 to 65%[3,39,40]. As exceptions to this, its sensitivity was only 34% [95% CI 34, 38%] in a New Zealand study[5], and in one study[3] the sensitivity for women was 46% [95% CI 34, 58%]. In one study where the standard cut-offs were not used[41], the sensitivity of the BJMHS was considerably higher, ranging from 82-95% depending on the breadth of disorders included in the case definition, and the choice of cut-off. At these lower cut-off scores that achieved higher sensitivity, there was a significant drop in the specificity of the BJMHS (ranging from 30 to 60%, whereas most studies using the usual cut-off scores had a specificity in the range from 70-85%[3,5,39]). In most studies, the overall accuracy was in the range of 65-75%. As the exception to this, the use of lower cut-offs with men, resulted in slightly lower overall accuracy (i.e. 58%)[41]. Given comparable overall accuracy, the less stringent cut-offs for the BJMHS that were statistically selected by Ford and colleagues[41] may warrant further consideration as they had similar overall accuracy, but with fewer missed cases of mental illness.

Correctional Mental Health Screen for Men. At its recommended cut-off of 6 or more items, the CMHS for men (CMHS-M) had a sensitivity of 74% [95% CI 65, 82%] in the development study[41] and 70% [95% CI 56, 81%] in the replication study[42] for the detection of an Axis I or II disorder, with specificity of 75% [95% CI 66, 82%] and 83% [95% CI 71, 90%] respectively. Lowering this cut-off to 4 or 5 might be considered by those prioritizing detection of mental illness regardless of the false positive rates, as these cut-offs achieved sensitivity of 80% [95% CI 67, 89%] and 89%, [95% CI 77, 95%] respectively in the validation study sample.

The decrease to a cut-off of 5 may be particularly appealing as the overall accuracy was slightly higher (79% versus 77% at a cut-off of 6), with a specificity of 78% [95% CI 66, 87][42].

Correctional Mental Health Screen for Women. At its recommended cut-off of 5 or more items, the CMHS for women (CMHS-W) had a sensitivity of 65% [95% CI 52, 76%], in the development study[41] and 64% [95% CI 51, 75%], in the replication study[42] for the detection of an Axis I or II disorder. Specificity at this cut-off was 85% [95% CI 70, 93%] in the development and 92% [95% CI 79, 97%] in the development and replication studies respectively. Lowering this cut-off to 3 might be considered by those prioritizing detection of mental illness regardless of the false positive rates, as this cut-off achieved a sensitivity of 85% [95% CI 74, 92%], in the validation study sample. However, this lowered cut-off results in a sharp increase in the false positive rate, with a specificity of 49% [95% CI 34, 64%]. A cut-off of 4 achieved a better balance of sensitivity (74% [95% CI 62, 83%]) and specificity (72% [95% CI 56, 84%]), with a similar overall accuracy (73%) to the recommended cut-off score (75%).

England Mental Health Screen. The EMHS achieved perfect sensitivity in a small pilot study for men over the age of 21 and for women, although the sensitivity was only 50% for the small subsample of 18-21 year old males[10]. In a study[56] using a highly similar four-item tool, a sensitivity of 76% [95% CI 67, 83%] was reported. In a replication study in New Zealand[5], however, the sensitivity of the EMHS was only 42% [95% CI 38, 56%]. Reflecting variable specificity values ranging from 68% among females to 88% among young males, overall accuracy for the EMHS was highly variable. For all sub-samples in the pilot study it was 80 % or 90%, whereas the two larger studies reported an overall accuracy was 60%[5] and 74%[56].

Jail Screening Assessment Tool. Performance of the JSAT was somewhat more variable across studies, which may reflect the use of structured professional judgement to make referral

decisions. In the development study[11,12], the JSAT achieved a sensitivity of 84% [95% CI 65, 94%] among men, with a specificity of 67% [95% CI 54, 74%]. On replication among a small sample of women[44], the tool performed comparably, with a slight decrease in sensitivity (75% [95% CI 47, 91%]) and a slight gain in specificity (71% [95% CI 47, 87%]). However, in a subsequent replication with male offenders[40] the JSAT sensitivity ranged from 38 to 50% depending on the breadth of disorders included in the case definition. A structured scoring model was proposed in this study, which would have achieved a sensitivity ranging from 67 to 72% depending on the breadth of disorders included in the case definition, with specificity between 65 and 69%.

Referral Decision Scale. As the oldest of the screening tools considered in the review, the RDS has the most extensive body of research. However, the BJMHS was developed to address limitations of the RDS, most notably concerns with the naming of the subscales corresponding with specific diagnostic categories. Veysey and colleagues noted that the RDS lacked specificity to distinguish the three categories of diagnoses (psychotic, bipolar, and major depressive disorders), and cautioned against the use of the tool due to the potential for results to be misinterpreted and lead to diagnostic errors[51]. In the majority of studies with the general offender population[41,46,47], the RDS had high sensitivity, with low specificity. However, the tool's authors[38] and one other study[45] reported strong sensitivity (70% or above) and specificity (80% or above).

Tools without replication studies. Of the tools with single studies, few appeared to perform sufficiently well to justify their implementation. The K6, BSI/SCL-90, and GHQ-28 may warrant further investigation in settings where the six replicated tools do not perform as well as desired given their widespread use in community and other settings[19,53]. The DHS[18] may

also warrant further investigation given that it is designed specifically to take into account contextual differences inherent in the correctional setting and population. It is not clear at this time that any of these tools out-perform the six previously mentioned tools. Using the commonly recommended cut-off score of 13, the K-6 had a low sensitivity for both men (35%) and women (54%)[19], although this is similar to its performance in the general population[9]. Kubiak and colleagues suggested modifying the cut-off to the point that achieved the highest overall accuracy (a cut-off of 6 for both men and women). At this cut-off, the sensitivity improved to 72% for men and 88% for women, with a specificity of 85% for men and 84% for women. At the cut-point with the highest overall accuracy, the GHQ-28 had a sensitivity of 65% [95% CI 54, 75%] and a specificity of 69% [95% CI 60, 77%] in a sample of male pre-trial detainees[53]. When used together, the BSI and DHS had a sensitivity of 76% [95% CI 70, 82%] and specificity of 65% [95% CI 60, 70%][28]. When used alone, the SCL-90 (the longer version of the BSI) performed well in a Chilean prison, with a sensitivity of 78% [95% CI 69, 85%] and specificity of 78%, [95% CI 68, 86%] to detect severe mental illness based on the MINI[16]. This cut-off was statistically selected, but similar sensitivity (72%) and specificity (78%) was reported for a replication in a second sub-sample.

Performance by sex. Two tool developers explored the need for sex-specific screening tools[39,41]. While items related to Post Traumatic Stress Disorder and anxiety were added to the BJMHS in an attempt to improve performance for women, the CMHS male (CMHS-M) version contains four additional items as compared to its female counterpart (CMHS-F). Steadman et al. found that the additional items did not increase performance of the BJMHS, and argued that the original version performed adequately in the second sample of women studied[39]. However, as the sensitivity was only 61%, 95% CI [49, 72%] in this second study, others have argued that the

BJMHS has not been adequately validated for use among women offenders[37]. The CMHS appears to perform slightly better among men than among women. Lowering the cut-off to 3 or 4 might be preferable to achieve acceptable sensitivity for women using the CMHS-W as discussed previously. The JSAT also had a slight decrease in sensitivity (75% [95% CI 47, 91%]) in a small study with women offenders[44] compared to the original research on the tool[11,12], with a similar specificity (71%; 95% CI [47, 87%]). However, there was an even larger decrease in sensitivity (50% for severe mental illness; 95% CI [31, 69%]) upon replication with male offenders, unless a scoring algorithm (sensitivity for severe mental illness = 67%; 95% CI [47, 82%]) was used in place of structured professional judgment[40].

The NYS BST performed well for women in particular in a small study[50], with a sensitivity of 88%, 95% CI [60, 97%] and a specificity of 84%, 95% CI [58, 95%]. While the sensitivity was approximately 20% higher for women than for men (67% [95% CI 21, 94%]), there is a lack of statistical power to determine whether this difference is simply the result of sampling error or a true difference in the performance of the tool. Given that most tools appear to perform worse among women inmates (with the K-6 being one exception), this tool may warrant a more rigorous evaluation in a general offender population as opposed to a health care setting.

The RDS had high sensitivity in two studies with women[41,46], with lower specificity. It should be noted that these two studies used different cut-off scores from the traditional RDS scoring. Earthrowl et al.[46] used a cut-off of 3 on any scale, and Ford et al[41] used a cut-off of any 2 items. In both studies, referral rates exceeded 60%. Of the studies among men using the RDS some found slightly worse performance among men particularly in terms of specificity[2,41,51]. Others[38,45] found stronger performance of the RDS among men, particularly in terms of specificity.

The Co-Occurring Disorders Screening Instrument for Mental Disorder (COSDI-MD) and Co-Occurring Disorders Screening Instrument for Severe Mental Disorder (COSDI-SMD) performed comparably for men and women[36]. Unsurprisingly, the four tools (the Global Appraisal of Individual Needs Short Screener [GSS], Global Appraisal of Individual Needs Short Screener – Internal Disorder Screener [GSS-IDS], Mental Health Screening Form [MHSF], and the Mini-International Neuropsychiatric Interview – Modified [MINI-M]) from which the COSDI items were selected also performed similarly among both men and women. Performance was also similar for men and women on the EMHS[10], in a small sample of 30 women.

Performance by race. Few studies reported performance of tools by race. We have not reproduced the analyses by combination of sex and race presented by Ford and colleagues[57] for space reasons. Ford and colleagues recommended that the CMHS performed comparably across races for both men and women, aside from a suggestion to consider a lower cut-off score to improve the sensitivity of the tool for white women. Nonetheless, in their replication study[42] this recommendation was not pursued. The only other study to compare performance by race[49], found comparable performance of the COSDI-MD and COSDI-SMD among White, Black and Latino offenders. While not a direct test of performance in different racial/ethnic groups, two studies[5,40] failed to replicate the performance of the BJMHS and the EMHS in countries with high rates of Aboriginal inmates (New Zealand and Canada). In New Zealand[5], the BJMHS and EMHS lacked sensitivity (34% [95% CI 30, 38%], but had high specificity (86% [95% CI 83, 88%]), although as discussed below performance differed by disorder. Conversely, in the Canadian study[40], while the sensitivity of the BJMHS was similar to studies in the United States at approximately 65% in all cases, the specificity was considerably lower (i.e. 59% [95% CI 47, 69%] as compared to 76% [95% CI 69, 82%] and 84%, 95% CI [77, 88%] in the original American studies[3,39].

The recent study by Ober and colleagues[25] validating a screening tool that was designed to be culturally appropriate for use with Aboriginal inmates reported performance that was much more in line with the performance of screening tools for the general offender population. For example the IRIS has sensitivity of 82%, 95% CI [69, 90%] for the detection of major depression and 68%, 95% CI [58, 76%] for anxiety disorders, with corresponding specificity values of 59%, 95% CI [53, 64%] and 60%, 95% CI [54, 66%] respectively.

Performance by Disorder. Few studies compared the performance of tools to detect various disorders. Evans et al[5] reported that the majority of false negatives using the EMHS and BJMHS were depressive disorders, whereas the tools missed very few cases of psychosis. Ober[25] and colleagues found higher detection of major depression (82%) than anxiety disorders (68%). The CMHS-M and CMHS-W[42], JSAT[40], and K6[19] performed comparably across a range of diagnostic categories. The COSDI-SMD generally performed poorly, although it was more sensitive to severe mental illness (ranging from 50 to 59%) than to any axis I or II disorder (ranging from 36 to 41%)[49].

Performance by Correctional Facility. Only five studies included prison populations (one of which was restricted to those in health care units[50]). The COSDI-MD, COSDI-SMD (and the tools from which these items were drawn – the MHSF, MINI-M and GSS), the MCMI-III, the NYS BST and the RDS are the only tools to be tested in a prison setting. Of these tools, only the RDS has been tested in both jail and prison settings. While the RDS had a relatively high sensitivity (79% [95% CI 70, 86%]) and specificity (99% [95% CI 98, 99%]) in a prison setting[38] as compared to other studies of the RDS, this study was the original cross-validation by the developers, which relied on a secondary data set. Replications in jail settings have had variable

results, creating challenges determining whether there are differences in performance across settings for the RDS.

Discussion

This review identified that a large number of screening tools have been considered for use in jails and prisons, however, few have been well studied. Thus, recommendations that can be made about screening are limited on the basis of the existing evidence. Nonetheless, a number of factors arose from this review that may be relevant to consider in further evaluations of the performance of screening in correctional settings.

Contextual Factors

Our review identified important contextual considerations for those selecting a tool. For example, both the BJMHS and the EMHS performed well in initial studies. However, in validation studies in Canada[40] and New Zealand[5] their performance decreased considerably, in particular in the detection of major depression[5]. Gagnon[40] and Evans et al[5] suggested that differences between countries in access to health care might influence referral rates on tools such as the BJMHS and EMHS which include past psychiatric treatment items. Furthermore, both countries have relatively large Indigenous populations who have relatively less utilisation of mental health services in the community[58]. As both the BJMHS and EMHS include items regarding mental health treatment history, poorer performance in ethnically diverse populations may reflect their lack of access to health care in the community[58], or cultural differences in interpreting the meaning of constructs and tools to measure them[59]. A recent study[60] found lower referral rates among Black and Latino inmates screened with the BJMHS. Black and Latino inmates had less prior service utilization, items which result in automatic referral. The EMHS relies entirely on historical variables, whereas the BJMHS, the CMHS and the JSAT all include

items regarding history and current symptoms. Thus the EMHS may be less sensitive to mental illness among inmates who have not previously accessed psychiatric treatment, similar to the previous findings of Teplin[61]. In her seminal work in a pre-trial jail, she found that while overall only 32.5% of inmates who were currently ill were provided with treatment within one week of admission, 91.7% of those with a known history were provided treatment.

Staff characteristics

Staff characteristics, skills, and training also appear to be important factors. Steadman et al[3,39] found higher referral rates when screening was completed by a female as compared to a male staff member. They also found that many false negative cases were inmates who disclosed more information to health care professionals than they did to correctional officers. Steadman et al[39] noted that correctional officers felt a need for training on establishing trust and eliciting information, and that they noted challenges asking questions related to current symptoms. These findings are the only evidence that addresses questions raised by Hart and colleagues whether screening tools would perform as well when administered by correctional officers rather than trained clinical research assistants[2]. They noted that inmates may refuse to disclose information to correctional officers if they fail to build rapport and engage inmates in the process, which could in turn increase the false negative rates. In addition, they suggest that changing roles between a security role and a "service-delivery" role was highlighted as a challenge by some correctional officers, and that this tension might create challenges in responding to major security incidents.

Inmate characteristics

While there was little data available regarding sub-groups of inmates for whom screening is more or less effective, this is an area where future focus is warranted. There is a dearth of

evidence investigating the need for sex, culture or race-specific screening tools. The limited evidence that does exist suggests that current tools do not perform as well for women or individuals of minority racial or cultural groups.

In terms of inmates' clinical presentation, it is possible that common disorders such as depression and anxiety are over-diagnosed due to the failure of diagnostic systems to adequately account for symptoms that are normal responses to the prison context. If individuals who are 'false negatives' are predominantly those whose symptoms naturally remit over time (or with less intensive and potentially non-clinical services), this would be more acceptable than if those missed by screening experienced significant impairments in their functioning that could have been mitigated or reduced with earlier and more intensive interventions.

Limitations and Future Directions

This review identified a number of screening tools in the literature. This review is limited by the lack of replication studies of otherwise well designed tools; a finding which did not change when extending the search by nearly five years (i.e. to include publications from 2012-2016) from the original publication. There have been considerable reductions in performance upon replication of some tools, therefore limiting our ability to draw conclusions about many tools reviewed. While we have attempted to include all relevant literature, it remains possible that we were unable to access or locate additional work – particularly grey literature studies in which tools performed poorly and tools published in languages other than French or English. The paucity of replication studies and study quality issues for a number of tools limit conclusions regarding their application, and may lead to biased estimates of their performance. The BJMHS, the CMHS-M, the CMHS-W, the EMHS, the JSAT, and the RDS have been best studied. The

BSI and SCL-90 also appear promising, but as they are pay per use tools others have suggested they may not be feasible to implement[57].

Given that the BJMHS was developed to address limitations of the RDS, use of the RDS should be carefully considered. However, the remaining five tools are recommended as first options for implementation, as the majority of studies have supported their use. Whereas the BJMHS, CMHS-M and CMHS-W and EMHS are brief tools (i.e. 5 minutes or less) that can be administered by health or custodial staff, the JSAT is completed by nursing or psychology staff, and requires 20-30 minutes to complete. Only three studies included in this review compared these tools against one another. Evans et al compared the BJMHS and the EMHS, and found that they had roughly comparable performance[5]. Ford et al[41] found higher accuracy of the CMHS tools compared to the BJMHS and RDS, except for Black women. One study that was excluded on the basis that it was conducted in police custody[6] found comparable performance between the JSAT and the BJMHS.

The lack of trials evaluating the impact of introducing screening tools limits our ability to assess the improvements in detection rates following the introduction of a mental health screening tool. If screening tools identify the same group of inmates with mental illness who would have been detected through routine observation, self-referral and other standard processes, this raises questions about the value of and need for screening. In their development study, Steadman and colleagues acknowledged that the BJMHS performed worse for women offenders, but noted that it represented an improvement over previous screening results[3]. While the argument supports the use of the tool, it was based on the results of Teplin[61] from approximately twenty years earlier. It is possible that detection would have improved since this time without screening given increased attention to mental illness in corrections. While not always feasible, an

experimental or quasi-experimental design (e.g. randomized controlled trials, cluster randomized trials, stepped wedge, or time-series designs) should be used to compare detection rates prior to and following implementation of screening. It is encouraging that the updated search identified five studies that explored questions of access to care[30-34]; more methodologically rigorous designs are needed to explore long-term outcomes following screening.

Our findings are in line with observations of others[1] that rates of detection of mental illness may be increased by screening. Nonetheless, further work is needed to identify minimum standards for a tool to be clinically useful and feasible for implementation. We have suggested four potential standards that could be used to determine what adequate performance of a screening tool means within each specific context. Furthermore, there are a number of factors that may impact the performance of screening tools such as sex, race/ethnicity/culture, jail versus prisons, country factors (e.g. availability of services in the community), and staff qualifications and training that have received minimal attention in the literature. An increased understanding of these factors is needed to inform more accurate, cost-effective, and feasible mental health screening.

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Table 1. Data extraction tool variables and coding options.

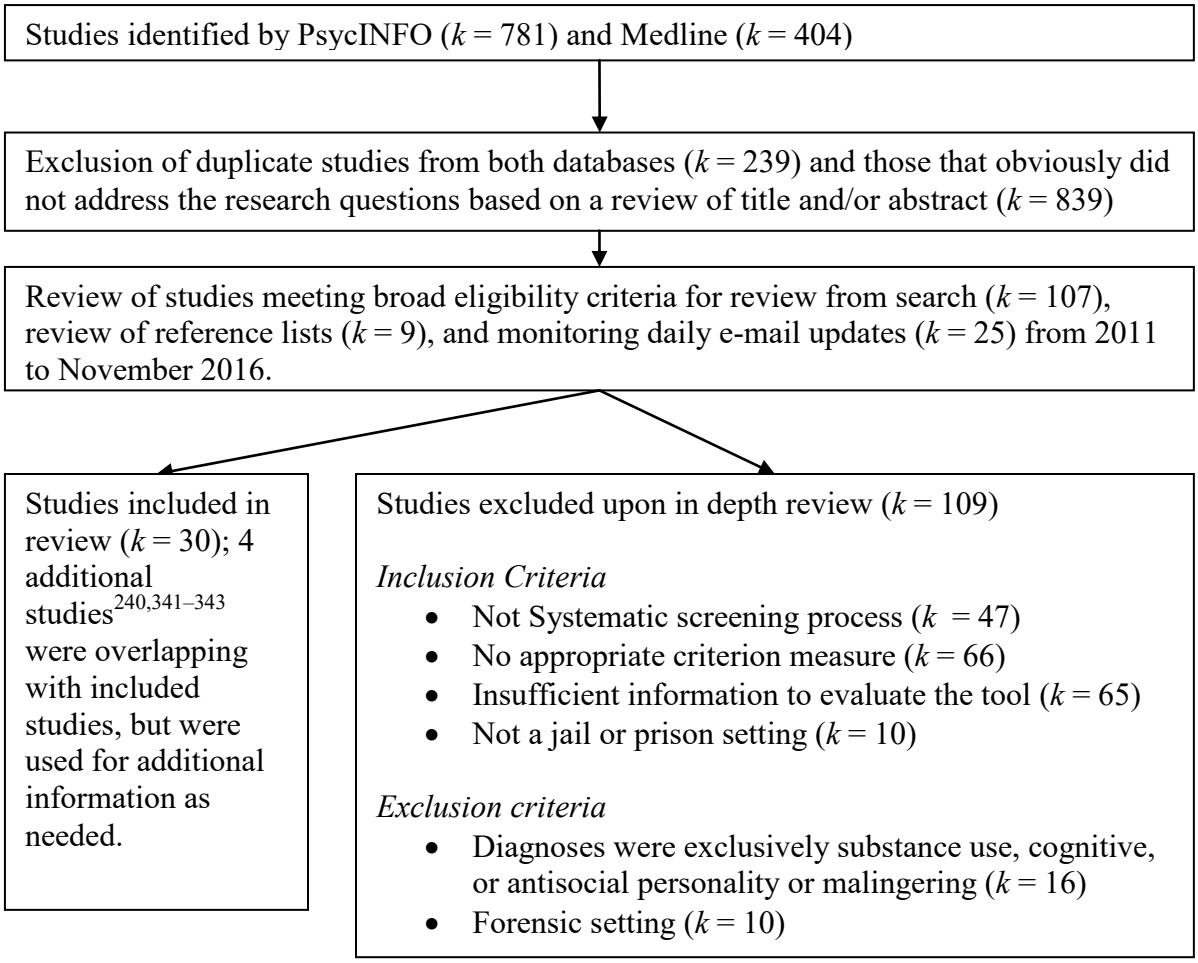
Variable	Options
Setting	Jail, prison, psychiatric unit, women's institution
Screening tool name and cut-off score	Free text
Gold standard/criterion tool name	Free text
Diagnoses included in criterion	Axis I, Axis I or II, Severe mental illness, Psychotic disorder, Mood disorder, Anxiety disorder, Mental health need for treatment
Timeframe of criterion	Current, Lifetime
Sample size	Free text
Sex	% male and % female
Race	%Aboriginal, Asian, Black, Latin, White, Other
Frequencies from 2x2 table of screening result vs. gold standard	Number of true positives, false positives, true negatives and false negatives
Referral rate	% identified by screening tool
Accuracy statistics	Overall accuracy (%), sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio, other

Table 2. Study quality (QUADAS-2) ratings of studies included in the review.

	RISK OF BIAS				APPLICABILITY CONCERNS		
Reference	Patient selection	Index Test	Reference Standard	Flow & Timing	Patient Selection	Index test	Reference Standard
[25]	L	?	?	L	L	H	H
[18]	L	H	L	?	L	L	L
[28]	L	H	H	L	L	L	H
[19]	H	H	H	L	?	H	L
[26]	?	H	?	L	L	L	L
[16]		H	H	L	L	H	L
[56]	L	H	?	L	L	H	L
5	L	L	L	L	L	L	L
2	L	L	L	L	L	H	L
3	H	L	L	L	L	L	L
[17]	?	L	L	H	L	L	H
[10]	L	L	?	L	L	L	H
[12]	H	L	L	H	L	L	L
[38] (Construction sample)	L	H	L	H	L	H	H
[38] (validation sample)	?	L	L	H	L	H	H
[52]	H	L	H	H	H	L	L
[49]	?	H	L	H	H	H	H
[40]	H	L	L	H	L	L	L
[50]	H	L	H	H	H	L	H
[51]	H	H	H	H	H	H	H
[47]	H	H	?	L	H	L	L
[45]	H	L	L	?	L	H	L
[44]	H	L	L	L	L	L	L
[39]	H	L	L	L	L	L	L
[41]	L	H	L	L	L	H	L
[53]	L	H	L	L	H	H	L
[42]	L	H	L	L	L	L	L
[46]	H	L	H	H	L	L	H
[43]	H	L	H	H	H	L	H
[55]	?	L	H	H	?	L	H
[54]	L	L	H	L	L	L	L

L= Low; H = High; ? = Unclear

Figure 1. Identification and Evaluation of Studies Relative to Inclusion and Exclusion Criteria



Supplementary File S1. Summary table of research on mental health screening tools in correctional settings.

Acronym	Full Screening Tool Name
BJMHS	Brief Jail Mental Health Screen
BJMHS-R	Brief Jail Mental Health Screen - Revised
BSI	Brief Symptom Inventory
CMHS-F	Correctional Mental Health Screen for Women
CMHS-M	Correctional Mental Health Screen for Men
COSDI-MD	Co-Occurring Disorders Screening Instrument for Mental Disorder
COSDI-SMD	Co-Occurring Disorders Screening Instrument for Severe Mental Disorder
DHS	Depression Hopelessness Suicide Screening Form
EMHS	England Mental Health Screen
GHQ-28	General Health Questionnaire (28 item)
GSS	Global Appraisal of Individual Needs Short Screener
GSS-IDS	Global Appraisal of Individual Needs Short Screener - Internal Disorder Screener
IRIS	Indigenous Risk Impact Screen
JSAT	Jail Screening Assessment Tool
K6	Kessler 6
MCMI-III	Millon Clinical Multiaxial Inventory–III
MDSIS	Mental Disability/Suicide Intake Screen
MHS-A	Mental Health Screen for Adults
MHSF	Mental Health Screening Form
MINI-M	Mini-International Neuropsychiatric Interview–Modified

NYS BST New York State Brief Screening Tool

PAS Personality Assessment Screener

PISP Prisoner Intake Screening Procedure

PQ-B Prodromal Questionnaire - Brief

RDS Referral Decision Scale

- B = Bipolar scale
- D = Depression scale
- S = Schizophrenia scale

PS Screening Instrument for Psychosis

SCL-90 Symptom Checklist 90

Definitions of Criterion Variables

For all criterion measures, a notation of either L (Lifetime), C (Current) or NR (Not reported) is made in parentheses to denote the time period covered. Specific criterion measures are as follows:

- SMI = Severe mental illness (i.e. psychotic disorders, bipolar disorder, and major depression)
- Axis I = Definitions were not always clear in papers, this typically refers to SMI plus anxiety disorders, dysthymia, etc. This excludes substance abuse and paraphilias
- Axis I and II = An Axis I disorder (as defined above) or a personality disorder, other than antisocial personality disorder
- Mental health need = Non-diagnostic outcome measures, such as a clinician assessment of need for treatment, receipt of services, or a referral for mental health services.

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
Tools with replication studies											
BJMHS	[3]	Jail	Female; half AA	146	2 symptoms or one service utilization item	35	SMI (C)	42	.46 [.34, .58]	.73 [.63, .81]	62%
	[39]	Jail	Female; majority AA	256	2 symptoms or one service utilization item	34	SMI (C)	24	.61 [.49, .72]	.75 [.69, .81]	72%
	[41]	Jail	Female; majority white	101	Any 1 item	85	I or II (C)	60	.95 [.86, .98]	.30 [.18, .45]	69%
					Any 2 items	69	I (C)	43	.90 [.78, .96]	.46 [.34, .59]	65%
							I or II (C)	60	.88 [.77, .94]	.60 [.45, .74]	77%
	[3]	Jail	Male, half AA	211	2 symptoms or one service utilization item	35	SMI (C)	27	.66 [.53, .76]	.76 [.69, .82]	73%
	[39]	Jail	Male, majority AA	205	2 symptoms or one service utilization item	24	SMI (C)	16	.64 [.47, .78]	.84 [.77, .88]	80%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
	[5]	Jail	Male; 42% white; 34% Maori; majority are remand cases	530	2 symptoms or one service utilization item	23	SMI (C)	46	.34 [.30, .38]	.86 [.83, .88]	62%
	[41]	Jail	Male; half white; 35% black	201	Any 2 items	53	I (C)	17	.82 [.66, .91]	.53 [.45, .60]	58%
					Any item	70	I or II (C)	50	.92 [.85, .96]	.41 [.32, .51]	58%
	[40]	Jail	Male	106	2 symptoms or one service utilization item	47	I (C)	35	.68 [.52, .80]	.64 [.52, .74]	65%
							I & SUD (C)	27	.66 [.47, .80]	.60 [.49, .70]	61%
							SMI (C)	23	.67 [.47, .82]	.59 [.47, .69]	60%
						58	I (C)	49	.81 [.70, .89]	.64 [.52, .75]	73%
BJMHS-R	[39]	Jail	Female; majority AA	258	2	41	SMI (C)	24	.65 [.53, .76]	.66 [.59, .72]	66%
			Male, majority AA	206	2	33	SMI (C)	16	.67 [.50, .80]	.73 [.66, .79]	72%
CMHS-W	[41]	Jail	Female, majority white	101	1	94	I or II (C)	60	.98 [.91, 1.0]	.13 [.06, .27]	64%
					2	87	I (C)	43	.98 [.89, 1.0]	.21 [.12, .33]	54%
					5	45	I or II (C)	60	.65 [.52, .76]	.85 [.70, .93]	73%
					6	39	I (C)	43	.63 [.48, .76]	.79 [.67, .88]	72%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
	[42]	Jail	Female, approximately 40% each white and black, and 20% Latin	100	1	96	I or II (C)	61	.98 [.91, 1.0]	.08 [.03, .21]	63%
					2	84	I or II (C)	61	.93 [.84, .97]	.33 [.20, .49]	70%
					3	72	I or II (C)	61	.85 [.74, .92]	.49 [.34, .64]	71%
					4	58	I or II (C)	61	.74 [.62, .83]	.72 [.56, .84]	73%
					5	42	I or II (C)	61	.64 [.51, .75]	.92 [.79, .97]	75%
					6	32	I or II (C)	61	.48 [.36, .60]	.92 [.79, .97]	65%
					7	15	I or II (C)	61	.23 [.14, .35]	.97 [.86, .99]	52%
					8	2	I or II (C)	61	.03 [.01, .11]	1.0 [.91, 1.0]	41%
CMHS-M	[41]	Jail	Male, majority white	201	6	66	I or II (C)	50	.74 [.65, .82]	.75 [.66, .82]	50%
					7	35	I (C)	17	.68 [.51, .81]	.72 [.65, .78]	71%
	[42]	Jail	Male, approximately 40% each white and black, and 20% Latin	106	1	91	I or II (C)	43	1.0 [.92, 1.0]	.15 [.08, .26]	52%
					2	86	I or II (C)	44	.98 [.89, 1.0]	.23 [.14, .35]	56%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
					3	74	I or II (C)	44	.91 [.79, .96]	.40 [.29, .53]	62%
					4	62	I or II (C)	43	.89 [.77, .95]	.60 [.47, .71]	73%
					5	51	I or II (C)	45	.80 [.67, .89]	.78 [.66, .87]	79%
					6	41	I or II (C)	44	.70 [.56, .81]	.83 [.71, .90]	77%
					7	33	I or II (C)	43	.63 [.49, .75]	.90 [.80, .95]	78%
					8	20	I or II (C)	44	.44 [.31, .58]	.98 [.91, 1.0]	74%
					9	10	Axis I or II (C)	44	.24 [.14, .38]	1.0 [.94, 1.0]	67%
					10	9	I or II (C)	43	.20 [.11, .34]	1.0 [.94, 1.0]	65%
					11	4	I or II (C)	43	.09 [.04, .21]	1.0 [.94, 1.0]	61%
					12	1	I or II (C)	43	.02 [.00,.11]	1.0 [.94, 1.0]	57%
EMHS	[10]	women inst.	female sample	30	1	57	SMI (L)	37	1.0 [.74, 1.0]	.68 [.46, .85]	80%
		Jail	male sample	90	1	29	SMI (L)	19	1. 0 [.82, 1.0]	.88 [.78, .93]	90%
		Jail	young offender (18-21) male sample	30	1	20	SMI (L)	7	.50 [.09, .91]	.82 [.64, .92]	80%
	[5]	Jail	Male; 42% white; 34% Maori; majority are remand cases	530	1	33	SMI (C)	47	.42 [.38, .56]	.75 [.72, .78]	60%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
	[56]	Jail	all male	534	1	38	I (L)	19	.76 [.67, .83]	.71 [.67, .76]	74%
	[43]	Jail	all male	43	1	33	I or II (NR)	NR	Unable to calculate – only assessed 41 positive screens out of 201 total offenders screened. PPV can be estimated at .23 as 10/41 assessed had a diagnosis		
JSAT	[44]	Women inst.	female sample	29	SPJ	48	I (NR)	41	.75 [.47, .91]	.71 [.47, .87]	72%
	[6]	Police cells	91% Male; 81% white	150	SPJ	68	SMI (C)	43	1.0 [.94, 1.0]	.56 [.45, .66]	75%
							I (C)	51	.99 [.93, 1.0]	.64 [.53, .74]	82%
	[40]	Jail	male sample	106	SPJ	27	I (C)	35	.43 [.28, .59]	.81 [.70, .89]	68%
							I and SUD (C)	27	.38 [.23, .56]	.77 [.66, .85]	66%
							SMI (C)	23	.50 [.31. .69]	.79 [.69, .87]	73%
					BPRS ≥4, mental health issue or placement recommendation	43	I (C)	35	.70 [.54, .83]	.69 [.58, .78]	70%
							I and SUD (C)	27	.72 [.54, .85]	.69 [.58, .78]	70%
							SMI (C)	23	.67 [.47, .82]	.65 [.54, .74]	65%
	[11,12]	Jail	male sample	127	SPJ	43	SMI (C)	20	.84 [.65, .94]	.67 [.57, .75]	70%
RDS	[46]	Women inst.	female; 67% Maori or Maori/Mixed; 28% White	131	3 on any scale	60	SMI (L)	22	.86 [.69, .95]	.47 [.38, .57]	56%
					3 on B	14	BPD (L)	Unreported – PPV = .22			

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
					3 on D	32	Maj. dep (L)	Unreported – PPV = .38			
					3 on S	15	Psy dx (L)	Unreported – PPV = .26			
	[2]	Jail	All male; little other information	182	2 on S or 3 on D or B		SMI (NR)	Unreported – PPV = .35 and NPV = .92			
				182	3 on B or 2 on D or S		SMI (NR)	Unreported – PPV = .32 and NPV = .96			
					2 on D	39	Maj. dep (NR)	Unreported – PPV = .15 and NPV = .99			
					3 on D	20	Maj. dep (NR)	Unreported – PPV = .19 and NPV = .98			
					2 on S	5	Psy dx (NR)	Unreported – PPV = .33 and NPV = .97			
					3 on B	13	BPD (NR)	Unreported – PPV = .13 and NPV = .97			
	[45]	Jail	Male; 82% Caucasian	95	3 on B, 2 on D or S	22	SMI (NR)	12	.73 [.43, .90]	.84 [.75, .91]	83%
	[38]	Prison	Male; 51% black, 45% white	1149	3 on B, 2 on D or S	7	SMI (L)	8	.79 [.70, .86]	.99 [.98, .99]	97%
		Jail	Male; 81% black	728	1 on B	13	BPD (L)	3	.96 [.64, 1.0]	.90 [.86, .93]	90%
				728	1 on D	17	Maj. dep (L)	5	1. 0 [.77, 1.0]	.87 [.82, .91]	88%
				728	1 on S	6	Psy dx (L)	3	.88 [.55, .98]	.96 [.93, .98]	96%
				728	2 on B	5	BPD (L)	3	.92 [.59, .99]	.98 [.96, .99]	98%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
				728	2 on D	6	Maj. dep. (L)	5	.92 [.66, .98]	.98 [.96, .99]	98%
				728	2 on S	5	Psy dx (L)	4	.67 [.38, .87]	.99 [.96, .99]	97%
				728	3 on B	3	BPD (L)	3	.83 [.51, .96]	1.0 [.99, 1.0]	99%
				728	3 on D	3	Maj. dep.(L)	5	.50 [.26, .74]	1.0 [.98, 1.0]	97%
				728	3 on S	2	Psy dx (L)	3	.38 [.14, .68]	1.0 [.98, 1.0]	98%
				728	4 on B	1	BPD (L)	3	.33 [.12, .65]	1.0 [.99, 1.0]	98%
				728	4 on D	1	Maj. dep (L)	5	.14 [.04, .41]	1.0 [.98, 1.0]	96%
				728	4 on S	0	Psy dx (L)	3	.04 [.00, .36]	1.0 [.99, 1.0]	97%
				728	5 on B	0	BPD (L)	3	.04 [.00,.36]	1.0 [.99, 1.0]	97%
				728	5 on D	0	Maj. dep. (L)	5	.00 [.00,.23]	1.0 [.98, 1.0]	95%
				728	5 on S	0	Psy dx (L)	3	.00 [.00, .30]	1.0 [.99, 1.0]	97%
	[41]	Jail	Female; majority white	101	1	87	I or II (C)	60	.97 [.89, .99]	.28 [.17, .43]	69%
				101	1	87	I (C)	43	.98 [.89, 1.0]	.21 [.12, .33]	54%
				101	2	74	I or II (C)	60	.90 [.80, .95]	.50 [.35, .65]	74%
				101	2	74	I(C)	43	.93 [.81, .98]	.40 [.28, .53]	63%
			Male; 49% White, 34% Black	201	2	66	I or II (C)	34	.87 [.77, .93]	.45 [.37, .53]	59%
				201	2	66	I (C)	17	.94 [.81, .98]	.40 [.33, .48]	49%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
	[47]	Jail	51% female; 79% European American	100	1 on D	79	Maj. dep. (NR)	13	1.0 [.77, 1.0]	.24 [.16, .34]	34%
				100	2 on D	55	Maj. dep. (NR)	13	.85 [.58, .96]	.49 [.39, .59]	54%
				100	3 on D	31	Maj. dep (NR)	13	.54 [.29, .77]	.72 [.62, .80]	70%
				100	4 on D	20	Maj. dep. (NR)	13	.46 [.23, .71]	.84 [.75, .90]	79%
	[51]	Jail	Males with SMI; 90% male, 53% Black, 43% White	207	2 on D	74	Maj. dep. (C)	27	.73 [.60, .83]	.25 [.19, .33]	38%
				207	2 on S	74	Psy dx (C)	31	.85 [.74, .91]	.31 [.24, .39]	47%
				207	3 on B	84	BPD (C)	15	.84 [.68, .93]	.16 [.11, .22]	26%
Tools without independent replication studies											
BSI & DHS	[28]	Prison	all male; 21% Aboriginal; 16% history of treatment	500	T-score of 65 on either test		MH need	50	.76 [.70, .82]	.65 [.60, .70]	69%
							I (L)	50	.83 [.72, .91]	.55 [.50, .60]	58%
					T-score of 60 on either test		MH need	67	.86 [.80, .90]	.43 [.38, .49]	59%
							I (L)	67	.92 [.82, .96]	.36 [.32, .40]	43%
COSDI -MD	[49]	prison subst. abuse tx. unit	all AA; 56% male	96	3	68	I or II (L)	67	.80 [68, .88]	.56 [.39, .72]	72%
			all white; 58% male	137	3	72	I or II (L)	74	.82 [.74, .88]	.56 [.40, .70]	75%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
			all Latino; 61% male	120	3	69	I or II (L)	74	.81 [.71, .88]	.64 [.47, .79]	77%
	[36]	prison subst. abuse tx. unit	female; approximately half white, 1/3 Latino, 1/5 AA	74	3	84	I (L)	86	.86 [.75, .92]	.30 [.11, .60]	78%
			male; approximately half white, 1/3 Latino, 1/5 AA	106	3	66	I (L)	73	.74 [.63, .82]	.55 [.38, .72]	69%
COSDI -SMD	[49]	prison subst. abuse tx. unit	all AA population; 56% male	96	2	30	I or II (L)	67	.41 [.29, .53]	.91 [.76, .97]	57%
							SMI (L)	30	.59 [.41, .75]	.82 [.71, .89]	75%
			all white; 58% male	137	2	31	I or II (L)	74	.40 [.31, .49]	.94 [.82, .98	54%
							SMI (L)	43	.59 [.47, .71]	.91 [.83, .96]	77%
			all Latino; 61% male	120	2	28	I or II (L)	74	.36 [.27, .46]	.97 [.84, .99]	52%
							SMI (L)	30	.50 [.34. .66]	.82 [.73, .89]	73%
	[36]	prison subst. abuse tx. unit	female; approximately half white, 1/3 Latino, 1/5 AA	74	2	42	SMI (L)	58	.56 [.41, .70]	.77 [.60, .89]	65%
			male; approximately half white, 1/3 Latino, 1/5 AA	106	2	21	SMI (L)	30	.50 [.34, .66]	.92 [.83, .96]	79%
DHS	[18]	Prison	Female; 71% white, 14%	98	Depression >=5	47	Dysthymia (C)	20	.90 [.70, .97]	.64 [.53, .74]	69%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
			black, 10% Aboriginal		Hopelessness >=2	35	Dysthymia (C)	20	.58 [.37, .77]	.71 [.60, .80]	68%
					Hopelessness >=4	21	Dysthymia (C)	20	.47 [.27, .68]	.86 [.77, .92]	78%
					Total>=5	51	Dysthymia (C)	20	.90 [.70, .97]	.59 [.48, .69]	65%
GHQ-28	[53]	Jail	Remand jail in Denmark; majority in solitary confinement	184	2	90	I (C)	41	.91 [.82, .96]	.10 [.06, .17]	43%
					3	79	I (C)	41	.88 [.79, .94]	.28 [.20, .37]	53%
					4	79	I (C)	41	.88 [.79, .94]	.28 [.20, .37]	53%
					5	66	I (C)	41	.81 [.71, .88]	.44 [.35, .53]	59%
					6	66	I (C)	41	.81 [.71, .88]	.44 [.35, .53]	59%
					7	54	I (C)	41	.72 [.61, .81]	.58 [.49, .67]	64%
					8	54	I (C)	41	.71 [.60, .80]	.58 [.49, .67]	63%
					9	54	I (C)	41	.71 [.60, .80]	.58 [.49, .67]	63%
					10	45	I (C)	41	.65 [.54, .75]	.69 [.60, .77]	68%
					11	45	I (C)	41	.65 [.54, .75]	.69 [.60, .77]	68%
					12	40	I (C)	41	.59 [.48, .69]	.73 [.64, .80]	67%
					13	38	I (C)	41	.59 [.48, .69]	.76 [.67, .83]	69%
					14	36	I (C)	41	.56 [.45, .67]	.77 [.68, .94]	68%
					15	35	I (C)	41	.52 [.41, .63]	.77 [.68, .84]	66%
					16	35	I (C)	41	.52 [.41, .63]	.77 [.68, .84]	66%
					17	25	I (C)	41	.40 [.30, .51]	.86 [.78, .91]	67%
GSS	[36]	prison subst. abuse tx. unit	female; approximately half white, 1/3 Latino, 1/5 AA	74	2	91	I (L)	86	.92 [.83, .97]	.20 [.06, .51]	82%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
			male; approximately half white, 1/3 Latino, 1/5 AA	106	2	73	I (L)	73	.81 [.70, .88]	.48 [.31, .66]	72%
GSS-IDS	[36]	prison subst. abuse tx. unit	female; approximately half white, 1/3 Latino, 1/5 AA	74	5	27	SMI (L)	58	.37 [.24, .52]	.87 [.71, .95]	58%
			male; approximately half white, 1/3 Latino, 1/5 AA	106	5	14	SMI (L)	30	.38 [.23, .55]	.96 [.89, .99]	78%
IRIS	[25]	Mixed prison	All Aboriginal; 83% male;	379	11 or more	47	Dep (C)	34	0.35 [0.27, 0.43]	0.46 [0.4, 0.53]	42%
				379	11 or more	47	Anxiety (C)	39	0.46 [0.38, 0.54]	0.52 [0.46, 0.58]	50%
K6	[19]	Jail	Male; ~60% black	494	1	71	I (C)	33	0.94 [0.89, 0.97]	0.41 [0.36, 0.46]	59%
				494	2	62	I (C)	32	0.9 [0.84, 0.94]	0.51 [0.46, 0.56]	63%
				494	3	55	I (C)	32	0.87 [0.81, 0.91]	0.6 [0.55, 0.65]	69%
				494	4	48	I (C)	33	0.83 [0.76, 0.88]	0.69 [0.64, 0.74]	74%
				494	5	40	I (C)	33	0.76 [0.69, 0.82]	0.78 [0.73, 0.82]	77%
				494	6	34	I (C)	33	0.72 [0.65, 0.78]	0.85 [0.81, 0.88]	81%
				494	7	30	I (C)	33	0.67 [0.59, 0.74]	0.89 [0.85, 0.92]	82%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
				494	8	27	I (C)	33	0.63 [0.55, 0.7]	0.9 [0.86, 0.93]	81%
				494	9	24	I (C)	34	0.57 [0.49, 0.64]	0.93 [0.9, 0.95]	81%
				494	10	22	I (C)	34	0.5 [0.43, 0.57]	0.93 [0.9, 0.95]	78%
				494	11	20	I (C)	33	0.47 [0.4, 0.55]	0.94 [0.91, 0.96]	78%
				494	12	18	I (C)	33	0.43 [0.36, 0.51]	0.94 [0.91, 0.96]	77%
				494	13	15	I (C)	33	0.35 [0.28, 0.43]	0.95 [0.92, 0.97]	75%
				494	14	13	I (C)	32	0.3 [0.23, 0.38]	0.95 [0.92, 0.97]	74%
				494	15	12	I (C)	35	0.26 [0.2, 0.33]	0.96 [0.93, 0.98]	72%
				494	16	11	I (C)	33	0.25 [0.19, 0.32]	0.96 [0.93, 0.98]	73%
				494	17	10	I (C)	32	0.24 [0.18, 0.31]	0.97 [0.95, 0.98]	73%
				494	18	9	I (C)	34	0.23 [0.17, 0.3]	0.98 [0.96, 0.99]	72%
				494	19	7	I (C)	33	0.17 [0.12, 0.24]	0.98 [0.96, 0.99]	72%
				494	20	6	I (C)	30	0.14 [0.09, 0.2]	0.98 [0.96, 0.99]	73%
				494	21	4	I (C)	34	0.11 [0.07, 0.17]	0.99 [0.97, 1]	69%
				494	22	4	I (C)	37	0.09 [0.06, 0.14]	0.99 [0.97, 1]	66%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
				494	23	4	I (C)	35	0.09 [0.06, 0.14]	0.99 [0.97, 1]	68%
				494	24	4	I (C)	35	0.09 [0.06, 0.14]	0.99 [0.97, 1]	68%
			Female; ~60% black	515	1	88	I (C)	67	0.98 [0.96, 0.99]	0.33 [0.26, 0.4]	76%
				515	2	82	I (C)	67	0.98 [0.96, 0.99]	0.51 [0.44, 0.58]	82%
				515	3	77	I (C)	68	0.96 [0.93, 0.98]	0.64 [0.56, 0.71]	86%
				515	4	72	I (C)	67	0.94 [0.91, 0.96]	0.73 [0.66, 0.79]	87%
				515	5	68	I (C)	67	0.91 [0.88, 0.94]	0.79 [0.72, 0.84]	87%
				515	6	64	I (C)	67	0.88 [0.84, 0.91]	0.84 [0.78, 0.89]	87%
				515	7	59	I (C)	67	0.82 [0.78, 0.86]	0.87 [0.81, 0.91]	84%
				515	8	55	I (C)	68	0.76 [0.71, 0.8]	0.9 [0.85, 0.94]	81%
				515	9	51	I (C)	67	0.73 [0.68, 0.77]	0.93 [0.88, 0.96]	80%
				515	10	47	I (C)	67	0.67 [0.62, 0.72]	0.94 [0.89, 0.97]	76%
				515	11	45	I (C)	67	0.64 [0.59, 0.69]	0.95 [0.91, 0.97]	74%
				515	12	43	I (C)	67	0.62 [0.57, 0.67]	0.95 [0.91, 0.97]	73%
				515	13	37	I (C)	67	0.54 [0.49, 0.59]	0.98 [0.95, 0.99]	68%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
				515	14	35	I (C)	67	0.51 [0.46, 0.56]	0.98 [0.95, 0.99]	66%
				515	15	33	I (C)	66	0.48 [0.43, 0.53]	0.98 [0.95, 0.99]	65%
				515	16	29	I (C)	68	0.42 [0.37, 0.47]	0.99 [0.96, 1]	60%
				515	17	27	I (C)	67	0.4 [0.35, 0.45]	0.99 [0.96, 1]	59%
				515	18	26	I (C)	67	0.38 [0.33, 0.43]	0.99 [0.96, 1]	58%
				515	19	21	I (C)	67	0.32 [0.27, 0.37]	1 [0.98, 1]	55%
				515	20	19	I (C)	67	0.29 [0.24, 0.34]	1 [0.98, 1]	53%
				515	21	18	I (C)	67	0.27 [0.23, 0.32]	1 [0.98, 1]	51%
				515	22	16	I (C)	69	0.23 [0.19, 0.28]	1 [0.98, 1]	47%
				515	23	14	I (C)	68	0.21 [0.17, 0.26]	1 [0.98, 1]	47%
				515	24	13	I (C)	66	0.19 [0.15, 0.23]	1 [0.98, 1]	46%
MCMI-III	[54]	Prison	90% male; 46% Caucasian, 30% Hispanic, 21% AA	9468	T score of 75						
Schizoid Scale						12	MH need	15	Unable to calculate. Odds ratio = 2.8		
Avoidant Scale						25	MH need	15	Unable to calculate. Odds ratio = 2.4		
Depressive Scale						18	MH need	15	Unable to calculate. Odds ratio = 3.5		

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
Dependant scale						15	MH need	15	Unable to calculate. Odds ratio = 2.7		
Histrionic scale						13	MH need	15	Unable to calculate. Odds ratio = .8		
Narcissistic Scale						21	MH need	15	Unable to calculate. Odds ratio = .7		
Antisocial scale						29	MH need	15	Unable to calculate. Odds ratio = 1.5		
Sadistic scale						20	MH need	15	Unable to calculate. Odds ratio = 1.6		
Compulsive scale						6	MH need	15	Unable to calculate. Odds ratio = .8		
Negativistic scale						21	MH need	15	Unable to calculate. Odds ratio = 2.1		
Self-defeating scale						12	MH need	15	Unable to calculate. Odds ratio = 2.6		
Schizotypal scale						3	MH need	15	Unable to calculate. Odds ratio = 4.2		
Borderline scale						7	MH need	15	Unable to calculate. Odds ratio = 5.3		
Paranoid scale						7	MH need	15	Unable to calculate. Odds ratio = 2		
Anxiety scale						38	MH need	15	Unable to calculate. Odds ratio = 2.9		
Somatoform scale						1	MH need	15	Unable to calculate. Odds ratio = 8.1		
Mania scale						3	MH need	15	Unable to calculate. Odds ratio = 3.1		
Dysthymia scale						15	MH need	15	Unable to calculate. Odds ratio = 3.7		
Alcohol scale						27	MH need	15	Unable to calculate. Odds ratio = 1.4		
Drug scale						18	MH need	15	Unable to calculate. Odds ratio = 1.6		
PTSD scale						6	MH need	15	Unable to calculate. Odds ratio = 5.2		
Thought disorder scale						1	MH need	15	Unable to calculate. Odds ratio = 7		
Major depression scale						3	MH need	15	Unable to calculate. Odds ratio = 9.5		
Delusional scale						2	MH need	15	Unable to calculate. Odds ratio = 3		

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
MDSIS	[47]	Jail	51% female; 79% European American	100							
composite score					1	73	Maj. dep (NR)	13	1.0 [.77, 1.0]	.31 [.22, .41]	40%
					2	53	Maj. dep (NR)	13	.92 [.66, .99]	.53 [.43, .63]	58%
					3	39	Maj. dep (NR)	13	.77 [.50, .92]	.67 [.57, .76]	68%
					4	28	Maj. dep (NR)	13	.62 [.36, .83]	.77 [.67, .85]	75%
current depression scale					1	13	Maj. dep (NR)	13	.46 [.23, .71]	.92 [.84, .96]	86%
					2	5	Maj. dep (NR)	13	.23 [.08, .50]	.98 [.92, .99]	88%
					3	1	Maj. dep (NR)	13	.00 [.00, .23]	.99 [.94, 1.0]	86%
past mood symptoms scale					1	64	Maj. dep (NR)	13	.92 [.66, .99]	.40 [.30, .51]	47%
					2	37	Maj. dep (NR)	13	.69 [.42, .87]	.68 [.58, .77]	68%
					3	16	Maj. dep (NR)	13	.31 [.13, .58]	.86 [.77, .92]	79%
Suicide/ treatment scale					1	45	Maj. dep (NR)	13	.63 [.37, .83]	.58 [.48, .68]	59%
					2	30	Maj. dep (NR)	13	.69 [.42, .87]	.76 [.66, .84]	75%
					3	14	Maj. dep (NR)	13	.23 [.08, .50]	.87 [.78, .93]	79%
MHS-A	[52]	Jail	Male	45	4 cut-offs	84	I or II (NR)	80	.94 [.82, .98]	.56 [.27, .81]	87%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
MHSF	[36]	prison subst. abuse tx. unit	female; approximately half white, 1/3 Latino, 1/5 AA	74	3	93	I (L)	86	.97 [.89, .99]	.30 [.11, .60]	88%
					11	27	SMI (L)	58	.42 [.28, .57]	.94 [.79, .98]	64%
			male; approximately half white, 1/3 Latino, 1/5 AA	106	3	72	I (L)	73	.79 [.69, .87]	.48 [.31, .66]	71%
					11	15	SMI (L)	30	.34 [.20, .52]	.93 [.85, .97]	76%
MINI-M	[36]	prison subst. abuse tx. unit	female; approximately half white, 1/3 Latino, 1/5 AA	74	5	81	I (L)	86	.83 [.72, .90]	.30 [.11, .60]	76%
					10	34	SMI (L)	58	.49 [.35, .63]	.87 [.71, .95]	65%
			male; approximately half white, 1/3 Latino, 1/5 AA	106	5	61	I (L)	73	.70 [.59, .79]	.62 [.44, .77]	69%
					10	24	SMI (L)	30	.41 [.26, .58]	.84 [.74, .90]	71%
NYS BST	[50]	Jail	Female; 69% Black, 15% Hispanic	26	4 cut-offs	41	Need (C)	45	.88 [.60, .97]	84 [.58, .95]	73%
			Male; 68% Black, 21% Hispanic	66		28	Need (C)	5	.67 [.21, .94]	.74 [.62, .83]	74%
PAS	[47]	Jail	51% female; 79% European American	100							
Composite Score					7	35	Maj dep. (NR)	13	1.0 [.77, 1.0]	.75 [.65, .83]	79%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
					8	21	Maj dep. (NR)	13	.69 [.42, .87]	.86 [.77, .92]	84%
					9	19	Maj dep. (NR)	13	.62 [.36, .83]	.88 [.80, .93]	85%
Negative Affect					6	31	Maj dep. (NR)	13	.92 [.66, .99]	.78 [.68, .85]	80%
					7	18	Maj dep. (NR)	13	.62 [.36, .83]	.89 [.81, .94]	85%
PISP	[45]	Jail	Male; 82% White	95	NR	8	SMI (NR)	12	.45 [.21, .72]	.96 [.90, .99]	91%
PISP or RDS					NR	25	SMI (NR)	12	.91 [.62, .98]	.83 [.74, .90]	84%
PS – narrow	[55]	Jail	all male	567	3	23	Psy dx (L)	10	.65 [.52, .76]	.83 [.79, .86]	86%
PS – broad	[55]	Jail	all male	567	2	24	Psy dx (L)	10	.75 [.62, .84]	.83 [.79, .86]	87%
PTSD Checklist	[26]	Prison	All male; 53% Black, 29% White; 14% Latin; 17% other. Computer administered screen (<7 days between screen and diagnosis)	41	39	61	PTSD (C)	46	0.95 [0.75, 0.99]	0.68 [0.47, 0.84]	80%
				41	39	61	PTSD + sub-threshold (C)	54	0.96 [0.78, 0.99]	0.79 [0.57, 0.91]	88%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
			(<14 days between screen and diagnosis)	70	43	61	PTSD (C)	40	0.93 [0.77, 0.98]	0.6 [0.44, 0.73]	73%
				70	43	61	PTSD + subthres hold (C)	53	0.89 [0.75, 0.96]	0.7 [0.53, 0.83]	80%
			All male; 53% Black, 29% White; 14% Latin; 17% other. Interview administered screen; (<7 days between screen and diagnosis)	31	56	32	PTSD (C)	42	0.69 [0.42, 0.87]	0.94 [0.74, 0.99]	84%
				31	41	64	PTSD + subthres hold (C)	52	0.94 [0.72, 0.99]	0.67 [0.42, 0.85]	81%
			(<14 days between screen and diagnosis)	71	45	59	PTSD (C)	54	0.84 [0.7, 0.93]	0.7 [0.53, 0.83]	77%
				71	37	79	PTSD + subthres hold (C)	63	0.96 [0.85, 0.99]	0.5 [0.32, 0.68]	79%
PQ-B	[17]	Jail	All male; 38% white	301	1 of 24 items causing distress	82	ARMS + Psychotic disorder (C)	19	0.97 [0.89, 0.99]	0.22 [0.17, 0.28]	37%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
				301	1/25 items causing distress	83	ARMS + Psychotic disorder (C)	20	0.97 [0.89, 0.99]	0.2 [0.15, 0.25]	35%
				301	2/25 items causing distress	76	ARMS + Psychotic disorder (C)	21	0.97 [0.89, 0.99]	0.29 [0.24, 0.35]	43%
				301	3/25 items causing distress	69	ARMS + Psychotic disorder (C)	20	0.93 [0.84, 0.97]	0.37 [0.31, 0.43]	48%
				301	4/25 items causing distress	63	ARMS + Psychotic disorder (C)	20	0.9 [0.8, 0.95]	0.44 [0.38, 0.5]	53%
				301	5 of 24 items endorsed	80	ARMS + Psychotic disorder (C)	20	0.98 [0.91, 1]	0.24 [0.19, 0.3]	39%
				301	5 of 25 items endorsed	80	ARMS + Psychotic disorder (C)	20	0.98 [0.91, 1]	0.24 [0.19, 0.3]	39%
				301	5 of 33 items endorsed	80	ARMS + Psychotic disorder (C)	20	0.98 [0.91, 1]	0.24 [0.19, 0.3]	39%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
				301	5/25 items causing distress	56	ARMS + Psychotic disorder (C)	20	0.86 [0.75, 0.93]	0.51 [0.45, 0.57]	58%
				301	6 of 33 items endorsed	78	ARMS + Psychotic disorder (C)	20	0.97 [0.89, 0.99]	0.27 [0.22, 0.33]	41%
				301	7/25 items causing distress	47	ARMS + Psychotic disorder (C)	20	0.82 [0.7, 0.9]	0.62 [0.56, 0.68]	66%
				301	8/25 items causing distress	39	ARMS + Psychotic disorder (C)	20	0.57 [0.44, 0.69]	0.66 [0.6, 0.72]	64%
				301	5/24 items endorsed	61	ARMS + Psychotic disorder (C)	20	0.87 [0.76, 0.93]	0.45 [0.39, 0.51]	53%
				301	5/25 items endorsed	65	ARMS + Psychotic disorder (C)	20	0.87 [0.76, 0.93]	0.4 [0.34, 0.46]	49%
				301	6/25 items endorsed	58	ARMS + Psychotic disorder (C)	20	0.84 [0.73, 0.91]	0.49 [0.43, 0.55]	56%

Tool	Study	Setting	Population	*N*	Cut-off	% referred	Criterion	% cases	Sensitivity	Specificity	Overall accuracy
SCL 90	[16]	Prison	54% male; Chilean mixed prison; 49% with history of self-harm	214	GSI ≥1.42	51	SMI (C)	52	0.78 [0.69, 0.85]	0.78 [0.69, 0.85]	78%
				213	GSI ≥ 1.42	48	SMI (C)	52	0.72 [0.63, 0.8]	0.78 [0.69, 0.85]	75%

Results: Primary studies

Statement of Contributions

For concision, a general statement of contributions is provided for the five primary studies that comprise this thesis. All articles are based on a single dataset that I acquired access to through the Correctional Service of Canada. My contributions to all articles consisted of:

- Formulating research questions and designing the studies to address these questions
- Defining data requirements for the project and working with CSC analysts who extracted the raw data in multiple datasets
- Linking separate datasets, and recoding the data for analysis purposes.
- Designing the analysis plan, and conducting and interpreting the analyses
- Writing the first draft of the manuscripts and incorporating feedback from my co-authors/thesis advisory committee

My Thesis Advisory Committee members (Drs Colman, Crocker, Potter and Wells) are co-authors on all papers as they were involved at all stages of this project by providing input on the study design and proposed variable requirements, analysis plan, interpretation of results. Rebecca Grace is a co-author on Chapters 7 and 8, and was involved in providing input on study design, analysis, and interpretation of results. All co-authors have reviewed and approved the final versions of these articles.

Copies of the ethics approval and renewal letters for this work are provided in Appendix 1.

Chapter 6: Validation of the intake mental health screening system

Chapter 6 explores the first component of the conceptualization of the impacts of screening - namely the accuracy of screening to detect illness. This chapter has been published in the journal *PLoS ONE*[263]. The final text of this publication follows. Documents that were posted as online supplements to the article, are provided at the end of the Chapter. The final published version of the article can be accessed (open-access) online at: http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0154106

Yield and efficiency of mental health screening: A comparison of screening protocols at intake to prison

Short title: Yield and efficiency of mental health screening

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Abstract

Background: The value of screening for mental illness has increasingly been questioned in low prevalence settings due to high false positive rates. However, since false positive rates are related to prevalence, screening may be more effective in higher prevalence settings, including correctional institutions. We compared the yield (i.e. newly detected cases) and efficiency (i.e. false positives) of five screening protocols to detect mental illness in prisons against the use of mental health history taking (the prior approach to detecting mental illness).

Methods and findings: We estimated the accuracy of the six approaches to detect an Axis I disorder among a sample of 467 newly admitted male inmates (83.1% participation rate). Mental health history taking identified only 41.0% (95 % CI 32.1, 50.6) of all inmates with mental illness. Screening protocols identified between 61.9 and 85.7% of all cases, but referred between 2 and 3 additional individuals who did not have a mental illness for every additional case detected compared to the mental health history taking approach. In low prevalence settings (i.e. 10% or less) the screening protocols would have had between 4.6 and 16.2 false positives per true positive.

Conclusions: While screening may not be practical in low prevalence settings, it may be beneficial in jails and prisons where the prevalence of mental illness is higher. Further consideration of the context in which screening is being implemented, and of the impacts of policies and clinical practices on the benefits and harms of screening is needed to determine the effectiveness of screening in these settings.

Introduction

Between a quarter and half of individuals with severe mental illness receive appropriate treatment, both in the general population[1,2] and in institutional settings such as jails and prisons[3,4]. While screening is an intuitive solution to improve uptake of services, it is resource intensive. As jail and prison inmates have higher rates of mental disorder[5] that are often undetected[3,4], screening for mental illness is commonly recommended[6]. While there are a number of studies examining the psychometric properties of screening tools in jails and prisons, there is no evidence examining the conditions under which screening improves outcomes compared to prior case detection practices[7]. The costs and benefits of screening must be carefully weighed to choose which screening test(s) - if any - will work best in the specific context[8,9]. Increasing the detection of cases of mental illness (i.e. increasing sensitivity or screening yield) is typically the primary focus of screening, given that delays in treatment are associated with a worse prognosis[10,11]. However, false positives (i.e. low specificity and positive predictive values) can overburden resources[12,13]. They may also have risks such as stigma for the false positive patient[14]. If false-positive screening results are not identified by clinical staff providing follow-up, in addition to the costs of providing treatment, there may also be the risk of adverse outcomes such as medication side-effects[15] and abuse[16] for the individual. Effective triage following screening is thus an important component to reducing costs of unnecessary treatments and any potential consequences of being falsely identified by screening[17].

There is no clear guidance on the levels of accuracy that define an acceptable screening tool[7]. There is increasing recognition that screening may not be effective in the general population due to low positive predictive values and evidence that new cases detected by screening are often of mild severity that do not benefit from treatment[18,19]. No single screening

tool has been shown to detect more than approximately 70-75% of illness among prisoners, and low specificity is an issue[7,20]. Multiple tests can be used to increase sensitivity (i.e. by referring anyone exceeding the cut-offs on either test, which we refer to as simple cut-offs) or to increase specificity (i.e. by requiring the cut-offs on multiple tests to be exceeded). This approach of combining multiple tests has been taken in Canadian and New Zealand prisons[7,17,21], although the added value of multiple versus a single test is unclear at this time.

Because sensitivity and specificity are generally constant properties of a test, they are most commonly reported. They indicate the percentage of persons with an illness who screen positive (sensitivity) and the percentage of persons without illness who screen negative (specificity). However, sensitivity and specificity work backwards from the outcome to the screening result, which is the opposite of how clinicians use screening in practice. The positive and negative predictive values conversely start from the screening result, and indicate the percentage of individuals referred by screening who are in fact ill (positive predictive value) and the percentage of individuals who fall below the cut-off scores who are not ill (negative predictive value). This information is useful to clinicians, who (ideally in consultation with the patient) must judge whether the likelihood of illness is sufficiently high to initiate treatment or to pursue further testing[22].

While they are more clinically useful, positive and negative predictive values vary in relation to the prevalence of illness[23,24]. In relative terms, a positive screening result is typically associated with a constant increase in the probability that a person has illness (if test accuracy varies in different sub-groups, in particular those that are related to illness severity, these estimates may be biased and thus vary when applied in practice[25]). In absolute terms the probability a person who is sampled from a higher prevalence group (i.e. a prison) is more likely

to be ill than a person from a lower prevalence group (i.e. the general population). Since screening does not change a person's baseline risk, the positive predictive value of a test (a measure of the probability that a person with a positive screen is ill) will be higher when applied in the higher prevalence setting[24].

The current study compared the screening yield (i.e. rate of newly identified cases of illness) and efficiency (i.e. rate of false positives) of various screening protocols to detect mental illness in prisons as compared to the prior detection method.

Methods

This study was conducted following the STAR-D guidelines (see Supplementary File S1 for the completed checklist). All procedures were approved by the Ottawa Health Science Network Research Ethics Board (protocol number 20150240-01H). As we undertook secondary analysis of data collected in the course of routine screening of inmates, and from a research study conducted by Correctional Service of Canada (CSC) to estimate the prevalence of mental illness in prison[26], informed consent for our specific project was not obtained. CSC obtained written consent from inmates at two points – prior to completing mental health screening and prior to participating in the prevalence study – which included a statement that de-identified data may be used for research purposes consistent with the Privacy Act[27]. De-identified data were provided by CSC in four separate data files, which we combined by matching on the random study ID code assigned by the CSC analyst: (1) demographic variables (i.e. sex, age, race) and results of the gold standard diagnostic interview; (2) mental health screening results; (3) admissions to treatment centres (accredited hospitals) for intensive mental health treatment and (4) mental health services provided by mental health professionals in regular prisons (i.e. primary care).

Sample

Participants in the current study were those who participated in screening (as part of routine practice) and the diagnostic interview (for research purposes to estimate the prevalence of illness in CSC prisons). The final sample consisted of 467 male inmates admitted to prisons in the provinces of Manitoba, Saskatchewan, and Alberta between January and June 2013, and in the province of Quebec between January and September 2014. Because there were different sampling frames for screening and the prevalence study, we evaluated potential selection biases by defining our eligible study population as all inmates who completed screening between the earliest and latest dates on which inmates who participated in the clinical interviews completed screening (N = 1,017). Of these eligible inmates, 562 (55.3%) were invited to participate in the prevalence study, of whom 83.1% (n = 467) agreed to participate. To ensure that there was no verification bias[28], we compared the 467 inmates included in our sample to the 550 inmates who refused or withdrew their consent prior to completing the interview (n = 95; 9.4%) or were not approached to participate (n = 455; 44.7%). The participation rates were similar for inmates who were referred for follow-up services following screening (47.8% of screened individuals completed the gold standard) and those who were not (45.0% of screened individuals completed the gold standard; see Figure 1). Participants and non-participants were also similar in terms of age (mean age of 36 for both groups) and ethnicity. Among participants, 61% self-reported white race, 24% identified as Aboriginal, and 14% reported belonging to other minority ethnic groups. Among those without a structured diagnostic interview these proportions were similar: 63%, 22%, and 14% respectively.

Measures and procedure

Screening. Inmates complete the computerized screening within 14 days of admission. The screening includes four standardized mental health screening tools - the Brief Symptom

Inventory (BSI)[29], the Depression Hopelessness Suicide Screening Form (DHS)[30], the General Ability Measure for Adults[31] and the Adult Self-Report Screening Scale for Attention-Deficit Hyperactivity Disorder[32] (because the latter two tools screen for intellectual functioning and ADHD, which are not the focus of this study, we do not do not discuss them further). Screening also includes nine mental health history indicators. Three of these indicators pertain to the inmate's current status (diagnosis, psychotropic medication use, hospitalization prior to incarceration). Prior to the implementation of screening, these three indicators were used to identify mental illness and to monitor the prevalence of mental health needs among inmates[33]. Thus, endorsement of any of these three indicators provides a baseline method of case detection at intake to prison against which screening protocols could be compared. The remaining six indicators concern lifetime mental health diagnoses, treatments and self-harm.

The BSI includes 53 items, to which the respondent indicates the frequency at which they have experienced various symptoms of distress in the past 7 days on a scale from 0 (never) to 4 (always). Three overall distress scores and nine subscale scores are calculated by taking the average of the items relevant to that scale. The nine subscales are somatisation, obsessive-compulsive, interpersonal-sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Three overall distress scores reflect the overall rate of distress (the Global Severity Index), the number of symptoms endorsed (the Positive Symptom Total) and the intensity of endorsed symptoms (the Positive Symptom Distress Index). The test authors recommend that a T-score of 63 (based on general population norms) or higher on the Global Severity Index or any 2 of the 9 sub-scales should be used to define 'caseness' (i.e. likely mental illness)[29].

The DHS comprises 39 true-false items, which produce subscale scores for depression, hopelessness and a total score. It also includes ten "critical items" that inquire about current suicide ideation, thoughts supportive of suicide, and historical suicide indicators. Two additional critical items inquire about a past diagnosis of depression and whether the inmate knows someone who has completed suicide. However, slightly more than half of all inmates endorsed one of these twelve items, and few offered incremental predictive validity in the prediction of incidents of self-injury or suicide attempts during the first 180 days following intake to prison[34]. Using a subset of five items reflecting more recent or frequent histories of self-harm and current suicide ideation, the referral rate decreased to 17.7%, with a sensitivity of 84.2% and a specificity of 82.6%. Previously recommended cut-off scores for the DHS are a depression scale score of 7 or higher, a hopelessness score of 2, a total score of 8 or higher[35,36] or any of the 5 critical items regarding current or recent suicide ideation or attempts[34].

Initially, CSC implemented screening where an inmate would be referred if they exceeded a T-score of 65 on the Global Severity Index or any 2 of the 9 subscales on the BSI, if they exceeded a T-score of 60 on any of the DHS scales, or if they reported any of the 12 critical items for suicide risk on the DHS. A preliminary validation study using un-blinded clinical judgment found that this model had a referral rate of 62%, a sensitivity of 86% and a specificity of 52%[37]. In order to reduce the false positive rate, CSC implemented a tree-based scoring model that was developed using the Iterative Classification Tree (ICT) approach to incorporate the multiple tests and mental health history indicators. The model uses recursive partitioning techniques to identify combinations of scores on the various screening tests that best discriminate individuals with mental illness from those without. Groups with a high probability of mental illness (i.e. who score high on multiple scales) are classified as flagged (i.e. referred for further

assessment or treatment), and groups with a low probability of illness (i.e. low scores on multiple scales) are classified as screened out. Inmates who have ambiguous screening results (i.e. score high on some scales but low on others), are designated as unclassified. For inmates who are designated as unclassified, clinicians have discretion whether to refer the inmate (at a minimum they are required to review information from the inmate's medical and prison files). In order to determine staff decisions for unclassified inmates, we retrieved service use data in the 90 days following screening from CSC's electronic records of mental health service contacts and transfers to Treatment Centres. The model was estimated to have a sensitivity between 56 and 88% and a specificity between 69 and 95% depending on how well clinicians responded to unclassified inmates[37]. However, this performance has yet to be replicated in an independent sample.

Gold-standard diagnostic interview. Inmates were interviewed by a research assistant to complete the mood, anxiety and psychotic disorder modules of the Structured Clinical Interview for DSM-IV[38] and the modified Global Assessment of Functioning (GAF) Scale[39] as part of the mental health prevalence study conducted by CSC's research branch. Given that by definition mental illness should cause moderate to severe symptoms or impairment[40], the case definition for this study was a current diagnosis of a mood, psychotic or anxiety disorder plus a GAF score of 60 or less[39]. Diagnostic categories were not mutually exclusive, and thus an inmate could be diagnosed with multiple disorders. Interviewers were blind to screening results, and diagnostic interview results were not shared with screening staff. Interviews typically occurred after screening (n =431; 92.3%), with a range from 38 days prior to screening to 83 days after screening. As only nine (1.9%) participants received treatment between completing screening

and the diagnostic interview, it is unlikely that any bias introduced by treatment between the two tests would materially change our findings.

Analysis

We sought to validate five decision rules that were previously developed and that were embedded within the current battery of screening tests in Canadian prisons. Specifically we validated (1) the ICT model (the decision rule that is currently used when reviewing screening results); (2) the BSI alone (a T-score of 63 or greater on the Global Severity Index, or on two of the nine sub-scales)[29]; (3) the DHS alone (a depression scale score of 7 or higher, a hopelessness score of 2, a total score of 8 or higher[35,36] or any of the 5 critical items regarding current or recent suicide ideation or attempts[34]); (4) referral for an inmate who exceeds the cut-offs on either of the BSI or DHS (which we refer to as simple cut-offs) (5) referral for an inmate who exceeds the cut-offs on both the BSI and DHS (referred to as multiple cut-offs). We compared these screening protocols to the prior case detection method used in Canadian prisons of gathering mental health history information and referring an inmate reporting a current diagnosis, medication use, or recent hospitalization.

We calculated the sensitivity, specificity, and positive and negative predictive values (PPV and NPV) and 95% confidence intervals for each case detection method. The sensitivity of each method to detect mood, psychotic and anxiety disorders are also reported separately as past research suggests higher detection of psychotic than mood disorders[3,4,17].We also report standardized true positive, true negative, false negative and false positive rates per 1,000 inmates screened. Because these rates are most relevant clinically (i.e. they reflect the impact of screening on clinical caseloads) we discuss the results primarily in these terms. These rates are used to identify the conditions under which screening would provide a net benefit. In the absence

of exact costs and benefits of screening, the ratio of how many additional false positives would be identified by screening to identify each additional case can be used to compare options and determine the conditions under which screening would provide a net benefit[41]. If for example there were ten false positives for every true positive, the benefits of treating each true positive would have to be at least ten times greater than the costs associated with false positives to offset the fact that in absolute numbers false positives are more common.

As sensitivity analyses, we calculated the expected number of false positives per additional case detected if the screening protocols were implemented in settings with different prevalence rates and with a lower prior detection rate as drawn from a prior study in British prisons[4]. Since sensitivity and specificity are generally independent of prevalence[23], we conducted the sensitivity analyses in three steps: (1) calculate the number of cases and non-cases based on the prevalence; (2) for each case detection method, estimate the number of true positives and false negatives based on the sensitivity and the number of true negatives and false positives using the specificity; (3) calculate the ratio of false positives per true positive for each screening approach compared to the alternative case detection method (these steps are illustrated in Online supplement S2).

Results

In total, 105 participants (22.5%) met the case definition for mental illness. Table 1 presents the performance of the various protocols to accurately classify inmates' mental health status. 16.3% of inmates were referred based on history taking, whereas the various screening protocols had referral rates between 33.0% and 56.7%. Under the history taking approach, of every 1,000 screenings, only 92 individuals with mental illness are referred, whereas 133 individuals with mental illness are not referred (sensitivity: 41.0%, 95% CI 32.1, 50.6). Under

the various screening protocols, between 139 and 193 individuals with mental illness are referred for every 1,000 screenings (sensitivity ranges from 61.9% to 85.7%). All screening protocols increased the detection rate of psychosis (sensitivity ranges from 84.2 to 94.7%) by approximately one third compared to history taking (sensitivity of 63.2%). However, because of the lower prevalence, there was minimal difference in absolute numbers of detected cases of psychotic disorders (i.e. approximately 2-4 per 1,000 inmates screened) between the screening protocols. The more sensitive screening protocols (e.g. the BSI or DHS alone, or the use of simple cut-offs) result primarily in higher numbers of detected mood and anxiety disorders compared to the more specific screening protocols (e.g. the ICT or the use of multiple cut-offs on the BSI and DHS). For example, of 45 additional true positives per 1000 inmates screened using the simple cut-offs there were an additional 26 detected mood disorders and 34 anxiety disorders (recall that inmates could be diagnosed with multiple disorders). For each additional illness detected by any of the screening protocols, between 2 and 3 additional individuals without illness are also referred relative to history taking. For the screening protocols to be beneficial compared to the prior approach, the benefits of treating a true positive must be at least double the harms associated with a false positive result.

As noted previously, these ratios depend on the prevalence. Table 2 presents the sensitivity analyses, where we calculated the absolute number of false positives per additional true positive for each screening protocol (holding sensitivity and specificity constant) in settings with different prevalence rates. If the prevalence is 10% or less, the screening protocols would result in 4.6 to 16.2 false positives for every additional detected case compared to mental health history taking. Conversely, in settings with a prevalence of 40% the consequences of false negatives must only be similar to those of false positives for screening to be beneficial. In

settings where prior detection rates are lower (e.g. in UK prisons only 25% of inmates with mental illness and 3% without mental illness were assessed by in-reach teams[42]), these ratios are slightly less, but the same pattern emerges that screening is less effective in low prevalence settings.

Discussion

Studies on mental health screening typically do not evaluate the yield of new cases and efficiency of screening relative to usual clinical detection, which may over-estimate both the accuracy and value of screening[7,25]. The ratio of how many additional false positives screening generates in order to detect each new case helps illustrate how tools of varying levels of sensitivity and specificity perform in practice depending on the prevalence of mental illness and the prior levels of detection of mental illness. Others have proposed that this ratio can be used to inform decision making about whether the benefits of screening (e.g. preventing events associated with illness and/or improving recovery rates) outweigh the harms (e.g. costs, inconvenience, and harms of treatments that are inappropriately provided to those who are not ill), after taking into account the relative importance of both types of errors[41]. It is noteworthy that in higher prevalence settings, the number of additional false positives per newly detected case is similar for each of the five screening protocols as compared to history taking. This suggests that despite the emphasis on the psychometric properties of screening tools in the literature, the effectiveness of screening likely depends much more on characteristics of the screened population, and system-level practices and policies that are associated with benefits (e.g. treatments that improve outcomes) for newly detected cases and minimize the costs (e.g. effective triage to avoid un-necessary treatments) for false positives. Since these population characteristics, and practices and policies will likely vary across settings, it is not possible to

make unequivocal recommendations about screening. Therefore, in Figure 2, we summarize our findings regarding conditions under which screening is more likely to be beneficial and when it may be harmful.

Our findings are consistent with prior research that screening is inefficient in settings with low prevalence, even if detection rates of illness are low (e.g. community settings)[18,43,44]. This perspective is reflected by the rates of roughly 5 to 16 false positives per newly detected case in our sensitivity analyses for a prevalence of either 5% or 10%. Screening is more efficient when the prevalence of illness is high, and in particular when prior detection is low (the upper right quadrant of Figure 2) as there will be the greatest number of new cases to detect through screening, and the proportion of false positives will be lower[24]. Nonetheless, the ratio of 2 to 3 false positives per additional true positive indicate that after accounting for cases that would be detected in the absence of screening only one quarter [i.e. 1/(3+1)] to one third [i.e. 1/(1+2)] of new referrals will be for people with a mental illness.

The effectiveness of screening depends on provision of appropriate follow-up of inmates with elevated scores. While this question has received little attention, recent studies in the United Kingdom[45] and Australia[46] both found that approximately 25% of inmates identified by screening did not receive follow-up. Conversely, a recent study in New Zealand showed that mental health caseloads had doubled within 2 years of implementing screening (from approximately 5 to 10%) despite a low screening rate of only 25%. Further work is needed to examine the examine the effect of screening generated referrals on longer-term outcomes. A meta-analysis found that counseling interventions in primary care were more effective for individuals with depression identified through routine clinical practice versus those identified by screening[47]. Inmates with psychotic disorders and mental health histories are often detected by

staff even without screening[3,4], suggesting that these might be the highest need cases based on obvious signs of impairment. Symptoms may resolve naturally for up to half of all inmates reporting depression and anxiety at intake[48,49]. Therefore, many individuals with mental illness that is detected only through screening require little more than close monitoring. It may be of particular value to determine whether individuals who are detected only through longer and more sensitive screening benefit from treatment to the same extent as those who are identify by shorter, more specific screening. If they do not, developing referral pathways that prioritize the urgency of follow-up (see for example the PolQuest[50] screening tool) may be an effective strategy.

The prior discussion has focused on patient outcomes, which should be the primary consideration when deciding whether to screen. Nonetheless, screening results contribute valuable information that can be used for research, quality improvement and resource allocation decisions. Routine screening is a cost-effective and timely way of monitoring changes in rates of mental health symptoms over time, between institutions, or between groups of inmates, and provides valuable information for examining outcomes of persons with mental illness. Accurate estimates of psychometric properties of screening tools can be used in sensitivity/bias analyses in such studies[51]. From an organizational perspective, if the costs of excess assessments are less than the costs that would be devoted to other quality improvement and research activities, screening would be a value added activity that could support better patient outcomes.

Conclusions

Our findings suggest that screening may be beneficial in higher prevalence settings such as jails and prisons. However, given the lack of empirical evidence about the harms and benefits it is unclear how much benefit screening may provide or whether this is cost-effective. It is

important to consider the circumstances unique to the specific context prior to implementing screening (e.g. the prevalence of illness and the current detection rates) to identify whether the conditions are likely to be favourable for the implementation (or continuation) of mental health screening. Given the lack of data about the impact of screening, the yield and efficiency of screening compared to existing practices can provide some insight into the potential value of screening. If screening is implemented or further evaluated through randomized controlled trials to establish its effectiveness, policies and practices that minimize costs and maximize benefits of screening should be considered to increase the likelihood that screening will lead to improved outcomes.

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Table 1. Accuracy (95% CI) of 6 approaches to detect mental illness.

	History taking	ICT	Multiple cut-offs	BSI	DHS	Simple cut-offs
Referral rate	16.3 (13.2, 19.9)	33.0 (28.9, 37.4)	33.2 (29.1, 37.6)	44.3 (39.9, 48.8)	45.6 (41.1, 50.1)	56.7 (52.2, 61.1)
True positives/1000 screens	92	139	148	171	169	193
Mood disorder	54	81	96	109	107	122
Anxiety disorder	60	92	101	118	116	135
Psychotic disorder	26	34	34	39	36	39
False positives/1000 screens	71	191	184	272	287	375
Extra false positives per true positive compared to history taking	--	2.6	2.0	2.5	2.8	3.0
False negatives/1000 screens	133	86	77	54	56	32
Mood disorder	75	47	32	19	21	6
Anxiety disorder	103	71	62	45	47	28
Psychotic disorder	15	6	6	2	4	2
True negatives/1000 screens	704	585	591	503	488	400
Sensitivity	41.0 (32.1, 50.6)	61.9 (52.3, 70.6)	65.7 (56.2, 74.1)	76.2 (67.2, 83.3)	75.2 (66.1, 82.5)	85.7 (77.7, 91.1)
Mood disorder	41.7 (30.1, 54.3)	63.3 (50.6, 74.4)	75.0 (62.8, 84.2)	85.0 (73.9, 91.9)	83.3 (71.9, 90.7)	95.0 (86.3, 98.3)
Anxiety disorder	36.8 (26.8, 48.0)	56.6 (45.4, 67.2)	61.8 (50.6, 71.9)	72.4 (61.5, 81.2)	71.1 (60.1, 80.1)	82.9 (72.9, 89.7)
Psychotic disorder	63.2 (41.1, 80.9)	84.2 (62.4, 94.5)	84.2 (62.4, 94.5)	94.7 (75.3, 99.1)	89.5 (68.6, 97.1)	94.7 (75.3, 99.1)
Specificity	90.9 (87.5, 93.4)	75.4 (70.7, 79.6)	76.2 (71.6, 80.3)	64.9 (59.9, 69.6)	63.0 (57.9, 67.8)	51.7 (46.6, 56.8)
PPV	56.6 (45.4, 67.2)	42.2 (34.7, 50.1)	44.5 (36.9, 52.4)	38.6 (32.2, 45.4)	37.1 (30.9, 43.8)	34.0 (28.6, 39.9)
NPV	84.1 (80.1, 87.4)	87.2 (83.0, 90.5)	88.5 (84.5, 91.6)	90.4 (86.2, 93.4)	89.8 (85.5, 92.9)	92.6 (88.1, 95.5)

Table 2. Number of extra false positives per true positive for varying levels of prevalence and prior detection rates.

Prevalence	ICT	Multiple cut-offs	BSI	DHS	Simple cut-offs
Compared to history taking (41% sensitivity; 90.9% specificity)					
5%	13.4	10.7	13.7	14.7	16.2
10%	6.7	5.3	6.7	7.4	7.8
15%	4.1	3.3	4.1	4.6	4.9
20%	3.0	2.3	2.9	3.3	3.5
25%	2.2	1.8	2.2	2.4	2.6
30%	1.7	1.4	1.7	1.9	2.1
35%	1.4	1.1	1.4	1.5	1.6
40%	1.1	0.9	1.1	1.2	1.3
Compared to detection from Senior et al (2012; 25% sensitivity and 97% specificity)					
5%	10.8	9.4	11.7	12.5	13.9
10%	5.3	4.6	5.6	6.1	6.7
15%	3.3	2.9	3.5	3.8	4.2
20%	2.3	2.0	2.5	2.7	3.0
25%	1.8	1.5	1.9	2.0	2.2
30%	1.4	1.2	1.5	1.6	1.7
35%	1.1	0.9	1.2	1.3	1.4
40%	0.9	0.8	0.9	1.0	1.1

Figure 1. Screening process and participant flow diagram.

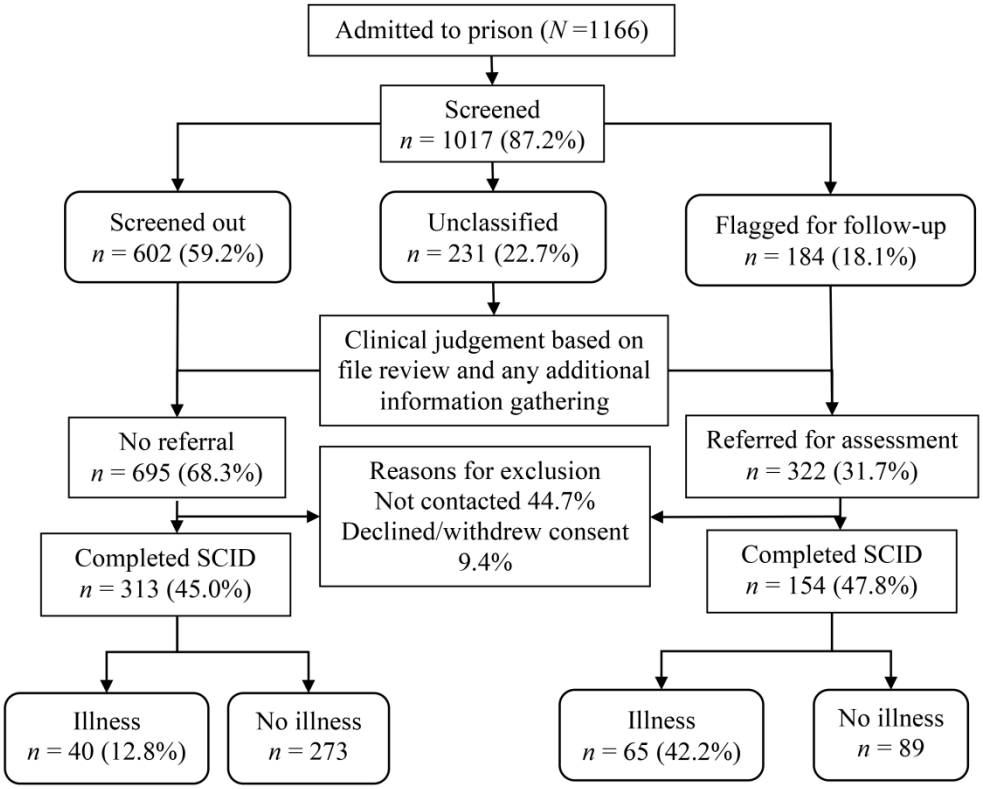
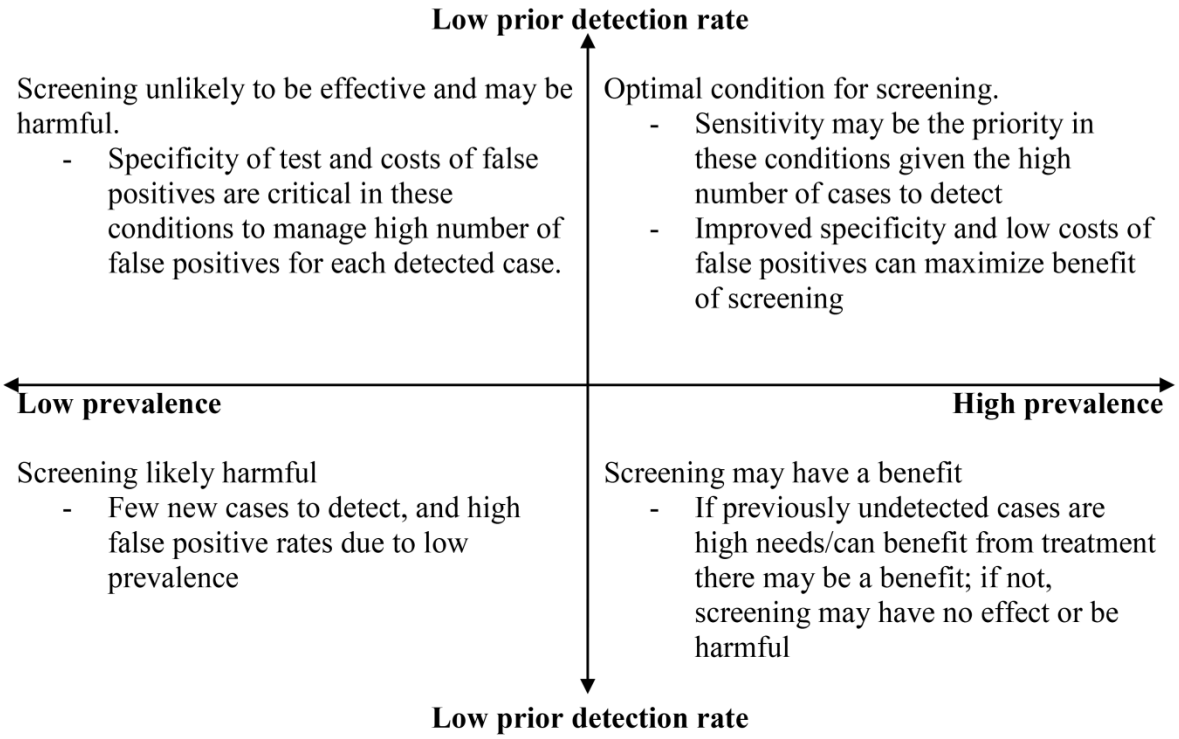


Figure 2. Relationship between prevalence, prior detection rate and potential impact of screening.



Online Supplement S1. STARD Checklist

STARD checklist for reporting of studies of diagnostic accuracy
(version January 2003)

Section and Topic	Item #		On page # (**Note:** page numbers were matched to the manuscript as submitted to the journal, and do not correspond to the pagination in this thesis).
TITLE/ ABSTRACT/ KEYWORDS	1	Identify the article as a study of diagnostic accuracy (recommend MeSH heading 'sensitivity and specificity').	MeSH heading sensitivity and specifity used Abstract indicates that "We compared the accuracy of five screening protocols to detect mental illness in prisons against the use of mental health history taking (the prior approach to detecting mental illness) to identify scenarios under which different screening approaches best balance benefits and harms.
INTRODUCTION	2	State the research questions or study aims, such as estimating diagnostic accuracy or comparing accuracy between tests or across participant groups.	Page 2: "The current study used screening data from a sample of Canadian prisoners to (1) estimate the accuracy of various previously developed screening protocols to detect mental illness in prison; and (2) compare the conditions under which the benefits of screening would outweigh its harms."
METHODS			
Participants	3	The study population: The inclusion and exclusion criteria, setting and locations where data were collected.	Page 2 (see Figure 1 for STAR-D flow diagram) "This study involved secondary analysis of data for a sample of 467 male inmates collected in the course of routine screening of inmates, and from a research study conducted by Correctional Service of Canada (CSC) to estimate the prevalence of mental illness in prison. Data were collected between January and June 2013 in the provinces of Manitoba, Saskatchewan, and Alberta, and between January and September 2014 in the province of Quebec. Inmates were eligible for the current study if they completed screening during this time (N = 1,017) and if they completed the gold standard psychiatric interview (described below). As the prevalence study used a different

			sampling frame from the current study, only 562 (55.3%) inmates who completed screening were invited to participate in the prevalence study, of whom 83.1% (n = 467) agreed to participate."
	4	Participant recruitment: Was recruitment based on presenting symptoms, results from previous tests, or the fact that the participants had received the index tests or the reference standard?	Page 2 (see paragraph for inclusion/exclusion criteria explaining that recruitment is based on completion of the index test and reference standard)
	5	Participant sampling: Was the study population a consecutive series of participants defined by the selection criteria in item 3 and 4? If not, specify how participants were further selected.	Yes – consecutive series
	6	Data collection: Was data collection planned before the index test and reference standard were performed (prospective study) or after (retrospective study)?	Retrospective study (see page 2). This study involved secondary analysis of data for a sample of 467 male inmates collected in the course of routine screening of inmates, and from a research study conducted by Correctional Service of Canada (CSC) to estimate the prevalence of mental illness in prison.
Test methods	7	The reference standard and its rationale.	Page 4: "Inmates were interviewed by a research assistant to complete the mood, anxiety and psychotic disorder modules of the Structured Clinical Interview for DSM-IV[38] and the modified Global Assessment of Functioning (GAF) Scale[39] as part of the mental health prevalence study. Interviewers were blind to screening results, and diagnostic interview results were not shared with prison staff. Interviews typically occurred after screening (n =431; 92.3%), with a range from 38 days prior to screening to 83 days after screening. Given that by definition mental illness should cause moderate to severe symptoms or impairment[40], the case definition for this study was a

			current diagnosis of a mood, psychotic or anxiety disorder plus a GAF score of 60 or less[39].”
	8	Technical specifications of material and methods involved including how and when measurements were taken, and/or cite references for index tests and reference standard.	See pages 3-4 for details about timing of administration of screening and reference standard and references for the tests
	9	Definition of and rationale for the units, cut-offs and/or categories of the results of the index tests and the reference standard.	Cut-offs were based on prior research described on page 5: “we validated (1) the ICT model (the decision rule that is currently used when reviewing screening results); (2) the BSI alone (a T-score of 63 or greater on the Global Severity Index, or on two of the nine sub-scales)[29]; (3) the DHS alone (a depression scale score of 7 or higher, a hopelessness score of 2 or higher[35] or any of the 5 critical items regarding current or recent suicide ideation or attempts[34]); (4) referral for an inmate who exceeds the cut-offs on either of the BSI or DHS (which we refer to as simple cut-offs) (5) referral for an inmate who exceeds the cut-offs on both the BSI and DHS (referred to as multiple cut-offs). We compared these screening protocols to the prior case detection method used in Canadian prisons of gathering mental health history information and referring an inmate reporting a current diagnosis, medication use, or recent hospitalization.“
	10	The number, training and expertise of the persons executing and reading the index tests and the reference standard.	Index tests were completed and interpreted using computers (see page 3).
	11	Whether or not the readers of the index tests and reference standard were blind (masked) to the results of the other test and describe any other clinical information available to the readers.	Double blinding was ensured; the readers of the index and reference tests never had access to the results of the other test. Page 4: “Interviewers were blind to screening results, and diagnostic interview results were not shared with prison

			staff."
Statistical methods	12	Methods for calculating or comparing measures of diagnostic accuracy, and the statistical methods used to quantify uncertainty (e.g. 95% confidence intervals).	Page 5: We calculated the sensitivity, specificity, and positive and negative predictive values (PPV and NPV) and 95% confidence intervals for each case detection method. The sensitivity of each method to detect mood, psychotic and anxiety disorders are also reported separately as past research suggests higher detection of psychotic than mood disorders[3,4,17]. We also report standardized true positive, true negative, false negative and false positive rates per 1,000 inmates screened.
	13	Methods for calculating test reproducibility, if done.	Not done as this was a replication of previously developed tests.
RESULTS			
Participants	14	When study was performed, including beginning and end dates of recruitment.	Page 4: "Data were collected between January and June 2013 in the provinces of Manitoba, Saskatchewan, and Alberta, and between January and September 2014 in the province of Quebec."
	15	Clinical and demographic characteristics of the study population (at least information on age, gender, spectrum of presenting symptoms).	Pages 2-3. "The participation rates were similar for inmates who were referred for follow-up services following screening (47.8% of screened individuals completed the gold standard) and those who were not (45.0% of screened individuals completed the gold standard; see Figure 1). Participants and non-participants were also similar in terms of age (mean age of 36 for both groups) and ethnicity. Among participants, 61% self-reported white race, 24% identified as Aboriginal, and 14% reported belonging to other minority ethnic groups. Among those without a structured diagnostic interview these proportions were similar: 63%, 22%, and 14% respectively." Prevalence of any psychotic, mood or anxiety disorder with moderate to severe impairment was 22.5% (see page

			6). The prevalence by disorder can be calculated from Table 1 by adding true positives and false negatives and dividing by 1000. This gives the prevalence of 4% for psychotic disorder, 12.8% for mood disorder and 16.3% anxiety disorder
	16	The number of participants satisfying the criteria for inclusion who did or did not undergo the index tests and/or the reference standard; describe why participants failed to undergo either test (a flow diagram is strongly recommended).	See figure 1 and pages 2-3: "The participation rates were similar for inmates who were referred for follow-up services following screening (47.8% of screened individuals completed the gold standard) and those who were not (45.0% of screened individuals completed the gold standard; see Figure 1). Participants and non-participants were also similar in terms of age (mean age of 36 for both groups) and ethnicity. Among participants, 61% self-reported white race, 24% identified as Aboriginal, and 14% reported belonging to other minority ethnic groups. Among those without a structured diagnostic interview these proportions were similar: 63%, 22%, and 14% respectively."
Test results	17	Time-interval between the index tests and the reference standard, and any treatment administered in between.	Page 4: "Interviews typically occurred after screening (n =431; 92.3%), with a range from 38 days prior to screening to 83 days after screening. Nine (1.9%) participants received treatment between completing screening and the diagnostic interview, suggesting that it is unlikely that treatment substantial bias our estimates of the performance of screening."
	18	Distribution of severity of disease (define criteria) in those with the target condition; other diagnoses in participants without the target condition.	Page 4: "Given that by definition mental illness should cause moderate to severe symptoms or impairment[40], the case definition for this study was a current diagnosis of a mood, psychotic or anxiety disorder plus a GAF score of 60 or less[39]."
	19	A cross tabulation of the results of the index tests (including indeterminate and missing results) by the results of the reference standard; for continuous results,	Table 1: The values of the cross-tabulation are provided in 4 rows (true positives, true negatives, false positives and false negatives); these numbers have been standardized as

		the distribution of the test results by the results of the reference standard.	rates per 1,000 tests to increase generalizability and ease of presentation, and can be converted back to unstandardized values by dividing by 2.14 (1000/467) if required.
	20	Any adverse events from performing the index tests or the reference standard.	As this is secondary analysis we have no access to this information, but do not anticipate there having been any adverse events.
Estimates	21	Estimates of diagnostic accuracy and measures of statistical uncertainty (e.g. 95% confidence intervals).	See table 1 for sensitivity, specificity, PPV and NPV with 95% confidence intervals
	22	How indeterminate results, missing data and outliers of the index tests were handled.	Indeterminate results exist only for the model currently in use by the prison service. As noted on page 4: "For inmates who are designated as unclassified, clinicians have discretion whether to refer the inmate (at a minimum they are required to review information from the inmate's medical and prison files). In order to determine staff decisions for unclassified inmates, we retrieved service use data in the 90 days following screening from CSC's electronic records of mental health service contacts and transfers to Treatment Centres."
	23	Estimates of variability of diagnostic accuracy between subgroups of participants, readers or centers, if done.	Not done
	24	Estimates of test reproducibility, if done.	Not done
DISCUSSION	25	Discuss the clinical applicability of the study findings.	See discussion section on pages 9-11

Online Supplement S2: Approach to sensitivity analyses

Calculations for sensitivity analyses.

Step 1: Calculate number of true positives, false positives, true negatives and false negatives per 1,000 inmates for the comparison approach to detecting mental illness (mental health history taking)

For example, for a prevalence of 5% (sensitivity of mental health history taking of 41.0% and specificity of 90.9%)

	No illness	Illness	Total
Screened out	863 (950 x 90.9%)	30 (50 – 20)	893 (863 + 30)
Screened in (referred)	87 (950-863)	20 (50 x 41.0%)	107 (87 + 20)
Total	950 (1000-50)	50 (1000 x 5%)	1000

Step 2: Calculate number of true positives, false positives, true negatives and false negatives per 1,000 screenings based on the prevalence of mental illness, sensitivity and specificity of the screening.

For example, for a 5% prevalence, for the ICT model (sensitivity of 61.9% and specificity of 75.4%).

	No illness	Illness	Total
Screened out	716 (950 x 75.4%)	19 (50 – 31)	735 (716 + 19)
Screened in (referred)	234 (950-716)	31 (50 x 61.9%)	265 (234 + 31)
Total	950 (1000-50)	50 (1000 x 5%)	1000

Step 3: Calculate the number of extra false positives per additional detected case (true positive)

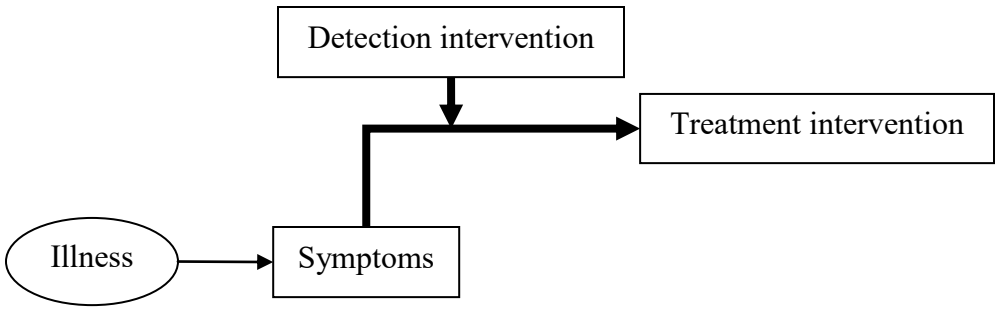
$$\frac{(False\ positives\ for\ screening - False\ positives\ for\ history\ taking}{True\ positives\ for\ screening - True\ positives\ for\ history\ taking} = \frac{(234-87)}{(31-20)} = \frac{147}{11} = 13.4$$

Repeat steps 2 and 3 for each screening protocol and prevalence value.

To compare against a different case detection method, repeat step 1 for the new comparison method, and repeat steps 2 and 3 for each screening protocol and prevalence value as compared to this new comparison standard.

Chapter 7: Impact of screening on service use.

While Chapters 5 and 6 offer some evidence in support of the first portion of the model presented in Figure 1 of this thesis (i.e. improved detection), they do not consider the actions that follow screening. Thus, this chapter addresses the second portion of the model outlining the potential impacts of screening that was presented in Figure 1. It examines whether inmates presenting with potential symptoms of illness receive follow-up treatment intervention.



Given that policy within CSC that it is only the screening result that determines whether a referral is made, this chapter seeks solely to describe the overall population outcomes after screening (rather than for example assessing what factors predict service use). These descriptive statistics can be used as indicators for quality improvement, and they can be directly compared with the psychometric properties of screening (i.e. since the positive predictive value of the ICT scoring model used by CSC was found to be 42.2% in Chapter 6, we would only expect that 40-50% of inmates who are referred would receive treatment). The second aim of this chapter was to determine an appropriate categorization of treatment that could be used in subsequent Chapters.

At the time of submission of this thesis, Chapter 7 was under peer-review (revisions had been invited).

Mental health treatment patterns following screening at intake to prison

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Abstract

Objective. While there is general consensus about the need to increase access to mental health treatment, it is debated whether screening is an effective solution. We examined treatment use by inmates in a prison system that offers universal mental health screening.

Methods. We conducted an observational study of 7,965 consecutive admissions to Canadian prisons. We described patterns of mental health treatment from admission until first release, death, or March 2015 (median 14 month follow-up). We explored the association between screening results and time of first treatment contact, duration of first treatment episode and total number of treatment episodes.

Results. 43% of inmates received at least some treatment, although this was often of short duration; 8% received treatment for at least half of their incarceration. Screening results were predictive of initiation of treatment and recurrent episodes, with stronger associations among those who did not report a history prior to incarceration. Half of all inmates with a known mental health need prior to incarceration had at least one interruption in care, and only 46% of inmates with a diagnosable mental illness received treatment for more than 10% of their incarceration.

Conclusion. Screening results were associated with treatment use during incarceration. However, mental health screening may have diverted resources from the already known highest need cases towards newly identified cases who often received brief treatment suggestive of lower needs. Further work is needed to determine the most cost-effective responses to positive screens, or alternatives to screening that increase uptake of services.

Keywords: Screening; Prisoners; Treatment

Public Health Significance Statement

Screening is frequently recommended to address the fact that the majority of people with mental illness do not receive treatment. This study shows the potential trade-offs between early identification of new cases and ensuring appropriate follow-up for already known cases. The treatment rate of inmates meeting diagnostic criteria was similar to prior studies in the prison context, suggesting little impact of introducing screening.

Mental health screening of prisoners is widely recommended to increase detection and treatment of illness[1,2]. While almost all correctional institutions report mental health and suicide screening[3,4], the use of evidence-based screening tools is rare, and questions vary from mental health history and suicide risk screening to asking about current symptoms[3,5]. Over 80% of inmates receiving treatment in jails and prisons[6,7] and 40-50% of all inmates[8,9] received mental health treatment at some time prior to incarceration. However, it is estimated that between half to three-quarters of inmates with current mental illness are not receiving treatment in prison[10–13], indicating potential under-detection of first episodes of illness or of those illnesses that were undetected in community settings. However, little research has examined whether mental health screening improves access to care. A meta-analysis of RCTs in community primary care settings found little impact of screening versus routine care on the detection and management of mental illness by clinicians[14]. A recent RCT of post-military deployment screening reached a similar conclusion[15].

A number of studies have estimated the accuracy of standardized mental health screening tools in correctional settings; but few have examined whether screening increases service use[16]. Two recent observational studies[17,18] offer a maximum potential benefit of screening in a prison setting of roughly 5% of the screened population. Pillai and colleagues[17] found an increase in the proportion of inmates on mental health caseloads from 5% of the prison population receiving treatment prior to implementing screening to approximately 10% four years later. However, screening was part of a change to the overall model of care, and only 25% were screened, making it unclear how much of the increase in caseload size was attributable to screening. Evans and colleagues[18] identified 24 individuals who were already psychotic and 94 who met ultra-high

risk criteria for psychosis based on screening 2,115 new admissions. Thus roughly 6% of those screened had newly identified illness, although only 3% ultimately received follow-up treatment.

Severity and duration of symptoms of distress reported at intake to jails and prisons are not well studied. Extant evidence suggests that a high proportion of inmates present with symptoms that resolve naturally as they adjust to the correctional environment[19]. This might suggest high rates of either no, or very brief, treatment among inmates with newly detected mental health needs at admission to prison, especially if symptoms resolve naturally during the course of the screening and assessment process. Individual service use patterns are needed to understand resource implications of the clinical contacts that follow a positive screen. To date, no studies have explored this question. To address this gap, the current study sought to examine the relationship between service use patterns in prison and inmates' mental health histories and screening results.

Methods

Sample

We conducted a secondary analysis of data collected by the Canadian federal prison service, responsible for the incarceration of individuals convicted of a criminal charge and sentenced to 2 years or longer. All 7,965 individuals who were admitted to prison following implementation of a revised mental health screening system (start dates varied by institution, between November 2012 and June 2013) until September 2014 were followed for a median of 14 months (range from 0.03 to 28.2); follow-up ended at first release from prison (n = 2199; 27.6%), death (n = 16; 0.2%), or March 2015 (n = 5750; 72.2%), whichever came first. The sample was primarily male (93.6%), with an average age of 35.7 years (SD = 12.3). Most

(58.7%) inmates self-reported White/Caucasian race, 23.4% reported Aboriginal ancestry, 8.5% African/Black race, and 9.4% reported another minority race.

Measures

Mental health screening. As part of routine practice, consenting inmates complete computerized mental health screening between 3 and 14 days after admission. Two standardized measures with established cut-off scores to screen for mental illness among prisoners[20–22] and three mental health history indicators are the focus of this study. The mental health history questions included within the screening capture self-reported psychiatric diagnosis, medication use, or hospitalization in the month prior to incarceration. Consistent with other screening tools such as the Brief Jail Mental Health Screen[23] or the Reception Health Screen used in the United Kingdom (also known as the Grubin tool)[24,25], endorsement of any of these history taking items would lead to referral. For concision, throughout this paper we describe inmates who reported one of these indicators as already known cases.

The Brief Symptom Inventory (BSI)[26] is a 53 item self-report questionnaire. Nine sub-scale scores and a Global Severity Index are calculated as the average item response. A respondent scoring above a T-score of 63 (using general adult population norms) on the Global Severity Index or on 2 of the 9 sub-scales is considered a possible case[26]. The Depression Hopelessness Suicide Screening Form (DHS)[27] is a 39 item questionnaire designed specifically for use with offender populations. Increased risk of self-harm is marked by endorsement of one of five items capturing either a recent (i.e. past 2 year) or multiple past suicide attempts, a history of self-harm or current self-harm thoughts or plan[28]. Depression and hopelessness sub-scale scores are calculated as the number of endorsed items. A score of 7 on the depression sub-scale, or 2 on the hopelessness scale is considered a possible case[29].

Mental health service use. Clinical contacts in regular prisons are documented by staff in the Mental Health Tracking System. Treatment episodes began at the time of the first documented treatment contact for counseling, medication review, crisis intervention, or reintegration planning services. Because treatment end dates were not systematically recorded, an inmate was considered to be receiving treatment if they had at least one treatment contact within the past 30 days. This timeframe was chosen based on the first author's employment experience with the prison service, which frequently included reviewing inmate files. Regularly scheduled appointments are rarely at an interval greater than every two weeks, and typically occur at a shorter interval (i.e. weekly or multiple contacts per week). Given the potential for appointments to be cancelled due to institutional factors (e.g. lockdowns precluding movement, scheduling conflicts, etc.), we assumed that a month or more with no further contact was evidence that the treatment episode had ended. Additionally, each of the prison service's 5 geographic regions has a regional treatment centre, which provides inpatient mental health care for acute and serious mental illness. We extracted admission and discharge dates from a regional treatment centre from the prison's transfer log. Inmates have daily clinical contact while in a treatment centre; thus if an inmate was not already receiving primary care prior to their admission, the admission date represented the start of a new clinical contact (although inmates typically were receiving primary care prior to their admission to a treatment centre admission and thus this represented a continuation of a treatment episode). The discharge date from a treatment centre represented the last clinical contact, and thus a treatment episode ended within 30 days of discharge from treatment centre if the offender did not receive primary care services following their return to a regular prison.

Analysis

We analyzed service use patterns as (1) time to initiation of treatment (i.e. timely access to service); (2) duration of first treatment episode (i.e. as a proxy for severity of symptoms); (3) total number of treatment episodes (i.e. as a proxy for potential premature termination of treatment and/or relapse). We also captured total time in treatment to aggregate the impacts of all three indicators. We are unaware of agreed upon definitions of treatment duration/intensity, although others have used 4 contacts plus medication or 8 contacts without medication as a minimal treatment standard[30,31], and recent clinical guidelines for the management of depression recommend 2-3 months of acute treatment followed by 6 to 24 months of maintenance care[32]. Because there were unequal follow-up times (and some offenders remained incarcerated at the end of the study), we expressed time in treatment in percentages. We categorized those who received treatment as brief (less than 10% of time on a caseload), acute (10-49.9%) or chronic (50% or more) service users. Brief service users typically had a single contact (69%) or 2-3 contacts (26%). 60% of acute service users had between 2-6 contacts and 17% had 7-12 contacts. 75% of chronic service users had 13 or more contacts. Our acute service use definition is within the range of the minimally adequate number of contacts and is comparable to the typical duration of manualized or structured interventions (e.g. a recent systematic review of psychological interventions for prisoners[33] found a range from 10 days to 18 weeks, with a mean of 10 weeks; based on the median follow-up of 14 months, our acute treatment group spent between 1.4 and 7 months in treatment). Our chronic service use definition is aligns with the recent depression management guideline (i.e. a minimum of roughly 7 months in treatment based on the median follow-up of 14 months).

We analyzed the relationship between service use patterns and self-reported recent mental health history, self-harm risk (from the 5 DHS questions previously described), and

elevated distress on the BSI and/or DHS. We were particularly interested whether the association between screening and treatment differed between those with already known mental health needs (who should not require screening) and those who could benefit from screening. All inmates were included in a Cox regression model measuring time from intake to prison to first treatment episode. Only inmates who received treatment were included in analyses of duration of first treatment episode and the proportion of inmates with recurrent treatment episodes. Duration of first treatment episode was analyzed using Cox regression predicting time from the first treatment contact to the end of the treatment episode (inmates whose first treatment episode was ongoing at the end of follow-up were censored). We tested differences in the proportions of inmates with multiple treatment episodes using chi-square tests, which were stratified by screening results.

Finally, as sensitivity analyses, we calculated the proportions of inmates receiving treatment stratified by whether they had a mental illness. These analyses were based on a sub-group of 459 inmates who had completed a diagnostic interview as part of a prior study conducted by the prison service[30]. A clinical research assistant administered the Structured Diagnostic Interview for DSM-IV[31] and the Global Assessment of Functioning[32] scale. Given that by definition mental illness should cause moderate to severe symptoms or impairment[33], in the current study the case definition was a current diagnosis of a mood, psychotic or anxiety disorder plus a GAF score of 60 or less[32].

Ethics. Approval was obtained from the Ottawa Health Science Network Research Ethics Board; the project was also approved by Correctional Service of Canada to ensure compliance with federal legislation (e.g. the Canada *Privacy Act*).

Results

Overall, 43.3% of inmates received at least some treatment. Risk of self-harm and higher distress were associated with more service use, particularly among those without a recent mental health history (see Table 1). Positive hazard ratios appear to reflect higher proportions of inmates receiving treatment, rather than faster access to care (see quadrants A and B of Figure 1). All curves (regardless of self-harm risk, distress levels, or recent mental health history) increased rapidly during the first 50 days after intake, and began leveling off after this point. For all groups, roughly two-thirds to three-quarters of those who received treatment at some point during follow-up had their first contact with a mental health professional in the first 50 days, with a smaller proportion beginning treatment later in their incarceration. For example, for the group with no recent mental health history and reporting low distress and self-harm risk, approximately 15% had been provided with treatment within 50 days of admission. By day 400, this increased to approximately 20% (see quadrant A of Figure 1).

We detected violations of the proportional hazards assumption through the use of Schoenfeld residual analyses and plots (see eFigures 1 and 2); thus hazard ratios in Table 2 are average effects over the entire follow-up that do not apply equally over time[34]. However, averaged hazard ratios approximate the association between screening results and treatment for those whose needs were likely identified only through screening. As described in the online supplement, the hazard ratios were substantially elevated during the first 3 days of imprisonment - prior to availability of screening results - whereas the hazard ratios after screening would be completed were highly similar to the averaged hazard ratio (this is discussed further in the online supplement, and time-varying hazard ratios are presented in eTable 1).

Screening results were weak predictors of treatment duration. Roughly half of those inmates who received treatment had a first treatment episode that lasted 100 days or less,

regardless of screening results or mental health history (see quadrants C and D of Figure 1). The only statistically significant hazard ratio (see Table 1), indicated quicker termination of treatment (i.e. shorter treatment duration) among inmates who reported only elevated self-harm risk; HR = 1.31, 95% CI [1.02, 1.68]. For this group, approximately half of all inmates ended treatment within approximately 50 days (see quadrant C of Figure 1).

There were significant differences in the rates of recurrent treatment episodes (see last 2 columns of Table 1), which were most common among those with a recent history. There were modest differences based on screening results for these known cases ($\chi^2(4) = 10.8$, $p = 0.03$ for test of differences between the 5 groups). The highest rate (58%) of recurrent episodes was among those reporting both high distress on the BSI and self-harm risk on the DHS. While differences were small between remaining groups, the proportion of inmates with recurrent episodes decreased as the severity of needs reported at intake increased (i.e. from 53% of those reporting neither distress nor self-harm risk to 46% who reported self-harm risk). Screening results were also associated with recurrent treatment among those without a recent psychiatric history ($\chi^2(4) = 42.7$, $p < .001$; see Table 2). Recurrent episodes were most common among those reporting higher needs at intake. Between 37 and 39% of those reporting self-harm risk and/or distress on both the BSI and DHS had multiple treatment episodes, compared to 29% of those reporting distress on either the BSI or DHS (but low self-harm risk) and 21% of those reporting neither self-harm risk nor distress.

The composite outcome analyses examined the incremental impacts of more intensive screening on service use. We proceeded through a series of potential case detection protocols that would entail offering the shortest screen possible to each inmate (see Figure 2 for graphical representation). Since those with a recent history would by definition not require screening (i.e.

screening aims to detect unknown illness), and screening results were less predictive among those with a recent history, the first proposed step is mental health history taking. This would identify 25% of the population, of whom 17% went on to be chronic service users. Among those who did not report a recent mental health history, each successive screening step had a higher referral rate, but a lower rate of chronic service use (similar patterns were seen for acute service use). 10% of inmates who did not report a recent mental health history reported at least one self-harm risk factor, of whom 8% went onto use chronic services. Among those proceeding to the mental health screen, 18% exceeded both tests' cut-offs (of whom 6% were chronic service users), and 26% exceeded either test's cut-offs (of whom 3% went on to be chronic service users).

Sensitivity analyses supported the main analyses (see Table 2). They confirm the high sensitivity of screening given that of the 82 inmates with illness who were assessed, 70 (85%) were detected by screening. They also reveal the high false positive rate given that in absolute numbers there are more inmates who are not ill but screen positive (n = 88). Surprisingly, there were an additional 149 inmates without illness who were assessed, despite screening negative. When examining inmates who progressed to receive at least some treatment, 69% (95% CI 63, 76; n = 132] did not have an illness; most of these inmates received either very brief or short-term treatment (i.e. less than 50% of their sentence). Of the 105 inmates with a diagnosable illness, only 17% [95% CI 10, 25] received chronic treatment and 29% [95% CI 20, 38] received an acute intervention; 54% received either no or very brief treatment. Analysis of clinical decision making stratified by screening results (Table 3) found that clinicians were only modestly more likely to provide treatment following a referral to an inmate with mental illness. While confidence intervals around the estimates are wide (due to small samples), the difference

in the proportions of inmates progressing to treatment following clinical contact when matched by screening result ranged from 4.8 to 7.9% higher rates of treatment among those meeting diagnostic criteria than those not meeting criteria. Exceptionally, inmates reporting self-harm risk (but no recent mental health history) were 12.1% more likely to receive treatment if they were not ill than if they were ill.

Discussion

To our knowledge this is the first examination of patterns of service use following mental health screening in a prison setting. Screening has the admirable aim of early detection and treatment. Findings supportive of earlier detection and treatment included the high proportion of inmates (43%) who received treatment, most of whom had their first contact within the first 2 months of incarceration. The positive association between screening results and initiation of service use was consistent with the fact that the screening tools used in Canadian prisons have psychometric properties that are comparable to the best studied tools (i.e. the sensitivity [75%] and specificity [71%] meet the threshold set by NICE in their recent guideline that screening should have a minimum sensitivity and specificity of 70%, which only one other screening tool that has been studied has met[16,25]). However, our sensitivity analyses raised questions whether the right offenders received treatment. While these analyses are limited by the fact that diagnoses were available only at intake to prison (and thus we cannot determine whether some of the inmates who originally did not meet diagnostic criteria developed illness during their incarceration), we found that 69% of inmates receiving treatment did not have mental illness. The finding that only 46% of inmates with mental illness received more than a very brief intervention is similar to previous estimates that half to three quarters of inmates with mental

illness have either fully or partially unmet need[10–12], despite the implementation of extensive screening.

In many areas of medical research it has been noted that screening can result in overdiagnosis (i.e. treatment of needs that would not cause impairment and/or would remit spontaneously)[35] and over-use of treatment by low needs cases; this can divert resources from higher need cases if resources are fixed[36–39]. The finding that the first treatment episode was of similar (and relatively short) duration regardless of screening results, but that inmates reporting recent mental health histories and more distress were more likely to have recurrent treatment episodes, might reflect this concurrent over and under-use challenge. Recurrent treatment episodes may be a sign that treatment was prematurely terminated[40] for a range of reasons (e.g. resource issues, offenders withdrawing consent, transfers between institutions, etc.). Since we did not have reliable data regarding reasons for terminating treatment, we cannot clearly distinguish recovery from interruptions in care and other reasons for terminating service (e.g. offenders withdrawing consent, transfers between institutions, resource issues, etc.). Past research suggests that while refusal of treatment may have contributed at least in part to interruptions in care or shorter duration of treatment than what was required, it is more common for services to not be offered; for example in the UK, Jakobwitz and colleagues[13] found it was more than five times more likely that needs (excluding substance abuse) were unmet because services were not offered (51%) than because inmates refused services (8%)

Longitudinal studies suggest that up to half of inmates who report elevated distress at intake (using measures similar to the tests contained in the current screening) no longer report distress within a relatively short period (e.g. 4 weeks)[19], although distress may be more enduring among women[9]. The over-use hypothesis would suggest that the provision of treatment to

inmates who were not mentally ill but were identified by screening (as well as those who were referred through other processes despite screening negative) detracted from the time available to staff to provide un-interrupted care to those with the highest needs. Given that the screening tools used in the current study perform comparably to the best studied tools in a prison context, if the over-use hypothesis is correct, further work may be needed to improve the accuracy of follow-up triage or assessment (e.g. development and implementation of standardized triage and assessment tools). This work might be especially warranted in responding to the high number of referrals of inmates who screened negative and were not ill, half of whom went onto receive at least some treatment.

An alternative hypothesis to the over-use hypothesis is that short-term treatment offers benefit by preventing adverse outcomes associated with distress and/or prevents the subsequent onset of illness[41]. If this hypothesis is true, the current findings would suggest a need for additional resourcing or to explore the use of more cost-effective interventions such as group treatment in order to reduce the proportion of recurrent treatment episodes or unmet needs. From a policy maker perspective, however, if additional resources cannot be obtained, there is a need to establish how to most efficiently use existing resources. Based on the current results, it appears as though the highest need cases in terms of length of involvement with clinical services are those who were already known to mental health services. Ensuring un-interrupted, high quality care for these inmates should be the first priority before implementing screening. While it is difficult to measure issues such as over-diagnosis and over-use, others have drawn on simulations[42] or clinical/anecdotal experience[43] to arrive at similar conclusions that with fixed resources, a greater return on investment could be achieved through better care of already known cases than pursuing detection of new cases through screening.

The current study examined the traditional model of screening all prisoners, followed by a triage and/or full assessment for those who obtain a positive screen in order to determine treatment needs[17,25,44]. This is also consistent with the USPSTF recommendation for screening in community primary care settings, which notes that "all positive screening results should lead to additional assessment that considers severity of depression and comorbid psychological problems [...], alternate diagnoses, and medical conditions"[45(p382)]. Others such as the National Institute for Care and Excellence[46] recommend either watchful waiting/enhanced monitoring or low-intensity self-directed interventions as a first response to a positive screen, in light of the fact that positive predictive values of screening tests are typically around 30-40%. Similarly, some research on interventions to prevent onset of depression has used a positive screening result to identify those at risk of developing depression with progression directly to a typically group-based preventive intervention[41].

Further work could determine whether these alternative models of follow-up for positive screens could offer greater value in prisons. For example, very brief group programs could be offered either universally (i.e. to all inmates with no known history of mental illness) or selectively (i.e. to all inmates screening positive in lieu of the traditional triage and assessment model). Targets of this programming might focus on issues related to the initial shock of incarceration (e.g. loss of contact with family and social supports, loss of privacy, concerns for safety, etc.) that may manifest as symptoms of distress on screening. These could potentially be of equal or lesser cost than providing screening and individual follow-up assessments, and would intervene on rather than simply assessing needs. Alternatively, the traditional screening model (especially for common mental disorder) might be more efficient if administered later after intake to allow inmates to adjust to prison routines[47]. If screening is implemented as a preventive

service, Evans and colleagues'[18] model that anticipated relatively brief intervention as part of an early intervention and prevention service that was separate from the usual in-reach service warrants further attention. Future work could test whether this model can mitigate against our findings where resources may be diverted from higher to lower need cases.

The current study represents the first description of longitudinal patterns of service use following screening of prisoners. Findings suggest a state of equipoise regarding the impact of screening on service use, in light of the fact that the screening tools seem valid and to lead to timely responses, although long-term service use patterns are more difficult to interpret. The absence of repeated measures of distress or symptoms limited our ability to make definitive conclusions about competing hypotheses discussed above. Furthermore, the focus of this work was on time in treatment and interruptions in care as these represent an extension of point in time estimates of detection rates of illness. However, improving outcomes for persons with mental illness requires not only detection and initiation of treatment, but also that the appropriate treatment is provided to meet the needs of the offender. We could not evaluate clinical decision making and treatment planning to determine how well clinicians respond to referrals following screening. This represents another important further direction, as issues at these follow-up stages could suggest a need for more structured diagnostic tools and/or greater use of manualized or structured treatment programs that have demonstrated efficacy[33,48]. Randomized controlled trials that evaluate different responses to positive screens or alternatives to screening (such as the universal and selective interventions discussed above) warrant consideration as one approach to address these questions. While the high prevalence of mental illness among inmates is well documented, and distress is common at intake to prison, evidence is lacking regarding the longitudinal course of symptoms and treatment needs. A clear understanding of trajectories of

onset, recovery and recurrence of mental illness is needed to identify if and when screening should be offered, and to guide appropriate actions in response to positive screening results.

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Table 1. Hazard ratios for screening results as predictors of time to start and end of first treatment episode and proportions with recurrent treatment episodes [95% Confidence Intervals].

	Time to start of treatment[a]		Time to end of treatment[b]		Recurrent episodes	
Screening cut-offs	No history	History	No history	History	No history	History
Low self-harm risk						
None	REF	REF	REF	REF	21% [18, 24]	53% [44, 62]
Simple	1.42 [1.26, 1.62]	1.44 [1.12, 1.85]	1.01 [0.89, 1.16]	1.18 [0.92, 1.53]	29% [24,33]	51% [43, 60]
Multiple	2.38 [2.10, 2.70]	1·59 [1·29, 1·97]	0.98 [0.86, 1.12]	1.03 [0.83, 1.28]	37% [32, 42]	47% [42, 52]
High self-harm risk						
Low distress on BSI	2.27 [1.78, 2.90]	1.53 [1.16, 2.01]	1.31 [1.02, 1.68]	0.78 [0.59, 1.04]	39% [28, 50]	46% [36, 56]
High distress on BSI	3.43 [2.93, 4.02]	2.11 [1.73, 2.58]	1.06 [0.90, 1.24]	0.92 [0.75, 1.13]	38% [31, 44]	58% [53, 62]

[a]Deviance test comparing a main-effect only model versus a model with an interaction term between screening results and mental health history was statistically significant, $\chi^2(4) = 22.2$, $p < .001$.

[b] Deviance test comparing a main-effect only model versus a model with an interaction term between screening results and mental health history was statistically significant, $\chi^2(4) = 14.2$, $p = .007$.

Table 2. Rates of treatment stratified by presence or absence of illness.

	Ill (n=104)		Not ill (n=355)	
	n	% [95% CI]	n	% [95% CI]
Any treatment	59	57 [47, 66]	132	37 [33, 42]
Proportion of sentence in treatment				
<10%	11	11 [5, 16]	70	20 [16, 23]
10-49%	30	29 [20, 38]	47	13 [10, 16]
50% +	18	17 [10, 25]	15	4 [2, 6]

Table 3. Treatment provision following referral in relation to screening results.

	Ill		Not ill		
	n (assessed)	% Treated	n (assessed)	% Treated	Difference in % treated [95% CI]
Screen positive	70	74.3%	88	69.3%	5.0 [-9.1, 19.0]
History	41	82.9.%	32	75.0%	7.9 [-11.0, 26.8]
Self-harm	15	53.3%	26	65.4%	-12.1 [-43.2, 19.1]
Multiple	14	71.4%	30	66.7%	4.8 [-24.3, 33.8]
Negative screen	12	58.3%	149	47.7%	10.7 [-18.3, 39.7]
Simple	8	62.5%	48	56.3%	6.3 [-30.1, 42.6]
None	4	50.0%	101	43.6%	6.4 [-43.5, 56.4]

Figure 1. Survival curves for time to treatment initiation and termination.

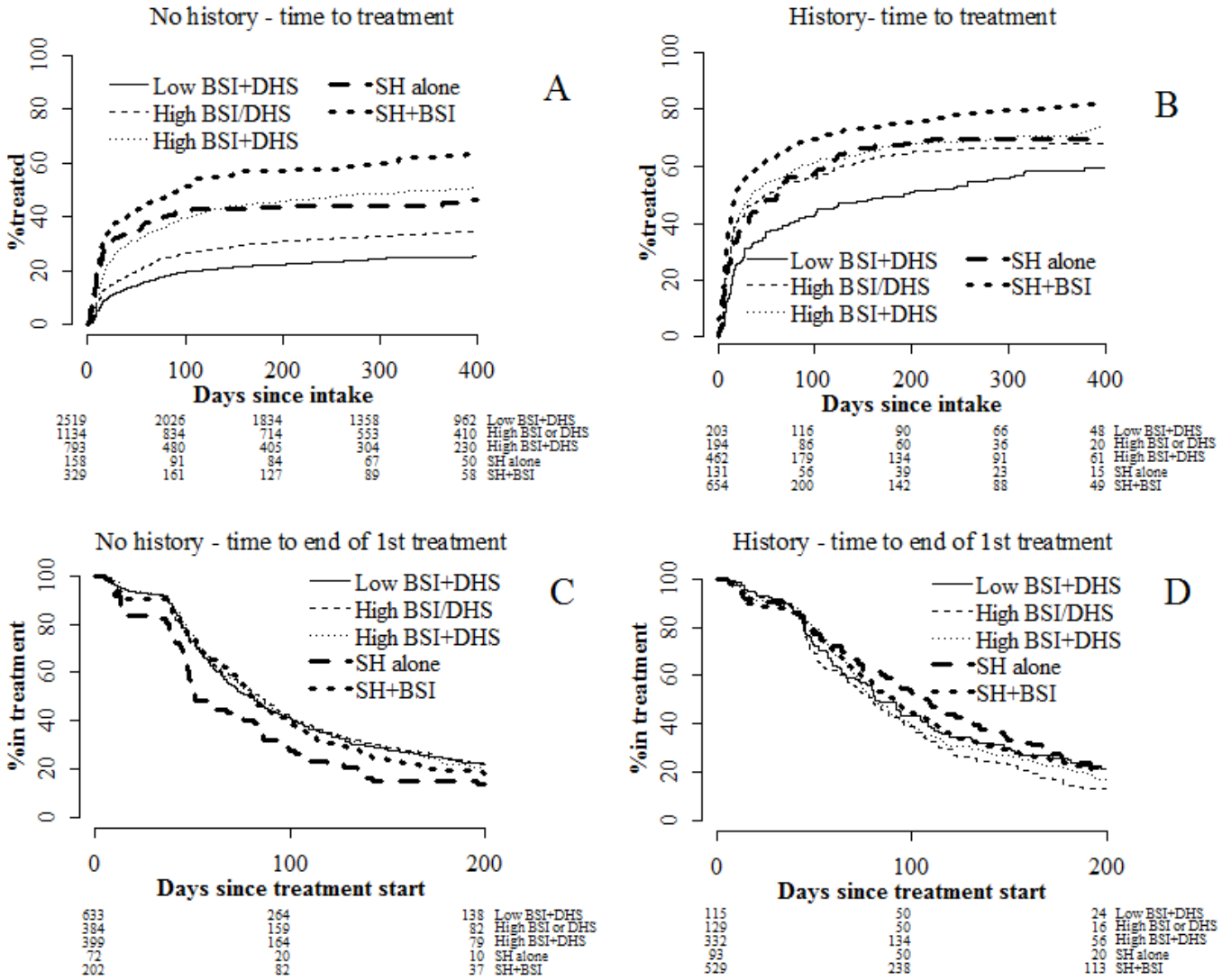
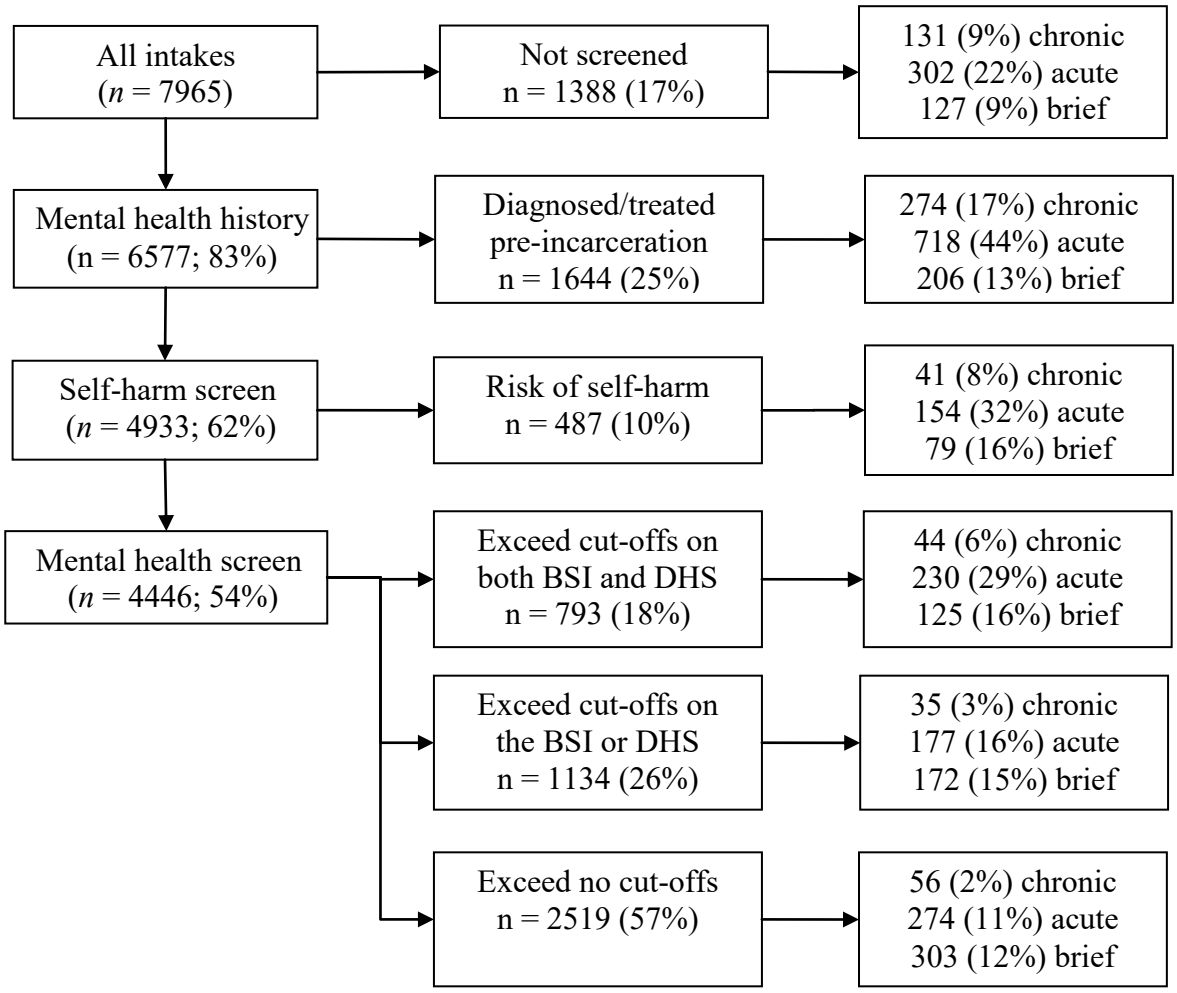


Figure 2. Percentage of referrals and service use by those referred at each possible screening step.



Online Supplement

As was seen in Figure 1 of the manuscript, there was some evidence of non-constant hazard ratios for the prediction of receiving any mental health treatment. This was particularly evident with the crossing curves for the multiple cut-off and self-harm risk only groups of the no history plot. We examined Schoenfeld residual plots displaying time-varying regression coefficients (and accompanying statistical tests of the correlation between regression coefficients and time[1]) to evaluate the impacts of non-constant hazard ratios. The plots (eFigures 1 and 2), suggested a quick decrease in hazard ratios (i.e. within 3 days) for those with a mental health history and risk of self-harm, whereas distress seemed to be associated with a decreasing hazard ratio around 30-60 days (this is also consistent with the survival curves in the main manuscript, which began to flatten out around 50-60 days).

Corresponding to what was seen in the plots, we divided the data into 3 time periods: early incarceration (first 3 days), the intake assessment period (days 4-60) and later incarceration (beyond 60 days). Tests for proportional hazards for a model including the interaction between these three time periods suggested that the proportional hazards assumption was met in this model, with an omnibus test p value of .998, and correlations between beta and time ranging between -0.01 to .00 when rounded to two decimals (with *p* values between .71 and .99; as noted by Therneau and colleagues this is expected given that the time strata were created based on the residual plots[2]). Separate survival analysis models for each of the 3 time periods are presented in eTable 1. It should be noted that once an inmate starts treatment they are no longer included in subsequent analyses, and thus the samples are not comparable between the three time periods. In effect, these stratified analyses answer different questions. The early incarceration analyses examine the association the association between screening results and service use for the entire population. This shows the

urgency with which self-harm risk - and in particular among those without a recent mental health history - is attended to in a prison setting. It should be noted that the screening results would not be available to staff at this time, and thus it reflects clinical detection of need that occurs even in the absence of the computerized screening. The 4-60 day period examines the effect of screening results for those who are not immediately detected upon intake (and thus the group who stand to benefit from the computerized screen). The fact that the hazard ratios in the 4-60 day post-intake period are highly similar to the averaged hazard ratios presented in the main manuscript reflects the fact that this is the time period immediately following the administration of the screening tests, and during which the majority of treatment was initiated.

The analyses post 60 days shed some light on the course of untreated distress or mental health needs (reflecting either inappropriate clinical judgment to consider a case a false positive, or the effect of deteriorating mental health among those who may have been at risk or vulnerable to develop mental illness) or alternatively of resource implications leading to inmates being waitlisted for treatment. They capture the hazard ratio that an inmate who was not provided treatment in the first 60 days, subsequently did start receiving treatment. Thus weakening hazard ratios are not surprising, given that there is a selection bias at play insofar as inmates who access treatment more quickly are likely higher need individuals. Furthermore, as more time lapses following screening, there is more opportunity for symptoms to fluctuate, potentially narrowing differences between groups if those who had higher symptoms at intake improve and/or those who did not report symptoms develop them. It is possible that accounting for events that arise during incarceration and/or repeated measures of symptoms would reduce (or eliminate) this trend of time-varying hazards.

As noted in the main manuscript, these findings suggest a more nuanced interpretation of the results. However, the general pattern of findings holds that screening results were more strongly predictive among those without a recent treatment history. As the most pronounced differences in hazard ratios were in the first three days, it is important to note that these hazard ratios are based on a relatively small group of inmates (n = 257; 3.2% of all intakes) compared to the 2149 inmates who had a first clinical contact between days 4 and 60, and 1046 whose first contact came more than 60 days after intake. Further work is needed to understand the differences between these groups to better understand how their needs are prioritized, whether these decisions are appropriate, and to understand whether it is possible to better distinguish these needs at the screening stage.

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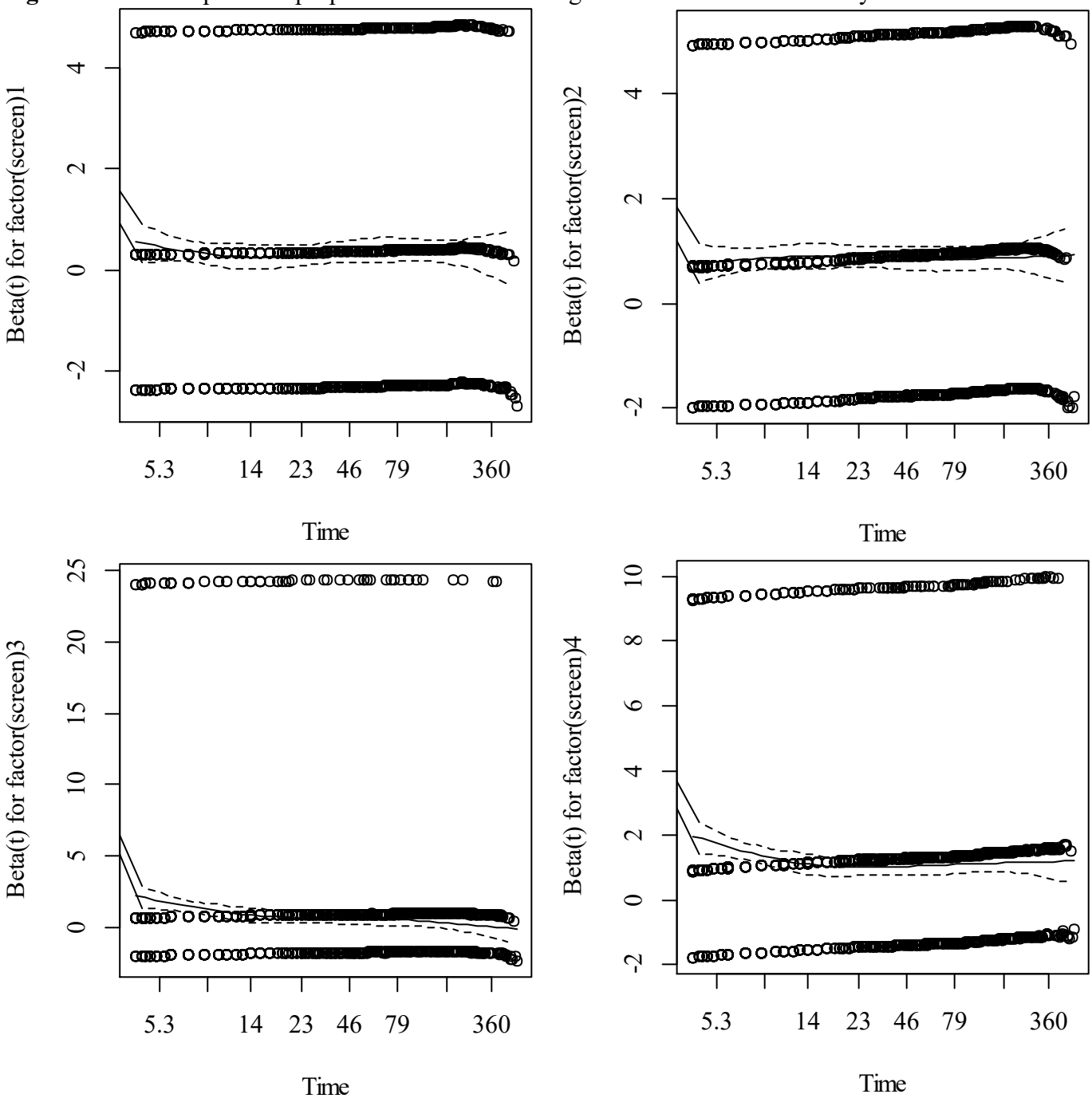
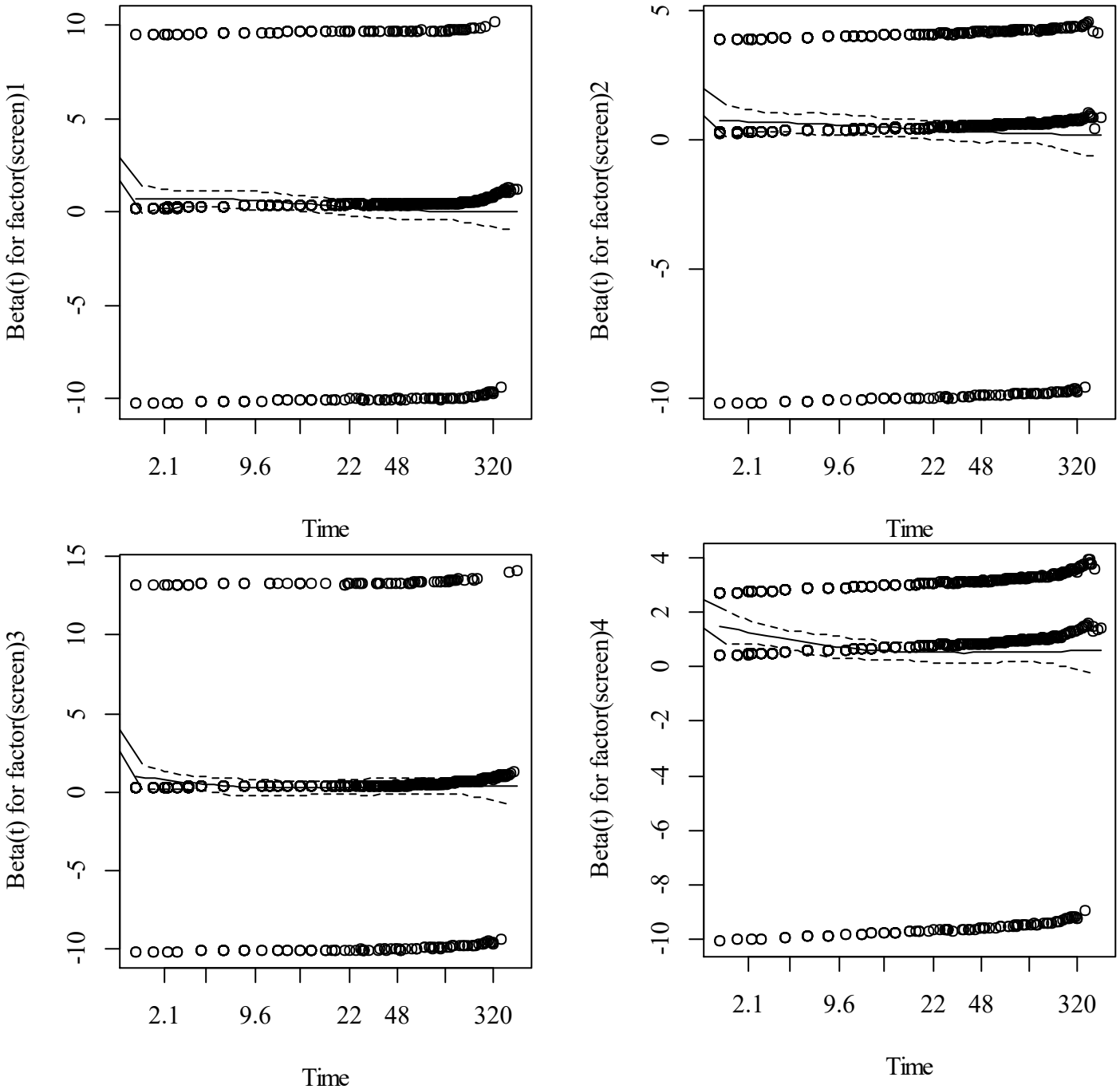
eFigure 1. Residual plots for proportional hazards among those with no recent history



Note. Screen is the 5 level variable used to capture combinations of self-harm risk and distress. 1 = Low self-harm risk and exceeding cut-offs on the DHS or BSI; 2 = Low self-harm risk and exceeding cut-offs on the BSI and DHS; 3 = High self-harm risk and exceeding cut-offs on the DHS or BSI; and 4 = High self-harm risk and exceeding cut-offs on the DHS and BSI. Beta(t) is the regression coefficient for the level against the reference category of screen = 0 (which represents low self-harm risk and scores below the cut-offs on both the DHS and BSI) at the time shown on the x-axis

eFigure 2. Residual plots for proportional hazards among those with a recent history



Note. Screen is the 5 level variable used to capture combinations of self-harm risk and distress. 1 = Low self-harm risk and exceeding cut-offs on the DHS or BSI; 2 = Low self-harm risk and exceeding cut-offs on the BSI and DHS; 3 = High self-harm risk and exceeding cut-offs on the DHS or BSI; and 4 = High self-harm risk and exceeding cut-offs on the DHS and BSI. Beta(t) is the regression coefficient for the level against the reference category of screen = 0 (which represents low self-harm risk and scores below the cut-offs on both the DHS and BSI) at the time shown on the x-axis

eTable 1. Time varying hazard ratios [95% Confidence Intervals]

	No history			History		
	First 3 days	Day 4-60	>60 days	First 3 days	Day 4-60	>60 days
Low self-harm risk						
None	REF	REF	REF	REF	REF	REF
Simple	2.09 [1.03, 4.22]	1.38 [1.17, 1.62]	1.46 [1.18, 1.81]	2.10 [0.63, 6.99]	1.54 [1.13, 2.10]	1.18 [0.74, 1.90]
Multiple	2.60 [1.25, 5.40]	2.32 [1.98, 2.72]	2.49 [2.01, 3.08]	2.33 [0.80, 6.80]	1.71 [1.31, 2.23]	1.29 [0.88, 1.90]
High self-harm risk						
Low distress on BSI	8.14 [3.48, 19.03]	2.61 [1.95, 3.49]	1.12 [0.63, 2.01]	1.56 [0.39, 6.22]	1.48 [1.05, 2.09]	1.71 [1.06, 2.77]
High distress on BSI	9.42 [4.84, 18.32]	3.28 [2.69, 4.00]	3.13 [2.32, 4.21]	5.79 [2.11, 15.85]	2.02 [1.56, 2.60]	1.86 [1.29, 2.67]

Chapter 8: Regional and demographic differences in mental health service use following screening among prisoners

This Chapter expands on the findings of Chapter 7 to examine whether there are differences in screening results or uptake of treatment based on regional or demographic differences. While there may be numerous variables that affect whether or not an inmate will report symptoms and subsequently whether they receive treatment following screening, I focus on three that are major priorities of correctional administrators (in particular CSC) - sex, racial and geographic/regional differences. In this Chapter, I explore potential differences that could reflect variations in service use prior to incarceration due to availability of services in different areas, or individual characteristics that may influence help seeking and/or treatment satisfaction and outcomes.

Mental health screening and differences in access to care among prisoners

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Abstract

Background. Disparities in mental health care exist between regional and demographic groups. While screening is recommended as part of a correctional mental health strategy, little work has been done to explore whether it can narrow disparities. Since screening cannot address all barriers to treatment, and the fact that these may differ between groups, we compared potential impacts of screening based on (1) sex, ethnic and regional differences in screening detection rates, and (2) rates of service utilization in relation to screening results. **Methods.** We followed a retrospective cohort of all 7,965 admissions to the prison system offering universal screening for a median of 14 months. **Results.** Males and inmates of non-Aboriginal minority racial groups had lower rates of mental health service use prior to incarceration. These differences generally persisted, as there were lower rates of treatment during incarceration among those who were identified as potential new cases by screening. Regional differences in pre-incarceration treatment rates were considerably narrowed during incarceration, although differences in rates of shorter interventions were noted. **Implications.** Regional, sex and racial differences in mental health treatment rates prior to and during incarceration warrant further attention to ensure responsiveness of mental health care to diverse demographic and geographically defined populations. While screening may improve access to care in some groups, greater attention to barriers to care is needed to identify optimal solutions to increase appropriate treatment uptake.

While many inmates with mental illness self-report and/or have documented contacts with mental health services immediately prior to their arrest[1–5], between 50-75% of inmates with mental illness have unmet needs for treatment during incarceration[6–8]. Understanding barriers to accessing mental health care is the first step in identifying solutions. Among individuals in the community, Mojtabai and colleagues[9] found that attitudinal barriers to accessing care (e.g. preference to manage on their own, stigma or perceived ineffectiveness of services; 97%) or not perceiving a need for care (45%) are more common than structural barriers (e.g. availability of services and knowledge of how to access them; 22%). Similar barriers have been reported within prisons, although the frequency of these barriers has not been quantified[10].

Mental health screening is recommended as part of a correctional mental health system[11–13]. However, the impact of screening on increasing uptake of mental health services in correctional settings is understudied[14]. In community primary care settings, a number of recent evidence syntheses have reported little or no impact on service use[15–17], although the United States Preventive Services Task Force[18] recently maintained its recommendation to screen as part of an integrated model with appropriate follow-up services in place. Individuals who did not access care due to structural barriers would likely benefit more from screening than those who report attitudinal barriers, as the latter may under-report symptoms and/or refuse treatment. Mojtabai and colleagues reported that groups that are over-represented in prison - i.e. those who are younger, of minority race, and with more severe illness - are more likely to report structural barriers to accessing care, and that women are more likely to perceive a need for care[9].

While there is limited data on the subject, inter-provincial differences in access to mental health care seem to exist in Canada. Self-reported past-year prevalence of any mental health service use (collected in 2002) among respondents 15 and older ranged from 6.7 to 11.3%[19],

whereas age-standardized rates of hospital discharges for mental health reasons ranged from approximately 500 to 1500 discharges per 100,000 population in 2014[20].

Because duration of untreated symptoms is predictive of prognosis[21,22], inequities in access to care prior to incarceration could manifest as longer service use patterns among under-served groups following screening at intake to prison. To examine potential differential impacts of screening, we explored gender, racial and regional differences in (1) proportions of inmates identified through mental health screening, and (2) service use patterns following screening.

Methods

Sample

We conducted a retrospective cohort of all 7,965 admissions to the Canadian prison system (i.e. those sentenced to 2 years or longer of incarceration) following implementation of a revised mental health screening system. Start dates varied by institution, between November 2012 and June 2013, with the final admission in September 2014. Median follow-up was 14 months (range 0.03 to 28.2), ending at first release from prison (27.6%), death (0.2%), or March 2015 (72.2%), whichever came first. The sample was primarily male (93.6%), with an average age of 35.7 years (SD = 12.3). The majority (58.7%) of inmates self-reported White/Caucasian race, 23.4% reported Aboriginal ancestry, 8.5% African/Black race, and 9.4% reported another minority race.

Measures

Mental health screening. Consenting inmates complete computerized mental health screening between 3 and 14 days after admission to prison. We focus on two of the screening measures that are validated to predict mental illness[1,23,24]. The Depression Hopelessness Suicide Screening Form (DHS)[25] is a 39 item questionnaire designed specifically for use with offender

populations. Increased self-harm risk is indicated by endorsement of one of five items capturing a recent (i.e. past 2 years) or multiple prior suicide attempts, history of self-harm, or current thoughts of or a plan to self-harm[26]. Depression and hopelessness sub-scale scores are calculated based on the number of endorsed items. A score of 7 on the depression sub-scale, or 2 on the hopelessness scale is considered a possible case[27]. The Brief Symptom Inventory (BSI)[28] is a 53 item self-report measure of psychological distress. Nine sub-scale scores and a global severity index are calculated as the average item response. A respondent scoring above a T-score of 63 (using general adult population norms) on the Global Severity Index or on 2 of the 9 sub-scales is considered a possible case[28].

We used items from the screening regarding self-reported diagnosis, psychotropic medication use, and hospitalization in the month prior to incarceration to distinguish already known from newly identified cases.

Mental health service use. Clinical contacts in regular prisons are documented by staff in the Mental Health Tracking System. Because treatment end dates were not systematically recorded, an inmate was considered to be receiving treatment if they had at least one contact with a mental health professional for counseling, medication review or crisis intervention within the past 30 days. Second, each of the prison service's 5 geographic regions has a regional treatment centre, which provides 24 hour inpatient mental health care for acute and serious mental illness. When an inmate is admitted to or discharged from a regional treatment centre, this is captured in the prison's electronic case management system's transfer log. We extracted admission and discharge dates for treatment centre admissions from this system.

Analysis

We explored demographic and regional differences in detection rates and service use patterns using chi-square analyses. Following prior work[29], we created mutually exclusive groups in relation to the least amount of information that would result in identifying potential mental health needs. These groups were defined as those who (1) did not complete screening; followed by those who reported (2) an identified mental health need immediately prior to incarceration; (3) one of the 5 DHS critical items for self-harm; (4) elevated distress on both the BSI and DHS. Treatment during incarceration was categorized based on whether the inmate was never treated, or a brief (in treatment for less than 10% of their incarceration), acute (10-49.9% of time in treatment) or chronic (50% or more of time in treatment) service user.

Ethics. Approval was obtained from the Ottawa Health Science Network Research Ethics Board; the project was also approved by Correctional Service of Canada to ensure compliance with federal legislation (e.g. the Canada *Privacy Act*).

Results

Demographic comparisons are shown in Table 1. Women were more likely than men to report a recent mental health history (45% vs 24%; $p < .001$). Among those not reporting a recent history, women were more likely to report increased risk of self-harm (17% vs. 10%). Women (25%) were also more likely than men (17%) to not be screened, potentially reflecting already known mental health needs. There was no difference in the proportion of newly detected mental health needs as 18% of both men and women (without a recent history or elevated self-harm risk) reported elevated distress on both the BSI and DHS. Within strata defined by mental health history, self-harm risk and distress, women were more than twice as likely to be chronic service users during incarceration than men. While this difference was slightly weaker (and not

statistically significant) among those who did not complete screening, women were approximately 1.5 times more likely (13% versus 9%) to be chronic service users than men.

All racialized groups (Aboriginal, Black, and other) had higher rates of non-completion (ranging from 22-25%) of screening than Caucasian (14%) inmates. Among those who completed screening, Aboriginal inmates had the highest rates of mental health histories, suicide risk and potential screen-detected cases. These rates among Aboriginal inmates were typically only slightly higher (i.e. 2-4% in absolute terms) than those of Caucasian inmates, with the exception that the rate of suicide risk was approximately twice as high. Black and other minority racial/ethnic groups were least likely to report a recent history, self-harm risk or elevated distress. These differences were most pronounced in terms of self-reported recent history, as the rates were less than half of those reported by Aboriginal and Caucasian inmates. Among those with a recent history and those reporting suicide risk at intake, service use rates were similar across racial groups. However, black and other minority race inmates who did not complete screening or reporting only distress, were significantly less likely to use mental health services.

Regional differences (see Table 2) revealed that the Quebec region had the lowest proportions of inmates reporting a recent history (16%) or distress alone (15%), and the second lowest rate of increased self-harm risk (9%). At the opposite end, the highest proportion of inmates reporting a recent history (37%) or distress alone (23%) was in the Atlantic region, which also had the second highest proportion with increased self-harm risk (11%). Within strata of screening results, there were similar rates of chronic service use across the regions. However, rates of acute service were higher in Ontario, Atlantic and Prairie regions, and lower in Quebec and Pacific.

Discussion

In this retrospective cohort study, we found considerable evidence of demographic and regional differences in receipt of mental health care prior to, and to a lesser extent during incarceration. Understanding these differences could help inform health and justice policy to reduce costly multi-system service use[30]. Many of our findings are consistent with trends in the non-incarcerated population. For example suicide ideation is reported by roughly twice as many Aboriginal individuals compared to non-Aboriginals[31]. The finding that the same patterns of suicide risk persist at intake to prison, reinforces the need for more work to divert both persons with mental illness and Aboriginal persons from the criminal justice system[32].

Our findings are also consistent with past findings that the odds of reporting medication use or hospitalizations prior to incarceration among Black, Latino and other racial groups were less than half of those of White inmates[33]. Given that in our work, rates of service use by potentially screen-detected cases were lower among Black and other minority inmates than among Caucasian and Aboriginal inmates, screening does not appear to be narrowing these disparities. In the absence of diagnostic assessments, it is unclear whether lower rates of self-reported distress and of follow-up treatment among ethnic minorities reflect true prevalence differences or differential performance of screening. Culturally-informed or responsive care principles emphasize that in order to reduce disparities policy and practice must acknowledge differences in how individuals understand mental health and report symptoms[34]. Among Canadians meeting criteria for major depression, Black and Asian ethnic groups were between 61-84% less likely to seek treatment than Caucasians (whereas Aboriginal and Latin Americans had non-statistically significant higher rates of accessing care)[35]. Others have observed that individuals of an ethnic or racial minority are more likely to have complex pathway to mental health care including the police or other parts of the justice system[36,37]. The proportions of

African or Caribbean-Canadian (almost 20%), Asian (approximately 10%) and Middle Eastern (approximately 10%) individuals in the Ontario forensic mental health system in 2012[38] were approximately double that of what was found in the CSC population studied in the current research (i.e. approximately 9% reported Black, Caribbean or African races and 9% reported any other origin including Asian and Middle Eastern countries). It is possible that previously unmet need among minority groups is being identified at an earlier point in the criminal justice system and these individuals are diverted from the prison system. Further work is needed to understand these complex system level factors.

Lower screening completion rates among all minority races also warrant consideration. While reasons for non-completion were not collected, these include inmate refusal, not attending screening, being admitted to a non-intake institution or transferred out of intake before screening could be completed. Alegria and colleagues[39] note that inappropriate matching of treatment to patient preferences, language, culture and other characteristics, and prior experiences of inadequate care, may lead to higher rates of refusing or not completing treatment, and missing appointments among minority groups. As one recommendation to eliminate racial and ethnic disparities in mental health care, they suggest campaigns to address stigma and trust issues, as well as providing specific information on accessing services[39].

Similar rates of service use by inmates of minority race who report either a mental health history or suicide risk suggest that for those with known mental health needs (which would be detected without screening, as they typically pre-date incarceration), continuity of care in prison is provided equally regardless of race or ethnicity. This is in contrast with findings of Sayers and colleagues[40], who found that African American and Asian inmates who had used psychiatric services in the community prior to incarceration were 4% and 10% less likely, respectively, to

access care while in prison. These data of Sayers and colleagues could in fact suggest an increase in racial/ethnic inequities in jails and prisons given that this group is restricted to those who were previously able to access community care.

Other differences in our work include the finding that women were approximately twice as likely to receive services, whereas Sayers and colleagues reported the absolute rate of service use was 4% lower among females[40]. Sayers and colleagues noted that the jail where they conducted their work (King County Jail) is one of the largest US jails with an average daily census of 2000-2400 inmates, in which women make up a minority of the population (13%). By contrast, in Canadian prisons, women are incarcerated in separate facilities, with rated capacities ranging from 81 to 171[41]. The ratio of mental health staff to inmates may be considerably greater in this context than in most other prison settings (including CSC's men's institutions), and there may be a greater focus on gender-informed correctional care[42] (including mental health needs). A greater emphasis on mental health needs of women through gender-informed correctional care may be reflected by earlier implementation of an overarching mental health strategy and of specific services for women offenders. For example, Dialectical Behavioural Therapy has been offered to women's offenders since 2001 within Structured Living Environments[43]. CSC recently added a similar level of care - referred to as Intermediate Care - for male offenders; there are concerns that this model remains under-resourced as it was introduced without any new funding[32].

Regional differences may identify differences in the effectiveness of health and justice policy. If regions with low rates of prior service use (e.g. Quebec) had more previously undetected symptoms, we might expect to see higher rates of self-harm risk and self-reported distress. Since we did not see this pattern, these findings seem to suggest a difference in the

prevalence of need for treatment among prison populations. Given that a high prevalence of mental illness was previously reported among inmates in provincial jails in Quebec (i.e. those sentenced to shorter sentences)[44], and the prevalence of mental illness in the general community is similar in Quebec to the rest of Canada[45], other explanations warrant further exploration. One potential explanation is the higher use of not criminally responsible verdicts in this province compared to the rest of Canada[46]; in Quebec more inmates with mental illness who commit serious crimes that would result in a longer prison sentence may be diverted to forensic hospitals.

Increased understanding of regional and demographic differences in detection and treatment of mental illness in community and correctional settings may identify good practices and gaps along the continuum of health and justice services. Identifying the most-cost effective system characteristics and policies to prevent the onset and recurrence of mental illness and criminal behaviour and to reduce inequities in health and justice systems is needed to address the over-representation of persons with mental illness in the criminal justice system. It is essential to ensure that screening efforts are responsive to the unique needs of different sub-populations, and that they do not reinforce any pre-existing inequities.

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Table 1. Demographic differences in detection rates and services provided to those identified at each screening step.

	Men	Women	*p*	Caucasian	Aboriginal	Black	Other	*p*
Step 1: all intakes	7455	510		4676	1860	677	752	
not screened	1263 (17%)	125 (25%)	<.001	632 (14%)	413 (22%)	152 (22%)	191 (25%)	<.001
Chronic service	115 (9%)	16 (13%)	.18	70 (11%)	46 (11%)	8 (5%)	7 (4%)	.003
Acute service	267 (21%)	35 (28%)	.08	169 (27%)	86 (21%)	21 (14%)	26 (14%)	<.001
Step 2: screened	6192	385		4044	1447	525	561	
recent history	1470 (24%)	174 (45%)	<.001	1101 (27%)	418 (29%)	63 (12%)	62 (11%)	<.001
Chronic service	219 (15%)	55 (32%)	<.001	184 (17%)	66 (16%)	12 (19%)	12 (19%)	.51
Acute service	635 (43%)	83 (48%)	.26	481 (44%)	182 (44%)	30 (48%)	25 (40%)	.85
Step 3: no history	4722	211		2943	1029	462	499	
increased self-harm risk	451 (10%)	36 (17%)	<.001	277 (9%)	173 (17%)	12 (3%)	25 (5%)	<.001
Chronic service	34 (8%)	7 (19%)	.01	19 (7%)	18 (10%)	2 (17%)	2 (8%)	.23
Acute service	139 (31%)	15 (42%)	.18	97 (35%)	45 (26%)	2 (17%)	10 (40%)	.12
Step 4: no history and low self-harm risk	4271	175		2666	856	450	474	
exceed cut-offs on BSI and DHS	762 (18%)	31 (18%)	.97	471 (18%)	188 (22%)	56 (12%)	78 (16%)	<.001
Chronic service	40 (5%)	4 (13%)	.09*	27 (6%)	15 (8%)	0 (0%)	2 (3%)	.03
Acute service	214 (28%)	16 (52%)	.005	141 (30%)	57 (30%)	12 (21%)	20 (26%)	.72

*Fisher exact test used due to cell counts less than 5.

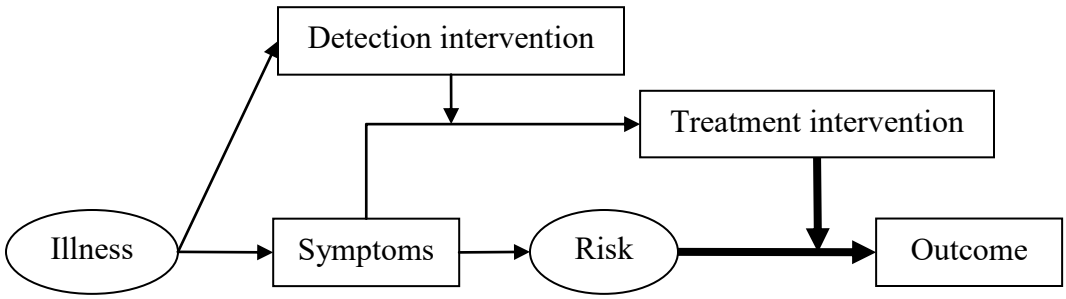
Table 2. Regional differences in detection rates and services provided to those identified at each screening step.

	Atlantic	Quebec	Ontario	Prairie	Pacific	*p*
Step 1: all intakes	885	2193	1570	2550	767	
not screened	78 (9%)	241 (11%)	367 (23%)	544 (21%)	158 (21%)	<.001
Chronic service	7 (9%)	29 (12%)	24 (7%)	55 (10%)	16 (10%)	.21
Acute service	21 (27%)	51 (21%)	104 (28%)	111 (20%)	15 (9%)	<.001
Step 2: screened	807	1952	1203	2006	609	
recent history	301 (37%)	315 (16%)	357 (30%)	484 (24%)	187 (31%)	<.001
Chronic service	50 (17%)	59 (19%)	55 (15%)	87 (18%)	23 (12%)	.34
Acute service	133 (44%)	112 (36%)	230 (64%)	196 (40%)	47 (25%)	<.001
Step 3: no history	506	1637	846	1522	422	
increased self-harm risk	55 (11%)	143 (9%)	43 (5%)	202 (13%)	44 (10%)	<.001
Chronic service	3 (5%)	9 (6%)	6 (14%)	16 (8%)	7 (16%)	.18
Acute service	26 (47%)	43 (30%)	21 (49%)	58 (29%)	6 (14%)	<.001
Step 4: no history and low self-harm risk	451	1494	803	1320	378	
exceed cut-offs on BSI and DHS	102 (23%)	225 (15%)	129 (16%)	272 (21%)	65 (17%)	<.001
Chronic service	4 (4%)	8 (4%)	7 (5%)	16 (6%)	9 (14%)	.06*
Acute service	29 (28%)	45 (20%)	71 (55%)	82 (30%)	3 (5%)	<.001

*Fisher exact test used due to cell counts less than 5.

Chapter 9: Impact of treatment on institutional incidents

Chapters 7 and 8 raised questions about potential inappropriate matching of treatment and differences between demographic and regional groups. Since the ultimate goal of screening is to increase treatment uptake, which should in turn lead to a reduction in adverse outcomes (or an increase in remission/recovery rates, although this question is not explored in the current thesis due to the unavailability of longitudinal measures of symptoms), this chapter explores whether the treatment that is being provided is associated with rates of adverse outcomes. This addresses the final portion of the model outlined in Figure 1 of the introduction, namely whether treatment reduces the risk of an adverse outcome from occurring. If screening identifies symptoms that are not related to risk, or if treatment is ineffective, then we would not expect to see a difference in the rate of adverse events pre- and post-treatment.



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Mental health screening, treatment and institutional incidents: A propensity score matched analysis of long-term outcomes of screening

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Abstract

Under-detection and treatment of mental illness in prisons has been consistently observed over the past three decades, despite various efforts - most notably screening - to increase access to care. Little research has been conducted in any setting to evaluate distal outcomes of screening, such as incident rates during incarceration. **Method.** We conducted an observational cohort study of all new admissions (N = 13,281) to Canadian prisons during a 33 month period, with a maximum 38 month follow-up (median = 15.9 months). We used full matching on propensity scores to explore the association between treatment and rates of health (i.e. self-harm, mortality, overdose), violent and victimization incidents during incarceration. **Results.** Inmates who were never treated had the lowest incident rates, and incidents typically occurred after treatment had been initiated, suggesting early identification and few missed needs. Treatment was associated with lower rates of victimization and violence; however, relationships between health incidents and treatment were mixed. While health incident rates decreased slightly for potentially screen-detected cases, they increased for those with pre-existing risk who accounted for the majority of incidents. **Implications.** Randomized controlled trials with longitudinal data are needed to evaluate longer-term outcomes following screening. The high rate of incidents by inmates with pre-existing risk highlights the need increased diversion options for inmates with pre-existing mental health needs from the criminal justice system.

Inmates with mental illness are perceived as one of the most challenging populations by correctional administrators[1], and experience a range of poorer outcomes during incarceration including self-harm, violence and victimization[2]. While meta-analyses have suggested positive benefits of treatment for offenders with mental illness including reductions in mental health symptoms, re-offending and institutional incidents[3–5], low detection rates and treatment uptake have been consistently reported over the past three decades[6–10]. In light of these challenges, screening has been widely recommended to improve detection rates[11–14].

Similar arguments have been made in community settings to recommend screening (i.e. that there are low rates of uptake of treatments that are known to be effective, and screening tools have higher sensitivity that clinical detection; see for example Siu et al.[15]. However, various task forces and researchers have found no effect of mental health screening in primary care on detection or recovery[16–18]. It is postulated that newly detected cases identified by screening have less severe needs, and thus the potential benefit of treatment is smaller[19,20]. For example, a systematic review found a weaker effect in trials of psychotherapy for depression in primary care where enrollment was based on screening rather than clinical detection[21].

There is only a small body of evidence examining actions taken in response to screening[22–24], and no evidence regarding outcomes such as recovery or functioning[25]. These studies have found that at least 20% of offenders screening positive do not have documented follow-up on file[22,23], which may explain in part why detection rates may not achieve the expected levels based on the sensitivity of the test. On the other hand, in one study, an increase in the proportion of inmates receiving treatment increased following the introduction of screening from 5% of all inmates who were actively receiving treatment to 10% within 4 years[24]. These data did not include an independent diagnostic instrument to ensure that the right inmates

were receiving care, but the finding is promising, particularly in light of the fact that only 25% of inmates were screened and no additional funding was provided to introduce the revised model of care. By comparison, prior work in the Canadian prison system - which offers extensive mental health screening that is described further in the methods section - found that over 40% of inmates received at least some mental health treatment, although this was often of brief duration, and a majority of those receiving longer-term care had at least one interruption in care of at least 30 days[26]. Based on a sub-sample of inmates who completed a structured research diagnostic interview it was found that 69% of those receiving treatment did not have a diagnosable illness, and that only 46% of inmates with a diagnosable illness received more than a brief intervention of one or two contacts.

No studies have examined the impact of treatment received following screening. The current study sought to address this gap by examining the associations between mental health treatment and rates of violence, victimization and adverse health outcomes such as self-harm, overdose and mortality during incarceration. Consistent with the community literature discussed previously, we hypothesized that newly detected cases would have less severe needs (and thus lower risk of adverse outcomes); thus, we were particularly interested in whether there were different associations between treatment and incidents among those with pre-existing versus newly identified needs.

Methods

Procedures

Sample and design. We conducted a secondary analysis of administrative data collected by the Canadian federal prison service, responsible for the detention of individuals convicted of a criminal charge and sentenced to 2 years or longer of incarceration. 13,281 inmates admitted to a

federal prison between January 2012 and September 2015 were followed up until (a) first release from prison (43.9%; *n* = 5830); (b) death (0.2%; *n* = 30); or (c) March 2015 (55.9%; *n* = 7421), for a median follow-up of 15.9 months (range 0.03 to 38.4 months). Participants were primarily male (*n* = 12473; 94%), with a mean age of 35.5 (*SD* = 12.2). 57.8% (*n* = 7674) reported White/Caucasian ethnicity, 23.0% (*n* = 3056) Aboriginal, 9.6% (*n* = 1280) Black/African, and the remaining 9.6% (*n* = 1271) were of other minority ethnic groups.

Outcomes. The outcome variables for the current study were documented institutional incidents, which were categorized in three categories: (1) health related; (2) violent; (3) victimization. Health related incidents included non-suicidal self-injury, non-fatal suicide attempts, non-fatal overdoses, and all-cause mortality (including deaths by suicide). Violent incidents included inmate fights, assaults, and murder. Victimization included all violent incidents where the inmate role in the incident was as a victim rather than instigator. Previous work has shown high reliability in the coding of violent (kappa = 0.84)[27] and self-harm incidents (complete agreement)[28] based on file reviews.

Screening. All inmates are offered a voluntary computerized mental health screening within 3 to 14 days of admission to prison. The screening protocol includes a number of standardized measures, two of which are the focus of this study as they measure generalized distress and are validated to predict mental illness[29–31]. The Depression Hopelessness Suicide Screening Form (DHS)[32] is a 39 item questionnaire designed specifically for use with offender populations. It includes 5 items that assess current suicide ideation, or recent or multiple prior suicide attempts that are signs of elevated risk of suicide[28]. The DHS also includes a total score and depression and hopelessness sub-scale scores calculated as the number of endorsed items. A score of at least 8 on the total score, 7 on the depression sub-scale, or 2 on the hopelessness scale

is considered a possible case[33]. The second screening test - the Brief Symptom Inventory (BSI)[34] is a 53 item self-report questionnaire. Nine sub-scale scores and a global severity index are calculated as the average item response. A respondent scoring above a T-score of 63 (using general adult population norms) on the Global Severity Index or on 2 of the 9 sub-scales is considered a possible case[34]. To achieve the greatest balance of sensitivity and specificity, an inmate was classified as screening positive if they exceeded the cut-offs on both the BSI and DHS; these rules have a sensitivity of 66% and specificity of 76%[29].

While CSC offered screening to all inmates at the time this study was conducted, we sought to distinguish cases who may not have required the full screening from those who would be newly detected. We used the 5 items from the DHS that measure self-harm risk to capture risk of self-harm or suicidal behaviour. Second, as part of a risk assessment measure used within CSC - the Statistical Information on Recidivism scale[35] - there is an item regarding whether or not the inmate had any violent incidents while in remand awaiting sentencing and/or transfer to prison for the current offence. We used this item as a measure of recent violence. Mental health staff in many jurisdictions are asked to provide an opinion regarding an offender's mental health in order to determine responses to violent incidents (e.g. segregation); thus, we use this item reflecting recent violent behaviour as one which could be sufficient to proactively refer an offender for mental health assessment. Other jurisdictions take similar approaches, such as automatically referring homicide offenders for an assessment based on the Grubin screening tool that is used in the UK[13]. By distinguishing impacts of treatment on inmates with recent and significant histories of disruptive behaviours from those without such a history, we aimed to assess the question of whether cases who might only be detected through in depth symptom based screening have similar treatment benefits to those cases who are well-known to mental

health services. We anticipate this question to be of relevance to help decision makers chose between very brief screens that typically focus on the most disruptive/significant needs (e.g. the Grubin tool[13]) from screening tools that are symptom and/or distress based (see Martin et al[25] for examples).

Throughout this paper, for concision we refer to those who would be identified by one of the six risk items (i.e. the five DHS items or the recent violence item) as high risk. Furthermore, because past research[28] showed that non-completion of screening was associated with the highest risk of self-harm - seemingly because these inmates had already been identified as requiring mental health treatment - we also included these inmates in the high risk group. We used this high risk group as a proxy for already known cases who may not receive in-depth mental health screening. Inmates without one of these factors are labeled as low risk, and described as the screen-eligible population. Inmates who do not report one of the risk factors but screen positive on the mental health screening tools are referred to as the screen-detected cases.

Mental health service use. The primary exposure of interest was an offender's current treatment status. We extracted dates of primary mental health treatment (e.g. counseling, medication review, crisis intervention, and reintegration services such as discharge planning) provided in mainstream institutions from the prison service's Mental Health Tracking System. We also extracted admission and discharge dates to acute psychiatric hospitals from the prison's case management system. Because treatment end dates were often missing in the data, we were forced to make an assumption about when an inmate's treatment. We made this decision based on the authors' experiences in reviewing files in an employment context, through which we have observed that common practice is to schedule offenders for contact at a minimum frequency of every two weeks (and often more frequently). To allow for the possibility that an offender was

still on an active caseload but their appointments were cancelled (e.g. due to lockdowns, staff availability, etc.) or missed, we doubled this time period and judged 30 days without any mental health contact as a sign that treatment had ended. We distinguished periods of time when the offender was not receiving treatment in 3 categories: (1) inmates who were never treated (i.e. their treatment status was always none); (2) pre-treatment (i.e. those who were currently untreated but subsequently received treatment); and (3) post-treatment (i.e. interruptions in service or following the last termination of care).

Correctional planning intake assessments. As part of the standard correctional intake process, inmates complete a number of assessments, including the Offender Intake Assessment [36]. Specific to this study, we considered overall ratings of seven dynamic domains of functioning considered by this assessment (family history, employment, community functioning, substance abuse, personal-emotional, criminal attitudes, and criminal associates) and overall ratings of static (i.e. criminal history and other unmodifiable risk factors) and dynamic criminal risk that are made by the parole officer using structured professional judgment based on interview and file information. The items and domains contained within the assessment have been shown to have high internal consistency (Chronbach's alpha > .70) and to have high predictive validity for re-offending[36]. These factors were included in the propensity score model to minimize (or eliminate) differences between inmates who received treatment and those who did not.

Data Coding and Analysis

To handle time-varying predictors (i.e. changes in treatment levels) and repeated outcomes, we fitted conditional Cox regression models using the Survival package in R[37,38]. Each participant's time under observation was divided into segments that started following: (1) intake to prison; (2) at the beginning or end of treatment; and (3) an incident. These segments of

person time are the unit of analysis, where each segment is treated as though the clock is reset to 0 in terms of counting time to event (i.e. an incident) or censoring. The model was then fit to these segments in the same way as a usual survival analysis, with the exception that clustered error terms (by participant) to account for the fact that repeated measures for the same participant would otherwise violate the assumption of independent observations.

The model was stratified by incident number in order to test whether treatment effects differed for preventing first versus repeat incidents. The first model estimated hazard ratios for a first incident (equivalent to the usual survival analysis model). The second model estimated hazard ratios for any repeat incidents. These stratified models were then pooled proportional to sample size to account for the fact that only those who experienced a first event were included in the model examining time to a repeat event (and thus this repeat event model carried less weight in the final pooled model). Before pooling, interactions of treatment by prior incident were fit to ensure that there was no evidence of effect modification. If effect modification was present, separate models for first versus repeat event incidents were presented.

Because screening aims to reduce the duration of untreated symptoms, the reference category for analyses was untreated segments of person time (i.e. when an inmate was not receiving treatment, but where he/she eventually received some treatment). We also evaluated whether there was effect modification of the association between treatment and outcomes based on screening. This was tested by including an interaction term between treatment status and our three level variable that classified inmates as (1) high risk of self-harm or violence, (2) a potential newly detected case based on a positive screen; (3) low risk and low mental health need cases (i.e. negative screens).

To address confounding by indication we used full matching* on propensity scores[39,40]. We had no time-varying predictors to include in the propensity model; therefore instead of predicting treatment status (i.e. pre-treatment, in treatment, post-treatment) for each segment, we created a propensity score for duration of service use during the entire incarceration using a proportional odds logistic regression model[41]. We assumed that a person with longer service use would likely have had higher symptoms if repeated measures were available, and thus predicting duration of treatment status should be more accurate than predicting any treatment. This was particularly relevant given that many inmates used relatively short-term treatment (as discussed below), and not recognizing the difference in level of need for treatment could have biased results. Consistent with prior work[26], inmates were classified as never treated, or as brief (less than 10% of follow-up in treatment), acute (10 to less than 50% of follow-up) or chronic (50% or more of follow-up) service users.

To ensure complete balance on mental health variables, these were not included in the propensity score calculation. Instead, participants were grouped based on their propensity score, their screening result, and their risk for self-harm or violence. Full matching to estimate the average treatment effect was achieved by calculating weights for each combination of propensity score, screening result, and treatment duration as,

$$\text{weight}_{ij} = \frac{p(tx=j) * n}{p(tx=j|ps=i)} \quad 42$$

where p(tx=j) is the overall proportion of inmates at treatment duration j, n is number of participants in stratum (of propensity score, risk, and screening result) i and p(tx = j | ps = i) is the proportion of inmates at treatment duration j in the propensity score grouping. Propensity scores are used to simulate a randomized trial where all individuals, regardless of their characteristics, have a similar probability of receiving treatment. Table 1 presents the raw and

weighted data, showing substantially improved balance on all individual variables entered in the propensity score, and perfect balance on all grouping variables[**].

Results

As seen in Table 2, over the 19,202 person years of observation, there were 1118 health incidents (incidence rate [IR] = 58/1000PY, 95% CI 55, 62), 1004 incidents of victimization (52/1000PY, 95% CI 49, 56) and 2738 violent incidents (IR = 143/1000PY, 95% CI 137, 148). Whereas there were relatively few instances of repeat victimization (800 of the 894 inmates who were victimized were victimized only once, and 82 were victimized twice), in the case of violent and especially health incidents a small number of inmates accounted for a substantial volume of incidents. In the case of violent incidents, 1140 inmates had only a single incident, whereas 314 had two incidents, 127 had 3 and 103 had 4 or more incidents. For health incidents 225 had a single incident, 47 had two, 27 had three, and 50 had four or more incidents. The 50 inmates with 4 or more incidents accounted for 718 (64%) of all health incidents. As seen in Table 2, most incidents occurred while inmates were in treatment or after treatment was provided. This may be in part attributable to the fact that inmates who received treatment typically began contacts with a clinician early in their sentence (this is seen in terms of the relatively small proportion of time pre-treatment, and proportionately more time spent in or following treatment).

Outcomes of never treated inmates. In an observational study, it would be expected that incident rates are lowest among those who are never treated due to the fact that treatment is provided based on apparent need/symptoms (i.e. confounding by indication). This can be seen by the lowest incident rates among those who are never treated, thus suggesting relatively low rates of missed need. These findings persisted after controlling for potential confounding. Health incident rates of inmates who were never treated were 67-90% lower compared to the untreated

period for those who ultimately received treatment (see Table 3). The rate of violence perpetration and victimization was approximately 35% lower among never-treated inmates compared to the pre-treatment period of those who ultimately received treatment (see Table 4).

Outcomes of treated inmates. For those who are treated, incident rates are likely to be highest during treatment, as treatment is most likely to be provided when symptoms are most severe. This pattern is observed in Table 2 among those who were at elevated risk of self-harm or violence and those who did not complete screening in terms of health and violence incidents. We did not observe the expected pattern among the screen-eligible population. In these cases, incident rates were generally stable (or declining) pre and during treatment, and lowest after treatment. Notably, incidence rates were similar when comparing those who screened positive and those who screened negative, and roughly 60% of all incident types among the screened group involved persons who obtained negative screening results.

Health incidents. Overall, health incident rates were similar during treatment [HR=0.95, 95% CI 0.48, 1.89] compared to the period of time prior to treatment, and were slightly increased following treatment [HR=1.50, 95% CI 0.93, 2.40]. However, interaction terms suggested that hazard ratios were approximately 50% lower among the screen-eligible groups compared to those who were high risk. These estimates were imprecise with *p* values between 0.14 and 0.28, owing to the relatively few health related incidents among the screen-eligible population (i.e. high risk inmates accounted for 877 [78%] of the 1118 incidents). Given that the magnitude of the differences in the hazard ratios we observed would likely be clinically relevant, we present results for both the full population and stratified based on potentially important effect modifiers.

Among those who were high risk, associations also differed depending on whether the inmate had a prior incident. The incidence rate for a first incident by a high risk inmate was

roughly twice as high during and following treatment compared to when he or she was untreated. However, the incidence of repeat incidents was 69% lower [HR = 0.31, 95% CI 0.10, 0.95] during treatment compared with the rate of inmates with a prior incident who had yet to receive treatment. Post-treatment, the incidence rate remained slightly lower but showed signs of returning to the pre-treatment risk of a repeat incident [HR = 0.79, 95% CI 0.32, 1.94].

Among the screen-eligible population, the rate of health incidents was lower both during [HR = 0.74, 95% CI 0.30, 1.84] and following treatment [HR = 0.64, 95% CI 0.28, 1.45], although wide confidence intervals preclude definitive statements about treatment effectiveness in these newly detected cases. Similarly, it is unclear whether large interactions within this sample reflecting a greater reduction during treatment of the incidence rate for repeat [HR = 0.31, 95% CI 0.02, 5.22] versus first incidents [HR = 0.67, 95% CI 0.26, 1.77], and among those screening positive [HR = 0.57, 95% CI 0.16, 2.02] versus those screening negative [HR = 0.81, 95% CI 0.24, 2.73] are real or chance findings.

Violent incidents. Rates of both perpetration and victimization of violent incidents were approximately one-third lower during treatment and roughly 15% lower following treatment (see Table 4). The incidence rates during treatment were similar to those among un-treated inmates as seen in highly similar hazard ratios for these two treatment statuses. Incidence rates of violence perpetration and victimization were highly similar in relation to treatment status, and we did not observe any meaningful patterns of interactions (p values ranged from .11 to .98, and the relative change in hazard ratios was less than 30% in most cases; the exception to this was a 70% increase in the hazard ratio of victimization during treatment among screen negative cases compared to the hazard ratio for those who were high risk).

Discussion

This real-world, observational cohort study of over 13,000 inmates is one of few to look at potential long-term impacts of mental health screening of inmates. Findings that support screening include the low rates of health, violent and victimization incidents among inmates who are never treated (and are thus presumed to not have mental illness) compared to untreated time periods for those who ultimately received treatment. These findings suggest that relatively few individuals who could have benefited from treatment were missed and highlight increased risk of adverse outcomes associated with untreated mental illness[2].

Lower violent incident rates were observed during treatment compared to untreated periods, and risk while in treatment was similar to that of inmates who were never treated. These findings reinforce that with treatment some violence by persons with mental illness is potentially preventable. Given that the post-treatment rate showed some signs of returning to untreated levels, this may reflect some lost benefit among those whose treatment ended prematurely (either due to the inmate withdrawing consent, or due to decisions by the treating clinician). Others have shown that risk of violence by persons with mental illness is increased among those who lack insight into their illness and are non-adherent to treatment[43–45]. Understanding reasons for treatment termination, and the link between fluctuations in symptoms, criminogenic needs, and incidents through longitudinal studies is needed to explore this hypothesis and inform practice.

Potential trade-offs of screening were also observed. Compared to the pre-treatment period, crude health incident rates decreased during and following treatment for the screen-eligible population, whereas they increased for the high risk population. This apparent lack of benefit of treatment for the higher risk group may reflect long histories of treatment non-response beginning in the community and continuing in prison[46]. Upwards of 80% of inmates with mental disorder in recent studies received community mental health treatment at some point

in their lifetime[46–48]. Others have argued that research and clinical efforts to identify best practices to improve poor treatment response and remission rates may provide a greater return on investments than would efforts to improve case detection such as screening[49–51]. It is possible that these weaker associations are attributable to under-treatment (e.g. the prior findings discussed in the introduction that roughly half of all inmates with a psychiatric history at the time of their incarceration had at least one interruption in treatment during their incarceration, and only 46% of inmates with mental illness received either an acute or chronic intervention[26]). More broadly, the high proportion of incidents by those at pre-existing high risk upon intake to prison highlight the need for earlier diversion from the criminal justice system, or the need for a legal mechanism for the prison service to divert inmates with severe mental illness to the health care system. Once an offender is sentenced to a prison term of two years or longer, under the *Canada Health Act,* the prison system assumes responsibility for all health care needs and the offender is excluded from coverage under the usual health care system in the province. While accessing outside hospital is possible, it is a complex undertaking requiring partnerships with hospitals across nine different provincial health systems who must be willing to accept challenging cases who have the additional stigma of a criminal record.

Findings regarding health incidents among the screen-eligible population highlight the need to consider fluctuations in mental state when planning services in prisons[52]. While reduced risk of incidents during treatment is expected, it is unusual to observe further reductions in risk after treatment is terminated. Because risk of incidents may be higher at intake to prison as inmates adjust to the stressors of prison, and most inmates began treatment early in their sentence, spontaneous remission is a plausible explanation for the reductions in incident rates for screen-detected cases during and following treatment. A small body of research on changes in

mental health state at intake to prison suggests that spontaneous remission may occur in up to one-third of cases, although possibly less so among women[52–54]. However, if brief interventions are markers of treatment response or reflect the importance of early intervention to prevent onset of illness[55,56], the goal might be to increase the number of brief service users. Encouraging brief interventions as a first response for common mental illness is the focus of models such as stepped-care as a means of cost-effectively allocating sparse resources in community settings, and some have argued this is appropriate even for those with higher initial symptoms[57].

As noted by Fazel and colleagues[2], there is a need for research on optimal service delivery models and modalities, including the appropriateness of group-based intervention. We did not attempt to distinguish impacts of different service types for two reasons. Because screening is intended simply to refer an individual for further assessment and treatment planning, the goal of this work was simply to see if practice as usual was sufficient following screening. Second, because the Mental Health Tracking System was designed for high level reporting purposes, there was likely high variation in the intensity or duration of contacts, the appropriateness of these services to match the needs of the offender, and the skill and experience of the clinicians delivering the services. Thus, any differences observed between types of treatment would have been difficult to interpret and generalize to other settings due to questions of reliability and validity. Furthermore, power would have been limited to test these differences as reflected by wide confidence intervals for many sub-group analyses, and in particular those among the screen-detected cases. However, this is an important area of further research with well-designed primary research studies. One approach that could be considered is group-based mental health programming to assist offenders with no prior mental health history with the transition to prison. This could be offered either in place of screening (i.e. as a universal

intervention for all offenders) or as the initial response to a positive screen (i.e. as a selective intervention). This might be a more cost-effective use of resources if a 3 to 4 session program teaching basic distress tolerance or emotion regulation skills could be delivered using the same resources that would be required to administer screening tests, interpret them and provide triage and comprehensive assessments.

Beyond the challenges associated with estimating treatment effects from observational data that have been discussed in relation to spontaneous remission and confounding by indication, other limitations of the current study should be noted. Institutional incidents are an important outcome for correctional administrators, and we have covered the major outcomes that have been shown to be associated with mental illness in prisons[2]. However, other measures of recovery such as symptoms and functioning are needed to fully evaluate impacts of mental health treatment[58]. Furthermore, low-intensity psychological interventions may also prevent onset of illness among those experiencing prodromal or sub-threshold symptoms[59,60]. Further work could examine the impacts of services for inmates who might be defined as false positives based on diagnostic criteria, but for whom treatment could prevent deterioration and onset of illness. One prior study in a prison context attempted a prevention service for inmates meeting criteria for ultra high risk for psychosis, and found positive impacts on symptoms in a small longitudinal study through which 4.4% of those screened were identified as ultra-high risk following screening and in depth assessment (28% screened positive). It is noteworthy that 47% of those who were identified as ultra-high risk did not receive the planned intervention, typically due to release or transfer to another prison, highlighting the challenges of influencing outcomes through follow-up treatment of identified cases in the prison context.

A second limitation is that we were unable to assess the appropriateness of treatment decisions. Neufeld and colleagues[61] (using a similar propensity score approach to analyze treatment effects from observational data) reported a significant positive effect of treatment when considering only those participants with a diagnosable illness, which was attenuated and no longer significant when re-running their model including all service users irrespective of need. While our stratification by risk as a proxy for pre-existing need versus screening-detected cases was an effort to partially address this issue, we lacked a gold-standard measure for our sample owing to the use of administrative data.

Methodological challenges highlight the complexity of estimating the value of screening, which may explain discrepant interpretations of the small body of existing evidence. However, evidence that these follow-up activities in fact led to better outcomes than would have been expected in the absence of screening is seemingly weak and reflects tensions between meeting known versus newly detected need. Relatively low rates of long-term service use and weaker associations between treatment and outcomes among the highest need cases highlight the challenges of ensuring adequate resourcing to provide necessary follow-up to screening. Further work to explore this question through designs that include an unscreened comparison group and/or randomization should be a priority either in settings considering implementing or scaling back screening efforts, or those which are modifying policies regarding responses to screening.

Footnotes

[*]An accessible general review on analytic approaches with propensity scores is provided by Austin[62]. Briefly, matching approaches achieve greater balance between treated and un-treated groups than stratification [62] (which has been shown to remove approximately 90% of imbalance[63]). However, balanced matching (e.g. typically one to one matching) results in excluding participants who do not have a match in the dataset. Full matching on propensity score achieves the benefits of stratification (i.e. retaining all cases) and traditional matching (i.e. greater balance) by matching each treated case to all untreated cases that are similar (i.e. there is not a constant ratio of matched untreated participants to each treated participant[40]). An alternative that is similar to full matching is inverse probability of treatment weighting. This approach can achieve similar reductions in bias to full matching when there are weaker or moderate selection biases at play. However, when there are strong selection biases it can result in more extreme weights that result in poorer performance than full matching[64]. The final use of propensity scores is regression adjustment (i.e. including the propensity score as a predictor in the regression model). Regression adjustment increases the risk of model misspecification as it requires a correctly specified model relating the propensity score to the outcome variable (i.e. that all interactions, non-linearity, etc. are correctly specified) in addition to a correctly specified propensity model (e.g. that there are no unmeasured confounders); matching approaches only require that the propensity model is correctly specified[62].

[**] The reduction of pre-existing differences can be seen by examining the weighted data for each variable in the right hand side of the table, which shows that after weighting the proportion of inmates receiving each level of treatment was similar in all sub-groups to that of the overall sample (i.e. proportions are often the same in all sub-groups, and never differ by more than 3%).

For example, while inmates who screened positive (13%) were more than 6 times more likely to receive chronic treatment than those who screened negative (2%) in the unweighted data, after applying the propensity weights there was the same proportion of inmates who received chronic treatment (8%) regardless of screening results.

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Table 1. Unweighted and weighted proportions of inmates receiving different duration of treatment.

		Unweighted				Weighted			
	n (%)	None	Brief	Acute	Chronic	None	Brief	Acute	Chronic
Total	13281	54%	15%	23%	8%	54%	15%	23%	8%
Aboriginal	3056 (23)	47%	18%	25%	10%	53%	17%	21%	8%
Non-Aboriginal	10158 (76)	57%	14%	22%	7%	55%	15%	23%	7%
Male	12473 (94)	56%	16%	22%	7%	54%	16%	23%	7%
Female	808 (6)	38%	6%	36%	20%	57%	9%	24%	10%
Low reintegration potential (RP)	4531 (34)	45%	17%	26%	11%	55%	16%	21%	9%
Medium RP	5467 (41)	55%	16%	22%	7%	54%	16%	23%	7%
High RP	3255 (25)	67%	12%	18%	3%	54%	13%	26%	6%
Minimum security	3379 (25)	65%	12%	19%	4%	55%	13%	25%	7%
Medium security	7880 (59)	52%	16%	24%	8%	55%	15%	22%	8%
Maximum security	1107 (8)	43%	19%	27%	11%	53%	17%	22%	7%
Moderate-severe needs*									
Employment	7456 (56)	52%	16%	24%	9%	55%	16%	22%	8%
Associates	8554 (64)	55%	16%	22%	7%	55%	16%	22%	7%
Community functioning	3386 (25)	44%	16%	27%	13%	56%	15%	20%	9%
Personal-emotional	9692 (73)	47%	16%	26%	10%	54%	15%	23%	8%
Attitudes	9770 (74)	54%	16%	23%	8%	54%	16%	22%	7%
Substance use	7912 (60)	48%	16%	26%	10%	55%	15%	22%	8%
Marital/family	4416 (33)	46%	16%	27%	11%	55%	15%	22%	8%
Negative on BSI and DHS	3931 (30)	72%	13%	12%	2%	54%	15%	23%	8%
Positive on only 1 of BSI or DHS	2624 (20)	58%	17%	20%	6%	54%	15%	23%	8%
Positive on both BSI and DHS	3924 (30)	33%	18%	36%	13%	54%	15%	23%	8%
Not screened	2802 (21)	56%	13%	22%	9%	54%	15%	23%	8%
Low risk of self-harm/violence	9459 (71)	60%	15%	19%	5%	54%	15%	23%	8%
High risk of self-harm/violence	3822 (29)	40%	16%	31%	13%	54%	15%	23%	8%

*For space reasons only the proportions with moderate to high needs are shown. Corresponding to the down-weighted proportions of inmates with the needs for most treatment levels, those with low needs were weighted upwards.

Table 2. Incident counts and rates in relation to screening results and treatment status.

		Health		Victim		Violence	
	PY	n	IR [95% CI]	n	IR [95% CI]	n	IR [95% CI]
Total	19206	1118	58 [55, 62]	1004	52 [49, 56]	2738	143 [137, 148]
Un-treated	9959	47	5 [3, 6]	373	37 [34, 41]	938	94 [88, 100]
Pre-treatment	1521	83	55 [43, 66]	131	86 [71, 101]	318	209 [186, 232]
In treatment	2353	634	269 [248, 290]	206	88 [76, 100]	604	257 [236, 277]
Post-treatment	5373	354	66 [59, 73]	294	55 [48, 61]	878	163 [153, 174]
Risk of harm							
Un-treated	3748	25	7 [4, 9]	203	54 [47, 62]	617	165 [152, 178]
Pre-treatment	767	65	85 [64, 105]	82	107 [84, 130]	229	299 [260, 337]
In treatment	1436	596	415 [382, 448]	144	100 [84, 117]	499	347 [317, 378]
Post-treatment	2664	320	120 [107, 133]	177	66 [57, 76]	608	228 [210, 246]
Screen positive							
Un-treated	1224	8	7 [2, 11]	44	36 [25, 47]	78	64 [50, 78]
Pre-treatment	304	9	30 [10, 49]	22	72 [42, 103]	45	148 [105, 191]
In treatment	447	13	29 [13, 45]	33	74 [49, 99]	54	121 [89, 153]
Post-treatment	1116	13	12 [5, 18]	54	48 [35, 61]	120	108 [88, 127]
Screen negative							
Un-treated	4986	14	3 [1, 4]	126	25 [21, 30]	196	39 [34, 45]
Pre-treatment	450	9	20 [7, 33]	27	60 [37, 83]	49	109 [78, 139]
In treatment	469	25	53 [32, 74]	29	62 [39, 84]	37	79 [53, 104]
Post-treatment	1593	21	13 [8, 19]	63	40 [30, 49]	122	77 [63, 90]

Table 3. Propensity score adjusted hazard ratios from recurrent events Cox regression predicting health incidents.

	High risk		Screen population		
	1st incident	Repeat incident	Overall	Screen positive	Screen negative
Untreated	0.33 [0.16, 0.70]	0.10 [0.01, 0.76]	0.22 [0.11, 0.48]	0.19 [0.05, 0.69]	0.23 [0.09, 0.59]
In treatment	2.47 [1.52, 4.01]	0.31 [0.10, 0.95]	0.74 [0.30, 1.84]	0.57 [0.16, 2.02]	0.81 [0.24, 2.73]
Post-treatment	2.12 [1.26, 3.57]	0.79 [0.32, 1.94]	0.64 [0.28, 1.45]	0.39 [0.12, 1.32]	0.77 [0.28, 2.17]

Table 4. Propensity score adjusted hazard ratios for prediction of violent incident perpetration and victimization.

	Perpetration	Victimization
Pre-treatment	REF	REF
Untreated	0.64 [0.54, 0.75]	0.66 [0.52, 0.83]
In treatment	0.67 [0.54, 0.82]	0.66 [0.48, 0.9]
Post-treatment	0.80 [0.66, 0.97]	0.86 [0.67, 1.12]

Chapter 10: Harms and Benefits of Mental Health Screening: A decision framework

In light of unclear benefits and harms of screening based on the analyses in Chapters 6-9, this article applies a framework for decision making when the costs of false positives and the benefits of true positives are unknown. Decision curve analysis is used to force reflection about the potential harms and benefits of screening. This analysis forces a shift towards thinking about the entire model presented in Figure 1 (i.e. accuracy of screening, subsequent follow-up and impact of treatment on outcomes). As a secondary objective, this chapter explores characteristics of inmates for whom screening is more or less valuable.

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Decision curve analysis as a framework to estimate the potential value of screening or other decision making aids.

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Abstract

There is increasing debate about whether screening increases access to treatment, and if this treatment is effective for lower need cases identified by screening. In this study, we illustrate the use of a decision making framework that can be applied when there is not sufficient data to support a traditional cost-benefit analysis. We conducted secondary analyses of data from 459 male prisoners who were screened upon intake, and who completed an independent structured diagnostic interview. We compared the potential benefit of different approaches (screening, history taking and universal interventions) to allocating treatment resources using decision curve analysis. Unless the costs of false positives are minimal, screening appears to offer a relatively small net benefit compared to offering alternative universal interventions. With more sensitive screening, co-occurring substance abuse, suicide risk and violent incidents were less common among newly identified cases, suggesting less potential benefit. Lower needs of cases that are newly identified by screening, combined with relatively high costs of false positives, raise questions about the value of universal screening. Restricting screening to sub-groups who stand to benefit the most, re-thinking responses to positive screens and consideration of alternatives to screening warrant consideration to improve mental health.

Keywords: Mental health, screening, prisons, decision analysis

There are high personal, social and economic costs associated with mental illness[1] and low rates of detection and treatment uptake[2,3]. A recent return on investment simulation model, estimated that if treatment rates for persons with depressive and anxiety disorders were increased by 20 to 30%, there would be a return on investment between three to four dollars in improved health and employment participation for every dollar spent on treatment[4]. However, this analysis did not describe how best to achieve this increase in treatment rates, or account for the fact that increasing detection rates of illness will also increase detection rates of those who are not ill. A recent meta-analysis of clinical detection by primary care physicians illustrates that in absolute numbers there will be more individuals who are not ill but receive diagnosis and/or treatment (i.e. false positives) than cases of undetected illness (i.e. false negatives)[2].

A widely studied discussed - and debated - strategy to increase detection of mental illness is screening. A number of recent systematic reviews and guidelines have concluded that there is little to no difference in detection and treatment of illness in settings that screen compared to those that do not[5,6] or there are no studies of sufficient methodological rigour examining this question[7]. However, drawing upon indirect evidence that screening tools can identify depression, and that treatment is likely to be effective for persons with illness, the USPSTF recently recommended screening[8]. Others have questioned this indirect evidence approach arguing that the positive predictive value of screening is too low to be feasible for clinical use, and that the evidence is not clear that newly detected cases benefit from treatment to the same extent as those who are detected through routine care[9–11].

Mojtabai[10] noted that while the USPSTF definition of harms focused primarily on side-effects of medications, there are other costs associated with false positives that should be considered. For example, false positive screening results lead to inconvenience and time/cost of

further appointments, and those who are eventually incorrectly diagnosed can experience significant harms such as treatment side-effects[12,13] and stigma[14]. At a system level, inefficient use of resources can result from the need to respond to false positives and overdiagnosis (i.e. treating illness that would have remitted naturally or not led to suffering or impairment[15]). Mojtabai[10] describes this challenge as an opportunity cost, noting that time and effort devoted to screening may be more profitably used for other activities such as improving care of patients with known illness. The competing challenge of over-use of resources by those with milder symptoms at the expense of under-treatment of those with the highest needs has been raised as a global challenge in many areas of health care[16].

While benefits of treatment for persons who are ill are well studied through RCTs that have been meta-analyzed and translated into clinical guidelines, harms such as consequences of treatment of persons who are not ill are not known. For example, RCTs evaluating interventions often have inclusionary criteria based on diagnoses or symptom severity, and exclude individuals not meeting these criteria. Similarly, opportunity costs following screening are not measured in light of the small body of evidence that has looked at services provided following screening. A prior simulation study[17] provides one example of opportunity costs, and suggested that sustained treatment to prevent relapse could have a greater impact in reducing prevalence of mental illness than increasing access to treatment through activities such as screening.

In settings where the prevalence is higher, the ratio of false positives to true positives is lower[2,18] and thus screening may be of greater value. Inmates are one population with a higher prevalence of mental illness, and screening is part of most standards or guidelines[19–22]; in the United States, courts have indicated that adequate mental health screening is a constitutionally guaranteed right for prisoners[23]. However, definitions of screening vary widely from one

jurisdiction to the next, and in many cases screening consists simply of gathering an inmate's mental health history and/or screening for suicide risk[24,25], with little or no measurement of current symptoms that may be either undetected or at an early prodromal stage.

While there are no RCTs in the correctional context, two observational studies have estimated increases from 3 to 5% in the proportions of offenders accessing treatment either compared to a period during which screening was not offered[26] or through a study design excluding already identified cases through usual care pathways[27]. However, none of these studies looked at duration of care or accuracy of treatment decisions. One prior study examining long-term follow-up to screening found evidence suggestive of potential opportunity costs in the form of over- and under-use of treatment resources[28]. Specifically, 69% of inmates who received at least some treatment did not meet diagnostic criteria, and as a potential consequence 54% of inmates meeting diagnostic criteria received very brief or no treatment. Only 17% of those with illness received long-term treatment whereas a further 29% received acute treatment (typically between 3 and 6 contacts). Furthermore, inmates with pre-existing mental health needs, had high rates of recurrent treatment (i.e. 50% of those with a known history experienced at least one interruption in care of 30 days or longer). Potentially as a result of this under- or interrupted treatment, rates of self-harm, suicide and overdose incidents increased during and following treatment compared to untreated periods, although risk of violent incidents were reduced.

Under-study of the impact of prognostic models is not unique to mental health screening, and methods have been proposed to evaluate the potential net benefit of screening where the exact harms (i.e. costs of false positives) and benefits (i.e. better outcomes among detected cases) are unknown. One such approach is decision curve analysis[29]. In this paper, we apply the method

to mental health screening and discuss its potential relevance to policy making and clinical practice.

Methods

This retrospective cohort study involved secondary analyses of data collected as part of routine practice in Canadian prisons, and research diagnoses (using the SCID) from a study conducted by the prison service[30]. The screening and diagnostic interview were completely independent; screening staff did not have access to the results of the SCID at any time, and research assistants for the prevalence study did not have access to the screening data. We included all male inmates who completed mental health screening and the SCID. Of 999 inmates who completed screening, 554 were contacted to complete the SCID, and 459 (82.9% of those contacted) participated. Participants had a mean age of 35.3. Based on self-reported ethnic/racial groups using standardized categories used by the Federal government,60% were White, 25% Aboriginal 5% Black, Sub-Saharan African or Caribbean, and 10% were other ethnicities sparingly distributed across 24 other ethnic or racial groups. Non-participants were of similar age (mean of 35.9) and ethno-racial distribution (all percentages were within 1%). Inmates who completed the SCID were slightly more likely to be referred for follow-up after screening (33%) than those who did not complete the SCID (30%).

Measures and Procedure

Screening. The computerized screening includes three self-reported items regarding diagnosis, psychotropic medication prescription(s), or psychiatric hospitalizations just prior to incarceration. We refer to this practice as history taking. While this does not meet the usual definition of screening (i.e. to detect unknown illness), it is commonly part of screening in prison contexts due to the fact that file information may not be readily available to ensure continuity of

care. Inmates also complete the Depression Hopelessness Suicide Screening Form (DHS[31]) and the Brief Symptom Inventory (BSI[32]). The DHS is a 39 item questionnaire designed specifically for use with offender populations. There are 5 items that assess current suicide ideation or plan, recent or multiple prior suicide attempts, or a history of self-harm; a positive response to any of these five items can be used to screen for elevated risk of self-harm[33]. A total score, and depression and hopelessness sub-scale scores capture the number of endorsed items. Any inmate reporting increased suicide risk, scoring at least 8 on the total score, 7 on the depression sub-scale, or 2 on the hopelessness scale is considered a possible case[34]. The BSI is a 53 item self-report questionnaire. Nine sub-scale scores and a global severity index are calculated as the average item response. A T-score of 63 or higher (using general adult population norms) on the Global Severity Index or on 2 of the 9 sub-scales is considered a possible case[32].

We compared increasingly broad mental health screening (thus increasing sensitivity, while decreasing specificity) that are reflective of the diverse types of screening offered in prisons and jails. At each step we added a new criterion, while retaining all prior criteria. The first step was referral of those reporting a recent mental health history. Second was to add one or more self-harm risk factors. Third, was to add elevated distress on both the BSI and DHS (which we refer to as multiple cut-offs). Finally, we added elevated distress on either of the BSI or DHS (which we refer to as simple cut-offs).

Gold Standard Diagnostic Interview. Inmates were interviewed by a research assistant to complete the SCID for DSM-IV[35] and the modified Global Assessment of Functioning (GAF) Scale[36]. To capture severe mental illness that caused moderate to severe symptoms or impairment, the case definition was a current diagnosis of a mood, psychotic or anxiety disorder plus a GAF score of 60 or less. Diagnoses of substance use were not used as part of the case

definition; however, we did compare the performance of screening for those with and without a substance use disorder. Research assistants were blind to screening results, and diagnostic interview results were not shared with screening staff.

Additional file information. We collected information about additional inmate characteristics from offender files to explore inmate needs, including community functioning prior to arrest, employment, and family history (both childhood relations and adult family) from a semi-structured intake assessment[37]. We also collected reintegration potential ratings that are determined based on the results of three structured risk assessments. An inmate is rated as low reintegration potential if they score high on at least two risk assessments, high reintegration potential if they score low on at least two assessments, and moderate otherwise[38].

Analysis

Traditional cost-benefit analysis requires valuations of the costs or utilities assigned to different health states; decision trees can be created to depict these utilities[39]. When exact costs and benefits of follow-up services are unknown, decision curve analysis[29] can estimate the potential prognostic utility of a test based on its psychometric properties (i.e. the sensitivity and specificity), and a valuation about the relative importance of the benefits of correctly identifying illness (i.e. true positives) to the costs of false identification of a person who is not ill (i.e. false positives). This relative importance of benefits and harms is quantified by the treatment threshold, which can be thought of as an exchange rate[40]. To understand this in a currency context, if a producer could sell a product for 1 dollar, but they had to purchase materials from a country trading in Euros, they would need to convert the cost from Euros to dollars to determine whether the money earned from the sale outweighed the cost of purchasing the material. If one dollar was equal to two Euros, the costs would be weighted by a factor of 0.5 to put them in the

same units - dollars - as the sale price. In this example, if the cost per unit was less than 2 Euro, the seller would make a profit. In relative terms a dollar is twice as valuable as a Euro.

In Table 1, we list some examples of harms and benefits of follow-up actions to a positive screen. Unlike the economic example above, there is no established exchange rate that can be applied to arrive at an exact valuation of the harms and benefits, and valuations of these harms and benefits will vary from one person to the next. However, decision curve analysis can reduce this question to the relative valuations of harms and benefits through the determination of how many false positives would be acceptable per true positive. To offer a simplified illustration of the process of establishing the treatment threshold. consider a decision maker who focuses only on re-offending in weighing harms and benefits (typically there are multiple possible harms and benefits to weigh). The benefit of true positives would be that by reducing symptoms one could reduce the risk of re-offending associated with acute symptoms. By contrast, a false positive result could lead to prolonged incarceration if a parole board either perceives the offender as being untreated due to misinterpreting the meaning of a screening result or if the offender was inappropriately treated but showed little sign of improvement (because they had no or little room for improvement). The decision maker might believe that no more than 4 inmates with mental illness should have their incarceration extended in order to prevent 1 inmate with mental illness from returning to prison after release, which suggests that for this decision maker the costs to society of re-offending are 4 times greater than the restrictions on an inmate's liberty due to prolonged incarceration (c.f. Vickers et al.[40]). In this case, because we would be willing to accept 5 referrals in order to detect one illness, the treatment threshold would be 1/5 = .20.

If there are more true positives than weighted false positives, decision curve analysis would recommend treating all those obtaining a positive screen to achieve a net benefit. This weighted net benefit (or harm) for the screened population can be calculated using the formula:

$$Prevalence \times Sensitivity - False\ Positive\ Rate \times (1 - prevalence) \times \frac{TreatmentThreshold}{1 - TreatmentThreshold}$$ ††

where False positive rate = 1 - specificity.

The first part of the formula (prevalence x sensitivity) indicates the proportion of the population who would be correctly referred (i.e. are true positives). Similar to the currency example where the costs (originally in Euros) were converted to the units of the profit (in dollars), the second half of the formula converts false positives into units that are equivalent to true positives. To define the unit of true positives in non-statistical terms, it can be noted that we are interested in true positives because they are individuals who stand to benefit from treatment. Thus throughout this paper, we express the net benefit of screening as the proportion of the population who stand to benefit (from the available treatment that should follow a positive screen). We use the term 'stand to benefit' because not everyone who is detected by screening will go on to receive treatment (i.e. they may refuse treatment, there may be a waitlist for service, etc.). As such the net benefit from decision curve analysis is likely a maximum achievable benefit.

It is typical in decision curve analysis to compare screening to clinical contact for everyone and for no one[29]. The comparison to no clinical intervention is simply to illustrate whether screening is beneficial or harmful. While it would be less relevant in health contexts where there is less diversity in terms of potential responses to a positive screen, the comparison

†† An alternate expression of the formula using frequencies rather than proportions can be derived as:

$$\frac{True\ positives - False\ positives \times \frac{TreatmentThreshold}{1 - TreatmentThreshold}}{n}$$

to intervention for all individuals could be especially informative in the mental health context. It compares screening to the option of skipping the screening step and progressing directly to follow-up. In the traditional mental health services model, this could consist of a brief triage for all inmates. Universal or selective public health interventions could also fall within this universal intervention case. For example, given that distress is highly common in early incarceration, but may resolve quickly, basic distress tolerance, relaxation techniques or other coping skills could be taught to inmates in group or self-directed formats that entail low harms (and thus a lower treatment threshold might be acceptable). Such a program could be offered to all inmates (i.e. as a universal intervention) or as a response to a positive screen (i.e. a selective intervention).

To interpret a decision curve, a decision maker would identify the range of plausible treatment thresholds for their setting (i.e. they might ascertain treatment thresholds from numerous stakeholders and consider the full range of values). The strategy that provides the greatest net benefit over the range of plausible thresholds would generally be recommended. In our presentation of decision curves where the different screening approaches are incremental, we use a single curve to represent the various screening options. We place a point on the curve at the treatment threshold for which it becomes beneficial to use the next least intensive screening. We do so for ease of interpreting the curves (by reducing the number of lines), and to for space reasons for presenting sub-group analyses (i.e. we present the relevant parameters for each decision curve in tabular form in lieu of requiring a figure for every group).

Results

Traditional accuracy statistics of the screening tests that are used in calculating the decision curves (i.e. sensitivity, specificity and positive and negative predictive values) are provided in Supplementary Table 1. Figure 1 illustrates the decision curve analysis for the entire

population; we also provide the traditional decision curve showing a separate line for each screening strategy to illustrate the benefit of our single curve presentation and to assist in understanding the parameters presented in Table 2 (we have aligned the scales of the two figures so that it can seen that the points represent the lowest and highest thresholds for which each strategy provides the greatest benefit compared to all other strategies). As seen in the figure (and numerically from the first row of Table 2), each strategy is optimal over a relatively narrow range of treatment thresholds. The broadest screening option (i.e. referral for an inmate meeting any of the 4 criteria) is the optimal strategy for thresholds between 0.06 and approximately 0.16 (or approximately 6-16 referrals to correctly detect one illness), with a net benefit for 13 to 17% of the screened population. Requiring an inmate to exceed distress cut-offs on both scales (or to report a recent mental health history or self-harm risk factor) is the optimal strategy between a threshold of 0.16 and 0.31 (or approximately 3 to 7 referrals to detect one illness); this provides a net benefit for 7-13% of the screened population. If the harms of inappropriate referrals are judged to be more significant, and no more than 2-3 referrals per correctly identified illness (thresholds of 0.31 to 0.56) are acceptable, restricting screening to history taking and self-harm screening would provide the greatest benefit. However, the maximum net benefit of 7% represents only one third of the prevalence of mental illness.

Table 2 provides parameters for the decision curve across various sub-groups, including the range of treatment thresholds for which including the criteria would lead to the maximum net benefit of screening, and the corresponding net benefits across these thresholds. For space reasons, we have not included the parameters for the treat all group. These can be inferred as optimal thresholds range from 0 to the lowest threshold for the broadest screen, and the benefit ranges from the highest benefit for the broadest screen up to the prevalence of illness. Both the

absolute net benefit of screening and the thresholds are generally higher in those groups with a higher prevalence of illness (i.e. there are more inmates with illness who can benefit from treatment both overall and among positive screens); this includes inmates with recent psychiatric histories, substance use disorders, lower reintegration potential and higher family, social functioning and employment needs. When taking prevalence differences into account by using relative differences in benefits (i.e. reflecting primarily the sensitivity of screening), we continued to observe greater benefits in many higher prevalence sub-groups. In other words, not only was screening more efficient (i.e. higher positive predictive values), but it was also more sensitive (i.e. detected a higher proportion of illness). While there were no clear differences in relative net benefits between those with and without a substance use disorder or for those with higher family functioning needs compared to those with low needs, differences are observed for the remaining variables - we discuss two of these differences (recent versus no recent history and ethnic groups) in detail to illustrate the table.

Relative differences are most noticeable in terms of screening of individuals with a reported psychiatric history versus those without a recent history. When considering the maximum benefit of the broadest screen in relation to prevalence, this benefit is 73% (0.41/0.56) of the prevalence for those with a psychiatric history versus 63% (0.1/0.16) of the maximum benefit for those without a recent history; this reflects the higher sensitivity of screening for those with a psychiatric history. Screening those without a recent history would provide a net benefit for 6-10% of the screened population if the broadest screen is implemented, as long as there was a willingness to accept between 6 and 16 referrals per detected case. If between 3 to 5 referrals per detected case were tolerable, it would provide the largest net benefit - up to a maximum of 5% of those screened - to refer only those who report elevated distress on both

measures, self-harm risk or a recent history. Thus the net benefit among the group who could be newly detected by screening is approximately half of what was estimated for the entire population (as the net benefit over the same treatment thresholds ranged from 7-17% for the full population).

Screening was also less accurate for ethnic minorities than for White inmates. This is most evident when considering that the net benefit of screening was between 1.5 and 7 times greater for White than non-Aboriginal inmates despite similar prevalence rates in these two groups. Using any screening option other than the broadest screen including simple cut-offs on the distress measures, would lead to a net benefit of less than half of the maximum achievable benefit (i.e. prevalence) for Aboriginals and less than 1/3 for other minority inmates. By comparison, screening with multiple cut-offs achieved 64% of the maximum benefit (.16/.25) and history taking alone would still achieve 1/3 of the maximum benefit for White inmates. There would be no net benefit of history taking for Aboriginal or other minority ethnicity inmates.

As seen in Table 3, the proportions of individuals with co-occurring substance abuse, self-harm risk, violence while in remand jail for the current sentence, and worse functioning prior to incarceration decreased in most cases when moving from those with a mental health history to those reporting a self-harm risk factor, and then progressing to those who exceeded both, either and finally no distress cut-off scores. This suggests the benefits of treatment may decrease with increasingly intensive screening efforts.

Discussion

In light of the debate about how best to increase access to mental health care, frameworks are needed to support decision making in this area. To our knowledge, this is the first study to

apply decision curve analysis to estimate the benefit of mental health screening. The negative relationship between the breadth of screening criteria and co-occurring needs, and lower maximum benefits and treatment thresholds for those without a psychiatric history are consistent with findings from community studies that individuals detected by screening have lower needs or benefit less from treatment than those who are detected clinically [41,42]. As noted by Chiolero and colleagues[43], providing the same interventions to those who are only identified through the use of more sensitive case detection methods will inevitably lead to a less favourable benefit to harm ratio given the lower needs of these newly identified cases.

While consequences of false positives are often considered to be mild, and manageable, there are often more individuals receiving treatment who do not meet diagnostic criteria than those who do[2,28]. While many of these individuals might have sub-threshold needs or could benefit from preventative services to prevent full blown illness[44], in other cases this may be a wasteful use of resources that can also potentially cause harmful side-effects[12,45]. Diverting resources from high need to low need cases can lead to overuse of services by those who do not require services and underuse by those who stand to benefit from them.

Screening also appears to have disparate benefit and treatment thresholds across ethnic groups. Lower sensitivity of mental health history taking among Aboriginal and other minority race inmates is consistent with other studies reporting less access to services in the community among minority ethnic groups[46,47]. Rather than narrowing pre-existing ethnic disparities in health care, screening of prisoners could conceivably widen them. Others have proposed the need for development of unique tools for ethnic and cultural minorities[48], and further work in this area appears warranted as few studies have compared the performance of screening tools within sub-groups[49].

Other important sub-group differences include the finding that the benefit of screening inmates who do not report a recent mental health history is approximately half of that which is estimated from the full sample. This emphasizes that spectrum bias[11,50] should be addressed by restricting screening studies only to those who could be newly diagnosed, or by conducting stratified analyses. Furthermore, the value of screening cases with recent mental health histories is unclear. Given that the recent NICE[22] guideline for criminal justice populations recommended to screen only those for whom concerns are already noted based on history taking and routine monitoring, this question requires further attention. While there is a benefit of screening individuals with a recent history for any treatment threshold above 0.25 (i.e. tolerating no more than 5 false positives per true positive), a negative screening result would seem to be insufficient to discontinue mental health interventions that pre-dated incarceration, and thus a lower treatment threshold should be more acceptable for this group of offenders.

These findings highlight some of the challenges of screening, and the need to carefully weigh harms and benefits. In our experience, the choice to screen is often made under the assumption that existing treatments are effective, but under-utilized. In this case, the traditional approach to ascertaining treatment thresholds as described in the methods section could be applied, and a decision maker would evaluate whether screening is the optimal strategy over the range of plausible thresholds based on the harms and benefits of follow-up activities[51]. However, in countries such as the United States where mental health screening is a constitutional right (or in settings where there are sufficient pressures that screening would be implemented even with equivocal evidence regarding its effectiveness), a model of care would need to be designed around the limitations of screening in order to maximize its benefits. That is responses following screening could be selected based on their costs and benefits aligning with the treatment

thresholds for which screening would be the optimal case-detection strategy. Based on the threshold for screening to provide a benefit identified through decision curve analysis, an intervention for which the relative weight of the harms and benefits is below this threshold could be directed by policy.

When selecting follow-up services, there may be value in risk stratification to determine intensity or type of follow-up, rather than forcing a dichotomous decision. Using this logic, the NICE recommendations to consider watchful waiting as a first response for mild to moderate common mental disorder may be an appropriate first step following screening[52], particularly if the screening is broad and thus lacks specificity. For those who may be uncomfortable with such an approach in prison settings, a wider range of lower harm interventions, including self-directed treatment such as bibliotherapy or online CBT[53] or health promotion and health literacy groups could be considered to minimize potential harm due to false positives. In the context of the current findings, inmates who were not receiving psychiatric services prior to incarceration could be offered these lower intensity responses for a fixed timeframe. This timeframe should reflect the time during which symptoms that may reflect adjustment issues to prison and may naturally remit[54]. After adequate follow-up, inmates who continue to display symptoms or who deteriorate, would be offered higher cost/harm interventions such as individual counselling or medication. These more intensive interventions might be considered more immediately after screening for those reporting recent histories and/or self-harm risk given that decision makers would likely have a lower treatment threshold when faced with these pre-existing and seemingly higher needs.

While decision curve analysis can offer valuable insights (as discussed above), such as integrating sensitivity, specificity, positive and negative predictive values and forcing reflection

about prognosis, it is not without limitation. Because prevalence determines the maximum potential net benefit, and positive predictive value determines the treatment threshold at which there would be no effect of the predictive model, decision curves will not generalize to settings with different prevalence of illness. Further work is needed to confirm whether the relative rankings of the curves (reflecting primarily sensitivity and specificity) are independent of prevalence. Despite this limitation, as the net benefit formula is relatively easy to apply, an interested policy maker, clinician or other individual, could use the estimated sensitivity and specificity of the test and prevalence in their setting to create a decision curve for their context.

It is also a challenge to properly estimate harms and benefits of interventions; clinicians and patients typically over-estimate benefit and under-estimate harm[55,56]. This challenge highlights the need for randomized clinical trials or other robust study designs to properly evaluate the actual impact of screening. A decision curve analysis might in this case be seen as a supplement to research validating a screening tool, which can establish that there is in fact a likely potential for screening to produce a net benefit based on expected benefits and harms of a positive screen[29]. If a decision curve analysis suggests no benefit of screening (or if the potential benefit is too low to justify the cost of screening), the costs of a trial would seem unjustified. It is highly unlikely that a decision curve analysis would under-estimate the benefit of screening in light of implementation issues following screening (e.g. patients and/or clinicians deciding treatment is not necessary following a positive screen, and the fact that treatment will not be effective for all those who access it), and because over-estimated benefits and under-estimated harms will result in an under-estimate of the true treatment threshold.

Following the recommendations of Steyerberg and colleagues[57] that a prognostic model should be developed, validated in a replication study and then tested for its impact, decision

curve analysis is particularly relevant at the development or validation stage as a supplement to traditional statistics of model performance to justify the progression to the subsequent testing step. Unfortunately, many screening tools never progress past the first of these three steps[22,49,52], and thus the likelihood of overestimating their value is high. Because of the risk of inaccurate estimates of treatment thresholds, the third and final step should always be pursued (i.e. testing the impact of screening following implementation, ideally through one or more RCTs), including a formal cost-benefit analysis that would be given precedence over results of a decision curve analysis. The results of decision curve analysis could help identify the control condition(s) for an RCT. For example if both screening and the treat all strategy may be likely to result in a net benefit, it would be more appropriate to offer the universal intervention rather than treatment as usual (or no screening) as the comparison condition. This strategy may also be required if, for example, the results of decision curve analysis suggest that screening is the optimal strategy, however, it is unclear how intensively to screen. For example, based on the current findings, a decision maker considering a range of thresholds between 0.1 and 0.2 would be faced with the decision between the broadest screen (i.e. screening in an inmate reporting any distress) versus the second most intensive screen (i.e. screening in only inmates reporting distress on both measures). An RCT comparing these options might be the recommended course of action from a decision curve analysis.

Another challenge related to ascertaining treatment thresholds is that they may not be generalizable across settings. This is because the intensity of follow-up to a positive screen may vary depending on individual needs and the priorities of the screening process. For example, screening may aim to identify sub-threshold or prodromal symptoms to prevent onset of illness [27,44]. In this case, the follow-up to screening will be lower intensity and entail less potential harm;

thus a larger number of false positives would be tolerable and the treatment threshold would be lower. Similarly, if a stepped-care model is in place to limit the intensity of the response to milder symptoms of illness (e.g. using watchful waiting or self-directed therapy as recommended by NICE[52]) this may mitigate the potential harms of overdiagnosis. Conversely, in a resource-limited setting, a higher treatment threshold might be required even if the same follow-up actions are to be provided, due to a greater need to limit over-use by lower need cases.

Conclusion

Despite many efforts to improve detection of mental illness through screening, it remains a challenge to balance the costs and benefits of current approaches. Given the limited body of research evaluating the impacts of screening on service use and health and behavioural outcomes, we have shown how decision curve analysis can be useful to approximate the potential value of screening. While there is some early evidence of accuracy and potential small benefits of screening, screening may not be the most cost-effective approach to improve clinical decision making and mental health outcomes. Guidelines, policies and laws (where they exist) should allow flexibility to consider a wider range of interventions, innovations and organization of services that ensure that the right care is being provided following screening or in place of it.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Table 1. Harms and benefits of triage/assessment or treatment for true and false positives.

Ill	Benefit of triage/assessment	Harm of triage/assessment	Benefit of treatment	Harm of treatment
Yes (true positive)	• Identify needs and plan treatment	• None (costs are warranted and part of providing care)	• Reduce symptoms • Prevent incidents, violence, premature mortality	• N/A (risk of adverse effects should be considered and balanced in choosing appropriate treatment)
No (false positive)	• Potential to propose strategies to address other needs outside of scope of work by mental health staff • Document baseline mental health status	• Inconvenience • Potential stigma • Divert resources to assessment that could be used to treat known illness	• Prevent later illness among sub-threshold cases • Provide support for distressing symptoms	• Adverse effects of treatment • Abuse of prescriptions in prisoner population • Divert treatment resources towards lower need cases who may benefit less • Mission creep (e.g. treating non-illness for security reasons) • Stigma

Table 2. Range of thresholds for which each strategy is most beneficial, and corresponding range of net benefits.

			Simple cut-offs		Multiple cut-offs		Self-harm		History taking	
	n/1000	prev	Threshold	Benefit	Threshold	Benefit	Threshold	Benefit	Threshold	Benefit
Total	1000	0.23	0.06, 0.16	0.13, 0.17	0.16, 0.31	0.07, 0.13	0.31, 0.39	0.05, 0.07	0.39, 0.56	0, 0.05
No recent hx	837	0.16	0.06, 0.16	0.06, 0.1	0.16, 0.31	0.01, 0.06	0.31, 0.39	0, 0.01	NA	NA
Psychiatric history	163	0.56	0.25, 0.52	0, 0.41	--	--	0.52, 0.67	0.15, 0	NA	NA
SUD	497	0.29	0.09, 0.18	0.16, 0.21	0.18, 0.34	0.09, 0.16	0.34, 0.37	0.08, 0.09	0.37, 0.59	0, 0.08
No SUD	503	0.17	0.04, 0.13	0.09, 0.13	0.13, 0.28	0.05, 0.09	0.28, 0.43	0.01, 0.05	0.43, 0.5	0, 0.01
High RP	269	0.09	0.03, 0.04	0.06, 0.06	0.04, 0.15	0.03, 0.06	0.15, 0.33	0, 0.03	--	--
Moderate RP	456	0.22	0.05, 0.18	0.11, 0.18	0.18, 0.24	0.09, 0.11	0.24, 0.35	0.06, 0.09	0.35, 0.64	0, 0.06
Low RP	275	0.38	0.16, 0.24	0.22, 0.26	0.24, 0.5	0, 0.22	--	--	0.5, 0.59	0, 0
White	610	0.25	0.06, 0.15	0.16, 0.2	0.15, 0.35	0.09, 0.16	0.35, 0.41	0.07, 0.09	0.41, 0.61	0, 0.07
Aboriginal	242	0.23	0.11, 0.14	0.11, 0.13	0.14, 0.26	0.05, 0.11	0.26, 0.35	0.01, 0.05	0.35, 0.4	0, 0.01
Other minority	148	0.13	0.03, 0.21	0.04, 0.11	0.21, 0.25	0.03, 0.04	0.25, 0.5	0, 0.03	--	--
Family functioning need	275	0.37	0.17, 0.23	0.19, 0.24	0.23, 0.42	0, 0.19	--	--	0.42, 0.61	0, 0
No-low family functioning need	725	0.17	0.04, 0.12	0.1, 0.14	0.12, 0.23	0.07, 0.1	0.23, 0.43	0.02, 0.07	0.43, 0.52	0, 0.02
Community functioning need	168	0.34	--	--	0.03, 0.29	0.23, 0	0.29, 0.7	0, 0.23	--	--
No-low community functioning need	832	0.20	0.06, 0.19	0.09, 0.15	0.19, 0.3	0, 0.09	--	--	0.3, 0.52	0, 0
Employment need	540	0.27	0.08, 0.16	0.17, 0.21	0.16, 0.39	0, 0.17	--	--	0.39, 0.63	0, 0
No-low employment need	460	0.17	0.04, 0.15	0.08, 0.13	0.15, 0.23	0.05, 0.08	0.23, 0.4	0.01, 0.05	0.4, 0.44	0, 0.01

Note. RP = reintegration potential, where higher potential indicates lower risk (or greater likelihood of reintegrating into society).
-- indicates that the screening strategy is never the optimal strategy (i.e. the more sensitive approach, is at least as effective and would thus be preferred so that the maximum benefit is achieved through treating more people who are ill rather than through screening out those who are not).
NA = history taking is not applied within sub-groups of inmates reporting a recent history or not because there is no variation within the groups (i.e. they are defined by this step).

Table 3. Needs [95% CI] of individuals in relation to screening risk strata.

	Recent history	Self-harm risk	Multiple cut-offs	Simple cut-offs	Screen out
%Moderate-Severe Impairment	58 [46,70]	57 [42,72]	42 [29,55]	27 [18,36]	17 [12,22]
%Substance use disorder	65 [54,76]	68 [54,82]	48 [35,61]	49 [39,59]	40 [33,47]
%Incidents in remand	19 [10,28]	5 [0,12]	12 [4,20]	7 [2,12]	4 [1,7]
%Employment need	64 [53,75]	66 [52,80]	49 [36,62]	48 [38,58]	52 [45,59]
%Community functioning need	28 [18,38]	20 [8,32]	23 [12,34]	16 [8,24]	10 [6,14]
%Family functioning need	44 [33,55]	36 [22,50]	28 [17,39]	34 [24,44]	16 [11,21]
Health incidents/1000PY	46 [4,89]	9 [0,32]	6 [0,23]	13 [0,33]	2 [0,8]
Violent incidents/1000PY	87 [29,146]	95 [16,174]	92 [26,158]	46 [8,85]	37 [12,62]
Victimization/1000PY	108 [43,173]	95 [16,174]	6 [0,23]	21 [0,47]	20 [1,38]

Figure 1. Decision curve analysis of screening for the entire inmate population.

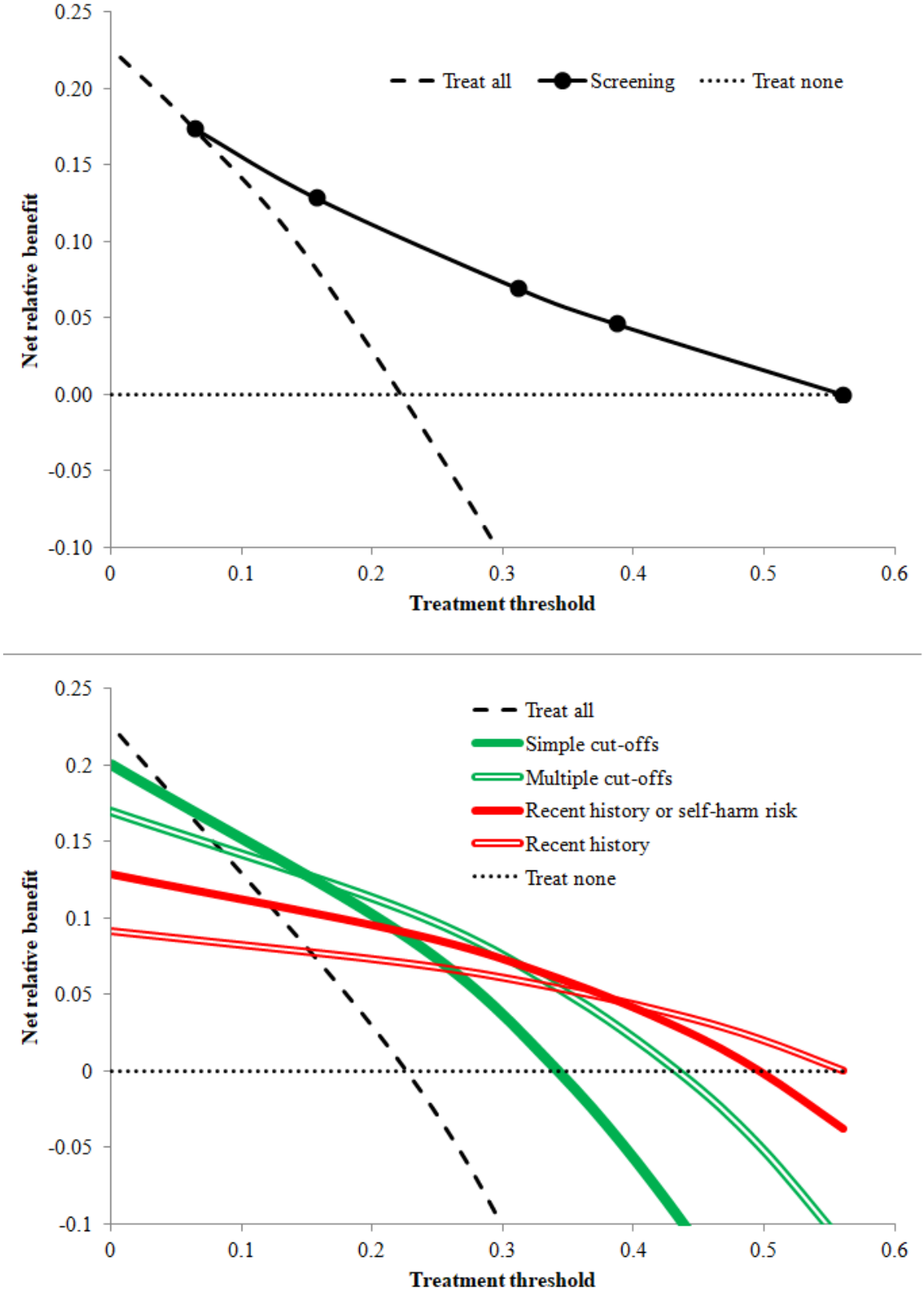
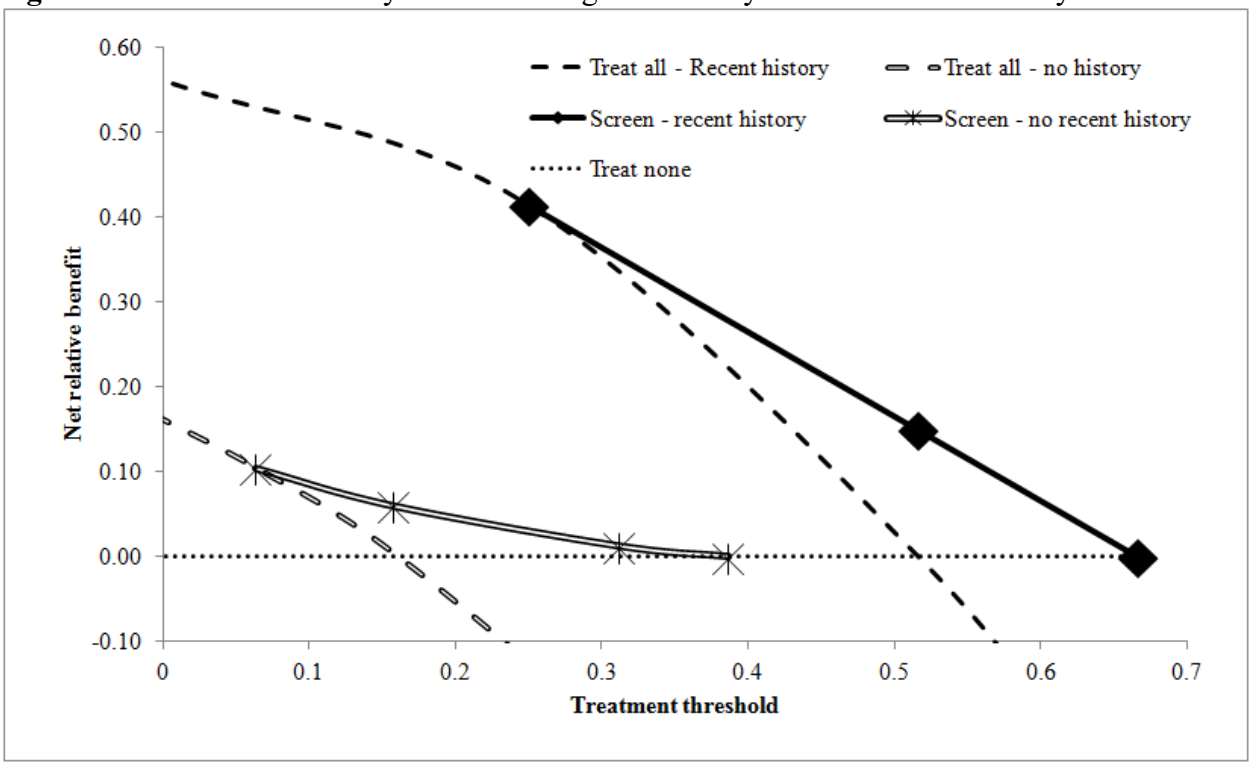


Figure 2. Decision curve analysis of screening stratified by recent treatment history.



Supplementary Table 1. Traditional measures of screening accuracy for entire sample and by sub-group.

Referral rule	By step				Cumulative screening performance				
	Δ TP	Δ FP	Δ Sens	PPV	% Referred	Sens	Spec	PPV	NPV
Full sample									
No screening	0	0	0	NA	0	0	100%	NA	77.5%
History	42	33	40.4%	56.0%	16.3%	40.4%	90.7%	56.0%	83.9%
Self-harm	17	27	16.3%	38.6%	25.9%	56.7%	83.1%	49.6%	86.8%
Multiple	**19**	**42**	**18.3%**	**31.1%**	**39.2%**	**75.0%**	**71.3%**	**43.3%**	**90.7%**
Simple	14	75	13.5%	15.7%	58.6%	88.5%	50.1%	34.2%	93.7%
Treat all	12	178	11.5%	6.3%	100.0%	100.0%	0.0%	22.7%	NA
No recent psychiatric history									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	83.9%
Self-harm	17	27	27.4%	38.6%	11.5%	27.4%	91.6%	38.6%	86.8%
Multiple	**19**	**42**	**30.6%**	**31.1%**	**27.3%**	**58.1%**	**78.6%**	**34.3%**	**90.7%**
Simple	14	75	22.6%	15.7%	50.5%	80.6%	55.3%	25.8%	93.7%
Treat all	12	178	19.4%	6.3%	100.0%	100.0%	0.0%	16.1%	NA
Recent psychiatric history									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	44.0%
Self-harm	24	12	57.1%	66.7%	48.0%	57.1%	63.6%	66.7%	53.8%
Multiple	**10**	**12**	**23.8%**	**45.5%**	**77.3%**	**81.0%**	**27.3%**	**58.6%**	**52.9%**
Simple	6	3	14.3%	66.7%	89.3%	95.2%	18.2%	59.7%	75.0%
Treat all	2	6	4.8%	25.0%	100.0%	100.0%	0.0%	56.0%	NA
Substance use disorder									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	71.5%
History	29	20	44.6%	59.2%	21.5%	44.6%	87.7%	59.2%	79.9%
Self-harm	11	19	16.9%	36.7%	34.6%	61.5%	76.1%	50.6%	83.2%
Multiple	**10**	**19**	**15.4%**	**34.5%**	**47.4%**	**76.9%**	**64.4%**	**46.3%**	**87.5%**
Simple	8	36	12.3%	18.2%	66.7%	89.2%	42.3%	38.2%	90.8%
Treat all	7	69	10.8%	9.2%	100.0%	100.0%	0.0%	28.5%	NA
No substance use disorder									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	83.1%
History	13	13	33.3%	50.0%	11.3%	33.3%	93.2%	50.0%	87.3%
Self-harm	6	8	15.4%	42.9%	17.3%	48.7%	89.1%	47.5%	89.5%
Multiple	**9**	**23**	**23.1%**	**28.1%**	**31.2%**	**71.8%**	**77.1%**	**38.9%**	**93.1%**
Simple	6	39	15.4%	13.3%	50.6%	87.2%	56.8%	29.1%	95.6%
Treat all	5	109	12.8%	4.4%	100.0%	100.0%	0.0%	16.9%	NA

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Referral rule	By step				Cumulative screening performance				
	Δ TP	Δ FP	Δ Sens	PPV	% Referred	Sens	Spec	PPV	NPV
High reintegration potential									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	91.1%
History	4	8	36.4%	33.3%	9.8%	36.4%	92.9%	33.3%	93.7%
Self-harm	2	4	18.2%	33.3%	14.6%	54.5%	89.3%	33.3%	95.2%
Multiple	**2**	**11**	**18.2%**	**15.4%**	**25.2%**	**72.7%**	**79.5%**	**25.8%**	**96.7%**
Simple	1	22	9.1%	4.3%	43.9%	81.8%	59.8%	16.7%	97.1%
Treat all	2	67	18.2%	2.9%	100.0%	100.0%	0.0%	8.9%	NA
Moderate reintegration potential									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	78.5%
History	18	10	40.0%	64.3%	13.4%	40.0%	93.9%	64.3%	85.1%
Self-harm	8	15	17.8%	34.8%	24.4%	57.8%	84.8%	51.0%	88.0%
Multiple	**7**	**22**	**15.6%**	**24.1%**	**38.3%**	**73.3%**	**71.3%**	**41.3%**	**90.7%**
Simple	8	37	17.8%	17.8%	59.8%	91.1%	48.8%	32.8%	95.2%
Treat all	4	80	8.9%	4.8%	100.0%	100.0%	0.0%	21.5%	NA
Low reintegration potential									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	61.9%
History	20	14	41.7%	58.8%	27.0%	41.7%	82.1%	58.8%	69.6%
Self-harm	7	8	14.6%	46.7%	38.9%	56.3%	71.8%	55.1%	72.7%
Multiple	**10**	**9**	**20.8%**	**52.6%**	**54.0%**	**77.1%**	**60.3%**	**54.4%**	**81.0%**
Simple	5	16	10.4%	23.8%	70.6%	87.5%	39.7%	47.2%	83.8%
Treat all	6	31	12.5%	16.2%	100.0%	100.0%	0.0%	38.1%	NA

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Referral rule	By step				Cumulative screening performance				
	Δ TP	Δ FP	Δ Sens	PPV	% Referred	Sens	Spec	PPV	NPV
White									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	75.0%
History	34	22	48.6%	60.7%	20.0%	48.6%	89.5%	60.7%	83.9%
Self-harm	9	13	12.9%	40.9%	27.9%	61.4%	83.3%	55.1%	86.6%
Multiple	**12**	**22**	**17.1%**	**35.3%**	**40.0%**	**78.6%**	**72.9%**	**49.1%**	**91.1%**
Simple	8	46	11.4%	14.8%	59.3%	90.0%	51.0%	38.0%	93.9%
Treat all	7	107	10.0%	6.1%	100.0%	100.0%	0.0%	25.0%	NA
Aboriginal									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	77.5%
History	6	9	24.0%	40.0%	13.5%	24.0%	89.5%	40.0%	80.2%
Self-harm	7	13	28.0%	35.0%	31.5%	52.0%	74.4%	37.1%	84.2%
Multiple	**5**	**14**	**20.0%**	**26.3%**	**48.6%**	**72.0%**	**58.1%**	**33.3%**	**87.7%**
Simple	3	18	12.0%	14.3%	67.6%	84.0%	37.2%	28.0%	88.9%
Treat all	4	32	16.0%	11.1%	100.0%	100.0%	0.0%	22.5%	NA
Other minority race/ethnicity									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	86.8%
History	2	2	22.2%	50.0%	5.9%	22.2%	96.6%	50.0%	89.1%
Self-harm	1	1	11.1%	50.0%	8.8%	33.3%	94.9%	50.0%	90.3%
Multiple	**2**	**6**	**22.2%**	**25.0%**	**20.6%**	**55.6%**	**84.7%**	**35.7%**	**92.6%**
Simple	3	11	33.3%	21.4%	41.2%	88.9%	66.1%	28.6%	97.5%
Treat all	1	39	11.1%	2.5%	100.0%	100.0%	0.0%	13.2%	NA
Moderate-high family functioning need rating									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	63.5%
History	20	13	43.5%	60.6%	26.2%	43.5%	83.8%	60.6%	72.0%
Self-harm	5	11	10.9%	31.3%	38.9%	54.3%	70.0%	51.0%	72.7%
Multiple	**9**	**8**	**19.6%**	**52.9%**	**52.4%**	**73.9%**	**60.0%**	**51.5%**	**80.0%**
Simple	7	23	15.2%	23.3%	76.2%	89.1%	31.3%	42.7%	83.3%
Treat all	5	25	10.9%	16.7%	100.0%	100.0%	0.0%	36.5%	NA
No-low family functioning need rating									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	82.6%
History	22	20	37.9%	52.4%	12.6%	37.9%	92.7%	52.4%	87.6%
Self-harm	12	16	20.7%	42.9%	21.0%	58.6%	86.9%	48.6%	90.9%
Multiple	**10**	**34**	**17.2%**	**22.7%**	**34.2%**	**75.9%**	**74.5%**	**38.6%**	**93.6%**
Simple	7	52	12.1%	11.9%	52.0%	87.9%	55.6%	29.5%	95.6%
Treat all	7	153	12.1%	4.4%	100.0%	100.0%	0.0%	17.4%	NA

(continued on next page)

Referral rule	By step				Cumulative screening performance				
	Δ TP	Δ FP	Δ Sens	PPV	% Referred	Sens	Spec	PPV	NPV
Moderate-high community functioning need rating									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	66.2%
History	14	7	53.8%	66.7%	27.3%	53.8%	86.3%	66.7%	78.6%
Self-harm	7	2	26.9%	77.8%	39.0%	80.8%	82.4%	70.0%	89.4%
Multiple	**4**	**10**	**15.4%**	**28.6%**	**57.1%**	**96.2%**	**62.7%**	**56.8%**	**97.0%**
Simple	0	14	0.0%	0.0%	75.3%	96.2%	35.3%	43.1%	94.7%
Treat all	1	18	3.8%	5.3%	100.0%	100.0%	0.0%	33.8%	NA
No-low community functioning need rating									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	79.6%
History	28	26	35.9%	51.9%	14.1%	35.9%	91.4%	51.9%	84.8%
Self-harm	10	25	12.8%	28.6%	23.3%	48.7%	83.2%	42.7%	86.3%
Multiple	**15**	**32**	**19.2%**	**31.9%**	**35.6%**	**67.9%**	**72.7%**	**39.0%**	**89.8%**
Simple	14	61	17.9%	18.7%	55.2%	85.9%	52.6%	31.8%	93.6%
Treat all	11	160	14.1%	6.4%	100.0%	100.0%	0.0%	20.4%	NA
Moderate-high employment need rating									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	72.6%
History	30	18	44.1%	62.5%	19.4%	44.1%	90.0%	62.5%	81.0%
Self-harm	11	18	16.2%	37.9%	31.0%	60.3%	80.0%	53.2%	84.2%
Multiple	**12**	**18**	**17.6%**	**40.0%**	**43.1%**	**77.9%**	**70.0%**	**49.5%**	**89.4%**
Simple	7	36	10.3%	16.3%	60.5%	88.2%	50.0%	40.0%	91.8%
Treat all	8	90	11.8%	8.2%	100.0%	100.0%	0.0%	27.4%	NA
No-low employment need rating									
No screening	0	0	0.0%	0.0%	0.0%	0.0%	100%	NA	82.9%
History	12	15	33.3%	44.4%	12.8%	33.3%	91.4%	44.4%	87.0%
Self-harm	6	9	16.7%	40.0%	19.9%	50.0%	86.3%	42.9%	89.3%
Multiple	**7**	**24**	**19.4%**	**22.6%**	**34.6%**	**69.4%**	**72.6%**	**34.2%**	**92.0%**
Simple	7	39	19.4%	15.2%	56.4%	88.9%	50.3%	26.9%	95.7%
Treat all	4	88	11.1%	4.3%	100.0%	100.0%	0.0%	17.1%	NA

Chapter 11: Discussion

This cohort study of the entire population of new admissions to prison during an almost 3 year period is one of the largest studies to explore the impact of mental health screening. As a real-world application of mental health screening, these findings are a valuable look at the impacts of mental health screening inclusive of implementation challenges that come with translating controlled research studies into practice . These findings raise challenging questions that require further attention from both research and practice perspectives. Returning to the model presented in Figure 1, screening will be effective if (1) it increases earlier detection and treatment of illness; and (2) this treatment reduces the risk of adverse outcomes (or improves prognosis). Based on the current findings, while screening appeared to be predictive of illness and service use and treatment was often provided quickly after intake to prison, it is unclear that treatment resources were used in the most efficient manner. In line with this model, I discuss implications of the current research in relation to the options for the two major interventions that form the model: (1) comparing screening approaches; (2) appropriate matching of treatment to needs and individual characteristics.

11.1. Comparing screening approaches

While almost all jurisdictions report screening for mental health and suicide risk at intake to correctional facilities, the approaches to screening are highly varied, ranging from tools administered by non-clinical (e.g. security) staff to screenings conducted by nurses, psychologists or psychiatrists[264–266]. Scheyett and colleagues found that very few jails who reported screening for mental illness used validated tools, and thus the accuracy of these processes are unknown[266]. Throughout this thesis, a number of approaches have been compared, although not all necessarily would be considered screening in the true sense of the practice as

defined at the outset of this thesis. While these distinctions may simply appear to be semantic in nature, they may warrant greater consideration in order to determine the best approach to detect mental illness or mental health needs. They may also have important implications in terms of determining the standard of mental health care required to ensure that prisons are providing an equivalent standard of care to that which is offered in the community[267–270].

While mental health history taking does not lead to detection of new cases, many correctional institutions rely only on these types of questions to screen for mental illness[50,266,271]. As shown throughout this thesis, it may be a highly effective detection method to identify the most severe cases, although it may be less effective for detecting needs of inmates of minority racial, cultural or ethnic backgrounds (see Chapters 8 and 10)[272–274]. Due to the fact that mental health history indicators were only added to the screening system mid-way through the period covered by this study, analyses of treatment effects were not stratified by those with and without a known mental health history. This represents an important avenue of further research to understand the benefits of identifying new cases of mental illness through screening in prisons. It would also be of particular value to better understand the finding that the individuals who did not have a recent mental health history used less mental health services. If these individuals adjust well to incarceration with no or limited intervention, this would suggest minimal value of screening.

In the current study, mental health history was self-reported. The reliability and accuracy of self-report versus official data warrants further consideration for potential gains in cost-effectiveness. Separate health and justice systems (as is the case in Canada where most provinces have separate health and justice ministries, and the federal government is responsible for the prison system) can result in delays in continuity of care and of sharing of information[275–277]. If

mental health needs of inmates are detected in community settings, or earlier in the criminal justice setting, significant cost savings could be realized through greater sharing of health related information, in particular for those high service users who bounce between multiple systems[278]. While many health and justice systems have moved towards increasing use of electronic records, most of these are system-rather than person-centred. That is, rather than having a single system used across a province, state or country, each health and justice system that I am familiar with uses its own system for documentation. While information sharing and privacy legislation impose restrictions on the implementation of cross-system platforms, further study of this issue to examine potential costs, benefits and feasibility of increased information sharing appear warranted[277]. To illustrate the potential benefit of this approach, consider the prior study by Lafortune[50] using electronic prison files to identify intake screening results completed by correctional officers and (separately stored) administrative data from provincial health care billing records for the five years (mostly) prior to incarceration. While he found that approximately 65% of those with a diagnosis of severe and persistent mental illness in the community were identified by the correctional screen, he concluded that "correctional services workers do not have the time and/or the working conditions to record the answers to these questions assiduously"[50(p97)]. If the diagnoses made in the community were available to correctional mental health staff, screening would not be required and 100% of those with a prior illness would be detected for assessment and/or treatment to ensure continuity of care.

Another common approach to screening for mental illness is the use of self-report indicators. Nearly all tools identified in the systematic review (Chapter 5) – other than the JSAT, which involves an interview and use of structured clinical judgment – fit this category, including the tools used by CSC (e.g. the BSI and DHS). To summarize extant evidence about these tools,

among the positive aspects of these tools, they can lead to improvements in detection of mental illness (of approximately 20-30% compared to history taking in the current work - see chapter 6), and seem to be predictive of service use (see chapter 7), and institutional incidents[34,159,201,250]. However, they also generate high rates of false positives (for every detected case of illness there are likely to be at least 2 incorrect referrals, and this increases in lower prevalence settings; see Chapter 6), and many screening tools lack high quality replication studies (see chapter 5). The high false positive rates are further concerning because false positive screening results do not appear to be easily identified as such, based on rates of inmates who do not meet diagnostic criteria but receive treatment (Chapter 7). Furthermore, the appropriateness for ethnic sub-groups in particular is questionable, given evidence of poorer statistical properties of many tools (Chapters 5 and 10) and low rates of service use following screening (Chapter 8). As noted briefly in the introduction to Chapter 8, it is essential to understand the reasons for which there is a low uptake of treatment. Self-report screening will not improve treatment uptake if individuals do not perceive a need for treatment or withhold symptoms[128,279]. In a correctional environment, concerns have been raised about the potential for malingered symptoms by inmates who are seeking medications or a more desirable cell placement, and as such numerous tools have been developed and tested to assess malingering[126,127,280–283]. In CSC the Paulhus Deception Scale was previously part of the computerized mental health screen, but it was removed as it was judged to be of limited value and the scale was widely used as part of other assessments within the prison service[240].

Observational/behavioural indicators can also be used for the purpose of detecting mental illness. This approach fits with the skills and experience of correctional staff at monitoring for changes in risk[89,90] and is useful for ensuring that detection of illness is an ongoing activity, and

not simply restricted to the intake period. The analytic approach of stratifying the analyses by risk of self-harm and violence used in Chapter 9 could inform a narrow, and mostly reactive surveillance-oriented approach to the use of observation or behavioural indicators (i.e. inmates with recent histories of violence or self-harm would be referred for assessment). This type of approach is partly embedded as a component of screening in the UK[210], where a homicide conviction leads to referral. Other approaches that are arguably more preventative, could involve looking for earlier warning signs or risk factors/markers for mental illness such as a lack of participation in programs, employment, leisure activities or other social determinants of health[284]. Since poor social, educational and employment outcomes are common among inmates populations[159,285], they may not be efficient to detect potential illness on their own. However, the higher prevalence of mental illness among those with higher needs on social functioning and familial domains mean that screening will be more efficient (i.e. have a higher positive predictive value) for these groups as seen in Chapter 10.

An alternative use of social determinants and social functioning measures could be to move from screening exclusively for mental illness, to incorporate (positive) mental health or resiliency and protective factors. This may lead to a screening approach that seeks to rule out illness (or need for treatment), rather than rule it in. Adopting this approach effectively requires the starting position that all inmates could benefit from some type of intervention or support. This may be reasonable given the high prevalence of lifetime mental health histories of inmates, and rates of self-reported distress (in addition to disorders such as substance abuse and personality disorders, which while technically part of diagnostic classification systems[286], are treated as distinct issues related to criminal behaviour in most justice systems[287]). Given that

43% of inmates received some (mostly individual) treatment in the current studies, the resource implications of shifting to lower intensity, population-based interventions may be feasible.

Pursuing improved mental health among the entire inmate population would align with Keyes two-continua model of mental illness and mental health[288,289]. This model emphasizes that persons with mental illness may achieve high mental health (i.e. may be flourishing in terms of positive functioning in life to employ Keyes terminology), and conversely individuals without mental illness may be 'languishing' in their daily functioning. Incorporating a focus on functioning (positive mental health) could foster recovery oriented mental health services within the criminal justice system, which has been identified as an important research priority[290,291], and early work attempting to operationalize recovery in forensic hospital settings[290,292,293] could be extended to jails and prisons. The pursuit of positive mental health would require shifting the focus from symptoms to demonstrating that the inmate has the ability to cope and function in the correctional environment, thus encouraging a more strength based, and skill acquisition oriented system.

To some extent, this is already the model in place to deliver correctional programming, and thus it may not be as dramatic of a shift for correctional institutions as it might be in other settings. This shift would be consistent with calls for services that are responsive to specific populations, as evidenced by a focus on strengths in some descriptions of gender[294]-, culturally[295]-, and/or trauma[296,297]-informed care. However, this would also require re-thinking what is meant by mental health interventions, and may require the use of less specialized clinical staff and/or non-clinical staff to deliver some lower intensity interventions (the previous discussion about stepped care models offers one approach to conceptualizing this, with the major difference being that stepping rules would consist of failure to achieve a positive outcome, rather

than persistence or deterioration of symptoms/needs). This is to my knowledge an un-tested approach to date, although shifts towards a more health promotion oriented health system have been called for in general mental health services, most notably the Mental Health Commission of Canada in its recently released mental health strategy for Canada[298].

11.2. Mental Health Treatment

As seen in chapter 7, the total amount of time spent in mental health treatment was proportional to what would appear to be more severe mental health needs, providing support for the predictive validity of the information gathered through screening. However, high referral rates based solely on mental health history and self-harm risk, combined with the 18% of inmates who did not complete screening indicate that nearly half of the CSC population might require a clinical mental health assessment and/or treatment even without a more in depth symptom screen at intake to prison. High referral rates based on these historical indicators may be unique to CSC and other prison systems. This is because prisoners have already been through early phases of the criminal justice system (e.g. pre-trial detention and/or provincial jails while awaiting transfer to CSC), and they may have been screened and started on treatment in these settings rather than in community. Depending on the time lapse since previous screenings, the computerized intake screening offered in CSC may offer little new information, and the most pressing mental health needs may have already been identified. These needs may also be identified if they are highly visible to staff and/or if inmates are willing to seek out care on their own. Studies at earlier points in the criminal justice pathway, and longitudinal studies through the justice system are needed to clarify these questions.

At a minimum it would be inefficient if screening identified few new cases. In the worst case scenario, it would be potentially harmful if the only new information overwhelmed

resources through high false positive rates (Chapter 10). In the current context, it is unclear if the high rates of recurrent treatment episodes (Chapter 7) and weaker treatment effects (Chapter 9) were related to resources being tied up to provide treatment to lower need cases who do not meet diagnostic criteria (as seen in Chapter 7). Findings that potential treatment benefits seem to be focused primarily among inmates who received relatively brief interventions, raise challenging ethical and policy questions about the cost-effective use of treatment resources. Because it is unclear whether those who received brief treatment would have improved even in the absence of treatment, spontaneous remission cannot be ruled out as discussed previously in Chapter 9. If brief interventions are in fact effective (and meeting very acute needs), this raises important ethical questions of whether those who are shown to respond to intervention should be prioritized for service over those with higher - but potentially treatment resistant - needs in situations where resources are sparse. If lower intensity and/or less specialized services can be provided with similar effectiveness, this would free up resources to offer more specialized and intensive services to those who are currently not responding to treatment.

To increase uptake of evidence-based treatments, and to better match treatment intensity to need, service models have been developed that recommend that more intensive intervention should only be provided to those who fail to show adequate response to a less intensive intervention, including stepped-care[299,300] or an "integrative stepwise approach"[301]. As noted in a recent review of stepped care for depression[300], these models are highly variable, with initial steps ranging from watchful waiting and self-help to low intensity treatment such as problem solving therapy. All of these models have clear rules to determine whether treatment should progress to the next step, or if there is evidence of treatment response. Such models may be especially appropriate to guide follow-up responses to positive screens, in light of high false

positive rates (or low positive predictive values) of screening and high rates of treatment provision to those who did not meet diagnostic criteria.

Implementing stepped-care models would require research establishing valid definitions of stepping rules, and thoughtful adaptations of models to the realities of correctional settings. For example, it would be necessary to address security issues around the use of computers which may be restricted or prohibited in some correctional settings in order to implement on-line self-help modules for health literacy or self-help therapies. Others have shown creative solutions to this issue, such as the use of an offline 'internet-in-a-box' system to simulate using the internet as part of a health literacy program in a county jail[302,303]. The implementation of computerized mental health screening in CSC represents another such approach showing possible solutions to security-related issues.

An alternative first step – whether in place of screening, or as the response to a positive screen – would be greater use of group-based preventive interventions targeting risk factors for mental illness. While population level interventions may offer less benefit at the individual level, they can have a greater impact on the incidence of outcomes at the population level[304,305]. For example, providing stress management, relaxation techniques or coping skills training to all inmates either in lieu of screening or prior to it might help address some of the adjustment issues at intake to prison. This could potentially reduce false positives on screening tests, and also provide valuable skills that inmates could use regardless of their mental health state. To my knowledge, such programming has not been provided in a prison setting. Goldstein and colleagues[306] offer an example of how such a model might be implemented, although their example is more reflective of a selective (rather than population level) prevention strategy. In their case, they sought to reduce use of psychiatrist time by providing an initial triage mental

health assessment by a social worker and providing "holistic treatment" to those with common complaints such as sleep issues and anxiety that are judged not to require medication and psychiatric care. They provided written directives with tips for managing anxiety and sleep disturbances as part of this service. As secondary benefits, if these universal or selective prevention interventions are carefully designed to normalize the experience of mental health symptoms among prisoners, they may help reduce stigma and other personal barriers to help-seeking[128,279,307,308].

Beyond the type of treatment provided, others have raised issues about the setting in which treatment is provided. For example, the Office of the Correctional Investigator (the ombudsperson for inmates in Canadian prisons) has argued that prison is not the appropriate place to deliver mental health treatment, and that arrangements with community psychiatric hospitals are required to manage the most complex mental illnesses[309,310]. Arrangements to transfer inmates with mental illness to community hospitals are used relatively broadly in other countries, such as the UK, where the National Health Service is responsible for health care in prisons. However, recent data from a women's mental health unit in the UK that provides 24 hour clinical services during delays in transferring inmates with mental illness to hospital, found that only 28% of admissions were eventually admitted to a hospital[311]. Findings suggested that lower risk, non-violent inmates and those with psychotic disorders were more likely to be transferred to hospital, whereas those with violent crimes, personality or mood disorders were more likely to return to regular prisons[311]. This raises the question as to whether community hospitals are in fact able and willing to accept the most inmates with the most complex presentations of mental illness and co-occurring personality disorders, substance abuse and risk of violence and/or self-harm. The very fact that many inmates were known to these services prior

to incarceration reflects these challenges. While it would clearly be preferable to treat mental illness in hospital and/or community mental health services that are designed with recovery as a primary goal, consideration should be given to enhancements to these services that may be necessary to simultaneously manage risk of criminality among the population of persons with mental illness and justice involvement[291].

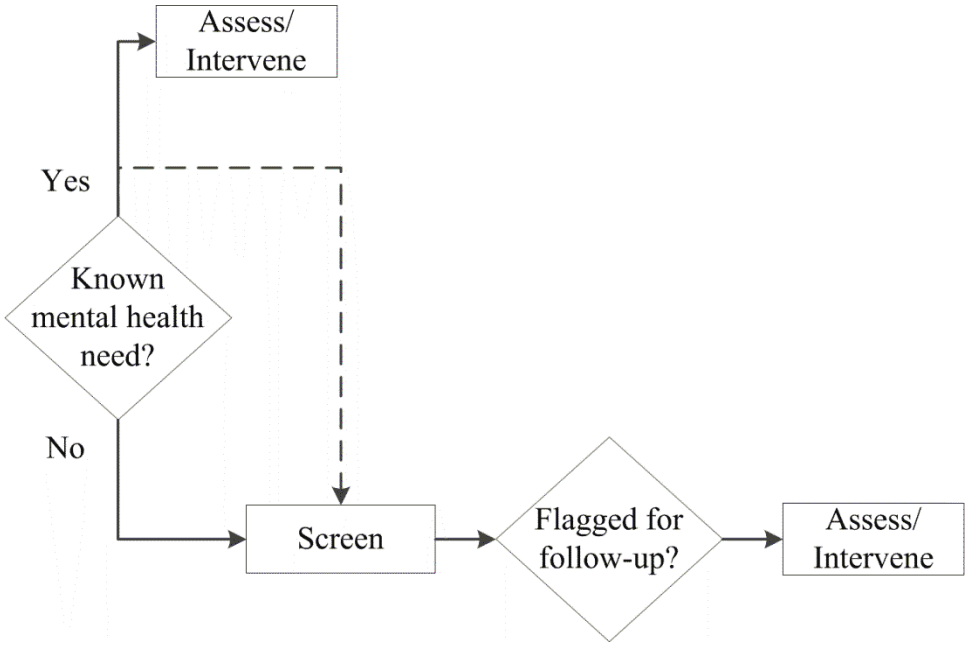
If mental health care of inmates is transferred to community settings, effective mental health screening is even more important to ensure the timely transfer of inmates to general or forensic psychiatric hospitals where warranted. Such screening would also need to be efficient, in order to avoid over-burdening community facilities with unnecessary referrals, and correctional systems with the high costs of transferring inmates to these settings (e.g. security officer time to supervise the inmates during transport to the hospital and potentially during their stay[312]). At present there is limited evidence about the most cost-effective responses to persons with mental illness who commit crime. A recent systematic review reported similar all-cause and suicide mortality rates following release for offenders who were treated through the forensic system compared to those who were incarcerated, and lower re-offending rates[313]. However, these results do not control for potential differences between the forensic and correctional populations, nor do they account for costs. Estimates from Alberta suggest that yearly costs of forensic hospitalization are more than double those of psychiatric treatment in CSC Treatment Centres (approximately $275,000 versus $125,000), and lengths of stay in forensic hospital are on average 3.5 times longer than correctional settings. Together, these estimates suggest that the costs per forensic case are approximately 8.5 times greater than those for a federal inmate (approximately $1 million versus $125,000).

11.3. Potential Models of Care

Based on the preceding two sections, there are a range of models that could be considered at the screening stage, and in terms of follow-up. While the optimal strategy for those who were already receiving care is likely to proceed directly to an assessment and/or continued treatment (see Chapter 10), all inmates are offered screening in CSC. This is common in many correctional settings, although as noted previously in many cases screening is limited to gathering this information about recent history due to a lack of access to information. Figure 4 depicts this practice of offering screening to every inmate and providing largely individual responses. This model is relatively resource intensive as it requires offering screening to all inmates (of whom 83% currently participate within CSC), and follow-up assessments to the many who are identified with some need (i.e. as seen in Chapter 7, 43% of those without a recent mental health history or current suicide risk report at least some distress on the current screening, with 18% reporting high distress on both tools). There are clear opportunities to improve the efficiency of this model, including only offering screening to those whose needs are not already known and/or changing the response to a positive screen. In the case of CSC, information about mental health histories and suicide risk is gathered upon arrival to the prison by a nurse and correctional officer (suicide risk only). CSC also receives information from the provincial jail where the inmate was incarcerated while awaiting trial and/or following their conviction but prior to transfer to CSC. Thus many of the 25% who reported a mental health history on screening were likely already known to mental health services[248]. This option to not screen the group with already known needs is depicted in Figure 4 by the dashed line from the question whether an inmate has a known mental health need to the box depicting the screening process. As noted in Chapter 10, screening with the self-harm and distress measures did little to identify false positives (i.e.

inaccurate reporting of recent histories, or inappropriate treatments provided before incarceration), and missed a number of true cases. The solid line from known mental health need to assess/intervene depicts this recommended practice.

Figure 4. Current practices in order to detect mental illness at intake to prison.



The second option to change the response to a positive screen, could include moving away from immediately progressing to the relatively resource intensive individual assessments that are currently provided for all inmates flagged by screening, and towards selective prevention strategies. This approach may be less appropriate for those with a mental health history or at high risk of self-harm (or at least it may be seen as high risk to policy makers and clinicians to provide lower intensity services to these higher risk groups), and thus this option may apply primarily to the group with apparently new onset symptoms of distress or illness. Consistent with the NICE[76] guidelines for common disorders discussed in the introduction, possible responses for this group could include watchful waiting, or the provision of group-based CBT or psychoeducation which have been shown to be effective at preventing onset of depression in at

risk populations in community settings[96]. Some CSC correctional programs provide skills training and address emotion regulation and coping. However, these programs typically start later in an inmate's sentence after they complete the intake assessment process, which typically lasts approximately 3 months (although pilot projects have been undertaken in recent years to engage inmates in programming at an earlier stage)[314], and are typically not delivered by mental health professionals[150]. Targeted mental health programs such as START NOW[315] are examples of manualized interventions that warrant consideration for this purpose. Arguably, most (if not all) inmates could benefit from these types of programs that address topics such as emotion management/regulation and distress tolerance, and thus even those inmates who are false positives against a diagnostic assessment could stand to benefit. More frequent interaction with staff and other inmates could create healthier prison environments by reducing isolation, which may be particularly harmful to mental health[316]. In addition to potential benefits in terms of improved outcomes, participating in a short group based program may provide greater value in terms of assessing needs through more frequent contact than a single individual assessment would.

There may also be ethical implications in terms of the decision to offer treatment to newly detected cases. If for example, low rates of recent mental health service use are tied to eligibility criteria or other barriers to accessing community mental health services, it raises questions about what services should be provided, and the role of correctional institutions to ensure continuity of care. As noted at the outset of this thesis, CSC assumes responsibility for the provision of health care to inmates in its institution, as they are no longer covered through provincial health ministries under the *Canada Health Act.* It is a challenge to ensure continuity of care for ex-offenders following return to the community both in Canada[275] and

internationally[317,318]. Given that prison staff have finite windows of opportunity to provide treatment, efforts have been made (and in some cases, is mandated by law[319]) to increase access to community health care services upon release, with mixed success. For example, CSC offers clinical discharge planning for inmates while still incarcerated leading up to their release, and community mental health specialist services following release to assist inmates in accessing health care and addressing other community reintegration needs such as obtaining housing, identification, employment, etc. An evaluation of this initiative found reduced re-offending for those receiving services in the community, but no effect of the institutional discharge planning service[320]. Based on intent to treat analyses of an Australian RCT, Kinner and colleages[321] found a small benefit of an individualized short-term case management service on use of mental health services at 6 months following release from prison, as 21% of the intervention and 13% of the control group were accessing mental health services. However, there was no effect at the 1 or 3 month follow-ups. A small RCT examining Critical Time Intervention in the weeks following release from British prisons found positive effects on medication use and registration with a GP at 6 weeks post-release[322].

These activities require considerable investment of time and resources, and have important implications for screening. For example, it is unclear whether newly identified cases of mental illness during incarceration are more or less likely to access services upon release. Depending on why these inmates were not receiving services prior to incarceration, it could potentially be more challenging to ensure linkages of previously unknown individuals to community services. If these are new onset illnesses during incarceration, or if incarceration addresses structural barriers to accessing mental health care such as clarifying how to access services, it might be an effective means of accessing community care. However, if inmates with

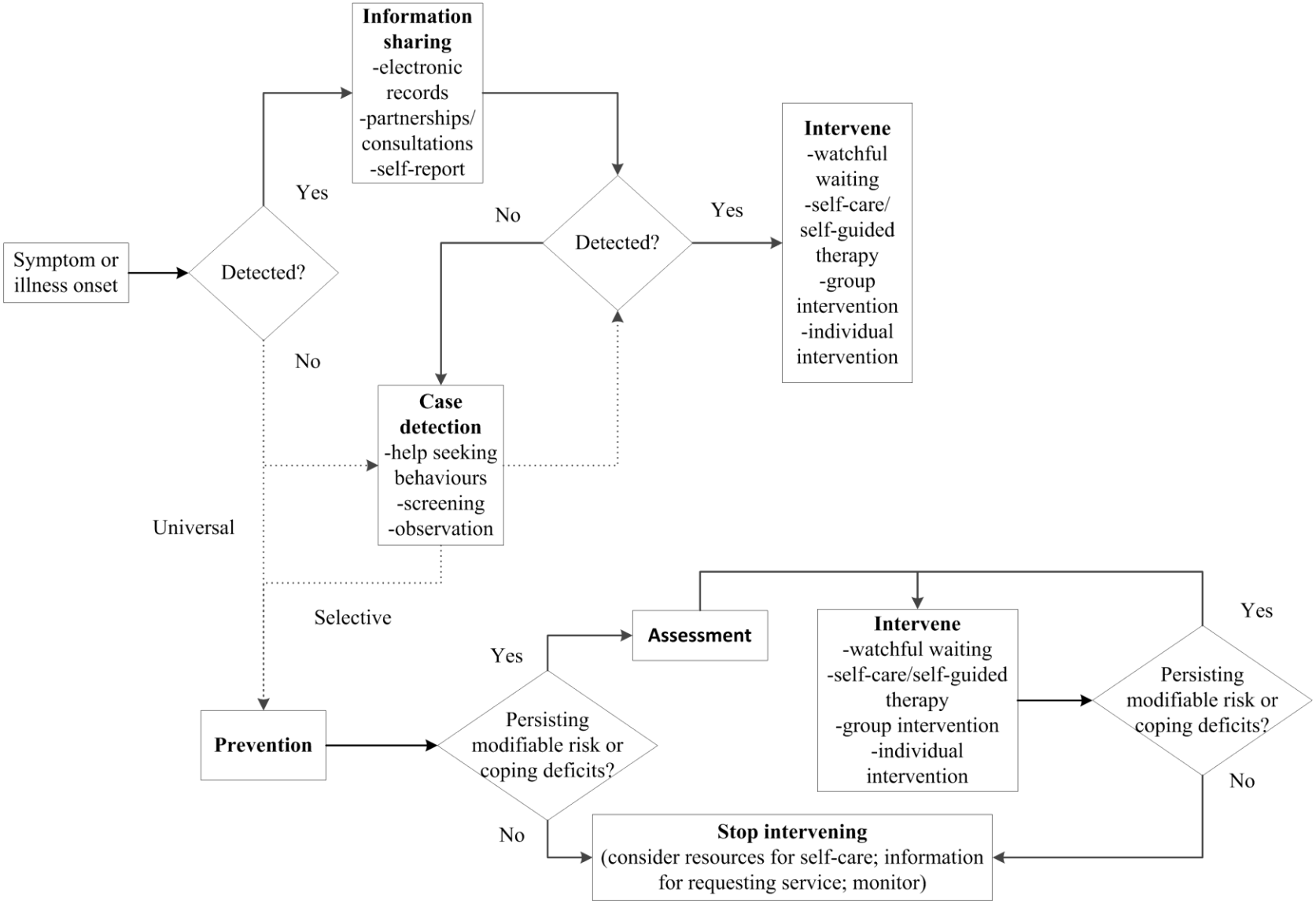
mental health needs identified in prisons are not eligible for community services, if required services are not available in their home communities, or if they are not interested in receiving treatment, screening and the appropriate follow-up services may have little effect on post-release mental health service use.

To my knowledge, this question has not been studied in relation to screening, as no prior studies have compared outcomes of newly detected cases during incarceration from those with a pre-existing history. While newly detected cases during incarceration may well require intervention to support them throughout their sentences - and could benefit from services upon release, further work (ideally through RCTs) is needed to compare the best service models to meet these needs. For example, comparing the effectiveness of the current approach to treatment (typically individual treatment, with discharge planning and community mental health services upon release) versus other approaches (e.g. offering newly detected cases lower intensity interventions that target primarily factors such as self-care, health promotion, coping skills, and insight into mental health symptoms, or self-guided therapy that could be continued upon release) is warranted. Another alternative solution to these challenges is for responsibility for correctional health care to remain with the ministry of health responsible for care in the community, as discussed in the prior section.

Overall, there appear to be at least four major categories of interventions and practices that could be matched to the unique characteristics of each correctional facility and its population to achieve the most cost-effective use of resources to identify and treat mental illness. First, information sharing between community and correctional partners should reduce the size of the population with undetected mental health needs and who would require screening upon intake to jail or prison. Second, case detection efforts need to address both the structural (e.g. providing

information about accessing services and screening to identify symptoms among those who for other reasons cannot access care) and attitudinal (e.g. reducing stigma, considering patient preferences for treatment) barriers to care. Third, it is essential that continuity of care is appropriately matched to need; this includes ensuring that those with the highest need are prioritized for service during transitions into and out of prison. Finally, selective prevention (i.e. for those identified at risk by screening) or universal prevention (i.e. for all inmates)[323], and ongoing monitoring could reduce the incidence of new onset illness during incarceration, and facilitate early intervention when symptoms do arise. While likely an over-simplification of how these pieces fit together, Figure 5 provides a depiction of how these components may be conceptualized. Dashed lines are used to depict the alternative options that may be considered for the population who would be the target of screening (i.e. those with unmet needs). This model is proposed as a hypothesis generating framework to be pursued through further research, given that to my knowledge alternatives to screening and universal or selective prevention initiatives have not been studied in the prison context. This figure is also intended to emphasize the complexity of screening as part of a larger system, and the multiple aspects of an overall model of care that represent either opportunities to improve the impacts of screening or obstacles to its success depending on the attention paid to them.

Figure 5. Hypothesis generating model illustrating opportunities for case detection, prevention and treatment.



11.4. Limitations and Future Directions

11.4.1. Design issues. The current research is limited by the absence of: (1) a comparison group for whom screening was not offered, (2) repeated symptom measures, and, (3) randomization (although this issue is partially mitigated through the use of propensity scores). A well-designed randomized controlled trial (particularly cluster randomized and stepped wedge designs which align with usual implementation of a new service) would address these limitations. An RCT or stepped wedge design could be used to evaluate alternatives to screening (e.g. universal health promotion or health literacy programs, training for correctional staff to detect illness, anti-stigma campaigns or other efforts to address barriers to help seeking, or usual care) or different responses to positive screens (e.g. watchful waiting, a stepped care model, selective prevention for inmates with distress, etc.)[324]. However, while these designs represent the gold standard, they may be challenging to implement in correctional settings. As argued by Coyne et al[66], these trials will require extremely large samples to detect significant effects if the incidence of new illness or adverse outcomes is low. This challenge was reflected in Chapter 9 with wide confidence intervals around interaction terms and treatment effect sizes for the population of inmates who were not already at high risk of harm prior to intake.

Beyond clinical trials, ongoing monitoring of screening as part of regular quality improvement by correctional services is needed. This might include the use of alternative designs such as comparisons between facilities that do and do not offer screening, or comparing changes over time within an institution following implementation of screening. The use of common screening tools or indicators across jurisdictions could support this task by providing opportunities for international research collaborations to increase sample sizes – which may be of particular importance for smaller populations within the criminal justice system, such as

women, and for studying rare outcomes such as self-harm and suicide. Furthermore, this could support benchmarking, quality assurance and/or evaluation activities to maximize the cost-effective use of mental health resources. From a clinical perspective, this could also increase opportunities for sharing information and tracking changes over time for inmates who move between jurisdictions.

In the next section, I discuss indicators informed by basic epidemiological concepts that could be measured by correctional institutions to identify components of this model that might be prioritized in order to achieve the best outcomes (in particular, I focus on decision making for those dotted lines in the model). I summarize these indicators in Table 6, and describe how this data might be interpreted in the paragraphs that follow.

Table 6. Indicators to identify potential value of screening.

Indicator
% of inmates with mental illness who were receiving treatment prior to incarceration
Duration and recurrence of treatment for newly identified inmates with mental illness and those with a recent history
Timing of adverse events in relation to treatment provision
Proportion of inmates with similar needs receiving treatment by race, sex, region, or other relevant equity dimensions

Indicator 1: Proportion of inmates receiving treatment prior to incarceration. This indicator influences the potential yield of screening. In a setting with a high proportion of inmates who have already been diagnosed and provided treatment, the potential yield of screening may be lower. In other words, this setting may have a high prevalence of illness, but low incidence. As discussed in the introductory chapter on diagnostic error, the meaning of symptoms measured by screening tools (or diagnostic interviews) may be altered in a correctional environment, particularly during early incarceration. As a result, there may be a

greater risk of misdiagnosis (or overdiagnosis) by applying screening without accounting for situational stressors due to incarceration.

Indicator 2: Patterns (duration and recurrence) of treatment. This indicator might be the most important to explore a number of the current findings, including the high rate of recurrent treatment episodes and of brief interventions (see Chapter 7). Implementation of screening that increases the rates of both short-term service use and recurrent treatment episodes (or long interruptions in treatment), may reflect inefficient use of resources. If brief interventions increase, without an increase in the rate of recurrent treatment episodes, and in particular if there is a reduction in incident illnesses in later years, this may reflect the benefits of early intervention. In this latter case, the incidence of mental health needs in prison could be high, but the prevalence might be relatively low if the duration of symptoms is short.

Because baseline data regarding patterns of service use were not available for CSC in the period prior to the implementation of screening, it was not possible to explore this question. These service use patterns might be one of the most straight forward indicators for correctional services to capture, and such baseline data would be valuable to collect to determine the potential value of screening prior to implementation. If for example, the rate of service use aligns with estimates of the prevalence of mental health needs among inmates, and seems to be provided with few instances of recurrent treatment, this may be evidence of a system that is already functioning well and well resourced. In this case focusing on case detection efforts does not seem to be warranted, and the more relevant question would be to examine the impacts of the interventions being provided on outcomes of interest.

Indicator 3: Timing of incidents. The timing of incidents has important implications for the potential value of screening. If most incidents occur well after treatment is initiated,

screening will have little or no impact since the need for treatment was already identified. It is possible in this case that mental health needs are not causally associated with incidents, or that that treatment is ineffective. If most incidents involve inmates who have not had contact with mental health services or very shortly after treatment is started, then screening could have a greater impact. While it is critical to ensure that mental health symptoms are causally related to violence (as opposed to other traditional criminogenic needs[193,201,325]), if incidents arise well after these symptoms are identified without screening, it is unlikely that screening will have any impact on these distal outcomes.

Incidents that arise shortly after treatment initiation, raise the potential for confounding by indication; this must be taken into account when interpreting this indicator. Monitoring how the incident rates among untreated individuals, during treatment and following treatment change over time, could provide valuable information whether screening tools could add value to facilitate earlier detection (and prevent symptoms from leading to adverse outcomes). Defining minimally sufficient treatment dose or time in treatment before an effect is expected could help to inform the design of these analyses. If for example, treatment would not be expected to reduce incident rates until the inmate has spent at least one month in treatment, then analyses could be lagged by one month before counting the incidence rate for treated inmates. As noted at the outset, incidents should not be the only outcome of interest when evaluating screening[157]. However, they can be seen as a proxy for treatment effectiveness, and may be easier to measure than changes in symptoms throughout treatment to define recovery.

Indicator 4: Inequalities. The over-representation of individuals of minority ethno-, racial-, and/or cultural minorities has been well documented in many countries[326–328], including the over-representation of Aboriginal and Black inmates in Canada[329,330]. These same groups

have been reported to have lower rates of accessing health care in community settings[273,331,332]. It warrants consideration as to whether screening will address the root causes of racial and ethnic disparities. Findings from Chapters 8 and 10, suggesting lower detection rates of non-Aboriginal minority groups in CSC, and lower uptake of services by those who are detected reinforce the need for further study of whether existing screening, assessment and treatment tools are culturally appropriate, or if there are true differences in prevalence of mental illness among racialized inmates. These questions address a number of key epidemiological concepts including whether there is differential misclassification of mental illness across demographic or regional groups, or if there is evidence of effect modification in terms of the impact of screening on service use or outcomes.

11.4.2 Generalizability. As noted at the outset of this thesis, CSC (as the federal prison system) is only a small piece of the criminal justice system, and arguably the last point at which mental health needs can be identified and treated. It is also the point along the continuum at which the conditions are least optimal to provide treatment, insofar as the primary aims of prisons are not to provide health care. Screening may be of greater benefit at an earlier point in the justice system, although this would need to be evaluated. For example, for inmates who are in police custody (i.e. awaiting a bail hearing upon arrest) or awaiting trial in a provincial jail the implications of delayed detection of mental illness are greater for a number of reasons. First, the risk of suicide is especially elevated in the very early period of incarceration in jail settings (i.e. very shortly after arrest); in prison settings, suicides tend to occur later in an inmate's sentence[333]. Second, and perhaps more importantly, for inmates who have yet to be tried, there are numerous alternatives to divert individuals with mental health needs from winding up in the prison system. These include mental health courts and speciality probation which allow individuals to remain in

the community provided they comply with treatment, and not criminally responsible on account of mental disorder verdicts to allow the individual to be managed either in the community or in a forensic hospital with appropriate mental health and risk management plans in place, and annual reviews by the provincial review boards. In these settings the benefits of detecting mental illness will be higher than those in a prison setting, and thus false positives would be more tolerable (or to use the terminology of Chapter 10 the treatment threshold that would be acceptable to stakeholders may be lower).

The potential impacts of screening on service use and outcomes may also differ at earlier points along the criminal justice continuum. One reason why screening may be seemingly less valuable in CSC is that inmates have already been screened and/or assessed at multiple points prior to arriving in prison, including in police custody, jail and/or for the courts. This information generally follows the offender through the justice system; CSC staff regularly collaborates with their provincial jail counterparts, and information from the courts is also shared with CSC. Thus, in many cases, inmates with mental health needs may already be known before arriving to CSC, and as a result screening results may have less of an impact on decision making. While I am unaware of research documenting trajectories of inmates through the criminal justice system, this represents an important avenue for future research to identify potential redundancies in terms of repeated screening, as well as questions of whether screening does offer greater value at initial entry into the justice system.

While the information is not necessarily achieving the goals of screening (i.e. earlier detection), it may have other value to staff, including corroborating information provided from other criminal justice partners or observations of CSC staff. These baseline measures of symptoms may also offer potential for routine outcome measurement to monitor response for

treatment[334]. If these data are more useful for these other purposes, greater consideration of the goals of administering the screening battery are needed so that resources can be used most effectively. Resources that may not be providing benefit can in turn be re-directed to address other gaps due to finite resources. Based on the current findings this may include increasing the availability of treatment for those of highest needs and minimizing interruptions in care for this group.

11.5. Conclusions

Taken in their entirety, the prior analyses suggest that while screening may offer some gains in the detection of mental illness, the overall benefit may be small due to the number and costs of false positives, and seemingly poorer outcomes among already known cases. There was relatively little evidence of an impact of screening on outcomes in light of findings that there were relatively low levels of service use by individuals who would only be identified through mental health screening (as opposed to history taking and self-harm risk assessment). On the surface, screening is an activity for which it seems unfathomable to many that it would be anything but effective, and in particular that it may cause harm. However, even when using a screening tool that performs as well as any that has been tested to date, there are important harms that can result from screening. Screening continues to be strongly supported by values, public opinion and politics, but empirical evidence remains weak. Ensuring that both the benefits and the harms of screening are taken into account, and that the impact of screening is considered in broader terms than the psychometric properties (i.e. accuracy) of a test is needed to maximize any investments in this area.

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Appendix 1: Ethics Certificates

Ottawa Hospital Research Institute
Institut de recherche de l'Hôpital d'Ottawa

uOttawa

UNIVERSITY OF OTTAWA HEART INSTITUTE
INSTITUT DE CARDIOLOGIE DE L'UNIVERSITÉ D'OTTAWA

Ottawa Health Science Network Research Ethics Board/ Conseil d'éthique de la recherche du Réseau de science de la santé d'Ottawa
Civic Box 411 725 Parkdale Avenue, Ottawa, Ontario K1Y 4E9 613-798-5555 ext. 14902 Fax : 613-761-4311
http://www.ohri.ca/ohsn-reb

April 15, 2015

Dr. Ian Colman
University of Ottawa
Epidemiology and Community Medicine
451 Smyth Road, Rm 3230C
Ottawa, ON
K1H 8M5

Dear Dr. Colman:

Re: Protocol # 20150240-01H **Detection and treatment of mental disorder in prison - Validating mental health screening of Canadian federal inmates**

Protocol approval valid until - April 14, 2016

I am pleased to inform you that this protocol underwent delegated review by the Ottawa Health Science Network Research Ethics Board (OHSN-REB) and is approved. No changes, amendments or addenda may be made to the protocol without the OHSN-REB's review and approval.

Approval is for the following:
- Protocol (version 1) dated April 15, 2015

If the study is to continue beyond the expiry date noted above, a Renewal Form should be submitted to the REB approximately six weeks prior to the current expiry date. If the study has been completed by this date, a Termination Report should be submitted.

The Ottawa Health Science Network Research Ethics Board (OHSN-REB) was created by the merger of both the Ottawa Hospital Research Ethics Board (OHREB) and the Human Research Ethics Board (HREB) for meetings held at the University of Ottawa Heart Institute.

OHSN-REB complies with the membership requirements and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans; the International Conference on Harmonization - Good Clinical Practice: Consolidated Guideline and the provisions of the Personal Health Information Protection Act 2004.

Yours sincerely,

Raphael Saginur, M.D.
Chairperson
Ottawa Health Science Network Research Ethics Board
RS/kd

Ottawa Hospital
Research Institute
Institut de recherche
de l'Hôpital d'Ottawa

uOttawa

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HEART INSTITUTE
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April 15, 2016

Dr. Ian Colman
University of Ottawa
Epidemiology and Community Medicine
451 Smyth Road, Rm 3230C
Ottawa, ON
K1H 8M5

Dear Dr. Colman:

RE: Protocol# - 20150240-01H **Detection and treatment of mental disorder in prison - Validating mental health screening of Canadian federal inmates**

Renewal Expiry Date - April 14, 2017

I am pleased to inform you that your Annual Renewal Request was reviewed by the Ottawa Health Science Network Research Ethics Board (OHSN-REB) and is approved. No changes, amendments or addenda may be made in the protocol without the OHSN-REB's review and approval.

Renewal is valid for a period of one year. Approximately one month prior to that time, a single renewal form should be sent to the REB office.

The OHSN-REB complies with the membership requirements and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans; the International Conference on Harmonization - Good Clinical Practice: Consolidated Guideline and the provisions of the Personal Health Information Protection Act 2004.

Yours sincerely,

Raphaël Saginur, M.D.
Chairperson
Ottawa Health Science Network Research Ethics Board

/kd

Ottawa Hospital
Research Institute
Institut de recherche
de l'Hôpital d'Ottawa

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Friday, April 28, 2017

Dr. Ian Colman
University of Ottawa
Epidemiology and Community Medicine
451 Smyth Road, Rm 3230C
Ottawa, ON
K1H 8M5

Dear Dr. Colman:

RE: Protocol# - 20150240-01H **Detection and treatment of mental disorder in prison - Validating mental health screening of Canadian federal inmates**

Renewal Expiry Date - Friday, April 27, 2018

Thank you for the Annual Renewal Report dated March 9, 2017. I am pleased to inform you that your Annual Renewal Request was reviewed by the Ottawa Health Science Network Research Ethics Board (OHSN-REB) and is approved. No changes, amendments or addenda may be made in the Protocol without the OHSN-REB's review and approval.

Your request to extend the projected date of study completion to December 30, 2017 is approved.

Renewal is valid for a period of one year. Approximately one month prior to that time, a single renewal form should be sent to the REB office.

OHSN-REB complies with the membership requirements and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans; the International Conference on Harmonization - Good Clinical Practice: Consolidated Guideline; and the provisions of the Personal Health Information Protection Act 2004.

Yours sincerely.

Raphael Saginur, M.D.
Chairperson
Ottawa Health Science Network Research Ethics Board

/TB