
A descriptive analysis of suicides and their
interface with healthcare facilities in the Western
Cape, South Africa: 2011-2015.

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Contents

Part 0: Preamble	5
Plagiarism Declaration	6
Dedication	7
Acknowledgements.....	8
Abstract	9
Part A: PROTOCOL	11
Abbreviations	12
Introduction	13
Summary of Literature Review	14
Risk Factors for Suicide	15
Age and Gender at suicide	15
Methods of Suicide	16
Mental Health and Suicide.....	16
Interventions.....	17
Motivation for the study.....	17
Purpose	17
Aims and Objectives.....	18
Methods.....	18
Study design.....	18
Data Source.....	20
Measurements.....	20
Data Management	21
Ethical and Legal Considerations	21
Resources.....	23
Timelines.....	23
References	24
Part B: LITERATURE REVIEW	26
Objectives of literature review	27
Search strategy	27
Definition of terms.....	27
Epidemiology of Suicide.....	28
Risk Factors for suicide.....	29
Individual.....	30
Mental health.....	31

Substance Abuse.....	31
Societal.....	32
Access to means/Methods of suicide	32
Interpersonal.....	33
Community.....	33
Barriers to healthcare and health systems issues.....	33
Stigma	33
Laws, Regulations and Data Sources.....	34
Interventions.....	35
Conclusion.....	37
References	39
Part C: PUBLICATION READY MANUSCRIPT	42
Abstract	43
Introduction	45
Methods.....	46
Results.....	47
Discussion.....	55
Limitations	58
Conclusion.....	58
References	60
APPENDIX 1: Variables List.....	62
Appendix 2: Ethics Approval Letter (Original).....	65
Appendix 3: Ethics Annual Renewal.....	66
Appendix 4: South African Medical Journal Publication Guidelines	67
Appendix 5: Additional Figures of Suicide Methods for Males who contacted healthcare facilities by Age Categories	71
Appendix 6: Additional Figures of Suicide Methods for Females who contacted healthcare facilities by Age Categories	72
Appendix 7: Additional Figures of suicides who presented with Mental Health versus 'other medical conditions'	73

Part 0: Preamble

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Plagiarism Declaration

I know that plagiarism is wrong. Plagiarism is to use another's work and pretend that it is one's own.

I have used the Vancouver convention for citation and referencing. Each contribution to, and quotation in, this dissertation from the work(s) of other people has been attributed and has been cited and referenced.

This dissertation is my own work.

I have not allowed, and will not allow, anyone to copy my work with the intention of passing it off as his or her own work.

Signature:

Signed by candidate

Date: 16 September 2020

Dedication

I am forever grateful to my Lord, Jesus Christ - My Saviour who has been the lamp upon my feet and one who carried me when I could not carry myself.

To my dear husband, my family and prayer family. I would not have made it without your prayers, your love and support.

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Abstract

[Word Count = 379 words]

BACKGROUND: Suicide is a preventable public health problem affecting 800 000 people every year and 79% occurs in low to middle incomes countries. Males are mostly affected, and at-risk age groups are adolescents and young adults. Hanging, firearms and ingestion of pesticides are amongst the most common methods of suicide. Prevention strategies have been applied by various countries to target the use of common methods of suicide however there is little evidence that supports detection of suicide risk in healthcare facilities. This study profiles all suicides that occurred in the Western Cape during the year 2011-2015 and their interface with the healthcare facilities up to one year prior to death.

OBJECTIVES: This study assesses the incidence of suicides in the Western Cape. It tests for associations between methods of suicide and demographic characteristics for suicide. Ascertains the characteristics of those suicide cases who made previous contact with a healthcare facility in the past 12 months and proposes context specific interventions for the prevention of suicides.

METHODS: A retrospective descriptive study was conducted. All suicides recorded by the forensic pathology service during the years 2011-2015 were linked to patient data held by the provincial health data centre. A total of 3 561 suicides were recorded during the study period. Crude suicide rates were calculated using population denominator from the Statistics South Africa's national census projections. Multiple logistic regression was used to determine associations between the group utilising various methods of suicide and demographic characteristics.

FINDINGS: Males were found to be four times more likely to die from suicide compared to females. The age groups most at risk were 20-39 years. Hanging was the method of choice by males and overdose on medication, in females. Two thirds of the 2 367 suicides were positively linked to healthcare facilities. Most cases who sought healthcare up to one year prior to suicide were males that presented with 'other medical conditions' rather than mental health conditions.

CONCLUSION: This study highlights missed opportunities for the detection of suicide risk for those who seek healthcare for all healthcare conditions. Although suicide rates have remained constant over the assessment period, a key focus for prevention should be interventions applied at healthcare facilities as well as other 'upstream' preventions that reduce the availability of various methods for suicide.

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Part A: PROTOCOL

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Abbreviations

AIC- Akaike Information Criterion

COPC - Community orientated Primary Care

DALYs - Disability-adjusted Life Years

HIC - High Income Countries

FPS – Forensic Pathology Services

LMIC –Low- and Middle-Income Countries

NMSS - National Mortality Surveillance Systems

mhGAP - WHO Mental Health Gap Action Programme

Ops - Organophosphates

OP - Outpatient

PHDC –Provincial Health Data Centre

PYLL - Potential Years of Life Lost

SASH -The South African Stress and Health Study

SADAG - South African Depression and Anxiety Group

UCT – University of Cape Town

WC - Western Cape

WHO – World Health Organisation

Introduction

Background

Suicide is an 'act of someone taking their own life'. It is a serious and worsening public health issue globally contributing to preventable deaths commonly affecting adolescents and young adults.

Suicide is differentiated from para-suicides or attempted suicides where the outcome of the incident is not death. Suicides are experienced in both in high income (HICs) and low and middle income countries (LMICs) with over 79% reported to be in LMICs.(1)

Suicide rates are approximately double in males than in females, worldwide. There are many variations in the incidence rates amongst regions and countries, an issue attributable to under reporting, inaccurate data and misclassification of suicides resulting from weak surveillance systems and tendency to classify suicides as accidental deaths.(2)

South Africa's burden of suicides is often hidden in the large burden of unnatural deaths. Half of unnatural deaths are due to intentional injuries. Suicides form approximately a tenth of unintentional injuries with males recorded to contribute over double the proportion when compared to females. Western Cape suicides make up 10.9 % of unnatural deaths making them the third highest contributor to unnatural deaths in the country.(3)

There are multiple risk factors associated with suicide mortality. The most common risk factor identified being mental health disorders, forming 90% of people who die from suicide.(4) Using the socio-ecological or life course approaches, other risk factors that are context specific are identifiable and these include age, gender, excessive alcohol use, substance abuse and violence.(5)

Interventions have been put in place to prevent suicides in different countries worldwide. These range from upstream interventions such as policies to reduce guns; to downstream factors focusing on assessing risk at a patient level.

In South Africa, the high-risk group – teenagers are advocated for by groups such as the SA depression and anxiety group (SADAG) and focus on education, awareness and psychological support.

Numerous clinical studies have been done worldwide showing the association between suicide and specific risk factors but epidemiological studies profiling the incidence, rates, associated context-specific risk factors commonly found in literature are from HIC, rarely LMIC.(6)

As a researcher working within the Western Cape department of health at the Health Impact Assessment Directorate, there is limited understanding the burden of suicides and their characteristics in the province and how these differ from other provinces.

This study seeks to provide up to date, relevant information on the epidemiology of suicide in the Western Cape.

The research questions the study will answer are;

- “What is the burden and distribution of suicides amongst all age groups of the Western Cape Province?”
- “What are the characteristics among people who died due to suicide who interacted with the public healthcare service?”

Search strategy and Keywords

A broad search strategy was used to search for literature. Articles were found using various databases such as University of Cape Town (UCT) online libraries, Google Scholar, Cochrane, Pubmed and Medline with electronic search terms such as “Suicide”, “mental health and suicide”, “epidemiology of suicide”, “suicide interventions”, “risk factors for suicide”, “incidence of suicide”. WHO and South African Depression and Anxiety Group websites were used to search for suicide guidelines and published surveys.

Summary of Literature Review

Globally, the burden of suicides is not really known. All information that is available is based on estimated data, usually found from mortality registers or existing databases. (1)

In South Africa, suicide is classified as unnatural deaths. The cases are referred either by the police called to the scene of the crime or clinician who declared the patient dead at a health facility. Thereafter, all suicides are referred to state mortuaries for autopsy by forensic pathologists where the manner of death is determined and further investigations such as toxicology tests conducted.

Risk Factors for Suicide

The risk factors associated with suicide can be identified using the Socio-ecological or Life-course approaches. The diversity of risk factors therefore can guide the intervention strategies.

Using the socio-ecological model, these risk factors are categorised into individual, interpersonal, community and societal.(7)(8)

Individual – previous suicide attempt, mental illness, substance abuse (alcohol and recreational drugs), genetics (9), other medical conditions (HIV infection/AIDS, diabetes, chronic pain) (10), population group, occupation.

Interpersonal –abusive relationship, family history of suicide, lack of family support

Community – barriers to healthcare, cultural acceptability (11)

Societal – Access to means of suicide, lack of policies on mental health (screening and management), unemployment, poverty(12), natural disasters (e.g. fires).

Age and Gender at suicide

Globally, suicide is the second leading cause of mortality among people aged 15–29 years, with great variations by region and population group. It is uncommon in children less than 12 years where the incidence increases as they age. (8)

The global age-standardised suicide rates are 11.4 per 100 000 population, with the rates higher in males as compared to females.(6) The WHO 2017 fact files report South Africa's 2015 age-standardised suicide rates at 12.3 per 100 000 population and four times higher in males than females. The overall SA suicide rates are comparable to the world rates with small variations between the provinces. (9)

Methods of Suicide

Various methods are used for suicide in South Africa such as hanging, use of firearms, poisoning using various poisons and medications, jumping from heights, in front of moving objects, drowning, burns etc.(13) Hanging is the most common method throughout the world followed by firearms use.(14) These above two methods are usually context-specific depending on what agents are readily available to those contemplating suicide but recorded more in urban than rural settings. Predominantly rural settings reported poisoning from pesticides as a common method. (11), (15),(16)

Mental Health and Suicide

Mental health disease is commonly associated with approximately 90% of all suicide globally and due to the lack of epidemiological data for mental health, suicide is used as a proxy for mental health disease. The gap between the need for treatment and its provision is large with 76% -85% of people with severe mental disorders estimated to receive no treatment in LMICs and 35% - 50% in HICs.(2)

The South African Stress and Health (SASH) study was the first population-based study done to assess the burden of mental health, risk factors, patterns of treatment, and barriers to treatment and potential approaches to improving care. It places the lifetime prevalence of any mental health disorder in South Africa at 30.3%.(6)

The most common mental health disorders associated with suicide are major depression, bipolar disease, schizophrenia and comorbidities such as substance abuse. These disorders, depending on their severity, result in a high risk for suicide and often para-suicide. In a study done in Durban, South Africa para-suicides comprised 17% of admissions presenting to emergency departments.(5),(14),(15)

Mental health patients rarely die due to suicide whilst in healthcare facilities but do so in their communities. The risk of suicide is often not detected at the last visit prior to suicide. A systematic review done in high income countries revealed that approximately 45% of all age groups who died from suicide had previously sought healthcare 1 month before they died due to suicide and the majority of patients seek care in Primary Health Care than in Mental Health Facilities.(19)

Interventions

Interventions for prevention of suicide are based on the identified risk factors and target upstream factor such as installing barriers at “hotspot bridges” where people jump, limiting carbon monoxide levels in domestic gases and restricting access to pills such as paracetamol, reducing access to objects or means of self-harm including firearms and controlling access to pesticides. (17)

Protecting persons at high risk of suicide by early identification and management of mental disorder and of suicidal behaviours is important. Patients hospitalised with a suicide attempt are prioritised and systems are put in place to preserve contact with the health system. Maintaining contact with at risk patients can be achieved in various ways i.e. by regular follow up either telephonically or regular appointments at health facilities. Introduction of call centres and readmission on patient request has been a worthy intervention in other countries. The continuous training of healthcare professionals on suicide risk identification and management is a vital intervention that has been effective.(20),(21)

Motivation for the study

To date, there is generally a lack of in-depth analysis of suicide in published literature worldwide. There is under reporting and misclassification of suicide due to various problems in the collection and collation of data. In addition, South Africa lacks a national surveillance system from which suicide could be quantified, analysed and monitored so that trends are known, and interventions made timeously. This study will serve as a foundation for the formulation of other study hypotheses on suicide in the fields of mental health and occupational health medicine, as mentioned by researchers based in these specialities during consultation about the topic.

Purpose

The overall purpose of the study is to improve the current understanding of the burden of suicide and their demographic characteristics in the Western Cape Province for the period 2011-2015

Aims and Objectives

Aim

To assess the overall burden and characteristics for suicide amongst all age groups in the Western Cape.

Objectives

- To assess the incidence of suicide in the Western Cape
- To describe the characteristics of those who died from suicide in the Western Cape Province (2011-2015)
- To test for associations between methods of suicide and demographic characteristics for suicide in the Western Cape Province.
- To ascertain the characteristics of those suicide cases who made previous contact with a healthcare facility in the past 12 months.
- To propose context specific interventions for the prevention of suicide that would support future Mental Health service planning.

Methods

Study design

This will be a retrospective descriptive population study of suicide that occurred in the Western Cape Province between 2011-2015, a 5-year period.

Advantages of study design choice

The advantage of this study design is that it studies the whole population of suicide. There is no sampling therefore eliminates random error and selection bias (prevalence bias). The results obtained will be truly representative of the population. The study design can provide information on the burden, multiple characteristics and impact of disease over a specified period. It provides information that is useful for health service planning.

Limitations of study design

The population is limited to the unnatural deaths that have a diagnosis of suicide. As misclassification of suicide is common according to literature, misclassified suicide

will not be included in the study population therefore excluded. Temporality of characteristics cannot be established.

The use of secondary data is likely to introduce information bias. The type of information bias is differential misclassification. In this context, differential misclassification would occur when there are errors in the measurement of the disease status. A suicide could be misclassified into another category of unnatural deaths such as poisons. The results would cause bias away from the null therefore inflating the study results. The researcher is not able to prevent bias in this study design by ensuring quality control of the measurement tools and training of those using the tools as the dataset was compiled prior to commencement of the study.

The data already exists and classified accordingly therefore the researcher had no influence on the data collection activities.

Population and sampling

All suicide cases of all age groups recorded in the Western Cape and certified from 2011-2015. There are approximately 600 suicide deaths per annum in the Western Cape. Therefore, the total sample population will be $N = 3\ 000$. All suicide cases are recorded in a mortuary register and receive a post-mortem. An unknown proportion of these suicide cases are patients treated at a healthcare facility in the Western Cape therefore further analysis will be conducted to assess the characteristics of these patients. These are suicide cases who had an episode or encounter with a healthcare facility for up to a year before the suicide.

Inclusion and Exclusion Criteria

Inclusion

- All recorded suicide cases of all ages will be included, males and females.
- Suicide recorded during the period 2011 to 2015.

Exclusion

- Suicide cases that fall outside the 2011 to 2015 period.
- Deaths due to other injuries and homicides and those with an undetermined cause.

Data Source

Secondary data analysis will be conducted for this study.

Data will be obtained from two sources: Forensic Pathology Information System and the Western Cape Provincial Health Data Centre (PHDC).

- *The forensic pathology laboratory.* The data comprises of information from death certificates and various data collected from documents that were completed at the scene of injury. The documents are death declaration, scene injury, death certificates and clinical information documents. Furthermore, post-mortem reports, toxicology and blood alcohol results will be available as part of the data.

Variables that will be collected are; age, sex, population group, occupation, year of death, month of death, day of death, place of incident, town of death, district of death, methods of suicide, Autopsy done or not, blood test done (categorised according to levels), toxicology results.

- The second source of data is the PHDC. For all suicides in the forensic dataset, the PHDC will be searched to ascertain if they had a visit to a public sector health facility. In addition, these two datasets will be matched to see if there are suicides in PHDC, not recorded in the mortuary dataset. This will serve to assess the completion of the mortuary data.

The following variables will be obtained; visit to healthcare facility within 1 month and 1 year of suicide, type of healthcare facility (PHC, hospital outpatient etc.), district of healthcare facility, mental disorder diagnosis or other diagnosis.

Only descriptive data will be obtained, and no details of the patient record will be obtained as this is not required by the scope of this study.

Measurements

A codebook that describes the variables of interest will be kept and used to identify for the analysis. The PHDC will merge the data from the mortuary and PDHC so that on receipt by the researcher, it is one dataset. This will be a large dataset.

Data Management

- On receipt of data from the dataset, a new dataset will be created, and new variables generated and stored as the study dataset. The original dataset will not be altered.
- Missing data will be recognised and dealt with by deleting all cases with three or more missing variables.
- The study dataset will be compiled into an excel spreadsheet and stored on the Redcap computer software, together with the original dataset.

Statistical Analysis

- The analysis will be done using STATA version 14.
- Descriptive statistics will be conducted to analyse all suicides in the data set.
- Chi squared tests will be used to test associations various methods of suicides and demographics of suicides.
- Crude Suicide rates will be calculated using yearly population estimates in the Western Cape.
- Age-standardised suicide rates using WHO- world standard populations.

Ethical and Legal Considerations

This research study follows the ethical considerations outlines in the Helsinki Declaration of 1964 and the National Health Act.(22)(23)

The ethical approval for this study will be obtained from the University of Cape Town's Faculty of Health Sciences Human Research Ethics Committee.

The study participants are deceased therefore are persons with diminished autonomy. Autonomy will be respected by respecting the person's data and not divulging specific information. In addition to the ethics approval from the above-mentioned ethics committee, further permission will be sought from Western Cape Health Research Committee and Forensic Pathology Committee.

The PHDC will be requested to supply the researcher with anonymised data ensuring confidentiality of the data and requested to waiver consent.

The principle of non-maleficence will be respected by ensuring their data is handled by one researcher and not discussing the information with others. The study carries

minimal risk because of the use secondary data analysis however the topic itself carries psychological risk to study researcher and her team. This risk is small - likely of sad feelings. This will be managed by debriefing sessions with the team.

The potential benefits of the study will be at population level. It will provide a high-level description of the incidence and characteristics associated with suicides and enable calculation of crude and standardised rates for comparisons with other regions and the world. This information will inform suicide prevention interventions, future mental health planning and serve as a basis for future analytic research on suicides within the Western Cape.

Confidentiality will be respected by ensuring all data from the PHDC is obtained in an anonymised format. The data will be stored on the RedCap software, a web-based programme. The secondary place where the data will be stored is on the provincial research store which is password protected. Data will be stored here for 5 years then destroyed, according to the policies of the organisation.

To ensure justice, the study sample includes rural and urban regions and the interventions recommended will be context specific, benefiting each community. The results of the study will be communicated via a publication in a peer reviewed journal and oral and written reports presented to the main stakeholders.

This study will be used by Western Cape Strategic Management and district managers to inform interventions and future planning to fulfil the national Department of Health's vision HealthCare 2030.

Resources

Resource	Unit Cost/Provider	Cost
Transport	Use own Car to meet with stakeholders	R 1500
Internet access	After hours	R350
Grand Total		R 1 850

Timelines

Activity	Proposed Time period
30 th November 2017	Submit Concept Note
15 th January 2018	Develop Research Protocol
15 th July 2018	Submit to Ethics
August 2018-December 2018	Data analysis
Jan 2018- March 2019	Report Writing
March 2019	Submission for marking

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Part B: LITERATURE REVIEW

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Objectives of literature review

This literature review will analyse the body of work on completed suicides and their linkage with the healthcare system. It will describe the epidemiology of suicide, risk factors associated with the act of suicide, explore the laws that govern data collection and analysis for suicides as well as highlight the interventions used globally and locally to reduce and prevent their occurrence.

Search strategy

A broad search strategy was used to search for literature.

Articles were found using various databases such as UCT online libraries using PRIMO and OpenUCT search engines for published and unpublished literature, Google Scholar, Cochrane, PubMed and Medline with electronic search terms such as "Suicides", "mental health and suicides", "epidemiology of suicide", "suicide interventions", "risk factors for suicides", "incidence of suicides", "toxicology". WHO and South African Depression and Anxiety Group websites were used to search for suicide guidelines and published surveys.

Definition of terms

Suicide – all cases of death resulting directly or indirectly from a positive or negative act of the victim himself, which he knows will produce this result.(1)

Suicide rates – The number of deaths from intentional self-harm per 100 000 people. (2)

Unnatural deaths- deaths caused by external causes.(3)

Social Integration –a collective consciousness that binds people together. The consciousness is made up of people's norms, beliefs and values. A shared way of understanding and behaving in the world.(4)

Parasuicide - suicide attempts and deliberate self-harm inflicted with no intent to die.(5)

Epidemiology of Suicide

Suicide was first defined by Durkheim, a sociologist who systematically investigated suicides in France towards the end of the 19th century. He demonstrated that suicide was not uniformly distributed in society but differs amongst population subgroups. He defined suicide as 'all cases of death resulting directly or indirectly from a positive or negative act of the victim himself, which the person conducting the act knows will produce this result'.(1)

Suicide rates are commonly used to measure the incidence of suicide in the community and is the preferred measure of occurrence. Low suicide rates reveal a 'healthy' level of social integration while high suicide rates, a pathological social integration state.(1) Though researchers have commonly used suicide rates, it has been argued that the potential years of life lost (PYLL) rate is a better measure as it reflects both the mortality rate and age at which death occurs.(2) It is a measure that takes into account an argument that the death of a young person is a bigger loss than that of an older person.(3) PYLL is particularly important when analysing the suicide related deaths compared to other causes of death, trying to understand the impact of suicide-related deaths.(2) Once age specific interventions have been put in place, PYLL is useful to evaluation measure.(3)

The overall global age- standardised suicide rate is 11.4 per 100 000 population and when stratified by sex, is 15.0 for males and 8.0 for females.(6) However the global crude suicide mortality rate is lower at 10.6 per 100 000 population.(7)

Approximately 8 000 South Africans die from suicide annually.(8) South Africa's age-standardised suicide rate are comparable to the world rates, with small variations between provinces.(9) In 1994, suicides made up 7% of unnatural deaths in the Cape Metropolitan area (10) and, in 2007 contributed 2.3% to the total Disability-adjusted Life Years (DALYs) in the province.(11)

White males are reported to be at higher risk compared to other groups and this pattern is seen internationally and locally.(12) Suicide was previously known as a disease of the wealthy (13),(14) with those of a higher social status reported to have died by suicide more often. However this has been changing over time as suicides are increasingly seen in poverty-stricken communities.(15)

Geographical location shows different patterns in the choice of methods for suicide.(16)

In countries with long winter seasons, northern hemisphere studies have recorded a higher incidence of suicides during these periods. However, in some countries, suicide has not been positively associated with seasonal patterns. In South Africa, suicides are reportedly higher in the summer months because of the availability of alcohol and cash in hand during the festive season.(17)

Suicide is preventable therefore it is important to understand the risks that make it likely for individuals to die by suicide. The risks are numerous and found at individual as well as population levels. Identifying the risks will inform targeted interventions for prevention therefore reducing the burden.

Risk Factors for suicide

Suicide is a complex phenomenon not the result of one cause, but has a complex aetiology influenced by biological, social and behavioural factors.(18) There is no clear cause and effect for suicide. Identification of the diverse risk factors implicated should guide which interventions be put in place. The use of a framework approach can aid in understanding this complexity.

In the studies analysed, the Socio-ecological Model was the preferred approach as it analyses suicide risk factors at different levels.(6), (19), (20) The Life Course approaches is also used, though not as common, and identifies risk factors of an individual from conception to adulthood.(21), (18) The Socio-ecological model identifies risk factors operating at different levels, and can identify where interventions can be targeted whereas the life course approach can identify the age group affected by suicide, the factors at play, including the reasons underlying the phenomenon by age.

In this review, the socio-ecological model(20) is used to assess the literature. This model categorises determinants into individual, interpersonal/relationship, community and societal components.(18), (22) This model differentiates between the 'upstream' and 'downstream' determinants of health. 'Upstream' are those socio-structural factors considered to be the root causes of suicides, whereas downstream causes are thought to be in the causal pathway.(11)



Figure1: Social Determinants of Health(20)

Individual

These refer to the biological factors associated with suicide such as age, sex, population group, genetics, individual history of mental health, chronic diseases (HIV infection/AIDS, Diabetes), Epilepsy (23), cancers (24) chronic pain and occupation.

The World Health Organisation (WHO) ranks suicide as one of the three leading causes of death worldwide in the group aged 15–34 years and it accounts for 12.9% of annual deaths among all age groups.(6) Suicides follow a bimodal age distribution affecting younger and older people. The youngest person reported to have died due to suicide was 9 years old.(25) In South Africa, adolescents have the highest suicide rate compared to adults and the aged and rates are believed to be higher than worldwide rates at 25 deaths per 100,000 people in 2003.(17)

Men are more likely to die due to suicide than females globally and this difference ranges across countries. In high income countries, rates for males are up three times higher than females while the picture in the LMICs varies. (6) In countries such as China, Angola and Japan, females are reported to have higher rates of suicide while the reverse was reported in countries such Sri Lanka and Mongolia. Therefore among men suicide rates of up 12 times were reported.(26) In South Africa males are five times more likely to die due to suicide than females. (16), (27)

Mental health

Mental health disease is associated with approximately 90% of all suicides globally. Due to the lack of epidemiological data for mental health, suicide is used as a proxy for mental health disease.

The South African Stress and Health (SASH) study was the first population-based study done to assess the burden of mental health, risk factors, patterns of treatment, and barriers to treatment and, potential approaches to improving care. It places the lifetime prevalence of any mental health disorder in South Africa at 30.3%.(22) For every suicide there are many more people who attempt suicide every year.

Significantly, a prior suicide attempt is the single most important risk factor for suicide in the general population.(6) In a study done in Durban, South Africa, parasuicides comprised 17% of admissions presenting to emergency departments and the risk of suicide further increased for those patients who diagnosed with repetitive parasuicides.(29)

Common mental health disorders associated with suicide are major depression, bipolar mood disorder, schizophrenia and substance abuse. According to the South African Depression and Anxiety Group (SADAG), 60% of people who die due to suicide are depressed.(30) In a study done on Turkish women 7.6 % of the suicide cases in the study were on treatment for depression, and 18.2 % had made a previous suicide attempt.(31)

Substance Abuse

Alcohol, pharmaceutical agents (anti-depressants, benzodiazepines etc.) and illicit drugs (cannabis) are common substances reported in toxicology reports of people who died due to suicide. There is either one substance or multiple substances found present.(9)

Darke et al. determined the prevalence and circumstances of psychoactive substances amongst non-overdose completed suicide and found that substances were present in 67.2% of cases. Alcohol was the most prevalent present in 40.6% of cases while illicit drugs were 20.1%. (32)

Toxicology in suicide deaths is useful in discovering how a person died. The identification of an intoxicating drug assists in the identification and understanding of how drugs play a role in the behaviour of the person who died due to suicide.(33) An eight (8) year retrospective study done in Washington DC between the years 2009 and 2016, reported that ethanol was present in 26.4% of suicide cases and detected in five methods suicide namely hanging, drowning, firearm, suffocation and poisoning.(34) These findings are lower than those reported in a retrospective review done in a Metropolitan area of South Africa, where alcohol in blood was found to be present in 48.1% of the suicide cases.(12)

Societal

Access to means/Methods of suicide

Men are more likely to die due to suicide than females and these differences may lie in the fact that men tend to choose more violent means of dying due to suicide such as guns and hanging as compared to females who opt for other less violent methods.(12)(16) The ingestion of pesticides, hanging and firearms are among the most common methods of suicide globally, but many other methods are used, with method choice often varying according to population group.(6)

In low to middle income countries (LMIC) such as Tanzania, Kenya and Zimbabwe, suicide is largely associated with exposure to organophosphates.(35) Various methods are used to die due to suicide in South Africa such as hanging, use of firearms, poisoning using various agents and medications (36), jumping from heights, in front of moving objects, drowning and burns.

Hanging, firearm use and ingestion of pesticides are among the most common methods of suicide throughout the world. (6) In South Africa, hanging is the most common method of suicide, followed by poison ingestion, shooting, gassing and burning. (16) (30)

A systematic review looking at suicide and poverty in LMICs showed there was a positive association between suicide and poverty. Poverty was measured in this review as unemployment, financial problems and debt.(15)

Interpersonal

Abusive relationships have been associated with increased risk for suicide. In a study amongst Turkish women, physical examination of 12 (18.2 %) cases revealed traumatic signs of violence, such as ecchymosis, laceration and haematoma that occurred in different time periods.(31) The relationship between violence against women and suicide is well known in LMICs.(37) Other factors known to contribute are family history of suicide and lack of family support.

Community

Barriers to healthcare and health systems issues

The gap between need for mental healthcare and its provision is large. High proportions (76%-85%) of people with severe mental disorders were estimated to receive no treatment in LMICs and 35%-50% in High Income Countries (HICs) .(21) The WHO identified this gap as a priority and in 2008 launched the WHO Mental Health Gap Action Programme (mhGAP). This programme provides evidence-based technical guidance to scale up service provision and care in countries for mental, neurological and substance use disorders as outlined in the WHO Mental Health Action Plan 2013–2020.(21)

Mental health patients rarely die due to suicide whilst visiting or admitted to healthcare facilities but do so in their communities. The risk of suicide is often not detected at the last visit prior to suicide. A systematic review done in high income countries revealed that approximately 45% of all age groups who die due to suicide had previously sought healthcare one (1) month before they died due to suicide and the majority of patients sought care in Primary Health Care than in Mental Health Facilities.(38)

Stigma

Stigma surrounding suicide is still prevalent globally, as awareness of suicide being a major public health problem is lacking. Poor recognition means that suicide prevention is not prioritised, and the WHO reported that only a few countries included suicide prevention in their health priorities.(7) In addition, there is a lack of

cultural(18) and religious acceptability of suicide, which exacerbates and reinforces the lack of awareness of its importance.

Laws, Regulations and Data Sources

Globally, suicide data is generated from mortuary data systems. Currently, epidemiological data is generated from the 60 member nations of the WHO. Even in countries with good vital registration data, suicides may often be misclassified as an accident or another cause of death. Registering a suicide is a complicated procedure involving several different authorities, often including the police as law enforcement. In countries without reliable registration of deaths, suicides may simply occur uncounted.(7)

Data is collated from existing registers in mortuaries in the different countries globally. All current systems are not without flaws, therefore there is general agreement in suicide and injury literature that deaths due to suicide are often misclassified and under-reported. (39)

The availability and quality of suicide data is a challenge not unique to suicides alone, however there is the added complexity of sensitivity and illegality of suicide behaviour in some countries, resulting in under-reporting and misclassification of suicides.(16),(7)

In high-income countries such as the United States, national mortality data are compiled on an annual basis, from standardized death certificate information submitted by the States to the National Centre for Health Statistics. In contrast, African countries experience fragmentation of information systems due to a lack of resources to collect and collate information for suicides, and a lack of laws that guide its management.

In South Africa, suicides are legislated by the Inquest Act 58 of 1959 for the management of unnatural deaths in the country. This enforces all unnatural deaths to receive an autopsy by a qualified medical practitioner with the main purpose to determine the cause of death. The act states that

“ the body of a person who has allegedly died from other than natural causes is available, it shall be examined by the district surgeon or any other medical practitioner, who may, if he deems it necessary for the purpose of ascertaining with

greater certainty the cause of death, make or cause to be made an examination of any internal organ or any part or any of the contents of the body, or of any other substance or thing".(40)

The autopsies are recorded in mortuary death registers located in mortuaries. Post mortem reports are generated for reporting purposes.(17) Forensic pathologists do not determine manner of death but the probable manner of death. The classification of a case as suicide remains the ultimate the function of the SA Police Service (SAPS), usually in conjunction with the director of public prosecutions or the inquest court magistrate (as provided for by the Inquests Act of 1959).(12)

In 2001, according to the National Mortality Surveillance Systems (NMSS), pathologists could give their opinion with regard to the manner of death at the time of the post-mortem examination but this is purely for statistical purposes.(25) Therefore pathologists are not legally obliged to specify the precise manner of death, e.g. suicide, homicide, or the specific external cause of injury, though this would improve the quality of mortality information.(41)

The current medico-legal process in South Africa lends itself to the provision of a comprehensive database on non-natural mortality. Unfortunately, no data collected at local medico-legal laboratory level is fed into either provincial or national health information systems, and this is due to the legal processes which govern ownership and use of such data.(10)

Interventions

Suicide is a complex issue, and therefore suicide prevention efforts require coordination and collaboration amongst multiple sectors of society. These efforts must extend beyond the health sector to other sectors such as education, labour, agriculture, business, justice, law, defence, politics, and the media. Efforts must be comprehensive and integrated, as no single approach can make a sustained impact on an issue as complex as suicide.(7)

Interventions for prevention of suicide are based on risk factors identified and target upstream and downstream factors; in this regard the socio-ecological model is useful. This framework allows for the organising of the risks as well as protective factors which then inform the relevant prevention strategies. The four levels; individual, relational, community and societal. The WHO released a guide in 2012 to

member countries on the suicide prevention strategies.(6) In a ten year systematic review that analysed the effectiveness of suicide prevention strategies, it was evident that no single strategy was effective but a combination of strategies at both individual and population levels is appropriate utilising evidence based methodologies.(42)

A socio-ecological conceptual analysis conducted in 2017, looking at multilevel suicide preventions suggested that core prevention should address the education of clinicians on depression and suicide, access to care for high risk groups and restricting access to lethal means of dying due to suicide.(19)

One of the limitations in suicide prevention efforts includes the inability to accurately predict suicide behaviour in individuals. These were the findings of a meta-analysis conducted over a 50 year period on studies that identified risk factors for suicidal thoughts and behaviours.(43) The life course approach is useful here, to intervene the life of individuals from conception to old age, as described by Gunnell.(18)

Gunnell proposed that the life course approach suggests that intervention programmes should define two discrete areas of work: preventing and managing high risk mental health disorders.

i. **Preventing & Managing high risk patients (7)**

This entails:

- a. early identification, treatment and care of people with mental and substance use disorders, chronic pain and acute emotional distress. Results of randomised control trials using this approach, have shown a statistically significant reduction in suicide rates. Interventions included keeping contact, sending postcards periodically, telephone calls and allowing patients to readmit themselves on demand.(44) Community orientated Primary Care (COPC) in South Africa provides a screening tool (PHQ-9 - a multipurpose instrument for screening, diagnosing, monitoring and measuring the severity of depression for suicides).This is a basic service delivered to individuals in their homes.(45)
- b. training of non-specialized health workers in the assessment and management of suicidal behaviour;
- c. follow-up care for people who attempted suicide, and provision of community support.

ii. **Preventing suicide (7)**

This entails:

- a. reducing access to the means of suicide.

Evaluation studies have shown a significant effect in reducing the suicide rates when interventions have been implemented. These include legislated control of control of firearms; installing barriers at “hotspot bridges” where people jump; limiting carbon monoxide levels in domestic gases; restricting access to pills such as paracetamol; reducing access to objects or means of self-harm including firearms; and controlling access to pesticides.(46)

- b. reporting by media in a responsible way as lead by a code of ethics on suicide reporting. The reporting and portrayal of actual of fictional suicides has been found to influence patterns of suicidal behaviour. Media may influence acceptability of suicide in society as well as an individual’s choice of method of suicide.(47)

- c. introducing alcohol policies to reduce the harmful use of alcohol.

- d. improved availability and quality of data from vital registration, hospital-based systems and surveys.(7)

Conclusion

Suicide remains a preventable public health concern and contributor to premature mortality, particularly in the adolescent age group. Suicides are not uniformly distributed in society but differ amongst population subgroups. Suicide is under-reported, due to its stigma, the complexity making diagnosis, data collation, analysis and interpretation. South Africa’s suicide rates are higher than global rates and males are at highest risk. The choice of suicide method is dependent on the availability of the methods in society. Generally rural areas report suicides due to organophosphate poisoning while urban areas hanging, and gunshot are common.

Multiple risk factors have been identified using the socio-ecological model. Risk factors were identified at individual level such as age, sex, history of mental health other chronic medical conditions (HIV, cancers). Societal level included risks due to

the access to methods of suicide, barriers to healthcare and health systems issues and stigma. Structural level are laws and regulations that govern reporting of suicides.

Cross-national differences in the patterns of suicide, and changes in rates, characteristics and methods of suicide highlight the need for each country to improve the comprehensiveness, quality and timeliness of their suicide-related data. This includes vital registration of suicide, hospital-based registries of suicide attempts and nationally representative surveys collecting information about self-reported suicide attempts (7) For effective implementation of prevention strategies, setting up information systems, improved surveillance and monitoring are vital. These interventions should be applied downstream where detection and prevention strategies could be applied at an individual and societal levels as well as upstream with a focus on reducing availability of methods used for suicide, media messaging to influence patterns of suicidal behaviour as well as policies to reduce availability of alcohol, pharmaceuticals and illicit drugs.

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Part C: PUBLICATION READY MANUSCRIPT

SOUTH AFRICAN MEDICAL JOURNAL (SAMJ)

University of Cape Town

A descriptive analysis of suicides and their interface with healthcare facilities in the Western Cape, South Africa: 2011-2015.

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Abstract

[Word Count = 379 words]

BACKGROUND: Suicide is a preventable public health problem affecting 800 000 people every year and 79% occurs in low to middle incomes countries. Males are mostly affected, and at-risk age groups are adolescents and young adults. Hanging, firearms and ingestion of pesticides are amongst the most common methods of suicide. Prevention strategies have been applied by various countries to target the use of common methods of suicide however there is little evidence that supports detection of suicide risk in healthcare facilities. This study profiles all suicides that occurred in the Western Cape during the year 2011-2015 and their interface with the healthcare facilities up to one year prior to death.

OBJECTIVES: This study assesses the incidence of suicides in the Western Cape. It tests for associations between methods of suicide and demographic characteristics for suicide. Ascertain the characteristics of those suicide cases who made previous contact with a healthcare facility in the past 12 months and proposes context specific interventions for the prevention of suicides.

METHODS: A retrospective descriptive study was conducted. All suicides recorded by the forensic pathology service during the years 2011-2015 were linked to patient data held by the provincial health data centre. A total of 3 561 suicides were recorded during the study period. Crude suicide rates were calculated using

population denominator from the Statistics South Africa's national census projections. Multiple logistic regression was used to determine associations between the group utilising various methods of suicide and demographic characteristics.

FINDINGS: Males were found to be four times more likely to die from suicide compared to females. The age groups most at risk were 20-39 years. Hanging was the method of choice by males and overdose on medication, in females. Two thirds of the 2 367 suicides were positively linked to healthcare facilities. Most cases who sought healthcare up to one year prior to suicide were males that presented with 'other medical conditions' rather than mental health conditions.

CONCLUSION: This study highlights missed opportunities for the detection of suicide risk for those who seek healthcare for all healthcare conditions. Although suicide rates have remained constant over the assessment period, a key focus for prevention should be interventions applied at healthcare facilities as well as other 'upstream' preventions that reduce the availability of various methods for suicide.

KEYWORDS: "Suicide"; "Methods of Suicide"; "Epidemiology of Suicide"; "Suicide Interventions"; "Suicide and healthcare"

Introduction

Suicide is a public health concern and an important preventable cause of death globally. Approximately 800 000 people die of suicide every year with 79% of deaths occurring in low- and middle-income countries (LMICs). Suicide deaths are the second leading cause of mortality among people aged 15–29 years and uncommon in children less than 12 years.(1)

Suicide is illegal in certain countries in all continents, making under-reporting of information on suicide deaths common.(1) In addition, those countries who have legalised suicide with good vital registration data, often misclassify suicide as accidents or another cause of death as it is a stigmatised condition for families.(1) The cause of death is noted on the death certificates which are given to families and this results in no life assurance benefits by many schemes for the beneficiaries of those who die due to suicide.

Suicide rates, an incidence rate is the most appropriate measure the burden of suicide globally.(2) Crude and age-standardised rates are used to make comparisons of the burden of suicide across the regions and countries. (1),(2) There are variations in suicide rates across populations and regions; attributed to the cultural and religious acceptability of suicide, socio-economic conditions, and the varying legal definitions of suicide.(3)

In South Africa (SA), suicides are classified as unnatural deaths, and are legislated by the Inquest Act 58 of 1959 to undergo a post-mortem examination to determine the cause of death.(4) Attention to the reporting of suicides over the years, has been overshadowed by interpersonal violence and transport injuries, as these two categories constitute the majority on unnatural deaths in the country.(5) However, suicides are sizable, and in 2007, suicides were reported to be 10% of all unnatural deaths.(6) Similarly in the Western Cape province, the burden of suicide contributed 10% of unnatural deaths in 2013.(7)

Nationally, the epidemiology of suicide is reported in studies describing the injury burden of disease countrywide. However there are limited studies looking at the relationship between completed suicides and prior contact with healthcare facilities. (8),(9),(10),(11) Access to healthcare prior to suicide has been reported to be common and prevention strategies have been put in place to address it in high

income countries.(12) Access to general healthcare remains a challenge in (LMICs) as there is often a lack of resources or staff not adequately equipped with detecting the risk for suicide, various cultural beliefs and stigma associated with suicide.(13)

This study aims to assess the overall burden and characteristics for suicides amongst all age groups in the Western Cape. It further determines if suicide cases utilised health care facilities, up to one year prior to dying due to suicide.

Methods

All suicides recorded by Forensic Pathology services, occurring during the years 2011-2015, were matched to the database of all patients accessible to the Provincial Health Data Centre (PHDC).(14)

The data from the forensic pathology comprises of information from death certificates and various data collected from documents that were completed at the scene of injury. The documents are death declaration, scene injury, death certificates and clinical information documents. Furthermore, post-mortem reports, toxicology and blood alcohol results will be available as part of the data. PHDC houses a list of all patients seen in all healthcare facilities of the Western Cape – the patient master index. This allows for data sets to be linked using specific identifiers; comprising a unique health service folder number, national identity document numbers and diagnoses. Data linkage for this study was done through a third party - Centre for Infectious Disease Epidemiology and Research (CIDER) - situated at the University of Cape Town's School of Public Health and Family Medicine. We linked all patients for whom there was positive evidence of utilising healthcare facility up to one year prior to suicide.

Data was analysed using Stata version 14. Crude suicide rates were calculated and presented by sex, year and district. The population denominator was the Statistics South Africa's national 2011 census projections.(15) Multiple logistic regression was used to determine associations between groups (those whose suicide was due to the various methods and the different demographics such as age, gender, and district). The p-value threshold of 0.05 was used. The outcome variables were suicide method (Hanging, Overdose on Medication, Gunshot) and the independent variables were risk factors (Sex, Age, District of Death), and adjustment for confounders was performed. Model building was conducted using the forward selection procedure and

the final model selected by comparing the likelihood ratio test and Akaike Information Criterion (AIC).

Ethical approval was granted by the University of Cape Town Faculty of Health Sciences, Human Research Ethics Committee with reference number HREC:506/2018.

Results

A total of 3 561 suicides were recorded during 2011 and 2015 in the Western Cape Province, South Africa. All the suicides were recorded in the forensic pathology. Analysis of the total suicide (figure 1 below) 67% contacted the healthcare facilities up to one year prior to suicide. Those who never visited healthcare facilities during their life, comprised of 29% of suicides. The remaining proportion, 4% did not have enough evidence to link them to healthcare facilities. (Figure 1)

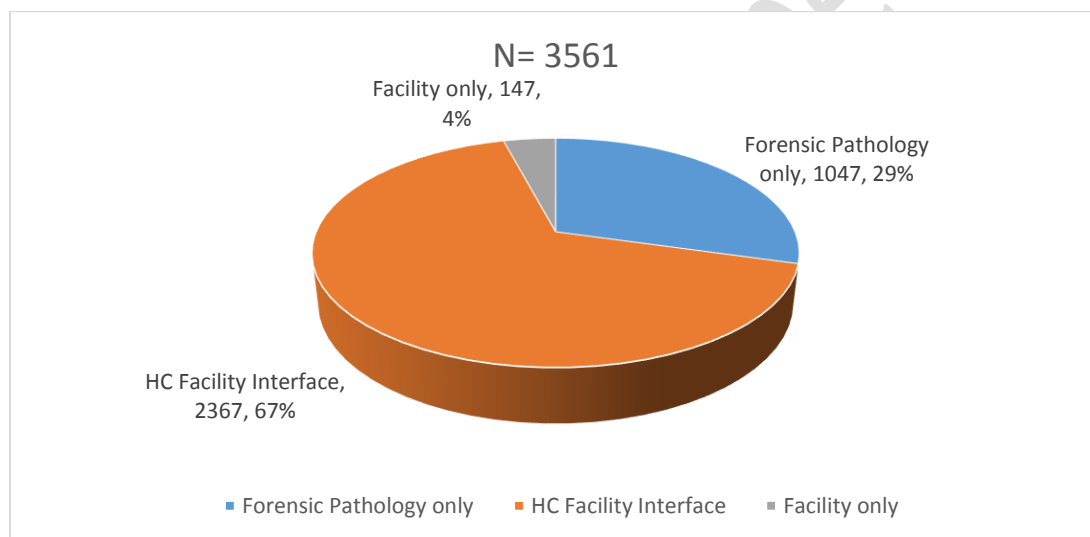


Figure 1: Data linkage of Suicides

A summary description of the total suicides is shown in Table 1. Most suicide cases were male (78.9%) and it commonly affected young adults – age groups 20-24 (13.4%); 25-29 (16.7%); and 30-34 (13.7%). The youngest case recorded was 9 years old. Hanging was the most common method, at 56.4%, overdose of pills 14.5% and gunshot at 10.0%. Grouped into the 'other' category was suicide death due to pesticide poisoning (2.0%), gassing (3%) and jumping from a height (3%). Positive alcohol results were recorded in 28.1% of suicides

Table 1: Summary statistics of Suicides in Western Cape, 2011-2015

N = 3561	
Variable	N (proportion %)
Sex	
Male	2 809 (78.9%)
Female	752 (21.1%)
Year of Death	
2011	672 (18.9%)
2012	767 (21.6%)
2013	718 (20.2%)
2014	679 (19.1%)
2015	725 (20.4%)
Age Categories (years)	
05-09	2 (0.06%)
10-14	32 (0.9%)
15-19	213 (6.0%)
20-24	477 (13.4%)
25-29	593 (16.7%)
30-34	487 (13.7%)
35-39	422 (11.9%)
40-44	325(9.1%)
45-49	266 (7.5)
50-54	227(6.4%)
55-59	138(3.9%)
60-64	118(3.3%)
65-69	94 (2.6%)
70-79	62 (1.7%)
80-84	31(0.9%)
+85	29(0.85)
Unknown age	3 (0.1%)
District of Death	
Cape Metro	2 254 (63.3%)
Cape Winelands	417 (11.7%)
Central Karoo	31 (0.9%)
Eden	457 (12.8%)
Overberg	170 (4.8%)
West Coast	232 (6.5%)
Method of Death	
Hanging	2009 56.4%
Overdose on pills	518 14.5%
Gunshot	356 10.0%
Pesticide Poisoning	173 4.9%
Others	358 10.1%
N/A	147 4.1%
Blood Alcohol Results (g/100ml)	
0	1679 (47.2%)
0.01-0.05	146(4.1%)
0.06-0.09	162(4.6%)
0.10-0.19	362(10.2%)
0.20-0.29	267(7.5%)
0.30-0.49	54(1.5%)
>1	6 (0.2)
N/A	147(4.1%)
No Result	738(20.7%)

An analysis of the suicide trends by month (Figure 2) shows a peak in the case load of suicides with the highest incidence seen in December. These findings are not statistically significant ($P>0.05$).

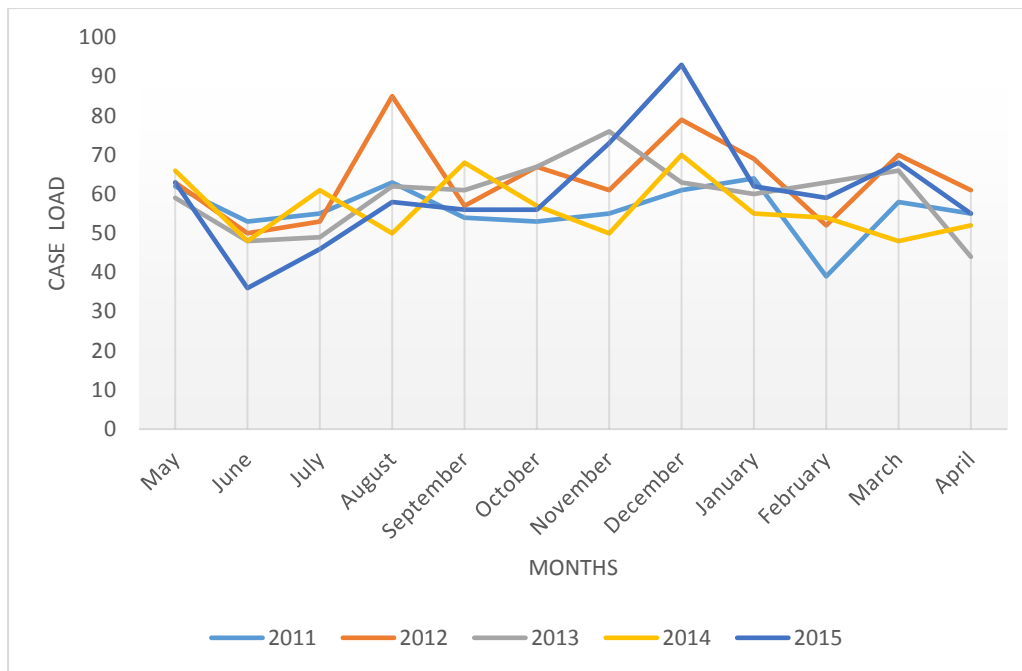


Figure 2: Seasonal trends (months) of suicide case load by year (2011-2015)

The incidence of suicide is shown in Table 2. The overall suicide rate for the Western Cape was found to be 11.43 per 100 000 population over the period of 2015. Male suicides rates (17.83-18.35 per 100 000 population in 2015 and 2011 respectively) are four times higher than those in females (4.94-5.25 per 100 000 population in 2015 and 2011 respectively) and these differences were statistically significant.

Stratified by sex, the suicide rates per district for the year 2015 were analysed. There were variations in the incidence rates between the rural and urban districts. In the Cape Metro, an urban area, suicide rates were similar to the overall province at 11.02 per 100 000 population, 95% CI (8.20;14.20). There were variations in rural settings, particularly in West Coast, Overberg and Central Karoo. Eden had the highest incidence – 15.58 per 100 000, 95% CI (8.82;23.99).

Table 2: Crude Suicide Rates of Suicide by sex (per 100 000) of Demographic Characteristics of Suicide Cases in Western Cape, South Africa

Variable	Males			Females			Total		
	Population Estimates	N(%)	Suicide Rate per 100 000 (95%CI)	Population Estimates	N(%)	Suicide Rate per 100 000 (95%CI)	Population Estimates	N(%)	Suicide Rate per 100 000 (95%CI)
Year									
2011	2 860 372	525	18.35(14.89;21.66)	2 976 472	147	4.94(1.94;9.57)	5 836 844	672	11.5(9.14;14.11)
2012	2 924 338	600	20.52(17.34;23.96)	3 029 026	167	5.51(2.49;9.98)	5 953 364	767	12.88(10.61;15.49)
2013	2 988 989	584	19.54(16.38;22.97)	3 092 094	134	4.33(1.66;9.49)	6 081 083	718	11.81(9.57;14.43)
2014	3 053 607	544	17.81(14.70;21.31)	3 155 653	135	4.28(1.65;9.42)	6 209 260	679	10.94(8.65;13.48)
2015	3 118 796	556	17.83(14.71;21.24)	3 220 102	169	5.25(2.46;9.87)	6 338 898	725	11.43(9.22;13.99)
District (calculated using the 2015 population estimates per 100 000)									
CT Metro	1 995 952	340	17.03(13.21;21.49)	2 070 207	108	5.92(2.07;11.70)	4 066 159	448	11.02(8.20;14.20)
West Coast	220 489	39	17.69(7.53;33.53)	219 315	8	3.65(0.00;36.94)	439 804	47	10.69(3.54;23.10)
Cape Winelands	419 431	67	15.97(8.49;27.48)	430 246	16	3.72(1.58;30.23)	849 677	83	9.77(4.25;18.11)
Overberg	142 086	37	26.04(13.79;44.11)	137 014	7	5.1(0.00;40.96)	279 100	44	15.77(6.64;30.07)
Eden	304 119	68	22.36(12.90;33.76)	324 778	30	9.23(2.11;26.53)	628 897	98	15.58(8.82;23.99)
Central Karoo	36 715	5	13.62(0.50;71.64)	38 538	0	0(0)	75 253	5	6.64(0.00;52.21)
Western Cape	3 118 796	556	17.83(14.71;21.24)	3 220 102	169	5.25(2.46;9.87)	6 338 898	725	11.43(9.22;13.99)

The multiple logistic regression revealed that there is a positive association between the methods of suicide (hanging, overdose of pills, shooting) with sex as demonstrated in Table 3 below. There is a higher likelihood of choosing hanging as a method of suicide. It was 4.63 times higher in males compared to females (95% CI: 3.85;5.57, $p < 0.05$). Similarly, gunshot was 2.03 times higher in males compared to females (95% CI: 1.47; 2.82, $p < 0.05$). In contrast, the likelihood of choosing overdose as a method of suicide was 86% lower in males when compared to females (95% CI: 83%;89%, $p < 0.05$).

When stratified by age, the likelihood of hanging was statistically significant for ages 30 upwards compared to those less than 14-year-old. However, the likelihood of choosing overdose of medication and gunshot is not associated with any age group. There is a positive association between living in Eden district and using a gun as a method of suicide, (95%CI: 1.10;2.70, $p < 0.05$).

Table 3: Results of multiple logistic regression of between Methods of Suicide by Demographic Characteristics of Suicide cases in the Western Cape:2011-2015

Variable	Hanging N = 2009			Overdose on Medication N=518			Gunshot N=356		
	OR	95%CI	P-value (P<0.05)	OR	95%CI	P-value (P<0.05)	OR	95%CI	P-value (P<0.05)
Sex									
Females	ref			ref			ref		
Males	4.63	3.85;5.57	0.00	0.14	0.11;0.17	0.00	2.03	1.47;2.82	0.00
Age (years)									
09-14	ref			ref			ref		
15-19	0.48	0.20;1.1	0.10	3.52	0.98;12.68	0.05	0.50	0.13;1.95	0.32
20-24	0.50	0.22;1.14	0.10	2.87	0.81;10.10	0.10	0.43	0.12;1.53	0.19
25-29	0.55	0.24;1.27	0.16	2.19	0.62;7.76	0.22	0.40	0.11;1.40	0.15
30-34	0.41	0.18;0.94	0.04	3.04	0.86;10.73	0.08	0.55	0.16;1.93	0.35
35-39	0.39	0.17;0.89	0.03	2.77	0.78;9.81	0.12	0.90	0.26;3.11	0.87
40-44	0.26	0.11;0.61	0.00	3.55	0.99;12.66	0.05	0.97	0.28;3.4	0.96
45-49	0.23	0.10;0.56	0.00	3.6	1.00;12.94	0.05	1.12	0.31;3.94	0.96
50-54	0.16	0.07;0.37	0.00	3.66	1.01;13.21	0.05	1.73	0.50;6.02	0.39
>54	0.10	0.05;0.24	0.00	2.25	0.64;7.91	0.21	3.57	1.07;11.97	0.04
District									
Cape Winelands	ref			ref			ref		
Cape Metro	1.00	0.80;1.26	0.94	0.89	0.65;1.22	0.45	1.11	0.76;1.63	0.60
Central Karoo	1.05	0.47;2.32	0.90	0.46	0.10;2.09	0.31	0.33	0.04;2.58	0.29
Eden	0.86	0.64;1.15	0.31	1.15	0.78;1.69	0.50	1.72	1.10;2.70	0.02
Overberg	1.45	0.97;2.17	0.07	0.73	0.40;1.32	0.30	1.24	0.66;2.33	0.50
West Coast	1.02	0.72;1.45	0.90	0.97	0.60;1.60	0.91	1.25	0.72;2.19	0.43

The overall methods of suicides were analysed according to the age categories and method of suicides (Figure 3). The most common method for suicide in males was asphyxiation by hanging. The age group that used hanging as the main method peaked between 25 and 29 years, This trend declined after the age of 39 but remains the selected method compared with overdose and shooting throughout all the age categories.

The second most common method was overdose on medication, and is reflected throughout all ages until the age of 54. The curve first peaks at ages 15-19 and 25-29 then decreases;. Gunshot is less common in ages less than 50. This method becomes as common as hanging in those older than 50 years of age. Hanging and overdose on medication. Other methods such as pesticide poisoning and gassing are least preferred methods.

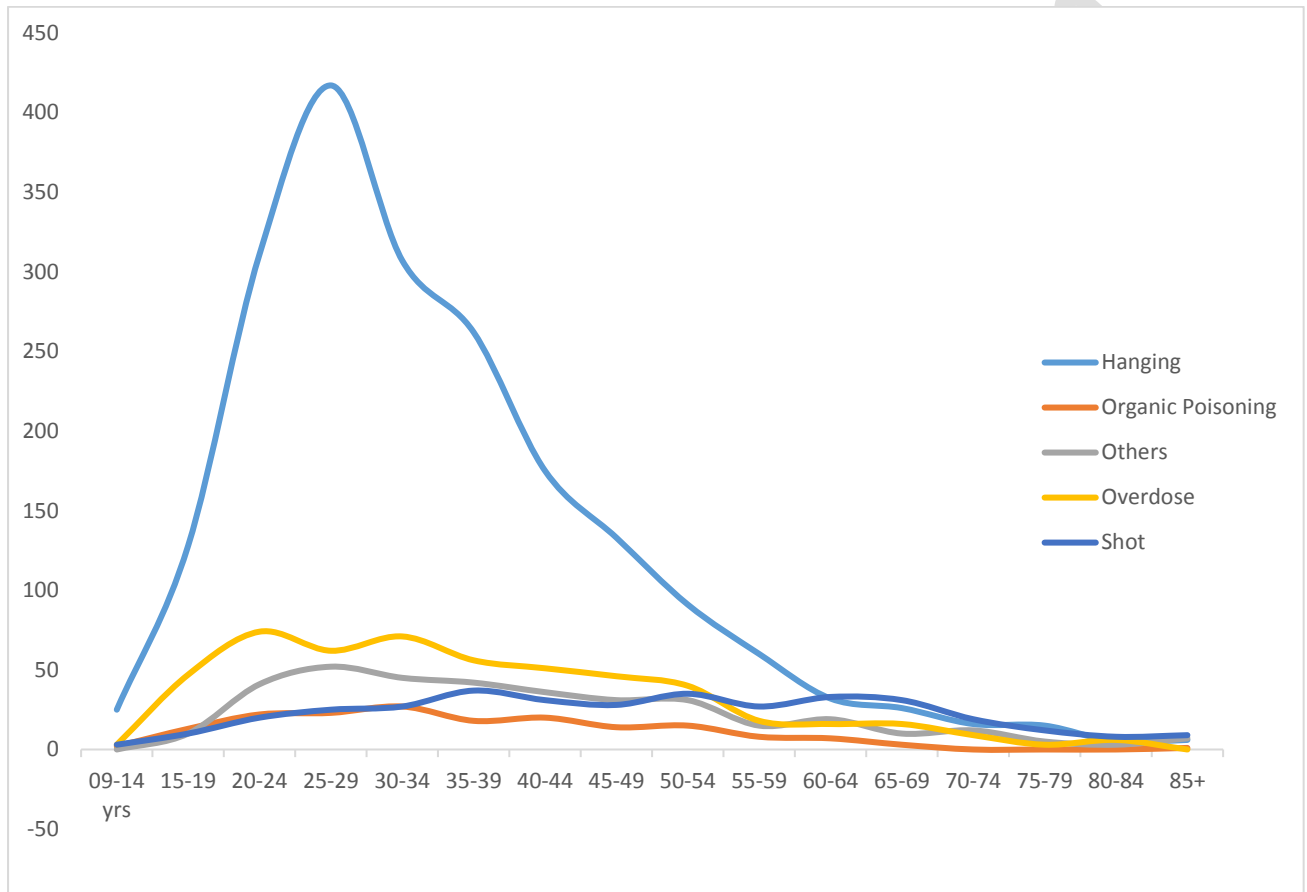


Figure 3: Suicide cases who made contact with healthcare facilities by age categories and method of suicide.

Contact with Healthcare Facilities

Two thirds (2 367) of suicide cases recorded during the assessment period made contact with the healthcare facilities within one year of suicide (Table 4). Males formed the largest proportion of suicides at 76.89% (95%CI: 0.75;0.79) compared to females 23.10% (95%CI: 0.21;0.25). A smaller proportion 15.12% (95%CI:

0.14;0.17) of suicide cases who made contact with the healthcare facility had a mental health diagnosis when compared to 43.05% (95% CI: 0.41;0.45) had another medical condition. Due to incomplete folder entries, a further 41.83% (95%CI: 0.40;0.44) had no definitive diagnosis recorded in the folder, and therefore information was missing from the data.

Table 4: Characteristics of Suicides that made contact with healthcare facilities (2011-2015)

N= 2367	N(proportion)	95% CI
Sex		
Males	1820 (76.89%)	(0.75; 0.79)
Females	547 (23.10%)	(0.21; 0.25)
Year of Death		
2011	416 (17.57%)	(0.16;0.19)
2012	499 (21.08%)	(0.19;0.22)
2013	485 (20.49%)	(0.19;0.22)
2014	483 (20.41%)	(0.19;0.22)
2015	483 (20.36%)	(0.19;0.22)
Mental Health diagnosis		
Yes	358 (15.12%)	(0.14;0.17)
No	1019 (43.05%)	(0.41;0.45)
No diagnosis recorded	990 (41.83%)	(0.40;0.44)

Suicide cases who presented with a mental health diagnosis were compared to those who presented with other diagnoses and stratified by sex. As females and males are known to have a different health seeking behaviour (16), a difference between the group proportions was measured. The null hypothesis was, there is no difference between the groups while the alternate hypothesis was there is the difference between the groups. The results of the Pearson's chi squared showed $P < 0.05$ confirming a difference between the groups. The comparison was done over time (Figure 4).

For males, a mental health diagnosis was present in 11.04% (95%CI: 0.08;0.15) of suicide cases in 2011 and increased to 17.30% (95%CI:0.14;0.21) by 2015.

Similarly mental health diagnosis in females was present in 17.64% (95%CI:0.11;0.26) in 2011 and increased to 25.71% (95%CI:0.19;0.32) by 2015.

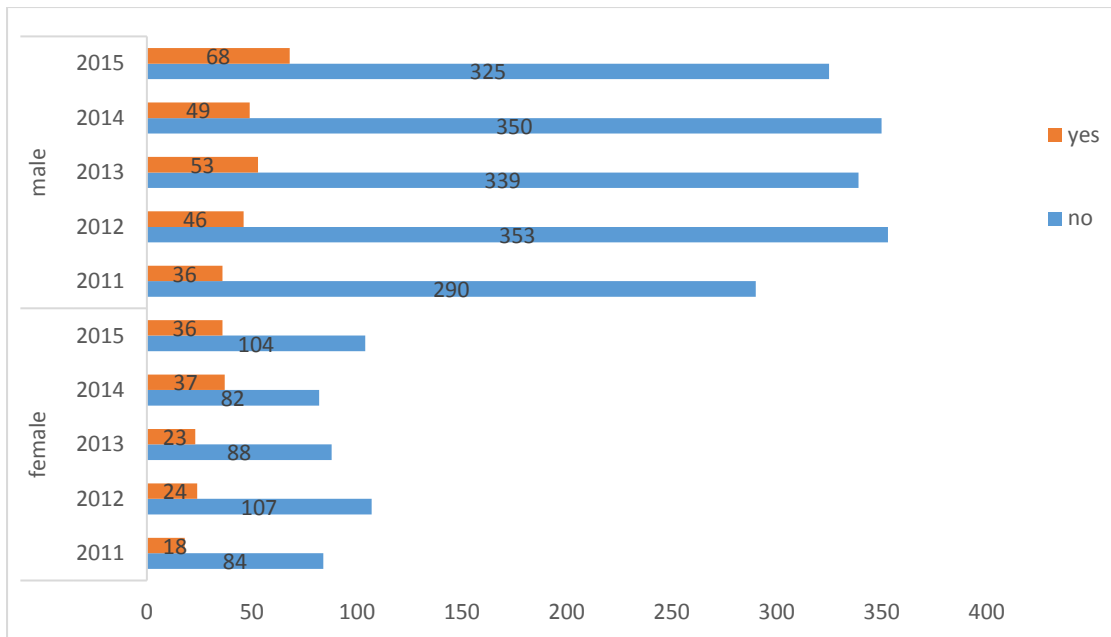


Figure 4: Suicide cases who presented with a mental health diagnosis versus other medical conditions

We analysed the facility type that people who later died due to suicide presented to (figure 5). It shows that 25% of patients presented to PHC facilities in the years 2014 and 2015, this is a 9% increase when comparing to 2011 results. Patients who presented to the hospital outpatients formed 20% of patients. Only 10% of patients were hospital admissions and the 45% majority of patients had no record of the type of facility visited in 2015.

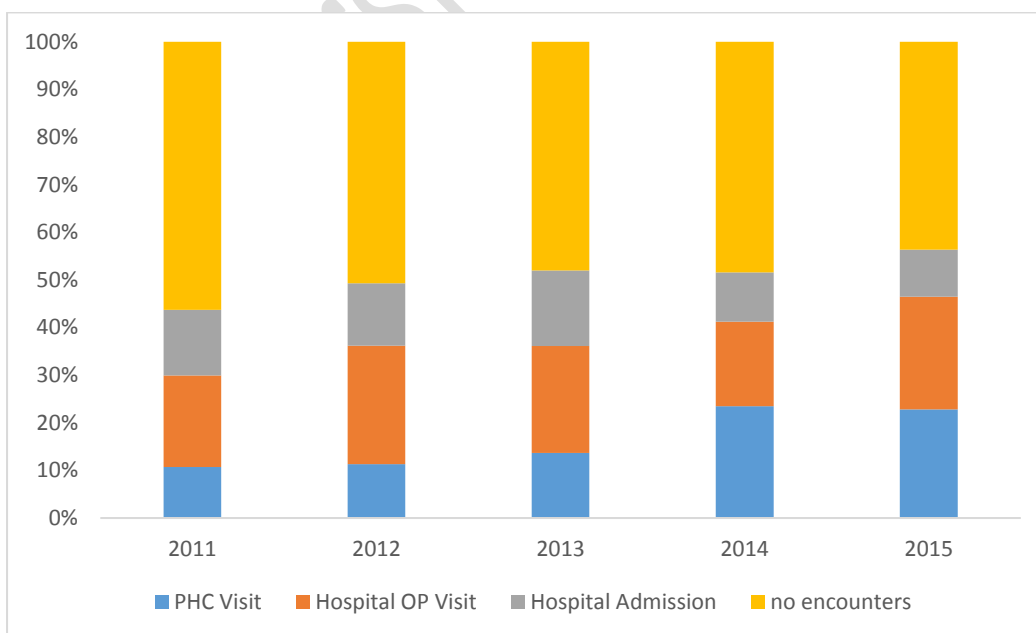


Figure 5: Suicide cases per year by facility type

Discussion

These results profile the people who died due to suicide and their interface with the provincial healthcare services in the Western Cape, South Africa over the years 2011-2015. In addition, it identifies associations between the most common methods (hanging, overdose and gunshot) and demographic profiles of the cases. It provides new and important information about people committing suicide who contacted the provincial public healthcare system one year prior to committing suicide. Previous studies have analysed suicides in the context of unnatural deaths.(9)

The overall crude suicide rate remained constant from 2011-2015. The Western Cape provincial and district rates are higher than global crude rates of 10.4 per 100 000 overall and higher than the African crude rates of 7.4 per 100 000 population.(2) The suicide rates within Western Cape's districts show a difference between urban and rural district. The Cape Metro district which houses two-thirds of the Western Cape Province population demonstrated a rate of 11.02 per 100 000 population, equivalent to the province overall (Table 3). Although rural provinces of Eden and Overberg showed higher rates compared to the Cape Metro, the wide non-significant confidence intervals make these results insignificant.

Hanging, gunshot and overdose of pills are the most common methods of suicide in the Western Cape and these are particularly seen in the urban areas. In the rural areas organophosphate poisoning is more common.(17) In high income countries (HICs), hanging accounts for 50% of suicides whereas existing data from the rural areas in certain LMIC's in Africa, estimate that pesticide self-poisoning accounts for 35% of suicides.(1) Unfortunately comparisons cannot be made amongst LMICs due to the lack of data.

We found males to be 4.63 (CI:3.85;5.57, $p < 0.05$) times more likely to commit suicide by hanging compared to females. Young adults, 20-39 years, were mostly affected and the most common method of suicide was asphyxiation by hanging which accounted for over half (56.4%) of suicides in the 5 years' retrospective analysis. These findings are similar to those found in another South African study where 55.9% of the suicides were due to hanging (18) but higher than the 33.3% of all suicides reported in the study of hanging conducted in the Eastern Cape in 2003.(19) Hanging and gunshot are more common amongst males (89.10%) and (86.52%) respectively, whereas overdose on medication remains the preferred

method amongst females (56.6%). Gunshot injuries remain the leading cause of violent (unnatural) deaths in South Africa(9) and especially in the urban area of the Western Cape suggesting accessibility and availability of this method. This is despite progress made under the Firearms Control Act 60 of 2000 that regulates ownership of firearms by civilians.(20)

Seasonal variation in suicide incidence was found to not be statistically significant in the Western Cape as shown in Figure 1. These were contrary to the findings by Stark et al in a study of suicide cases in Bloemfontein for the year 2003-2007 which found an increased incidence during the months October, November and December.(18) Seasonality as a risk factor to suicide in South Africa was previously studied by Flisher et al.(21) who analysed 16 389 suicides from a national suicide register between 1980-1989 and found a peak in spring (September and October months) and a trough, during the winter months and these findings were similar to those seen in the northern hemisphere. However, in a systematic review looking at suicide and seasonality in the northern and southern hemispheres, there was no evidence of seasonal variation in the incidence of suicides.(22)

The study found there is an association between alcohol and those who die from suicide. As a measure of intoxication, South Africa puts the legal driving limit for alcohol to 0.05g/100ml therefore any reading less than that is considered low levels of blood alcohol. In this study, 4% of the total completed suicides showed low positive alcohol blood results and 24% had high alcohol levels. These findings are consistent with those of a study done in USA which quantified the association between acute alcohol use on suicide. The participants were all cases that attempted suicide within 48 hours and results showed that higher alcohol levels posed greater risk to committing suicide than lower levels of drinking and no drinking. Low levels of blood alcohol were considered to 1-3 standard drinks in females and 1-4 drinks in males.(23)

The results of the methods of suicide for this study confirm global findings that males tend to choose more violent means to commit suicide compared to females.(24)

Due to the complexity of aetiology of suicide, researchers have speculated about reasons for the sex differences in suicide, and consequently this area of research is not well explored.(25) However, one reason for increased lethality by males was

explored in a cross sectional study done in USA. Although the study looked at men in later life, it concluded that men tend to have higher levels of suicidal intent resulting in more violent choices(26) and tend to be 'more unconcerned with consequences because of a high risk-taking orientation'.(25)

Contact with Healthcare Facilities

In this study, a total of 1820 (76.9%) of suicide cases contacted healthcare facilities were males compared to only 547 (23.1%) females, a finding that is contrary to that understood as the usual male health seeking behaviour. Globally males are reported to have lower life expectancy for all ages. This was described by Wang et al. analysing a 40 year period between 1970 to 2010 finding that the female's life expectancy of females from birth increased over time compared to that of males partly due to poor health seeking behaviour.(27) In LMICs, societal culture and masculinity – a concept of what is considered a 'real man'- lead to disconnection with health services and casual approach to health and well-being.(28) In this study, the findings suggest that in the Western Cape, males who end up dying from suicide do seek healthcare but the risk is not detected at point of interface with healthcare facilities.

Mental health is reported to be most common medical risk factor. In psychological autopsy studies from Europe and United states, up to 90% of patients who died due to suicide suffered from a mental health condition. (29) In this study, only 15.1% of suicide cases were known with a mental health diagnosis. The remainder of the suicide cases attended healthcare services for 'other medical conditions' 43.1%. When stratified by sex, males are diagnosed of mental health less often than females suggesting that males present to healthcare facilities more often for 'other medical conditions' (Figure 4).

The proportion of suicide cases that attended healthcare at an outpatient services in the primary health care and hospital outpatient was found to be 45% in 2015 compared to those who were admitted as inpatients (10%) (Figure 5). These proportions increased over time and this is attributed to improved record keeping as evidenced by the decreasing trend the proportion of whose records did not have a definitive diagnosis. These findings resemble those recorded in a systematic review

of 40 studies from first world countries (UK, Sweden and USA), by Luoma et al., examining rates of contact with primary healthcare and mental healthcare individuals before they died by suicide. They found that a greater portion of the people who died due to suicide had made contact with primary care providers more than with mental health specialists.(10)

Limitations

This study was conducted using service-related data, and therefore data accuracy and completeness is not assured. Data inconsistencies include that 4% of the suicides reported from the healthcare facility data could not be matched to the mortuary. According to the Inquest Act, all suicides are unnatural deaths and consequently undergo a post-mortem whereupon they are classified as suicides. In South Africa, a suicide death that does not get a post-mortem result cannot obtain death certificate. Therefore, it is more likely that there were issues in the misclassification and ICD coding of these cases as 'suicide' or data incompleteness at facility level.

A large proportion 41.9% of cases that were recorded in facilities had no diagnosis recorded, which highlights data collection issues at healthcare facilities. These range from lack of ICD 10 codes, wrong coding, missing information in the folders and incomplete records reflecting data capturing and data processing challenges.

Secondary data analysis was used for this study posing the limitation that predictors such population group and socioeconomic status were not available in dataset

Conclusion

This study confirms that suicide rates in the Western Cape are higher than those in the African region and globally, predominantly affecting younger men. Hanging is the preferred method of suicide by males while overdose on medication is preferred by females. Gunshot was the next preferred method by both males and females.

There is an association between alcohol and those who die from suicide.

Interventions to reduce alcohol at a societal level would be likely to reduce the burden of suicide.

Importantly, a large proportion of people who died due to suicide visited a healthcare facility one year before death. They did not necessarily present with mental health

problems and a large proportion presented with other medical conditions. Contrary to previous research (16), males were found to have a good health seeking behaviour.

This study gives evidence that can be used to reduce the incidence of suicide. Upstream factors such as reducing access to hanging ligatures, medication and alcohol need to be targeted. At societal and structural levels, it is suggested that gun and pharmacy regulations are revised to decrease access to guns as well as focus on drug schedules – to limit access to toxic medication and increase requirements for a script from a qualified health professional. The availability of alcohol needs better regulation mechanisms. Downstream, screening methods at healthcare level should be established to target those at risk. Healthcare workers are to be trained continuously to detect patients at risk as part of integrated approach to preventing these deaths in the future.

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Conflict of interests:

There are no conflicts declared.

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APPENDIX 1: Variables List

Table A1 describing all variables to be requested from the dataset

Variable	Type of variable
Sex Males Females	Categorical - binary
Age categories 0-9 10-18 19-29 30-39 40-49 50-59 >60	Categorical - nominal
Month of death January February March April May June July August September October November December	Categorical - nominal
District of Death Cape Winelands Central Karoo	Categorical - nominal

Cape Metro Eden Overberg West Coast	
Method of Suicide Hanging Drowning Electrocution Firearms Overdose of medication Suffocation Gassing Burns (Fire) Jumping Organic Poisoning Unspecified means	Categorical - nominal
Toxicology results Done Not done	Categorical - binary
Blood Alcohol levels	Categorical - nominal
Visit to healthcare within 1 month of suicide Yes No	Categorical - binary
Visit to healthcare within 1 year of suicide Yes No	Categorical - binary
Type of healthcare facility last attended PHC District	Categorical - nominal

Regional Psychiatric Hospital	
District of healthcare facility Cape Winelands Central Karoo Cape Metro Eden Overberg West Coast	Categorical - nominal
Mental Health diagnosis Yes No	Categorical - binary

University of Cape Town

Appendix 2: Ethics Approval Letter (Original)



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room E53-46 Old Main Building
Grootte Schuur Hospital
Observatory 7925
Telephone [021] 406 6626
Email: shuretta.thomas@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

10 August 2018

HREC REF: 506/2018

Dr V Zweigenthal
Public Health & Family Medicine
Room 4.27
Falmouth Building

Dear Dr Zweigenthal

PROJECT TITLE: SUICIDE MORTALITY AMONGST ALL AGE GROUPS IN THE WESTERN CAPE PROVINCE, SOUTH AFRICA, A DESCRIPTIVE STUDY (MMed Candidate - Dr Z Mgugudo-Sello)

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned.

Approval is granted for one year until the 30 August 2019.

Please submit a progress form, using the standardised Annual Report Form if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

Please quote the HREC REF in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal Investigator **must** obtain appropriate Institutional approval, where necessary, before the research may occur.


The HREC acknowledge that the student, Ziyanda Mgugudo-Sello will also be involved in this study.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FHS HUMAN RESEARCH ETHICS COMMITTEE
Federal Wide Assurance Number: FWA00001637.
Institutional Review Board (IRB) number: IRB00001938

HREC 506/2018

Appendix 3: Ethics Annual Renewal




UNIVERSITY OF CAPE TOWN
 IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

HUMAN RESEARCH ETHICS COMMITTEE
 09 JUL 2019

HEALTH SERVICES FACULTY
 UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES
 Human Research Ethics Committee



FHS017 - Annual Progress Report / Renewal

Record Reviews/Audits/Collection of Biological Specimens/Repositories/Databases/Registries

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval including any documentation described below.			
<input checked="" type="checkbox"/> Approved	Annual progress report	Approved until/next renewal date	30-08-2020
<input type="checkbox"/> Not approved	See attached comments		
Signature Chairperson of the HREC		pp. <i>Uburgess</i>	Date Signed: 09/10/2019

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	26/09/2019		
HREC REF. Number	506/2018	Current Ethics/Approval was granted until:	30th August 2019
Protocol title	Suicide mortality amongst all age groups in the Western Cape Province, South Africa. A descriptive Study		
Principal Investigator	Dr Zweigenthal		
Department / Office Internal Mail Address	Public Health Medicine		
1.1 Does this protocol receive US Federal funding?			<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

2. Protocol status (tick ✓)

<input type="checkbox"/> Research-related activities are ongoing.
<input checked="" type="checkbox"/> Data collection is complete, data analysis only.
Please indicate (in the block below) the titles and HREC reference numbers of any projects currently making use of the Database/registry/repository.
None

3. Protocol summary - noted on attached supporting document TB

Total number of records or specimens collected, reviewed or stored since the original approval	
Total number of records or specimens collected, reviewed or stored since last progress report	
Have any research-related outputs (e.g. publications, abstracts, conference presentations) resulted from this research? if yes, please list and attach with this report.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (attached)

4. Signature

Signature of PI	<i>Muller</i>
Date	30 September 2019

Appendix 4: South African Medical Journal Publication Guidelines

Research Manuscript preparation

Guideline word limit: 4 000 words

Research articles describe the background, methods, results and conclusions of an original research study. The article should contain the following sections: introduction, methods, results, discussion and conclusion, and should include a structured abstract (see below). The introduction should be concise – no more than three paragraphs – on the background to the research question, and must include references to other relevant published studies that clearly lay out the rationale for conducting the study. Some common reasons for conducting a study are: to fill a gap in the literature, a logical extension of previous work, or to answer an important clinical question. If other papers related to the same study have been published previously, please make sure to refer to them specifically. Describe the study methods in as much detail as possible so that others would be able to replicate the study should they need to. Results should describe the study sample as well as the findings from the study itself, but all interpretation of findings must be kept in the discussion section, which should consider primary outcomes first before any secondary or tertiary findings or post-hoc analyses. The conclusion should briefly summarise the main message of the paper and provide recommendations for further study.

Select figures and tables for your paper carefully and sparingly. Use only those figures that provided added value to the paper, over and above what is written in the text.

Do not replicate data in tables and in text .

Structured abstract

- This should be 250-400 words, with the following recommended headings:
 - **Background:** why the study is being done and how it relates to other published work.
 - **Objectives:** what the study intends to find out
 - **Methods:** must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.
 - **Results:** first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.
 - **Conclusion:** must be supported by the data, include recommendations for further study/actions.
- Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors.
- Do not include any references in the abstracts.

Main article

All articles are to include the following main sections: Introduction/Background, Methods, Results, Discussion, Conclusions.

The following are additional heading or section options that may appear within these:

- Objectives (within Introduction/Background): a clear statement of the main aim of the study and the major hypothesis tested or research question posed
- Design (within Methods): including factors such as prospective, randomisation, blinding, placebo control, case control, crossover, criterion standards for diagnostic tests, etc.
- Setting (within Methods): level of care, e.g. primary, secondary, number of participating centres.

- Participants (instead of patients or subjects; within Methods): numbers entering and completing the study, sex, age and any other biological, behavioural, social or cultural factors (e.g. smoking status, socioeconomic group, educational attainment, co-existing disease indicators, etc) that may have an impact on the study results. Clearly define how participants were enrolled, and describe selection and exclusion criteria.
- Interventions (within Methods): what, how, when and for how long. Typically for randomised controlled trials, crossover trials, and before and after studies.
- Main outcome measures (within Methods): those as planned in the protocol, and those ultimately measured. Explain differences, if any.

Results

- Start with description of the population and sample. Include key characteristics of comparison groups.
- Main results with (for quantitative studies) 95% confidence intervals and, where appropriate, the exact level of statistical significance and the number need to treat/harm. Whenever possible, state absolute rather than relative risks.
- Do not replicate data in tables and in text.
- If presenting mean and standard deviations, specify this clearly. Our house style is to present this as follows:
- E.g.: The mean (SD) birth weight was 2 500 (1 210) g. Do not use the \pm symbol for mean (SD).
- Leave interpretation to the Discussion section. The Results section should just report the findings as per the Methods section.

Discussion

Please ensure that the discussion is concise and follows this overall structure – sub-headings are not needed:

- Statement of principal findings
- Strengths and weaknesses of the study
- Contribution to the body of knowledge
- Strengths and weaknesses in relation to other studies
- The meaning of the study – e.g. what this study means to clinicians and policymakers
- Unanswered questions and recommendations for future research

Conclusions

This may be the only section readers look at, therefore write it carefully. Include primary conclusions and their implications, suggesting areas for further research if appropriate. Do not go beyond the data in the article.

Authorship

Named authors must consent to publication. Authorship should be based on: (i) substantial contribution to conceptualisation, design, analysis and interpretation of data; (ii) drafting or critical revision of important scientific content; or (iii) approval of the version to be published. These conditions must all be met (uniform requirements for manuscripts submitted to biomedical journals; refer to www.icmje.org)

If authors' names are added or deleted after submission of an article, or the order of the names is changed, all authors must agree to this in writing.

Please note that co-authors will be requested to verify their contribution upon submission. Non-verification may lead to delays in the processing of submissions. Author contributions should be listed/described in the manuscript.

Conflicts of interest

Conflicts of interest can derive from any kind of relationship or association that may influence authors' or reviewers' opinions about the subject matter of a paper. The existence of a conflict – whether actual, perceived or potential – does not preclude publication of an article. However, we aim to ensure that, in such cases, readers have all the information they need to enable them to make an informed assessment about a publication's message and conclusions. We require that both authors and reviewers declare all sources of support for their research, any personal or financial relationships (including honoraria, speaking fees, gifts received, etc) with relevant individuals or organisations connected to the topic of the paper, and any association with a product or subject that may constitute a real, perceived or potential conflict of interest. If you are unsure whether a specific relationship constitutes a conflict, please contact the editorial team for advice. If a conflict remains undisclosed and is later brought to the attention of the editorial team, it will be considered a serious issue prompting an investigation with the possibility of retraction.

Research ethics committee approval

Authors must provide evidence of Research Ethics Committee approval of the research where relevant. Ensure the correct, full ethics committee name and reference number is included in the manuscript.

If the study was carried out using data from provincial healthcare facilities, or required active data collection through facility visits or staff interviews, approval should be sought from the relevant provincial authorities. For South African authors, please refer to the guidelines for submission to the National Health Research Database. Research involving human subjects must be conducted according to the principles outlined in the Declaration of Helsinki. Please refer to the National Department of Health's guideline on Ethics in Health research: principles, processes and structures to ensure that the appropriate requirements for conducting research have been met, and that the HPCSA's General Ethical Guidelines for Health Researchers have been adhered to.

Illustrations/photos/scans

- If illustrations submitted have been published elsewhere, the author(s) should provide consent to republication obtained from the copyright holder.
- Figures must be numbered in Arabic numerals and referred to in the text e.g. '(Fig. 1)'.
- Each figure must have a caption/legend: Fig. 1. Description (any abbreviations in full).
- All images must be of high enough resolution/quality for print.
- All illustrations (graphs, diagrams, charts, etc.) must be in PDF or jpeg form.
- Ensure all graph axes are labelled appropriately, with a heading/description and units (as necessary) indicated. Do not include decimal places if not necessary e.g. 0; 1.0; 2.0; 3.0; 4.0 etc.
- Scans/photos showing a specific feature e.g. *Intermediate magnification micrograph of a low malignant potential (LMP) mucinous ovarian tumour. (H&E stain).* –include an arrow to show the tumour.
- Each image must be attached individually as a 'supplementary file' upon submission (not solely embedded in the accompanying manuscript) and named Fig. 1, Fig. 2, etc.

Tables

- Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged.
- Large tables will generally not be accepted for publication in their entirety. Please consider shortening and using the text to highlight specific important sections, or offer a large table as an addendum to the publication, but available in full on request from the author
- Embed/include each table in the manuscript Word file - do not provide separately as supplementary files.
- Number each table in Arabic numerals (Table 1, Table 2, etc.) and refer to consecutively in the text.
- Tables must be cell-based (i.e. not constructed with text boxes or tabs) and editable.
- Ensure each table has a concise title and column headings, and include units where necessary.
- Footnotes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || then ** †† ‡‡ etc.

References

NB: Only complete, correctly formatted reference lists in Vancouver style will be accepted. Reference lists must be generated manually and not with the use of reference manager software. Endnotes must **not** be used.

- Authors must verify references from original sources.
- Citations should be inserted in the text as superscript numbers between square brackets, e.g. These regulations are endorsed by the World Health Organization,^[2] and others.^[3,4-6]
- All references should be listed at the end of the article in numerical order of appearance in the Vancouver style (not alphabetical order).
- Approved abbreviations of journal titles must be used; see the List of Journals in Index Medicus.
- Names and initials of all authors should be given; if there are more than six authors, the first three names should be given followed by et al.
- Volume and issue numbers should be given.
- First and last page, in full, should be given e.g.: 1215-1217 **not** 1215-17.
- Wherever possible, references must be accompanied by a digital object identifier (DOI) link). Authors are encouraged to use the DOI lookup service offered by CrossRef:
 - On the Crossref homepage, paste the article title into the 'Metadata search' box.
 - Look for the correct, matching article in the list of results.
 - Click Actions > Cite
 - Alongside 'url =' copy the URL between { }.
 - Provide as follows, e.g.: <https://doi.org/10.7196/07294.937.98x>

Appendix 5: Additional Figures of Suicide Methods for Males who contacted healthcare facilities by Age Categories

Male suicides who contacted the healthcare facility were further analysed according to the age categories and method of suicides. (Figure A1) The most common method for suicide in all males who contacted the healthcare facilities was asphyxiation by hanging. The age group that used hanging as the main method peaked between 24 and 29 years, declined and peaked again at the age of 39. The trend declined after the age of 39 but remains the selected method compared with overdose and shooting throughout all the age categories.

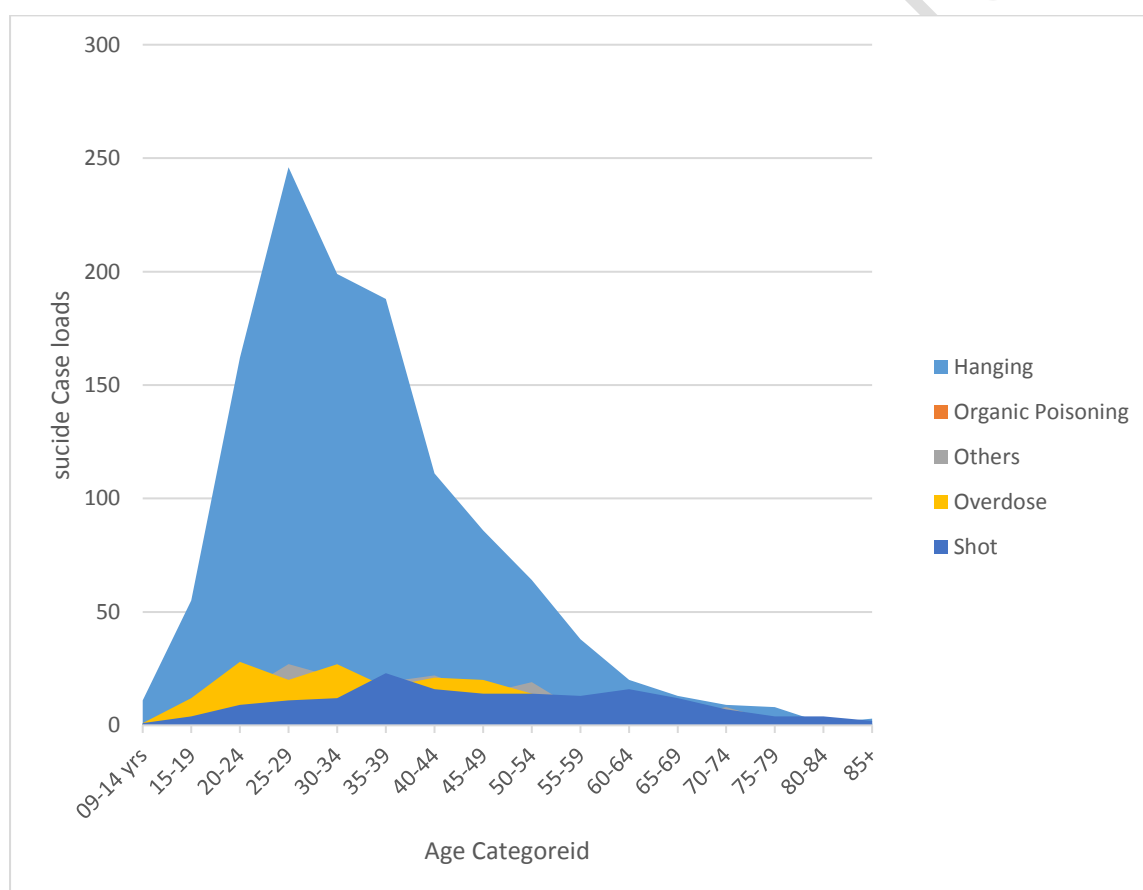


Figure A1: Male suicide cases who made contact with healthcare facilities by age categories and method of suicide.

Appendix 6: Additional Figures of Suicide Methods for Females who contacted healthcare facilities by Age Categories

Compared to males, the distribution of females by age who made contact with the healthcare facilities is multimodal and asymmetric. (Figure A2) The curve first peaks at ages 15-39 and plateaus; and the second smaller peak is at ages 40-54 years before declining followed by a smaller peak seen in the 60-69 years age group. The most common method was overdose on medication, and is reflected throughout all ages until the age of 79. Other methods such as pesticide poisoning and gassing are the preferred methods after the age of 80 years. Gunshot is less common but recorded as the second preferred method all age groups.

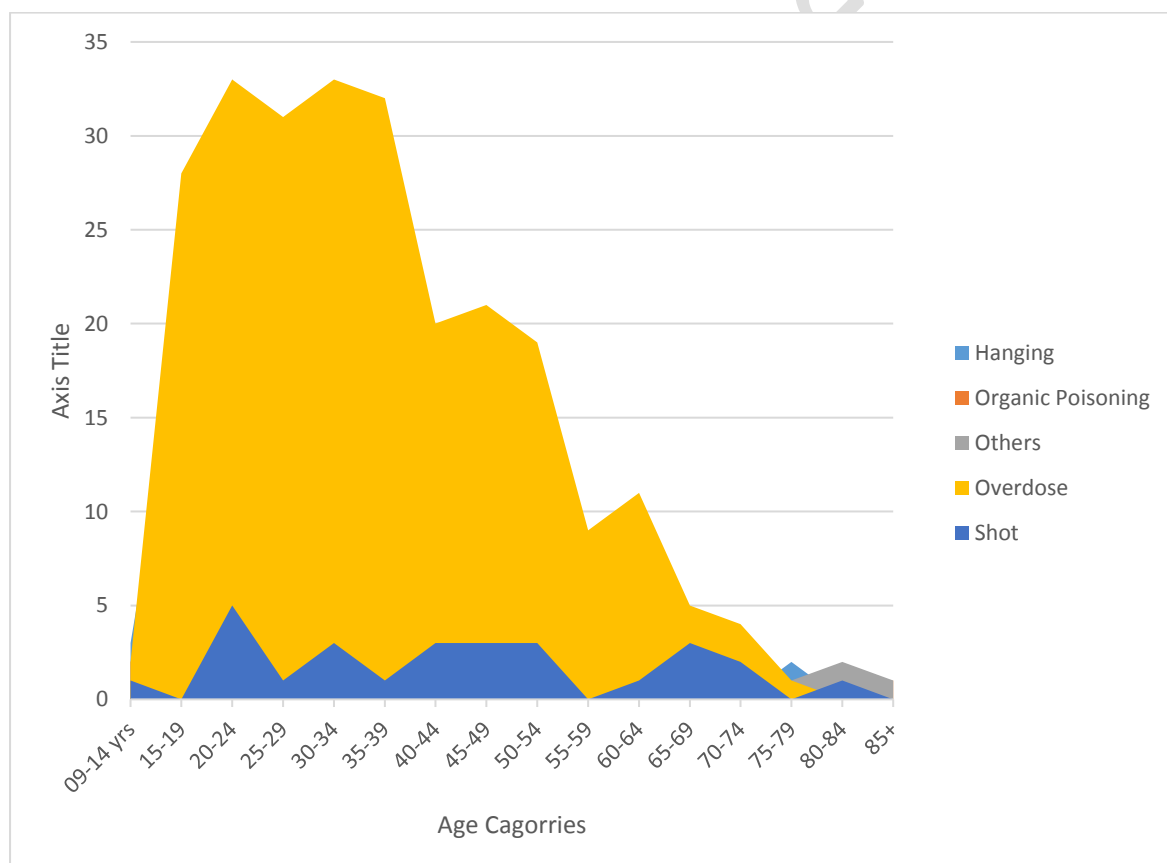


Figure A2: Female Suicide cases who made contact with healthcare facilities by age categories and method of suicide.

Appendix 7: Additional Figures of suicides who presented with Mental Health versus ‘other medical conditions’

Table A2 highlights that most suicide cases did not have a mental health diagnosis but presented with ‘other medical conditions’. This is true for both males and females and the proportions increase over time.

This suggests that patients at risk for suicide are likely to present to healthcare facilities for ‘other medical conditions’ and not necessarily for mental health conditions as literature suggests.

The case load of males that presented for other medical conditions is three times that of females and these findings are statistically significant.

Table A2: Table showing the trend in the caseload of suicides by sex who had mental health diagnosis versus those who had ‘other medical conditions’

	Mental Health (No)		Mental Health (Yes)	
female	No of cases (%)	CI	No of cases (%)	CI
2011	84(82.35%)	(0.74;0.89)	18(17.64%)	(11.4;26.3)
2012	107(81, 67%)	(0.74;0.87)	24(18.32%)	(0.13;0.26)
2013	88(79.27%)	(0.71;0.86)	23(20.72%)	(0.14;0.29)
2014	82(68.91%)	(0.60;0.76)	37(31.09%)	(0.23;0.40)
2015	104(74.28%)	(0.66;0.81)	36(25.71%)	(0.19;0.32)
male	No of cases (%)	CI	No of cases (%)	CI
2011	290(88.95%)	(0.85;0.92)	36(11.04%)	(0.08;0.15)
2012	353(88.47%)	(0.84;0.91)	46(11.52%)	(0.09;0.15)
2013	339(86.47%)	(0.84;0.90)	53(13.52%)	(0.10;0.17)
2014	350(87.71%)	(0.84;0.91)	49(12.28%)	(0,94;0.15)
2015	325(82.69%)	(0.79;0.86)	68(17.30%)	(0.14;0.21)