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# BMJ Open

## Multi-site sentinel surveillance of self-harm in New Zealand: Protocol for a cross-sectional observational study

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**Multi-site sentinel surveillance of self-harm in New Zealand: Protocol for a cross-sectional observational study**

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## ABSTRACT

### Introduction

New Zealand (NZ) has a persistently high rate of suicide, particularly among young people. Hospital presentation for self-harm (SH) is one of the strongest predictors of death by suicide. Improving the monitoring of SH and suicide is a key recommendation for suicide prevention by the World Health Organisation. This study will establish sentinel surveillance for SH at several large hospitals and a monthly survey of all practicing paediatricians in NZ. The study will provide robust information about the epidemiology of SH, factors associated with SH and the types of interventions required for those presenting to hospital with SH.

### Method and Analysis

This cross-sectional observational study will establish SH surveillance in the emergency departments of three public hospitals in NZ, where study population will include individuals of all ages who present with SH or suicidal ideation. The study methodology is in line with the WHO Best Practice guidelines and international collaborators in Australia and Europe. Electronic triage records will be reviewed manually by the research team to identify potential cases that meet inclusion criteria. For all eligible cases, variables of interest will be extracted from routine clinical records by the research team and recorded on a secure web-based survey application. Additionally, SH surveillance data for the national paediatric population (<15 years) will be obtained via the *New Zealand Paediatric Surveillance Unit*; paediatricians will report on included cases using the same secure survey application. A de-identified dataset will be produced for aggregated statistical analysis.

### Ethics and Dissemination

The University of Otago Health Ethics Committee granted ethical approval for this study in addition to local ethics approval at participating hospital sites. The study findings will be disseminated to relevant stakeholders in NZ, in addition to international audiences through publications in peer-reviewed scientific journals and conference presentations.

**Keywords:** Self-harm, suicide, surveillance, epidemiology, New Zealand

STRENGTHS AND LIMITATIONS

1. Using the WHO best practice guidelines, the surveillance system will provide real-time data monitoring of SH to establish good quality epidemiological information about SH presentations to hospitals in New Zealand, which has not been publicly reported since 2013
2. The surveillance system will provide information about the characteristics of people presenting to hospital following SH, allowing robust service planning decisions and the ability to evaluate the impact of interventions on subsequent presentations
3. Real time surveillance allows the detection of novel methods of SH, and appropriate intervention to reduce access, where possible
4. This study is based on presentations for self-harm to public hospitals so is not an accurate estimate of community cases of self-harm
5. There is significant variation in the completeness of routinely collected data, so not all cases of self-harm may be identified

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## INTRODUCTION

In 2016, the World Health Organisation (WHO) estimated an annual global suicide rate of 10.5 per 100 000<sup>1</sup>. Premature deaths by suicide are particularly tragic; first they occur early in the life course, resulting in significant Disability-Adjusted Life Years (DALY's)<sup>2</sup> and economic costs of around \$2.2 billion<sup>3</sup>. Secondly, suicide is preventable. Thirdly, the social and health cost of suicide borne by those affected by suicide death is significant.

People who have engaged in self-harm (intentional self-injury or self-poisoning regardless of degree of intention to die) are at much greater risk suicide than the general population<sup>4-6</sup> with a risk of suicide around 30 thirty higher in the year following hospital presentation for SH. Males, older adolescents, those presenting with self-injury (compared with self-poisoning) and repeated SH are at particularly elevated risk of death by suicide<sup>7</sup>. Although relatively common, suicidal ideation (having thoughts or plans for suicide but not acted on them) is also an important factor to target in suicide prevention. Around three in five individuals transition from ideation to a plan and suicide attempt within the first year of having suicidal ideation<sup>8</sup>. Hospital presentation for SH is key predictor of suicide, so a comprehensive understanding of this high-risk population, and their treatment needs is essential as part of a multi-level approach to suicide prevention<sup>9 10</sup>.

In 2016, the most recent year for which there are publicly available data, New Zealand (NZ) reported a total population suicide rate of 11.3 deaths per 100,000 people, with higher rates among young people (16.8 per 100,000)<sup>11</sup> and indigenous Māori (RR 1.85, CI 1.64-2.10)<sup>12</sup>. Despite high public interest, relatively little progress has been made in reducing suicide in NZ<sup>11</sup>, partly due to lack of good quality data to inform interventions. Current data reporting practices in NZ undercount SH presentations by an estimated 50 - 60% for several reasons including only episodes with a length of stay greater than 48 hours. Publicly reported data refers to episodes rather than individuals making it hard to estimate repetition rates, and report on a limited number of variables<sup>11 13</sup> most of which are not amenable to change.

Improving the monitoring of SH and suicide is a key recommendation from the World Health Organisation and setting up a SH surveillance system is one of the key approaches<sup>14</sup>. Surveillance data can help establish the true rate of hospital presentations for SH and suicidal ideation, provide robust data about risk factors, give a much better understanding of who comes to hospital following SH/suicidal ideation, the types of hospital treatments they receive, and indications of which interventions may be likely to reduce representations to hospital, and ultimately deaths by suicide<sup>1 15</sup>.

Internationally there are a small number of dedicated surveillance systems in place<sup>16</sup>. These include the *Multicentre Study of Self-Harm* in England<sup>17</sup>, the *Hunter Area Toxicology Service* in Australia<sup>18</sup>, the *Bristol Self-Harm Surveillance Register*<sup>19</sup>, and the *Irish National Self-Harm Registry*<sup>20</sup>. These systems operate within hospital emergency department (ED) settings and collect data from either regional geographical area in the case of *Hunter Area Toxicology Service* and *Bristol Self-Harm Surveillance Register* or a broader geographical area in the case of the *Multicentre Study of Self-Harm*, and nationally in the case of the *Irish National Self-Harm Registry*. These surveillance systems contribute valuable epidemiological data about prevalence and patterns of SH in their respective geographical areas and are actively utilised to provide high quality information to inform suicide prevention initiatives.

Several small, short term studies of ED presentations of SH in NZ have shown that a surveillance approach can be achieved<sup>13 21</sup>. However, these studies are relatively old, and focused on a single hospital, a specific sub-group of patients or a single method of presentation. Using the WHO practice manual for establishing and maintaining surveillance systems for suicide attempts and SH<sup>16</sup>, this study aims to achieve the following primary objectives:

1. To establish sentinel surveillance for SH at several large hospitals and a monthly survey of all practicing paediatricians in Aotearoa/New Zealand in conjunction with the *New Zealand Paediatric Surveillance Unit* (NZPSU)<sup>a</sup>
2. To establish and test robust data collection methods;

<sup>a</sup> The New Zealand Paediatric Surveillance Unit (NZPSU), based at the University of Otago, facilitates national surveillance to improve the knowledge of a number of uncommon high-impact childhood conditions in New Zealand, [www.otago.ac.nz/nzpsu](http://www.otago.ac.nz/nzpsu)

3. Identify the epidemiology of current presentations for SH in terms of age, gender, ethnicity, methods of SH, alcohol/substance misuse, prior history of SH, degree of intention to die, exposure to SH/suicide, mental health assessments and discharge outcomes;

The secondary objectives of this study are to (i) identify potential gaps in SH services; (ii) identify systemic levers for suicide prevention; and (iii) identify predictors of repetition of SH.

The study objectives and methods will be comparable with international SH surveillance programmes in Australia, the UK and Ireland to facilitate international comparisons. A well-functioning surveillance system can provide a real-time warning of sudden increases in presentations of SH, SH clusters or emerging methods of SH. Monitoring the rates of SH presentations over time is an important indicator of impact of different approaches to management of SH and rates of SH repetition. High quality data on diverse geographical settings will be a key resource to inform decisions about resource allocation to areas of highest need. Once established, this system will have the potential to act as a barometer of success of national suicide prevention strategies<sup>22</sup>.

## METHOD & ANALYSIS

### Study Design and Setting

This cross-sectional observational study will adopt the WHO practice guidelines for sentinel surveillance of suicide attempts and SH<sup>16</sup>. We have also taken advice from academic and advocate with lived experience of self-harm regarding the design of this study. Sentinel surveillance sites will be set up at three NZ hospital EDs and nationally in partnership with NZPSU.

i. Hospital sites: *SH* surveillance sites will be established in the Emergency Departments of Middlemore Hospital in Auckland, Dunedin Hospital in Dunedin, and Southland Hospital in Invercargill. Surveillance data will be collected for hospital presenting cases of SH and suicidal ideation among all age-groups at Dunedin and Southland Hospitals and for paediatric age group (< 15 years) at Middlemore Hospital. Study sites have been selected as they serve some of the most socio-economically deprived and ethnically diverse communities who also experience relatively high burden of suicide deaths<sup>23</sup>. Middlemore Hospital has approximately 110,000 ED presentations per annum, of which there are around 800 episodes of SH in the paediatric population (up to 18 years). Dunedin Hospital has 36,000



ED presentations and around 1,800 SH episodes per annum. Southland Hospital has around 30,000 ED presentations annually<sup>24</sup>.

ii. New Zealand Paediatric Surveillance Unit (NZPSU): The NZPSU is a surveillance system to detect rare diseases and meets New Zealand reporting obligations to the WHO. This has been in operation for many years and has previously been used to collect information on sensitive topics such as foetal alcohol syndrome and perinatal HIV exposure. SH will be added to the current list of diseases that are monitored by the NZPSU surveillance system. Study data will be collected via registered Paediatricians (approximately 200 throughout NZ) on a monthly basis. This will ensure national coverage and a good sampling of smaller and regional hospitals where younger patients tend to be admitted to paediatric units due to difficulty in accessing mental health services. The number of SH cases seen by paediatricians is currently unknown as there has been no previous study of this type in New Zealand.

Study status: The data collection both, at the hospital sites and via the NZPSU, commenced on July 1, 2020 and will continue until July 2022.

Eligible participants: The study population is outlined below:

1. *Dunedin and Southland Hospital Emergency Departments*: individuals of all ages who present with either SH or suicidal ideation
2. *Middlemore Hospital*: individuals under the age of 15 years presenting with either SH or suicidal ideation
3. *NZPSU*: individuals under the age of 15 years presenting with SH and coming under the inpatient care of a Registered Paediatrician at any public hospital in New Zealand

The focus on paediatric populations at Middlemore Hospital and NZPSU has been informed by the lack of high-quality data for this group, the prominence of SH among those who die at a young age by suicide and the support of a specific funder.

For all sites, SH is defined as intentional self-injury or self-poisoning, irrespective of motivation or degree of suicidal intent<sup>25</sup>. This definition incorporates non-suicidal self-injury and is used by the study team to reflect the complexity of self-harm in clinical settings. It recognises that reported motivation/intent may vary episode to episode and there also may be disagreement between clinical

staff and service users themselves about the meaning of an act of SH<sup>26 27</sup>. Self-poisoning is defined as intentional ingestion of more than the prescribed or recommended dose of any drug (e.g. analgesics, antidepressants), and includes poisoning with non-ingestible substances (e.g. household bleach), overdoses of 'recreational drugs', and severe alcohol intoxication where clinical staff consider such cases to be acts of SH. Self-injury is defined as any injury that has been deliberately self-inflicted (e.g. self-cutting, jumping from a height, hanging, strangulation, self-immolation, gunshot). Suicidal ideation is defined as having a suicide plan or having suicidal thoughts but not having acted on these thoughts or plans at the time of hospital presentation.

#### Inclusion criteria:

Individuals of any age group presenting to ED at Dunedin or Southland Hospital or individuals less than 15 years of age presenting to Middlemore Hospital or to paediatricians reporting via NZPSU. The individual has engaged in either of the following:

- Self-injury or self-poisoning that is intentional and not accidental; or
- Suicidal ideation only (at Emergency Departments not via NZPSU)

#### Exclusion criteria:

- Accidental overdose of alcohol in an individual who drinks alcohol to excess requiring hospital treatment, but without any intention to SH, and who does not combine alcohol with other methods of SH
- Accidental overdose of illicit drugs in an individual who takes illicit drugs on a regular basis but without any intention to SH
- Accidental overdose of prescription or over-the-counter medications by incorrectly following a prescribed dosage
- SH in the context of significant intellectual disability or developmental disorder

#### Sampling

All consecutive cases of SH or suicidal ideation presenting to Emergency Departments at Dunedin, Southland and Middlemore Hospital (<15 years) will be identified by the study staff as per the case-ascertainment definition. For NZPSU, all consecutive cases of SH (<15 years) under the inpatient care of a registered paediatricians are identified and reported by the paediatricians as per the case-ascertainment definition.

Participant recruitment:

This is a surveillance study using routinely collected clinical data. There is no direct contact with patients/cases/participants.

*i. Hospital sites* - All patients who present to ED receive usual care including triage and a routine clinical assessment by ED clinicians. The study team will manually review the triage descriptions described on electronic ED lists. Cases which include terms such as suicide ideation, self-harm, suicide attempt, overdose, hanging, jumping, cutting will be reviewed in addition to broader terms such as abdominal pain, collapse due to unknown cause will be reviewed for inclusion. Once an episode of SH or suicidal ideation is identified, further investigation of the patient records via relevant electronic record system will be undertaken. Additionally, in Middlemore Hospital, if the electronic medical record is unclear, the study team will review relevant paper records. For all eligible participants in the hospital settings, routine clinical data will be extracted from the clinical record by a member of the research team (see Table 1) and entered directly into the research data capture tool (REDCap, see further description in Data Management section of this protocol).

*ii. NZPSU* - The NZPSU team will inform the study team about any reported cases of paediatric SH as notified by Registered Paediatricians on their monthly report card. The reporting paediatrician is contacted by the study team and provided a unique URL which will link them directly to the secure REDCap data capture tool. Paper-based data collection forms will be available to any paediatrician who requests this format.

*Table 1. Data collection fields*

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1. Sociodemographic information: NHI, gender, age, ethnicity, usual residential address, occupation
  2. Description of presenting complaint (narrative)
  3. Date and time of SH
  4. Date and time of hospital presentation and discharge
  5. How the patient arrived at the hospital (ambulance/police/own transport)
  6. Did the patient present with self-injury, self-poisoning, suicidal ideation
  7. Location of SH (home/public place)
  8. How did the patient harm themselves
  9. Was alcohol and/or an illegal substance involved
  10. Did the patient make a statement of intention to die
  11. Problems/difficulties associated with the current episode of SH or suicidal ideation
  12. History of exposure to SH and suicide among peers/family
  13. Prior history of SH
  14. Referrals to specialist services such as social worker, ICU
  15. Referral for mental health assessment during this episode
  16. Did this episode lead to a hospital admission
  17. Discharge location from ED
  18. For cases of self-poisoning, name, amount, strength and source of substance used
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#### Determination of SH/suicidal ideation relatedness, data quality and reliability

Initial training in case ascertainment will involve 2-3 members of the research team who will review all ED presentations to each hospital study site. Each case will be reviewed by the team against the inclusion/exclusion criteria, robust discussion will ensure capture of all cases. Once accurate case ascertainment has been achieved, an ongoing review process to determine inter-rater reliability of case determinant and accurate extraction of key variables will include:

- (1) An independent review by a second team member, cross-checking the routinely collected clinical data for 10% participants registered every month at each hospital site. Cases will be selected using a

random number generator. Any discrepancies in case ascertainment will be documented and resolved by the study PI.

(2) An independent review, by a second researcher, of extracted key variables for a random sample of 20 identified cases over a period of six months, against routinely collected clinical records to check for consistency in data extraction. Cases will be selected using the random number generator in statistical software.

Intra-rater (within reviewer) reliability will also be determined by comparing the determination of SH/suicidal ideation, and consistency in extraction of key variables, between the beginning and end of the data collection period. The reasons behind any inconsistencies or discrepancies between reviewers will be examined further and if necessary, cases will be re-coded.

Consent

Participant consent is not required; the study does not require patients to take part in any additional procedures nor does it affect care or treatment they receive. The study research team will not have any direct patient contact as the study is based only on routinely collected information.

Stakeholder engagement

A project advisory committee, comprising of national and international experts on suicide prevention including clinicians, academics, and those with lived experience, will be established in line with international best practice. The committee will assist in identifying issues that need to be addressed and opportunities for the surveillance system. The committee will also provide advice to the data management plan and delivering culturally relevant research outcomes.

Data Management

A customised data collection mechanism, specific to this study, will be developed using Research Electronic Data Capture (REDCap). REDCap is a secure web-based application designed to support data capture for research studies. It is suitable for collecting personal information which is covered by Health Information Privacy Principles, The Privacy Act and Ethics Committee specifications that

require the use of a secure survey tool<sup>28</sup>. All survey data collected via REDCap will be securely stored at the University of Otago.

Any missing values or variables will be checked against records to ensure that all possible information is included. This may require the study team to revisit some case files to collect any missing information. A preliminary statistical analysis will be conducted after every 100 cases (for the initial period of 6 months) to ensure that necessary data has been captured correctly.

The WHO protocol suggests it is essential to collect personal information about participants for case ascertainment<sup>16</sup> particularly where the person re-presents to hospital while complying with local regulations<sup>29</sup>. Potential cases will be identified using clinical record identifiers. However, once cases have been selected, all identifying information such as name, home address, NHI (national health index number)<sup>b</sup>, and date of birth variables will be partitioned off and a unique participant code will be allocated. Thus, the study team will use a de-identified dataset for aggregated statistical analysis and subsequent publications. The study data will be solely used for addressing the research objectives and will not be used for any dissemination that may potentially identify an individual. Original data will be securely stored by the study team for a minimum of 10 years. The research data will be solely owned by the University of Otago.

### Data Analysis

The primary outcomes of the study are 1. annual number of episodes of hospital-presenting SH and suicidal ideation; 2. trends in frequently used methods of SH; 3. “new” or emerging methods of SH; 4. frequently used drugs in overdose related SH; 5. variations (seasonal/demographic/temporal) in presentations of SH and suicidal ideation; and 6. average time taken between time of SH and time of ED presentation.

We would also include outcomes related to incidence rates: 1. annual rates of SH per 100,000 population for the total population, for subgroups by age and sex; 2. annual rates of SH in paediatric population (<15 years); 3. annual rates of suicidal ideation; 4. variation by gender, age, ethnicity; and geographical

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<sup>b</sup> A unique identifier that is assigned to every person who uses health and disability support services in New Zealand

region. The secondary outcomes will focus on identifying predictors of repetition of SH, potential gaps in SH services and systemic levers for suicide prevention.

For comparison, crude and age-specific SH rates will be calculated using the NZ Census 2018 and WHO world standard population. An analysis of repeat events will be conducted using conditional risk set analysis and Cox hazard proportional models will be used to identify independent and multivariable predictors of repetition of SH. All the study data will be analysed using SPSS version 27.0.

**ETHICS AND DISSEMINATION**

This study has received approval from University of Otago Human Ethics Committee (H19/165) including the Ngāi Tahu Research Consultation Committee, to review the research plan in context to the indigenous population of NZ (Māori). Institutional approvals were provided by Counties Manukau DHB which oversees Middlemore Hospital and the Southern DHB which oversees Dunedin and Southland Hospitals. Each team member has a confidentiality agreement with the DHB.

We will publish aggregated study data to both national and international audiences via publications in peer reviewed scientific journals and conference presentations. Submission of study findings will also be made to local regulatory authorities including DHB management teams, local Suicide Prevention Coordinators, and the New Zealand Suicide Prevention Office.

**CONCLUSION**

The main aim of this study is to establish multi-centre sentinel surveillance of patients presenting with SH or suicidal ideation as per the recommended WHO practice guidelines on surveillance systems<sup>16</sup> and to provide up-to-date, detailed and robust epidemiological data which will establish trends in SH in NZ. In doing so, the study findings will inform suicide prevention efforts to support the development of evidence-based interventions and workforce development in a way that is most likely to reduce SH and ultimately suicide deaths.

**AUTHORS CONTRIBUTIONS**

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SF conceptualised the study and developed the study protocol with the other co-investigators - KS, SH, GM. RM provided inputs to the study design. LH and VS assisted in finalisation of the protocol and drafted this manuscript.

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## CONFLICT OF INTEREST

None declared



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**Multi-site sentinel surveillance of self-harm in New Zealand: Protocol for an observational study**

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## ABSTRACT

### Introduction

New Zealand (NZ) has a persistently high rate of suicide, particularly among young people. Hospital presentation for self-harm (SH) is one of the strongest predictors of death by suicide. Improving the monitoring of SH and suicide is a key recommendation for suicide prevention by the World Health Organisation. This study will establish the first ever sentinel surveillance for SH at several large hospitals and a monthly survey of all practicing paediatricians in NZ. The study will provide robust information about the epidemiology of SH, factors associated with SH and the types of interventions required for those presenting to hospital with SH.

### Method and Analysis

This observational study will establish SH surveillance in the emergency departments of three public hospitals for the first time in New Zealand, where study population will include individuals of all ages who present with SH or suicidal ideation. The study methodology is in line with the WHO Best Practice guidelines and international collaborators in Australia and Europe. Electronic triage records will be reviewed manually by the research team to identify potential cases that meet inclusion criteria. For all eligible cases, variables of interest will be extracted from routine clinical records by the research team and recorded on a secure web-based survey application. Additionally, SH surveillance data for the national paediatric population (<15 years) will be obtained via the *New Zealand Paediatric Surveillance Unit*; paediatricians will report on included cases using the same variables using a secure survey application. A de-identified dataset will be produced for aggregated statistical analysis.

### Ethics and Dissemination

The University of Otago Health Ethics Committee granted ethical approval for this study in addition to local ethics approval at participating hospital sites. The study findings will be disseminated to relevant stakeholders in NZ, in addition to international audiences through publications in peer-reviewed scientific journals and conference presentations.

**Keywords:** Self-harm, suicide, surveillance, epidemiology, New Zealand

### STRENGTHS AND LIMITATIONS

1. Using the WHO best practice guidelines, the surveillance system will provide real-time data monitoring of SH to establish good quality epidemiological information about SH presentations to hospitals in New Zealand, which have not been publicly reported since 2013

2. The surveillance system will provide information about the characteristics of people presenting to hospital following SH, allowing robust service planning decisions and the ability to evaluate the impact of interventions on subsequent presentations
3. Real time surveillance allows the detection of novel methods of SH, and appropriate intervention to reduce access, where possible
4. This study is based on presentations for self-harm to public hospitals so is not an accurate estimate of community cases of self-harm
5. There is significant variation in the completeness of routinely collected data, so not all cases of self-harm may be identified

## INTRODUCTION

In 2016, the World Health Organisation (WHO) estimated an annual global suicide rate of 10.5 per 100 000<sup>1</sup>. Premature deaths by suicide are particularly tragic; first they occur early in the life course, resulting in significant Disability-Adjusted Life Years (DALY's)<sup>2</sup> and economic costs of around \$2.2 billion<sup>3</sup>. Secondly, suicide is preventable. Thirdly, the social and health cost of suicide borne by those affected by suicide death is significant.

People who have engaged in self-harm (intentional self-injury or self-poisoning regardless of degree of intention to die) are at much greater risk suicide than the general population<sup>4-6</sup> with a risk of suicide around 30 thirty higher in the year following hospital presentation for SH. Males, older adolescents, those presenting with self-injury (compared with self-poisoning) and repeated SH are at particularly elevated risk of death by suicide<sup>7</sup>. Although relatively common, suicidal ideation (having thoughts or plans for suicide but not acted on them) is also an important factor to target in suicide prevention. Around three in five individuals transition from ideation to a plan and suicide attempt within the first year of having suicidal ideation<sup>8</sup>. Hospital presentation for SH is key predictor of suicide, so a comprehensive understanding of this high-risk population, and their treatment needs is essential as part of a multi-level approach to suicide prevention<sup>9 10</sup>.

New Zealand is a high-income country spread across two large Islands (North Island, South Island) with a population of 5 million people, from a range of ethnic groups including European/Pakeha (70%), indigenous Māori (17%), Asian (15%) and Pacific Peoples (8%)<sup>11</sup>. The healthcare system in New Zealand provides free of charge universal care to eligible citizens funded via general taxes. Around one third of the population also carry private health insurance<sup>12</sup>. Currently 20 District Health Boards operate around 40 public hospitals, of which 28 have 24/7 emergency departments. There are approximately 1 million presentations per annum with wait time and resource challenges similar to other high income countries<sup>13</sup>.

In 2016, the most recent year for which there are finalised publicly available data, New Zealand reported a total population suicide rate of 11.3 deaths per 100,000 people, with higher rates among young people (16.8 per 100,000)<sup>14</sup> and indigenous Māori having rates which are nearly double (RR 1.85, CI 1.64-2.10)<sup>15</sup> those of non-Maori (17.1 per 100,000 compared with 8.1 per 100,00 for Pacific peoples and 11.3 per 100,000 for other ethnic groups. The burden of suicide is particularly evident for Māori males (31.3 per 100,000 compared with non-Māori males 14.4 per 100,000), however rates among Māori women have risen 40% between 1996-2016<sup>16</sup>. The WHO estimate that New Zealand suicide rates in 2019 (provisional data) were 10.3 per 100,000, the same as Canada, higher than Ireland (8.9 per 100,000) and United Kingdom (6.9 per 100,000) and lower than Australia (11.3 per 100,000) and the USA (14.5 per 100,000)<sup>17</sup>.



Despite high public interest, relatively little progress has been made in reducing suicide in NZ<sup>14</sup>, partly due to lack of good quality data to inform interventions; current data reporting practices based on routinely collected data on presentations to public hospitals in undercount SH presentations in New Zealand by an estimated 50 - 60% for several reasons including only episodes with a length of stay greater than 48 hours which misses a significant proportion of presentations. Government reported data also refers to episodes rather than individuals, making it hard to estimate repetition rates, and report on a limited number of variables<sup>14 18</sup> most of which are not amenable to change. In addition mental health presentations appear particularly poorly coded by hospital staff compared with physical health complaints, which leads to further undercounting of this population<sup>19</sup>.

Improving the monitoring of SH and suicide is a key recommendation from the World Health Organisation and setting up a SH surveillance system is a key strategy<sup>20</sup>. Surveillance data can help establish the true rate of hospital presentations for SH and suicidal ideation, provide robust data about risk factors, give a much better understanding of who comes to hospital following SH/suicidal ideation, the types of hospital treatments they receive, and indications of which interventions may be likely to reduce representations to hospital, and ultimately deaths by suicide<sup>1 21</sup>.

Internationally there are a small number of dedicated surveillance systems in place<sup>22</sup>. These include the *Multicentre Study of Self-Harm* in England<sup>23</sup>, the *Hunter Area Toxicology Service* in Australia<sup>24</sup>, the *Bristol Self-Harm Surveillance Register*<sup>25</sup>, and the *National Self-Harm Registry Ireland*<sup>26</sup>. These systems operate within hospital emergency department settings and collect data from either regional geographical area in the case of *Hunter Area Toxicology Service* and *Bristol Self-Harm Surveillance Register* or a broader geographical area in the case of the *Multicentre Study of Self-Harm in the UK*, and nationally in the case of the *National Self-Harm Registry Ireland*. These surveillance systems contribute valuable epidemiological data about prevalence and patterns of SH in their respective geographical areas and are actively utilised to provide high quality information to inform suicide prevention initiatives. This New Zealand surveillance system will use similar methods to facilitate comparisons and build on existing learnings, but is novel in the use of manual screening of all hospital emergency department presentations to check for cases, the inclusion of cases with suicidal ideation only and the first international use of Paediatric Surveillance system to monitor self-harm as a condition of interest.

Several small, short term studies of emergency department presentations of SH in New Zealand have shown that a surveillance approach can be achieved<sup>18 27</sup>. However, these studies are relatively old, and focused on a single hospital, a specific sub-group of patients or a single method of presentation. Using the WHO practice manual for establishing and maintaining surveillance systems for suicide attempts and SH<sup>22</sup>, this study aims to achieve the following primary objectives:

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1. To establish sentinel surveillance for self-harm at several large hospitals and a monthly survey of all practicing paediatricians in Aotearoa/New Zealand in conjunction with the *New Zealand Paediatric Surveillance Unit* (NZPSU)<sup>a</sup>
2. To establish and test robust data collection methods;
3. Identify the epidemiology of current presentations for SH in terms of age, gender, ethnicity, methods of SH, alcohol/substance misuse, prior history of SH, degree of intention to die, exposure to SH/suicide, mental health assessments and discharge outcomes;

The secondary objectives of this study are to (i) identify potential gaps in SH services; (ii) identify systemic levers for suicide prevention; and (iii) identify predictors of repetition of SH.

The study objectives and methods will be comparable with international SH surveillance programmes in Australia, the United Kingdom and Ireland to facilitate international comparisons. A well-functioning surveillance system can provide a real-time warning of sudden increases in presentations of SH, SH clusters or emerging methods of SH. Monitoring the rates of SH presentations over time is an important indicator of impact of different approaches to management of SH and rates of SH repetition. High quality data from diverse geographical settings will be a key resource to inform decisions about resource allocation to areas of highest need. Once established, this system will have the potential to act as a barometer of success of national suicide prevention strategies<sup>28</sup>.

## METHOD & ANALYSIS

### Study Design and Setting

This observational study will adopt the WHO practice guidelines for sentinel surveillance of suicide attempts and SH<sup>22</sup>. We have also taken advice from academic and advocate with lived experience of self-harm regarding the design of this study. Sentinel surveillance sites will be set up at three New Zealand hospital emergency departments and nationally in partnership with NZPSU.

i. Hospital sites: SH surveillance sites will be established in the Emergency Departments of Middlemore Hospital in Auckland (North Island), Dunedin Hospital in Dunedin, and Southland Hospital in Invercargill (South Island). Surveillance data will be collected for hospital presenting cases of SH and suicidal ideation among all age-groups at Dunedin and Southland Hospitals and for paediatric age group (< 15 years) at Middlemore Hospital. Study sites have been selected as they serve some of the most socio-economically deprived and ethnically diverse communities who also experience relatively high

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<sup>a</sup> The New Zealand Paediatric Surveillance Unit (NZPSU), based at the University of Otago, facilitates national surveillance to improve the knowledge of a number of uncommon high-impact childhood conditions in New Zealand, [www.otago.ac.nz/nzpsu](http://www.otago.ac.nz/nzpsu)

burden of suicide deaths<sup>29</sup>. Middlemore Hospital has approximately 110,000 ED presentations per annum, of which there are around 800 episodes of SH in the paediatric population (up to 18 years). Middlemore is the largest of three hospitals with a 24/7 Emergency Department in the Auckland region which a total population of 1.7 million people Middlemore serves large Māori and Pacific communities<sup>11</sup>, and was selected to better understand the urgent suicide prevention opportunities for young people in these groups. Oversampling Māori and Pacific presentations is important, as they are typically undercounted in most health datasets in New Zealand. Findings are likely generalisable to the wider Auckland region which is very multicultural. Dunedin Hospital has 36,000 ED presentations and around 1,800 SH episodes per annum. Southland Hospital has around 30,000 ED presentations annually<sup>30</sup>. The Southern District Health Board, that operates these hospitals has experienced suicide rates significantly higher than the national average in most years since 2009 (<https://www.health.govt.nz/publication/suicide-web-tool>). In combination these two hospitals cover around one third of the population who live in the South Island making the findings generalisable while also allowing greater understanding of rural populations.

ii. New Zealand Paediatric Surveillance Unit (NZPSU) (<https://www.otago.ac.nz/nzpsu/index.html>): The NZPSU is a surveillance system to detect rare diseases and meets New Zealand reporting obligations to the WHO. This has been in operation for many years<sup>31</sup> and has previously been used to collect information on sensitive topics such as foetal alcohol syndrome and perinatal HIV exposure. Self-harm will be added to the current list of diseases that are monitored by the NZPSU surveillance system that paediatricians are asked to complete a surveillance ‘card’ for. Study data will be collected via registered Paediatricians (approximately 200 throughout NZ) on a monthly basis, using the same data collection variables using a secure electronic survey link. This will ensure national coverage and a good sampling of smaller and regional hospitals where younger patients tend to be admitted to paediatric units due to difficulty in accessing mental health services. The number of SH cases seen by paediatricians is currently unknown as there has been no previous study of this type in New Zealand. The weakness of this approach is the reliance on busy paediatricians to report on cases and the inability to know (in most hospitals) what proportion of cases presenting are reported on. However, we will be able to estimate this ratio in the hospitals covered by both systems without double counting cases.

Study status: The data collection both, at the hospital sites and via the NZPSU, commenced on July 1, 2020 and will continue until 2024.

Eligible participants: The study population is outlined below:

1. *Dunedin and Southland Hospital Emergency Departments*: individuals of all ages who present with either SH or suicidal ideation

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2. *Middlemore Hospital*: individuals under the age of 15 years presenting with either SH or suicidal ideation
3. *NZPSU*: individuals under the age of 15 years presenting with SH and coming under the inpatient care of a Registered Paediatrician at any public hospital in New Zealand

For all sites, SH is defined as intentional self-injury or self-poisoning, irrespective of motivation or degree of suicidal intent<sup>32</sup>. This definition incorporates non-suicidal self-injury and is used by the study team to reflect the complexity of self-harm in clinical settings. It recognises that reported motivation/intent may vary episode to episode and there also may be disagreement between clinical staff and service users themselves about the meaning of an act of SH<sup>33 34</sup>. Self-poisoning is defined as intentional ingestion of more than the prescribed or recommended dose of any drug (e.g. analgesics, antidepressants), and includes poisoning with non-ingestible substances (e.g. household bleach), overdoses of 'recreational drugs', and severe alcohol intoxication where clinical staff consider such cases to be acts of SH. Self-injury is defined as any injury that has been deliberately self-inflicted (e.g. self-cutting, jumping from a height, hanging, strangulation, self-immolation, gunshot). Suicidal ideation is defined as having a suicide plan or having suicidal thoughts but not having acted on these thoughts or plans at the time of hospital presentation. Details of the method of self-harm will be recorded verbatim to facilitate a more nuanced understanding in addition to allowing coding to ICD10 codes.

#### Inclusion criteria:

Individuals of any age group presenting to the emergency department at Dunedin or Southland Hospital or individuals less than 15 years of age presenting to Middlemore Hospital or to paediatricians reporting via NZPSU. The individual has engaged in either of the following:

- Self-injury or self-poisoning that is intentional and not accidental; or
- Suicidal ideation only (at Emergency Departments but not via NZPSU)

#### Exclusion criteria:

- Accidental overdose of alcohol in an individual who drinks alcohol to excess requiring hospital treatment, but without any intention to SH, and who does not combine alcohol with other methods of SH
- Accidental overdose of illicit drugs in an individual who takes illicit drugs on a regular basis but without any intention to SH
- Accidental overdose of prescription or over-the-counter medications by incorrectly following a prescribed dosage

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- SH in the context of significant intellectual disability or developmental disorder

Sampling

All consecutive cases of SH or suicidal ideation presenting to Emergency Departments at Dunedin, Southland and Middlemore Hospital (<15 years) will be identified by the study staff as per the case-ascertainment definition. For NZPSU, all consecutive cases of SH (<15 years) under the inpatient care of a registered paediatricians are identified and reported by the paediatricians as per the case-ascertainment definition.

Participant recruitment:

This is a surveillance study using routinely collected clinical data. There is no direct contact with patients/cases/participants.

*i. Hospital sites* - All patients who present to ED receive usual care including triage and a routine clinical assessment by ED clinicians. The study team will manually review the triage descriptions described on electronic ED lists. Cases which include terms such as suicide ideation, self-harm, suicide attempt, overdose, hanging, jumping, cutting will be reviewed in addition to broader terms such as abdominal pain, collapse due to unknown cause will be reviewed for inclusion. Once an episode of SH or suicidal ideation is identified, further investigation of the patient records via relevant electronic record system will be undertaken. Additionally, in Middlemore Hospital, if the electronic medical record is unclear, the study team will review relevant paper records. For all eligible participants in the hospital settings, routine clinical data will be extracted from the clinical record by a member of the research team (see Table 1) and entered directly into the research data capture tool (REDCap, see further description in Data Management section of this protocol).

*ii. NZPSU* - The NZPSU team will inform the study team about any reported cases of paediatric SH as notified by Registered Paediatricians on their monthly report card. The reporting paediatrician is contacted by the study team and provided a unique URL which will link them directly to the secure REDCap data capture tool. Paper-based data collection forms will be available to any paediatrician who requests this format.

Table 1. Data collection fields

1.	Sociodemographic information: NHI, gender, age, ethnicity, usual residential address, occupation
2.	Description of presenting complaint (narrative)
3.	Date and time of SH

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4. Date and time of hospital presentation and discharge
  5. How the patient arrived at the hospital (ambulance/police/own transport)
  6. Did the patient present with self-injury, self-poisoning, suicidal ideation
  7. Location of SH (home/public place)
  8. How did the patient harm themselves (record verbatim)
  9. Was alcohol and/or an illegal substance involved
  10. Did the patient make a statement of intention to die
  11. Problems/difficulties associated with the current episode of SH or suicidal ideation
  12. History of exposure to SH and suicide among peers/family
  13. Prior history of SH
  14. Referrals to specialist services such as social worker, ICU
  15. Referral for mental health assessment during this episode
  16. Did this episode lead to a hospital admission
  17. Discharge location from ED
  18. For cases of self-poisoning, name, amount, strength and source of substance used <sup>b</sup>
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#### Determination of SH/suicidal ideation relatedness, data quality and reliability

Initial training in case ascertainment will involve 2-3 members of the research team who will review all ED presentations to each hospital study site. Each case will be reviewed by the team against the inclusion/exclusion criteria, robust discussion will ensure capture of all cases. Once accurate case ascertainment has been achieved, an ongoing review process to determine inter-rater reliability of case determinant and accurate extraction of key variables will include:

- (1) An independent review by a second team member of the routinely collected hospital presentation data to check accurate identification of cases for inclusion at each hospital site on a regular basis
- (2) An independent review by a second team member, cross-checking the routinely collected clinical data for 10% participants registered every month at each hospital site. Cases will be selected using a random number generator. Any discrepancies in case ascertainment will be documented and resolved by the study PI.
- (3) An independent review, by a second researcher, of extracted key variables for a random sample of 20 identified cases over a period of six months, against routinely collected clinical records to check for

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<sup>b</sup> Codes/categories available on request

consistency in data extraction. Cases will be selected using the random number generator in statistical software.

Intra-rater (within reviewer) reliability will also be determined by comparing the determination of SH/suicidal ideation, and consistency in extraction of key variables, between the beginning and end of the data collection period. The reasons behind any inconsistencies or discrepancies between reviewers will be examined further and if necessary, cases will be re-coded.

Consent

Participant consent is not required; the study does not require patients to take part in any additional procedures nor does it affect care or treatment they receive. The study research team will not have any direct patient contact as the study is based only on routinely collected information.

Stakeholder engagement

A project advisory committee, comprising of national and international experts on suicide prevention including clinicians, academics, and those with lived experience, will be established in line with international best practice. The committee will assist in identifying issues that need to be addressed and opportunities for the surveillance system. The committee will also provide advice to the data management plan and delivering culturally relevant research outcomes.

Data Management

A customised data collection mechanism, specific to this study, will be developed using Research Electronic Data Capture (REDCap). REDCap is a secure web-based application designed to support data capture for research studies. It is suitable for collecting personal information which is covered by Health Information Privacy Principles, The Privacy Act and Ethics Committee specifications that require the use of a secure survey tool<sup>35</sup>. All survey data collected via REDCap will be securely stored at the University of Otago.

Any missing values or variables will be checked against records to ensure that all possible information is included. This may require the study team to revisit some case files to collect any missing information. A preliminary statistical analysis will be conducted after every 100 cases (for the initial period of 6 months) to ensure that necessary data has been captured correctly.

The WHO protocol suggests it is essential to collect personal information about participants for case ascertainment<sup>22</sup> particularly where the person re-presents to hospital while complying with local regulations<sup>36</sup>. Potential cases will be identified using clinical record identifiers. However, once cases

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have been selected, all identifying information such as name, home address, NHI (national health index number)<sup>c</sup>, and date of birth variables will be partitioned off and a unique participant code will be allocated. Thus, the study team will use a de-identified dataset for aggregated statistical analysis and subsequent publications. The study data will be solely used for addressing the research objectives and will not be used for any dissemination that may potentially identify an individual. Original data will be securely stored by the study team for a minimum of 10 years. The research data will be solely owned by the University of Otago.

## Data Analysis

The primary outcomes of the study are 1. annual number of episodes of hospital-presenting SH and suicidal ideation; 2. trends in frequently used methods of SH; 3. “new” or emerging methods of SH; 4. frequently used drugs in overdose related SH; 5. variations (seasonal/demographic/temporal) in presentations of SH and suicidal ideation; and 6. average time taken between time of SH and time of ED presentation.

We would also include outcomes related to incidence rates: 1. annual rates of SH per 100,000 population for the total population, for subgroups by age and sex; 2. annual rates of SH in paediatric population (<15 years); 3. annual rates of suicidal ideation; 4. variation by gender, age, ethnicity; and geographical region. The secondary outcomes will focus on identifying predictors of repetition of SH, potential gaps in SH services and systemic levers for suicide prevention.

For comparison, crude and age-specific SH rates will be calculated using the NZ Census 2018 and WHO world standard population. An analysis of repeat events will be conducted using conditional risk set analysis and Cox hazard proportional models will be used to identify independent and multivariable predictors of repetition of SH. All the study data will be analysed using SPSS version 27.0.

## ETHICS AND DISSEMINATION

This study has received approval from University of Otago Human Ethics Committee (H19/165) including the Ngāi Tahu Research Consultation Committee, to review the research plan in context to the indigenous population of NZ (Māori). Institutional approvals were provided by Counties Manukau DHB which oversees Middlemore Hospital and the Southern DHB which oversees Dunedin and Southland Hospitals. Each team member has a confidentiality agreement with the DHB.

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<sup>c</sup> A unique identifier that is assigned to every person who uses health and disability support services in New Zealand

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We will publish aggregated study data to both national and international audiences via publications in peer reviewed scientific journals and conference presentations. Submission of study findings will also be made to local regulatory authorities including DHB management teams, local Suicide Prevention Coordinators, and the New Zealand Suicide Prevention Office.

The main aim of this study is to establish multi-centre sentinel surveillance of patients presenting with SH or suicidal ideation as per the recommended WHO practice guidelines on surveillance systems <sup>22</sup> and to provide up-to-date, detailed and robust epidemiological data which will establish trends in SH in NZ. The focus on paediatric populations at Middlemore Hospital and via the New Zealand Paediatric Surveillance Unit has been informed by the lack of high-quality data for this group who have historically been excluded from studies due to relatively small numbers, the prominence of self-harm among those who die at a very young age by suicide and the support of a specific paediatric health funder. Hospitals were selected for study inclusion because they have large numbers of patients presenting for emergency care, allow for purposeful oversampling of indigenous youth, serve large populations. The inclusion of paediatricians reporting on presentations around the country allows triangulation of data, and a greater understanding of the epidemiology of self-harm beyond large hospital catchment areas. In doing so, the study findings will inform suicide prevention efforts to support the development of evidence-based interventions and workforce development in a way that is most likely to reduce SH and ultimately suicide deaths.

**AUTHORS CONTRIBUTIONS**

SF conceptualised the study and developed the study protocol with the other co-investigators - KS, SH, GM. RM provided inputs to the study design. LH and VS assisted in finalisation of the protocol and drafted this manuscript.

**FUNDING STATEMENT**

This study is funded by Cure Kids (Grant number – 3592) for paediatric presentations of SH, and the James Hume Bequest Fund, University of Otago, at Dunedin and Southland Hospitals.

**CONFLICT OF INTEREST**

None declared

**PUBLIC AND PATIENT PARTICIPATION**

The research question and priority is part of a broader programme of work in which the voice of those with living or lived experience of suicidal distress is central and based on active collaboration with lived

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3 experience academics. This study connects with systematic reviews by this group on service user  
4 experiences of self-harm<sup>37</sup> and staff attitudes towards those seeking hospital care after self-harm<sup>38</sup>.  
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