

University of Alberta

Self Harm Assessment using Psychometric and Clinical Factors
in the Emergency Department

by

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A thesis submitted to the Faculty of Graduate Studies and Research
in partial fulfillment of the requirements for the degree of

Master of Science

in

Epidemiology

Department of Public Health Sciences

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Fall 2011

Edmonton, Alberta

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Abstract

The assessment of self harm risk is a common, difficult, and perplexing task for many physicians, especially those working in the emergency department (ED). A cohort study was conducted where 181 patients were enrolled in two EDs within the city of Edmonton. Initial interviews were conducted in the ED which collected basic demographics and medical history as well as psychometric measures. One of these measures was a novel method of assessing implicit cognitions of self harm and death. The occurrence of self harm behaviour was assessed 3 months after presentation. Regression analysis found a model, including a measure of implicit cognition, which was effective at predicting future self harm for most patients. Receiver operating characteristics of the final logistic regression model using two cut-points obtained a sensitivity of 96.6% and specificity of 53.9% for the low cut off and 58.6% and 96.2% for the high cut off.

Preface

This dissertation is my own work and contains nothing which is the outcome of work done in collaboration with others, except as specified in the text, acknowledgements, and below.

A version of chapter 2 has been submitted for publication/accepted for publication/published. Randall JR, Colman I, Rowe BH 2011. *Journal of Affective Disorders*.

A version of chapter 3 has been submitted for publication/accepted for publication/published. Randall JR, Rowe BH, Dong K, Colman I 2011. *Psychosomatic Medicine*.

A version of chapter 4 has been submitted for publication/accepted for publication/published. Randall JR, Rowe BH, Colman I 2011. *Canadian Journal of Psychiatry*.

A version of chapter 5 has been submitted for publication/accepted for publication/published. Randall JR, Rowe BH, Dong K, Nock MK, Colman I 2011. *The British Journal of Psychiatry*.

Acknowledgements

I would like to thank my supervisors, Brian Rowe and Ian Colman, for helping me with every aspect of this study from finding the psychometric tools that were used to designing and carrying out the assessments and follow ups and finally with their help writing and editing the resulting papers.

I would also like to thank Kathryn Dong for her insights into the project as well as the help she provided in getting the project underway at the Royal Alexandra Hospital. I also want to thank Scott Kirkland and Justin Lowes for their help enrolling the patients without which I would not have been able to complete the project in a reasonable timeframe.

I'd like to thank the Western Regional Training Center for Health Services Research for their financial support during this project. I would also like to thank them for helping to expose me to other areas of health research allowing me to broaden my knowledge base.

I would also like to thank those who agreed to participate in this study and who were willing to undertake a long interview and assessment process while they were often quite distressed. Their openness and perseverance under duress allowed this study to be undertaken.

I would like to thank my parents for their support of my academic interests.

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List of Abbreviations

+LR	Positive likelihood ratio
-LR	Negative likelihood ratio
AUC	Area under the curve
BAI	Beck Anxiety Inventory
BDI	Beck Depression Inventory
BHS	Beck Hopelessness Scale
BIS	Barrett Impulsiveness Scale
BPRS	Brief Psychiatric Rating Scale
BSI	Brief Symptom Inventory
BSIS	Beck Suicide Intent Scale
BSS	Beck Scale for Suicidal Ideation
CI	Confidence Interval
CTAS	Canadian Triage Acuity Score
DAST	Drug Abuse Screening Test-10
ED	emergency department
EMS	emergency medical service
GSI	Global Severity Index
HDRS	Hamilton Depression Rating Scale
HRCS	High Risk Construct Scale
IAT	Implicit Association Test
ICU	Intensive Care Unit
IQR	Interquartile Range
MSHR	Manchester Self Harm Rule

MSPS	Modified SADPERSONS score
OR	Odds Ratio
OTT	Optional Thinking Test
PICO	Population, Intervention, Control, Outcome
PSDI	Positive Symptom Distress Index
PST	Positive Symptom Total
QUADAS	Quality Assessment of Diagnostic Accuracy Studies
ROC	Receiver Operating Characteristic
SC	Symptom Checklist-90 Revised
SPIS	Severity of Psychiatric Illness System
VASA	Violence and Suicide Assessment Form
WHO	World Health Organization

1.1 Mental health and suicide

There is increasing awareness of mental health issues in the decade following the 1999 recognition by the WHO that the impact of mental health has been chronically underestimated. Since then, mental health issues have been increasingly recognized as major contributors to global morbidity and mortality.¹ In particular there is increased recognition of depressive spectrum disorders as well as anxiety disorders. More recently there has been discussion over the large direct and indirect burden of disease caused by mental health and neurological diseases through comorbidity with other diseases.¹

Suicide has been specifically recognized as a mental health issue that results in substantial mortality and morbidity burden.¹ An estimated 800,000 suicides occur each year worldwide.¹ Most of these deaths occur at relatively young ages (between 15 and 45) years of age¹ with youth (10-19 years of age) at particularly high risk. One study suggested that suicide may be the leading cause of death in India for this age group.² Like other forms of injury, the years of productive life lost (YPLL) from suicide is high, since suicide occurs disproportionately in younger age groups. A high rate of self harm in youth is also present in the province of Alberta, Canada with the highest rate of self harm occurring in those in their late teens and early twenties.³

In 2004, suicide was the leading cause of injury deaths with a total of 3616 recorded suicides in Canada.⁴ Over 18,000 instances of hospital admission for self injury were identified in that year and over 4,000 individuals suffered some degree of permanent disability as a result of their self-injury. Of these a total of 199 patients suffered from what was classified as a total permanent disability. The economic burden

of suicide and self injury is also high. A study by Ferris et al. estimated that the cost of a suicide attempt can exceed \$400,000 (2005 US dollars).⁵ The total cost of these injuries to Canada and the Canadian healthcare system was estimated to be \$2.4 billion.⁴ The total burden of self injury in Canada has been estimated by the WHO to be 265 disability adjusted life years per 100,000.⁶ This is higher than the burden of disease of all respiratory conditions in Canada (199 disability adjusted life years).⁶

Recently there has been increased recognition of a limitation in psychiatry and clinical psychology; diagnosis and prognosis is often based on imprecise diagnostic criteria that rely on proxy behaviour symptoms. These have often been selected with diagnostic reliability in mind rather than validity.⁷ There are significant gaps in knowledge about the objective biochemical, cognitive or neurophysiological etiology of the mental health disorders currently listed in either the Diagnostic and Statistical Manual – Version 4 (DSM-IV) or the International Classification of Disease (ICD-10) - 10th Revision.⁸ There are also gaps in our knowledge about the interplay between genetics, biology and the social determinants of mental health.^{8;9} This has proven problematic for research into mental health. An obvious complication is that, without understanding the underlying physical and cognitive issues that account for these problems, it becomes more difficult to find effective treatments. Moreover, this lack of understanding makes it even more difficult to predict the prognosis of individual patients with mental illness. This is especially evident in the case of suicidal patients.

Research to date has shown some risk factors that are connected to suicide.¹⁰⁻¹³

A history of mental illness is a major factor in suicides as an estimated 90% of those who

completed suicide have a history of mental illness.¹¹ Depression is the mental illness most commonly associated with suicide, however, only an estimated 4% of those with depression eventually die due to suicide.^{11;13} Since depression is one of the most common psychiatric conditions it is implicated in a significant proportion of suicides. Compared to depression there are higher rates of suicide in those with bipolar disorders (10-15%) and Schizophrenia (5-13%).^{11;12} Drug and alcohol abuse, anxiety disorders as well as personality disorders have also been associated with an increased risk of suicide.^{11;14;15}

Both environmental and genetic factors have been implicated as risk factors for suicide. Those who have a relative who committed suicide are at increased risk especially if that relative is a twin sibling.¹¹ Environmental factors include a history of physical and sexual abuse as well as unemployment or underemployment.¹³ Socially marginalized groups, such as the Aboriginals (e.g., First Nations of Canada or the Aborigines of Australia), transgendered, homosexual, and other groups are also at an increased risk compared to the majority Caucasian population of those respective countries.¹¹ Access to lethal means of suicide is also a risk factor for completing suicide and is a possible explanation for some of the increased risk of suicide in certain professions (health care professions in particular) as these professionals have the access to lethal methods required to successfully commit suicide.¹¹

1.2 Definitions

Suicide is one type of several behaviours that are classified as self-injurious behaviour. There is still some contention regarding the classification of various kinds of self-injurious behaviour. **Suicide** is understood as being any self-injury resulting in death. **Suicide attempts** are considered any self-injury that occurs as a result of an attempt to end one's life where the person survived. **Parasuicide** is a term that is used by some to denote self-injury that occurs where the aim of the behaviour is not death. This type of behaviour is also sometimes referred to as a "suicidal gesture". Other terminology used is **non-suicidal self injury** which is essentially identical to parasuicide. **Deliberate self harm** is another term used to denote the occurrence of self injury regardless of the intentions behind the behaviour. It is often unclear in a particular instance of self-injury which term is correct due to uncertainties over the actual intent of the patient. There is also ambiguity between the various terminologies; if a patient engages in self injurious behaviour without suicidal intent but dies due to their injury is this the same as a patient who dies purposefully?

For the remainder of this thesis, in order to simplify the description of these behaviours and avoid mislabeling due to intentions, all self-injurious behaviours will be referred to as self harm behaviours regardless of intent or whether the patient died or survived. For the purpose of this thesis the definition of self harm will be:

An act in which an individual deliberately initiates a non-habitual behaviour that, without intervention from others, is expected to cause harm to themselves.

This definition is based on the definition used in the *WHO/Euro Multicentre Study on Parasuicide*.¹⁶ This definition has been modified to include fatal outcomes of self harming behaviour. The portion of the original definition involving the patients' reason and motivations behind their self harm behaviour has been removed from this definition. The focus of this definition will be on the behavioural aspects of self rather than the physical results of the behaviour. So even behaviour that does not actually succeed in harming the patient will be considered self harm if there was intent on the patients part to harm themselves and some action was undertaken to cause this harm. This definition will allow those people who were interrupted in a self harm attempt to be identified as being more similar to those that engage in self harm rather than those that do not. For instance someone who attempts to poison themselves using carbon monoxide gas but is interrupted would be identified as engaging in self harm even if no damage had yet occurred.

1.3 Suicide risk assessment

With respect to patients who report suicidal thoughts or intentional self-harm behaviour the diagnostics problems of mental health become especially poignant. It is well known that many mental health conditions predispose their sufferers to increased risk of suicide. Only a small portion of people that commit suicide have no history of mental illness¹⁷ and yet those having a history of mental illness, or even a history of suicidal ideation or suicidal attempts, more often than not do not complete suicide.¹⁸ The gap of knowledge between the neurobiological, cognitive and environmental causes

of mental illness has so far made it difficult to determine exactly why one person with mental illness commits suicide while another similar person never attempts or even considers suicide as an option. Even within the portion of the population with a history of self harm behaviour only 11 to 13% appear to complete suicide within 5 years of their attempts.¹⁹⁻²¹ Many others never engage in any self harm behaviour before they commit suicide.¹⁰

Those interested in understanding the interrelationship between the biopsychosocial determinants of health and suicidal behaviour have found the problem to be complex. Many hypothetical mental constructs have been contemplated to serve as mediators to fill the gaps of knowledge between the risk factors of mental health disorders, suicidal ideation, self harm behaviours and future incidences of self harm. Constructs such as hopelessness,²² severity of depression,¹³ and locus of control²³ have all been theorized to be the missing link between the disorders and social factors associated with suicide and the actual occurrence of self harm behaviour. Proper measurement of these factors was hoped to allow a reasonable level of prognostic ability to be brought to bear. To this end numerous questionnaire and other assessment methods have been devised and tested that were hoped to improve the prediction of these events. While some of these tests were shown to be predictive of suicidal behaviours in general, they still lacked sufficient level of precision and thus were rarely used in clinical decision making.²⁴⁻²⁷

1.4 Suicide risk assessment in the emergency department

Suicide risk assessment is commonly encountered in the context of the ED. It is estimated that suicidal patients comprise around 0.4%²⁸ of the patients that present to a typical ED in the United States. The city of Edmonton, Canada has a particularly high rate of self harm incidents that present to the ED (2.49 events per 1000).²⁹ It is estimated that approximately 11-37% of patients who present with self harm have an additional instance of self harm within 6 months.³⁰⁻³⁴ When a patient presents to the ED with suicidal ideation or after engaging in self harm behaviour, proper assessment and treatment of the patient can have a significant impact on the future behaviour of that patient. Improper assessment can lead to over hospitalization and over treatment for self harm risk (i.e. intensive treatments for patients who are actually at low risk of engaging in self harm) at considerable cost to the health care system and possibly to the deficit of better treatment options for a patients' non-self harm related psychosocial needs.

The suicide research conducted so far has lead to the creation of a variety of mnemonics (words and short phrases used to remind clinicians of important risk factors) and questionnaires that are potentially useful as diagnostics aids in the ED setting (see Table 1 for examples of mnemonics). However, it is uncertain how often these devices are used within the ED setting and how effective they are at predicting suicide. Measuring certain behavioural markers to predict suicide risk can be affected by a person's current psychological state.³⁵ This is relevant to assessment in the ED as it is possible that tools that were developed for use in community and inpatient settings might perform differently in an ED setting. In the ED, patients are often in an acute

psychological state and therefore might register higher scores for measurements of psychological distress. Patients in the ED might also be malingering or exaggerating their suicide risk in order to achieve a number of possible objectives ranging from admission in an attempt to escape their problems or discharge in order to pursue their goal of ending their life.³⁶

In this situation the problems of assessment mentioned earlier become further heightened. In addition to diagnostic uncertainty about underlying biopsychosocial factors, there is also a level of uncertainty over the accuracy of the information obtained from the patient. This problem extends to both clinical judgment and background history as well as any attempt to objectively measure previously theorized risk factors such as hopelessness or severity of depression. Some research has shown that self-assessment tools can reduce this kind of bias;³⁷ however, for those patients that deliberately mislead physicians the use of self-assessments should not be expected to improve the accuracy of their assessments.

1.5 Self harm as an assessment goal in the emergency department

While future suicide is a major concern for mental health patients that present to the ED, assessment for the risk of completed suicide is an extremely difficult task. One factor contributing to this difficulty is that even in high risk populations, those who have expressed serious suicidal ideation, have a history of attempts or are presenting with a serious suicide attempt, the rate of completed suicide within the year after visiting the ED is very low.³⁸ In order to successfully predict self harm risk researchers must also examine the patients using a cohort study as many of the aspects that could

be potentially relevant to predicting suicide are not possible to determine after someone is deceased. Therefore attempting to study completed suicides requires large cohorts of patients to be enrolled especially if the follow up time frame is relatively short. Future suicides are extremely hard to predict even with large samples of high risk patients.

There is a significant deterioration in quality of life for those who engage in self harm due to both the psychological and medical precursors of the self harm behaviour as well as the physical damage and related medical sequelae that result from self injury.^{6;39} Those who engage in self harm are also at considerably higher risk of suicide in both the near and distant future.¹⁹⁻²¹ The treatment of self harm injuries results in a significant usage of primary care resources and staff, as well as inpatient resources in both psychiatric units and medical wards.⁴ Therefore targeting this larger patient group would not only allow mental health resources to be focused at patients to reduce repeat self harm and related sequelae but also potentially reduce suicide rates and the usage of primary care for the treatment of self harm. On a practical level, assessing for the risk of any form of future self harm (attempted suicides as well as intentional self-harm injuries) is a better goal for the ED staff.

1.6 Implicit Association Tests

Recently, a tool was developed that attempts to measure the strength of suicidal ideation in individual patients more directly. By bypassing assessments using questionnaire formats that are easily manipulated by malingering or otherwise

misleading patients, it is hoped that the Implicit Associations Test (IAT) can increase the accuracy of the assessments. The IAT is designed to allow increased accuracy in the prediction of self harm behaviours for patients that present to the ED at risk for these behaviours.

The origin of the IAT lies within the field of social and cognitive psychology and most of the research involving the use of this measurement method has been related to those fields of psychology.⁴⁰ The recent creation of several suicide and self injury related IATs by Nock and colleagues,⁴¹ has allowed attempts to utilize this form of measurement in ways which could be clinically relevant in the assessment of self harm risk. These tests function by requiring people to use a computer to sort various stimuli into two groups by pressing two keys on the computer. Two sorting tasks are performed at the same time and the subjects' accuracy and response time is measured. For instance, one IAT involves having subjects sort images of depressed and suicidal people at the same time as they sort words that either refer to 'me' (I, myself, mine) or refer to other people or 'not me' (them, theirs, other). This task would be repeated twice, once with the words referring to the subject aligned with the suicide stimulus so the patient would sort those two groups with the same key and once more with the suicide stimulus aligned with the words that refer to others and sorted using a different key than the words referring to the subject. The accuracy and speed in which the subject completed the two tasks are later compared. If the patient was faster and more accurate when the suicide and 'me' categories were sorted together using the same key then this would be evidence that they associate suicide with their self-perception and this might indicate a higher level of risk for suicide and self harm.^{40;42} Such a finding has been reported for research

performed in the United States by Nock et al where this method of assessment was shown to be strongly related to further self harm events;^{41;42} however, it is yet to be validated elsewhere or in Canada.

1.7 Thesis objectives

The primary objective of this research was to examine the ability of the IAT assessments in predicting further self harm behaviour in the ED setting. A systematic review was conducted in order to determine the level of evidence that currently exists for assessing this population group. It also examined the usage of several standard psychometric questionnaires for the assessment of potentially relevant psychology constructs; namely the Beck Hopelessness Scale,²² Brief Symptom Inventory,⁴³ Barratt Impulsivity Scale,⁴⁴ CAGE questionnaire⁴⁵ and Drug Abuse Screening Test-10.⁴⁶ It was conducted within the ED setting in order to maximize similarity to how the tool would be used in actual practice and to minimize possible confounding factors that can occur if patients were approached after they were admitted or discharged. This study attempted to determine if this tool is also useful in addition to factors already known to be predictive of future self harm events.^{47,48} Lastly, this study attempted to see if a multivariable predictive model can be created using this tool as well as risk factors established in previous research that has been done on self harm behaviour.

Appendix**Table 1.1:** Commonly used psychiatric mnemonics

Mnemonic	Helps assess	Criteria
SIGECAPS	Depression	Suicidal thoughts Interests decreased Guilt Energy decreased Concentration decreased Appetite disturbance Psychomotor changes Sleep disturbance
SAD PERSONS	Suicide Risk	Sex Age Depression Previous attempts Ethanol abuse Rational thought loss Social support lacking Organized Plan No spouse Sickness
DIG FAST	Mania	Distractibility Indiscretion Grandiosity Flight of ideas Activity increase Sleep deficit Talkativeness
MASSALAD	Suicide Risk	Mental status Attempt (present and past) Sex Support Age Losses Alcohol Drugs

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2.1 Background

For emergency department (ED) and primary care physicians, suicide risk assessment is a difficult task fraught with uncertainty.¹⁻³ Although patients commonly present at risk for suicide and self harm, the low occurrence of subsequent completed suicide or serious self injury makes it difficult to accurately predict these future events without exaggerating the risk for a large portion of this ED population^{4;5} or under-estimating potential risk of an event with dramatic consequences.⁶ A large volume of research has examined and identified factors that place patients at heightened risk for further self harm attempts.^{4;7-12} however, self harm risk in the ED is still assessed primarily through clinical judgment.^{4;13} Consequently, the accuracy of assessment varies from one physician to another and the quality of the assessment can vary within and among EDs.^{14;15}

There are additional obstacles to admissions for patients with self harm presentations or intent. ED overcrowding places pressures on health care workers, and these pressures may increase the vulnerability of patients to adverse outcomes.¹⁶ Additionally, there are variable pressures exerted by patients and families regarding in-patient and out-patient care. These factors can result in the discharge of patients who may have benefited from admission or more in depth psychiatric response while at the same time admitting and potentially over-treating other patients not at high risk for future self-harm.

Research has been undertaken on the development and validation of various methods for suicide and self harm assessment in the ED.^{4;17-27} These methods could lead to a more systematic and less variable method of assessment for self-harm risk in the ED environment. The purpose of this systematic review was to examine the current evidence for tools for assessment of the risk of self harm in the ED and how useful these methods are during clinical assessment in predicting future self harm or hospitalization.

A version of this chapter has been submitted for publication/accepted for publication/published. Randal JR, Colman I, Rowe BH 2011. Journal of Affective Disorders.

2.2 Methods

2.2.1 Protocol

A protocol was developed for the systematic review *a priori*. The Population, Intervention, Control, and Outcome (PICO) was defined and reviewed among the research team. The inclusion criteria focused on prospective studies that classified patients into risk groups based on either clinical or actuarial assessment. Studies were limited to those involving predominantly adult patients treated specifically in an ED and only those studies that assessed patients who were considered at risk for self harm. The outcome variables selected were recurrence of self harm or suicidal ideation as well as studies that assessed the sensitivity or the specificity of admission prediction.

2.2.2 Search

The databases of MEDLINE, EMBASE, PsychINFO, Scopus, Cochrane Library, and Web of Science were searched for relevant articles. The search criteria used Medical Subject Heading (MeSH) keywords and was defined with three groups of terms. The first identified terms related to suicidal behavior and included self-poisoning, self-harm and automutilation. The second included terms for questionnaires, interviews and assessments, and included such terms as risk and probability. Lastly the search looked for keywords related to emergency medicine. Studies matching all three of these search terms were located. The search was performed in June of 2010 and included unpublished and foreign language literature (see summary in **Figure 2.1** and **Table 2.1**).

This search was supplemented by searches of the grey literature including online archives of grey literature such as T-spot, Scirus and Scopus as well web searches using both surface web and deep web search engines (e.g., Google, Dogpile, Complete Planet and Incy Wincy).

2.2.3 Selection

Abstracts were reviewed by two researchers and potentially relevant studies were retained while clearly irrelevant studies were excluded. Full manuscripts of potentially relevant studies were reviewed for suitability by two independent researchers.

2.2.4 Assessment of bias and study quality

In order to assess bias in the studies the Quality Assessment of Diagnostic Accuracy Studies (QUADAS)²⁸ tool was used as the studies assessed were diagnostic tests and this method was specifically designed to assess bias for these types of studies. This tool assesses the potential for bias by evaluating whether the study being examined had a representative sample as well as whether the follow-up methodology was appropriate to maintain the representative sample and determine the outcome measures of interest. The tool also examines how studies assess both the assessment

tools being studied and the reference standard being used to determine if their use is proper and independent of each other.

2.2.5 Synthesis

The data are reported using descriptive statistics, including medians and interquartile ranges (IQR). We intended to pool the study results to obtain a better estimate of the psychometric properties of the included studies; however, pooling was not possible for this review due to heterogeneity in assessment tools and methods. The Manchester Self Harm rule was discussed in several studies but pooling was unnecessary as all these studies used the same subjects. The Modified Sad Persons scale was used in two studies measuring admission outcome; however, the differences in patient severity precluded pooling. Due to concerns that a meta-analysis performed on observational studies with potentially heterogeneous populations can lead to spurious results and prevent the assessment of population effects on the study results,²⁹ it was decided not to pool these results but to assess the two studies independently.

2.3 Results

2.3.1 Search and selection

The search strategy identified 556 potentially relevant abstracts. Of these, a total of 30 studies were reviewed in their entirety to determine if they met inclusion criteria; 12 met the above criteria and were included in the review (details in **Figure 2.1**). The initial review of the papers produced good agreement amongst the reviewers on which papers should be included (Cohen's kappa= 0.79). One study was initially selected despite using an inpatient population and was not included in the review. Two more used only admission as an outcome and it was decided that admission outcomes would be analyzed as a secondary outcome. Therefore these two studies were included in the review.

Of full manuscripts reviewed, 10 were excluded because they were not cohort studies. Another 5 did not have a suitable outcome measure. There was no proper risk assessment in 4 studies and 2 studies were excluded because the study population did not meet the PICO criteria. Three studies did not meet two of the criteria.

2.3.2 Characteristics of included studies

The 12 included studies were performed in a variety of countries; however, the UK and USA produced four studies each. Canada, France, Ireland and Switzerland each contributed one study to the review. Of these studies, seven examined further incidences of suicidal ideation or self harm. Two studies examined the use of actuarial

methods in prediction of admission and two studies assessed both prediction of self harm and admission. One additional study measured an outcome they defined as “deterioration”. See **Table 2.2** for further information regarding the studies in this review.

2.3.3 Assessment of bias and study quality

The final QUADAS scores for the tests used to predict admission and self harm are presented in **Table 2.2**. The scores for both the admissions and self harm studies were generally good with the admission studies performing better overall. Two studies had lower scores than the other studies and were the only studies that were found with a QUADAS score below 10.^{21;26} The lower scores of the self harm compared to the admission studies resulted from a) uncertainties regarding ascertaining all future self harm incidences and b) the follow-up time frame allowing some confounding effects on the accuracy of the test performed at presentation. Overall, the risk of bias was considered moderate to low in this review.

2.3.4 Self harm risk assessment

Numerous tools were used to assess future self harm risk. These included the Beck Hopelessness Scale²² (BHS), Beck Suicide Intent Scale²⁶ (BSIS), Beck Scale for Suicidal Ideation²² (BSS), Optional Thinking test²⁶ (OTT), Brief Psychiatric Rating Scale²⁰

(BPRS), Symptom Checklist-90 Revised²⁰ (SC), Manchester Self Harm Rule¹⁷⁻¹⁹ (MSHR), Violence and Suicide Assessment Form²³ (VASA), Modified Sad Persons scale^{22;24} (MSPS), Severity of Psychiatric Illness System²⁵ (SPIS), Beck Depression Inventory²² (BDI), Beck Anxiety Inventory²² (BAI), High Risk Construct Scale²² (HRCS), Self injury Implicit Associations Test²⁷ (IAT) and the Hamilton Depression Rating Scale²¹ (HDRS). Nine studies reported one specific measure whereas the remaining three studied 2, 3 and 7 scales at once. One study produced a regression algorithm based upon risk factors.¹⁸

2.3.5 Follow-up

Follow-up varied from 3 weeks to 4 years (median = 6 months; IQR: 6 months to 1 year). Two studies failed to specify follow-up periods during the patients' admission and one study used both a 6 month and 1 year follow-up period for different groups of patients. The Beck Hopelessness Scale, Beck Suicidal Intent Scale), Optional Thinking Test (this test has two separate scoring methods- Relevancy Ratio and Relevant Options Score), Brief Psychiatric Rating Scale, Symptom Checklist-90 Revised, Manchester Self Harm Rule, Violence and Suicide Assessment Form, Modified Sad Persons Score, Implicit Association Test and Hamilton Depression assessment tools were examined in the studies examining future self harm^{4;17-21;23;24;26;27}. Clinical assessment⁴ and risk factor analysis¹⁸ were also used to assess self harm. These details are displayed in **Table 2.3**.

2.3.6 Further self-harm events as outcome

The studies included in this review that used future self harm behaviour as an outcome measure largely used future self harm without differentiating between self harm with intent to die (suicides or suicide attempt) and non-suicidal self-inflicted injury. The scales that are part of the Manchester self harm project, the IAT program and the Violence and Suicide Assessment Form were found to be significant predictors of self harm (**Table 2.3** and **Graph 2.1**).

The Manchester Self Harm Rule reported a sensitivity of 94% and a specificity of 26% (positive Likelihood Ratio (LR): 1.3; negative LR: 0.23) and detected all of the 22 suicides that occurred within 6 months of the index visit. The Violence and Suicide Assessment Form reported a significant correlation of 0.41; however, did not provide sensitivity or specificity data. The Implicit Association Test study found a sensitivity of 50% and specificity of 81% (positive LR: 2.6; negative LR: 0.62). The remaining studies either had poor follow-up data or found no significant difference between the recidivist and non-recidivist patients according to the measures they used. Cremniter found significant relationships between the paranoia and hebephrenia scale of the Brief Psychiatric Rating Scale and deterioration but it is unlikely that this deterioration is relevant to self harm risk assessment.²⁰ The Optional Thinking Test was significantly associated with self harm repetition only for patients presenting with a first incidence of self harm; however, only 20% of those considered high risk recorded a second attempt. The study assessing the Modified Sad Persons Score found no completed suicides in the group with low scores.

2.3.7 Admission as outcome

The four studies²²⁻²⁵ that assessed prediction of admission during the index visit as an outcome utilized 8 different actuarial methods (Violence and Suicide Assessment Form, Modified Sad Persons Score, Severity of Psychiatric Illness System, Beck Depression Inventory, Beck Anxiety Inventory, Beck Hopelessness Scale, Beck Scale for Suicidal Ideation, and the High Risk Construct Scale). Of the scales assessed, 6 of them were found to be significant predictors of admission (Violence and Suicide Assessment Form, Severity of Psychiatric Illness System, Beck Hopelessness Scale, Beck Scale for Suicidal Ideation, Modified Sad Persons Score and High Risk Construct Scale). The results obtained for these measures are found in **Table 2.4** and **Graph 2.2**. In general, the sensitivities reported by the studies were very high with most of them being able to achieve close to 100% sensitivity; however, the specificities were low.

2.4 Discussion

This systematic review summarizes the best available evidence on the effectiveness of self harm and parasuicide assessment tools for identifying patients with mental health presentations who require admission or who will engage in future self harm behaviour. To our knowledge, this is the first effort to synthesize the psychometric properties of these tools in the acute setting. Using a comprehensive search strategy to avoid publication bias and multiple reviewers to avoid selection bias, 12 studies were identified for inclusion in the review. Overall, there is a lack of strong evidence for effective measures of future self harm in this setting; however, it appears to be considerably more difficult to predict the occurrence of future self harm than it is to predict hospitalization.

2.4.1 Prediction of future events

Studies investigating future incidences of self-harming behaviour are significantly more intensive than studies examining admission. For example, studies that examined further self harm incidents are of lower quality than the admission prediction studies. Of the studies identified in this review, only the Manchester self-harm and Hockberger et al. studies specifically examined future completed suicide events in their analysis. The remaining studies examined any self harm events including incidents that were likely not suicidal in nature. It is uncertain how effectively these measures discriminate between those at risk for future suicide attempts versus those at risk for

future non-suicidal self harm events. Given that recurrence of self harm is more common³⁰ than serious suicide attempts, it is likely that these statistics are heavily influenced by their ability to detect non-suicidal self harm rather than suicide attempts.

Using the Manchester tool, close to 80% of patients presenting to the ED were rated as being at high risk; this finding underscores a likely lack of utility of this and other tools in clinical practice. For example, in the patients studied¹⁷ a positive screen would place the patient at a 21% likelihood of further self harm compared to an initial risk of 16.9% in the study population; a clinically unimportant change. While others have proposed these tools could be used to “rule out” the condition for patients who are at low risk for self harm,¹⁹ the clinical properties of the tools are insufficient to accomplish this. For example, a negative test screen on the Manchester tool suggests the patient risk is 4%; however, only 22% of the population would receive a negative screen, which significantly reduces the effectiveness of the tool. The Manchester rule, however, did manage to successfully identify all 22 subsequent suicides in their study population.

The characteristics of the Implicit Association Test²⁷ would similarly be of limited use to clinicians at the bedside for a variety of reasons. First, this test requires the use of a computer and up to 20 minutes of uninterrupted time, which may be difficult in a busy ED setting or for some patients with acute mental health issues. Second, assuming a 16.9% baseline risk, the post-test likelihoods for a positive and negative test would be 35% and 11%, respectively. Due to the relatively small increase in detection of self harm risk that these methods provide over physician gestalt, they should not be universally

adopted for decision-making and, when used alone, they are insufficient measures to influence a clinician's assessment of individual suicide risk.

From the studies identified in this review, the available tools remain clinically unhelpful in determining self harm risk in isolation. Future studies should focus on how to assess suicide risk and predict self harm outcomes as well as how to integrate these methods into the practice of a busy ED. Otherwise, it is possible that these methods will be misappropriated to the detriment of patients presenting with suicidal concerns³¹ as there are factors other than suicide risk⁵ that can necessitate admission. Patients presenting with self harm events or suicidal ideation also suffer from higher risk of co-morbid conditions and all-cause mortality.^{32;33} Therefore, even if one of these methods did have strong psychometric properties for future self harm risk then it is still unlikely that a thorough clinical assessment can be made based solely on one of these methods.^{22;33} It might also be useful to evaluate the effectiveness of a combination of tools in detecting future self harm risk. It is possible that a combination of tools would provide a fuller clinical picture of patients and improve the accuracy of the assessment.

2.4.2 Prediction of admission

Tools for assisting clinicians in decisions regarding which patients are sufficiently high risk to benefit from in-patient management have also been assessed. With the exception of the Modified Sad Persons Score, none of these scales were used more than once in different populations measuring the same outcome variable. This limits the

ability of this review to comment on variations in effectiveness that these scales might experience based on different ED patient characteristics. These studies also inherently rely on the assumption that the admission decision is a good reference standard and this may not necessarily be true for this group of patients.^{14;15} Therefore, the true effectiveness of these assessment tools is partially distorted by uncertainties in the overall accuracy of the physician assessments. Future research should consider using different outcome measures in place of admission due to the inherent variability of admission standards both within sites (variation from physician to physician) and among sites.

Overall, many of the studies produced statistically significant results when scores were compared to admissions. Most of the scales, however, failed to discriminate patients and would result in the admission of considerably more patients who would not currently be admitted. Therefore, using these tools in isolation has the potential for reducing the overall quality of the assessment in order to facilitate expedience.²² A more suitable use of these methods, based on these studies, would be to use them as an adjunct to clinical judgment or as a pre-screening tool.²² They could be used by non-physician staff either during the triage process or shortly after in order to help determine the assessment path that the patient should undergo. Some also question the usefulness of these tools as triage indications due to their low specificity;¹¹ however, other research has shown that similar uses of actuarial methods in the triaging process can be effective at improving patient care.³⁴ Since the stronger tools studied have 100% sensitivity, these tools would detect those who need physician assessment and allow

some patients to be directed towards assessment by mental health nurses. This could allow faster referrals to outpatient treatment services potentially saving them a long wait time in a busy ED. Research into the inclusion of psychometric tools into the triaging and assessment protocols of the ED would be more useful than further research examining admission as an outcome variable.

2.4.3 Limitations

This review has several limitations. An important limitation of the review is the small number of studies that were included and the overall number of included patients. Consequently, few of the methods used were replicated in other studies which prevented the use of pooling to more precisely determine the accuracy of these assessments. Moreover, we found few studies that evaluated clinical tools commonly used at the bedside such as mnemonics (e.g., SADPERSONS). The included measures also have a tendency to have inter-rater and inter-patients variability and the lack of replication makes it difficult to assess both reliability and validity of the scales used in this setting.

We elected to record admission as a secondary outcome because the validity and reliability of this outcome are weak. For example, variability exists among physicians and across institutions and the decision is further influenced by ED and hospital crowding, co-payments, and staffing differences.

Selection bias in both individual patients and in research setting is potentially an issue in this review. This is due to how patients were selected in the studies, the type of site where these studies usually occurred (teaching hospitals) and potential effects of incomplete follow-up in some studies. These concerns lead to some uncertainty over the generalizability of these results in other populations as well as concerns over whether these results can be replicated.

Two important potential systematic review limitations are publication and selection bias with respect to included studies. It is possible that a preference for publication of positive results has led potentially useful negative results from being published or made publically available. This could potentially increase the apparent effectiveness of the interventions examined in this review. However, attempts were made to search the grey literature and they revealed no additional relevant studies. The inclusion of additional unpublished negative studies would also only strengthen our conclusion that the evidence supporting self-harm risk assessment in emergency settings is weak.

2.5 Conclusion

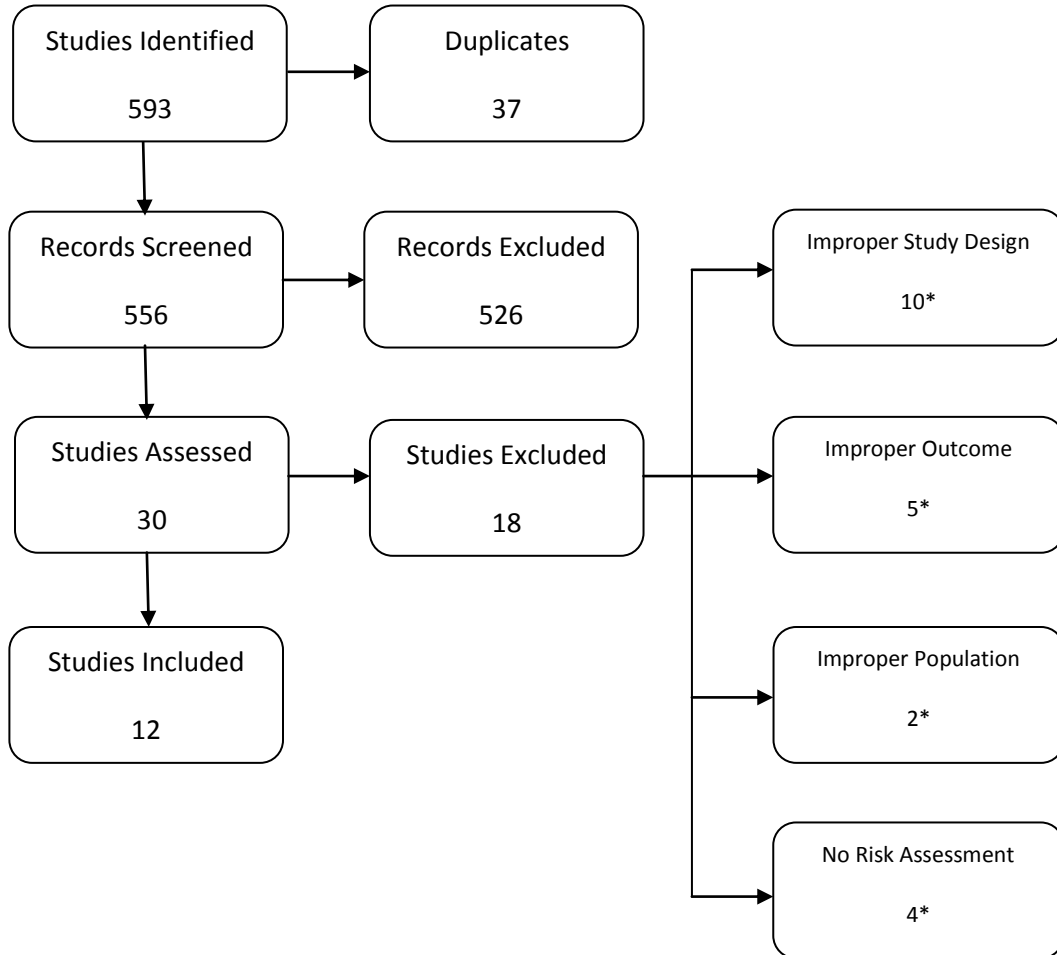
This review attempted to determine the evidence for the effectiveness of decision tools in the assessment of self harm risk for patients presenting to an ED. Specifically this review attempted to determine whether there were measurement tools that were both psychometrically and clinically effective at determining admission status or the occurrence of future self harm behaviour. Overall, the evidence in this area appears to be weak.

The performance of the tools evaluated for prediction of future self harm shows that these methods are not clinically useful at this point. Future research that attempts to correlate the scores from these tests with other clinical measures or to more thoroughly detail methods of integrating this information with clinical assessment in order to arrive at a treatment decision should be encouraged.

Many of the psychiatric assessment tools tested in these studies were associated with admission; however, there is a lack of evidence with regards to actuarial methods. Further research in this area should attempt to ascertain which methods have the clinical impact in terms of both assessment accuracy and resource efficiency and how to use that method as part of an assessment process.

Appendix

Figure 2.1: PRISMA figure of article selection process



*Some studies had multiple exclusion reasons

Table 2.1: Search criteria for systematic review

Selecting for:	Selection Terms
Self harm studies	(self injurious behavior/ or self poisoning/ or suicidal ideation/ or suicide/ or suicide attempt/ OR self mutilation/ OR (suicid\$ adj2 (thought\$ or ideation or attempt\$ or risk\$ or prevention)).mp.)
Assessment/Risk studies	(risk assessment/ OR interview/ or delphi study/ or semi structured interview/ or structured interview/ or unstructured interview/ or questionnaire/ or open ended questionnaire/ or structured questionnaire/ OR suicidal ideation questionnaire.mp. OR checklist/ or clinical assessment tool/ or rating scale/ or scoring system/ or summated rating scale/ OR exp psycholog test/ OR psychometry/ OR risk of suicide questionnaire.mp. OR suicide risk screen.mp. OR screening test/ OR suicide probability scale.mp. OR (test\$ adj mnemonic).mp. OR sad persons.mp. OR chronological assessment of suicide events.mp. OR ((assessment or screening) adj2 (test\$ or scale\$ or instrument\$ or questionnaire\$ or score\$ or inventory)).mp.)
ED Population	(Emergency/ OR emergency medicine/ OR emergency treatment/ or emergency care/ OR emergency ward/ OR emergency patient/ or emergency health services OR (emergency or emergencies).mp.)

Table 2.2: Descriptive characteristics of studies included in the review

Study authors, year	Country	Population	Assessment	QUADAS Score	Outcome
McAuliffe et al. 2008	Ireland	Adults	Beck Hopelessness Scale, Beck Suicide Intent Scale, The Optional Thinking Test	9	Further Incidences
Cremniter et al. 2001	France	Adults and Peds	Brief Psychiatric Rating Scale, Symptom Checklist-90 Revised	12	Deterioration
Cooper et al. 2005	UK	Adults and Peds	Risk Factors	11	Further Incidences
Kapur et al. 2005	UK	Adults and Peds	Emergency Physician Clinical Assessment	11	Further Incidences
Cooper et al. 2007	UK	Adults and Peds	Manchester Self Harm Rule	11	Further Incidences
Feinstein and Plutchik 1990	USA	Adults and Peds	Violence and Suicide Assessment Form	13 12	Admission Further Incidences
Hockberger et al. 1986	USA	Adults	Modified Sad Persons Scale	14 12	Admission Further Incidences
Cooper et al. 2006	UK	Adults and Peds	Manchester Self Harm Rule	11	Further Incidences
Lyons et al. 1997	USA	Not Stated	Severity of Psychiatric Illness System	11	Admission
Cochrane-Brink 2000	Canada	Adults	Modified Sad Persons Scale, Beck Depression Inventory, Beck Anxiety Inventory, Beck Hopelessness Scale, Beck Scale for Suicidal Ideation, High Risk Construct Scale	13	Admission
Caihol et al. 2007	Switzerland	Adults	Hamilton Depression Rating Scale	9	Further Incidences
Nock et al. 2010	USA	Adults	Self-Injury Implicit Associations Test	10	Further Incidences

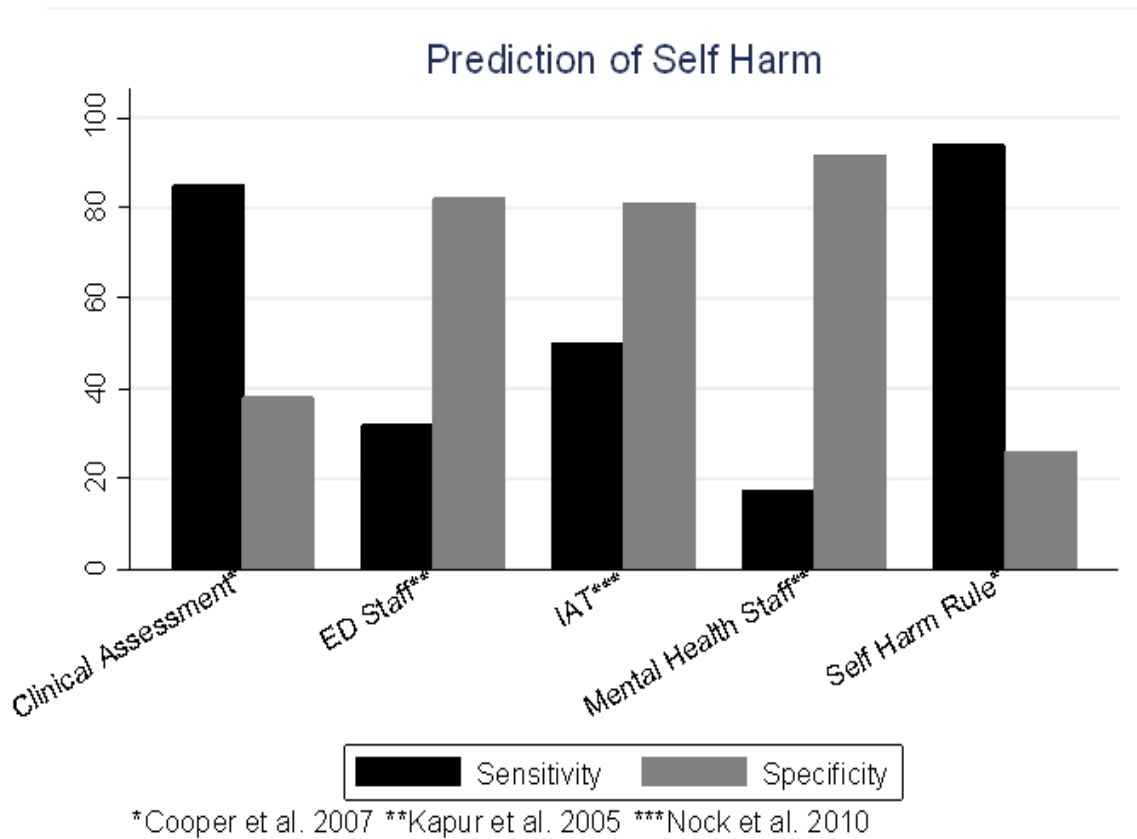
Table 2.3: Analysis of results for prediction of self harm

Study/ authors, year	Assessment	Cut-off	Sensitivity/Specificity	Other Results	p-value
McAuliffe et al 2008	Beck Hopelessness Scale	14	No data	High Risk 1.90 OR (0.73-4.97)	> 0.05
McAuliffe et al 2008	Beck Suicide Intent Scale	9-13	No data	Moderate Risk 0.97 (0.35-2.70)	> 0.05
McAuliffe et al 2008	The Optional Thinking Test (Relevancy Ratio)	Not Stated	No data	High Risk 1.70 OR (0.69-4.21)	> 0.05
McAuliffe et al 2008	The Optional Thinking Test (Relevant Options)	Not Stated	No data	Moderate Risk 0.32 OR (0.09-1.11)	> 0.05
Cremnitter et al 2001	Brief Psychiatric Rating Scale	None	No data	Low Score 2.31 OR (0.81-65.6)	> 0.05
Cremnitter et al 2001	Symptom Checklist-90 Revised	Not Stated	No data	Medium Score 2.45 OR (0.88-6.84)	> 0.05
Cooper et al. 2005	Risk Factors	N/A	N/A	Low Score 1.81 OR (0.64-5.13)	> 0.05
Kapur et al. 2005	Clinical Assessment	N/A	ED Staff 32% / 82% Mental Health Staff 17.3% / 91.8%	Medium Score 2.20 OR (0.79-6.18)	> 0.05
Cooper et al. 2007	Manchester Self Harm Rule	1	Clinical Assessment 85% / 38% Self Harm Rule 94% / 26%	Paranoia factor OR not given Hedephrenia factor 1.17 OR (1.04 - 1.31)	0.017 0.008
Fenstein and Plutchik 1990	Violence and Suicide Assessment Form	None	No Data	Regression Hazard Ratios Avoided discovery 2.82 (1.44-5.50) Cutting as method 2.10 (0.97-4.56) Not living with close relative 2.90 (1.48-5.67) Previous psychiatric treatment 1.76 (0.95-3.28) Alcohol misuse 2.05 (1.12-3.74) Physical problems 2.10 (0.93-4.74)	No data
Hodkberger et al. 1986	Modified Sad Persons Scale	>5	No Data	+ve LR = 1.8 -ve LR = 0.83	< 0.001
Cooper et al. 2006	Manchester Self Harm Rule	1	94% / 25%	+ve LR = 2.1 -ve LR = 0.9	< 0.001
Calhoun et al. 2007	Hamilton Depression Scale	None	No Data	+ve LR = 1.4 -ve LR = 0.39 +ve LR = 1.3 -ve LR = 0.23	No Data
Mock et al. 2010	Self-injury/Implicit Associations Test	D>0	50% / 81%	F=0.41 with inpatient suicide attempts	< 0.05
				No suicides in those with scores 5 or lower	No Data
				+ve LR = 1.3 -ve LR = 0.24	No Data
				Mean Score 21.5 Recidivists 22.9 Non-recidivists.	> 0.05
				+ve LR = 2.6 -ve LR = 0.62	< 0.05

Table 2.4: Analysis of results for prediction of admission

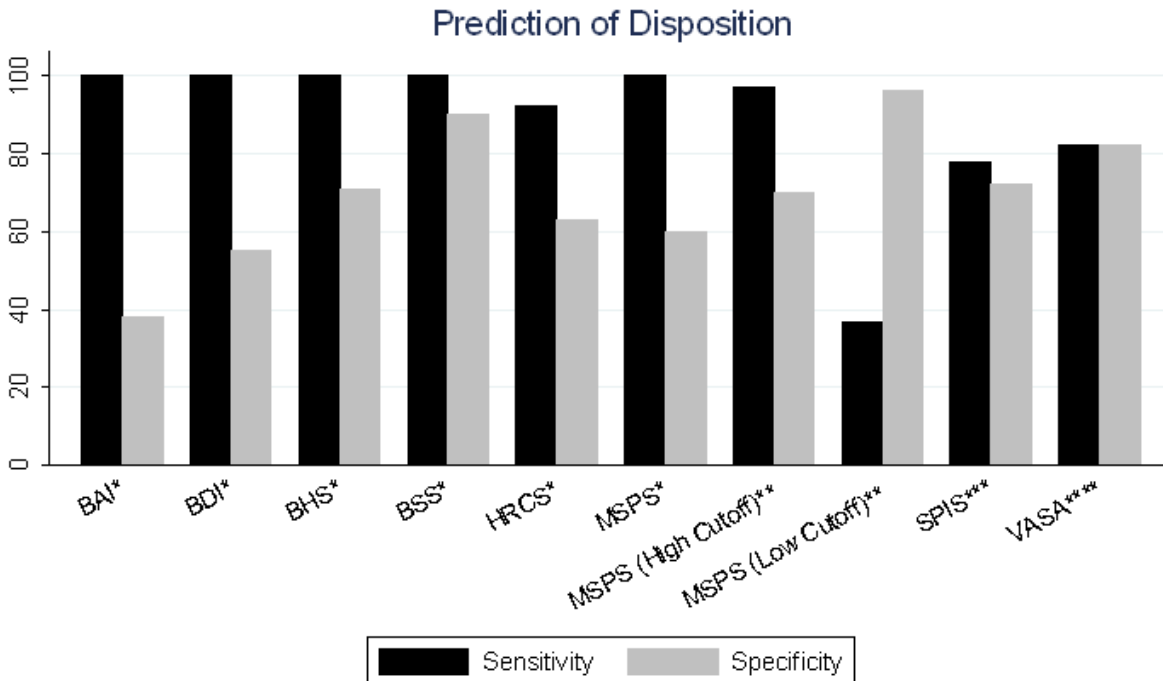
Analysis of Results for Prediction of Admission					
Study	Assessment	Cut-off	Sensitivity/Specificity	Other Results	p-value
Feinstein and Plutchik 1990	Violence and Suicide Assessment Form	11	82% / 82%	+ ve LR = 4.6 -ve LR = 0.22	<0.001
Hockberger et al. 1986	Modified Sad Persons Scale	>5	97% / 70%	+ ve LR = 3.2 -ve LR = 0.22	None
		>8	37% / 96%	+ ve LR = 9.3 -ve LR = 0.04	
Lyons et al. 1997	Severity of Psychiatric Illness System	Not given	78% / 72%	+ ve LR = 2.8 -ve LR = 0.31	<0.001
Cochrane-Brink 2000	Modified Sad Persons Scale	>5	100%/60%	+ ve LR = 2.5 -ve LR = 0.0	0.000
Cochrane-Brink 2000	Beck Depression Inventory	>29	100%/55%	+ ve LR = 2.2 -ve LR = 0.0	0.06
Cochrane-Brink 2000	Beck Anxiety Inventory	>25	100%/38%	+ ve LR = 1.6 -ve LR = 0.0	0.23
Cochrane-Brink 2000	Beck Hopelessness Scale	>14	100%/71%	+ ve LR = 3.4 -ve LR = 0.0	0.02
Cochrane-Brink 2000	Beck Scale for Suicidal Ideation	>23	100%/90%	+ ve LR = 10 -ve LR = 0.0	0.001
Cochrane-Brink 2000	High Risk Construct Scale (NEW)	>4	92%/63%	+ ve LR = 2.5 -ve LR = 0.13	0.000

Graph 2.1: Prediction of self harm



Clinical Assessment, Mental Health Staff and ED staff are estimates obtained by having staff working the ED classify patients as low, moderate or high risk. The statistics are obtained by combining the moderate and high risk groups for the ED staff and Mental Health Staff and group the low and moderate risk groups together for the Clinical Assessment measure.

Graph 2.2: Prediction of disposition



*Cochrane et al. 2000 **Hockberger et al. 1986 ***Lyons et al. 1997 ****Feinstein and Plutchik 1990

- BAI= Beck Anxiety Index
- BDI= Beck Depression Inventory
- BHS= Beck Hopelessness Scale
- BSS= Beck Scale for Suicidal Ideation
- HRCS= High Risk Construct Scale
- MSPS= Modified Sad Persons Score
- SPIS= Severity of Psychiatric Illness System
- VASA= Violence and Suicide Assessment Form

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3.1 Introduction

The assessment of suicidal patients is a common occurrence in primary care¹ particularly in the emergency department (ED).² There has been extensive research on risk factors³⁻⁶ and the use of psychometric tools⁷⁻¹¹ and their relationship with self harm and suicide. There are limited data available on measures and/or clinical factors related to self harm presentations in the ED.⁴ In order to obtain the best possible data this information must be obtained from the patient while they are still in the ED. Inpatient studies focused on similar factors may be biased due to the patient characteristics that are correlated with admission status. For psychometric measures it is also important to have relatively immediate assessment of this group as the measure of short term states that are related to self harm are likely to change rapidly after presentation to the ED.

If self harm serves to reduce mental distress, as theorized by some researchers,¹² then it should occur at a high point in psychological distress. Therefore it is expected that measures of distress (e.g. history of mental illness, presence of acute psychological symptoms) would be higher in those who present with self harm compared to the rest of the sample.¹³ It is also likely that those who present with a history of self harm would also have a higher occurrence of past mental illness such as depression.¹³ Examining the relationship between potential risk factors in this setting may help highlight particular psychological states that are associated with the act of self harm. Such examination may also help improve the prediction of future self harm events by allowing a greater understanding of differences within this patient sample that may need to be adjusted for in a clinical risk assessment.

This paper examines the characteristics of a group of patients that presented to two EDs in Edmonton, Canada. It examines the occurrence of various clinical and demographic measures as well as scores on psychometric measures potentially relevant to self harm. Measures identified for use in this study include those that have some evidence for their association with self harm: Manchester Self Harm rule,¹⁴ the Self-Injury Implicit Associations Test¹⁵ and the Beck Hopelessness Scale.¹⁶ Other psychometric tools included were identified as potentially useful assessments of personality traits and psychological distress. These tools were the Brief Symptom Inventory,¹⁷ Barrett Impulsiveness Scale,¹⁸ Drug Abuse Screening Test – 10¹⁹ and the CAGE mnemonic.²⁰ Two subgroups, those with a history of self harm and those who presented to the ED with a self harm incident, were examined. The characteristics of those who presented with recent self harm were compared to those without recent self harm. In addition those with a history of self harm were compared to those with no history of self harm to determine if any significant differences occurred between members of those two groups. By examining the characteristics of those who present to the ED at risk of self harm or with an episode of self harm it may be possible to gather greater insight into the characteristics of these patients that are predictive of future events

3.2 Methods

3.2.1 Sample

Patient enrolment occurred within the EDs of the Royal Alexandra Hospital and the University of Alberta Hospital in Edmonton, Canada. Study enrolment began in late August 2009 and was completed in May 2010. These sites are the two largest EDs and teaching hospitals in the Edmonton region with fulltime day ED psychiatric staff and inpatient mental health services.

Patients presenting to these EDs with suicidal/self-harm ideation or self harm were enrolled while they were being assessed in the ED. Only permanent residents of Alberta were enrolled and enrolment was limited to the adult population (age >17). We excluded patients that were violent or did not have the capacity to provide informed consent to the study as well as those suffering an acute medical condition that would prevent them from participating (e.g., overdose, coma, etc). Those who were unable to understand and communicate in English were also excluded. Eligibility for the study was determined by the most responsible physician; normally an ED physician but frequently a psychiatrist or psychiatry resident.

3.2.2 Pilot testing

A pilot study of 5 patients was performed at each hospital to determine the feasibility of the project as well as examine and adjust for potential issues during the enrolment phase.

3.2.3 Assessments

Patients who consented to the study participated in a verbal interview questionnaire that collected relevant demographics (age, gender, education level, etc) and medical history (e.g. history of psychiatric disorders, self harm). Descriptive data were gathered from the patient interview in the ED and from chart review. In addition patients were also administered several questionnaires. These questionnaires include the Beck Hopelessness Scale (BHS), CAGE questionnaire, Drug Abuse Screening Test-10 (DAST), Brief Symptom Inventory (BSI), and Barrett Impulsiveness Scale (BIS). Patients were also administered an Implicit Associations Test (IAT).¹⁵

The BSI¹⁷ is a 53-item questionnaire that assesses a variety of psychiatric symptoms present in the past week using a five point rating scale where higher scores indicate higher distress. Subscales of this questionnaire measure anxiety, depression, hostility, interpersonal sensitivity, obsessive compulsivity, paranoid ideation, phobic anxiety, psychoticism and somatisation. The BIS¹⁸ is a 30-item questionnaire designed to measure a person's level of impulsiveness using a four point rating scale where a higher rating indicates impulsiveness. The questionnaire provides several subscales that attempt to measure specific aspects of impulsiveness. These subscales derived from this questionnaire are the attentional, attentional impulsiveness, cognitive complexity, cognitive instability, motor, motor impulsiveness, non-planning impulsiveness, perseverance and self-control subscales. The BHS²¹ is a 20-item true or false questionnaire that attempts to measure the level of hopelessness that a patient has about their future. The CAGE²⁰ questionnaire is a 4-question alcohol abuse screen with a

cut off score of 3 or greater while the DAST¹⁹ is a 10-item questionnaire that measures the use of drugs. A Manchester Self Harm rule²² risk assessment was calculated by the researcher at the time of the interview based on information gathered from the patient and medical staff. The Manchester Self Harm rule contains four screening questions; does the patient have a history of psychiatric treatment? Is the patient currently undergoing psychiatric treatment? Does the patient have a history of self harm? Did the patient present to the ED with a benzodiazepine overdose? A positive response to any question entails a positive overall screen.

The IAT¹⁵ is a computer based task that uses word and picture stimuli to measure a person's implicit cognitive association between two concepts. The IAT tests in this study tested the relationship between the concept of the self and suicide related items (suicide, self injury, and death) in 6 separate tasks. This test requires subjects to categorize stimuli into groups by hitting one of two possible response keys. The test then requires the subject to perform a second sorting task, this time sorting something that the researchers hope will be cognitively linked to the previous stimuli, at the same time as they perform the first task. For instance the subject might have to sort death and life stimuli at the same time as they sort words categorized as 'me' (I, mine etc.) or 'not me' (they, them etc.). This task would be completed twice; once with death and 'me' words sorted using the same key and then again with death and 'not me' words sorted together on one key. It was expected that those carrying implicit thoughts of death or self-harm would respond more quickly when words associated with death were matched with words associated with 'me'. The IAT program used had six versions of the IAT: three suicide IATs (Suicide, Suicide pictures, Suicide/Life), two death IATs (Death

and Death/Life) and one wrist cutting IAT. The Suicide, Suicide pictures and Death IATs had patients sort only one group of stimuli related to death or suicide in addition to the 'me' and 'not me' stimuli. The cutting IAT required subjects to determine whether a picture of a wrist had a cutting injury or not. The other tasks all required the subject to sort two groups of additional stimuli, namely life (e.g., job, marriage etc) related words for the Suicide/Life and Death/Life tasks, in addition to the suicide and death stimuli sorted in the other tasks mentioned.

Emergency physicians at the two sites were also asked to fill out short forms on the patients participating in this study. They were asked about how they had assessed the patient, what presentation type they thought best described the patient (self harm with intent to die, suicidal ideation without plan etc). They were also asked to give an estimate for the probability that the patient would engage in self harm with 48 hours or 6 months. They were also asked how confident they were regarding their assessment and treatment choice.

3.2.4 Analysis

Failure to answer one or more of the questionnaire items was adjusted for during analysis. The method of scoring for the BSI²³ adjusted for missing answers by averaging the scores of the responses. The BHS and BIS do not have explicitly stated methods to deal with missing values; however, the same method used for the BSI was applied to questionnaires that had 90% or more of the questions answered. For the BIS

this method was not practical so it was decided that mean replacement would be used for missing questions. As with the BHS questionnaire, those BSI questionnaires that were less than 90% completed were counted as missing.

Continuous variables were assessed for symmetry and transformations were performed to convert skewed variables to approximate a normal distribution. Data which were not suitable for analysis as a continuous variable were grouped. With the exception of the BSI Positive Symptom Total (PST) score, all of the scores from the BSI and BIS questionnaires were adjusted so their values ranged from 0-4 so their respective ORs and CIs would be easier to interpret. Univariate analysis was performed on the transformed and grouped variables.

The IAT data were analyzed using the methods described by Anthony Greenwald.²⁴ The program used had six subtypes of the IAT: three suicide IATs (Suicide, Suicide pictures, Suicide/Life), two death IATs (Death and Death/Life) and one wrist cutting IAT. A score was calculated for each of these tasks with a positive score meaning that the subject performed faster when the suicide stimuli were sorted along with the 'me' stimuli.

Descriptive statistics were derived from the information obtained from the patient interview, chart review, psychometric tools and physician survey. Patient characteristics were examined comparing those with a self harm presentation to those without recent self harm. Those with a history of self harm were compared to those without a history of self harm for significant differences. First, ANOVA or regression analysis was performed using a categorical variable with all 4 possible subgroup

combinations of the two variables of interest (history of self harm, presentation with self harm). If a significant p-value was obtained for the overall model ANOVA or logistic regression was used to determine which of the two variables were individually significant. ANOVA was used to analyze the questionnaire data. Non-parametric data were transformed prior to ANOVA analysis when necessary. Logistic regression analysis was used for binary variables (e.g. history of mood disorder) and multinomial logistic regression was used for categorical variables (e.g. age category).

3.2.5 Ethics

This study received approval from the Human Research Ethics Board of the University of Alberta. Informed written consent was obtained from each participant.

3.3 Results

3.3.1 Sample

A total of 181 patients agreed to participate in the research project while 89 patients refused to participate. Of the 181 enrolled patients complete information was obtained for a total of 106 patients (see **Figure 3.1** for full enrollment information). Those who agreed to participate in the study did not differ from those who refused based on gender, age, occurrence of self-harm at presentation, psychiatry consultation and disposition (population characteristics described in **Table 3.1**).

3.3.2 Demographics and medical history

Details on demographic and medical history are presented in **Table 3.2**. Overall, 51.4% of the sample was male and 0.6% of the sample was transgendered. Presentation with self-harm occurred in 82 (45.3%) of those enrolled in the study with the most common methods of self-harm being OD/poisoning (n=54) and laceration/puncture injuries (n=21). Most patients (72.6%) had a previous history of self-harm. The sample was comprised largely of Caucasian patients (87.2%) with First Nations and Metis comprising an additional 6.7%.

Table 3.3 contains information about patient presentation including Canadian Triage and Acuity Scale (CTAS) scores, arrival status, alcohol related presentation, status of mental health certification as well as medications given in the ED. The bottom of the table also contains information on whom the patients currently see for psychotherapy if

they have a history of mental illness. EMS was involved in 57.5% and alcohol usage was detected in 59.8% of those enrolled in the study. During their ED presentation 22.5% of the patients were given some form of psychiatric medication. The most common medication was a benzodiazepine which was given to 17.9% of the patients. A past history of mental illness was present in 72.1% of the sample with the most common diagnosis being a mood disorder (44.9%). Data on the occurrence of mental illness in the total sample and the subsamples with a history or current presentation of self harm are located in **Table 3.4**.

3.3.3 Physician survey

The results of the physician survey are detailed in **Table 3.5**. The physician survey shows that 27.5% of physician use a mnemonic as part of their assessment; however, 32.0% of the ED physician relied on either psychiatry or the mental health team to do the assessment. Moreover, 80.2% of the responding physicians said they used clinical judgment as part of their assessment. The responses were similar in the subsection of the physician surveys that assessed those that had self harm presentations. With 32.1% of the total group, those categorized as having suicidal ideation that described using a lethal method to commit suicide were the largest subset of patients seen in the ED. The next largest group was patients classified as having undertaken a suicidal attempt where there was an intent to die with a total of 22.1% of the patient group.

Graph 3.1 illustrates the range of responses for the ED physicians' assessment of 48 hour and 6 month risk of self harm as well as the level of confidence they had in their assessment. The graphs are divided into four groups; those without a history or presentation with self harm (neither group), those with both (both group), and two groups with those having a presentation or history of self harm but not both. There were no significant differences detected between the groups.

3.3.4 Presentation with self harm

Those who presented with self harm were compared to those without self harm at presentation to determine if any significant differences existed between those two groups. Those who presented with self-harm had a lower occurrence of a history of a mood disorder compared to those who did not present with self-harm (35% vs 53%; $p < 0.05$). There were no other significant differences in the rate of the measured psychiatric disorders between those with a presentation including self-harm and those without a self-harm presentation. The CTAS scores for those presenting with self-harm were higher than those without self harm with 69.5% of them being classified as CTAS 1 or 2 compared to 47.4% of those without recent self harm ($p < 0.01$). Those presenting with self harm were also significantly more likely to be brought in by EMS (70.4% vs 29.6%; $p < 0.01$). They were also more likely to be formally certified when in the ED (68.3% vs 57%; $p < 0.01$). Patients presenting with self harm were more likely to receive non-psychiatric medication than the rest of the sample (61.7% vs 33.9%; $p < 0.01$).

Comparing those with a self harm presentation to those without any self harm at presentation found several significant differences in questionnaire scores (**Table 3.6**). For the BSI the Global Severity Index (GSI; $p=0.020$), Positive Symptom Distress Index (PSDI; $p=0.023$), PST ($p=0.026$), Anxiety ($p=0.020$), Depression ($p=0.014$), Hostility ($p=0.003$), Interpersonal Sensitivity ($p=0.036$), Obsessive Compulsive ($p=0.005$) and Phobic Anxiety ($p=0.032$) were significantly different to those presenting (self harm patients endorsed less symptoms than those without self harm). The BIS found the Attentional Impulsiveness ($p=0.026$), Cognitive Instability ($p=0.015$), were significantly lower in those presenting with self harm. The Beck Hopelessness Scale was also significant ($p=0.012$). The DAST-10 scale and CAGE questionnaire were not significant. For the results of the IAT analysis (**Table 3.7**) the only significant relationship was found to be the Death IAT as those who both presented with self harm and had a history of self harm were more likely to score positive on the Death IAT($p<0.05$).

3.3.5 History of self harm

Demographic and medical variables were also examined comparing those with a history of self-harm to those without a history of self harm. Patients with a history of self-harm were less likely to be admitted with 43.1% admitted compared to 65.3% for those with no history of self-harm. The presence of a mood disorder was significantly higher in those with a history of self harm compared to those without (50% vs 31%; $p=0.023$). Those with a history of self-harm were also more likely to have a past diagnosis of bipolar disorder than those without a history of self-harm (21.5% vs 4.2%; p

= 0.006). There was no significant difference in the occurrence of anxiety disorders, psychotic disorders, post-traumatic stress disorder and the other disorders between the two groups.

The questionnaire scores of those with a history of self harm were compared to those without a history in **Table 3.6**. The mean differences were examined and many of the scales were found to have significant difference. For the BSI the Global Severity Index (GSI; $p < 0.001$), Positive Symptom Total (PST; $p = 0.003$), Anxiety ($p = 0.006$), Depression ($p < 0.001$), Hostility ($p < 0.001$), Interpersonal Sensitivity ($p = 0.006$), Obsessive Compulsive ($p = 0.037$), Paranoid Ideation ($p = 0.003$), Phobic Anxiety ($p < 0.001$), Psychoticism ($p < 0.001$) and Somatization ($p = 0.024$) were significantly higher in the group with a history of self harm. Analysis of the BIS found that only the cognitive complexity subscale was not significant. All of the remaining subscales were significantly higher for the group with a history of self harm. Of the remaining three questionnaires, the DAST-10, Beck Hopelessness Scale and CAGE questionnaire, none were significant. The results of the IAT analysis are shown in **Table 3.7**. None of the IATs deviated significantly from the expected results among those with a history of self harm, though the Suicide and Suicide/Life IAT did approach significance ($p < 0.1$).

3.4 Discussion

The descriptive data collected here agrees with previous research on risk factors for self harm.⁴ In particular this study shows that a history of mental illness, mood, personality and bipolar disorders specifically, tend to be associated with those who have a history of self harm. The study also shows that several of the questionnaires that were predicted to relate to history of self harm were significant as well as one of the self injury related IAT tasks. Interestingly, those who presented with self harm scored considerably lower than might be expected given their recent self harm.

3.4.1 Presentation with self harm

3.4.1.1 Demographics and medical history

A history of mental illness was very common in the study sample though it was less common in those who presented with self harm. This may be because while the sample is largely dominated by those with a history of recurrent suicidal thoughts and self harm, there is a subsection of patients who attempt suicide despite little clear mental health history. There was a lower than expected rate of mood disorder in those who presented with self harm. While a mood disorder might strongly predispose someone to attempt self harm or experience suicidal ideation, other causes are more likely to cause repeated self harm and this would affect the rates observed in the ED. It is also possible that mood disorders are less likely to be diagnosed before a self harm

event compared to other disorder types which would make it appear as if this disorder is less prevalent than it is in those presenting with self harm.

The age breakdown found in this sample also seems to suggest that either self harm is becoming more common in younger age groups or there is a decline in the rate of self harm in older age. A WHO report of suicide and self harm behaviours supports the idea that youth are at highest risk for self harm.²⁵ There has been some evidence for an increase in the rate of self harm in adolescents and young adults;²⁶ however, this study did not enroll adolescents and it is unclear if this is occurring in the Edmonton region. It is difficult to determine with any certainty if this is the case with this data. It is possible that the apparent low self harm presentation rate in the older patients is due to the attrition of high risk individual in that age cohort due to suicide or other factors.

3.4.1.2 Questionnaires

Questionnaire responses from those who presented with self harm were significantly different from the other patients that did not have recent self harm. Interestingly, lower mean scores were seen on many of the scales for patients presenting with self harm compared to those without self harm. There are several potential explanations for this result. One explanation is that engaging in self harm can have a cathartic effect and that afterwards these patients may feel less psychologically distressed than similar patients who did not engage in self harm. A second explanation is that the patient could be minimizing their reported psychological distress as a

response to being in the ED. Another possibility is that this difference is due to the variation between state and trait levels among the different patient groups in the study. Lastly it is possible that the portion of patients without a history of mental illness or self harm is significantly different on these measures compared to the rest of the population and is affecting the mean score of those who presented with self harm.

While it is possible that there is some form of cathartic effect at work for those who engaged in self harm, overall the evidence for cathartic affects in suicide is mixed.^{27,28} Evidence against this particular cause is provided by previous research by Walker et al²⁷ that showed that the presence of a cathartic effect is not immediate after the self harm but takes the form of an improvement in the time period after the self harm. This effect cannot entirely be ruled out as a possible explanation as a recent study detected an immediate effect consistent with this in a group of self harming patients.²⁹

Another explanation is that these results are indicative of a difference between measuring states and measuring traits in this population. Limitations of questionnaire assessment with respect to state versus trait distinction and has shown that a large component of the variation in the results is due to the patients present state³⁰ and that using these measures to predict future self harm is affected by the unknown variation of state and trait factors. In this case of this study, the patients presenting with self harm were there for different reasons than those who presented with suicidal ideation. It is possible that for the patients presenting without self harm the questionnaires were measuring the heightened state of psychological distress that they were in. These

patients would be presenting at a time when they would be at an acute stage of distress and therefore the measurements used in this study would be measuring the high acuity states of the individuals rather than stable traits. Those who presented with actual self harm may have engaged in this behaviour for reasons other than being in a state of acute psychological distress. Therefore it is possible that this difference illustrates that it is necessary to take into account the state of individuals when they present to the ED and attempt to use that information in addition to the raw scores for psychological assessment in order to get stronger assessment measures.

3.4.2 History of self harm

Though a history of self harm is considered one of the strongest predictors of future self harm,⁶ the rates of admission for patients with a history of self harm was significantly lower than expected. There are several possible explanations for this observation. First, it is possible that the patients with chronic non-suicidal self injury would have lowered the admission rates for this patient subgroup as they are generally considered not ideal patients for admission and effective out-patient treatment exists.³¹ Second, it is possible that those presenting without a history of self harm or suicidal ideation, and those who present with a first incidence of self harm in particular, are more readily admitted in order to perform a more thorough assessment as there is greater uncertainty of future risk for these patients.

Those aged 30-44 were also significantly more likely to have a history of self harm when compared to the oldest age bracket (45+) which may indicate that a

significant portion of the older patients that presented did not have a history of mental health issues. Their presentation to the emergency department at risk for self harm may be due in part to aging related concerns rather than mental health. Those with a history of mood disorder also reported a higher than expected history of self harm which agrees with previous research linking the two.⁴ Personality and bipolar disorders were also more common among those with a history of self harm; over 90% of the patients within these two groups had a history of self harm. Those with a history of self harm had higher scores for most of the questionnaires and subscales compared to those without a history of self harm. This is possibly due to an increased occurrence of long term mental health concerns in this group of patients. Those patients with long histories of mental illness would likely present at points when their illness is in an acute stage. Therefore they would be expected to score higher on measures of psychological distress at presentation to the emergency department.

3.4.3 Limitations

As this is a cross sectional study, attempts to determine any causal patterns from the data provided should be done with caution as directionality of any established relationship cannot be ascertained with a high degree of certainty. Due to the large number of comparisons and the occurrence of small N subgroups there is a risk of Type I error for the differences detected in this paper. For differences such as those detected in the questionnaire mean scores, however, the chance that these scores are spurious

are reduced by the high agreement between multiple questionnaires and scales that show the same trend in group difference.

This study also represents a convenience sample of patients. Although attempts were made to determine if these patients were different than those that were not included in the study and these differences appear to be minimal, it is still possible that the enrolled patients may differ from those that refused to join the study in significant ways. This study was also not capable of enrolling patients who presented with high risk self harm attempts as these patients were often admitted to the ICU or were otherwise ineligible for study participation. It is therefore uncertain if those who present with high risk self harm incidents were different from those that were described in this study.

3.5 Conclusion

While the data collected in this study reinforce the well known connection between mental illness and the occurrence of self harm, they also show that a significant portion of the population presenting to the ED with self harm often do not have a history of mental illness or previous self harm. Further research into those without a history of self harm or mental illness may be informative, as well as useful, in assessing those who present with self harm to the ED. The questionnaire results seem to reinforce the idea that there are differences between those who present with self harm and those who don't even when these patients have similar medical backgrounds. This may be due to the patients presenting in different states of psychological distress in the two groups and further research should take this into account when attempting to predict further incidents of self harm. Stratifying risk between these groups may prove beneficial in predicting self harm behaviour.

Appendix

Figure 3.1: Enrolment flowchart

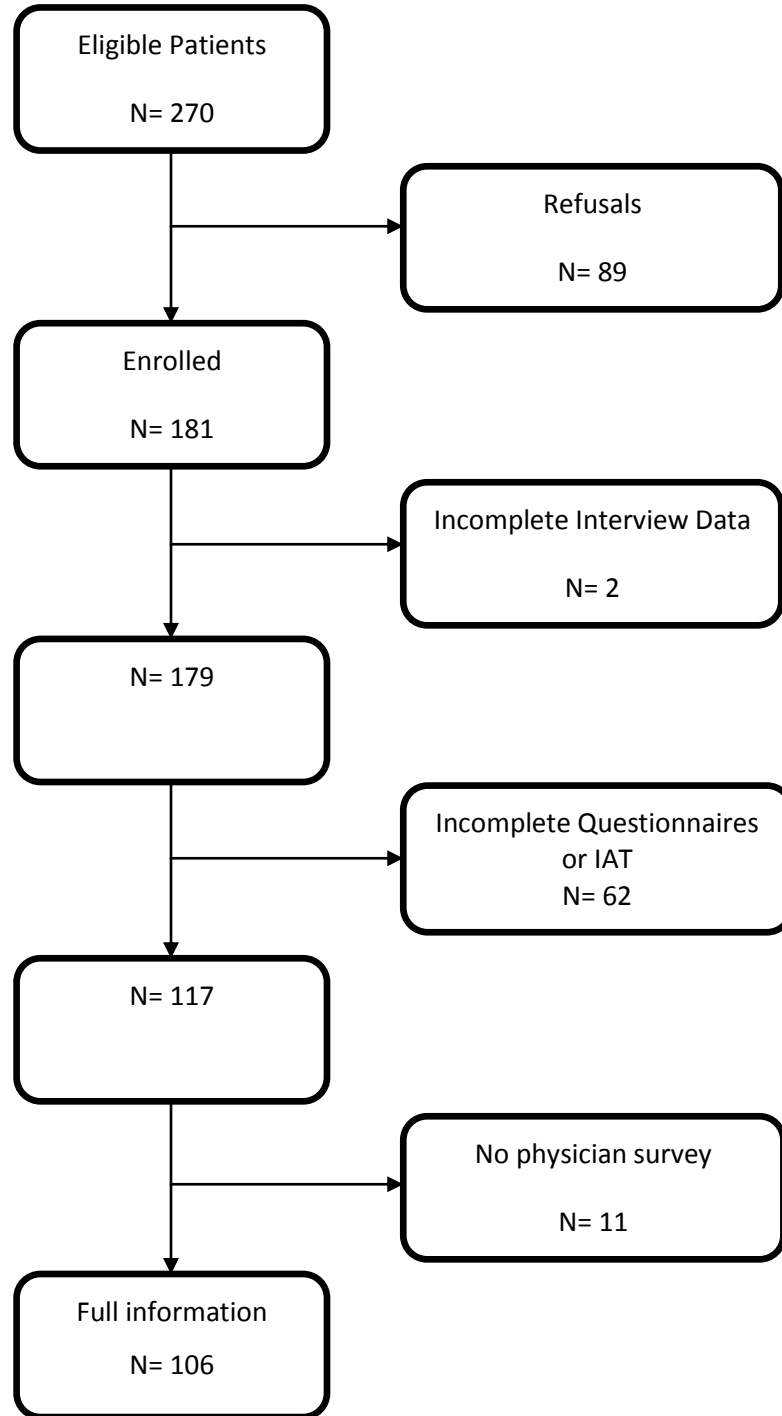


Table 3.1: Characteristics of sample versus refusal group

Variable	Category	Study Sample		Refused	
		N	%	N	%
Gender	Male	93	51.4	49	55.1
	Female	87	48.1	40	44.9
	Transgendered	1	0.6	---	---
Age	18-29	65	35.9	35	39.3
	30-45	64	35.4	30	33.7
	45+	52	28.7	24	27.0
Method of Self Harm*	OD/Poisoning	55	30.6	26	33.8
	Hanging/Suffocation	5	2.8	1	2.7
	Laceration/Puncture	21	11.7	8	10.4
	All Other	6	3.3	4	2.9
	Any Self Harm	82	45.6	37	44.5
Psychiatry Consult	Yes	158	87.3	71	79.8
	No	23	12.7	18	20.2
Admitted	Admitted	90	49.7	35	39.3
	Discharged	91	50.3	54	60.7

*Some patients presented with more than one method of self harm

Table 3.2: Demographic and presentation characteristics compared to history of self harm and presentation with self harm I

Category		All Subjects	History of Self Harm		Self Harm Presentation	
		N (%)	Yes N (%)	No N (%)	Yes N (%)	No N (%)
		179 (100)	130 (100)	49 (100)	82 (100)	97 (100)
Gender	Male	92 (51.4)	65 (50.0)	27 (55.1)	39 (47.6)	53 (54.6)
	Female	86 (48.0)	64 (49.2)	22 (44.9)	42 (51.2)	44 (45.4)
	Transgendered	1 (0.6)	1 (0.8)	0 (0.0)	1 (1.2)	0 (0.0)
Site	University of Alberta	96 (53.6)	66 (50.8)	30 (61.2)	46 (56.1)	50 (51.5)
	Royal Alexandra	83 (46.4)	64 (49.2)	19 (38.8)	36 (43.9)	47 (48.5)
Age	18-29	65 (36.3)	46 (35.4)	19 (38.8)	*35 (42.7)	*30 (30.9)
	30-44	64 (35.8)	*53 (40.8)	*11 (22.4)	30 (36.6)	34 (35.1)
	45+	50 (27.9)	*31 (23.8)	*19 (38.8)	*17 (20.7)	*33 (34.0)
Self Harm method	OD/Poisoning	54 (30.2)	39 (30.0)	15 (30.6)	54 (65.9)	N/A
	Hanging/Suffocation	4 (2.2)	2 (1.5)	2 (4.1)	4 (4.9)	N/A
	Laceration/Puncture	21 (11.7)	18 (13.8)	3 (6.1)	21 (25.6)	N/A
	All Other	6 (3.4)	6 (4.6)	0 (0.0)	6 (7.3)	N/A
	Any Self Harm	82 (45.8)	61 (46.9)	21 (42.9)	82 (100)	N/A
Psychiatry Consult	Yes	168 (93.9)	123 (94.6)	45 (91.8)	75 (91.5)	93 (95.9)
	No	11 (6.1)	7 (5.4)	4 (8.2)	7 (8.5)	4 (4.1)
Admitted	Admitted	88 (49.2)	*56 (43.1)	*32 (65.3)	37 (45.1)	51 (52.6)
	Discharged	91 (50.8)	*74 (56.9)	*17 (34.7)	45 (54.9)	46 (47.4)
Education	No Diploma	48 (26.8)	41 (31.5)	7 (14.3)	27 (32.9)	21 (21.6)
	High School	43 (24.0)	30 (23.1)	13 (26.5)	18 (22.0)	25 (25.8)
	Some College	24 (13.4)	18 (13.8)	6 (12.2)	13 (15.9)	11 (11.3)
	Post-secondary	64 (35.8)	41 (31.5)	23 (46.9)	24 (29.3)	40 (41.2)
Ethnicity	Caucasian	156 (87.2)	113 (86.9)	43 (87.8)	72 (87.8)	84 (86.6)
	First Nations/Métis	12 (6.7)	10 (7.7)	2 (4.1)	6 (7.3)	6 (6.2)
	Other	11 (6.1)	7 (5.4)	4 (8.2)	4 (4.9)	7 (7.2)
Lives with/in:	Family	46 (25.7)	37 (28.5)	9 (18.4)	26 (31.7)	20 (20.6)
	Significant other	49 (27.4)	32 (24.6)	17 (34.7)	20 (24.4)	29 (29.9)
	Friends	17 (9.5)	12 (9.2)	5 (10.2)	10 (12.3)	7 (7.2)
	Alone	49 (27.4)	34 (26.2)	15 (30.6)	19 (23.2)	30 (30.9)
	Institution	5 (2.8)	4 (3.1)	1 (2.0)	2 (2.4)	3 (3.1)
	No fixed address	13 (7.3)	11 (8.5)	2 (4.1)	5 (6.1)	8 (8.2)
Marital Status	Single/Never Married	84 (46.7)	61 (46.9)	23 (46.9)	44 (53.7)	40 (41.2)
	Married/Common-law	56 (31.7)	37 (28.5)	19 (38.8)	25 (30.5)	31 (32.0)
	Divorced/Widowed	39 (21.7)	32 (24.6)	7 (14.3)	13 (15.9)	26 (26.8)

*Chi² P<0.05 **Chi² P<0.01

Table 3.3: Demographic and presentation characteristics compared to history of self harm and presentation with self harm II

	Category	All Subjects	History of Self harm		Self Harm Presentation	
		N (% Column)	Yes N (%)	No N (%)	Yes N (%)	No N (%)
		179 (100)	130 (100)	49 (100)	82 (100)	97 (100)
CTAS	1	1 (0.6)	0 (0.0)	1 (2.0)	1 (1.2)	0 (0.0)
	2	102 (57.0)	77 (59.2)	25 (51.0)	**56 (68.3)	46 (47.4)
	3	72 (40.2)	50 (38.5)	22 (44.9)	**23 (28.0)	49 (50.5)
	4	4 (2.2)	3 (2.3)	1 (2.0)	2 (2.4)	2 (2.1)
Arrival	EMS	103 (57.5)	71 (54.6)	32 (65.3)	**57 (70.4)	46 (47.4)
	Self	74 (41.3)	58 (44.6)	16 (32.7)	**24 (29.6)	50 (51.5)
ETOH	Yes	107 (59.8)	80 (61.5)	27 (55.1)	43 (52.4)	64 (66.0)
	No	71 (39.7)	50 (38.5)	21 (42.9)	38 (46.3)	33 (34.0)
Certified	Yes	102 (57.0)	74 (56.9)	28 (57.1)	**56 (68.3)	46 (47.4)
	No	74 (41.3)	53 (40.8)	21 (42.9)	**24 (29.3)	50 (51.5)
Medications received in ED						
Benzodiazepine	Yes	32 (17.9)	26 (20.0)	6 (12.2)	15 (18.3)	17 (17.5)
	No	147 (82.1)	104 (80.0)	43 (87.8)	67 (81.7)	80 (82.5)
Typical Anti-psychotic	Yes	3 (1.7)	3 (2.3)	0 (0.0)	3 (3.7)	0 (0.0)
	No	176 (98.3)	127 (97.7)	49 (100)	79 (96.3)	97 (100)
Atypical Anti-psychotic	Yes	5 (2.8)	5 (3.8)	0 (0.0)	3 (3.7)	2 (2.1)
	No	174 (97.2)	125 (96.2)	49 (100)	79 (96.3)	95 (97.9)
Other Psychiatric	Yes	7 (3.9)	4 (3.1)	3 (6.1)	2 (2.4)	5 (5.2)
	No	172 (96.1)	126 (96.9)	46 (93.9)	80 (97.6)	92 (94.8)
Other Medication	Yes	60 (33.9)	42 (32.6)	18 (36.7)	**37 (45.7)	23 (24.0)
	No	117 (66.1)	87 (67.4)	30 (61.2)	**44 (54.3)	73 (76.0)
Current psychotherapy provider						
No one		61 (47.3 [†])	46 (44.7 [†])	15 (57.7)	26 (48.1 [†])	35 (46.7)
General Practitioner		13 (10.1 [†])	9 (8.7 [†])	4 (15.4)	5 (9.3 [†])	8 (10.7)
Psychiatrist		45 (34.9 [†])	39 (37.9 [†])	6 (23.1)	17 (31.5 [†])	28 (37.3)
Psychologist		10 (7.8 [†])	9 (8.7 [†])	1 (3.8)	4 (7.4 [†])	6 (8.0)
Counsellor		4 (3.1 [†])	3 (2.9 [†])	1 (3.8)	2 (3.7 [†])	2 (2.7)
Other		1 (0.8 [†])	1 (1.0 [†])	0 (0.0)	0 (0.0 [†])	1 (1.3)
Total		129 (100 [†])	103 (100 [†])	26 (100)	54 (100 [†])	75 (100)

[†] Percent of patients with history of mental illness (N=129) within the three groups

* χ^2 p<0.05 ** χ^2 p<0.01

Table 3.4: Co-occurrence of Mental illness, history of self harm and presentation with self harm

	All Subjects N (%)	History of Self Harm		Self Harm Presentation	
		N (%) Yes	N (%) No	N (%) Yes	N (%) No
All subjects	179 (100)	130 (100)	49(100)	82 (100)	97 (100)
Past medical history					
Mood disorder	80 (44.9)	*65 (50.0)	*15 (30.6)	*29 (35.3)	*51 (52.6)
Personality disorder	22 (12.4)	20 (15.4)	2 (4.1)	9 (11.0)	13 (13.4)
Bipolar disorder	30 (16.8)	*28 (21.5)	*2 (4.1)	13 (15.9)	17 (17.5)
Anxiety disorder	21 (11.8)	17 (13.1)	4 (8.2)	8 (9.8)	17 (17.5)
Psychotic disorder	13 (7.3)	9 (6.9)	4 (8.2)	8 (9.8)	9 (9.3)
Post-traumatic stress disorder	6 (3.4)	4 (3.1)	2 (4.1)	2 (2.4)	4 (4.1)
Other	15 (8.4)	13 (8.4)	2 (4.1)	6 (7.3)	13 (13.4)
Any mental health diagnosis	129 (72.1)	**103 (79.2)	**26 (53.1)	*54 (65.9)	*75 (77.3)
History of self harm					
Times engaged in self harm	N (%)	N (%)	N/A	N (%)	N (%)
0	49 (27.4)	---	---	20 (24.4)	29 (29.9)
1-4	86 (48.0)	86 (66.2)	---	35 (42.7)	51 (52.6)
5+	28 (15.6)	28 (21.5)	---	17 (20.7)	11 (11.3)
Unknown	16 (8.9)	16 (12.3)	---	10 (12.2)	6 (6.2)
Any self harm	130 (72.6)	130 (100)	---	62 (75.6)	68 (70.1)

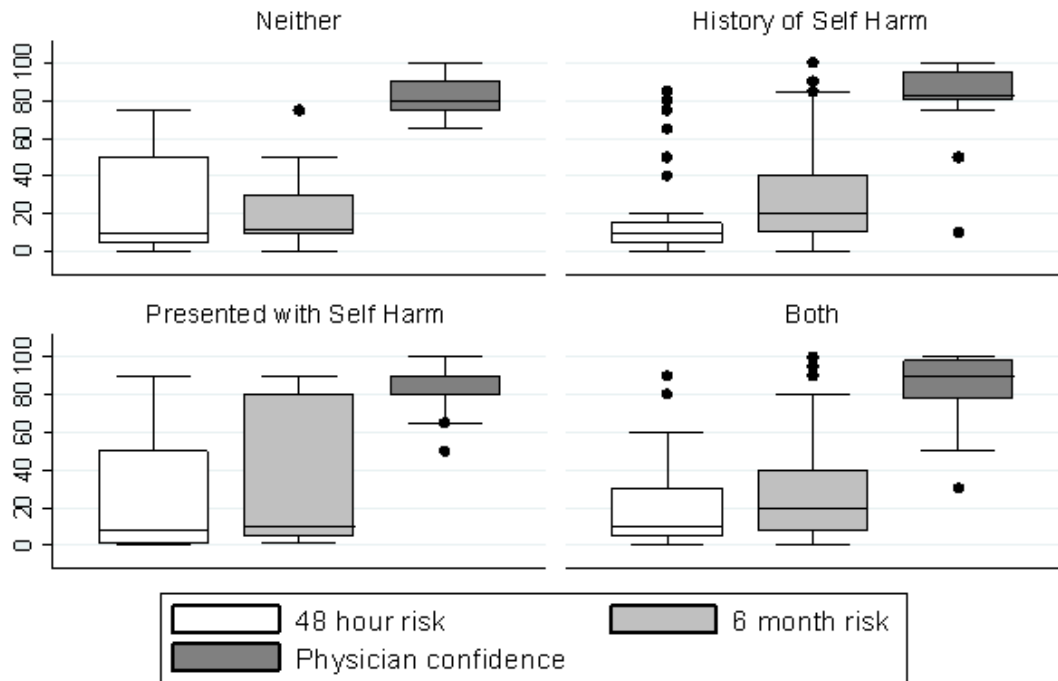
*Chi² p-value <0.05 **<0.01

†percent of those with history of self harm

Table 3.5: Physician assessments

	All patients		Presented with self harm			
	N	%	Yes		No	
	131	100	54	100	77	100
Assessment method						
Mnemonic	36	27.5	12	22.2	24	31.2
Psychiatry	29	22.1	11	20.4	18	23.4
Clinical Judgment	105	80.2	38	70.4	67	87.0
Mental Health team	13	9.9	5	9.3	8	10.4
Other	4	3.1	4	7.4	0	0.0
Presentation type	N	%				
Suicide attempt, Intent to die	29	22.1				
Suicide attempt, No Intent to die	20	15.3				
Ideation, Lethal Method	42	32.1				
Ideation, without lethal method	20	15.3				
Personality disorder, Non suicidal self injury	10	7.6				
Depression, not suicidal	2	1.5				
Other	8	6.1				

Graph 3.1: Physician risk assessment graphs by patient subgroup



Graphs by Engaged in Self-harm and History of Self-Harm

Table 3.6: Questionnaire Score comparison of means between subgroups

Questionnaire/Scale	Sample	History of Self harm		Presented with Self Harm	
		Yes	No	Yes	No
Subscale (BSI)	Mean	Mean	Mean	Mean	Mean
GSI	2.4	***2.5	***2.0	*2.2	*2.5
PSDI	2.9	2.9	2.8	*2.8	*3.0
PST	37.0	**38.6	**33.4	*34.1	*39.4
Anxiety	2.5	**2.6	**2.1	*2.3	*2.6
Depression	3.1	***3.3	***2.7	*2.9	*3.3
Hostility	2.1	***2.3	***1.6	**1.8	**2.3
Interpersonal Sensitivity	2.6	**2.7	**2.2	*2.4	*2.7
Obsessive Compulsive	2.6	*2.7	*2.3	*2.2	*2.8
Paranoid Ideation	2.0	**2.3	**1.6	1.9	2.1
Phobic Anxiety	1.8	***2.0	***1.3	*1.6	*2.0
Psychoticism	2.3	***2.5	***1.9	2.1	2.4
Somatization	1.9	*2.0	*1.6	1.7	2.0
Subscale (BIS)	Mean	Mean	Mean	Mean	Mean
BIS Score	76.4	***78.6	***71.5	74.4	78.0
Attention	12.4	**12.8	**11.3	11.9	12.7
Attentional Impulsiveness	19.9	**20.6	**18.3	*19.0	*20.7
Cognitive Complexity	13.6	13.9	12.9	13.3	12.9
Cognitive Instability	7.6	**7.8	**6.9	*7.1	*8.0
Motor	17.6	*18.1	*16.7	17.8	17.5
Motor Impulsiveness	27.2	*28.0	*25.9	27.1	27.5
Non-planning Impulsiveness	29.3	**30.0	**27.3	28.4	29.8
Perseverance	9.6	*9.9	*9.1	9.2	10.0
Self-control	15.6	**16.1	**14.4	15.1	15.9
Other questionnaires	Mean	Mean	Mean	Mean	Mean
Beck Hopelessness Scale	13.2	13.8	12.2	*12.1	*14.3
DAST-10	2.7	3.0	2.0	2.5	2.7
CAGE	1.5	1.6	1.1	1.4	1.4
SAD PERSONS	4.4	***4.8	***3.1	4.5	4.2

F statistic p-value *<0.05 **<0.01 ***<0.001

Table 3.7: IAT results for those with history or presentation with self harm

IAT	History of self harm		Presentation with self harm		Interaction
	Chi ²	p-value	Chi ²	p-value	p-value
Suicide/Life IAT	2.89	0.089	0.15	0.697	0.151
Death/Life IAT	0.50	0.480	0.40	0.527	0.928
Suicide pictures IAT	0.09	0.765	0.57	0.450	0.638
Cutting/Not Cutting	0.69	0.407	0.21	0.649	0.470
Suicide IAT	3.32	0.068	1.29	0.256	0.419
Death IAT	0.00	0.973	0.00	0.961	0.042

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4.1 Introduction

The assessment of patients for suicidal ideation is a common occurrence in primary care¹ and the emergency department (ED).² These assessments are difficult due to the lack of valid and reliable suicidal or future self harm scales, the low rate of suicide even in high risk groups, and the fact that many of these patients provide false or inaccurate information to physicians.³⁻⁶ There has been extensive research on risk factors⁷⁻¹⁰ and the use of psychometric tools^{5;11-14} in the prediction of suicide and self harm. Research on the psychometric evaluation of depression,¹⁵ hopelessness^{15;16} and a variety of suicide specific questionnaires.¹⁷ The evidence, however, is unclear as to which tool best to predicts the risk of future self harm to an individual patient.¹

Within the ED specifically, a large component of suicide risk assessment is determining the immediacy of the threat to the patients' health in order to determine the appropriate level of care.¹⁸ Given the often brief interactions between patients and clinicians in this setting, the long term risk management and prediction of completed suicides is not a feasible goal within the ED.^{18;19} Rather the goal of assessment is immediate and sub-acute risk management and directing patients to the appropriate level of care. Due to this, many of the risk factors identified for suicide may be more or less useful in this setting depending on their reliance on research using long term follow-up or on completed suicides.²⁰ Risk factors that are determined based on comparison to community populations may also not be useful indicators within the ED as a large portion of the patients needing assessment for suicidal ideation or self harm would have risk factors such as a history of mood disorder. Therefore, research that is to be clinically

useful in the ED should focus on immediate and sub-acute risk of suicidal gestures and needs to better reflect the population characteristics of this setting.

While clinical judgment is still the standard approach in a majority of EDs, there has been considerable research completed on using psychometric tools^{7;12;15;17;18;21} in order to provide a more objective and consistent method of determining risk of future self harm. To date, there has been some success in determine objective predictive factors^{11;11;14;22;23} in the ED setting; however, a recent systematic review on the topic²⁴ found that these tools are still not very effective at determining level of risk as none of these tools has been able to achieve both strong sensitivity and specificity in prediction of self harm.

The purpose of this paper is to expand on this knowledge by examining the effectiveness of the Manchester self harm rule¹¹ (MSHR), Beck Hopeless Scale¹⁶ (BHS), Brief Symptom Inventory²⁵ (BSI), Barrett Impulsiviness Scale²⁶ (BIS), CAGE²⁷ and the Drug Abuse Screening Test-10²⁸ (DAST) questionnaires and their related psychological constructs in the prediction of self harm within a 3 month time frame following presentation to the ED.

A version of this chapter has been submitted for publication/accepted for publication/published. Randal JR, Rowe BH, Colman I 2011. Canadian Journal of Psychiatry.

4.2 Methods

4.2.1 Sample

This study used the same sample that was collected for **Chapter 3**. See methods section of **Chapter 3** for details on methods related to sample.

4.2.2 Pilot testing

See methods section of **Chapter 3**.

4.2.3 Assessments

See methods section of **Chapter 3**.

4.2.4 Outcome

Three months after enrolment patients were contacted via telephone and asked whether they had engaged in self harm since their visit to the hospital. Electronic health records were also reviewed to determine if enrolled patients had visited an emergency department for self harm. Both outcome assessment methods were used for all patients. If either of the methods indicated the occurrence of self harm than the patients outcome was considered to have been positive. In the event of an electronic record that was ambiguous (e.g. overdose presentation where it is uncertain whether it was intentional or unintentional) then it was not counted as an incident of self harm.

4.2.5 Analysis

Univariate analysis was performed on the transformed and grouped variables. Multivariable logistic regression analysis for future self harm events was performed on the subscores of the BIS and BSI questionnaires by starting with all the significant subscores included in the model and then removing, one at a time, all the variables that had p-values > 0.1 starting with the highest p-value. After only variables with a p-value less than 0.1 remained, the scales not included were added, one at a time, back into the model to check for confounding effects. A threshold of 15% change in the beta statistic of an included variable was required in order to include a variable for its confounding effect.

Using hierarchical logistic regression analysis these multivariable models, as well as the significant univariate regression variables, were added one at a time to a logistic regression model containing age, marital status, history of self harm, self-reported history of mood disorder and self-reported history of personality disorder. These factors were selected due to previous research associating them with self harm⁸ as well as their being typical information obtained during a clinical assessment. The significance of adding each of the questionnaire variables and models to this model was tested using the Wald test to determine if the information gathered from these questionnaires added significantly to information normally collected during the assessment process. Receiver operating characteristic (ROC) analysis was performed on the questionnaires and models resulting from multivariate analysis to determine their sensitivity, specificity, area under the curve (AUC) and likelihood ratios. All statistics were obtained through the use of STATA Intercool version 11.²⁹

4.2.6 Ethics

This study received approval from the Human Research Ethics Board of the University of Alberta. Informed written consent was obtained from each participant.

4.3 Results

4.3.1 Sample

During the study period, a total of 270 eligible patients were approached to participate in the study; 89 (33%) refused and 181 (67%) patients agreed to be enrolled in the study. Of the 181 patients enrolled in the study, the questionnaire material was completed by 157 (86.7%) of the patients and 128 (82%) of those patients were successfully contacted at the end of the 3 month follow up period (refer to **Figure 4.1** for enrolment information). The characteristics of the 157 patients who completed the questionnaires were not significantly different (in age, rate of admission, or self harm) from the patients who refused to participate in the study (see **Table 4.1**). The rate of psychiatric consultation was significantly ($P < 0.001$) higher in the enrolled patients (93.6%) than in the refusal group (79.8%).

The study sample was 51.1% male, mean age was 37.2 years, and 44.5% presented with self harm. Almost half of the study sample was admitted to an inpatient ward (49.7%) and nearly three quarters (71.6%) had a history of self harm. The sample was evenly divided between the two sites with 50.3% of the patients being enrolled at the University of the Alberta Hospital site. Overall, 36.3% of the sample was between the age of 18 and 29 while 35.7% of the sample was 30 to 44 years of age. The remainder were 45 and older. From the 148 patients who were successfully followed up, 40 (26.9%) reported self harm events in the 3 month period.

Those who engaged in future self harm were significantly different from those who did not in terms of age as 40% of those aged 18-29 engaged in self harm versus 19.6% and 18.9% for the 30-45 and 45+ age groups, respectively. There was also a

significant difference with respect to education with 46.2% of those having no high school diploma engaging in self harm compared to 17.6% for those with a high school education, 26.3% for those who had some college education and 19.3% of those that completed post-secondary. Of those with a history of self harm 32.7% engaged in self-harm whereas only 10.5% of those without a history engaged in self harm behaviour. There were no significant differences in gender, site of enrolment, method of self harm, ethnicity, rate of admission and rate of psychiatry consultation between the two groups (see **Table 4.2**). Agreement between the two methods of outcome assessment was good with 89.2% agreement ($\kappa = 0.55$). A total of 32 patients with self harm were detected using the electronic databases and 19 were detected using telephone interviews. The combined method identified a total of 40 patients with self harm in the sample. The individual screening methods both appear to have underestimated the overall rate of self harm in the sample. Electronic screening indicated a self harm rate of 18% while telephone interviews showed a rate of 15%. Sensitivity analysis on the combined data from both methods of outcome assessment indicates that the minimum self harm rate that the sample could have had was 22%.

4.3.2 Univariate analysis

Univariate logistic regression resulted in a mixture of significant and non-significant results from the questionnaire data (see **Tables 4.3** and **4.4**). The overall scores for the BSI (Global Severity Index (GSI); OR = 1.63; 95% CI: 1.10 to 2.43) and BIS (OR of 3.05 ; 95% CI: 1.36 to 6.84) questionnaires were both significantly related to future self harm. The BHS was not a significant variable both as a continuous variables

(OR = 1.05; 95% confidence interval (CI): 0.99 to 1.12) and as a binary variable using the recommended cut-off score of 14¹⁶ (OR = 1.41; 95% CI: 0.64 to 3.08). The CAGE questionnaire was also ineffective at discriminating recidivists from non-recidivists using the established cut off score of 3 (OR = 1.39; 95% CI: 0.62 to 3.08). The DAST questionnaire was not significant ($p=0.14$) when analyzed by grouping into 5 risk groups (0, 1-2, 3-5, 6-8, 9-10); however, the highest risk category did produce a significant result (OR = 7.08; 95% CI: 1.21-41.5). The remaining risk categories all produced ORs close to 1. The Manchester Self Harm rule produced an OR of 3.36; however, this result was not significant ($p=0.077$).

Subscales of the BSI and BIS were analyzed individually (results in **Table 4.4**). The BSI had 5 significant results out of the 12 possible scales and all of the scales had ORs greater than 1. In addition to the GSI score, the anxiety (OR = 1.42; 95% CI: 1.03 to 1.97), hostility (OR = 1.51; 95% CI: 1.05 to 2.15), obsessive-compulsive (OR = 1.39; 95% CI: 1.00 to 1.92) and somatisation (OR = 1.48; 95% CI: 1.03 to 2.15) subscales were all significant.

The BIS had 6 of a possible 10 scales significantly related to future self harm and all of the possible scales from this questionnaire produced ORs greater than 1. The significant scores from this questionnaire were the total BIS score from the questionnaire and the attention (OR = 2.33; 95% CI: 1.11 to 4.89), attentional impulsiveness (OR = 2.30; 95% CI: 1.21 to 4.37), cognitive instability (OR = 1.55; 95% CI: 1.03 to 2.34), motor (OR = 2.02; 95% CI: 1.14 to 3.57), and motor impulsiveness (OR = 4.06; 95% CI: 1.23 to 13.40) subscales.

4.3.3 Model building

Model building using the BSI and BIS questionnaires resulted in models with three and two variables respectively. The BSI model contained the hostility, somatisation and interpersonal sensitivity variables. The BIS model contained the attentional impulsivity and motor subscales.

4.3.4 Hierarchical logistic regression

These models were compared to predictive models already containing age, marital status, history of self harm, history of mood disorder and history of personality disorder; they did not provide significant results ($p = 0.113$ for the BSI model; $p = 0.117$ for the BIS model). It was not possible to enter the MSHR as a variable into the model due to collinearity with self harm. Even after removing self harm from the initial model the MSHR variable did not prove to be an important factor in the model ($p = 0.14$). Similarly, the DAST questionnaire did not prove to be an important factor in the model ($p = 0.22$) when all of the risk categories were used. The results were more impressive ($p = 0.03$) when the DAST questionnaire was simplified into a binary variable with the highest risk score category and added to the demographic and medical history variables, compared to the remaining categories.

Testing the individual scales of the BSI and BIS in the second step of the hierarchical regression proved more successful with the GSI (0.087), obsessive compulsive (0.098), Somatization (0.062), BIS total score (0.046), Attentional Impulsiveness (0.87), Motor (0.076) and Motor impulsiveness (0.096) being significant using the $p < 0.1$ cut-off.

4.3.5 ROC analysis

The BIS model had the highest AUC (0.6611) although none of the questionnaires produced cut points with both high sensitivity and specificity. The BHS and CAGE both had non-significant results and did not offer high sensitivity or specificity using their established cut off criteria. The DAST managed to produce a high specificity cut off (97.9%) but this resulted in low sensitivity (14.7%). It failed to produce a score that had a high sensitivity. The Manchester Self Harm Rule produced a sensitivity of 95% with a specificity of 15%.

The BIS model managed to produce cut points with high sensitivity or high specificity but not both at the same time. The two cut offs picked produced sensitivities and specificities of 33%/93% and 97%/10%, respectively. The BSI model, despite producing a lower AUC, managed to produce slightly stronger cut off points than the BIS with its high and low cut off points producing sensitivities and specificities of 22%/98% and 94%/23%. The BSI model allows a slightly stronger rule in (positive likelihood ratio of 10.44 versus 6.91) and rule out (negative likelihood ratio of 0.24 versus 0.27) when compared to the BIS model. However, this difference was not significant. Using the BSI model with these cut off points, only 23.2% of the population fell into one of the extremes and the remaining 76.8% would need additional assessment. The BIS model would have resulted in only 16.7% of the sample population being assigned either a high or low risk assessment.

4.4 Discussion

This study enrolled patients in the ED with suicidal ideation and used reportedly valid measurements to predict suicidal and self harm activity within three months of the ED visit. Univariate analysis supports a relationship among many of the constructs that the questionnaires are designed to measure and future self harm events. In particular, there is evidence that the impulsivity constructs measured are related to self harm in the three months following assessment as well as several of the general psychiatric constructs measured by the brief symptom inventory and level of drug abuse as measured by the DAST questionnaire. Attempting to create multivariable predictive models from the scales of the BSI and BIS resulted in only modest gains in predictive power. None of the measures tested in this study, however, proved to be sufficiently associated with future self-harm to make them effective clinical tools in isolation. Some of the measures demonstrated potential use as adjuncts to clinical assessment based on demographic and medical history risk factors.

4.4.1 Psychometric assessment of self harm risk

For the BSI questionnaire the hostility subscale had the strongest association with self harm and it appears that a high level of interpersonal sensitivity may reduce the effect of hostility on future self harm. Part of the predictive effect of the hostility construct in isolation appears to be due to a correlation with somatisation. Despite being the strongest during model building the hostility subscale was not significant in the hierarchical model. This is possibly due to hostility being a proxy measure of personality disorder as indicated by an article by Keilp et al on the relationship between

hostility and borderline personality.³⁰ However it should be noted that this article also suggests that impulsiveness factors are only effective in predicting self harm outcomes in that they serve as proxy measures of personality disorder. These findings are not replicated by this study as several of the impulsiveness scales and the overall score from the BIS were significant. However a key difference between the studies is that the Keilp et al study stratified based on borderline personality disorder whereas this study grouped all of the cluster B personality disorders together during analyses. Hostility was more strongly associated with future self harm than a history of personality disorder so there is potential for this scale to be used as a more accurate substitute in place of a history of personality disorder but there appears to be no added value in using both at the same time.

Despite several studies that indicate its potential in screening for self harm the MSHR did not perform well in this study sample. This could be due to its over-inclusiveness resulting in a large standard error, as it managed to achieve a reasonable OR (3.36) when compared to many of the significant questionnaires and produced statistics (95% sensitivity, 15% specificity) similar to those produced in the original studies.^{11;31} The proportion of the sample that was deemed to be low risk according to this screen, however, was so small that it prevented the measure from being clinically useful.

The DAST questionnaire also showed some relationship with future self harm; however, based on this sample, only patients who registered very high drug abuse scores according to the questionnaire actually engaged in self harm more often than drug abstainers. This could indicate that recreational drug use is not associated with self

harm behaviours but that those with severe addiction issues are at increased risk. The poor performance of this tool for predicting self harm by itself is not surprising since it does not attempt to measure concepts directly related to suicide, however, it did add significantly to the hierarchical regression analysis so it may be useful as part of a clinical assessment and/or with other psychometric measures.

Although long considered a substantial risk factor for suicide,^{32;33} alcohol abuse as measured by the CAGE questionnaire did not seem to relate to increased risk of self harm in this sample. The BHS and the depression scale of the BSI were also not significantly related to future self harm despite indication that they measure constructs that are factors in long-term risk.^{15;34} It is possible that in these constructs serve as proxy measures of other psychological characteristics that lead to suicidal ideation and eventually to self-harm and suicide. Since this sample consisted entirely of people experiencing suicidal ideation and often a history of self harm behaviour, it is possible that they are not a risk factor in populations where everyone is already at risk for self-harm or that they are so ubiquitous in this population that it does not function effectively as a discriminator of risk. It is also possible that the CAGE questionnaire does not adequately measure alcohol abuse in a way that is relevant to future self-harm risk.

As with previous attempts to determine prediction methods,^{11;23} adopting cut off points for these scales one must sacrifice sensitivity or specificity. Some of these methods have potential uses as rule in or rule out mechanisms but they are still only able to screen in/out a portion of the population that they are administered to. The model made from the BSI had the best psychometric properties; however, was only able to screen 23% of the population with a reasonable degree of certainty.

4.4.2 Limitations

There are several limitations to this research. First, the sample of 157 patients represents a convenience sample, not all possible patients with suicidal ideation. While refusals appear to be similar to enrolled patients, only minimal data were available to compare groups. Second, selection bias is an issue with this study as both of the locations were larger teaching hospitals and the patients enrolled in the study tended to be slightly more acute than those who were not enrolled in the study. This should not be a major limitation as the sample examined in this study would likely be the same group that undergoes rigorous risk screening.

Third, the use of questionnaires to measure abstract psychological constructs always introduces a level of measurement error. The measures used in this study, however, have been used extensively and their ability and limitations in regards to measuring the relevant constructs have been studied. It remains possible that the accuracy of these questionnaires is affected by the unique environment of the ED or that patients modified their responses to the questionnaires in order to affect their treatment outcome. Procedural bias is likely minimal as long as the findings of this study are not extrapolated outside of this population as the procedure used in this study would be near identical to clinical assessment using these measurement tools.

Fourth, this study design also cannot control for the effects of unforeseen future events. Many patients at high distress when presenting to the ED reported during the follow up that life style changes (e.g., job changes, divorces, etc) strongly affected their psychological distress at the time of the interview. It is difficult to control for these

effects though limiting the follow up period to a shorter length of time would help to reduce this effect.

The combination of non-suicidal self injury and suicide attempts in the outcome measure may be considered problematic as these may be distinct outcomes. However recent research has supported the view that these outcomes are more similar than dissimilar and that non-suicidal self injury may be on a causal pathway to suicide attempts for some patients.^{35;36} This indicates that non-suicidal injuries are also an important risk factor for suicide attempts. This lends credence to the importance of assessing for the risk of any self harm in this setting as any form of this behaviour entails high risk. Therefore the researchers felt that it was appropriate to measure all forms of self harm as a single outcome. The use of multivariate analysis also helps to address this issue by allowing the use of multiple risk factors that may be stronger at detecting different forms of self harm to be used in conjunction to predict these behaviours in their totality.

Finally, there is also a possibility that the patients who were lost to follow up were significantly different in some fashion from those who were successfully followed up. The risk of this is reduced by a high follow up rate (82%).

These limitations are offset by some notable study strengths, including a large sample from an acute setting, the prospective study design and a high follow-up rate.

4.5 Conclusion

While many of the questionnaires and subscales examined in this study were associated with future self harm events, none of them are related strongly enough to future parasuicidal behaviour to make them useful diagnostic tools for predicting self harm. In this sample, some of the long term risk factors associated with suicide in previous studies (e.g., hopelessness, severity of depression) were not strong indicators of short-term risk. Caution is indicated for those attempting to use risk factors determined from long term studies in this setting.

There is potential that future research focusing on combining the identified significant constructs with demographic variables may prove more useful than focusing on measures limited to psychological constructs. Future research on this population of patients should focus on short term risk assessment (6 months and under) as this may increase the accuracy of assessment by reducing potential confounding effects of unknowable events following enrolment.

Appendix

Figure 4.1: Enrolment summary

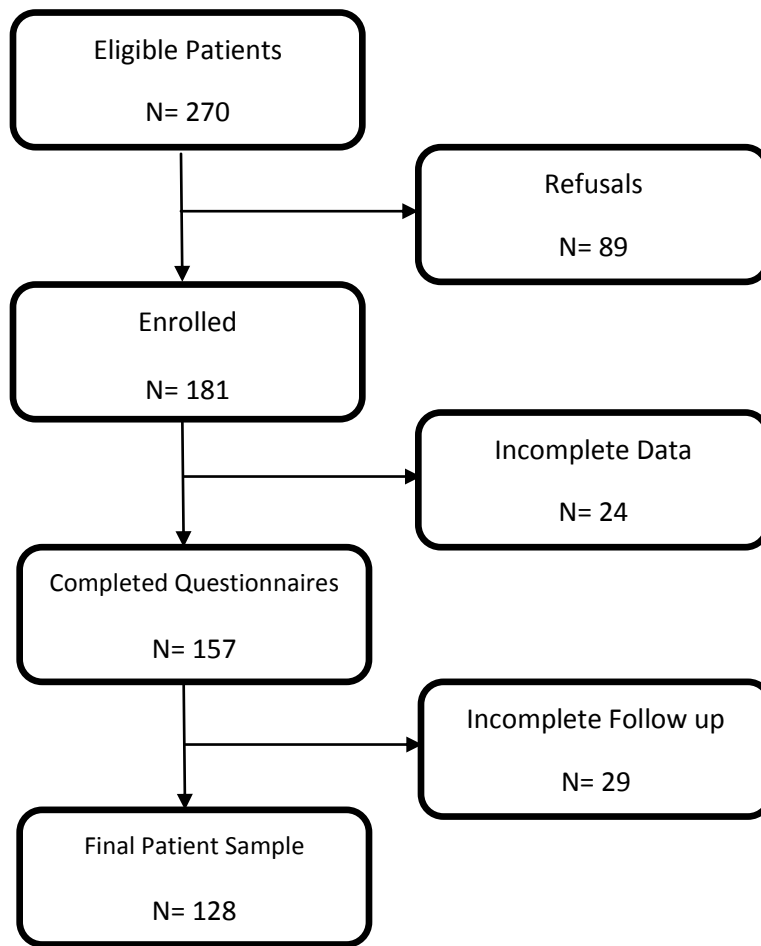


Table 4.1: Demographics and medical characteristics of study sample and refusal group.

Variable	Category	Study Sample		Refused	
		N	%	N	%
Gender	Male	81	51.1	49	55.1
	Female	75	48.3	40	44.9
	Transgendered	1	0.6	---	---
Site	University of Alberta	79	50.3	57	64.0
	Royal Alexandra	78	49.7	32	36.0
Age	18-29	57	36.3	35	39.3
	30-44	56	35.7	30	33.7
	45+	44	28.0	24	27.0
Method of Self Harm	OD/Poisoning	47	30.0	27	30.3
	Hanging/Suffocation	4	2.5	1	1.1
	Laceration/Puncture	18	11.5	8	9.0
	All Other	5	3.2	3	3.4
	Any Self Harm	70	44.5	37	42
Psychiatry Consulted* Admitted	----	147	93.6	71	79.8
	Admitted	78	49.7	35	39.3
	Discharged	79	50.3	54	60.7
Education	No Diploma	41	26.1		
	High School diploma	36	22.9		
	Some College courses	21	13.4		
	Completed Post-secondary	56	37.6		
History of Self Harm	Yes	111	71.6		
	No	44	28.4		
Ethnicity	Caucasian	135	86.0		
	First Nations/Métis	11	7.0		
	Other	11	7.0		
Lives with/in:	Family	43	27.6		
	Significant other	43	27.6		
	Friends	15	9.6		
	Alone	43	27.6		
	Institution	2	1.3		
Marital Status	No fixed address	10	6.4		
	Single/Never Married	73	46.5		
	Married/Common-law	50	31.9		
	Divorced/Widowed	34	21.7		

*P<0.001

Table 4.2: Characteristics of patients with further self harm within 3 months

Variable	Category	All Subjects	Self Harm	
		N	N	%
		149	40	26.8
Gender	Male	74	16	21.6
	Female	74	23	31.1
	Transgendered	1	1	100
Hospital Site	University of Alberta	76	16	21.1
	Royal Alexandra	73	24	32.9
Age*	18-29	52	21	40.4
	30-44	54	11	20.4
	45+	43	8	18.6
Method of Self Harm	OD/Poisoning	45	13	28.8
	Hanging/Suffocation	4	2	50.0
	Laceration/Puncture	18	11	61.1
	All Other	4	1	25.0
	Any Self Harm	67	23	34.3
Psychiatry Consulted	Yes	140	40	28.6
	No	9	0	00.0
Admitted	Admitted	74	18	24.3
	Discharged	75	22	29.3
Education*	No Diploma	39	18	46.2
	High School diploma	34	5	14.7
	Some College courses	19	5	26.3
	Completed Post-secondary	46	11	23.9
History of Self Harm*	Yes	110	36	32.7
	No	38	4	10.5
Ethnicity	Caucasian	130	32	24.6
	First Nations/Métis	8	5	62.5
	Other	11	3	27.3
Lives with/in:	Family	40	8	20.0
	Significant other	44	11	25.0
	Friends	12	4	33.3
	Alone	40	11	27.5
	Institution	2	1	50.0
	No fixed address	10	5	50.0
Marital Status	Single/Never Married	65	22	33.8
	Married/Common-law	50	8	16.0
	Divorced/Widowed	33	10	30.3

*P<0.05

Table 4.3: Univariate logistic regression analysis for association with future self harm.

Univariate Logistic Regression Analysis for Self Harm	Cut off Score	Odds ratio	95% CI
Brief Symptom Inventory Global Severity Index Score	N/A*	1.63	1.10 to 2.43
Barrett Impulsivity Scale	N/A*	3.05	1.36 to 6.84
Beck Hopelessness Scale- Continuous Score	N/A*	1.05	0.99 to 1.12
Beck Hopelessness Scale- Binary Score	14	1.41	0.64 to 3.08
CAGE Screen	3	1.39	0.62 to 3.08
DAST Criteria	0	Reference	
	1-2	0.94	0.34 to 2.66
	3-5	0.77	0.25 to 2.36
	6-8	0.71	0.17 to 2.95
	9-10	7.08	1.21 to 41.5
Manchester Self Harm Rule	1	3.36	0.73 to 15.4

*Continuous variable used

Table 4.4: Univariate logistic regression analysis II: subscale analysis

Subscales (BSI)	Odds ratio	95% CI
GSI	1.63	1.10 to 2.43
PSDI	1.50	0.97 to 2.31
PST	1.01	0.99 to 1.04
Anxiety	1.42	1.03 to 1.97
Depression	1.27	0.94 to 1.71
Hostility	1.51	1.05 to 2.15
Interpersonal sensitivity	1.03	0.93 to 1.13
Obsessive Compulsive	1.39	1.00 to 1.92
Paranoid ideation	1.34	0.94 to 1.92
Phobic Anxiety	1.46	0.98 to 2.17
Psychoticism	1.47	0.95 to 2.27
Somatization	1.48	1.03 to 2.15
Subscales (BIS)	Odds ratio	95% CI
BIS Score	3.05	1.36 to 6.84
Attention	2.33	1.11 to 4.89
Attentional Impulsiveness	2.30	1.21 to 4.37
Cognitive Complexity	1.44	0.81 to 2.56
Cognitive Instability	1.55	1.03 to 2.34
Motor	2.02	1.14 to 3.57
Motor Impulsiveness	4.06	1.23 to 13.40
Non-planning Impulsiveness	1.70	0.98 to 2.92
Perseverance	1.75	0.94 to 3.27
Self-control	1.62	0.99 to 2.64

Table 4.5: Hierarchical logistic regression analysis

Step and Model/Variable	Wald Chi ² Statistic (df)	P-value	Chi ²	Pseudo R ²
Step 1			19.73	0.116
Initial Model*	16.16 (6)	0.013		
Step 2a			23.68	0.156
BSI Model	5.98 (3)	0.113		
Step 2b			24.14	0.157
BIS Model	4.28 (2)	0.117		
Step 2c			24.17	0.165
DAST (All categories)	5.68 (4)	0.224		
Step 2d			22.87	0.156
DAST (Dichotomous: score >8)	4.62 (1)	0.032		
Step 2e			21.27	0.141
GSI score	1.71(1)	0.087		
Step 2f			19.79	0.131
Anxiety	1.22 (1)	0.222		
Step 2g			20.10	0.133
Hostility	1.34 (1)	0.180		
Step 2h			21.10	0.139
Obsessive Compulsive scale	1.66 (1)	0.098		
Step 2i			21.88	0.145
Somatization	1.87 (1)	0.062		
Step 2j			23.79	0.155
BIS total score	1.99 (1)	0.046		
Step 2k			22.29	0.145
Attention	1.60 (1)	0.111		
Step 2l			22.66	0.148
Attentional Impulsiveness	1.71 (1)	0.087		
Step 2m			21.10	0.138
Cognitive Instability	1.20 (1)	0.228		
Step 2n			22.90	0.149
Motor	1.77 (1)	0.076		
Step 2o			22.53	0.147
Motor Impulsiveness	1.67 (1)	0.096		

*Contains history of self harm, age, marital status, history of mood disorder, history of personality disorder

Table 4.6: ROC analysis for prediction of future self harm

Model	Cut-off	Sensitivity	Specificity	+LR	-LR	ROC Area	ROC 95% CI
BHS	14	65.79	42.27	1.14	0.81	0.5403	0.45 to 0.63
BSI Model	1.87	22.22	97.87	10.44	0.79	0.6392	0.53 to 0.75
BSI Model	0.45	94.44	23.40	1.23	0.24		
BIS Model	3.6	33.33	92.78	4.62	0.72	0.6611	0.55 to 0.77
BIS Model	2.0	97.22	10.31	1.08	0.27		
DAST	9	14.71	97.87	6.91	0.87	0.5629	0.50 to 0.63
CAGE	3	36.36	69.15	1.20	0.86	0.5322	0.42 to 0.64
MSHR	1	95.12	14.71	1.12	0.33	0.5491	0.50 to 0.60

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5.1 Introduction

The prediction of self harm has proven to be a substantial challenge. Measuring the level of suicidal ideation or the severity of patients' thoughts of engaging in non-suicidal self harm has proven difficult using standard questionnaire and interview formats.¹ This is not only due to the limitations of relying on patients to try and estimate the severity of their symptoms but also because patients may attempt to conceal their suicidal thoughts and plans from the assessing clinician.²

Implicit Association Tests have been developed to allow researchers to gain some insight into the nature of people's implicit cognition.³ Such tests require subjects to categorize stimuli into groups. The speed and accuracy in which the subject can categorize the stimuli in the IAT task indicates the level of implicit cognitive association between the two cognitions being tested. Faster and more accurate sorting of two cognitive constructs together indicate a stronger implicit link in those constructs for the subject.^{3;4}

Researchers have adapted the IAT methodology in an attempt to measure the implicit association that people have surrounding suicide, death and self injury⁴ in an attempt to measure meaningful underlying cognitive associations that could predict future self harm events. Current methods for the assessment of self harm risk in the emergency department (ED) are lacking⁵ resulting in the reliance on individual clinical judgment to determine the risk of self harm. This can lead to variable quality of assessment due to the different level of assessment skill of individual physicians and the varying availability of specialized mental health staff within different EDs.^{6;7} Since self harm risk is both a common occurrence in this setting and the ED often serves as the

first point of contact for patients experiencing suicidal ideation or self harm^{1,8} then determining if Implicit Association Tests are useful in this context can lead to improved assessment of those at acute risk for self harm behaviour. The objective of this paper was to determine if the IAT assessment could successfully predict self harm behaviour within 3 months among at-risk patients that present to an ED, and whether this assessment could add to the predictive ability of already known risk factors.

A version of this chapter has been submitted for publication/accepted for publication/published. Randal JR, Rowe BH, Dong K, Nock MK, Colman I 2011. Archives of General Psychiatry.

5.2 Methods

5.2.1 Sample

This study used the same sample that was collected for **Chapter 3**. See methods section of **Chapter 3** for details on methods related to sample.

5.2.2 Pilot testing

Two pilot studies of 5 patients each was performed at the University of Alberta Hospital and the Royal Alexandra Hospital to determine the feasibility of the project as well as examine and adjust for potential issues during the enrolment phase.

5.2.3 Assessments

See methods section of **Chapter 3**.

5.2.4 Outcome

Three months after enrolment patients were contacted via telephone and asked whether they had engaged in self harm since their visit to the hospital. Electronic health records were also checked to see if enrolled patients had utilized any health services due to an incident of self harm. Both outcome assessment methods were used for all patients. If either of the methods indicated the occurrence of self harm than the patients outcome was considered to have been positive. In the event of an electronic record that was ambiguous (e.g. overdose presentation where it is uncertain whether it was intentional or unintentional) then it was not counted as an incident of self harm.

5.2.5 Analysis

Counts and percentages are reported and compared using χ^2 statistics and odds ratios (OR) with 95% confidence intervals (CIs). The IAT data were analyzed using the methods described by others.⁹ A score was calculated for each of these tasks with a positive score meaning that the subject performed faster when the suicide stimuli were sorted along with the 'me' stimuli.

These were analyzed individually using logistic regression for their relationship with further self harm events. Purposeful model building was performed on identified risk factors and the significant IAT scores. A p-value of less than 0.1 or previous research indicating clinical relevance¹⁰ was needed before a variable would be included in the initial model. Variables assessed during the initial purposeful regression were age, gender, presentation with self harm, history of self harm, education level, marital status, history of mood disorder, personality disorder and psychotic disorder. Variables were removed if their p-value increased to over 0.05 and the removed variables were tested to determine if they had a confounding affect on the included variables. The threshold for a confounding effect was set at a 15% change in the coefficient value. Results of the questionnaires, including significant subscales of the BIS and BSI, and other potentially relevant clinical variables were added individually to the initial model to test if they would add significantly to the model. Receiver operating characteristic (ROC) analysis was performed on the IAT results. ROC analysis was also used to determine the predictive ability of the two models developed. All statistics were obtained through the use of STATA Intercool version 11.¹¹

5.2.6 Ethics

This study received approval from the Human Research Ethics Board of the University of Alberta. Informed written consent was obtained from each participant.

5.3 Results

5.3.1 Sample

During enrolment 270 potentially eligible patients were approached to participate in the study and of these 89 refused and 181(67%) agreed to participate. A total of 147 patients completed at least a portion of the IAT task and 127 patients completed the entire IAT task. Overall, 109 (85.8%) of the patients who completed all of the IAT tasks were successfully followed up during the 3 months after their index visit (refer to **Figure 5.1** for enrolment flowchart).

The characteristics of the 127 patients completing all of the IAT material were not significantly different from those not enrolled in the study with respect to a history of self harm, self harm presentation and rate of admission (refer to **Table 5.1** for descriptive statistics of enrolled and refused patient groups). The rate of psychiatric consultation was significantly higher in the sample group ($p<0.001$) compared to the refusal group. As well the rate of enrolment and task completion at the University of Alberta site was significantly ($p<0.01$) lower than the rate of the Royal Alexandra Hospital. Patients in the 45+ age bracket were also less likely to complete the full computer task ($p<0.01$). Those patients who resided in an institution were also less likely to complete all the study tasks ($p<0.05$). Divorced and widowed patients were also more likely to not complete the task ($p<0.05$).

The study sample consisted of 67 (52.8%) men and one patient was identified as transgendered (0.8%). A presentation with self harm occurred for 44.1% of the patients with overdose ingestion/poisoning occurring in 28.3% of the total sample. Half (50.4%) of the patients were eventually admitted during their index visit. 74.8% of the sampled

patients had a history of self harm. A total of 30 (27.5%) patients had an incident of self harm in the three month follow up period.

5.3.2 Logistic regression analysis

The only significant variable derived from the IAT task in predicting self harm during the follow-up period was the Death/Life IAT (OR = 2.83; 95% CI: 1.15-6.96). The Death IAT approached significance (OR = 2.25; 95% CI: 0.96-5.30); however, failed to research significance. The remaining three IAT tasks showed no sign of being significant with ORs ranging from 1.05 to 1.26 and wide confidence intervals (full details in **Table 5.2**).

5.3.3 Multivariate model building

The multivariate model for prediction of self harm during the three-month follow-up period included history of self harm, education level, history of psychotic disorder with comorbid depressive symptoms, presentation with a non-overdose self harm event and the Death/Life IAT subscale. Adding the results from the questionnaires including the significant subscales of the BSI and BIS resulted in none of the questionnaire variables achieving a p-value of less than 0.1 (full statistics displayed in **Table 5.3**). A total of 107 patients had sufficient information to be included in the final model. The OR obtained for the Death/Life IAT was 5.09 for the final model and the IAT had a p-value of less than 0.05 (full model information in **Table 5.4**).

5.3.4 ROC analysis

The results from the Death/Life IAT as well as the two regression models are shown in **Table 5.5**. The Death/Life IAT by itself produced a sensitivity of 43.3% and a specificity of 78.8% (positive likelihood ratio (+LR) 2.04, negative likelihood ratio (-LR) 0.72). A two cut off scoring method was adapted for the final five-variable model created during the regression analysis. The model had a sensitivity and specificity of 96.6% and 53.8% (+LR 2.09, -LR 0.06) for the low cut off and 58.6% and 96.2% (+LR 15.2, -LR 0.43) for the high cut-off. The model managed to assign 58.9% of the sample into either a high risk or low risk category with a high degree of diagnostic certainty. Of those classified as high risk (scoring above the high cut-off) using this system 85% engaged in self harm while only 2.3% of those in the low risk category (scoring below the low cut-off) had an incident of self harm (more information in **Table 5.6**).

5.4 Discussion

In this study of 107 patients at risk for self-harm, several factors were identified as significant predictors of self harm during a three-month follow-up period, including an Implicit Association Test. Most of the IAT tasks tested in this study were found to not be effective at predicting future self harm events within a 3 month time frame. However, the study did identify an IAT task that considered implicit thoughts of both death and life, that has been significantly related to future self harm in previous research¹² as being significant in this sample. This study expands on the previous study by examining the usefulness of the IAT tool as it would be applied in a clinical setting; as part of a risk assessment along with other risk factors. Model building and ROC analysis shows that this assessment tool has potential as part of a model estimating patient risk. This model is stronger than previous attempts to measure self harm risk^{5;12-14} and also uses a shorter follow up period than other similar studies. This makes the results more useful for the assessment of immediate and short term risk for self harm behaviours which is the primary goal of ED self harm assessment. The results of this study indicate that the objective clinical and behavioural assessment information collected appear to be stronger predictive variables than those based on the patients' subjective assessments of their own mental state. The superiority of objective measures, when available, compared to subjective patient self reports has been indicated in other areas of research.¹⁵

5.4.1 IAT discussion

The Death/Life IAT was significantly related to self harm in isolation though the results of the ROC analysis show that, like many other single predictors of suicidal behaviour, the IAT task was not a particularly effective risk assessment by itself. However, when combined with other predictive variables, the p-value and beta coefficient of the task improved and the IAT also seemed to improve the effectiveness of the other variables included in the final model. It is possible that measuring implicit cognition of how patients associate thoughts of death with themselves is both a significant predictor of future self harm events and measures a latent factor that is distinct from what is captured from questionnaires and clinical examination. Therefore this assessment method appears to measure a relevant risk factor that does not appear to be strongly correlated with previously determined risk factors and could be very useful in establishing clinical risk assessment models for self harm. Another benefit to using this method of assessment is that it is more resilient to patients attempting to fake a desired result from the test¹⁶ which could improve the assessment of patients attempted to conceal their true level of suicidal intent.

These results could also indicate that thoughts of death specifically are more relevant than general suicidal ideation at predicting the occurrence of self harm behaviour.¹⁷ It also seems that it is important to measure the cognitive relationship for life related stimuli as well as death stimuli as the IAT task using only the death stimuli was not significantly related to future self harm during regression analysis. Those with a strong association with the life stimuli appear to be at low risk for self harm even if they have a strong association with the death stimuli. Those with a strong cognitive

connection with death but lacking a cognitive self connection with the positive life stimuli appear to be at particularly increased risk.

In addition to the Death/Life IAT, it is notable that depressive symptoms in those with a history of psychotic disorders is also a strong indicator of risk. Psychotic disorders have been implicated as a risk factor for self harm in previous studies.^{18;19} Recently studies have identified increased risk with those experiencing comorbid psychotic disorders and depressive symptoms.^{20;21} This study also identified this comorbid condition as a significant indicator of increased risk in the ED setting as well and suggests that those with depressive symptoms and a history of psychoses that present to the emergency department are at a significantly increased risk of self harm. Although limited by a small sample with a history of psychotic disorders, this study suggests that a large portion of the increased risk of self harm experienced by those with psychotic disorder is potentially due to those with comorbid depressive symptoms. This comorbid condition was identified as the strongest individual indicator of risk of self harm after adjusting for confounding effects if several other relevant factors.

5.4.2 Regression model

A simple regression model containing only five variables all with previous research supporting their association with increased risk of self harm,^{12;13;20;22;23} including the Death/Life IAT, was effective at predicting self harm in the three months following assessment. There is potential for clinical use of this tool as part of a computerized assessment where the precision afforded by using regression analysis to weigh the important clinical variables is made possible in the emergency department

setting. Although the full IAT task with all 6 IATs was found to occasionally be too much stress for patients that were already distressed it is possible that the length of the task could be reduced to focus only on the Death/Life IAT that was significant in this study and the previous study done by Nock et al.¹²

5.4.3 Computer aided assessment

The use of computer aided diagnostic tools has been explored with success in other areas of medicine²⁴ and the use of computer based diagnostic tools has also been shown to not only improve assessment but also the prognosis of the patients.²⁵ The clinical factors in the final model could be included as part of a computer based assessment along with the Death/Life IAT. This would allow a risk assessment using the variables identified to be used during clinical assessment to produce an accurate risk assessment. It would also allow the results to be immediately available to the clinical staff without the need for manual scoring of the results. With minimal training this task can be administered by any member of the clinical staff within the ED and can often be performed before the patient has been seen by the physician. The results could be immediately available to a clinician as an aid in risk assessment. This method of assessment using two cut-offs could allow physicians to assign the patients they see into risk levels. Those who score above the upper cut-off have a high rate of self harm and would be considered at high risk for this behaviour. Those with a score below the lower cut-off have a low rate of self harm and treatment for these patients can focus on other concerns as well as establishing long term follow up for the patients rather than focusing on reducing self harm risk as a priority. Those who fall within the two cut-offs

could be considerate at moderate or uncertain risk of self harm. For these patients further assessments may be required.

Importantly, older patients had difficulty completing the computer program and therefore this method of assessment may be less effective for this subgroup of patients. There might also be difficulties experienced trying to use the IAT tool for those with severe cognitive disabilities as it is more cognitively demanding than pen and paper or interview assessments. It should be noted that decreasing the length of the IAT program may affect the accuracy of the results and will need to be tested in future studies.

5.4.4 Future research

Future research including a larger sample and centers from multiple cities could be beneficial in both fine tuning the models described in this study and also in determining other potentially useful variables that should be included in future models to improve diagnostic precision. Studies with larger samples and longer follow up periods should also be undertaken in order to determine if the IAT task is related to future suicides as well. Further research should attempt to control for factors that occur after assessment in the ED to estimate the size of their effect on the risk of self harm within the 3 months following their presentation.

5.4.5 Limitations

This study is limited in that it only enrolled patients from two hospitals located within one metropolitan area and represents a convenience sample of patients presenting to those hospitals. While refusals were similar to those who completed the

tasks in this study in relevant clinical characteristics only a limited comparison was possible between those that were enrolled in the study and those that were not. The patients enrolled in this sample were at high risk for self harm and therefore caution should be exercised in generalizing these results to lower risk settings. The patients enrolled in this study were also predominantly Caucasian and from the same geographic region; it is uncertain whether cultural norms affect the cognitive relationship between death and self and therefore affect the psychometric properties of the IAT tool.

This design cannot control for the effects of events occurring after the initial assessment that could affect whether a patient eventually engages in self harm behaviour within the 3 month period. There is also the possibility that the loss of patients during the follow up period could have affected the results of the study; however a high follow up rate (86%) reduces this possibility. Measurement error is also a possibility with respect to the IAT results. It is still uncertain how precisely these methods assess the cognitive relationships they attempt to measure. Therefore caution is advised when attempting to discuss potential causal relationships between self harm and the implicit cognitions this task attempts to measure.

The combination of non-suicidal self injury and suicide attempts in the outcome measure may be considered problematic as these may be distinct outcomes. However recent research has supported the view that these outcomes are more similar than dissimilar and that non-suicidal self injury may be on a causal pathway to suicide attempts for some patients.^{35;36} This indicates that non-suicidal injuries are also an important risk factor for suicide attempts. Therefore this lends credence to the importance of assessing for the risk of any self harm in this setting as any form of this

behaviour entails high risk. Therefore the researchers felt that it was appropriate to measure all forms of self harm as a single outcome. The use of multivariate analysis also helps to address this issue by allowing the use of multiple risk factors that may be stronger at detecting different forms of self harm to be used in conjunction to predict these behaviours in their totality.

5.5 Conclusion

This study confirms that the Death/Life IAT task is significantly related to future self harm events and expands on previous research using this assessment method by developing a prediction algorithm for assigning patients into risk groups. This algorithm has better psychometric properties compared to the previous predictive scales and methods described in the literature. Future research should attempt to use larger and more diverse samples to validate this model and/or identify variables to add to this model to improve its properties. Research should also attempt to determine whether reducing the IAT task to only those tasks that were significant would allow a faster assessment without sacrificing the predictive ability of the tool.

Appendix

Figure 5.1: Enrolment summary

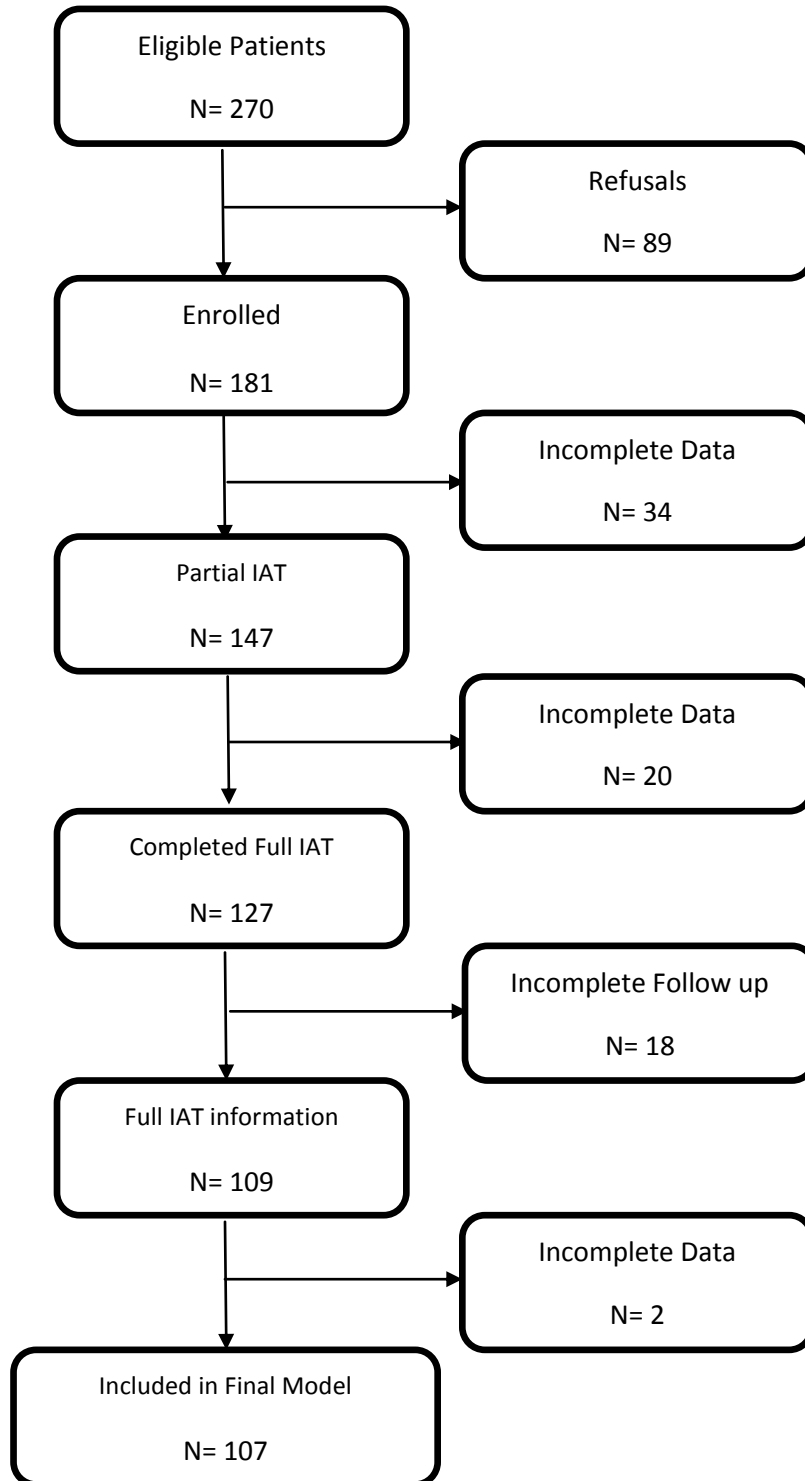


Table 5.1: Demographics and medical characteristics of study sample and refusal group.

Variable	Category	Study Sample		Incomplete Data		Refused	
		N	%	N	%	N	%
Gender	Male	67	52.8	25	47.2	49	55.1
	Female	59	46.5	28	52.8	40	44.9
	Transgendered	1	0.8	0	0.0	---	---
Site	University of Alberta	56	44.1	41	77.36**	57	64.0**
	Royal Alexandra	71	55.9	12	22.64**	32	36.0**
Age	18-29	52	40.9	13	24.5	35	39.3
	30-44	51	40.2	13	24.5	30	33.7
	45+	24	18.9	27	50.9**	24	27.0
Method of Self Harm	OD/Poisoning	36	28.3	18	34.0	27	30.3
	Hanging/Suffocation	3	2.4	1	1.9	1	1.1
	Laceration/Puncture	18	14.2	3	5.7	8	9.0
	All Other	4	3.1	2	3.8	3	3.4
	Any Self Harm	56	44.1	24	45.3	37	43.8
Psychiatry Consulted	----	120	94.5	49	92.5	71	79.8**
Admitted	Admitted	64	50.4	25	47.2	35	39.3
	Discharged	63	49.6	28	52.8	54	60.7
Education	No Diploma	34	26.8	14	26.9		
	High School diploma	28	22.0	15	28.8		
	Some College courses	17	13.4	7	13.5		
	Post-secondary	48	37.8	16	30.8		
History of Self Harm	Yes	95	74.8	35	67.3		
	No	32	25.2	17	32.7		
Ethnicity	Caucasian	113	89.0	43	82.7		
	First Nations/Métis	8	6.3	4	7.7		
	Other	6	4.7	5	9.6		
Lives with/in:	Family	31	24.4	15	28.9		
	Significant other	39	30.7	10	19.2		
	Friends	13	10.2	4	7.7		
	Alone	33	26.0	16	30.8		
	Institution	1	0.8	4	7.7*		
	No fixed address	10	7.9	3	5.8		
Marital Status	Single/Never married	65	51.2	19	46.9		
	Married/Common-law	41	31.9	16	31.3		
	Divorced/Widowed	21	16.5	18	21.8*		

*P<0.05 **P<0.01

Table 5.2: Univariate logistic regression results for the Implicit Association Tests and self harm outcome

Self harm within 3 months		
IAT	OR	95% CI
Suicide/Life IAT	1.26	0.53-2.99
Death/Life IAT	2.83	1.15-6.96
Suicide pictures IAT	1.21	0.53-2.78
Cutting/Not Cutting	1.17	0.51-2.69
Suicide IAT	1.05	0.46-2.39
Death IAT	2.25	0.96-5.30

Table 5.3: Regression model building results

Step and Model/Variable	Chi ² Statistic (df)	P-value	Chi ²	Pseudo R ²
Step 1- Initial Model*			51.07	0.408
History of Self Harm (0, 1-4, 5+)	13.14 (2)	0.001		
Education (Diploma or higher)	4.07 (1)	0.044		
Non-Overdose Self Harm Presentation	10.02 (1)	0.002		
Comorbid Psychotic Disorder/Depressive symptoms	5.56 (1)	0.018		
Death/Life IAT	5.37 (1)	0.021		
Step 2- Hierarchical Regression (Questionnaires)**				
Beck Hopelessness Scale	0.44 (1)	0.505		
Global Severity Index	0.48 (1)	0.490		
Anxiety subscale	0.01 (1)	0.932		
Hostility subscale	0.09 (1)	0.760		
Obsessive Compulsive subscale	0.20 (1)	0.658		
Somatization subscale	0.04 (1)	0.840		
Barrett Impulsivity Score	0.25 (1)	0.616		
Attention subscale	1.37 (1)	0.241		
Attentional Impulsiveness subscale	1.62 (1)	0.203		
Cognitive Instability subscale	1.02 (1)	0.313		
Motor subscale	0.05 (1)	0.825		
Motor Impulsiveness subscale	0.07 (1)	0.787		
CAGE	0.17(1)	0.680		
DAST-10 (Score >8)	1.15 (1)	0.284		
SADPERSONS Score	1.03 (3)	0.795		
Step 3- Hierarchical Regression (Other Clinical)**				
CTAS***	0.31 (2)	0.858		

* Initial model derived by purposeful selection analysis of risk factors for self harm and Death/Life IAT¹

** Variables tested individually for significance in initial model

***Canadian Triage Acuity Score

¹ Initial model determined by including all potentially relevant clinical factors and IAT results and removing those that fail to achieve significance or do not have a confounding effect on the model

Table 5.4: Regression model

	Beta coefficient	Odds Ratio	P-value
Final Model			
History of Self Harm (0, 1-4 events, 5+ events)			0.001
1-4 events	1.05	2.85	
5+ events	3.52	33.67	
Education (High school diploma or higher)	-1.29	0.28	0.044
Comorbid Psychotic Disorder/Depressive symptoms	3.97	44.51	0.018
Non-Overdose Self Harm Presentation	2.43	11.38	0.002
Death/Life IAT	1.63	5.11	0.021

Table 5.5: ROC analysis for Death/Life IAT and regression models

Model/Variable	Cut-off	Sensitivity	Specificity	+LR	-LR	ROC Area	ROC 95% CI
Death/Life IAT	>0	43.3	78.8	2.04	0.72	0.610	0.51-0.71
Final Model	>=0.34	96.6	53.8	2.09	0.06	0.892	0.83-0.96
	>=3.48	58.6	96.2	15.2	0.43		

Table 5.6: Self harm occurrences during a three-month follow-up period (n=107) using two cut-off multivariate regression model

Risk Category	N	N with self harm	Self Harm (%)
Low Risk	43	1	2.3
Moderate Risk	44	11	25.0
High Risk	20	17	85.0

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6.1 Summary of thesis

To date the evidence base for the assessment of self harm risk in the emergency department (ED) has been weak. This thesis was designed to expand the knowledge of suicide assessments in a typical ED setting. The thesis work examined what is known regarding suicide risk assessment from the current literature, the value of currently available suicide risk assessment tools, and the validity of a new Implicit Association Tests (IAT) tool for predicting future self harm behaviour after ED presentation.

The systematic review conducted in **Chapter 2** illustrated the lack of clinically relevant objective assessment measures designed to assess this risk. So far the research in this area has focused on using individual assessment methods in isolation to gauge the risk of self harm.¹⁻⁶ This thesis attempted to look for psychometric assessment methods that could be combined with clinical risk factors in order to develop a risk assessment model that could be used to improve the determination of risk in the ED setting.

The primary focus was on the use of IAT⁷ in the area of self harm risk assessment as they have potential to directly measure cognitions that could be useful in a risk assessment in the ED. This study attempted to expand the research already undertaken in this area^{1;8} and to focus on the usefulness of this tool as part of a risk factor assessment along with other psychometric measures. This could potentially help to circumvent some of the assessment issues that surround psychiatry that were mentioned in the introduction of this thesis. The results discussed in **Chapter 5** suggest

that these types of tests and this specific task in particular could be useful areas of research both for theoretical and practical purposes. **Chapter 5** also examined a model of assessment using one of the IAT tasks that shows promise as a method of improving the accuracy of clinician assessment of self harm.

6.2 Implicit Associations Tests

6.2.1 Detection and prediction of self harm behaviours

Compared to the questionnaires examined in **Chapter 3** and **4** the IAT tasks in isolation do not seem to be uniquely interesting. The true strength of the IAT task, however, becomes apparent in the multivariable regression analysis. In combination with other measures, the viability of the questionnaire results is greatly diminished as the information that they provide is better accounted for by clinical risk factors, namely education level, history of self harm and psychiatric disorders. The strong association between Death/Life IAT relationship and future self harm is maintained after adjustment for these factors. In fact, the odds ratio and statistical significance of the Death/Life IAT improves after adjusting for the effects of other predictive variables and appears to improve the predictive ability of these variables. Therefore, the measurement of internal cognitions does appear to have some potential future application as well as possibilities for additional research. These results reinforce the conclusions that many risk factors that are found in isolation in patients presenting with self harm behaviour assess underlying factors that are often better measured by other

variables.⁹ As well this research reinforces the study done by Nock et al.¹ showing that this tool adds significantly to other risk factors.

6.2.2 Results between chapters

An interesting result of examining **Chapter 3** and **Chapter 5** is the lack of congruence of results for the IAT in the different chapters. In **Chapter 3**, the performance of the IAT at identifying those who either presented with self harm or had a history of self harm before their presentation found inconsistent results between the IATs. The results of **Chapter 3** indicated that the Death IAT was the only significant predictor of who presented with self harm during the index visit and that no other IAT was statistically significantly associated. These results contradict previous studies showing the Cutting/No Cutting and Death/Life IATs as being significant at predicting recent self harm.^{1,8,10} Only the Suicide and Suicide/Life IATs showed any predictive capacity in those who had a history of self harm. It should be noted that neither of the suicide IATs were significant at the $P < 0.05$ level though both were below $P < 0.1$. Finally, the only significant predictor of future self harm was the Death/Life IAT.

The significance of the Death IAT at predicting the occurrence of recent self harm can be explained by the cognitive linking of death in those patients who attempted self harm and survived. Therefore these patients would score positive on the Death IAT and improve its ability to detect recent self harm. This result also agrees with previous studies that have shown that thoughts of death, dying and other related

concepts are related to suicidal ideation.¹¹ The Death IAT, however, was not significant at predicting future self harm even though the related Death/Life IAT was significant. Reminiscent of Freudian theories of a struggle between life and death drive,¹² patients appear to only be at risk for further self harm if the death/self relationship is stronger than the life/self relationship. This finding is also supported by a study that found that adolescents in with both high and low levels of suicide ideation had occurrences of thinking about death.¹³ This suggests that thoughts of death may not be sufficient in themselves to cause increased risk of suicide.

It is possible that the experience of surviving an attempted suicide might cause some patients to have a stronger cognitive connection between Life and their concept of self. This might be considered a form of cognitive catharsis as there is some evidence that self harming behaviours can affect cognitions and affect.¹⁴ Those that had stronger life/self associations would not score positive on the Death/Life IAT and lower its ability to predict recent self harm. Research has indicated that endorsement of similar life concepts in questionnaire format is inversely related to occurrence of self harm and suicide.^{15,16} Therefore those who had a stronger life/self cognitive connection would be less likely to engage in self harm again and therefore the Death/Life IAT would be capable of identifying individuals who do not constitute a high risk of recidivism in the near future. In part, this could explain why the Death IAT was not significant at predicting future self harm since it does not adjust for the patients' cognitions about life.

The potential for an association between the suicide related IATs and a history of self harm is also interesting. Two of the three suicide IATs produced some indication of an association with a history of self harm and the one IAT that showed no indication of an association was the IAT that used picture cues which have been shown to be less effective in IATs than textual clues.¹⁷ These IATs did not show any sign of an ability to predict future self harm events. This may be because they are capable of detecting people who self identify themselves as suicide attempters and these patients would logically have a history of suicide attempts. However, those patients who engaged in non-suicidal self injury might not cognitively categorize themselves as suicide attempters and therefore not be detected by these IATs. The subgroup who engaged in non-suicidal self harm appear to present at higher risk for self harm in the short term due to the frequency of self harm in this subgroup.¹⁸ Therefore it is possible that a failure to identify this subgroup of patients is partially responsible for the failure of the suicide IATs to obtain statistical significance in the prospective study.

The Death and Death/Life IATs may not be effective at determining past self harm history because not everyone who has engaged in self harm may have a strong association with death. Those with a history of non-suicidal self harm could conceivably have a weak cognitive connection with death since the objective of their self harm was not suicide. One study estimated that up to 40% of patients who engage in non-suicidal self injury have suicidal ideations.¹⁹ The remaining patients report no suicidal intent and it is less likely this group, comprising the majority of the non-suicidal self harmers, would have strong associations with death or suicide. It is possible that the

psychological association with Death responds to the person's current psychological state and therefore it is possible that the Death IATs may measure more transient cognitive patterns whereas the suicide IATs may measure long term associations.

The Death/Life IAT was previously found to be significantly related to presenting with a suicide attempt.¹ However it was not found to be significant at predicting which patients presented with non-suicidal self injuries in the same study. This results of this thesis focused on self harm without specifying intent and did not find this version of the IAT to be effective are detecting this type of presentation. The Cutting/No Cutting version of the IAT was also not found to be significantly related to any of the outcomes assess in this thesis. These results contradict two cross-sectional studies^{8;10} illustrating a significant relationship between the results of this IAT and the occurrence of non-suicidal self injuries (cutting injuries in particular). This may be explained by the combination of suicidal and non-suicidal self harm presentations in this thesis.

6.3 Prediction of self harm using regression models

The variables identified in the final model in **Chapter 5** are all supported in previous research.^{1;9;20-22} One of the variables (non-overdose self harm presentation) has research that supports its usefulness as a risk factor for future events of self harm; however, the research around this risk factor is more nuanced. While it has been found that methods of self harm such as hanging/suffocation have higher risks associated with them compared to overdose/poisoning attempts there are also increased risks that

come with more severe self harm within each type of self harm.²¹ For instance those who present with serious overdoses (e.g., those in a coma, requiring intensive care admission, having dialysis, etc) are at higher risk than those who present with mild overdoses (e.g., antibiotics, benzodiazepines, etc). This makes stratifying risk based on the method of self harm more complicated. The division used in this study compared those with no self harm at presentation or a presentation with an overdose to all other methods. The majority of the non-overdose patients presented with laceration/puncture wounds with another smaller group presenting with hanging/suffocation attempts and then a handful of other methods which only had 1 or 2 patients with that type of presentation. Therefore, the higher risk that this variable conferred would seem to largely arise from the group with laceration/puncture wound presentations. This may mean that this variable is identifying patients who more likely engage in chronic cutting behaviour rather than those who presented with more serious self harm methods. Since cutting as a method of self harm has been identified as a risk factor for completed suicide in this setting as well,²² a much larger sample would be required in order to separate these subgroups and permit a more granular assessment of this risk factor variable.

It is also unclear how effective this regression model would be if used on a general population or in less acute medical settings (i.e., family physicians 'offices). It is unlikely that the tool or the predictive model described in this thesis would be as effective as it was in the more acute ED population. It is likely that the rate of false positives would be considerably higher in less acute settings.²³ This would likely limit the

application of this tool as a screening tool for suicide and/or self harm risk. This does not entirely limit the possibility of developing another model using the Death/Life IAT and other predictive variables that would be effective in non-ED settings. The lower the baseline rate for self harm is within the population, the more difficult it will be to develop a predictive algorithm with an acceptable level of false positives. Therefore, the usefulness of this tool will likely be restricted to the ED, inpatient and potentially within medical clinics for patients presenting with ideation or self harm. It is also very likely that different scoring algorithms will be needed in each of those three settings though the variation between them is uncertain.

6.4 Issues with computer based assessment

It is likely that the IAT and the model devised from might limit the patients it can be used to assess. The IAT is more complicated to administer than a standard pen and paper questionnaire and requires a higher degree of cognitive functioning and focus. It may not be an effective tool in those patients who present with low cognitive functioning either from a developmental disorder, psychotic disorder, cognitive impairment from drugs/alcohol, or similar cognitive issues. Slow performance is compensated for during the analysis of the IAT²⁴ therefore the main concern with patients is ensuring they have high enough cognitive functioning to both understand and perform the task. An excessive rate of mistakes is likely an indicator of a failure of cognitive sufficiency for the IAT and the current method of handling high error rates is

to drop that subject during analysis. Likely the only way to overcome this issue during clinical assessment would be to design the computer task to detect high error rates and to ignore the IAT results for that patient and use an alternate scoring algorithm for those patients.

Older patients also appear to have a more difficult time completing the computer task due to a combination of age related factors (e.g. poor vision, slower reaction times) and reduced experience with computers. Research has shown that the reduced cognition of elderly patients is largely due to a slowing of the processing rate of the brain.^{25;26} The advanced scoring methods used for the analysis of the IAT results adjust for the effect of slower cognition and reaction time through the use of the patients own response time as the basis for comparison.²⁴ Therefore, the major obstacle to using this tool in elderly is potentially the occurrence of dementia particular in its early stages where it may not yet be noticed by clinical staff. The inability to remember what task one is currently performing would increase the number of mistakes and make the patients responses more erratic if they need to pause to remember and refocus on the IAT task. This would likely have to be corrected using the method mentioned in the previous paragraph (dropping subjects with high error rates).

6.5 Questionnaires and self harm behaviour

Another interesting result of this study is the group differences discovered by analyzing the results of the questionnaires for those who presented to the ED with self

harm. While one could logically predict that those presenting with self harm would score higher on scales of psychological distress, this was not the result of this study. Those who presented with self harm scored significantly lower on many of the scales used in this study. This effect was apparent in both the scales that were found to be related to future self and those that were not found to relate significantly to future self harm. This reinforces methodological concerns about detecting risk factors using cross-sectional studies.²⁷ This result increases the importance of obtaining risk factor data from cohort studies. It also suggests that the effects of different presentation characteristics should be controlled either through stratification or through the use of properly conducted purposeful regression modeling as was done in this study. The underlying interpretation of these results is uncertain with the data that were obtained. Research has indicated that most of the variation in psychometric measures of self harm related factors is due to current mental state rather than due to persistent personal traits.²⁸ It is possible that these results could be due to those currently at high levels of distress presenting to the ED because of their acute psychological distress. Those with self harm were there specifically for self harm and were not necessarily significantly distressed in ways that would be detected by the measures used.

6.6 Methodological issues and limitations

There are several methodological issues that should be considered for their possible effect on the results of the study. The first issue is the method of patient

selection. Patients were selected from only two major hospitals in a limited geographic setting. The patients were racially and culturally homogeneous. It is uncertain whether cultural, geographic or other differences would have a significant effect on the IAT results. Cultural effects on IAT results have been noticed in other IATs²⁹ though there is a lack of evidence for the specific tasks used in this thesis. It is uncertain what the effect size of culture is for this IAT and whether cultural effects can be compensated for during regression analysis. It is also possible that there was some bias in patient selection due to both the use of a non-consecutive enrolment method as well as patients refusing to agree to participate in the study.³⁰ Attempts were made to compare those who did not participate or did not complete the IAT tasks with those who did and the differences were small and limited to admission and psychiatry consultation rate. The selection bias in this study should not be large enough to effect the conclusions on the hypothesis. Another potential limitation of the study is the combination of patients presenting with suicidal ideation and suicide attempts with patients presenting with non-suicidal self injuries. It is uncertain with this outcome how effective this assessment method is within those specific subgroups.

Follow up was performed using two methods in order to improve the overall follow up rate and accuracy of the results. Since part of the follow up data was obtained using electronic database information it is possible that the overall rate of self harm in the sample was over-estimated as only confirmed incidences of self harm can be detected using electronic databases. A patient that presented to an ED within the Edmonton region for self harm would be detected via the databases and the occurrence

of self harm would be indicated due to standard triaging practices. For patients who are not contacted directly to determine outcome status, it is unlikely any data will be detected via electronic health records that would reliably indicate that they did not engage in self harm during the follow up period. Therefore, only those who could be contacted by telephone could be determined to have not engaged in self harm.

However if those who engaged in self harm were significantly more likely to be missed during the follow up then the rate of self harm could be under-estimated. Due to the high follow up rate either of these effects, if present, should be small and not significantly affect the main results of the study.

The use of regression analysis has the potential for erroneous results if the assumptions for the analysis are not met.²⁷ Attempts were made to ensure that continuous variables had normal distributions or were converted to categorical variables in order to increase the accuracy of the analysis. In addition to this, the models attempted to adjust for confounding and its effect on the models created. The models developed were also assessed for collinearity and goodness-of-fit and were found to be acceptable.

Type I errors are always a concern when a large number of comparisons are made;²⁷ however, in **Chapter 5** the main results obtained in the final model have previous support for their relationship with future risk of self harm events. Therefore, the chance that the results are in part spurious due to multiple testing is low. It is still possible that some of the significant questionnaire results are still due to type I error. Due to the small sample size adjusting for Type I errors was not possible without

significantly reducing the power of the study.

Although cohort studies are stronger than case-control and cross-sectional studies for developing risk models they have drawbacks that should be noted.²⁷ While measurement error and failure to measure potentially important risk and protective factors during enrolment is possible in all of these designs, cohort studies also lead to the possibility that they may fail to recognize factors that have occurred after the initial assessment that may be relevant to a patient's self-harm risk.²⁷ For example, a person with self-harm who is deemed at low risk, may lose their job and start increasing alcohol consumption following their ED visit, thus complicating suicide risk assessment. These factors affect the eventual outcome of the patient and reduce the usefulness of the assessments used by clouding it with other confounding effects. Using a shorter follow up period such as the 3 month period used in this study, compared to 6 month and 1 year follow ups in other studies, should help to reduce the potential for the patient's risk changing after the ED in-person assessment.²⁷

The use of shorter follow up periods is also indicated for other reasons. ED personnel are primarily responsible for immediate and short term risk assessment whereas long term assessment should be the responsibility of mental health services. Rather than trying to predict the outcome of individual patients for long periods of time during a single assessment it may be more practical to assess the patient repeatedly for short term risk on a scheduled basis. The ED is often an entryway into the mental system so the development of an assessment tool for short term could be seen as the initial stage of continuous reassessment of risk for patients experiencing first contact for

self harm risk in the ED. For patients with a history of mental illness it would serve as both a short term risk assessment and as redirection for patients that have fallen out of the mental health system.

6.7 Implications for clinicians

Since this work was performed to improve risk assessment in the ED setting, the results are of particular interest to emergency physicians. The risk assessment algorithm could allow an initial suicide risk assessment to be performed before or after physicians interview the patient. This method would provide an estimate of self harm risk (high, moderate or low) that the physician could then use as part of their clinical assessment for the patient to determine the proper treatment course. This method performed better than previous assessment methods tested in the literature that were examined in **Chapter 2** and should assist decision-making by physicians in this setting.

This thesis also identifies other key risk factors that have been identified in previous literature as being significant predictors of self harm risk.^{9;20-22;31} Even without including the IAT portion, the confirmation of these risk factors in this setting is useful for ED physicians as part of an assessment using clinical judgment alone. History of self harm (particular those with 5 or more events), psychosis with depressive symptoms, low education and a non-overdose self harm presentation are easily obtainable indicators of increased risk that maintain clinical usefulness when combined with each other. The results of **Chapter 3** indicate that the use of questionnaires to assist in clinical

assessment may be confounded with presentation status. Those who presented with self harm scored consistently lower on many of the questionnaire scores that were predictive of self harm in **Chapter 4**. This is despite an increased level of risk overall for patients who presented with self harm. Although the reasons for this discrepancy are not entirely clear, this information should be considered when using scores from similar questions as adjuncts to clinical judgments and potentially adjusted for by clinicians in order to improve assessment.

6.8 Implications for future research

Future research should examine the usefulness of the Death/Life IAT and the models created in this thesis in larger samples preferably with consecutive sampling. This would allow confirmation of the results as well as increasing the confidence in the sensitivity and specificity estimates obtained. It would also allow other potential predictors to be assessed that might not be significant in this sample largely due to the small sample size. Larger samples could also allow some of the dichotomized variables tested during model building (i.e., education, age) to be categorized into more granular subgroups. Larger samples would also allow researchers to attempt to separate those who participate in the study into groups depending on whether they presented with suicide attempts or non-suicidal self injuries. The outcome analysis could also be stratified to assess the ability of these and other predictors to evaluate the risk of non-suicidal injuries versus suicide attempts in the follow up period. Combining an

automatically scored version of the IAT with staff input for the clinical factors identified in the regression model will also be necessary before this method of assessment could be used in an ED setting.

A study using a more comprehensive follow up procedure might also prove useful. Using a larger sample and with more regular follow ups that assess both occurrence of outcomes as well as treatments undertaken would be advantageous. It might be possible to improve our understanding of both the IAT and its relationship with future self harm and other risk factors. It would also allow estimation of the effect size of various treatments. A very well designed study might also be able to determine factors that affect treatment compliance and effectiveness that could prove useful to physician during an ED assessment for self harm risk. Improved knowledge of factors which were not controlled for in this thesis would help to better understand their confounding effect in regards to predicting patient trajectory in the ED. They would also be potentially useful in determining treatment options for patients.

Additional studies more fully examining the experiences of ED physicians and how they assess self harm risk might also be helpful. In particular understanding how physicians currently assess risk for these patients and how this assessment can be improved by incorporated the knowledge gained from the studies performed in this thesis could produce beneficial results. Of particular use will be how knowledge of a high risk of self harm should affect treatments options for patients with different psychiatric conditions. For example, knowing that a patient is at high risk for self harm because of comorbid psychotic and depressive symptoms will likely entail different

treatment methods than a patient at high risk due to a history of chronic non-suicidal self injury or a positive result on the IAT. The research done so far on the IAT test indicates it may be a sign of increased risk for a potentially serious suicide attempt¹ and therefore patients with this risk factor may be more suitable candidates for admission and inpatient treatments compared to patients whose history of repeated self harm likely indicates non-suicidal self injury or borderline characteristics which may be better treated in the community.³²

6.9 Conclusion

Ultimately, the work in this thesis points towards the usefulness of a predictive algorithm using implicit association tests. Such an algorithm need not be complex, either in administration or scoring, but would contribute towards a comprehensive assessment of patients in the ED. Prospective cohort studies should continue to look for factors that would make valuable contributions to the estimation of patient risk in this setting.

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7.1: Drug Abuse Screening Test- 10

I'm going to read you a list of questions concerning information about your potential involvement with drugs, excluding alcohol and tobacco, during the past 12 months. When the words "drug abuse" are used, they mean the use of prescribed or over-the-counter medications/drugs in excess of the directions and any non-medical use of drugs. The various classes of drugs may include: cannabis (e.g., marijuana, hash), solvents, tranquilizers (e.g., Valium), barbiturates, cocaine, stimulants (e.g., speed), hallucinogens (e.g., LSD) or narcotics (e.g., heroin). Remember that the questions do not include alcohol or tobacco. If you have difficulty with a statement, then choose the response that is mostly right. You may choose to answer or not answer any of the questions in this section.

Have you used drugs other than those required for medical reasons?

Do you abuse more than one drug at a time?

Are you always able to stop using drugs when you want to?
(If never use drugs, answer "Yes")

Have you had "blackouts" or "flashbacks" as a result of drug use?

Do you ever feel bad or guilty about your drug use?
If never use drugs, choose "No".

Does your spouse (or parents) ever complain about your involvement with drugs?

Have you neglected your family because of your use of drugs?

Have you engaged in illegal activities in order to obtain drugs?

Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs?

Have you had medical problems as a result of your drug use (e.g., memory loss, hepatitis, convulsions, bleeding, etc.)?

7.2: CAGE Questionnaire

Have you ever felt you should *cut* down on your drinking?

Have people *annoyed* you by criticizing your drinking?

Have you ever felt bad or *guilty* about your drinking?

Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover (*eye-opener*)?

7.3: Beck Hopelessness Scale

This page has been removed due to copyright restrictions. It contained the questions for the Beck Hopelessness scale.

7.4: Barrett Impulsiveness Scale

DIRECTIONS: People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate circle on the right side of this page. Do not spend too much time on any statement.

Answer quickly and honestly.

Rarely/Never Occasionally Often Almost Always/Always

I plan tasks carefully

I do things without thinking

I make-up my mind quickly

I am happy-go-lucky

I don't "pay attention"

I have "racing" thoughts

I plan trips well ahead of time

I am self controlled

I concentrate easily

I save regularly

I "squirm" at plays or lectures

I am a careful thinker

I plan for job security

I say things without thinking

I like to think about complex problems

I change jobs

I act "impulse"

I get easily bored when solving thought problems

I act on the spur of the moment

I am a steady thinker

I change residences

I buy things on impulse

I can only think about one thing at a time

I change hobbies

I spend or charge more than I earn

I often have extraneous thoughts when thinking

I am more interested in the present than the future

I am restless at the theater or lecture

I like puzzles

I am future oriented

7.5: Brief Symptom Inventory

This page has been removed due to copyright restrictions. It contained the questions for the Brief Symptom Inventory and the scoring scale.