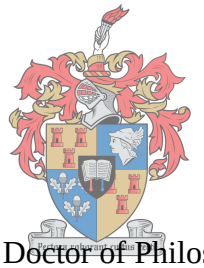
Substance use and self-harm at an urban South African hospital: implications for suicide prevention, service delivery and future research

by

Elsie Breet



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Promotor: Dr. Jason Bantjes

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DECLARATION

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ABSTRACT

Self-harm is a form of suicidal behaviour which constitutes a serious public health problem in low-income and middle-income countries (LMICs). The World Health Organization identifies substance use as a potentially modifiable risk factor for suicidal behaviour, including self-harm. Little is known about the prevalence, correlates, nature, and context of substance use among self-harm patients in South Africa. In this thesis, I explored the relationship between substance use and self-harm among patients who presented for treatment at an urban hospital in the Western Cape, South Africa.

I employed a mixed methods research design and present my findings in the form of four journal articles. In the first article, I report on the results of a systematic review to investigate what is known, and what remains unknown, about the relationship between substance use and suicidal behaviour in LMICs. From the review results, I argue that: (1) the assessment and management of substance use should be integral to the care of at-risk patients; (2) suicide prevention research in LMICs should focus on reducing hazardous use of alcohol, tobacco, cannabis, opioids, sedatives, stimulants and non-medical use of medications; and (3) more research is required to understand the nature of the relationship between substance use and suicidal behaviour.

In articles two and three, I report on two quantitative studies, consisting of a retrospective review of patient files to establish the demographic characteristics, patterns of medical service utilisation, and sociocultural differences between self-harm patients who report substance use and other self-harm patients (i.e. those who reported no substance use) among 238 self-harm patients. I focused on acute use of substances (i.e. substance intoxication) (AUS) in article two and chronic substance use (i.e. recurrent substance use over an extended period) (CSU) in article

three. In article two, bivariate and multivariate statistical analysis showed that one in five self-harm patients reported AUS. Compared to other self-harm patients, the AUS sub-group were more inclined to: have depressed levels of consciousness on admission; utilise more medical resources; report previous acts of self-harm; and state an intention to die as a result of their injuries. In article three, 37% of self-harm patients reported CSU. Compared to other self-harm patients, the CSU sub-group were more likely to be male; to inflict damage to their body tissue; and to have a history of self-harm. A significantly smaller proportion of CSU patients, compared to other self-harm patients, were referred for psychiatric assessment ($p<0.001$).

For article four, I conducted a qualitative study by analysing semi-structured interviews of 80 self-harm patients who were admitted to the hospital. I made use of a multiple-case study methodology and identified seven ways in which patients understood their substance use was implicated in their self-harm: impulsivity, poor judgment, and aggression; auditory hallucinations or paranoia related to substance use; substance use to facilitate self-harm; substance use as a method of self-harm; unsuccessful treatment for substance use disorder; the breakdown of substance use as a means of coping; and third-party substance use.

I conclude this thesis by, reflecting on the broad aim and offering recommendations for future research and suicide prevention at the hospital where data were collected.

OPSOMMING

Selfbeskadiging is ‘n vorm van selfmoordgedrag wat 'n ernstige openbare gesondheidsprobleem is in lae-inkomste- en middelinkomste-lande (LMIL). Die Wêreldgesondheidsorganisasie (WGO) identifiseer substansgebruik as 'n potensieel veranderbare risikofaktor vir sekere uitkomste onder individue wat selfbeskadig. Min is bekend oor die voorkoms en korrelate, aard, en konteks van substansgebruik onder selfbeskadigingpasiënte in Suid-Afrika. In hierdie proefskrif, ondersoek ek die verhouding tussen substansgebruik en selfbeskadiging, asook die sosiokulturele konteks waarin hierdie gedrag plaasgevind het, onder pasiënte wat behandeling ontvang in 'n stedelike hospitaal in die Wes-Kaap, Suid-Afrika.

Ek het 'n gemengde metode navorsingsontwerp onderneem en my gevolgtrekkings in vier tydskrif artikels aangebied. In die eerste artikel rapporteer ek die resultate van 'n sistematieseoorsig om ondersoek in te stel oor wat bekend is, en wat nog onbekend is, van die verhouding tussen substansgebruik en selfmoordgedrag in LMIL. Vanuit die resultate argumenteer ek dat: (1) die assessering en bestuur van substansgebruik ’n integrale deel moet wees van die versorging van risiko-pasiënte; (2) selfmoordvoorkomingsnavorsing in LMIL moet fokus op die vermindering van die gevaarlike gebruik van alkohol, tabak, cannabis, opioïede, kalmeermiddels, stimulante en die nie-mediese gebruik van medisyne; en (3) meer navorsing benodig word om die aard van die verhouding tussen substansgebruik en selfmoordgedrag te verstaan.

In artikels twee en drie, rapporteer ek oor twee kwantitatiewe studies wat behels die retrospektiewe hersiening van pasiëntlêers om die demografiese eienskappe, patrone van mediese diensbenutting en sosiokulturele verskille te identifiseer tussen selfbeskadigingpasiënte wat substansgebruik rapporteer en ander selfbeskadigingpasiënte (diegene wat geen

substansgebruik rapporteer het nie) onder 'n kohort van 238 selfbeskadigingpasiënte. In artikel twee het ek gefokus op die akute gebruik van substanse (d.w.s. substansinname) (AGS) terwyl ek in artikel drie gefokus het op chroniese substansgebruik (d.w.s. herhalende substansgebruik oor 'n verlengde tydperk) (CSG). In artikel twee het bivariate en multivariate statistiese analise getoon dat een uit vyf selfbeskadigingpasiënte AGS gerapporteer het. In vergelyking met ander selfbeskadigingpasiënte was die AGS-subgroep meer geneig om depressiewe vlakke van bewussyn te toon by opname in die hospitaal; gebruik te maak van meer mediesehulpbronne; langer hospitaalopnames te vereis; vorige selfbeskadigings dade te noem; en te beoog om te sterf as gevolg van hul beserings. In artikel drie het 37% van die selfbeskadigingpasiënte CSG geraporteer. In vergelyking met ander selfbeskadigingpasiënte was die CSG-subgroep meer geneig om manlik te wees; skade aan hul liggaamsweefsel te veroorsaak; en 'n geskiedenis van selfbeskadiging te hê. 'n Statistiesebeduidende kleiner persentasie CSG-pasiënte, in vergelyking met ander selfbeskadigingpasiënte, is verwys vir psigiatriese assessering ($p<0.001$).

In artikel vier het ek 'n kwalitatiewe studie gedoen deur semi-gestruktureerde onderhoude te analiseer van 80 selfbeskadigingpasiënte wat in die hospitaal opgeneem is. Ek het gebruik gemaak van 'n meervoudige gevallestudie-metodologie en het sewe maniere geïdentifiseer waarop pasiënte verstaan hulle substansgebruik betrokke was in hul selfbeskadiging: impulsiwiteit, swak oordeel, en aggressie; ouditiewe hallusinasies of paranoia wat verband hou met substansgebruik; substansgebruik om selfbeskadiging te fasiliteer; substansgebruik as 'n metode van selfbeskadiging; onsuksesvolle behandeling vir substansgebruiksversteuring; die ineenstorting van substansgebruik as 'n manier om moeilikhede te hanteer; en derdeparty-substansgebruik.

In die tesis gevolgtrekkingshoofstuk reflekteer ek op die breë doel van hierdie PhD-studie en maak ek aanbevelings vir toekomstige navorsing en selfmoordvoorkoming by die hospitaal waar data ingesamel is.

STATEMENT REGARDING BURSARIES AND JOURNAL PUBLICATION

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LIST OF ABBREVIATION

AIDS	Acquired immune deficiency syndrome
APA	American Psychiatric Association
ATS	Amphetamine-type stimulant
AUS	Acute use of substances
CSU	Chronic substance use
DSM	Diagnostic and Statistical Manual of Mental Disorders
EAP	East Asia and Pacific
ECA	Europe and Central Asia
ED	Emergency department
HIC	High income country
HIV	Human immunodeficiency virus
LAC	Latin America and the Caribbean
LIC	Low-income country
LMIC	Low-income and middle-income country
LOC	Level of consciousness
MeSH	Medical subject heading
MNA	Middle East and North Africa
NFSB	Non-fatal suicidal behaviour
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist
PSIS	Pierce Suicide Intent Scale
SA	South Africa
SAS	South Asia

SIB	Suicidal ideation and behaviour
SIPD	Substance-induced psychotic disorder
SSA	Sub-Saharan Africa
UMIC	Upper middle-income country
WHO	World Health Organization

CHAPTER 1: General introduction and methodology

1.1 Introduction

Suicide is the 10th leading cause of death, according to global estimates (Hawton & van Heeringen, 2009) with more than 800 000 deaths by suicide worldwide during 2012 (WHO, 2014a). The WHO Mental Health Action Plan aims to reduce suicide by 10% across all member states between 2013 and 2020 (WHO, 2013). Approximately 75% of suicides occur in low-income and middle-income countries (LMICs) (WHO, 2014a). People who use substances are at increased risk of engaging in suicidal behaviour (WHO, 2014a; WHO, 2014b; Bohnert et al., 2014) and self-harm (Ness et al., 2015). Consequently, the WHO report on Preventing Suicide highlights the need to target harmful use of substances and substance use disorders as priority areas of focus in global action in suicide prevention (WHO, 2014a). Understanding the relationship between substance use and suicidal ideation or behaviour (SIB) is particularly important for suicide prevention in LMICs where health care staff and resources are limited (Bantjes et al., 2016; Petersen, 2000) and where rates of substance use are high (GBD 2015 Risk Factors Collaborators, 2016; WHO, 2014b). Without a deeper understanding of the relationship between substance use and SIB, as well as considering the sociocultural context the behaviour occurs in, health care providers will be limited in their capability for effective evidence-based suicide prevention and intervention. It is against this backdrop that I decided to complete a PhD thesis by publication to examine substance use as a potentially modifiable risk factor of certain outcomes among patients who engage in suicidal behaviours, including self-harm. A detailed justification for doing this PhD thesis by publication is included in section 1.3.2.

Despite increasing research and prevention within the field of suicidology, the rates of suicide (McKeown, Cuffe, & Schulz, 2006; Nock et al., 2008) and suicidal behaviour (Kessler,

Berglund, Borges, Nock, & Wang, 2005) have not shown a significant decrease in decades (Franklin et al., 2017). During 2012, suicide was estimated as the second leading cause of death for ages 15 to 29 years worldwide (WHO, 2014a). For every suicide there are approximately 20 to 30 acts of non-fatal suicidal behaviour (NFSB) (WHO, 2014a). Furthermore, it is estimated that for every suicide attempt there are 10 individuals who experience suicidal ideation (Borges et al., 2010). A systematic analysis of global estimates for the burden of disease demonstrated a 24% increase in self-harm from 1990 to 2010 (Murray et al., 2012). The review further reported that among the 291 conditions assessed for their disease burden, self-harm was found to be the 18th leading contributor globally and the 27th leading contributor in southern Sub-Saharan Africa (Murray et al., 2012). Some caution is necessary when interpreting these results since reliable epidemiological data on self-harm are often hard to find among countries in Sub-Saharan Africa. A report of SA national injury mortality data showed that suicide accounted for 10% (n=3125) of injury deaths (Donson, 2010). Approximately 70% (69.2%, n=2164) of the individuals who died by suicide were between the ages of 15 to 44 years (Donson, 2010). The large proportion of individuals dying of suicide during their most productive life years has a devastating impact on society (e.g. political, economical, and community growth). As such, research focusing on suicide prevention needs to unpack why this behaviour persists despite increased prevention efforts.

There are a number of reasons why we need to expand our knowledge of the ways in which substance use is implicated in suicidal behaviour, while also incorporating the sociocultural context in which these behaviours occur. Gaining insight into the nature of the relationship between substance use and suicidal behaviour as well as the potential sociocultural influencing factors is a necessary step toward the planning and implementation of suicide

prevention among patients who visit the hospital. This is especially important in LMICs, including South Africa (SA), where rates of substance use and suicide are high (Bantjies & Kagee, 2013) and where health services are limited by poor infrastructure, inadequate training for health professionals, inaccessible or a lack of appropriate referral pathways (Lund, Petersen, Kleintjes, & Bhana, 2012), professional apathy or frustration with difficult working conditions, and limited funding or resources (Jacob, 2017). More broadly, this insight could be useful for policy makers to develop effective culturally sensitive community-level and population-level intervention prevention.

Without an understanding of the nature of the relationship between substance use and suicidal behaviour, health services in LMICs will continue to be inadequate in their approach to prevention and service delivery among individuals who engage in suicidal behaviour. A 12-month population-based SA study between 2002 and 2004 reported that only approximately 25% of adults with mental disorders received the care that they needed (Williams et al., 2008). More recent estimates reported difficulties around accessibility (e.g. negative attitude among staff toward patients, overcrowding, long waiting periods, and unhygienic conditions) and affordability as main reasons for not seeking or receiving care in an urban area in SA (Stellenberg, 2015). Limited health care staff also contributes to difficulties in mental health care service delivery. A survey among public sector mental health service resources and utilisation in SA demonstrated that there are 0.28 psychiatrists per 100 000 population, 0.32 psychologists per 100 000 population, and 0.40 social workers per 100 000 (Lund, Kleintjes, Kakuma, Flisher, & MHaPP Research Programme Consortium, 2010). In more recent data, a comparisons between HICs and LMICs demonstrate significant differences in the availability of psychiatrists, nurses, psychologists, and social workers (Rathod et al., 2017). For example, in 2014 the WHO reported

that there were 0.39 psychiatrists per 100 000 population in SA (an upper-middle-income country), compared to, 12.4 psychiatrists per 100 000 population in the United States of America (WHO, 2015). Cultural or religious belief systems and stigma that influence help-seeking behaviour further dampen the planning and implementation of prevention efforts in mental health care (Rathod et al., 2017). As such, suicide prevention should also consider the social or cultural determinants and possible related resources instead of focusing only on psychiatric risk factors or psychiatric care. This point is explored further in section 7.2.2.3.

In this PhD study, I focused on one hospital setting, due to increasing evidence in support of the need for context specific evidence-based research to guide suicide prevention and intervention strategies. The setting is Groote Schuur hospital, which is a large academic hospital in Cape Town, SA (hereafter referred to as the hospital). The hospital is a Government-funded hospital that is situated near Observatory, which is a Cape Town suburb on the north-facing slopes of Devil's Peak. The hospital is situated near Valkenberg psychiatric hospital and serves nearby areas such as Mowbray and Salt Rivier. Based on census data from 2011, the population of the suburb consists of 9 207 (4605 male; 4602) individuals with a racial makeup of Black African (39.7%), Coloured (18.5%), Indian / Asian (3.6%), and White (34.4%) (Sub Place Observatory, 2011). The hospital is also within reasonable travel distance of specialist and non-specialist (e.g. Family and marriage society of SA) health services. In section 1.3.5, I offer a more detailed discussion of why I chose this study setting.

1.1.1 Aim of this research

In this exploratory study my aim was to investigate the association between substance use (acute and chronic) and self-harm, as well as considering the sociocultural context in which this behaviour occurred among patients who presented for treatment at an urban hospital in SA.

1.1.2 Background

This PhD study forms part of a broader on-going study. During 2013, my supervisor was approached by clinical staff from the hospital who were concerned about high rates of self-harm among patients presenting for treatment. Following this approach, a broader study was set up as a joint venture between clinical staff at Groote Schuur Hospital, the Department of Psychiatry at University of Cape Town, and the Department of Psychology at Stellenbosch University. The project is supported by funding from the National Research Foundation and Medical Research Council and Stellenbosch University. In 2014, the study started to investigate the epidemiology of self-harm and the sociocultural context in which this behaviour occurs among patients who presented for treatment at a large urban hospital in SA. The aim of the larger study is to plan hospital-based interventions to reduce the likelihood that patients who presented for treatment following self-harm would engage in future acts of fatal suicidal behaviour and NFSB. Provisional data collected from 2013 to 2014 confirmed high rates of self-harm at the hospital, with an average of four presentations of self-harm per week during this period. Moreover, provisional data demonstrate that acute and chronic substance use are directly and indirectly implicated in self-harm. However, the nature and sociocultural correlates of this relationship are not clear. In this PhD study, I set out to investigate more closely the relationship between substance use and self-harm in this sample as well as the sociocultural context in which this behaviour occurs. The broader context of my PhD study is to make suggestions for future research and intervention at the hospital (see section 7.2.2. and section 7.2.3. respectively).

1.1.3 Rationale for the research

People who use substances are at increased risk of engaging in suicidal behaviour (WHO, 2014a; WHO, 2014b; Bohnert et al., 2014) and self-harm (Ness et al., 2015). There is

considerable epidemiological literature from high income countries (HICs) demonstrating that substance use correlates with suicidal behaviour (Hawton & van Heeringen, 2009; Wilcox, Conner, & Caine, 2004) and self-harm (Hawton, Saunders, & O'Connor, 2012; O'Connor, Rasmussen, & Hawton, 2009). However, there is a relative paucity of data that show the nature of the relationship between substance use and self-harm in LMICs such as SA. This gap in available literature makes it difficult to understand how substance use is implicated in self-harm, which in turn hinders the planning of empirically supported hospital-based interventions in SA. Moreover, it is important that prevention strategies are based on an ongoing evidence base since suicidal behaviour among different groups changes across time (Schlebusch, 2012).

In this study, I set out to investigate the association between acute and chronic substance use and self-harm at the hospital. A review of the literature suggests that for every completed suicide there are approximately 8 to 22 visits to an emergency department following an act of self-harm (Pavarin et al., 2014). Hospital samples among individuals who engage in self-harm are important because firstly, these cases are medically serious and may be at increased risk of adverse outcomes such as a greater risk of repeating self-harm compared to those who do not need medical attention (Kapur, 2009); and secondly, these individuals are already in the health care system so they have an opportunity to receive the help that they need. Samples of self-harm patients drawn from hospitals could provide important insight into the demographic and sociocultural characteristics of patients who use substances and engage in self-harm (Arensman, Corcoran, & Fitzgerald, 2011). A deeper understanding of the association between substance use and self-harm will contribute to the development of appropriate, cost-effective evidence-based prevention at the hospital.

Accurate epidemiological data on substance use and self-harm in SA provides insight into the extent of this public health problem and the characteristics of this at-risk population. However, epidemiological data on its own is not enough. In order to plan empirically supported context specific hospital-based interventions to address the problem, it is necessary to understand the sociocultural context in which these behaviours occur as well as the meaning the behaviour holds for the individuals who engage in it (Hjelmeland, 2011). Therefore, in this study I employed a mixed method approach for a more in-depth exploration of the direct and indirect pathways in which both acute and chronic substance use are implicated in self-harm. I provide a more detailed explanation for my decision to use a mixed methods approach in section 1.3.1.

1.1.4 Definition of key concepts

1.1.4.1 Suicidal phenomena

Self-injurious behaviour is made up of non-suicidal self-injurious behaviour and suicidal phenomena (see Figure 1.1). Nonsuicidal self-injurious behaviour is not included in this dissertation as this behaviour refers to painful injuries that are self-inflicted to the surface of the skin or body with the intent to reduce negative emotions or to resolve an interpersonal conflict and where the outcome is not potentially fatal (American Psychiatric Association [APA], 2013). The term ‘suicidal phenomena’ is used to encompass suicide (with the intent to die), suicidal ideation, and NFSB (with or without intent to die). The term ‘suicide’ is defined as any death caused by a self-inflicted injury with any intent to die as a result of the behaviour (Rosenberg et al., 1988). Suicidal ideation refers to thoughts and cognitions related to suicide but without observable action undertaken with the goal of ending one’s life (Beck, Kovacs, & Weissman, 1979). The term ‘non-fatal suicidal behaviour’ includes suicidal behaviour and self-harm. Suicidal behaviour is conceptualised as a range of actions that include a preparatory act or

behaviour, a suicide attempt, a self-interrupted/aborted attempt, or an interrupted attempt (Crosby, Ortega, & Melanson, 2011). As such, suicidal behaviour is a more direct and focused range of actions, all of which are characterised by action taken with the intention of ending one's life (Schlebusch, 2005). The distinction between suicide or suicidal behaviour and other forms of NFSB (i.e. self-harm) hinges on the intent to die. The issue of intent has a contentious history in suicidology literature. Establishing intent is complex because it is a non-observable aspect of self-injurious behaviours that can only be measured subjectively. The measure of intent may also be influenced by the individual's motivation for the behaviour as well as a reluctance to report level of intent (e.g. fear of stigma or hospitalization) (Fox, Millner, & Franklin, 2016; Posner et al., 2014). Therefore, the qualifier of any 'non-zero intent to die' is used to indicate that the individual may have had a part of themselves that wanted to die while another part did not want to die (Posner et al., 2014). Self-injurious behaviour is characterised as suicidal behaviour if any non-zero stated or inferred intent to die is associated with the behaviour (Posner, Brodsky, Yershova, Buchanan, & Mann, 2014). Nonsuicidal self-injurious behaviour is therefore characterised by zero intent to die as a result of the behaviour.

The main focus of this PhD study was on self-harm, which is defined as intentional self-injury or self-poisoning, regardless of level of suicidal intent, that has a non-fatal outcome and is non-habitual behaviour (Hawton et al., 2012; Platt et al., 1992; WHO, 2014a). Medically serious self-harm refers to an act of self-harm that requires medical attention (e.g. a visit to the emergency department of a hospital) (Conner, Beautrais, & Conwell, 2003).

There is no standard nomenclature that is consistently used in the field of suicidality to describe the different behaviours that comprise the broad spectrum of suicide-related behaviours (Silverman et al., 2007). As a result, the available literature in suicidology employs a wide

variety of terms that refer to the same behaviour (Silverman, 2006). The inconsistency across studies presents a barrier for accurate measurement, development, and implementation of clinical intervention and suicide prevention (Silverman, 2006). Therefore, Silverman recommends that efforts in suicide prevention need to work toward developing and implementing a standardized classification system (Silverman, 2011). Marsh, however, argues that some caution is necessary in embracing uniformity of definitions used within suicidology, as such a system suggests that suicide is individual or static (see section 2.1.1.4) and encourages the exclusion of concepts that fall outside of the medical-scientific model that in turn reduces alternative possibilities for thought and action within suicide prevention (Marsh, 2015). For this reason, I have chosen to use terminology that is not pejorative and is widely agreed upon in the available published literature (WHO, 2014a). The term self-harm as I have defined it here includes other types of behaviour such as suicide attempt and deliberate self-harm.

It is important to note that substance use and accidental overdose is not considered suicide or NFSB. Substance use and accidental, or nonsuicidal, overdoses do not fit into existing categories of suicide or NFSB because individuals engage in this behaviour to hurt themselves or to convey a message to others with zero intent of ending their life (Fox et al., 2016).

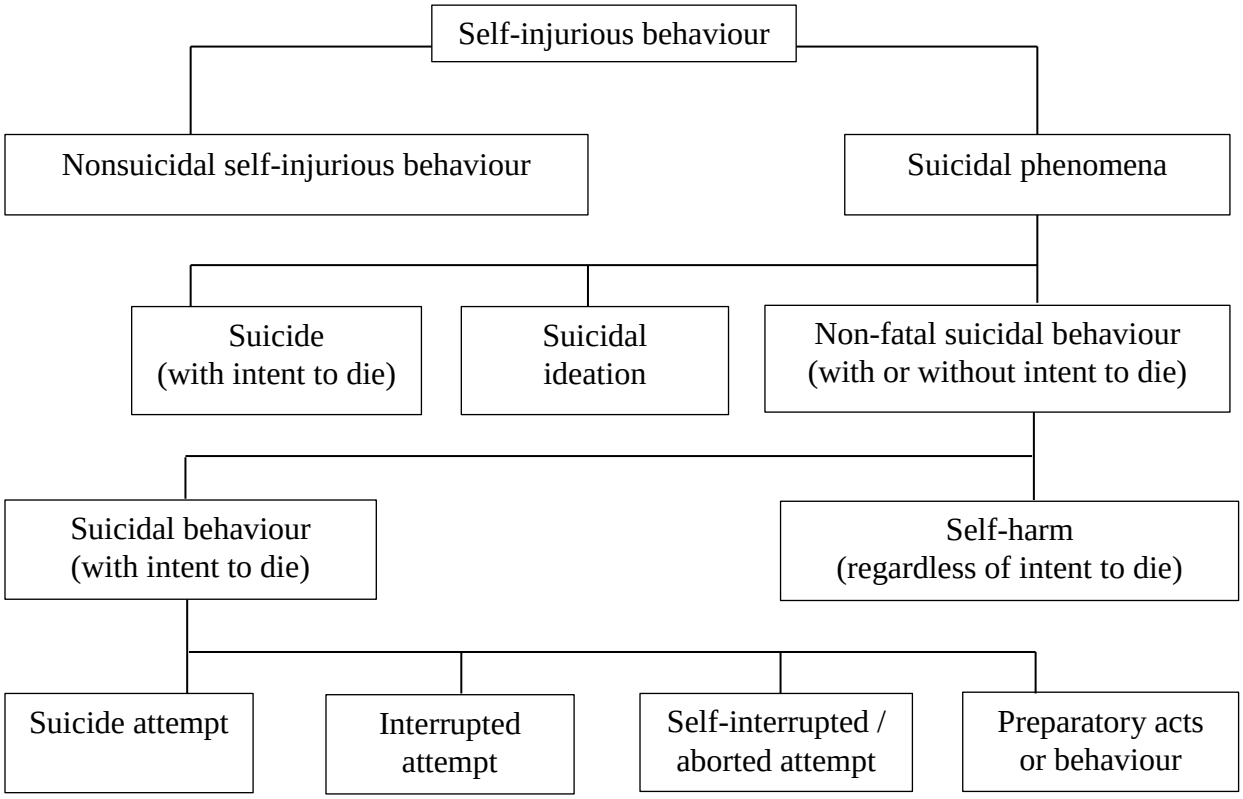

Figure 1.1 Flow chart of classifications of self-injurious behaviour.

1.1.4.2 Substance use

There is no one consistent way that substance use is defined and measured across studies globally. In this study, the range of substances used and dimensions of substance use were arranged according to the different classes of substances and dimensions identified in the DSM-5 (APA, 2013). Therefore, in this PhD study, the term 'substance' refers to alcohol, illicit drugs, and pharmaceutical medication used for non-prescription purposes. The term 'use' includes all dimensions of substance use, namely intoxication (i.e. drunkenness or use at the time of self-harm), use (i.e. any past or present use), and pathological use. The term 'pathological' is used here to refer collectively to substance misuse, abuse, addiction, dependence, and disorder.

The term 'acute use of substances' (AUS) is understood as substance use during or shortly before engaging in self-harm (Conner, Bagge et al., 2014). The term 'chronic substance

use' (CSU) is defined here as recurrent and harmful use of substances over an extended period of time. The definition I have used in the PhD study includes both substance use disorders and recurring patterns of hazardous substance use (Bechtold, Simpson, White, & Pardini, 2015; Conner, Bagge et al., 2014; Norström & Rossow, 2016; Papini, Ruglass, Lopez-Castro, Powers, & Hien, 2017).

1.1.5 Prevalence and epidemiology

1.1.5.1 Self-harm

Self-harm is a serious public health concern globally (WHO, 2014a), and in SA (an upper middle-income country [UMIC]) (Joe, Stein, Seedat, Herman, & Williams, 2008; Naicker, de Jager, Naidoo, & Mathee, 2016). Estimates from the WHO suggest a global annual suicide mortality rate of one million people, which is predicted to increase to 1.5 million by 2020 (Bertolote & Fleischmann, 2009). Lifetime prevalence rates among individuals from HICs (i.e. Canada, France, Korea, New Zealand, Puerto Rico, Taiwan, United States, West Germany) and one UMICs (i.e. Lebanon) show that between 3% to 5% of the population have made a suicide attempt at some point during their life (Weissman et al., 1999).

In SA, there are an estimated 5 514 to 7 582 suicides annually (Burrows & Schlebusch, 2008), while the prevalence of self-harm is less well documented. In 2009, a retrospective descriptive study of medico-legal post-mortem investigation data from mortuaries in SA showed an estimated suicide rate of 13.4 per 100 000 members of the population (Matzopoulos et al., 2015). A study that aimed to describe the patterns of causes of deaths in a rural demographic surveillance site in northern KwaZulu-Natal in SA in the period 2000 to 2011 found that 1.3% women and 0.3% of men died following intentional self-harm (Mossong, Byass, & Herbst, 2014).

Data from HICs suggest that self-harm most commonly occurs during late adolescence and early adulthood, with findings from a community-based study suggesting that approximately 10% of adolescents report self-harm (Hawton et al., 2012). Findings from retrospective life-course studies show that the risk of fatal self-harm is more likely among those who started self-harm at a younger age and those who reported repeated acts of self-harm (Fortune, Stewart, Yadav, & Hawton, 2007; Phillips et al., 2002). A UK study reported that 33% of the 10 498 patients who presented to hospital following self-harm, repeated self-harm within a 12 month period (Lilley et al., 2008). In some cases individuals engaged in repeated acts of self-harm within days of receiving medical attention (Gunnell, 2008). A UK population based birth cohort study among 4799 respondents showed that self-harm was associated with poorer psychological outcomes (e.g. depression, substance use, or anxiety) and poorer educational or employment outcomes (Mars, Heron et al., 2014). A cost-analysis incidence study as part of the WHO/Euro Multicentre Study on suicidal behaviour demonstrated that self-harm was associated with considerable health service and social costs (Sinclair, Gray, Rivero-Arias, Saunders, & Hawton, 2011).

In SA, the available published data suggest that self-harm is more common among South Africans who are female; younger (i.e. in the age group of 18 to 34 years); less educated; single; unemployed; socially isolated; or have a history of trauma (Toit et al., 2008; Joe et al., 2008). Likewise, a hospital-based study in Durban demonstrated that the majority of patients presenting to hospital following a suicide attempt were female, younger of age, not in a relationship, unemployed, had a low-income status, and reported a primary school education as their highest level of education (Naidoo & Schlebusch, 2013). A retrospective descriptive study of patients admitted to an accident and emergency department in KwaZulu-Natal following self-harm found

that most patients were young, single, African women with at least a secondary level of education (Ani, Ross, & Campbell, 2017). Data from the South African Stress and Health study among 4351 adult South Africans as well as a patient sample drawn from a Johannesburg hospital demonstrated that a history of previous NFSB served as a risk for repetition of NFSB (Joe et al., 2008; Moosa, Jeenah, Pillay, Vorster, & Liebenberg, 2005). More recent data from the Health, Environment and Development study among 2795 urban households in Johannesburg demonstrated that self-harm was associated with households exposed to a violent crime during the past year (Adjusted Odds Ratio (AOR) 5.72; 95% CI 1.64–19.97); that have a member suffering from a chronic medical condition (AOR 8.95; 95% 2.39–33.56); and households exposed to indoor smoking (AOR 4.39; CI 95% 1.14–16.47) (Naicker, de Jager, Naidoo, & Mathee, 2016).

These investigations from HICs and middle-income countries (MICs) suggest that a history of self-harm serves as a strong predictor of future self-harm. More research is needed to assess if this is true for low-income countries (LICs) (Mars, Burrows, Hjelmeland, & Gunnell, 2014). As such, more studies are needed that focus on preventing repeated acts of self-harm and in doing so, relieving the pressure on health care resources that may result from future suicidal behaviour.

1.1.5.2 Substance use

Substance use constitutes a significant public health concern with global estimates suggesting that annually 3.3 million deaths are attributed to alcohol use (WHO, 2014b). Epidemiological studies from the US demonstrate that the 12-month prevalence rates of substance dependence are approximately 12% for alcohol dependence and 3% for illicit drugs, while the lifetime prevalence rates for alcohol use disorders are approximately 8% and illicit

drug use disorders 3% (Merikangas & McClair, 2012). National trends in substance use among US youth from 2002 to 2014 showed that the 12-month prevalence of any substance use decreased by 27.1%, while substance dependence or abuse decreased by only 0.6% (Han, Compton, Blanco, & DuPont, 2017). Findings from a survey on the epidemiology of substance use among adolescents in London showed that 20.4% of students aged 15 to 18 years reported lifetime use of at least one recreational drug, 47.8% reported alcohol use and 18.7% reported cannabis use (Penney, Dargan, Padmore, Wood, & Norman, 2016).

In 2010, estimates suggested that SA adults on average drink approximately 27.1 liters of pure alcohol annually (WHO, 2014b). However, the same report demonstrated that approximately 59.4 % of adults abstain from drinking which suggests that the minority of SA adults drink heavily (WHO, 2014b). More recent data from the Global Burden of Disease Study 2015 demonstrate that the harmful use of alcohol was the fifth leading cause of death in the country (GBD 2015 Risk Factors Collaborators, 2016). The South African National Council on Alcoholism and Drug Dependence and the South African Community Epidemiology Network on Drug Use conducted a study among drug abuse treatment centres across nine provinces. Their findings demonstrated that alcohol was the most frequent substance to be used (51%), followed by cannabis (21%), crack/cocaine (9.6%), heroin/opiates (7.9%), methamphetamine (Tik) (4.5%), prescription/over-the counter drugs (2.0%), and cannabis/mandrax (1.7%) (Ramlagan, Peltzer, & Matseke, 2010).

A number of studies demonstrate high rates of substance use among SA youth. For example, lifetime prevalence of township secondary school pupils in the Free State was 40% for alcohol use and approximately 5% for cannabis use (Masitsa, 2007). A regional study conducted among youth from rural KwaZulu-Natal demonstrated that alcohol is the most common

substance used among high-school pupils (Taylor, Jinabhai, Naidoo, Kleinschmidt, & Dlamini, 2003). Findings from a cross-sectional study among 895 pupils from Atteridgeville, Gauteng demonstrated a lifetime prevalence of 51.4% for alcohol, 25.2% for smoking, and 13.2% for cannabis (Moodley, Matjila, & Moosa, 2012).

Epidemiological data from a US national survey on drug use and health between 2005 and 2013 showed that 40.2% of the total of 16 757 patients with cannabis use disorder reported past-year admission to an emergency department, while 10% reported past-year inpatient hospitalization (John & Wu, 2017). The same study reported that alcohol use disorder, being female, a lower level of income, depression, and other substance use disorders were associated with increased health care utilization (John & Wu, 2017). In another national epidemiological survey from the US, cannabis use disorder was associated with being male, a young adult, and from a lower income level (Kerridge et al., 2017).

In a SA cross-sectional study among adults from nine provinces, substance use was associated with being male and from a lower level of education (Ramlagan et al., 2010). Among SA youth, substance use has been consistently associated with being male (Reddy, Resnicow, Omardien, & Kambaran, 2007; Taylor et al., 2003; Tshitangano & Tosin, 2016), a lower socio-economic status (Flisher, Parry, Evans, Muller, & Lombard, 2003; Morojele, Brook, & Brook, 2017), and poorer academic performance (Reddy et al., 2007).

1.1.5.3 Substance use in self-harm

A review of the literature from HICs and MICs showed a prevalence rate of 10% to 73% for alcohol intoxication among self-harm cases (Norström & Rossow, 2016). The lifetime prevalence for suicide attempts ranges between 17% and 43% among Canadians who use substances (e.g. cocaine, amphetamine, opioids, sedative-hypnotics, cannabis and alcohol)

(Artenie et al., 2014). Data on medically serious self-harm presentations to a hospital in Ireland demonstrated that alcohol played a role in 43% of self-harm presentations (Griffin et al., 2017).

Studies focusing on the association between suicide or suicidal behaviour and substance use among samples from middle-income countries (e.g. SA) and LICs are scarce. The available literature on suicide from middle-income countries reports that approximately 39% of individuals who die by suicide test positive on assays of blood alcohol (Scribante, Blumenthal, Saayman, & Roos, 2004). Findings from a hospital sample in SA showed that substance use contributed to 7.1% of NFSB (Toit et al., 2008). In a more recent hospital-based study, 41% of participants reported that they smoke, while 35% consumed alcohol at the time of the study (Naidoo & Schlebusch, 2013). In a review of the epidemiological data of suicide, Bantjes and Kagee highlight the need to study the role of other (non-alcohol) substances in suicide given the high incidence of drug use in SA (Bantjes & Kagee, 2013).

Findings from two national registries in Ireland showed that patients who reported that alcohol consumption played a role in their self-harm were male, between the ages 25 and 64 years, and employed a drug overdose or drowning as the method of their self-harm (Griffin et al., 2017). Substance use is known to be a strong predictor of NFSB (Schlebusch, 2012) and represents a risk factor for suicide in the self-harm population (Haw, Hawton, Houston, & Townsend, 2001). Findings from a meta-analysis estimate that individuals who use alcohol are approximately 9.8 times more likely to engage in self-harm that ends in suicide when compared with the general public (Wilcox et al., 2004). Although limited, studies investigating other (non-alcohol) substances (e.g. opioid use) estimate that these individuals are nearly 14 times more likely to engage in self-harm that leads to suicide (Wilcox et al., 2004). The estimated lifetime self-harm repetition rates range between 25% and 86.2% among individuals with substance

misuse or dependence (Beautrais, 2004; Cavanagh, Caron, Sharpe, & Lawrie, 2003; Cuijpers & Schoevers, 2004; Haw et al., 2001).

Alcohol or drug use has also been reported as a risk factor for increased risk of engaging in suicidal behaviour in LICs (Mars, Burrows et al., 2014). Findings from a cross-sectional survey among suicide attempters in Butajira, Ethiopia showed that people who reported problem drinking were more likely to report lifetime suicide attempts than those people who reported no problem drinking (Alem, Kebede, Jacobsson, & Kullgren, 1999). Similar findings were reported among people who were admitted to a hospital in Tanzania following a suicide attempt (Ndosi & Waziri, 1997). A prospective cohort study among 2042 adolescents from Chile reported that girls who persistently misused cannabis were at slightly increased risk of self-harm (OR 1.14 95 % CI 0.36–3.60 for boys and OR 4.08 95 % CI 1.31–12.74 for girls) (Spears, Montgomery, Gunnell, & Araya, 2014).

Published literature from HICs and LMICs suggest that people who use substances are at increased risk of engaging in SIB with a proportion reporting repetition of suicidal attempts and poor treatment compliance (Monti, Cedereke, & Öjehagen, 2003). As such, it is important to conduct studies focused on reducing self-harm among individuals who use substances. A deeper understanding of the ways in which substance use is implicated in self-harm could help to inform the development and implementation of prevention and intervention in this area. In the next section, I provide a brief description of some examples from the literature of the known ways in which substances play a role in self-harm.

1.1.6 Ways in which substance use is implicated in self-harm

There are a number of ways that substance use might be implicated in self-harm (Breet & Bantjes, 2017; Hawton & van Heeringen, 2009; Wilcox et al., 2004). As an illustration, some

ways in which substance use is associated with self-harm are briefly discussed below. In Chapter 5, I offer a detailed insider view of the different ways in which substance use was implicated in the medically serious self-harm of patients who presented for treatment at the hospital.

There is a considerable body of literature to show that individuals who use alcohol are at elevated risk for engaging in self-harm. Disinhibition produced by substance use facilitates the shift from suicide ideation to attempt, often impulsively. Acute use of substances, particularly alcohol, is known to increase impulsivity; psychological distress (i.e. feelings of hopelessness and loneliness); aggressiveness (toward other and the self); and inhibition of coping skills (Hufford, 2001; Wojnar et al., 2009). There is also some evidence that substance intoxication at time of the suicidal behaviour is associated with methods that result in damage of body tissue (i.e. firearms) (Conner, Li, Meldrum, Duberstain, & Conwell, 2003), suggesting that individuals who engage in suicidal behaviour while intoxicated might be more likely to engage in medically serious self-harm. Fewer studies have investigated the association between drug use and suicidal behaviour. For example, data from longitudinal studies in Australia and New Zeeland showed that age of starting drug use is an important factor to consider since daily cannabis use before the age of 17 years was associated with an increased risk of suicide attempt (OR=6.83, 95% CI 2.04-22.90, $p<0.05$) (Silins et al., 2014). The findings from this study highlights the importance of efforts that reduce adolescent cannabis use.

Similar characteristics have been observed among individuals who report chronic substance use when compared to individuals who report AUS. Findings from developed countries suggest that those with CSU are more likely to be unemployed, have a history of childhood trauma, and report higher scores of anger, impulsivity, and aggression (Haw et al., 2001; Roy, 2003). Social withdrawal, breakdown of social bonds, and social marginalization

associated with chronic substance use could also serve as risk factors for suicidal behaviour (Pompili et al., 2010). The combination of co-morbid chronic substance use and psychiatric disorder (e.g. personality disorder or major depressive disorder) is also known to be a strong predictor of repetition of self-harm (Finkelstein et al., 2016). The association between acute or chronic drug use and self-harm has not been studied sufficiently in SA. This is important given the high rates of substance use such as cannabis, cocaine, heroin, and TIK (crystal methamphetamine) in SA (van Heerden et al., 2009).

Limited studies have investigated substance-induced psychotic disorder (SIPD). The available published research specifically reports a link between the use of methamphetamine and SIPD, with higher rates of SIPD among drug users who report a younger age of onset and more frequent drug use (Hides et al., 2015). Lifetime diagnosis rates of SIPD are estimated to range between 16% and 39% among methamphetamine users (Hides et al., 2015). Findings from psychiatric patients in Taiwan reported that continuous use of methamphetamine and poly-substance use were predictors of suicide attempts among drug users with SIPD (Wang, Chiang, Su, Lin, & Chen, 2012). A Finnish study reported that a younger age, poly-substance use, depressive symptoms, and physical violence against others were strong correlates of suicide attempts among individuals with a diagnosis of SIPD (Suokas et al., 2010). Few studies have investigated the role of substances in the association between SIPD and self-harm.

Substance use may play an indirect role in self-harm when an individual has to deal with the difficulties of other people's substance use (Norström & Rossow, 2016). Parental substance use is known to play a role in offspring suicidal behaviour (Brent & Mann, 2005; Glowinski et al., 2001; Gould et al., 1996; Statham et al., 1998).

1.1.7 Suicide prevention in South Africa

In recent decades, there has been a steady increase in the development and implementation of national suicide prevention strategies across HICs, while LMICs continue to lag behind. Effective prevention initiatives require consistent and reliable information on SIB in order to identify high-risk groups and to explore trends that might inform the development and evaluation of timeous and adequate suicide intervention or prevention (Schlebusch, Burrows, & Vawda, 2009). During 2012, the WHO reported that none of the countries in the African region, including SA, had a formal national suicide prevention plan (WHO, 2014a). In 2013, the World Health assembly proposed action for WHO Member States to reduce suicide by developing and implementing comprehensive national strategies for suicide prevention (WHO, 2013). At the time of this PhD study, no formal national strategy for suicide prevention exists in SA. However, Schlebusch (2012) has identified some priorities and prevention strategies in an effort to propose a framework for a national suicide prevention strategy in SA.

There were 28 countries in 2012 known to have suicide prevention strategies (WHO, 2014a). Regarding LMICs, Bhutan (Dorji et al., 2017), Iran (Malakouti et al., 2015), and Sri Lanka (De Silva et al., 2016) are among the few countries that have some form of national prevention strategies. The process of establishing a national suicide prevention strategy requires a participatory approach between multiple and diverse stakeholders. This means that stakeholders from government, non-government organizations, and health, non-health sectors need to pool their resources and skills to work toward the communal goal of suicide prevention. For effective suicide prevention, national suicide prevention objectives could include, among others, enhancing surveillance and research, identifying vulnerable groups, encouraging responsible reporting by the media, restricting access to means of suicide, creating awareness of

environmental and individual protective factors, and reducing stigma pertaining to suicide (Khan & Syed, 2011; WHO, 2014a).

Although there are a number of general principles for suicide prevention in the literature, no two strategies can be identical due to the influence of the cultural and social context in which the behaviour occurs (WHO, 2014a). However, strategies developed elsewhere might be helpful if the goals, objectives, and interventions followed in suicide prevention are tailored according to the context in which they are implemented.

1.1.8 Research questions

The study had three main research questions, each of which had several sub-questions. Each primary research question was addressed in a different research project with a distinct methodology that is described in section 1.3 and in the respective chapters. The research questions are presented in Table 1.1:

Table 1.1
Primary research question and sub-research question for each project

Primary research questions:	Sub-questions:
1. *What are the ways in which substance use is associated with SIB in LMICs?*	a) What is known about the ways in which substance use is associated with SIB in LMICs? b) What remains unknown about the ways in which substance use is associated with SIB in LMICs? c) Where should researchers focus their attention with regard to the ways in which substance use is implicated in SIB in LMICs?

Table 1.1
Primary research question and sub-research question for each project (Continued)

	Primary research questions:	**Sub-questions:**
2.	*What are the demographic, medical service utilisation, and sociocultural differences between patients who report AUS or CSU and other patients (i.e. patients who report no substance use) among of 238 self-harm patients presenting for treatment at an urban hospital in SA?*	<u>AUS patients (i.e. individuals who were intoxicated at the time of engaging in self-harm):</u> a) What is the prevalence of AUS among patients who present to the hospital for treatment following self-harm? b) How do patients who report AUS differ from other self-harm patients (i.e. no AUS) with respect to demographic characteristics, methods of self-harm, intention and reasons for self-harm, the extent of the injuries sustained, and utilisation of medical services? <u>CSU patients (i.e. individuals who reported a history of substance use):</u> c) What is the prevalence of CSU among patients who present to the hospital for treatment following self-harm? d) How do CSU patients differ from other self-harm patients (i.e. no CSU) with respect to demographic characteristics, methods of self-harm, intention and reasons for self-harm, the extent of the injuries sustained, and utilisation of medical services?

Table 1.1

Primary research question and sub-research question for each project (Continued)

3. *What can we learn from the themes emerging from interviews with patients who engage in self-harm about the direct and indirect ways in which substance use is implicated in self-harm and the sociocultural context in which these behaviours occur?*	*a)* What meaning does an act of self-harm hold for an individual who engages in self-harm and uses substances (i.e. how do self-harm patients who use substances understand their own behaviour?) *b)* What is the psycho-social and cultural context in which individuals who use substances engage in self-harm? *c)* What are the circumstances precipitating an act of self-harm for individuals who uses substances? *d)* How was substance use implicated in medically serious self-harm from the perspective of patients who were admitted following self-harm? *e)* What are the intended and unintended consequences of a past act of self-harm for individuals who use substances? *f)* What is the personal history of substance use and self-harm (i.e. the duration, progression, severity and intensity of symptoms of substance abuse and self-harm respectively) and their history of treatment (where and how did they access medical and psychological help/support in the past)?

1.1.9 Theoretical framework

The field of suicidology has been hindered by the limited use of theory that explains suicide and suicidal behaviour (Bantjes et al., 2016; Hawton & Van Heering, 2000). As noted above, research in the field of suicidology have been dominated by epidemiological studies that identify correlates and risk-factors for suicidal behaviour. What is less known, is the nature of this association or why some individuals engage in suicidal behaviours while others do not. Some theories have been proposed in recent years to explain how individual psychological characteristics or sociocultural and contextual factors might be implicated in the association between substance use and suicidal behaviour. A list of some of these theories along with a brief description of each is provided in Table 1.2. The theoretical framework for this study is discussed below.

This study is grounded in the field of social epidemiology and thus focuses on the effects of social-structural factors (e.g. gender, social networks) on health (Honjo, 2004). Theories within social epidemiology are united by their assumption that the distribution of disease is profoundly influenced by contextual, social, cultural, economic, and political factors (Almgren, 2013). Studies grounded in social epidemiology seek to identify the social characteristics that affect the pattern of health and disease in a specific context, while also trying to understand mechanisms (such as agency and access to health care) and the destitution of resources, as well as political factors (such as who benefits from and who pays the costs of particular health outcomes) (Anderson, 2004). There are three main theories employed by social epidemiologists: 1) psychosocial; 2) social production of disease; and 3) ecosocial theory and related multi-level frameworks (Honjo, 2004). For the purpose of this PhD study, I made use of ecosocial theory and related multi-level dynamic perspectives as the theoretical framework for this study.

The use of ecosocial theory and its multi-level dynamic perspective in this study was deemed appropriate because a primary focus of this PhD study was to examine the sociocultural context in which substance use is associated with self-harm. The ecosocial theory and related multi-level framework seeks to understand health, disease, and well-being in relationship to every level of biological, ecological, and social organisation (Krieger, 2001). This theory proposes that an individual's biological influences cannot be separated from an individual's social influences (Kriegel, 2001). Therefore, an individual's health, disease, and well-being cannot be understood without knowledge of an individual's biological characteristics as well as aspects of an individual's history, cultural, and societal influences.

Despite receiving only modest attention over the last 20 years, some literature does exist that articulates theory on the sociocultural connection between substance use and suicidal behaviour. For example, the harmful use of alcohol and related behaviour could evoke antagonistic responses from other individuals that result in conflict and the breakdown of social bonds that might have otherwise offered support (Norström, 1995; Skog, 1991). Cultural acceptance of substance use might also play a role in suicidal behaviour. Individuals who form part of a culture that is accepting of alcohol use might be less isolated than individuals who form part of a dry drinking culture (Norström, 1995; Ramstedt, 2001). Moreover, the national pattern of substance use along with the policies and laws governing access to substances might also influence the nature of the association between substance use and suicidal behaviour. There are more complex and alternative hypotheses to the examples that I have offered here. More research should be done to explore why substance use is associated with suicidal behaviour.

Table 1.2
Theories that are commonly endorsed within the field of suicidology

Theoretical models of suicidal behaviour	Description
Diathesis-stress-hopelessness model of suicidal behaviour (Schotte & Clum, 1987)	Suicide and suicidal behaviour may be determined by an interplay of cognitive vulnerability (e.g. social problem-solving) and stressors (e.g. environmental or life events) experienced by the individual.
Interpersonal-psychological theory (Joiner, 2005)	Suicide and suicidal behaviour may be the result of the interaction between: 1) feelings of not being connected with others (i.e. thwarted sense of belonging); 2) thoughts and feelings of being a burden to others (i.e. perceived burdensomeness), and 3) a diminished fear of pain or death due to continuous experiences of painful or fear-provoking life events.
Social theory (Durkheim, 1897)	Suicide and suicidal behaviour may be inversely associated with an individual's level of social integration or regulation. Substance use could have destructive consequences for social integration and could hamper social regulation, which in turn leads to suicide and suicidal behaviour.

1.2 Layout of the chapters and publication status

As mentioned in section 1.1.1, this dissertation follows a PhD (by publication) style. Therefore, traditional sections such as the Methods, Results, and Discussion are replaced as each article includes each of these components along with a review of the relevant literature. Each article is presented as an individual chapter. The dissertation's chapters have been planned to integrate the four articles into a cohesive whole. A short description is offered at the beginning of

each article chapter in order to facilitate continuity. I provide a summary of each of the chapters in this dissertation below.

1.2.1 Brief summary of each chapter in this dissertation

Chapter 1 consists of the introduction to the dissertation. The introduction provides a brief description of the broader study which this dissertation forms part of, followed by definitions of key concepts used and the rationale for the research. These include epidemiology of self-harm, reasons for focusing on substance use among self-harm, prevalence of substance use among self-harm, ways in which substance use is implicated in self-harm, factors that hamper suicide prevention, and justification for suicide prevention research. The aim of the study is stated, followed by an outline of the research questions and sub-questions.

In Chapter 2, I discuss some conceptions and theories of suicide prevention.

Chapters 3 to 6 are presented in manuscript format and have currently been submitted for peer-review to suitable journals (see Table 1.3). I was the first-author for all of the articles. Details with regard to authorship contribution is presented at the end of each article.

In Chapter 7, I discuss recommendations for future suicide prevention research in the field of substance use and self-harm at an urban hospital in SA.

Table 1.3
Layout of chapters and publication status

Chapter	Topic	Publication status	Authors and Title
1	General introduction, rationale, aim, and methodology.	-	-
2	Systematic review.	Submitted to *BMC Public Health.*	Breet, E., Goldstone, D., & Bantjes, J. (2017). Substance use and suicidal behaviour in low-income and middle-income countries: a systematic review.
3	Acute use of substances and self-harm.	Submitted to *BMC Health Service Research.*	Breet, E., Bantjes, J., & Lewis, I. Substance use and self-harm: prevalence, correlates and patterns of medical service utilisation among patients admitted to a South African hospital.
4	Chronic substance use and self-harm.	Submitted to *African Journal of Primary Health Care and Family Medicine.*	Breet, E., Bantjes, J., & Lewis, I. Chronic substance use and self-harm in a primary health care setting.
5	Substance use and self-harm: Case studies.	Published in *Qualitative Health Research.*	Breet, E. & Bantjes, J. (2017). Substance use and self-harm: Case studies from patients admitted to an urban hospital following medically serious self-harm.
6	Future research and concluding thoughts.	-	Substance use and self-harm at an urban South African hospital: recommendations for future suicide prevention and concluding thoughts.

1.2.2 Chapter 2: Conceptions and theories of suicide prevention

This chapter provides some literature to highlight the need for context specific

quantitative and qualitative research within LMICs. I offer an overview of some of the limitations of contemporary suicide research that inform prevention, followed by a discussion of how these limitations were addressed in this dissertation.

1.2.3 Chapter 3: Substance use and suicidal behaviour in low-income and middle-income countries: a systematic review.

This chapter provides a systematic review of the literature to highlight the paucity of work published in scientific and research literature on the association between substance use and SIB in LMICs. I begin by detailing the need for research that explores the relationship between substance use and SIB in LMICs. Key concepts are defined and a brief summary discussed of the theories that have advanced our understanding of the relationship between substance use and SIB. I then go on to describe the research questions for the review, search strategy and search terms used, the types of studies and participants included, steps followed to identify the studies, data extraction and management process, assessment of methodological quality, and the data analysis. In the results, I present literature on the association between a variety of substances and SIB. Notably more studies investigated alcohol as the substance than any other type of substance. In conclusion, I assert that suicide prevention should focus on reducing substance use as a potentially modifiable risk factor of SIB in LMICs. I also state a few suggestions for future research.

1.2.4 Chapter 4: Substance use and self-harm: a cross-sectional study of the prevalence, correlates and patterns of medical service utilisation among patients admitted to a South African hospital.

In this chapter, I document the prevalence and correlates of AUS (i.e. substance use during or shortly before engaging in self-injurious behaviour) among patients treated at an urban

hospital in SA. An overview of the association between AUS and self-harm in HICs and SA is provided. Details are described with regard to data collection procedures, measures used, and the statistical analyses completed. In the results I provide a glimpse of the range of substances used, methods of self-harm, level of consciousness on admission and medical intervention received, suicidal intent, level of admission and length of hospital stay, stated intention, suicidal self-injury, stated reasons for self-harm, history of self-harm, and whether the act was impulsive or not. In the conclusion I affirm that AUS may be associated with more violent and medically serious self-harm in SA. I then go on to argue that future research should explore the context in which these behaviours occur with a specific focus of reducing the utilisation of scarce medical resources in the country.

1.2.5 Chapter 5: Chronic substance use and self-harm in a primary health care setting.

In this chapter, I detail the epidemiology of CSU and self-harm to highlight the implications for primary health care service delivery and suicide prevention in SA. I offer definitions of key concepts and a brief description of the epidemiology of CSU and self-harm. I then go on to discuss that CSU is a modifiable risk factor for repetition of self-harm and offer literature showing that self-harm patients account for a significant proportion of patients who present for treatment in the emergency department. I argue that a visit to the emergency department provides a window of opportunity not only to treat the presenting problem but also to treat precipitating factors. In furthering the argument, I propose that a visit to the emergency department could be used as an opportunity to reinforce health promoting behaviours, provide psycho-education, and make appropriate referrals. This is particularly important in LMICs, like SA, where people with mental health problems do not typically have access to specialised health care services. The study design, setting, sampling strategy, measures used, data analysis, and

ethical considerations are described. In the findings, I suggest that CSU is associated with greater medical service utilisation from primary health care settings which highlights the need for psychiatric services to be an integral component of primary care. I conclude the chapter by emphasising that a better understanding of the epidemiology of CSU and self-harm is a first step in organising care for these patients, providing early detection, and delivering effective interventions for this vulnerable population.

1.2.6 Chapter 6: Substance use and self-harm: Case studies from patients admitted to an urban hospital following medically serious self-harm.

In Chapter 5, I take the reader through qualitative data from interviews with patients in an effort to delineate distinct ways in which substance use was implicated in self-harm. I start the chapter by explaining that the available published literature on the association between substance use and self-harm is dominated by uncontrolled descriptive studies that have explored a handful of variables that researchers have assumed are important. I go on to highlight that there is a scarcity of qualitative studies in the field. In the chapter, I emphasise that a major strength of employing qualitative methodology is that it permits an exploration from the perspective of the participants to illustrate how they make sense of the diverse and complex ways in which substance use is mentioned in medically serious self-harm. I offer an overview of the quantitative and the small body of qualitative research on substance use and self-harm before stating the aim for the article. In the methods, I detail how a multiple-case study design was followed and how I used inductive thematic analysis to make sense of the data. This description is then followed by details on the study setting, participants, and steps followed during data collecting. In the findings I bring to a fore different ways in which participants understood the links between substance use and their self-harm. Finally, I further highlight how substance use cannot be

separated from other factors (such as strong emotions and situational stressors) in the aetiology of self-harm.

1.2.7 Chapter 7: Substance use and self-harm at an urban South African hospital: recommendations for future suicide prevention and concluding thoughts.

In this chapter, I discuss possibilities for future research and action in the field of suicidology with a focus on substance use. I continue to emphasise the importance of considering the sociocultural context in order to plan effective prevention and intervention at the hospital. Before making recommendations for future research and action, I reflect and expand on some of the critique of contemporary suicidology offered in Chapter 1. This is done in order to highlight what this research has contributed to the field and to assess if the aim for this PhD study was achieved. I also describe some limitations of this PhD study. I conclude this chapter by considering whether the findings from this study may be transferred to other settings, not only in SA but also other LMICs.

1.3 Methodology

1.3.1 Why I chose a mixed methods research design

In this study I used a mixed methods research design as a combination of quantitative and qualitative data helped to strengthen the exploration of how substance use is implicated in self-harm. A mixed-methods research approach permits a broadening of the research questions that form part of this PhD study, while also allowing for an investigation of the subjective or lived experiences of patients (Kral, Links, & Bergmans, 2012). The quantitative component of this study investigated the prevalence, characteristics and relationship between AUS or CSU and self-harm respectively. For a more in-depth understanding and description it was necessary to conduct qualitative research to explore the different ways that substance use was implicated in

self-harm as well as the sociocultural context in which these behaviours took place. A qualitative approach is pivotal as it enabled me to explore the relationship between substance use and self-harm as well as important sociocultural factors in ways that would not be possible using quantitative methods with predetermined and standardised questions (Malterud, 2001).

1.3.2 Justification for doing the PhD by publication

Given that we used different quantitative and qualitative methods it is conceptually clearer to present the various methods as separate publications each with a specific research question, methodology, results, and discussion. These articles were then put together to form a cohesive whole as one dissertation with one broad research aim. Given the well-established correlation between substance use and suicidal behaviour in developed (Bagge et al., 2015; Oliffe et al., 2012) and developing countries (Scribante et al., 2004) as well as the relatively high prevalence of substance use among people who report suicide (Bantjes & Kagee, 2013) the topic deserves urgent attention. Publishing each section as the data was collected was the most efficient way to contribute to the available research and as such, to contribute to current empirically supported hospital-based interventions. This study is the first to give a holistic overview of the prevalence, correlates (from quantitative data), and different ways (from qualitative data) in which substance use was implicated in self-harm. This is an exciting new field to develop at Stellenbosch University.

1.3.3 My reflections

The importance of reflexivity has been highlighted for its importance in qualitative research (Watt, 2007). Due regard was given to issues of reflexivity and how reflexivity shapes the research. This was accomplished through close communication between supervisor and

student as well as the keeping of a reflexive journal. The reflexive journal was used to keep a record of methodological decisions (e.g. steps taken to ensure accountability, transparency, and truthfulness), the reasons for these decisions, logistics of the study, and reflection upon what was happening in my own process. During this study, I had direct interaction with patients who presented to the hospital for treatment following self-harm. In the interviews, I listened to stories of their subjective lived-experiences and struggles related to self-harm and substance use. My experience of the issues discussed could have influenced the manner in which I asked questions as it would have been difficult, at times, to hide my reaction to what was being said. I also remained mindful of the impact my age, gender, ethnicity, status as a researcher and not a clinician, and absence of shared experiences (e.g. substance use or self-harm) could have on the interviews and analysis or interpretation of the data.

1.3.4 Systematic literature review

The review offered in Chapter 3 demonstrates the available published literature on the association between substance use and suicidal behaviour in LMICs. The review demonstrates what is known about the ways in which substance use is associated with SIB in LMICs, what remains unknown about this association, and where we should focus our attention in future research. Details with regard to the search strategy, inclusion criteria, exclusion criteria, and data analysis are described in Chapter 3. The search strategy for each database, country classification of LMICs included in the review, study quality assessment criteria, and the final assessed study quality for each included article are discussed in Chapter 3.

1.3.5 Why I chose the study setting

There are compelling reasons for exploring the relationship between substance use and self-harm in this specific setting. First, cultural and social conditions are important determinants that may influence the association between substance use and self-harm (Fitzpatrick, Hooker, Kerridge, 2014; Hjelmeland, 2016). Given the important role of sociocultural context in SIB, it is not appropriate to transfer directly findings from one context to another (Schlebusch, 2012; WHO, 2014a). Patients at the hospital may experience unique problems such as poverty, lack of transport to different types of care, inability to access secondary or tertiary health care services, high rates of alcohol and illicit drug use, and access to means for self-harm, which patients in private hospital might not. Understanding these unique factors may guide the planning and implementation of context specific research and prevention (WHO, 2014a). Second, evidence suggest that individuals who reside in SA communities with a low socio-economic background tend to seek health care from tertiary hospitals (Petersen, Bhana, & Swarts, 2012). The hospital is a large tertiary hospital that serves communities with varying socio-economic backgrounds. Third, as mentioned in section 1.1.3, the cases that present to hospital following self-harm are medically serious and may be at increased risk for repetition of suicidal behaviour compared to individuals who do not require medical attention (Gunnell et al., 2008). Fourth, individuals who seek treatment from the hospital are already in the health care system and their seeking treatment presents a window of opportunity to receive the care that they need. Fifth, there are no other studies that I know of that have investigated the association between substance use and self-harm at an urban SA hospital.

1.3.6 Participants

1.3.6.1 Quantitative study

The sample consisted of 238 patients who presented to the emergency department of the hospital for treatment following engagement in self-harm. All patients who were older than 18 years, and who were identified by the medical staff as having engaged in self-harm were included in the sample. More detail on participant characteristics were presented in Chapters 3 and 4.

1.3.6.2 Qualitative study

The sample consisted of 80 patients who were admitted to the hospital following a medically serious act of self-harm. Patients who were interviewed were over the age of 18. The interviews were conducted in English or Afrikaans as the language of communication. All isiXhosa mother-tongue speakers were given the option of having an isiXhosa-speaking interpreter. Detail with regard to the participants included in the qualitative study is described in Chapter 5.

1.3.7 Data collection

1.3.7.1 Quantitative study

The quantitative study aimed to investigate the prevalence and correlates of substance use among patients who presented for treatment at the hospital following an act of self-harm. Data were collected from a retrospective review of hospital records of patients who presented for medical treatment following an act of self-harm over a 12 month period between 16 June 2014 and 29 March 2015. The data were analysed to investigate the prevalence and correlates of AUS and CSU among patients who presented for treatment at the emergency department. Data

collected included patients' demographics, time of admission, day of admission, date of admission, method of self-harm, level of admission to the hospital, stated intension, stated reason for the attempt, history of self-harm, and history of psychiatric/psychological treatment (see Appendix A).

The data were extracted from patient records by the researcher with the help of an experienced psychiatric nurse under the supervision of Dr Jason Bantjes. Patients were identified from the register that is kept in the Accident and Emergency Unit. Data were collected directly from patients' medical folders. It is important to notice that there were no questions included in the questionnaire that are not routinely asked to self-harm patients. As such, the data collection was not any more intrusive or potentially upsetting than the normal hospital assessment and psychiatric evaluation of self-harm patients. More detail on the data collection process is offered in Chapters 4 and 5.

1.3.7.2 Qualitative study

The qualitative study aimed to delineate the different ways that substance use was implicated in self-harm by examining interviews with individuals who engaged in medically serious self-harm that required an admission to hospital. Data were collected from semi-structured interviews (see Appendix B) with patients who presented for medical treatment following an act of self-harm. All interviews were audiotaped and transcribed. The interviews were conducted by Dr Jason Bantjes who is registered with the Health Professions Council of South Africa as a psychologist. The interviews were only conducted once a medical officer had confirmed that the patient was medically stable and able to participate. The interviews were conducted in a way that was sensitive and empathetic. In the event where a patient became

distressed, the interview was stopped and the appropriate clinical staff were alerted to this. More detail on the data collection process is presented in Chapter 6.

1.3.8 Data analysis

1.3.8.1 Quantitative study

Data were captured and analysed using Statistical Package for the Social Sciences' (SPSS v.19) (SPSS Inc., Chicago, Illinois, USA). After descriptive analyses, univariate analyses of the association between substance abuse and self-harm was performed using chi-square statistics or Fisher's exact for categorical variables. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for each predictor variable. Between-group analyses of the continuous variables with nonnormal distributions were completed using the Mann-Whitney test. All variables that present a $p<0.05$ or lower in the univariate analyses were included in the multivariate analyses (logistic regression analysis). Statistical significance was set at $p<0.05$. Details about data analysis are offered in Chapters 4 and 5.

1.3.8.2 Qualitative study

Inductive thematic analysis was used to identify main themes emerging from the data which were coded and organised using Atlas.ti software version 7 (Atlas.ti, 2012). Specifically, I focused on the nature of implication (direct or indirect) of substance use among patients who had been interviewed (Braun & Clarke, 2006; Fitzpatrick & Boulton, 1994). The data were analysed against the backdrop of relevant research to support claims with evidence based practice and theory. The data were discussed and interpreted by Elsie Breet and Jason Bantjes (Barbour, 2001). Detail with regard to the steps followed in the data analysis is provided in Chapter 6.

1.4 Ethical considerations

As part of the larger study, institutional permission to conduct this study at the hospital had already been obtained from the relevant ethics committees at SUN (see Appendix C) and UCT (see Appendix D). The permission letter from the hospital has been attached in Appendix E.

Patients were asked to give informed consent prior to participation in an interview (see Appendix F). All interviews were conducted by a Psychologist registered with the Health Professionals Council of South Africa. All interviews were conducted in a manner that was sensitive and empathetic. During all of the interviews each participant was monitored closely and if it became apparent that the participant was distressed beyond what is reasonable during participation in this study, the interview was terminated and the patient was referred for psychological support to the Psychiatric Liaison Services Unit within the Department of Psychiatry and Mental Health, University of Cape Town. This process was managed by Dr K Louw (Psychiatrist, Psychiatric Liaison Services) in consultation with the clinicians responsible for the patients' care.

Where necessary, interviews were conducted in family rooms and other private interview rooms (in consultation with the ward staff and at times when these are not being used by the clinical staff) so as to protect patient confidentiality. Anonymity and confidentiality was protected by not recording patients' names and removing all details which could lead to the identification of individuals. Data were stored electronically on a password protected computer.

The collection of this data were done at a time and in a manner which did not interfere with the staff's normal duties nor compromise the medical care of the patients. There were no questions included on this data capture form which were not routinely asked to self-harm

patients. As such, the data collection was not any more intrusive or potentially upsetting than the normal psychiatric assessment of self-harm patients.

The available literature proposes that the use of patient medical folders for research purposes without obtaining informed consent directly from patients is permissible when: the research has been reviewed by the institutional review board, the research is considered low risk; identifiers are removed; and there is no practical way that the research study can be conducted without the waiver (Kass et al., 2003). Informed consent was not obtained from patient's whose medical records were reviewed for the quantitative component of this study. The process of collecting informed consent from patients who had already been discharged would have been too expensive, time-consuming, and produced selection bias as not all patients provided reliable contact information. Even though the use of patient medical files for research is a common practice, it is necessary to keep in mind that patients utilise hospital services because they are unwell, and not to become participants in research. A paucity of research exist on ethical issues and public attitudes related the use of patient medical folders in research. Even though this PhD study took care to store data in a way that patients cannot be identified, it is possible that some patients might have felt that their trust and confidentiality were betrayed by the use of personal medical record in research. Future research should explore this issue to illicit the perspective of academics and patients.

CHAPTER 2: Conceptions and theories of suicide prevention

2.1 Problems with suicide prevention and theories on the limitations of existing research

An in-depth investigation of the factors that hinder suicide prevention is not the focus of this PhD study. However, I highlight some factors in this chapter to illustrate the need for context specific quantitative and qualitative research within LMICs. To do this, I offer an overview of some of the limitations of contemporary suicide research that inform prevention, followed by a discussion of how these limitations were addressed in this dissertation. The topics described are based on views described in the book entitled Critical suicidology, transforming suicide research and prevention for the 21st century (White, Marsh, Kral, & Morris, 2016) and complemented by literature from the social movement called critical suicidology. To facilitate continuity for the reader, each sub-section is organised according to: 1) a description of the critique to illustrate how it is placed within and how it guides suicide research; 2) the limitations placed on research by accepting the critique as the dominant truth; and 3) the contribution made by my research to achieve the study aim in the light of this critique.

2.1.1 Focus on risk factor epidemiological studies

The available published empirical research in suicidology has predominantly employed studies within a risk-factor paradigm (Hjelmeland, 2016). As such, an overwhelming body of research exists to demonstrate the correlates and possible risk factors of SIB. A primary aim of research that identifies important risk factors is establishing an evidence base of correlates and trends that informs assessments and effective treatment for individuals who engage in SIB. It is partly through the use of risk factor epidemiological studies that the harmful use of substances has been established as a priority area in planning and implementing suicide prevention and

intervention. In addition, risk-factor studies demonstrate how some risk factors may interact, and how their combined effect further increases the risk for engaging in SIB.

However, some studies show that even when using tools to identify risk factors, researchers still find it difficult successfully to identify and treat individuals who engage in self-harm. Evidence of this is seen in a recently published meta-analysis which concluded that in spite of decades of suicide research, experts' ability to identify patients who will engage in suicidal behaviour is no better than chance and has not improved significantly in the last five decades (Franklin et al., 2017). Despite an abundance of risk-factor studies to inform the development of measures, prevention, and intervention for self-harm, there is still something missing from our approach, or perhaps thinking, about suicide prevention. Furthermore, the abundance and complex nature of risk factors are particularly problematic at the hospital where health care resources, time, and staff are limited. The medical and mental health care staff are unlikely to adopt suggestions if it only increases their already heavy workload especially in the absence of feasible and effective intervention or referral strategies. Therefore, careful consideration is needed to decide which factors in addition to substance use, should be considered among patients at the hospital who present for treatment following self-harm.

2.1.2 Suicidology is a science best explored with quantitative methods

It is in principle not wrong to think of suicidology as a science but what is important is how the concept of science is understood and how this perception determines the research scope, discourse, and methods used. The current field of suicidology is positioned within a positivist framework that considers quantitative studies as research that is substantial, worthy of receiving funding, and more likely to be published (Marsh, 2016). In a critique of mainstream Suicidology, Hjelemland and Knizek report that only 3% of studies that were published within the three

dominant suicidology journals during the period from 2005 and 2007 had employed a qualitative research design (Hjelmeland & Knizeck, 2010). A systematic mapping of the relationship between poverty and suicidal behaviour in LMICs demonstrated that most of the 84 included studies employed a risk-factor paradigm without exploring the subjective lived-experiences of individuals who engage in suicidal behaviour (Bantjes et al., 2016). Similarly, a review of literature across the African continent concluded that more qualitative studies are needed which are able to take into account more of the complexity of suicidal behaviour (Mars, Burrows, Hjelmeland, & Gunnell, 2014). For example, a qualitative study among Canadian men living with depression explored their lived experiences of suicidal behaviour. The study illustrated how a complex interplay between alcohol or drug use to relieve emotional, mental, and physical pain, along with social isolation related to substance use and depression served to increase the risk of engaging in suicidal behaviour (Oliffe, Ogrodniczuk, Bottorff, Johnson, & Hoyak, 2012).

The predominance of quantitative studies, that are favoured for being objective and based on fact, is helpful in establishing potential risk factors or correlates of suicide and suicidal behaviour but they do not offer an insight into the experiences of those individuals who engage in such behaviours (Bantjes et al., 2016). There is increasing literature that criticises the certainty and enclosed nature of standardized, evidence-based approaches to suicide research, and the comparative lack of theory or situated meaning related to suicide. For example, White (2012) argues that the predominance of quantitative studies result in narrowly defined conceptualisations that may be scientifically rigorous but exclude from consideration possible alternative approaches or views of suicide prevention. A recent meta-analysis concluded that the homogeneity and methodological constraints of available risk-factor literature in suicidology poses a major limitation to consider the findings outside of the context in which they were

explored (Franklin et al., 2017). Therefore, caution is necessary when attempting to generalise suicide prevention strategies across contexts.

In planning this PhD study, I worked from the perspective that research may be strengthened by a shift away from the focus on producing a predominantly quantitative evidence base or identifying risk factors only. Instead, I attempted to move toward a deeper understanding of suicidology not only from a research or academic perspective but also from the perspective of subjective-lived experiences among those who engage in substance use and self-harm (Marsh, 2016). To be clear, my stand-point is not that research should halt all quantitative studies until we have the same number of qualitative studies. Rather, I am advocating that more qualitative research is needed in the field to supplement the quantitative work being done. Therefore, I incorporated a qualitative research component into this PhD study in order to gain a deeper understanding of the association between substance use and self-harm among patients at the hospital. Although helpful, we need to be careful not to idealize qualitative methods or to overstate the contribution that they make to the field of suicidology (Bantjes & Swartz, 2017).

2.1.3 Suicide is a symptom of pathology

A dominant assumption that drives suicide research, policy, and practice is that 95% to 100% of individuals who die by suicide had a psychiatric disorder (Joiner et al., 2016). Marsh explains that the psychiatric view that accepts expert knowledge as the dominant truth results in a limited or narrow understanding of suicide prevention because alternative sources of gaining knowledge are ignored (Marsh, 2010). The renewed interest in sociocultural context has led to some authors arguing that suicide is about more than mental disorders (Kral & White, 2017). The research in support of this claim mostly emerges from psychological autopsy studies where the family members of the deceased are interviewed.

Assumptions based solely on findings from psychological autopsy studies are problematic because diagnosis by proxy could generate data that is unreliable and invalid (Hjelmeland & Knizek, 2010). Moreover, the belief that suicide is pathological has resulted in somewhat of a self-authenticating style of reasoning among researchers that is defensive and does not allow sufficient room for meaningful reflection or necessary critique (Marsh, 2016). The argument is not that working within a predominantly medical or health paradigm is not helpful in preventing suicide. Rather, if suicide is understood through individual pathology, it is important to be cautious and acknowledge that there is limited empirical evidence that shows the nature of this relationship (Hjelmeland, Dieserud, Dyregrov, Knizek, & Leenaars, 2012).

In Chapter 1, I described a number of reasons why I aimed to investigate the association between substance use and self-harm at the hospital. For example, in the findings from a thematic analysis of interviews with patients from the same hospital where this PhD study was conducted, the author highlighted patients' requests for ongoing psychiatric and psychological care related to psychopathology (Bantjes, 2017). Consequently, psychopathology might be an important factor to consider in suicide prevention at the hospital. In this same study, patients also asked for assistance in resolving interpersonal conflict, in establishing a sense of connectedness within their community, and guidance on ways to resolve situational problems (e.g. joblessness) (Bantjes, 2017). In light of the literature that SIB is complex or multifaceted and should not only be viewed as pathological, it was important for me also to explore the context in which this behaviour occurred. In order to address the broader aim of this PhD study, I made sure to illuminate those sociocultural factors that, in combination with substance use, were related to self-harm among patients at the hospital (see Chapters 3 to 6).

2.1.4 Suicide is individual and separate from context or culture

Mainstream suicidology predominantly assumes that suicide is individual and static (Marsh, 2016). In contrast, Kral (1998) states that suicide is not something that originates within the individual and that we should not ignore the biological, psychosocial, or cultural factors that could be related to suicide. Jaworski (2010) suggests that even the definition of suicide, when understood as the act of deliberately taking one's own life, is problematic as it proposes that the individual is the sole agent involved in the behaviour. A number of authors argue that by viewing suicide as a construct that is individual and acontextual, we come to the belief that it is best treated by mental health professionals with no regard for the potential cultural or historical influences (Hjelmeland, 2010).

Increasing research emphasizes that suicide and suicidal behaviour is complex and deeply embedded in a context that is influenced by political, economic, cultural, and social factors (Kral, 1998; Mars et al., 2014). Likewise, available evidence suggest that cultural context plays a crucial role in the aetiology of SIB; arguing that findings in one context cannot simply be accepted to be relevant in another context (Chan, 2013; Kral, 2016; WHO, 2014a). By denying the role of context, we also neglect to acknowledge the resources that lie within culture and community that could help to prevent or intervene in suicide and suicidal behaviour (Morris & Crooks, 2015). Much of the evidence in suicide prevention has ignored the context, which White and colleagues (2016) mark as an opportunity for introducing new ways of thinking and developing alternative approaches to suicide prevention and research.

The context in which substance use was associated with self-harm is a theme throughout this PhD study. As stated in section 1.3.5, I specifically selected this hospital setting in order to gather information that could inform suicide prevention in this specific context. In Chapters 4

and 5, I demonstrate data from the hospital to investigate the association between self-harm and variables such as language, race, socio-economic status, level of education, and level of unemployment in order to consider some of the contexts in which substance use and self-harm occurred. In Chapter 6, I adopt a qualitative research methodology in order to gain a deeper understanding of the association between substance use and self-harm among patients at the hospital along with the context in which this behaviour occurred.

It is noteworthy that careful planning were put into the methodological steps followed in the qualitative leg of this study. This is in light of the critique that despite an increase in qualitative research in the last few years, some studies are of poor quality and do not clearly state the steps followed during data collection, analysis, and interpretation (Hjelmeland, 2016). In Chapter 6, I provide a detailed account of the methodology followed in order to convey transparency and credibility of the findings.

2.1.5 Most research comes from high income countries

While research on the association between substance use and self-harm is receiving increased attention in many HICs, the topic has been rather absent from research conducted in LMICs. Khan suggests that one reason why there has been a steady increase in suicides even though there has been a successful decrease in a number of HICs is that there might be a hidden epidemic of suicide across LMICs (Khan, 2005). A multi-country survey to determine research priorities for mental health in LMICs reported that suicide was under-prioritized in research relative to its disease burden (Sharan, Gallo, Gureie, Lamberte, & Mari, 2009). This is particularly concerning given that LMICs, including upper middle income countries such as SA, account for most of the global disease burden related to self-harm (Hawton & van Heeringen, 2009; Phillips & Cheng, 2012; Vijayakumar, 2004). The paucity of available research and

relative heterogeneity in a number of studies conducted across different LMICs may result from limited resources that adequately assess or report suicide and suicidal behaviour, stigma, and the legal status of suicide (WHO, 2014a). Given literature stating that what is true in one context cannot simply be accepted to be true in another setting, suicide prevention in SA would not be complete if it is based on knowledge from HICs that are not challenged by poverty and have greater government involvement in issues related to substance use and self-harm. Therefore, context specific research is imperative if we aim to develop and implement effective suicide prevention in SA or in the case of this PhD, at the hospital.

CHAPTER 3: Substance use and suicidal behaviour in low-income and middle-income countries: A systematic review

Preface to ARTICLE 1

Focus of the article

In this chapter, I present a systematic review, which represents the first of four articles, of the available quantitative published literature in order to investigate the association between substance use and suicidal behaviour in LMICs.

Why I needed to include this article in the dissertation

The current available published literature for the association between substance use and SIB have predominantly been conducted in HICs. This is problematic given that researchers are increasingly arguing that findings from one context cannot simply be extrapolated to another context without being tailored to that context. The association between substance use and SIB in LMICs have gained research attention in recent years. Some systematic reviews among LMICs demonstrate the association between alcohol, tobacco, or illicit drug use and dimensions of SIB. No systematic review exists to explore the association between all substance types and SIB in LMICs. A better understanding of this association in LMICs has implications for developing context specific evidence –based policies and suicide prevention. In this systematic review, I set out to address the first research question of this PhD study, which consisted of three sub-questions: a) what is known about the ways in which substance use is associated with SIB in LMICs; b) what remains unknown about the ways in which substance use is associated with SIB in LMICs; and c) where should researchers focus their attention with regards to the ways in which substance use is implicated in SIB in LMICs.

Submission details

The article was first submitted to The Lancet Psychiatry (THELANCETPSYCH-D-16-00802) on 9th December 2016 and was rejected by the journal on 12th December 2016. The feedback from the journal stated that although the topic was of interest to the journal, the quality of the evidence that was available to be included in the systematic review did not quite meet the threshold necessary to make significant changes to practice. The article was then submitted to the British Journal of Psychiatry (MS ID#: BJP/2016/197277) on 14th December 2016 and was rejected by the journal on 16th April 2017 with the option of reworking the article and resubmitting it to the journal. The journal editor explained that the article was rejected because it did not represent a sufficiently profound step forward in understanding that would be of broad interest to researchers outside of the specialist field and the methodology did not yield definitive results with an impact on practice. After careful consideration, we reworked the article and resubmitte it to an open access journal in order to make this information available to those individuals working in low resource environments who may not have access to non-open access journals.

The article was subsequently submitted to BMC Public Health (PUBH-D-17-01252) on 1st May 2017 where it is currently under review. This journal was deemed appropriate for the submission of the systematic review as the scope of the journal includes understanding the epidemiology and social determinants of health as well as the impact of these issues on health policies and interventions. I present the article in this dissertation in the format requested by the journal guidelines for authors. The references were prepared according to examples provided on the journal website that follows a Vancouver style type. The impact factor of the journal at the time of the study is 3.00.

Due to the length of the supplementary information, this information has been included at the end of the dissertation (see Appendix G). In addition, a supplementary document is provided at the end of this dissertation, which contains additional data that have been submitted to the journal as supplementary material but, due to length, could not be included in the appendices of this dissertation.

Conference output

The findings from this part of the study was presented at the World Psychiatric Association international congress held in Cape Town between 18th and 22nd November 2016.

Authorship contributions

Elsie Breet coordinated the review; designed the search strategies; contributed to the searches, screening, quality assessment, data extraction, and analysed the data; contributed to the interpretation of the data; and wrote the first draft. Daniel Goldstone contributed to the searches; screening; quality assessment; and critically revised the manuscript. Jason Bantjes provided advice throughout the process; contributed to the interpretation of the data; and assisted with the writing of this review.

Substance use and suicidal behaviour in low-income and middle-income countries: a systematic review

Elsie Breet*, Daniel Goldstone and Jason Bantjes

Email addresses: elsie@sun.ac.za, 17041244@sun.ac.za, jbantjes@sun.ac.za

Elsie Breet MSc, Daniel Goldstone BSc (Hons), and Jason Bantjes D Lit et Phil.

Department of Psychology, Stellenbosch University, Stellenbosch, South Africa.

*Correspondence: Elsie Breet, Department of Psychology, Stellenbosch University, Private Bag X1 Matieland, South Africa, 7602.

Abstract

Background: Understanding relationships between substance use and suicidal behaviour has important public health implications for suicide prevention in low-income and middle-income countries (LMICs), where 75% of suicides occur. This systematic review explored the associations between substance use and suicidal behaviour in LMICs.

Methods: We searched five databases using a combination of keywords for substance use, suicidal behaviour and LMICs to identify English-written quantitative studies published between January 2006 and February 2016. Data were extracted to provide an overview of what is known about the topic, highlight gaps in the literature, and explore the implications of current knowledge for suicide prevention. Studies included in the review were assessed for methodological quality using the Scottish Intercollegiate Guidelines Network checklist.

Results: Analysis of included studies (N=108) demonstrated a consistent positive association between substance use and suicidal behaviour across all substances (i.e. alcohol, tobacco, cannabis, illicit drugs, non-medical use of prescription drugs), all dimensions of substance use

(i.e. intoxication, use, and pathological use) and all dimensions of suicidal behaviour (i.e. suicidal ideation, non-fatal suicidal behaviour, and suicide). Most of the available research evidence comes from upper-middle-income countries, only 23% comes from lower-income and low-income countries. Most studies focused on alcohol and tobacco, while neglecting substances such as cannabis, opioids, sedatives, stimulants, misuse of prescription medication, inhalants, and hallucinogens. Most of the studies employed a cross-sectional design, were conducted within a risk-factor paradigm, and provided little information about the potential interaction between variables.

Conclusions: Public health suicide prevention policy and research in LMICs should take account of the fact that: substance use is a potentially modifiable risk factor; assessment and management of substance use is integral to the care of at-risk patients; reducing consumption and hazardous use of substances in LMICs is important for suicide prevention; and research needs to be expanded to include more theory driven research that focuses on all dimensions of substance use and dimensions of suicidal behaviour, while employing more sophisticated statistical methods.

Keywords: Substance use, Suicidal behaviour, Low- and Middle-income country, Systematic review

Background

Suicide prevention, particularly in low- and middle-income countries (LMICs), is a serious public health challenge. Suicide is the 15th leading cause of death worldwide, with more than 800,000 people dying by suicide each year [1]. Seventy-five percent of suicides occur in LMICs, where the estimated age-standardized suicide rate is 11·2 per 100,000 people and the male-to-female ratio is 1·6:1 [1]. Research from high-income countries (HICs) suggests that substance use is a potentially modifiable risk factor for suicide [1]. Global action plans and strategies endorsed by the World Health Assembly consider substance use a priority area for global action in preventing suicide. The World Health Organization (WHO) Mental Health Action Plan 2013 to 2020 aims to reduce suicide rates by 10% across countries [2]. It has been proposed that suicide prevention efforts should focus on the full range of suicidal phenomena, including suicidal ideation and non-fatal suicidal behaviour (NFSB) [1]. It is within this context that we set out to conduct a systematic review of literature published in English reporting on the relationships between substance use and SIB in LMICs. We provide a synthesis of the research in this area and highlight gaps in the literature. The findings of this systematic review will be of interest to public health policy makers and researchers who are concerned about suicide prevention in LMICs.

For the purpose of this review, suicidal ideation refers to any thoughts of death, intention to kill oneself, or planning to end one's life. Non-fatal suicidal behaviour is understood as intentional self-injurious behaviour that is non-habitual, with or without suicidal intent and with a non-fatal outcome [1, 3]. Suicide refers to any act of deliberately killing oneself, and is synonymous with fatal suicidal behaviour [1]. The term suicidal ideation and behaviour (SIB) is

used to denote the full spectrum of suicidal phenomena, including suicidal ideation (SI), NFSB and suicide.

Globally, harmful alcohol use is implicated in an estimated 3·3 million deaths annually (5·9% of all deaths) and contributes to approximately 4·6% of disability-adjusted life years [4, 5]. Rates of deaths attributable to alcohol are almost double among males (7·6%) when compared with females (4%) worldwide [5]. Illicit drug use also constitutes a significant risk to the global burden of disease and disability. Approximately one out of every 20 people aged 15 to 64 years old reported illicit drug use at least once during 2013, where the substances used were commonly cannabis, opioids, cocaine and amphetamines [6]. A mortality rate of 40·8 drug-related deaths per million people aged 15 to 64 years old was reported in 2013, with drug overdose being the most common cause of death [6]. Across all drug types, it is roughly estimated that two thirds of the years of life lost and lived with disability are attributed to men [6]. Harmful alcohol use and illicit drug use estimates in LMICs vary greatly across settings and the available information is limited by inadequate national registries in these countries [5]. For example, 40% of the alcohol consumed in low-income countries (LICs) is unrecorded [1].

It is well established that SIB is associated with psychopathology, principally depressive disorders, bipolar mood disorders, personality disorders and psychotic illnesses [7, 8]. However, substance use and substance use disorders are also clearly associated with increased risk of suicide. For example, alcohol plays a role in every fifth suicide [5], while tobacco and illicit drug use (e.g. cannabis and heroin) have been positively associated with SIB [9]. The current evidence base for the association between substance use and SIB comes predominantly from research conducted in HICs [10]. In recent years, the association between substance use and SIB in LMICs has received increasing attention [1].

A number of hypotheses and theories have been advanced in an effort to explain the links between substance use and SIB. Biological theories postulate that substance use (e.g. acute intoxication that increases impulsivity or disinhibition and impairs judgement and problem-solving abilities) represents a vulnerability or predisposition (diathesis) to SIB. Within this model, stressful events (e.g. a depressive episode or relationship conflict) act as triggers which can lead to SIB [11]. The sociological theory of SIB suggests that the risk for SIB is inversely associated with the degree of social integration or regulation [12]. Problematic substance use may hold destructive consequences for social integration and disturb social regulation, which in turn leads to SIB [11]. Interpersonal theory builds on this premise by postulating that suicide risk results from the simultaneous experience of a low sense of belongingness or connectedness, perceived burdensomeness and the capability to engage in SIB [13, 14]. Social epidemiological theories posit that an individual's risk for suicide depends not only on their personal experiences, but also on the interplay between cultural, economic, social and environmental factors [15, 16].

While research on the association between substance use and SIB is receiving increased attention in many HICs, the topic has been rather absent from research conducted in LMICs. Given literature stating that what is true in one context cannot simply be accepted to be true in another setting, suicide prevention in LMICs would not be complete if it is based on knowledge from HICs that are not challenged by poverty and have greater government involvement in issues related to substance use and self-harm. Therefore, context specific research is imperative if we aim to develop and implement effective suicide prevention in LMICs. No systematic review has explored the association between substance use and SIB in LMICs. Previous reviews have established an association between alcohol [11, 17-23], tobacco [24], or illicit drug [17, 21, 22, 25] use and dimensions of SIB, yet none have focused on all substance types and a full range of

SIB across all LMICs. It is within this context that we investigate: (a) what is known about the ways in which substance use is associated with SIB in LMICs; (b) what remains unknown about the ways in which substance use is associated with SIB in LMICs; and (c) where researchers should focus their attention with regards to the ways in which substance use is implicated in SIB in LMICs.

Methods

Search strategies

A comprehensive search strategy was developed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist (PRISMA). We searched: PubMed/MEDLINE, CINHAL Plus (EBSCO), DARE (Database of Abstracts of Reviews of Effectiveness), Web of Science and PsycINFO (OvidSP) databases. A search strategy was designed for PubMed that combined keywords for suicide, substances, and LMICs. This strategy was then adapted for each subsequent database (Additional file 1; Appendix A).

We searched for studies with titles and abstracts published in English between 1 January 2006 and 10 February 2016. We limited our search to this period because an initial mapping exercise demonstrated that prior to 2006 there were few studies in LMICs that included robust methodologies investigating the association between substances and SIB. Reference lists of all included review articles were searched for relevant publications that had not been included after searching the databases.

Search terms

We included all substances and all dimensions of substance use (i.e. use, misuse, intoxication, withdrawal) identified in the substance-related and addictive disorders chapter of the Diagnostic and Statistical Manual of Mental Disorders (DSM) 4th edition [26] and 5th edition [27]. We

excluded studies that did not distinguish between illicit or prescribed drugs. Considering the classification of suicidal behaviour used by the WHO in 2014 [1], this review included a broad range of search terms for SIB, including suicidal thoughts/ideation, suicide plan, self-harm and attempted suicide. Studies related to violence, terrorism and assisted suicide were not included in this review. Search terms used to capture studies from LMICs included all the individual countries on the list of low- and middle-income countries from the World Bank (see Appendix G.2) [28]. All search terms included MeSH terms/subject headings.

Types of studies and participants

Studies reporting data on measures of the association or relationship between substances and SIB in LMICs were included in this review. We included cross-sectional studies, cohort studies, case-control studies, interrupted-time series studies, before-and-after studies, ecological studies and economic studies. Case report and case series studies were excluded. All included studies had to report quantitative data for bivariate or multivariate analyses that tested the association or relationship between substances and SIB. All studies that reported descriptive statistics only were not included in this review. In cases where a study reported both qualitative and quantitative findings, only the quantitative findings were reported.

Identification of studies

EB and DG conducted the literature search. A total of 2,237 articles were identified of which 647 were removed as duplicates (Fig. 3.1). After testing agreement on 30 articles, EB and DG independently reviewed the titles and abstracts of 1,593 articles to identify those articles that reported findings for an association or relationship between substances and SIB. The two authors did not discuss any of the articles during this screening process. Once compared, discrepancies were discussed until agreement was reached. If agreement could not be reached, JB was

consulted. This process yielded a total of 414 articles that met the initial screening criteria. Two authors independently screened the full-text of 414 articles against the inclusion and exclusion criteria, leaving 108 studies included in the systematic review. The literature search and screening process was managed using Zotero.

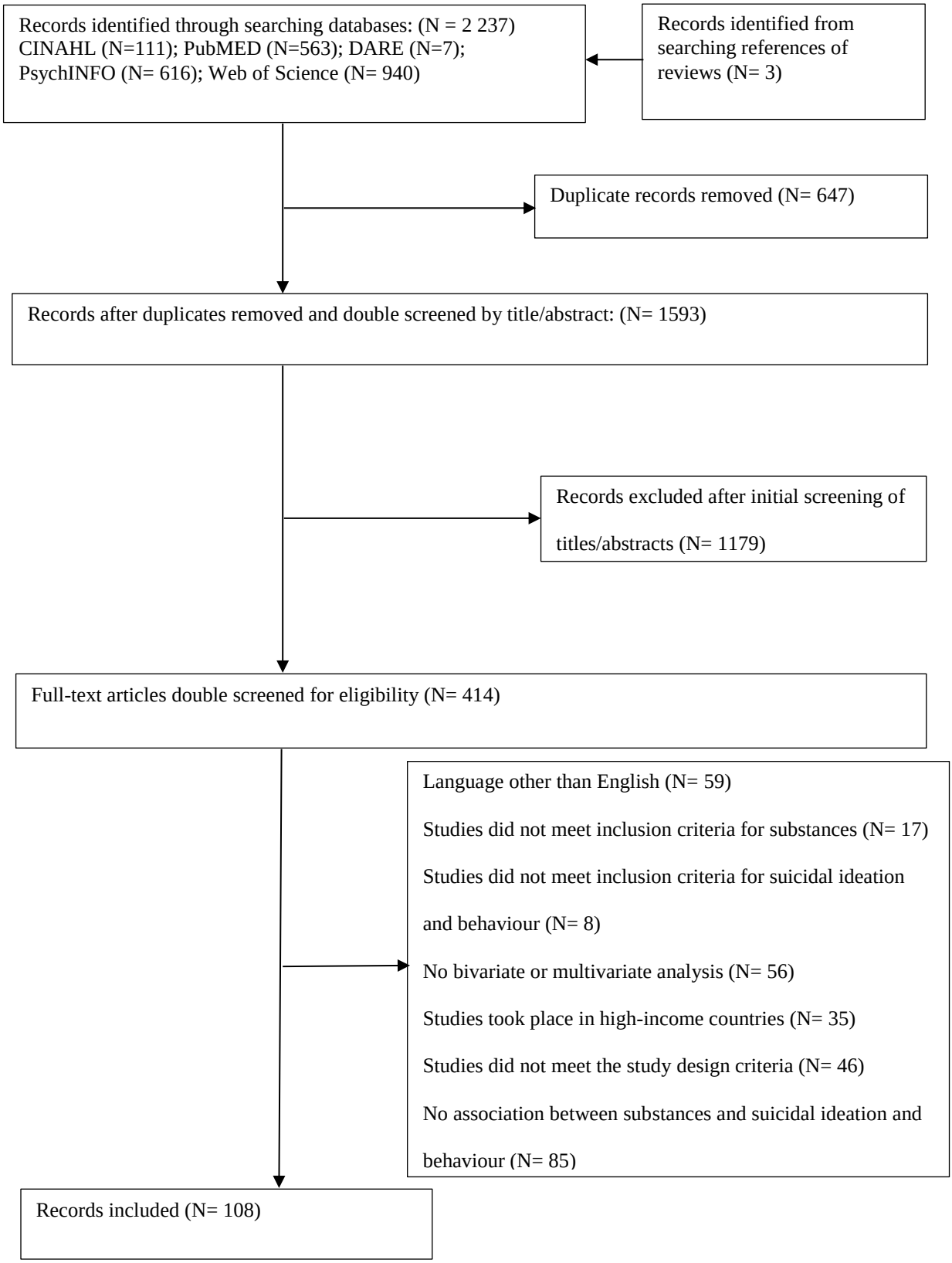

Figure 3.1 Flow chart of study search and selection process.

Data extraction and management

Data were extracted from the 108 included studies. The data that were extracted included: (a) study characteristics (author; year; country; region; data collection start and end date; rural/urban; study setting, aim and design; sample size; population age, gender and ethnicity); (b) substance dimensions; (c) SIB dimensions; and (d) association/relationship between substances and SIB (odds ratios and 95% confidence intervals). The data extraction was checked by EB for potential missing data, errors and statistical accuracy. We contacted authors in cases where data were not reported or information was unclear. Data extraction and presentation of the tables included in this systematic review was guided by other systematic reviews that focused on poverty in LMICs [29, 30].

Assessment of methodological quality

Quality and appropriateness of the included studies were assessed by DG and EB. A set of predetermined criteria derived from the Scottish Intercollegiate Guidelines Network checklist was used to assess the methodological quality and appropriateness of the studies included in this review (see Appendix G.3) [31]. Due to the large number of articles, time constraints, and limited resources, it was not possible for quality checking of all articles to be done independently by two authors. Quality checking of included studies was completed in three phases to ensure a high level of agreement between the authors. In the first phase, a baseline of 20 articles was independently quality checked by DG and EB. During quality checking, the authors did not discuss any of the articles. Once quality checking of the 20 articles was completed and compared, discrepancies were discussed until agreement was reached (see Appendix G.4). If agreement could not be reached, JB was consulted. In the second phase, a further baseline of 20 articles was independently checked and compared after quality checking was completed.

Discrepancies were discussed. In the third phase, the remaining articles were independently quality checked by DG (n=34) and EB (n=35).

Data analysis

In order to avoid bias related to the results of a single study that may be published in multiple publications, the unit of analysis was the study rather than the publication. The included studies were stratified according to substance type, substance dimension (i.e. intoxication, use, pathological use), suicide dimension and bivariate or multivariate method of statistical analysis.

In organising the data, we differentiated between studies that specified a particular substance (e.g. alcohol) and studies where the substance investigated was unspecified. We arranged the studies according to the different classes of substances identified in DSM-5 [27]. Dimensions of substance use were organised according to intoxication (i.e. drunkenness or use at the time of SIB), use (i.e. any past or present use) and pathological use. The term 'pathological' is used here to collectively refer to substance misuse, abuse, addiction, dependence and disorder. The collective term 'pathological substance use' was necessary, as the inconsistency in measures of substance use and lack of description used between studies made it difficult to meaningfully distinguish between misuse, abuse, addiction, dependence, and disorder.

We included data for positive, negative, null and unclear associations between substance dimensions and SIB. The results for bivariate and multivariate statistical analysis were reported separately in the tables and supplementary material so that we could highlight other influencing factors that were controlled for in multivariate studies. Given the heterogeneity of (a) study designs, (b) measures used to measure independent and dependent variables and (c) analysis strategies, it was not possible to conduct a meta-analysis.

Results

Overview of the studies

The characteristics of the 108 included articles are described in Table 3.1, while detail is reported in 'Additional file 1' on the disk attached to this PhD. With regards to study region, 28 studies were from East Asia and Pacific (EAP), 20 from Europe and Central Asia (ECA), 18 from Latin America and the Caribbean (LAC), 18 from Sub-Saharan Africa (SSA), 12 from Middle East and North Africa (MNA), ten from South Asia (SAS) and two studies from multiple regions. Only 41 of the 140 LMICs that were included in the search had published studies that could be reported in this review.

Table 3.1
Sample characteristics

Characteristic	Number of studies	Citations	%
Study region[a]			
EAP	28	32-59	26
ECA	20	60-79	19
LAC	18	80-97	17
MNA	12	98-109	11
SAS	10	110-119	9
SSA	18	120-137	17
Multiple study regions	2	138, 139	2
World Bank income group[b]			
LIC	5	114, 123, 130, 133, 136	5
LMC	19	47, 50, 60,61, 79, 109-113, 115-117, 119, 125, 127, 134, 135, 137	18
UMC	80	32-46, 48, 49, 51-59, 62-78, 80-108, 118, 120-122, 124, 126, 128, 130-132, 138, 139	74
Multiple income groups	4	33, 46, 138, 139	4
Study country			
Belarus	2	305, 306	1.4
Benin	1	301	0.71
Botswana	1	282	0.71

Table 3.1
Sample characteristics (Continued)

Characteristic	Number of studies	Citations	%
Brazil	14	38, 52, 61, 75, 90, 147, 247, 248, 249, 250, 251, 346, 352, 373	10
Bulgaria	1	251	0.71
China	16	91, 148, 160, 173, 176, 251, 268, 269, 370, 386, 388, 393, 394, 402, 403, 407	11
Chile	1	268	0.71
Colombia	1	251	0.71
Ethiopia	1	121	0.71
India	7	22, 169, 209, 251, 292, 348, 367	3.6
Iran	10	8, 96, 161, 241, 252, 253, 321, 332, 335, 341	7.1
Kenya	2	196, 281	1.4
Kiribati	1	284	0.71
Kosovo	1	19	0.71
Lebanon	2	224, 251	1.4
Malaysia	6	7, 67, 68, 69, 195, 397	4.29
Mexico	5	14, 51, 239, 251, 309	3.6
Morocco	1	399	0.71
Namibia	2	268, 281	1.4
Nepal	1	236	0.71
Nigeria	1	376	0.71
Pakistan	1	265	0.71
Peru	1	337	0.71
Philippines	2	268, 269	1.4
Romania	1	251	0.71
Russia	2	296, 307	1.4
Samoa	1	284	0.71
Serbia	2	229, 238	1.4
Solomon	1	284	0.71
South Africa	9	13, 74, 87, 140, 223, 251, 280, 283, 285	6.4
Sri Lanka	1	95	0.71
Swaziland	1	281	0.71
Taiwan	1	407	0.71
Thailand	6	71, 200, 245, 314, 349, 359	4.29
Turkey	11	104, 105, 108, 109, 113, 116, 179, 297, 369, 371, 377	7.9
Uganda	3	281, 311, 361	2.1
Ukraine	3	56, 251, 398	2.1
Vanuata	1	284	0.71
Vietnam	2	368, 407	1.4
Zambia	2	244, 281	1.4
Zimbabwe	2	281, 312	1.4

Table 3.1
Sample characteristics (Continued)

Characteristic	Number of studies	Citations	%
Location			
Urban	18	36, 50, 53, 56, 61,72, 79, 81,82, 88, 89, 94, 96, 112, 117, 124, 128, 136	17
Peri-urban	1	122	1
Rural	4	57, 77, 125, 134	4
Both urban and rural	21	33, 35, 37, 40, 44, 46, 51, 52, 54, 55, 58, 59, 78, 80, 98, 99,109, 113, 116, 121, 123	19
Multiple	3	102, 131, 138	3
Not available	61	32, 34, 38, 39, 41, 42, 43, 45, 47-49, 60, 62-71, 73-76, 83-87, 90-93, 95, 97, 100, 101, 103-108, 110, 111, 114, 115, 118-120, 126, 127, 129, 130, 132, 133, 135, 137, 139	56
Study setting			
Clinic based	7	38, 41, 43, 68, 92, 97, 131	6
Community based	18	33, 40, 44, 50, 54,57, 59, 85, 88, 103, 108, 110, 116, 121-123, 137, 138	17
Hospital based	34	35, 36, 45, 48, 53, 56, 62-64, 66, 67, 69, 73, 76, 78, 80, 83, 84, 86, 87, 91, 93, 98-100, 102, 105-107, 111, 113, 117, 120, 125	31
School based	27	32, 37, 39, 42, 46, 47, 49, 52, 55, 60, 65, 72, 94, 95, 101, 109, 112, 119, 124, 127-129, 132-135, 139	25
Others	22	35, 51, 58, 61, 70, 71, 74, 75, 77, 79, 81, 82, 89, 90, 96, 104, 114, 115, 117, 126, 130, 136	20
Substance (dimension)			
Intoxication	7	46, 49, 96, 101, 111, 127, 136	7
Use	52	32, 33, 35, 37-39, 42, 43, 45-50, 52, 54, 55, 60, 65, 68, 70, 72, 76, 80, 86, 88, 89,93-96, 99, 101, 103, 108, 109, 112, 116, 119, 120, 122, 125, 127-131, 133-136, 139	48
Pathological use (i.e., Misuse, Abuse, Addiction, Dependence, Disorder)	68	32, 34, 36, 38, 40, 41, 44, 45, 47, 51, 53, 56-64, 66, 67, 69, 71, 73-75, 77, 79-88, 90-92, 97, 98, 100, 102-107, 110, 113-118, 120, 121, 123, 124-126, 128, 131-133, 137, 138	63

Table 3.1
Sample characteristics (Continued)

Characteristic	Number of studies	Citations	%
Suicide (dimension group)			
Suicidal ideation	43	32, 33, 35, 37, 40, 41, 46, 47, 49, 50, 59-61, 72, 77, 83, 85, 88, 94-97, 99-101, 104, 109, 110, 112, 115, 127, 129-131, 133-139	40
Nonfatal suicidal behaviour	73	33-36, 38-40, 42, 44, 47-49, 52-56, 60-70, 76-78, 81, 82, 84-95, 98, 100, 103-109, 112, 113, 116-126, 128, 131-133, 137, 138	64
Fatal suicide	11	45, 51, 57, 58, 71, 73-75, 79, 102, 111	10

[a]Study regions: East Asia and Pacific (EAP), Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), Middle East and North Africa (MNA), South Asia (SAS), Sub-Saharan Africa (SSA). [b]World bank income group: Low-income country (LIC), Low-middle-income country (LMC), and Upper-middle-income country (UMC).

Of the 108 included studies, 69 (64%) were assessed as high-quality and 22 (20%) were acceptable quality (see Appendix G4). 17 (16%) were considered low-quality due to issues related to selection bias, attrition, the validity and reliability of exposure measures and whether or not confounding factors were accounted for.

The following substances were investigated: alcohol (n=70), tobacco (n=39), cannabis (n=12), cannabis and mandrax (consumed together) (n=1), opioids (n=5), sedatives (n=6), stimulants (n=4), unspecified prescription medication (n=3), inhalants (n=2) and hallucinogens (n=2). 60 studies did not specify the type of substance investigated.

Table 3.2 presents a summary of all studies by substance type specified dimension, suicide dimension, and low-quality status. Studies were included in this review even if they were rated as low-quality. Tables 3.3 and 3.4 summarise all associations between substances and SIB. The majority of the associations were positive when using bivariate (n=137) and multivariate

(n=113) analysis, indicating that substance use was consistently associated with SIB. Fewer associations were null when using bivariate (n=58) or multivariate (n=49) analysis, indicating no significant association. Almost half (n=21) of the null multivariate results had been positive in bivariate analysis. Two studies reported negative associations (between NFSB, and alcohol use and cannabis use, respectively) using multivariate analysis. Eight of the associations were unclear. Separate consideration of each substance dimension demonstrated substantial variation among associations.

Table 3.2

Number of Studies by Substance type Specified Dimension, Suicide Dimension, and low-quality status

Substance	Substance dimension	Suicidal Ideation	NFSB	Fatal suicide
Alcohol	Intoxication	7	2	2
	Use	18 (4 low-quality)	23 (4 low-quality)	0
	Pathological use	11	28 (2 low-quality)	6 (2 low-quality)
Tobacco	Intoxication	0	0	0
	Use	18 (4 low-quality)	20 (3 low-quality)	0
	Pathological use	8 (2 low-quality)	10 (1 low-quality)	0
Cannabis	Intoxication	0	0	0
	Use	6 (2 low-quality)	6 (1 low-quality)	0
	Pathological use	2	1	0
Cannabis and Mandrax	Intoxication	0	0	0
	Use	0	0	1
	Pathological use	0	0	0
Opioid	Intoxication	0	0	0
	Use	1	4	0
	Pathological use	0	4	0
Sedatives	Intoxication	0	0	0
	Use	3 (1 low-quality)	4 (1 low-quality)	0
	Pathological use	1	1	0
Stimulants	Intoxication	0	0	0
	Use	0	4	0
	Pathological use	0	0	0
Unspecified prescription medication	Intoxication	0	0	0
	Use	2	2	0
	Pathological use	0	0	0
Stimulants	Intoxication	0	0	0
	Use	0	1	0
	Pathological use	1	1	0
Inhalants	Intoxication	0	0	0
	Use	0	1	0
	Pathological use	1	1	0

Table 3.2
Number of Studies by Substance type Specified Dimension, Suicide Dimension, and low-quality status (Continued)

Hallucinogens	Intoxication	0	0	0
	Use	0	2	0
	Pathological use	0	0	0
Unspecified substance	Intoxication	0	1	0
	Use	15 (2 low-quality)	12 (3 low-quality)	0
	Pathological use	10 (1 low-quality)	31(8 low-quality)	4

Table 3.3

Associations by Substance use type Specified Dimension, Suicide Dimensions, and Method of Statistical Analysis

Substance dimension	*Suicide dimension*	*Analysis*	*Association between substances and suicide*				
			Positive	Negative	Null	Unclear	Total
Alcohol							
Alcohol intoxication (n=10)	Suicidal ideation	Bivariate	4 [49, 101, 127, 136]	0	0	0	4
		Multivariate	4 [46, 59, 101, 127]	0	2 [96, 136]	0	6
	Non-fatal suicidal behaviour	Bivariate	1 [49]	0	1 [53]	0	2
	Fatal suicide	Bivariate	1 [111]	0	0	0	1
		Multivariate	1 [111]	0	2 [45, 111]	1 [111]	4
Alcohol use (n=33)	Suicidal ideation	Bivariate	11 [33, 43, 47, 49, 60, 72, 88, 85, 129, 135, 139]	0	2 [88, 134]	0	13
		Multivariate	9 [32, 37, 46, 47, 50, 88, 96, 112, 129]	0	2 [88, 134]	0	11
	Non-fatal suicidal behaviour	Bivariate	12 [33, 47-49, 52, 54, 55, 60, 76, 88, 95, 103]	0	3 [33, 86, 108]	0	15
		Multivariate	8 [35, 47, 80, 93, 94, 112, 116, 125]	1 [55]	3 [88, 93, 128]	0	12
Pathological alcohol use (n=34)	Suicidal ideation	Bivariate	5 [40, 83, 85, 88, 133]	0	2 [77, 114]	0	7
		Multivariate	7 [41, 61, 82, 85, 131, 138]	0	3 [88, 110, 133]	0	10

Table 3.3
Associations by Substance type Specified Dimension, Suicide Dimension, and Method of Statistical Analysis (Continued)

Substance dimension	Suicide dimension	Analysis	Association between substances and suicide				
			Positive	Negative	Null	Unclear	Total
Pathological alcohol use (n=34)	Non-fatal suicidal behaviour	Bivariate	18 [34, 36, 40, 56, 67, 77, 78, 84, 85, 88, 90-92, 100, 117, 126, 133, 138]	0	9 [34, 36, 77, 78, 91, 92, 117, 120, 123]	0	27
		Multivariate	11 [56, 61, 64, 77, 81, 82, 85, 91, 128, 131, 138]	0	7 [82, 88, 91, 110, 126, 133, 138]	0	18
	Fatal suicide	Bivariate	5 [59, 71, 73-75]	0	0	0	5
		Multivariate	2 [58, 79]	0	0	0	2
Tobacco							
Tobacco use (n=28)	Suicidal ideation	Bivariate	10 [33, 43, 47, 88, 95, 109, 129, 133, 135, 139]	0	3 [33, 72, 134]	0	13
		Multivariate	4 [32, 46, 88, 94]	0	5 [47, 96, 131, 133, 134]	2 [47, 130]	13
	Non-fatal suicidal behaviour	Bivariate	13 [33, 46, 47, 49, 52, 55, 65, 88, 95, 103, 109, 129, 133]	0	5 [33, 48, 52, 108, 120]	0	18
		Multivariate	3 [88, 116, 119]	0	5 [94, 116, 122, 131, 133]	1 [47]	9
Pathological tobacco use (n=13)	Suicidal ideation	Bivariate	4 [40, 77, 83, 88]	0	1 [114]	1 [60]	6
		Multivariate	3 [61, 88, 115]	0	1 [61]	0	4
	Non-fatal suicidal behaviour	Bivariate	6 [40, 77, 88, 91, 100, 103]	0	3 [36, 60, 77]	0	9
		Multivariate	4 [61, 77, 81, 88]	0	1 [91]	0	5

Table 3.3

Associations by Substance type Specified Dimension, Suicide Dimension, and Method of Statistical Analysis (Continued)

Substance dimension	Suicide dimension	Analysis	Association between substances and suicide				
			Positive	Negative	Null	Unclear	Total
Cannabis							
Cannabis use (n=9)	Suicidal ideation	Bivariate	3 [47, 60, 127]		1 [95]	1 [135]	5
	Non-fatal suicidal behaviour	Bivariate	2 [47, 60]	0	2 [95, 103]	0	4
		Multivariate	1 [128]	1 [93]	1 [93]	0	3
Pathological cannabis use (n=2)	Suicidal ideation	Bivariate	0	0	1 [77]	0	1
	Non-fatal suicidal behaviour	Bivariate	2 [77, 126]	0	1 [77]	0	3
		Multivariate	1 [126]	0	0	0	1
Cannabis and Mandrax (smoked together) use (n=1)	Non-fatal suicidal behaviour	Multivariate	1 [128]	0	0	0	1
Opioid							
Opioid use (n=3)	Suicidal ideation	Multivariate	1 [42]	0	0	0	1
	Non-fatal suicidal behaviour	Bivariate	0	0	2 [103, 108]	0	2
		Multivariate	2 [42, 128]	0	0	0	2
Pathological opioid use (n=1)	Non-fatal suicidal behaviour	Multivariate	1 [98]	0	0	0	1
Sedatives							
Sedative use (n=5)	Suicidal ideation	Bivariate	0	0	0	1 [60]	1
		Multivariate	2 [42, 50]	0	0	0	2
	Non-fatal suicidal behaviour	Bivariate	1 [60]	0	1 [108]	0	2
		Multivariate	2 [42, 128]	0	0	0	2

Table 3.3
Associations by Substance type Specified Dimension, Suicide Dimension, and Method of Statistical Analysis (Continued)

Substance dimension	Suicide dimension	Analysis	Association between substances and suicide				
			Positive	Negative	Null	Unclear	Total
Pathological sedative use (n=1)	Suicidal ideation	Bivariate	1 [77]	0	0	0	1
		Multivariate	1 [77]	0	0	0	1
	Non-fatal suicidal behaviour	Bivariate	1 [77]	0	0	0	1
		Multivariate	1 [77]	0	0	0	1
Stimulants							
Stimulant use (n=4)	Non-fatal suicidal behaviour	Bivariate	0	0	1 [103]	0	1
		Multivariate	3 [38, 89, 128]	0	0	0	3
Use of unspecified prescription medication (n=3)	Suicidal ideation	Multivariate	2 [39, 50]	0	0	0	2
	Non-fatal suicidal behaviour	Multivariate	2 [39, 128]	0	0	0	2
Inhalants use (n=1)	Non-fatal suicidal behaviour	Multivariate	1 [128]	0	0	0	1
Pathological inhalant use (n=1)	Suicidal ideation	Bivariate	0	0	1 [77]	0	1
	Non-fatal suicidal behaviour	Bivariate	1 [77]	0	1 [77]	0	2
		Multivariate	1 [[77]	0	0	0	0
Hallucinogens use (n=2)	Non-fatal suicidal behaviour	Bivariate	1 [128]	0	1 [103]	0	2
Total	Suicidal ideation	Bivariate	38	0	12	3	53
		Multivariate	33	0	13	2	48
	Non-fatal suicidal behaviour	Bivariate	58	0	30	0	88
		Multivariate	49	2	19	1	69
	Fatal suicide	Bivariate	6	0	0	0	6
		Multivariate	3	0	2	1	6

Table 3.4

Associations by Unspecified Substance Dimension, Suicide Dimension, and Method of Statistical Analysis

Substance dimension	*Suicide dimension*	*Analysis*	*Association between substances and suicide*				
			Positive	Negative	Null	Unclear	Total
Substance intoxication (n=1)	Non-fatal suicidal behaviour	Bivariate	1 [62]	0	0	0	1
Substance use (n=21)	Suicidal ideation	Bivariate	8 [47, 72, 88, 99, 101, 109, 133, 139]	0	1 [99]	3 [47, 60, 139]	12
		Multivariate	7 [35, 46, 47, 96, 101, 129, 133]	0	4 [88, 94, 129, 136]	1 [47]	12
	Non-fatal suicidal behaviour	Bivariate	7 [47, 49, 68, 88, 109,133]	0	2 [60, 86]	1 [47]	10
		Multivariate	4 [35, 47, 94, 133]	0	2 [88, 133]	1 [48]	7
Pathological substance use (n=43)	Suicidal ideation	Bivariate	2 [88, 124]	0	1 [114]	0	3
		Multivariate	7 [82, 85, 97, 104, 115, 137, 138]	0	2 [82, 88]	0	9
	Non-fatal suicidal behaviour	Bivariate	15 [36, 53, 62, 63, 66, 69, 88, 91, 92, 105, 106, 113, 132, 137, 138]	0	9 [34, 36, 48, 78, 86, 87, 92, 107, 120]	0	24
		Multivariate	8 [36, 44, 88, 97, 104, 125, 137, 138]	0	9 [32, 80, 82, 85, 88, 91]	0	18
	Fatal suicide	Bivariate	1 [57]	0	2 [45, 102]	0	3
		Multivariate	1 [51]	0	0	0	1
Total	**Suicidal ideation**	**Bivariate**	10	0	1	3	14
		Multivariate	14	0	4	1	19
	Non-fatal suicidal behaviour	**Bivariate**	23	0	11	1	35
		Multivariate	13	0	11	1	25
	Fatal suicide	**Bivariate**	1	0	3	0	4
		Multivariate	1	0	2	0	3

We present a full account of the associations between SIB and substance use below by presenting the data for each type of substance and dimension of substance use. In cases where only one or two studies investigated a substance dimension, the results are elaborated. In cases where three or more studies investigated a substance dimension, only negative, unclear, or null results that are of interest for the discussion are highlighted.

Alcohol intoxication

Ten studies investigated the association between alcohol intoxication and SIB. Six studies found a positive association between ever having been drunk and SI, while two reported a null association. In Uganda, any drunkenness was associated with SI in bivariate but not in multivariate analysis [136]. Of the two studies exploring non-fatal suicidal behaviour, one study [49] found a positive association and one study [53] found a null association. A study from Sri Lanka showed a positive association between drinking alcohol and suicide, only amongst the men in the sample [111].

Half of the studies reporting on alcohol intoxication and SIB focused on adolescents as their target population [46, 59, 96, 101, 127] and yielded mixed results based on whether or not the study controlled for comorbid illicit drug use. For example, a population-based study among adolescents between 11 and 15 years old reported a null association between getting drunk in the last month and suicidal ideation after controlling for confounding factors that included unspecified illicit drug use [96]. In contrast, a school-based study among adolescents between 14 and 16 years old reported a positive association between having ever been drunk and suicidal ideation even while controlling for age, sex, worry, loneliness, ever smoked marijuana, felt sad or hopeless [127]. The three studies that did not control for illicit drug use found a positive association between alcohol intoxication and SI [46, 59, 101].

The studies are predominantly based in the EAP region (i.e. Thailand, China, Philippines, Vietnam, and Taiwan) and are widely spread across study regions for EAP [45, 46, 53, 49, 59] and the SSA region (i.e. Zambia and Uganda) [127, 136]. Individual studies were conducted in the MNA (i.e. Lebanon) [101] and LAC (i.e. Brazil) [96] region, while no studies were from the ECA region.

Alcohol use

Thirty-three studies investigated the association between alcohol use and SIB. Seventeen studies found a positive association between ever having consumed or used alcohol and SI, and two studies reported a null association. Among the 23 studies that focused on non-fatal suicidal behaviours, 20 reported a positive association and six reported a null association. A Chinese study reported that drinking alcohol before self-harm was positively associated with severity of self-harm in bivariate analysis, yet was inversely related to the severity of the self-harm when using multivariate analysis [54]. Thirty-one of the studies included in this sub-section also included adolescents in their sample, while only two studies focused solely on adults in their sample [80, 86].

The thirty-three studies that form part of this section represent all of the study regions within LMICs but are polarized to only some countries within these regions; EAP (i.e. Philippines, China, Malaysia, Vietnam, Taiwan, Thailand, Kiribati, Samoa, Solomon Islands, and Vanuatu) [32, 33, 35, 37, 43, 46, 47, 48, 49, 50, 52, 54, 55, 139], LAC (i.e. Mexico, Peru, Brazil) [80, 86, 88, 93, 94, 95, 96], ECA (i.e. Kosovo, Turkey) [60, 72, 76], SAS (i.e. India) [112, 116], SSA (i.e. Kenya, Namibia, South Africa, Swaziland, Uganda, Zambia, Zimbabwe) [125, 128, 129, 134, 135, 139], and MNA (i.e. Iran) [103, 108]. Only two of the studies reporting on the association between alcohol use and SIB made use of a case-control study design [48, 80].

Most of the thirty-three studies were assessed to be of high or acceptable quality. Eight studies were assessed to be of low quality [35, 43, 48, 60, 76, 86, 134, 135]. The studies assessed as low-quality were from the ECA, EAP, LAC, and SSA study regions

Pathological alcohol use

Thirty-three studies investigated the association between pathological alcohol use and SIB. Of the studies focusing on SI, 10 reported a positive association and six reported a null association. Twenty-three studies found a positive association with non-fatal suicidal behaviour and 14 studies reported a null association. All six studies focusing on suicide showed positive associations.

Of the thirty-three studies included in this sub-section, three studies made use of a case-control study design of which one study was assessed to be of low-quality [92], one acceptable quality [71], and one high quality [41]. A further two studies made use of an interrupted time-series design where both were assessed to be of low-quality [74, 75]. One other study using a cross-sectional study design was also assessed to be of low-quality [113].

The studies that investigated the association between pathological alcohol use and SIB varied with regard to study region and country. Only one study compared study settings across all study regions by including at least one country from each study region; Brazil (LAC), Bulgaria (ECA), Colombia (LAC), India (SAS), Lebanon (MNA), Mexico LAC, Nigeria (SSA), China (EAP), Romania (ECA), South Africa (SSA), and Ukraine (ECA) [138]. Specifically, the study by Nock and colleagues included only adults aged 18 years and older and made use of a cross-sectional study design that was assessed to be of acceptable quality.

Tobacco use

Twenty-eight studies explored the association between tobacco use and SIB. Thirteen studies reported a positive association between tobacco use and SI, seven reported a null association, and two reported unclear associations. In Botswana, tobacco smoking initiation at younger than 14 years old was associated with SI in the past 12 months among girls but not boys [130]. In Kiribati, Samoa, Solomon Islands, and Vanuatu, tobacco smoking initiation younger than 12 years old was associated with both SI and non-fatal suicidal behaviour, while tobacco smoking initiation at 12 years and older was not [47]. Fourteen studies reported a positive association between tobacco use and non-fatal suicidal behaviour, and ten studies reported a null association. One study [47] reported an unclear association.

Eighteen studies investigating the association between tobacco use and SIB, included only adolescents (i.e. 11 to 18 years old) in their sample [32, 46, 47, 55, 65, 72, 88, 94, 95, 96, 109, 119, 129, 130, 133, 134, 135, 139]. The studies in this sub-section predominantly made use of a cross-sectional research design with the exception of one case-control study that was assessed to be of low-quality [48]. A further five studies were assessed to be of low-quality [43, 48, 119, 120, 134, 135]. The twenty-eight studies were mostly conducted in the EAP [32, 33, 43, 46, 47, 48, 49, 52, 55, 139] and SSA [120, 122, 129, 130, 131, 133, 134, 135] study regions, while smaller groups of studies were from the ECA [65, 72], LAC [88, 94, 95, 96], MNA [103, 108, 109], and SAS [116, 119] study regions.

Pathological tobacco use

Thirteen studies explored associations between pathological tobacco use and SIB. Six studies [40, 61, 77, 83, 88, 115] reported a positive association with SI, and two studies [61, 114] reported a null association. One study from Kosovo reported unclear findings, as daily smoking

was associated with SI among males but not females [60]. Eight studies [40, 61, 77, 81, 88, 91, 100, 103] reported a positive association with non-fatal suicidal behaviour, while four studies [36, 60, 77, 91] reported a null association.

Most studies were cross-sectional studies [40, 60, 61, 77, 81, 83, 88, 100, 103, 114, 115], two were cohort studies [36, 91], and none were case-control or interrupted-time series studies. Only two studies were assessed to be of low-quality [60, 115]. The study regions include EAP [36, 40], ECA [60, 61, 77], LAC [81, 83, 88, 91], MNA [100, 103], and SAS [114, 115], while no studies were from the SSA study region.

Cannabis use

Nine studies explored the association between cannabis use and SIB. Two studies [47, 60] reported a positive association between cannabis use and SI, and two [95, 103] reported a null association. The results of a Zimbabwean study were unclear: cannabis smoking in the past 12 months was associated with SI among the total sample and males, but not females [135].

Of the six studies focusing on non-fatal suicidal behaviour, two [47, 60] reported a positive association and two [95, 103] reported a null association when using bivariate analysis. When using multivariate analysis, results were mixed. In South Africa, past month frequency of cannabis use was associated with a higher composite measure of suicide risk [128]. In Mexico, intake of cannabis prior to a suicide attempt was inversely associated with an impulsive or premeditated suicide attempt, while past cannabis use was not associated with any suicide attempt [93].

Seven of the studies on the association between cannabis use and SIB included only adolescents between the ages of 13 and 18 years old, while the remaining two studies included both adolescents and adults in their sample [93, 103]. The studies were predominantly cross-

sectional in nature, while one study was a cohort study [93] and none were case-control or interrupted-time series studies. The studies included in this sub-section were from the EAP [47], ECA [60, 72], LAC [93, 95], MNA [103], and SSA [127, 128, 135] study region, while no studies were from the SAS study region. Two of the nine studies were assessed to be of low-quality [60, 135].

Pathological cannabis use

Two studies [77, 126] reported the association between pathological cannabis use and SIB; both explored non-fatal suicidal behaviour and one [77] explored SI. In Turkey, cannabis abuse showed a null association with SI and suicide attempt, but a positive association with self-harm [77]. A South African study reported a positive association between cannabis use/abuse/dependence and suicide attempts [126]. One study included individuals between the ages of 16 and 22 years [77], while the other study included only adults aged 18 years and older [126]. Both studies were assessed to be of high quality and made use of a cross-sectional study design.

Cannabis and mandrax use (consumed together)

One study [128] explored the association between cannabis and mandrax use and SIB. This South African study reported an association between past month frequency of cannabis and mandrax use and higher suicide risk among males from the age of 15 to 18 years old. This study was assessed to be of high quality and made use of a cross-sectional study design.

Opioid use

Four studies investigated the association between opioid use and SIB; one [42] focused on SI and all four [42, 103, 108, 128] focused on non-fatal suicidal behaviour. In China, lifetime, past year, and past-month non-medical use of opioids was associated with SI, self-harm, and suicide

attempt [42]. In Iran, opioid use was not associated with lifetime suicide attempts [108]. In South Africa, higher past month frequency of opiate use was associated with higher suicide risk [128].

Two studies included males and females between the ages of 12 and 19 years old, while the remaining two studies included individuals from the age of 14 years and older. All four studies in this sub-section made use of a cross-sectional study design and were of a high quality. The study regions included in this sub-section were MNA [103, 108], SSA [128], and EAP [42], while no studies were from the ECA, LAC, and SAS study regions.

Pathological opioid use

Only one study [98], from Iran (i.e. MNA study region), explored the association between pathological opioid use and SIB among males and females from the age of 16 years old to 25 years old. Specifically, the study focused on non-fatal suicidal behaviour: opium dependence was associated with self-immolation. The study was assessed to be of a high quality and made use of a case-control study design.

Sedative use

Five studies investigated the association between sedative use and SIB; three [42, 50, 60] focused on SI and four [42, 60, 108, 128] focused on non-fatal suicidal behaviour. In Kosovo, tranquilizer use was associated with SI for females but not for males, making the association for the overall sample unclear [60]. In China, lifetime, past-year, and past-month non-medical use of sedatives were associated with self-harm [42].

Three studies included only adolescents in their sample, while one study included individuals between 14 years and 65 years old [50], and between 15 years and older [110]. All five studies employed a cross-sectional study design, where four studies were assessed to be of high quality and one of low-quality [60]. The study region in this sub-section included EAP [42,

50], ECA [60], MNA [110], and SSA [128], while no studies were from the LAC, or SAS study regions.

Pathological sedative use

Only one study [77] explored the association between pathological sedative use and SIB, focusing on SI and non-fatal suicidal behaviour. This Turkish study (i.e. ECA study region) showed that tranquilizer abuse was positively associated with SI, self-harm and suicide attempt. The individuals included in this sample were between 16 and 22 years old. The study made use of a cross-sectional study design and were assessed to be of high-quality.

Stimulant use

Four studies investigated the association between stimulant use and SIB. In China, past suicidal behaviour was positively associated with amphetamine-type stimulant (ATS) use [38]. A study from Iran reported a null association between ATS use and suicide attempt [103]. In Brazil, cocaine use was associated with suicide risk [89]. In South Africa, higher past month frequency of cocaine use was associated with suicide risk [128].

All four studies made use of a cross-sectional design and were assessed to be of high quality. The study regions included the EAP [38], LAC [89], MNA [103], and SSA [128], while no studies are from the ECA or SAS study region.

Use of unspecified prescription medication

Three studies explored the association between non-medical use of prescription medication and SIB; two [39, 50] focused on SI and two [39, 128] focused on non-fatal suicidal behaviour. A Chinese study reported positive associations between having ever considered suicidal behaviour or suicide attempts and non-medical use of prescription pain relievers [39]. In South Africa, higher past month frequency of over-the-counter drug use was positively associated with non-

fatal suicidal behaviour [128]. In Vietnam, any non-medical use of prescription pain relievers was positively associated with SI [50].

All three studies made use of a cross-sectional design and were assessed to be of high quality. The studies were conducted in the EAP [39, 50] and SSA [128] regions. Two of the studies included only adolescents [39, 128], while one study included individuals of 14 years and older [50].

Inhalant use

One study [128] explored the association between inhalant use and SIB, focusing on non-fatal suicidal behaviour. In South Africa, higher past month frequency of inhalant use was positively associated with higher suicide risk. The sample included only males between the ages of 15 years and 18 years old. The study made use of a cross-sectional design and was assessed to be of high quality.

Pathological inhalant use

One study [77] explored the association between pathological inhalant use and SIB, and focused on both SI and non-fatal suicidal behaviour. In Turkey, inhalant abuse was positively associated with self-harm, while a null association was found between inhalant abuse and SI and suicide attempt, respectively. The sample included only males and females between the ages of 16 years and 22 years old. The study made use of a cross-sectional design and was assessed to be of high-quality.

Hallucinogen use

Two studies [103, 128] explored the association between hallucinogen use and SIB; both focused on non-fatal suicidal behaviour. In Iran, a null association was found between hallucinogen use and suicide attempt [103]. In South Africa, higher past month frequency of hallucinogen use was

positively associated with higher suicide risk [128]. One study focused only on an adolescent males between 15 years and 18 years old [128], while the other study included males and females from the age of 14 years and older. Both studies made use of a cross-sectional design and were considered to be high-quality.

Unspecified substance intoxication

One study [62] explored the association between intoxication with an unspecified substance and SIB, and focused on non-fatal suicidal behaviour in a sample of males only. In Turkey, substance intoxication was positively associated with self-harm [62]. The study made use of a cross-sectional design and were considered to be high-quality.

Use of unspecified substances

Nineteen studies investigated the association between unspecified substance use and SIB; 15 [35, 45, 47, 60, 72, 88, 94, 96, 99, 101, 109, 129, 133, 136, 139] focused on SI, 12 [35, 47, 49, 60, 68, 70, 86, 88, 94, 109, 129, 133] focused on non-fatal suicidal behaviours, and none reported on suicide. Eleven studies [35, 46, 47, 72, 88, 96, 99, 101, 109, 133, 139] found a positive association between substance use and SI, five [88, 94, 99, 129, 136] reported a null association, and three [46, 60, 139] reported an unclear finding. A study from Kosovo did not report findings for the total sample but did report a positive association between usage of drugs other than cannabis (amphetamines, hallucinogens, or ecstasy) and SI for males but not for females [60]. A study that included samples from the Philippines, China, and Namibia showed that lifetime drug use was consistently associated with suicide plan across both genders in the Philippines and Namibia, but not China [139].

Ten studies [35, 47, 49, 68, 70, 88, 94, 109, 129, 133] found a positive association between substance use and non-fatal suicidal behaviour, four [60, 86, 88, 133] reported a null

association, and one [47] reported an unclear finding. In Kiribati, Samoa, Solomon Islands, and Vanuatu, substance initiation with one, two, or three substances before 12 years old was not consistently associated with SI and suicide attempt [47].

Fifteen studies included adolescent or young adult samples ranging from 11 years to 24 years old [46, 47, 49, 60, 68, 72, 88, 94, 96, 101, 109, 129, 133, 136, 139]. Only one study made use of a case-control design [68], no studies used an interrupted-time series design, where the remaining studies were cross-sectional or cohort studies. Three studies were assessed to of low-quality [35, 60, 86]. No studies in this sub-section were from the SAS study region, while studies where from the ECA [60, 68, 70, 72], EAP [35, 46, 47, 49, 139], LAC [86, 88, 94, 96], MNA [101, 109], and SSA [129, 133, 136, 139] regions.

Pathological use of unspecified substances

Fourty-two studies explored the association between pathological substance use and SIB. Nine studies reported a positive association with SI, and three reported a null association. Nineteen studies reported a positive association with non-fatal suicidal behaviour, and 16 reported a null association. Two studies [51, 57] reported a positive association with suicide, and two [45, 102] reported a null association.

Three studies made use of a case-control study design [48, 69, 92], while no studies used a interrupted-time series design. Nine studies were assessed to be of low-quality [69, 48, 86, 92, 105, 106, 113, 115, 120]. The studies were spread across all six study regions; SSA [80, 121, 124, 125, 132, 137], EAP [32, 34, 44, 45, 48, 53, 57], ECA [62, 63, 66, 69
SAS [114, 113, 115], MNA [102, 104, 105, 106, 107], and LAC [82, 86, 87, 88, 91, 92, 97, 138].

Discussion

The results from this review demonstrate a consistent positive association between SIB and substance use, substance intoxication, and pathological substance use in studies which use bivariate analysis. These positive associations are somewhat attenuated in studies employing multivariate analysis, but remain predominantly positive. Of the 170 associations reported in the multivariate analysis studies, 57 were null or unclear and only two studies showed negative associations. This pattern of predominantly positive associations was consistent across all substances, all dimensions of substance use (i.e. intoxication, use, and pathological use), and all dimensions of SIB (i.e. SI, non-fatal suicidal behaviour, and suicide). These findings support the assertion that substance use is an important risk factor for SIB in LMICs, and should be the target of continued public health policy, research and clinical attention in the effort to advance suicide prevention and reduce the morbidity and mortality associated with suicidal behaviour. A number of points from this review deserve attention and may provide directions for future research in this area.

First, it is significant that most of the included studies focused on alcohol and tobacco (n=78), while illicit drugs and non-medical use of prescription medication received comparatively less attention (n=19). Notable here is the absence of studies on substances such as methamphetamine (also known as Tik) and methcathinone (also known as Kat), which are used in LMICs [140, 141]. This bias in the literature may in part reflect the difficulties researchers face when trying to collect information on illegal activities. Under-reporting of illicit drug use in LMICs is linked to legal constrictions, limited resources and a lack of expertise to screen for drug use [27]. Furthermore, the studies included in this systematic review do not demonstrate the different effects of various substances (e.g. alcohol compared to different types of illicit drug use) as risk factors for SIB. Future research could employ rigorous epidemiological methods that

might report on the public health burden and potential mechanisms of the association between a range of substances or dimensions and SIB. For example, a timeline follow-back methodology may be used to identify potential mechanisms underlying the association between different types of substances and SIB. This information would be helpful to guide policy makers on whether to concentrate their efforts on the reduction of alcohol, tobacco, illicit drug use, or a combination of substances.

Second, the bulk of the evidence comes from studies conducted in upper-middle-income countries (n=70) and from EAP, ECA, LAC, and SSA regions. This seems to suggest that there is a relative scarcity of studies from LMICs as well as from regions such as SAS and MNA. Likewise, there are 67 of the 140 LMICs included in our search with no published studies that could be included in this review. As a result, there may be skewing of the data towards a few LMIC countries and generalizability of the findings to all LMICs is problematic. This finding is significant given that there are four LICs and one lower-middle-income country that are found among the top ten countries with the highest suicide rates in the world. These findings may in part reflect the fact that this review only included studies published in English. Nonetheless, the apparent unequal distribution of studies across LMICs warrants further attention.

Third, most of the literature in this field focuses on SI (n=47) and non-fatal suicidal behaviour (n=78); only 11 associations were reported between substance use and suicide. Seven positive associations were reported between alcohol and suicide, no associations were reported for illicit drug use and suicide, and two associations were reported for unspecified substance use and suicide. This suggests that there is a gap in the literature focusing on the association between death by suicide and substance use, particularly illicit drug use. This may in part reflect the

reality that in low-resource environments it is not routine practice to screen for illicit drugs in mortuaries [140] and that many LMICs lack mortality surveillance systems [1].

Fourth, 11 [42, 47, 60, 68, 75, 100, 111, 130, 134, 135, 139] of the included studies reported findings for men and women separately, while other studies combined them into one group. Globally, evidence suggests that men are at higher risk for substance use and that gender is an important variable in the aetiology of suicidal behaviour [1, 6, 11]. The specific role of gender in the association between substance use and SIB is complex and has not been adequately investigated in the reviewed literature.

Fifth, the majority of studies included in this review were conducted within a risk factor paradigm and have failed to advance the development of theory. This point has been made by other authors in the context of studies about poverty and SIB [142]. It might be helpful if subsequent studies moved beyond simply establishing that substance use is a risk factor for SIB. In this context it is also significant that most studies included in this review employed statistical analyses that only reported on an association between substance use and SIB, without taking potential confounding variables into account. Studies using sophisticated statistical analyses were scarce. One study [79] made use of structural equation modelling, but did not investigate the specific mechanism of action or how exactly substance use increases the risk for SIB. Among studies included in this review, factors that interacted with substance use and SIB were age [111], level of education [96], socioeconomic status [94], feelings of sadness or loneliness [127], parental physical abuse or neglect [136], and comorbid psychiatric disorder [88]. However, the nature of the interaction between these factors is not clear from the available evidence at this time. To answer questions about how substance use interacts with other variables to precipitate

SIB, it will be necessary to conduct studies which employ more sophisticated statistical methods and modelling to investigate the interaction between a wider array of variables.

Sixth, most included studies employed a cross-sectional study design. The comparative lack of longitudinal studies in this area is noteworthy. Longitudinal studies could help illuminate how contextual and temporal factors interact with substance use to precipitate SIB. Longitudinal studies will also help generate knowledge on the cumulative effects of substance use over time and how changes in patterns of use may influence SIB. Specifically, studies might focus on factors such as: the role of acute versus chronic substance use; patterns and quantity of substance use; and frequency of substance use. Moreover, SI is known to fluctuate over the course of time (sometimes rapidly) making it problematic to simply rely on results from cross-sectional studies [143]. Longitudinal studies may also assist us to understand the progression from SI to non-fatal suicidal behaviour and death by suicide among persons who use substances. Such knowledge could contribute to theory building in this area. It is likely that resource constraints in LMICs impede the completion of longitudinal studies in this field. There are a number of reasons why it is difficult to complete longitudinal research in low resource environments, including the high costs of this research, high rates of attrition, and the fact that many people living in low resource environments are highly mobile, making follow-up difficult and expensive [144, 145].

Study limitations

This systematic review represents an important first step in synthesizing the current literature and planning future public health research in this field. Nonetheless, this study has some limitations. The data may be influenced by publication bias, as studies that report negative or null associations often go unpublished [146]. Some caution is necessary when interpreting the findings from studies assessed as low-quality and where sub-section consist of only one or two

studies (i.e. pathological cannabis use, cannabis and mandrax use, pathological opioid use, pathological sedative use, inhalant use, and hallucinogen use). Excluding qualitative studies limits our ability to understand the mechanism by which substance use relates to SIB as well as the role of sociocultural factors that influence this association. This review only included studies published in English [147], and was limited to studies published between 2006 and 2016.

Conclusions

The results from this review strongly support the assertion that substance use is associated with increased risk of SIB. This confirms the call from the WHO to focus on substance use as a key element of suicide prevention in LMICs. We assert that the current evidence has the following public health implications in LMICs: (1) substance use is a potentially modifiable risk factor for fatal and non-fatal suicidal behaviour; (2) assessment and management of substance use should be integral to the care of at-risk patients; (3) suicide prevention in LMICs should focus on reducing consumption and hazardous use of alcohol, tobacco, cannabis, opioids, sedatives, stimulants and non-medical use of medications; and (4) more focused research is required in order to better understand the nature of the relationship between substance use and SIB across all types of substances, dimensions of SIB and spread throughout all LMICs. It would be helpful if future research focused on providing insight into the nature of this association in a way that permits an understanding of why substance use precipitates SIB among some individuals but not others. We suggest that research needs to be theory-driven and needs to integrate qualitative studies that explore the lived experience of substance use among individuals who engage in SIB.

List of abbreviations

LMICs: Low-income and middle-income countries; HIC: High income counties; WHO: World Health Organisation; SI: Suicidal ideation; SIB: Suicidal ideation and behaviour; LIC: Low-

income countries; PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist; DSM: Diagnostic and Statistical Manual of Mental Disorders (DSM); MeSH: Medical subject heading; EAP: East Asia and Pacific; ECA: Europe and Central Asia; LAC: Latin America and the Caribbean; SSA: Sub-Saharan Africa; MNA: Middle East and North Africa; SAS: South Asia; ATS: amphetamine-type stimulant.

Declarations

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Availability of data and material

All data generated or analysed during this study are included in this published article or the supplementary information file.

Authors' contributions

EB coordinated the Review, designed the search strategies, contributed to the searches, screening, quality assessment, data extraction, and analysed the data, contributed to the

interpretation of the data, and wrote the first draft. DG contributed to the searches, screening, quality assessment, and critically revised the manuscript. JB provided advice throughout the process, contributed to the interpretation of the data, and assisted with the writing of this Review.

Competing interests

The authors declare no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate

Not applicable.

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CHAPTER 4: Substance use and self-harm: a cross-sectional study of the prevalence, correlates and patterns of medical service utilisation among patients admitted to a South African hospital.

Preface to ARTICLE 2

Focus of the article

In this chapter, I present a quantitative study, which represents the second article of this PhD study, in order to investigate the epidemiology of AUS among self-harm patients in a SA hospital.

Why I needed to include this article in the dissertation

Extensive literature from HICs documents the prevalence and correlates of substance use and self-harm. Published literature on this association is sparse in LMICs where rates of substance use and SIB are high. Findings from the systematic review in Chapter 3 confirm that AUS is an important factor that should be addressed in the prevention of SIB in LMICs. This chapter set out to answer a sub-question of the second research question of this PhD study, with a focus on AUS. Therefore, I explored the ways in which the demographic, medical service utilisation, and sociocultural differences between patients who reported AUS and other patients (i.e. patients who report no substance use) presenting for treatment at an urban hospital in SA. I explain my motivation for why I chose this study setting in section 1.3.5. This information is important in order to plan strategies focused on addressing AUS among patients who engage in self-harm and for reducing the utilisation of scarce medical resources in the country.

Submission details

The article was first submitted to Journal of Studies on Alcohol and Drugs (JSAD-D-16-00329) on 29th July 2016 and rejected on 4th October 2016. The journal editor explained that the topic of the article was of interest but due to intense competition of for scarce publication space,

there were not enough significant findings to allow for the article to be published. The article was then submitted to the journal Substance Use and Misuse on 22nd November 2016 and rejected on 28th November 2016. The journal editor also stated that the article was not sent for review as not enough significant data is reported in the article. The article was then submitted to the South African Medical Journal on 19th December 2016 and rejected on 19th January 2017. According to the journal editor, the article was not suitable for the general readership of the journal.

I then submitted the article to BMC Health Service Research (BHSR-D-17-00316) on 1st March 2017 where the article is currently under review. This journal was deemed appropriate for the submission of this article as the journal considers aspects of health service research and health service utilisation. As stated in the preface to article 1, publishing this article in an open access journal would ensure that the information is available to individuals working in LMICs that may not have access to non-open journals. I present the article in this dissertation in the format requested by the journal guidelines for authors. The references have been prepared according to examples provided on the journal website that follows a Vancouver style type. The impact factor of the journal at the time of the study is 1.61. Supplementary files for this article are offered in Appendix H.

Conference output

The findings from this article has been presented as an oral presentation at the 16th European symposium on suicide and suicidal behaviour in Oviedo, Spain from 8th to 10th September 2016.

Authorship contributions

Elsie Breet participated in the study design, data collection and data analysis, data interpretation, wrote the first draft of the manuscript, and critically revised subsequent drafts. Jason Bantjes participated in the conception of the study, data interpretation, critical revision of the manuscript, and provided funding for the study. Ian Lewis assisted in the interpretation of the data and critically revised the manuscript/tables. All authors read and approved the final manuscript.

Substance use and self-harm: a cross-sectional study of the prevalence, correlates and patterns of medical service utilisation among patients admitted to a South African hospital

Elsie Breet[1*], MSc., Jason Bantjes[1], PH.D., and Ian Lewis[2], BSc., MBChB., FC Psych (SA).

Department of Psychology, Stellenbosch University, Stellenbosch, South Africa;

Department of Psychiatry and Mental Health, University of Cape Town, South Africa

*Corresponding author. Elsie Breet, Stellenbosch University, Private Bag X1, Matieland, Stellenbosch, Cape Town, 7602, South Africa. Email: elsie@sun.ac.za

Abstract

Background: Substance use is a potentially modifiable risk factor for suicidal behaviour. Little is known about the epidemiology of substance use among self-harm patients in South Africa. Objectives: This study set out to collect epidemiological data about the prevalence, correlates, and patterns of medical service utilisation among self-harm patients who used substances at the time of self-injury.

Methods: Data were collected from patient folders of 238 consecutive self-harm patients treated at an urban hospital in South Africa. The data were analysed using bivariate and multivariate statistics.

Results: Approximately 20% of patients reported substance use at the time of self-harm. When compared to other self-harm patients, higher rates of patients who had used substances: had depressed levels of consciousness on admission; utilised more medical resources and required longer hospital admissions; cited relationship difficulties and financial concerns as reasons for their self-harm; reported a previous episode of self-harm; and intended to die as a result of their

injuries. Although the observed differences were not statistically significant ($p>0.05$), the proportional differences were congruent with international literature.

Conclusion: Acute use of substances among self-harm patients warrants more focused research and clinical attention particularly in the context of reducing utilisation of scarce medical resources.

Keywords: Substance Use, Suicidal behaviour, self-harm, medical service utilisation, acute use of substances.

Background

Substance use is a recognised risk factor for self-harm (i.e., intentional, non-habitual self-injury with or without intent to die) and completed suicide [1]. Extensive literature documents the relationship between alcohol use and self-harm [2, 3]. A comparatively smaller body of literature describes associations between self-harm and the use of cannabis [4], heroin [5], methamphetamines [6] and cocaine [7]. Literature in this area comes predominantly from high-income Western countries. Research from low and middle-income countries is relatively scant despite the fact that 75.5% of all suicides occur in these countries [8]. To date no studies in South Africa (SA) document the prevalence and correlates of substance use among persons who engage in self-harm, although there is some evidence to suggest that completed suicides in the country are associated with substance use [9]. This study documents the prevalence and correlates of acute use of substances (AUS) (i.e., substance use during or shortly before engaging in self-injurious behaviour) [10] among patients treated at an urban hospital in SA.

Acute use of substances and self-harm

An abundance of literature from high-income countries report on the association between AUS and self-harm. The findings from cross-sectional studies show that AUS is associated with self-harm among males [11], and younger adults [1]. Moreover, evidence suggests that AUS (in particular the quantity of substances used and the time between substance use and self-harm) is associated with methods of self-harm that entail damage to body tissues such as hanging, cutting, burning, and gun shots [12]. High levels of substance use during social events are associated with self-harm, independent of the level of suicidal intent, as a result of disinhibition, increased impulsivity, impaired judgement, increased feelings of depression or hopelessness, and the urge to escape a situation or to change the behaviour of someone else [13, 14]. In cases with higher levels of intent to die and premeditation, AUS may facilitate self-harm by easing the distress of engaging in self-harm [15]. Substance use by self-harm patients may influence their medical management, the treatment they receive and the clinical decisions of medical staff. Ries and colleagues reported that self-harm patients who had used substances at the time of injury were discharged sooner than patients whose behaviour was not perceived to be related to substance use [16]. Clinicians believe that AUS related self-harm is related to lower levels of premeditation (i.e., is more impulsive) and lower levels of suicidal intent [15]. This belief together with aggressive or uncontrolled behaviour upon arrival at the emergency department, seems to lead to self-harm patients who had been using substances receiving less intensive medical care and being discharged sooner than patients who did not have a substance-related risk for suicidal behaviour [17].

Substance use and suicidal behaviour in South Africa

Alcohol is the most common substance used in SA [18]. Widespread unrecorded alcohol production (e.g., home-brewing of beer) and illegal selling of alcohol, make it difficult to accurately estimate alcohol consumption in SA [19]. Yet, available prevalence rates of lifetime alcohol use in the Western Cape range from 39% to 64%, while rates of risky drinking range from 9% to 34% [20]. Data on illicit drug use in SA is limited. Cannabis is the most common drug used (approximately 2% of the population), followed by cocaine (0.3%), sedatives (0.3%), amphetamines (0.2%), inhalants, hallucinogens, and opiates (0.1% each) [21]. However, these rates are thought to be underestimated with a report from the International Narcotics Board suggesting that up to 15% of the country's population regularly use some form of illicit drug [22].

Approximately 11% of non-natural deaths in SA are suicide-related [23] and an estimated 40% of suspected deaths by suicide test positive for assays of blood alcohol [9]. Nationally representative data from the South African Stress and Health study suggest that substance use disorder increased the risk for suicide attempts (OR=4.1), more than any other common mental disorder [24].

Better understanding the relationship between AUS and self-harm in SA may help identify strategies to reduce the morbidity and mortality associated with self-harm and to lessen the burden placed on the health care system; a system that is already under-resourced and overburdened [25, 26]. The aim of this study was to collect epidemiological data about the prevalence and correlates of AUS among self-harm patients seeking treatment in an urban hospital in the Western Cape Province of SA (hereafter referred to as the hospital). A secondary aim was to describe the pattern of medical service utilisation among this group of self-harm patients.

Methods

Data Collection Procedures

This study consisted of a point prevalence sample from a small population by collecting data from all self-harm patients who presented for treatment at the hospital between 16 June 2014 and 29 March 2015. During this time there were 270 consecutive presentations of self-harm, of which 238 were eligible for inclusion. Cases were excluded if: the files were missing or there was not sufficient information available in the patient file (17 patients); the patient had already been included in the sample on a prior presentation to the hospital during the period of data collection (9 patients); patients left the hospital before data were captured (1 patient); or patients died as a result of their injuries (5 patients). Sample size calculations were based on 15 patients per predictor variable in each model of logistic regression [27]. The largest logistic regression included five predictor variables (gender, SES, dependents, stated intention, and previous episode of self-harm) and required a sample size of at least 75 patients.

Definition of self-harm

In this study self-harm is defined as intentional self-injury or self-poisoning with non-fatal outcome, regardless of the degree of intent to die, which is deliberate and is non-habitual [1, 8, 28]. The term self-harm, as we have defined it, is synonymous with the term 'deliberate self-harm' and includes suicide attempts but does not include habitual or repetitive self-injury. We did not confine our study to suicide attempts because we could not reliably determine intent to die in order to differentiate suicide attempts from other forms of deliberate self-harm. This inclusion of cases of self-harm regardless of the level of intent is consistent with the approach adopted in other studies [29] and with the WHO's inclusion of self-harm as a component of non-fatal suicidal behaviour [8]. Within our definition of self-harm, substance use would not be

considered a form of self-harm since this behaviour is both habitual and the use of substances is not primarily motivated by a conscious desire to inflict bodily harm.

Measures

The following data were collected:

***Demographic information*.** Patient's age, gender, ethnicity, home language, relationship status, number of dependents, level of education, and employment status. It is worth noting that the hospital only treats patients 13 years and older. Socio-economic status (SES) was also recorded as low to moderate SES (ZAR0 to ZAR76 800) and high SES (ZAR76 801 to ZAR2 547 601) based on annual family income.

***Substance use*.** Self-reports of substance use at the time of self-harm, and type of substance(s) used. Rates of substance use may be limited by underreporting when relying on self-report measures. However, in SA self-report measures for harmful alcohol use and drug-related problems showed some agreement when compared to the use of biomarkers to determine substance use [30]. Studies that compare self-report measures with more objective measures of illicit use of other substances are scant.

Clinical features of self-harm. Method(s) of self-harm; medical intervention(s) received; psychiatric assessment conducted; level of admission required (i.e., treated and discharged, or admitted to the ICU, high care, medical / surgical ward, or emergency psychiatric unit), and length of stay in the hospital.

Level of consciousness on admission. The Glasgow Coma Scale (GCS) was used to measure the level of responsiveness to stimuli (i.e., level of consciousness) on arrival at the hospital. This study considered a score of 13 to 15 to indicate no or minimal depression in level of

consciousness (LOC), a score of 9 to 12 indicated moderately depressed LOC, and a score of 8 or less indicated significantly depressed LOC.

Level of suicidal intent. The 12-item Pierce Suicidal Intent Scale (PSIS) was used to measure suicidal intent among patients [31]. The PSIS scores range from zero to 25, where scores between zero and three indicates low suicidal intent, scores between four and 11 indicates moderate suicidal intent, and scores higher than 11 indicates severe suicidal intent. In this study, only three AUS patients reported low suicidal intent. The small number of patients makes meaningful analysis difficult. Therefore, two categories were created for the analysis consisting of low to moderate suicidal intent (i.e., scores between zero and 11) and high suicidal intent (i.e., scores higher than 11).

Details of self-harm. Patient's self-report of the stated intention for self-harm, reasons for engaging in the behaviour, history of a previous episode of self-harm, and whether the incident was impulsive (as opposed to planned).

The data was collected from patient records. The recording of this data is part of the routine clerking of all self-harm patients in the hospital. Quality checks for possible errors and missing data were done throughout data collection.

Statistical analyses

Data were analysed using SPSS v.18. Following descriptive analyses, bivariate analyses of the association between AUS and self-harm were performed using chi-square statistics or Fisher's exact test for categorical variables. Odds ratios (OR) and 95% confidence intervals (CI) were calculated for variables with significant p-values. The Mann-Whitney test was used for between-group analyses of continuous variables with nonnormal distributions. Logistic regression analysis was used to explore the relationship between AUS and gender, SES, having dependents,

suicidal intent, history of previous self-harm, LOC on admission, medical intervention required, level of suicidal intent, whether a psychiatric assessment was received, hospital admission required, and whether the self-harm was impulsive as opposed to planned. Statistical significance was set at $p<0.05$.

Ethical approval

Ethical approval for this study was granted by the Health Sciences Research Ethics Committee: at Stellenbosch University (reference number: N13/05/074) and University of Cape Town (reference number: 645/2013). Written permission was granted by the hospital before patient records were accessed. Information collected from patient records were saved on a password protected computer where each patient was assigned a unique number to protect patient confidentiality.

Results

Demographic characteristics of sample

The sample consisted of 238 self-harm patients, of which 20.2% reported substance use at the time of self-injury (i.e., AUS). The demographic characteristics of the sub-group of AUS patients and other self-harm patients with no AUS is shown in Table 4.1. The mean age of AUS patients was 32.9 (SD=11.8) years, while the mean age of other self-harm patients was 31.2 (SD=14.3) years. The sub-group of AUS patients were predominantly male (52.1%), Black African (37.5%), not in a relationship (85.4%), unemployed (72.9%), and were of low- to moderate SES (43.8%).

AUS self-harm patients were approximately 2.6 times more likely not to have dependents [x^2= 5.95 (df=1), p=0.015, OR = 2.59, 95% CI 1.122-6.119], when compared to those who had not used any substances at the time of their injuries. In the logistic regression analysis,

demographic characteristics (i.e., gender, SES, and having dependents) did not predict AUS when controlling for the other variables in the model (see Appendix H.2, Table S4.2).

Table 4.1
Description and Comparison of Sample Demographic Characteristics, by Acute Use of Substances

Variable	Yes [a] n=48 (%)	No [b] n=190 (%)	χ^2	df	*p* - value	OR (CI)
Gender	-	-	3.45	1	0.063	
Male	25 (52.1)	71 (37.4)	-	-	-	-
Female	23(47.9)	119 (62.6)	-	-	-	-
Mean (SD) Age (years)	32.9 (11.8)	31.2 (14.3)	-	-	-	-
[c]**Race**	-	-	7.93	4	0.094	
Black African	18 (37.5)	64 (33.7)	-	-	-	-
Indian / Asian	1 (2.1)	7 (3.7)	-	-	-	-
[d]Coloured	15 (31.3)	88 (46.3)	-	-	-	-
White	12 (25.0)	21 (11.1)	-	-	-	-
Not known	2 (4.2)	10 (5.3)	-	-	-	-
Relationship status	-	-	-	-	-	-
Married/In a relationship	7 (14.6)	39 (20.5)	-	-	-	-
Not in a relationship	41 (85.4)	150 (78.9)	-	-	-	-
Not Known	0	1 (0.5)	-	-	-	-
Have dependents			5.95	1	0.015	2.59 (1.12-6.12)
No dependents/pregnant	39 (81.3)	119 (62.6)	-	-	-	-
Dependents	9 (18.8)	71 (37.4)	-	-	-	-
[e]**Completed level of education**			5.92	2	0.052	-
Primary school	24 (50.0)	76 (40.0)	-	-	-	-
Secondary school	13 (27.1)	87 (45.8)	-	-	-	-
Tertiary school (Undergraduate or postgraduate)	11 (22.9)	27 (14.2)	-	-	-	-
[f]**Employment status**			-	-	-	-
Employed	13 (27.1)	44 (23.2)	-	-	-	-
Unemployed (unemployed, scholar, student)	35 (72.9)	141 (74.2)	-	-	-	-
Not known	0	5 (2.6)	-	-	-	-
[g]**SES**			5.23	2	0.073	-
Low to moderate SES (ZAR0 to ZAR76 800)	21 (43.8)	110 (57.9)	-	-	-	-
High SES (ZAR76 801 to ZAR2 547 601)	19 (39.6)	66 (34.7)	-	-	-	-
Not known	8 (16.7)	14 (7.4)	-	-	-	-

Notes: Total sample = 238. OR = Odds Ratio; CI = confidence intervals. Chi-square statistics were calculated for categorical variables: gender, race, having dependents or no dependents, completed level of education, and socio-economic status (SES). Mann-Whitney U test was used for between-group analyses of continuous variables with nonnormal distribution: Mean age (years).
[a]n = 48 patients with acute use of substances; [b]n = 190 other self-harm patients. [g]n = 216; [c]Race = the term race may be offensive in some countries, however this is an official term used in South Africa. [d]Coloured = the term Coloured may be offensive in some countries, however this is an official term used in South Africa (e.g. in the Higher Education Management Information System operated by the Department of Higher Education and Training). [e]Primary school = 1st grade to 7th grade in the United States; Secondary school = 8th grade to 12th grade/Senior in the United States; Tertiary school = any Diploma or University degree after completing Grade 12. [f]Employment status = 6 participants who indicated that they were retired were included in the employed category as they qualify to receive old age pension from the state worth ZAR1420 per month. [g]ZAR15.72 = 1 US dollar

Range of substances used

The range of substances used by self-harm patients is provided in Table 4.2. Alcohol (73%) was the most commonly used substance, while methamphetamine (10.4%), cannabis (6.25%), cocaine (6.25%), and heroin (4.17%) use was also reported. Only one patient reported using opioids. Multiple substance use at the time of the self-injury was reported by 19% of the sample.

Methods of self-harm

The methods of self-harm are provided in Table 4.2. Self-poisoning was the most common method of self-harm among AUS patients (77.1%). Among patients who reported self-poisoning, prescription medication was the most common method used among AUS patients (56.3%). There was no statistically significant association between status of AUS (i.e., AUS patients and other self-harm patients) and the methods of self-harm employed. That is, AUS patients and other self-harm patients equally reported the use of different methods of self-harm (Table 4.2). In regression models, AUS did not predict whether patients used self-poisoning or damage to bodily tissue (see Appendix H.2, Table S4.2).

Level of consciousness on admission and medical interventions required

A greater proportion of AUS, compared to other self-harm patients, had moderate to severe depressed LOCs on admission (16.7% vs. 15.2%), and required medical intervention (66.7% vs. 62.6%). There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and LOC (Table 4.2). In the regression analysis, AUS did not predict patients' LOC, or whether a medical intervention was required (see Appendix H.2, Table S4.2).

Suicidal intent

A slightly smaller proportion of AUS, compared to other self-harm patients, were assessed as having high levels of suicidal intent (16.7% vs. 17.9%), and were referred for psychiatric assessment (70.8% vs. 72.1%). There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and levels of suicidal intent (Table 4.2). AUS did not predict suicidal intent (see Appendix H.2, Table S4.2).

Table 4.2
Description and Comparison of Clinical Features by Acute Use of Substances

Variable	Yes [a] n=48 (%)	No [b] n=190 (%)	χ^2	df	*p*-value
[c]Acute substance used	-	- -	-	-	-
Alcohol	35 (72.9)	- -	-	-	-
Cannabis	3 (6.25)	- -	-	-	-
MDMA (Ecstasy)	1 (2.08)	- -	-	-	-
Methaqualone (Mandrax)	2 (4.17)	- -	-	-	-
Cocaine	3 (6.25)	- -	-	-	-
Methamphetamine (Tik)	5 (10.4)	- -	-	-	-
Heroin	2 (4.17)	- -	-	-	-
Opiates	1 (2.08)	- -	-	-	-
Multiple substance use	- -	- -	-	-	-
Yes	9 (18.8)	- -	-	-	-
No	39 (81.3)	- -	-	-	-

Table 4.2

Description and Comparison of Clinical Features by Acute Use of Substances (Continued)

Variable	Yes [a] n=48 (%)	No [b] n=190 (%)	χ^2	df	*p*-value
Method of self-harm	- -	- -	-	-	-
Self-poison	37 (77.1)	154 (81.1)	0.381	1	0.537
Prescription medication	27 (56.3)	118 (62.1)	0.552	1	0.458
Non-prescription medication	17 (35.4)	57 (30.0)	0.525	1	0.469
Ingestion or inhalation of poison	3 (6.25)	22 (11.6)	1.16	1	0.429
Damage body tissue	8 (16.7)	26 (13.7)	0.278	1	0.598
Laceration	4 (8.33)	18 (9.47)	0.040	1	0.769
Hanging	3 (6.25)	13 (6.84)	0.021	1	1.00
Asphyxiation	1 (2.08)	1 (0.53)	1.12	1	0.291
Immolation	1 (2.08)	0	-	-	-
Jumped off a height	2 (4.17)	1 (0.53)	0.332	1	0.564
Jumped in front of a train	1 (2.08)	2 (1.05)	0.327	1	0.493
Mixed method (i.e., self-poison and damage to body tissue)	3 (6.3)	8 (4.2)	0.290	1	0.703
Not known	0	2 (1.1)	-	-	-
Glasgow Coma Scale (Level Of Consciousness)	- -	- -	0.099	2	0.095
Minimal depression in LOC	40 (83.3)	161 (84.7)	-	-	-
Moderately depressed LOC	3 (6.3)	12 (6.3)	-	-	-
Significantly depressed LOC	5 (10.4)	17 (8.9)	-	-	-
Received Medical Intervention	-	-	0.269	1	0.604
Yes	32 (66.7)	119 (62.6)	-	-	-
No	16 (33.3)	71 (37.4)	-	-	-
Pierce Suicide Intent Scale (PSIS)	-	-	0.079	2	0.961
Low to moderate suicide intent	17 (35.4)	69 (36.3)	-	-	-
High suicide intent	8 (16.7)	34 (17.9)	-	-	-
Not known	23 (47.9)	87 (45.8)	-	-	-
Received a Psychiatric assessment	-	-	0.031	1	0.859
Yes	34 (70.8)	137 (72.1)	-	-	-
No	14 (29.2)	53 (27.9)	-	-	-

Note. Total sample = 238. Chi-square statistics were calculated for categorical variables: level of consciousness, medical intervention received, level of suicidal intent, and whether or not a psychiatric assessment was received.

[a]n = 48 patients with acute use of substances; [b]n = 190 other self-harm patients; [c]Description of type of, and single or multiple acute use of substances; [d]No or minimal depression in level of consciousness = a score of 13 to 15 on the Glasgow Coma scale; moderately depressed level of consciousness = a score of 9 to 12 on the Glasgow Coma scale; significantly depressed level of consciousness = a score of 8 or less on the Glasgow Coma scale. [e]Low to moderate suicide intent = a PSIS of 11 or lower; high suicide intent = a PSIS score of 12 or more.

Level of admission and length of hospital stay

Level of hospital admission required by self-harm patients and their length of stay in hospital, are provided in Appendix H.1, Table S4.1. Compared to other self-harm patients, AUS self-harm patients spent more time in short stay medical units [M=3.44 days (SD=2.06) vs. M=2.64 days (SD=1.54)], long stay medical or surgical wards [M=25 days (SD=34.1) vs. M=15.1 days (SD=22.4)], ICU or high care [M=6.25 days (SD=3.27) vs. M=4.62 days (SD=3.69)], and in an emergency psychiatric unit [M=6.80 days (SD=5.89) vs. M= 6.46 days (SD=5.54)], although these differences were not statistically significant. AUS did not significantly predict whether patients received a psychiatric assessment, whether patients were treated in the emergency department and discharged, or admitted to a long stay medical ward (see Appendix H.2, Table S4.2). Likewise, AUS did not predict whether patients were admitted to the ICU or a high care medical unit (see Appendix H.2, Table S4.2).

Stated intention

The most common intentions reported by AUS patients were to escape a situation (22.9%) and to communicate something (e.g., distress) (27.1%) (Table 4.3). There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and stated intension.

Suicidal self-injury

A greater proportion of AUS, when compared to other self-harm patients, stated that their intention was ‘to die’ (43.8% vs. 31.8%) There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and stated intension to die (Table 4.3). AUS did not predict whether patients reported that they intended to die (see Appendix H.2, Table S4.2).

Stated reasons for self-harm

The most common reasons given for self-harm among AUS patients were relationship (friendship, marital, or romantic) issues (33.3%), financial concerns (27.1%), and family conflict (22.9%) (Table 4.3). There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and stated reason for self-harm (see Appendix H.2, Table S4.2).

History of self-harm

Approximately half (45.8%) of AUS patients reported one or more previous episodes of self-harm, while 35.3% of other self-harm patients reported a previous episode of self-harm. There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and history of self-harm (Table 4.3).

Impulsive self-injury

A smaller proportion of AUS patients (18.8%) reported that their self-harm was impulsive compared to other self-harm patients (24.7%). There was no statistically significant association between status of AUS (i.e., AUS patients or other self-harm patients) and whether or not the self-harm was impulsive (Table 4.3). In the logistic regression, AUS did not predict whether the self-harm was impulsive (see Appendix H.2, Table S4.2).

Table 4.3

Comparison of Stated Intention and Reason, Previous Attempts, and Impulsivity, by Acute Use of Substances

Variable	Yes [a] n=48 (%)	No [b] n=190 (%)	χ^2	df	*p*-value	OR (CI)
Stated Intention	- -	- -	-	-	-	-
To regulate the behaviour of someone else	6 (12.5)	49 (25.8)	3.81	1	0.051	-
To regulate emotional state	3 (6.3)	22 (11.6)	1.16	1	0.429	-
To escape a situation	11 (22.9)	37 (19.5)	0.282	1	0.595	-
To communicate something (e.g. distress)	13 (27.1)	69 (36.3)	1.45	1	0.229	-
Mistake	5 (10.4)	9 (4.74)	2.23	1	0.135	-
Chronic physical pain/illness	1 (2.1)	2 (1.05)	0.327	1	0.493	-
Not known	5 (10.4)	10 (5.26)	1.72	1	0.192	-
Suicidal self-injury (i.e., 'to die' as one of their reasons)	- -	- -	-	-	-	-
To die	21 (43.8)	60 (31.6)	2.53	1	0.126	-
Other	22 (45.8)	118 (62.1)	4.19	1	0.041	-
Not known	5 (10.4)	12 (6.32)	0.972	1	0.324	-
Stated Reason	- -	- -	-	-	-	-
Financial concerns	13 (27.1)	34 (17.9)	2.04	1	0.153	-
Friendship/Marital/romantic relationship issues	16 (33.3)	58 (30.5)	0.141	1	0.707	-
Family conflict	11 (22.9)	76 (40.0)	4.82	1	0.028	2.24 (1.02-5.00)
Social issues (i.e., isolation, friendship problems, legal issues)	2 (4.2)	10 (5.26)	31.3	1	0.000	24.7 (4.79-170.9)
Medical illness	6 (12.5)	12 (6.32)	2.10	1	0.148	-
Psychiatric illness	8 (16.7)	28 (14.7)	0.111	1	0.739	-
Bereavement	3 (6.3)	7 (3.68)	0.627	1	0.426	-
Academic concerns	2 (4.2)	13 (6.84)	0.464	1	0.742	-
Unplanned pregnancy	0	3 (1.58)				-
Not known	7 (14.6)	22 (11.6)	0.323	1	0.570	-
Previous attempt of self-harm	- -	- -	-	-	0.340	-
Previous attempt	22 (45.8)	67 (35.3)	-	-	-	-
No previous attempt	11 (22.9)	58 (30.5)	-	-	-	-
Not known	15 (31.3)	65 (34.2)	-	-	-	-
Impulsive act	- -	- -	-	-	0.382	-
Yes	9 (18.8)	47 (24.7)	-	-	-	-
No	39 (79.2)	143 (75.3)	-	-	-	-

Notes: Total sample = 238. Chi-square statistics were calculated for categorical variables: stated intention, stated reason, previous attempt of self-harm, and impulsive act.
[a]n = 48 patients with acute use of substances; [b]n = 190 other self-harm patients.

Discussion

This study represents a small but important first step towards better understanding the relationship between AUS and self-harm in SA. In our sample, one in five self-harm patients presenting for treatment at an urban hospital reported that they had used substances at the time of their self-harm.

Compared to other self-harm patients in the sample, a greater proportion of patients who had used substances at the time of their self-harm had a depressed level of consciousness on admission, required a medical intervention, were admitted to an ICU or high care unit, had longer hospital stays than other self-harm patients, and reported that they intended to die as a result of their injuries. These associations calculated using the Chi-Square statistical test were not statistically significant ($p>0.05$), though the overall direction of the findings were in keeping with studies from high-income countries [12, 15, 32]. It is possible that given a larger sample and more accurate measures of AUS, we would have found the differences we observed to be statistically significant. This increased level of medical service utilisation among self-harm patients who had used substances at the time of their injuries highlights the economic importance of addressing this health problem, particularly in the light of scarce medical resources in SA [25, 26].

It is noteworthy that a higher proportion of self-harm patients who had used substances report a history of previous episodes of self-harm, compared to other self-harm patients. This association was not found to be significant ($p>0.05$) when using the Chi-Square statistical test, though the overall direction of the findings is consistent with the international literature [33] and

highlights the need for targeted interventions to reduce the risk of repetition among this population of patients.

The self-harm patients in this sample were all in contact with the health care system as a result of the injuries they had sustained. This contact with the health care system represents a potential opportunity for targeted interventions to address substance use problems, which seems to be important given the finding that 20% of self-harm patients had used substances at the time of their self-harm. Given that substance use is associated with risk of repetition of self-harm and eventual death by suicide [34], it seems sensible to utilise this contact with the health care system to address unhealthy patterns of substance use. It may be beneficial to routinely screen for problem substance use among self-harm patients and to offer referrals to appropriate substance use treatment centers or, where appropriate, to deliver brief targeted interventions as part of the management of self-harm at the hospital. This is particularly important in SA where there are high rates of substance use and problematic patterns of alcohol use [18, 22].

There are some limitations to this study. As the data was collected from one hospital setting it is not appropriate to generalise the findings to other settings. Future research should replicate this study by collecting data from different hospitals across multiple settings. Some caution is necessary when interpreting the findings since this study recruited a consecutive sample, which is a type of non-random purposive sampling and as such may result in selection bias. This study did not take account of variables such as the quantity of substances consumed, the context in which substances were consumed (i.e., socially versus in isolation) and the proximity of substance use to the incident of self-harm, which are potentially important variables. The data were collected from a retrospective review of patient files that included self-reported information on demographic information, substance use, and details of self-harm that

was collected during routine assessment of self-harm patients. The nature of the self-report measures used may have contributed to rates of not known data with regard to demographic information and details of self-harm. Likewise, given that patients may be reluctant to report substance use honestly [35] it is likely that the prevalence of AUS is lower than would have been found had we used more objective measures of substance use (e.g. testing blood alcohol concentration upon admission to the hospital). Furthermore, the use of more objective self-report measures for substance use could have allowed for the exploration of important aspects of substance use and self-harm that have been highlighted in the literature but were not part of the routine assessment that patients received. In this study, it would have been helpful to collect data that make a distinction between types of substance use, determined whether substance use was at a risky level, established when the individuals were exposed to the substance in proximity to self-harm, and assessed the pattern of substance use. Objective measures that would be appropriate to use in this context include but are not limited to the Alcohol, Smoking and Substance Involvement Screening Test (ASSIST), Alcohol Use Disorder Identification Test (AUDIT), and the Drug Use Disorder Identification Test (DUDIT). With regard to self-harm, the Columbia-Suicide Severity Rating Scale or the Mini International Neuropsychiatric Interview 6 (Module B) could provide insight into the past or present suicidal ideation, and details of past suicidal behaviour. Future research should also assess substance use patterns of behaviour and previous AUS without an act of self-harm. This study did not control for the influence of confounders such as: substance use disorder and comorbid psychiatric disorders and the context in which the substances were consumed. Future studies may shed light on the extent to which a history of substance use among this sub-group of patients may have played a role in causing the relationship and financial problems that precipitated their self-harm. The findings are an

important first step in drawing attention to the prevalence and correlates of acute substance use among self-harm patients in SA.

Conclusion

Substance use is a potentially modifiable risk factor for suicidal behaviour, yet knowledge on the epidemiology of substance use among self-harm patients in SA is scant. This study provides epidemiological data about the prevalence, correlates, and patterns of medical service utilisation among self-harm patients who reported substance use at the time of their self-harm. Given that AUS among self-harm patients is a public health problem in SA, future research should seek to investigate the context in which AUS plays a role in self-harm. This would be important especially in the context of the need to reduce the utilisation of scarce medical resources in the country and address the public health problems associated with substance use.

Declarations

Authors' contributions

EB participated in study design, data collection and data analysis, data interpretation, wrote the first draft of the manuscript, and critically revised subsequent drafts. JB participated in the conception of the study, data interpretation, critical revision of the manuscript, and provided funding for the study. IL assisted in the interpretation of the data and critically revised the manuscript/tables. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest. The authors alone are responsible for the content and writing of the article.

Availability of data and materials

The dataset supporting the conclusions of this article is included as supplementary material.

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Consent for publication

Not applicable.

Ethics approval and consent to participate

Ethical approval for this study was granted by the Health Sciences Research Ethics Committee: at Stellenbosch University (reference number: N13/05/074) and University of Cape Town (reference number: 645/2013). Written permission was granted by the hospital before patient records were accessed. Each participant signed a written consent to participate in this study.

Author details

[1]Department of Psychology, Stellenbosch University, Stellenbosch, South Africa. [2]Department of Psychiatry and Mental Health, University of Cape Town, South Africa.

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CHAPTER 5: Chronic substance use and self-harm in an emergency department

Preface to ARTICLE 3

Focus of the article

In this chapter, I present a quantitative study, which represents the third article of this PhD study, to compare self-harm patients with and without CSU, based on their demographic characteristics, method of self-harm, suicidal intent, history of self-harm, referral to hospital admission, and whether or not a referral for a psychiatric assessment was received.

Why I needed to include this article in the dissertation

It is well known that CSU is a significant public health problem and serves as serious risk factor for self-harm. This is specifically concerning in LMICs where health care resources are limited. The systematic review in Chapter 2 confirmed that CSU is associated with SIB in LMICs, highlighting the importance of addressing CSU in efforts to develop and implement suicide prevention in LMICs. No studies have investigated the prevalence and correlates of CSU and self-harm in SA. In this chapter, I set out to answer a sub-question of the second research question for this PhD study by exploring the prevalence and correlates of CSU and self-harm at the hospital. A deeper understanding of the prevalence and correlates of CSU and self-harm has implications for suicide prevention, service delivery, and future research at the hospital to ensure appropriate and effective care for this vulnerable population.

Submission details

The article has been submitted to African Journal of Primary Health Care and Family Medicine (Reference number: 1544) on 18th June 2017 were it is currently under review. The journal was considered to be an appropriate place for this articles because it welcomes submissions related to care within emergency department settings in an African and developing

world. The article has been formatted according to guidelines for authors from the journal. The references are included at the end of this article and have been formatted in accordance with the Vancouver referencing style.

Authorship contribution

Elsie Breet participated in the study design, data collection and data analysis, data interpretation, wrote the first draft of the manuscript, and critically revised subsequent drafts. Jason Bantjes participated in the conception of the study, data interpretation, critical revision of the manuscript, and provided funding for the study. Ian Lewis assisted in the interpretation of the data and critically revised the manuscript/tables. All authors read and approved the final manuscript.

Chronic substance use and self-harm in an emergency department

Elsie Breet[1*], MSc., Jason Bantjes[1], PH.D., and Ian Lewis[2], BSc., MBChB., FC Psych (SA).

Department of Psychology, Stellenbosch University, Stellenbosch, South Africa;

Department of Psychiatry and Mental Health, University of Cape Town, South Africa

*Corresponding author. Elsie Breet, Stellenbosch University, Private Bag X1, Matieland, Stellenbosch, Cape Town, 7602, South Africa. Email: elsie@sun.ac.za

Abstract

Background: Chronic substance use (CSU) is associated with health problems, including self-harm, placing a significant burden on emergency department resources. This is particularly problematic in low-income and middle-income countries, like South Africa (SA), where emergency departments are often poorly resourced.

Aim: To investigate the prevalence and correlates of CSU and self-harm and to consider the implications for emergency department service delivery and suicide prevention in SA.

Methods: Data were collected from 238 consecutive self-harm patients treated at the emergency department of an urban hospital in SA. The data were analysed using bivariate and multivariate analysis.

Results: Approximately 37% of self-harm patients reported CSU. The patients in the CSU subgroup, compared to other self-harm patients, were more likely to be male (OR=8.33, 95% CI 3.19-20.9, p=0.000), to have self-harmed by inflicting damaged to their body tissue (OR=4.45, 95% CI 1.77-11.2, p=0.001), and to have a history of self-harm (OR=3.71, 95% CI 1.44-9.54, p=0.007). A significantly smaller proportion of CSU patients, compared to other self-harm patients, were referred for a psychiatric assessment (OR=8.05, 95% CI 4.16-15.7, p=0.000).

Conclusion: The findings confirm that CSU is associated with greater service utilisation and repetition of self-harm among patients in this emergency department setting. Treating self-harm as the presenting problem within emergency department settings does not necessarily ensure that patients receive the care that they need. It might be helpful to include psychiatric assessments

and screening for CSU as an integral component of care for self-harm patients who present in emergency department settings.

Keywords: substance abuse, suicidal behaviour, self-harm, primary care service utilisation, emergency department.

Introduction

Chronic Substance Use (CSU) is understood as the recurrent and harmful use of substances over an extended period of time; this includes both substance use disorders and recurring patterns of hazardous substance use.[1,2,3,4] CSU is associated with adverse health outcomes among people who visit primary health care settings.[5,6] For example, CSU is associated with serious medical health issues (e.g. cardiac problems) and mental health issues (e.g. mood disturbances) that complicate treatment of acute health problems.[7] CSU also contributes to interpersonal violence and other forms of injury that require emergency medical care.[8] Likewise, it is well established that CSU increases the risk for self-harm among patients attending emergency department (ED) services.[9,10,11] CSU, especially when co-occurring with other medical or mental health issues, increases the use of high cost health services.[12] A recent systematic review of associations between substance use and suicidal behaviour in low-income and middle-income countries (LMICs) showed that acute and chronic substance use was associated with suicidal ideation and behaviour (SIB); highlighting the importance on ensuring that assessment of CSU and interventions that reduce the harmful use of substances should be integral to suicide prevention.[13] This is particularly important in LMICs, like South Africa (SA), where emergency care facilities are often poorly resourced, understaffed, overcrowded, and open for limited hours.[14,15] No studies have explored the prevalence and correlates of CSU and self-harm, or the implications for ED care in SA. Knowledge of the prevalence and correlates of CSU and self-harm in ED settings has the potential to contribute to improved service delivery and suicide prevention in ED settings. It is within this context that we set out to explore the prevalence and correlates of CSU and self-harm among patients presenting to an ED at an urban hospital in SA.

The term self-harm was defined as an intentional non-fatal self-injury or self-poisoning regardless of the level of intent to die.[16,17] The term includes deliberate self-harm and suicide attempts but does not include other forms of self-injurious behaviours that are habitual (i.e. non-

suicidal self-injury). The reason for using this broad definition of self-harm is that expert consensus suggests that suicide prevention should focus on the full range of self-injurious behaviours irrespective of the level of intent to die.[18] The definition of self-harm used in this study is also congruent with the definition used by the World Health Organisation to describe non-fatal suicidal behaviour, as well as other studies that have investigated self-harm.[16,17,19]

CSU has been consistently associated with self-harm although prevalence rates seem to vary by geographic region and gender. A study among 3 567 084 suicide attempt-related visits to an ED in the USA showed that 12.1% of self-harm patients met diagnostic criteria for substance-related disorders.[9] A longitudinal study among 1943 self-harm patients in England reported alcohol misuse among 36.1% of self-harm patients.[20] Gender accounts for some variability in reported prevalence of CSU among people who self-harm.[21] CSU is generally higher among men who self-harm compared to women, although some evidence show this phenomenon is increasing among women.[22] Among 400 Iranian patients who had made suicide attempts, 15.8% reported a history of drug abuse.[23] A study among 131 patients in SA found that patients who had made suicide attempts were three times more likely to also reported harmful alcohol use even when controlling for demographic characteristics (OR=3.01, CI=1.83-4.95, $p<0.001$).[24]

Research in high income countries (HICs) has consistently demonstrated that CSU is a risk factor for repetition of self-harm,[25] although evidence suggests that other factors interact with CSU to increase the risk of repetition. For example, a population-based study from Western Australia (N=16 966), reported that 6% of adolescents and 8% of young adults engaged in repetition of self-harm within 7 days of an index incident of self-harm, and that substance use disorders were significantly associated with risk of repetition (OR=1.76, 95% CI 1.46 – 2.13, $p<0.01$).[26] This same study highlighted that other significant risk factors for repetition of self-harm, were impulse-control disorders and personality disorder.[26] Data from another population-based study in Canada (N=81 675) showed that in addition to alcohol dependence, other factors such as symptoms of depression, lower socio-economic status (SES), and younger age predicted repetition of self-harm.[25] These data highlight the importance of a thorough psychiatric assessment, which includes screening for substance use and considering the interaction of variables such as age, gender, SES and co-morbid psychiatric disorders, among self-harm patients who present for treatment in ED settings.

Self-harm patients account for a significant proportion of those who present for treatment in the ED. In England there are an estimated 200 000 admissions to EDs per year for self-harm.[27] Data from the WHO multisite intervention study on suicidal behaviour reported that in a SA setting, 47% of suicide attempters sought medical attention in an ED.[28]

In HICs, self-poisoning is consistently the most common method of self-harm among patients treated in EDs, although damage to body tissue (cutting of body tissue or hanging) is also common.[29,30] Similarly, self-poisoning (e.g. pesticide poisoning) is the leading method of self-harm in LMICs.[31,32] Research has consistently shown associations between substance intoxication and method of self-harm,[2] although research in this area on the association of CSU with method of self-harm is scant.

For some patients a visit to the ED presents an opportunity not only to receive treatment or referral for the presenting problem (i.e. self-harm) but also to gain access to knowledge and resources to address the underlying predisposing and precipitating factors contributing to the presenting problem (e.g. CSU).[31] Bergen and colleagues demonstrated that receiving a psychiatric assessment accounts for a 13% (95% CI 1%-24%) decrease in risk of repetition of self-harm.[22] Therefore, a visit to the ED that includes a psychiatric assessment could decrease the risk of repetition of self-harm and ensure that patients receive the help that they need by, for example, providing an opportunity to reinforce health promoting behaviours, providing psychoeducation, and make appropriate referrals.[33] Despite the benefit of a psychiatric assessment in reducing self-harm, such assessments are not routinely conducted before discharge from the ED.[34] In SA, early detection of risk for self-harm and necessary care is not always feasible or available to everyone, as limited skills and resources hinder adequate and timeous treatment or referral.[35] The shortage of mental health care professionals in South African ED settings and the reality that ED care is still primarily biomedical in its orientation, means that it is not always possible to provide psychiatric assessments or psychosocial interventions in these settings, even when they are indicated.[36,37]

Although substance use is a growing public health problem in LMICS,[38] there are no published data on the risk for self-harm among those with CSU in SA. A better understanding of the prevalence and correlates of CSU and self-harm is a first step in better understanding how to organise care for these patients, provide early detection, and deliver effective interventions for this vulnerable population. The aim of this study was to compare the two groups of self-harm

patients, those with and without CSU, based on their demographic characteristics, method of self-harm, suicidal intent, history of self-harm, referral to hospital admission, and whether or not a referral for a psychiatric assessment was received.

Methods

Study design, setting and sampling

Data were collected from 270 consecutive self-harm patients presenting to the ED of a hospital in SA between 16 June 2014 and 29 March 2015. The hospital is a large public hospital in an urban city with a catchments area of 1.5 million people.[39]

Although data were collected for 270 patients, we included 238 patients in the final statistical analysis. Patients were excluded if their files were missing or there was not sufficient information available in the patient file (17 patients); if the patient had already been included in the sample on a prior presentation to the hospital during the period of data collection (nine patients); if the patient left the hospital before their information was captured (one patient); or where patients died as a result of their injuries (five patients).

Measures

Data were collected from patient records that contained information recorded by medical officers in the ED. The recording of this data is part of the routine clerking of all self-harm patients treated in the ED. These data were extracted from patient records with the help of an experienced psychiatric nurse. Quality checks for possible errors and missing data were done throughout data collection. The following data were collected:

Demographic information:

Patients' gender, age, race, relationship status, whether or not they had dependents, completed level of education, and employment status. SES was also recorded as low to moderate SES (0 ZAR to 76 800 ZAR) and high SES (76 801 ZAR to 2 547 601 ZAR) based on annual family income. At the time of this study 15.72 ZAR = 1 US dollar.

Time and day of presentation at the ED:

Time and day of admission was recorded as part of routine clerking of all patients treated in the ED.

Chronic Substance use:

Self-reports of a history of substance use disorder, and recurrent or habitual harmful use of alcohol or illicit drugs.[1,2,3,4] There is evidence, internationally and in the SA context, to show that

self-report measures of substance use are valid and reliable. Self-report of alcohol, cannabis, and methamphetamine use are consistent with measures of substance use biomarkers.[40,41]).

Clinical features of self-harm:

Method(s) of self-harm; whether or not the incident was impulsive, whether or not the patient was referred for a psychiatric assessment. The level of admission was recorded as 1) treated in ED and discharged; or 2) transferred to secondary or tertiary level care (ICU, high care, medical/surgical ward or emergency psychiatric unit).

Level of suicidal intent:

The 12-item Pierce Suicidal Intent Scale (PSIS) was used to measure suicidal intent among patients.[42] The PSIS scores range from zero to 25, where scores between zero and 11 indicate low to moderate suicidal intent, while scores higher than 11 indicate severe suicidal intent.

History of self-harm:

Patients' self-report of the number of previous episodes of self-harm was recorded.

Data analysis

Data were captured, cleaned and analysed with Statistical Package for the Social Sciences' (SPSS v.19) (SPSS Inc., Chicago, Illinois, USA). Three quality control checks were completed before the data were analysed. Descriptive statistics were calculated to provide an overview of the data. The association between CSU and self-harm was calculated using chi-square statistics or Fisher's exact for categorical variables. Odds ratios and 95% confidence intervals were calculated where appropriate. Between-group analysis of the continuous variables age, and length of stay in the hospital, were calculated using the Mann-Whitney test for non-normal distributions. Logistic regression analysis was used to determine the relationship between CSU and gender, age, SES, having dependents or not, history of self-harm, impulsive self-harm, method of self-harm, level of suicidal intent, psychiatric referral, and referral for secondary or tertiary care. Statistical significance was considered at $p<0.05$.

Ethical considerations

Ethical approval to conduct the study was granted by the Health Sciences Research Ethics committee of Stellenbosch University (reference number N13/05/074) and the University of Cape Town (reference number 645/2013). We obtained institutional permission from the hospital before patient records were accessed. The information collected from each patient record was

assigned a unique number and stored on a password protected computer to protect patient confidentiality.

Results

Demographic characteristics of sample

A total of 238 patients were included in this study of which 37% reported a history of chronic substance use (CSU). Table 5.1 presents the sample characteristics of the CSU patients and other self-harm patients. The mean age for the sub-group of CSU patients was 32.4 (12.5 SD) years, and the age range was 13 years to 82 years old. Most of the patients in the sub-group of CSU patients were Coloured (41.6%), not in a relationship (87.6%), unemployed (76.4%), from a low to moderate SES (52.8%), had completed a Grade 12 school level of education (46.1%), and did not have dependents (71.9%). The sub-group of CSU patients were more likely to be male when compared to the other self-harm patients (χ^2=24.4, df=1, p=0.000, OR=3.93, 95% CI 2.18-7.13). In the logistic regression, men were approximately 8 times more likely to report CSU when controlling for demographic variables, and impulsive self-harm or a history of self-harm (OR=8.33, 95% CI 3.19-20.9, p=0.000) (see Table 5.4).

Table 5.1
Description and Comparison of Sample Demographic Characteristics, by Chronic Substance Use

Variable	Yes †n=89 (%)	No ‡n=149 (%)	χ^2	df	*p* - value	OR (CI)
Gender	-	-	24.4	1	0.000	3.93 (2.18-7.13)
Male	54 (60.7)	42 (28.2)	-	-	-	-
Female	35 (39.3)	107 (71.8)	-	-	-	-
Mean (SD) Age (years)	32.4 (12.5)	31.0 (14.6)				
§**Race**	-	-	3.07	3	0.380	-
Black African	27 (30.3)	55 (36.9)	-	-	-	-
Indian / Asian	4 (4.5)	4 (2.7)	-	-	-	-
¶Coloured	37 (41.6)	66 (44.3)	-	-	-	-
White	16 (18)	17 (11.4)	-	-	-	-
Not known	5 (5.6)	7 (4.7)	-	-	-	-

Table 5.1
Description and Comparison of Sample Demographic Characteristics, by Chronic Substance Use (Continued)

Variable	Yes †n=89 (%)	No ‡n=149 (%)	χ^2	df	*p* - value	OR (CI)
Relationship status	-	-	3.72	1	0.054	-
Married/In a relationship	11 (12.3)	33 (22.1)	-	-	-	-
Not in a relationship	78 (87.6)	114 (77.2)	-	-	-	-
Not Known	0	1 (0.7)	-	-	-	-
Have dependents	-	-	3.56	1	0.059	-
No dependents/pregnant	64 (71.9)	91 (61.1)	-	-	-	-
Dependents	23 (25.8)	57 (38.3)	-	-	-	-
Not known	2 (2.2)	1 (0.7)	-	-	-	-
††**Completed level of education**	-	-	1.45	2	0.484	-
Primary school	33 (37.1)	67 (45)	-	-	-	-
Secondary school	41 (46.1)	59 (39.6)	-	-	-	-
Tertiary school (Undergraduate or postgraduate)	15 (16.9)	23 (15.4)	-	-	-	-
‡‡**Employment status**	-	-	0.000	1	0.989	-
Employed	19 (21.3)	32 (21.5)	-	-	-	-
Unemployed (unemployed, scholar, student)	68 (76.4)	114 (76.6)	-	-	-	-
Not known	2 (2.2)	3 (2)	-	-	-	-
§§**SES**	-	-	0.615	1	0.433	-
Low to moderate SES (ZAR0 to ZAR76 800)	47 (52.8)	84 (56.4)	-	-	-	-
High SES (ZAR76 801 to ZAR2 547 601)	35 (39.3)	50 (33.6)	-	-	-	-
Not known	7 (7.9)	15 (10.1)	-	-	-	-

Notes: Total sample = 238. OR = Odds Ratio; CI = confidence intervals. Chi-square statistics were calculated for categorical variables: gender, race, having dependents or no dependents, completed level of education, and socio-economic status (SES). Mann-Whitney U test was used for between-group analyses of continuous variables with nonnormal distribution: Mean age (years).
†n = 89 patients with chronic substance use; ‡n = 149 other self-harm patients. ᵍn = 216; §Race = the term race may be offensive in some countries, however this is an official term used in South Africa. ¶Coloured = the term Coloured may be offensive in some countries, however this is an official term used in South Africa (e.g. in the Higher Education Management Information System operated by the Department of Higher Education and Training). ††Primary school = 1st grade to 7th grade in the United States; Secondary school = 8th grade to 12th grade/Senior in the United States; Tertiary school = any Diploma or University degree after completing Grade 12.

‡‡Employment status = 6 participants who indicated that they were retired were included in the employed category as they qualify to receive old age pension from the state worth 1420 ZAR per month. §§15.72 ZAR = 1 US dollar

Methods of self-harm

The prevalence of different methods for self-harm and the comparison between the sub-group of CSU patients and other self-harm patients is presented in Table 5.2. Most of the sub-group of CSU patients used self-poisoning (64%) as the method of self-harm. Among the patients who utilised self-poisoning, abuse of prescription medication (36%) was the most common method of self-harm. A significantly greater proportion of the sub-group of CSU patients, compared to other self-harm patients (26.8% vs. 7.4%, p=0.000), utilised damage to body tissue as their method of self-harm (χ^2=16.8, df=1, p=0.000, OR=4.60, 95% CI 2.01-10.7). In the logistic regression analysis, the CSU self-harm patients, compared to other self-harm patients, were 5 times more likely to use damage to body tissue as the method of self-harm (OR=4.45, 95% CI 1.77-11.2, p=0.001) (see Table 5.4).

Level of suicidal intent

A slightly smaller proportion of CSU patients, when compared to other self-harm patients, reported low to moderate suicidal intent (29.2% vs. 40.3%, n=26 vs. 60, p=0.847). Likewise, only 13.5% of CSU patients reported high suicidal intent, while 20.1% of other self-harm patients reported high suicidal intent (see Table 5.2). More than half (57.3%) of the CSU patients did not receive a suicidal intent assessment, even though this is part of the routine care of self-harm patients in this setting. In the chi-square analysis, there was no significant difference in the level of suicidal intent between the subgroup of CSU patients and other self-harm patients. Likewise, in the logistic regression analysis CSU did not predict suicidal intent (see Table 5.4).

Referral for psychiatric assessment

Only 20.2% of CSU self-harm patients were referred for a psychiatric assessment (see Table 5.2), compared to 67.1% of other self-harm patients. In the chi-square analysis, the subgroup of CSU patients were eight times less likely to receive a psychiatric assessment compared to other self-harm patients (χ^2=49, df=1, p=0.000, OR=8.05, 95% CI 4.16-15.7). In the logistic regression analysis, this association did not remain significant, when controlling for gender, age, SES, and suicidal intent (see Table 5.4).

History of self-harm

Half (50.6%) of the CSU self-harm patients reported a history of self-harm (see Table 5.2), compared to 29.5% of other self-harm patients (50.6% vs. 29.5%, p=0.0.006). In the chi-square analysis, CSU was significantly associated with a history of self-harm (χ^2=2.51, df=1, p=0.006). Results from the logistic regression showed that patients who had a history of self-harm were approximately four times more likely to be in the CSU sub-group, when controlling for gender, age, SES, having dependents and impulsive self-harm (OR=3.71, 95% CI 1.44-9.54, p=0.007) (see Table 5.4).

Impulsive self-harm

A significantly smaller proportion of CSU patients, when compared to other self-harm patients, reported that their self-harm was impulsive (14.6% vs. 28.9%, p=0.004) (see Table 5.2). Results from the chi-square analysis showed that an impulsive act of self-harm was significantly associated with CSU (χ^2=2, df=2, p=0.004). In the logistic regression analysis, this association did not remain significant when controlling for gender, age, and SES (see Table 5.4).

Table 5.2
Description and Comparison of Clinical Features, by Chronic Substance Use

Variable	Yes †n=89 (%)	No ‡n=149 (%)	χ^2	df	*p*-value	OR (CI)
Method of self-harm	-	-	-	-	-	-
Self-poison	57 (64.0)	136 (91.3)	26.9	1	0.000	5.87 (2.73-12.8)
Prescription medication	32 (36.0)	66 (44.3)	-	-	-	-
Non-prescription medication	10 (11.2)	23 (15.4)	-	-	-	-
Ingestion or inhalation of poison	5 (5.6)	14 (9.4)	-	-	-	-
Mixed method of self-poisoning	10 (11.2)	33 (24.3)	-	-	-	-
Damage body tissue	24 (26.8)	11 (7.4)	16.8	1	0.000	4.60 (2.01-10.7)
Laceration	9 (10.1)	6 (4.0)	-	-	-	-
Hanging	9 (10.1)	3 (2)	-	-	-	-
Asphyxiation	1 (1.1)	0	-	-	-	-
Immolation	1 (1.1)	0	-	-	-	-
Jumped off a height	2 (2.2)	0	-	-	-	-
Jumped in front of a train	2 (2.2)	2 (1.3)	-	-	-	-

Table 5.2
Description and Comparison of Clinical Features, by Chronic Substance Use (Continued)

Variable	Yes †n=89 (%)	No ‡n=149 (%)	χ^2	df	*p*-value	OR (CI)
Mixed method (i.e. self-poison and damage to body tissue)	6 (6.7)	2 (1.3)	-	-	-	-
Not known	2 (2.2)	0	-	-	-	-
§**Pierce Suicide Intent Scale (PSIS)**	-	-	0.037	1	0.847	-
Low to moderate suicide intent	26 (29.2)	60 (40.3)	-	-	-	-
High suicide intent	12 (13.5)	30 (20.1)	-	-	-	-
Not known	51 (57.3)	59 (39.6)	-	-	-	-
Received a Psychiatric assessment	-	- -	49.0	1	0.000	8.05 (4.16-15.7)
Yes	18 (20.2)	100 (67.1)	-	-	-	-
No	71 (79.8)	49 (32.9)	-	-	-	-
History self-harm	-	-	7.47	1	0.006	2.51 (1.22-5.16)
History of self-harm	45 (50.6)	44 (29.5)	-	-	-	-
No history of self-harm	20 (22.5)	49 (32.9)	-	-	-	-
Not known	24 (27)	56 (37.6)	-	-	-	-
Impulsive self-harm	-	-	8.15	1	0.004	-
Yes	13 (14.6)	43 (28.9)	-	-	-	-
No	76 (85.4)	94 (63.8)	-	-	-	-
Not known	6 (6.7)	11 (7.4)	-	-	-	-

Notes: Total sample = 238. Chi-square statistics were calculated for categorical variables: method of self-harm, level of suicidal intent, and whether or not a psychiatric assessment was received, previous attempt of self-harm, and impulsive act.
†n = 89 patients with chronic substance use; ‡n = 149 other self-harm patients. §Low to moderate suicide intent = a PSIS of 11 or lower; high suicide intent = a PSIS score of 12 or more.

Time and day of presentation to the emergency department

A slightly larger proportion of CSU patients, when compared to other self-harm patients, presented to the ED between 7am and 5pm during the day (44.9% vs. 42.3%, p=0.651) (see Table 5.3). For both CSU patients and other self-harm patients, the largest proportion of patients presented to the ED after hours / during the night shift (i.e. between 5pm and 7am) (51.7% vs. 55%, p=0.651). There were no significant differences between the CSU patients and other self-harm patients with regard to time of presentation to the ED.

For both the CSU patients and other self-harm patients, the greatest proportion of patients presented to the ED on a weekday (71.9% vs. 63.1%, p=0.207) (see Table 5.3). A smaller

proportion of CSU patients, when compared to other self-harm patients presented to the ED on a Saturday or Sunday (28.1% vs. 35.6%, p=0.207).

Referral for hospital admission

Details about the number of self-harm patients referred for inpatient treatment are presented in Table 5.3. A slightly smaller proportion of CSU self-harm patients, compared to other self-harm patients, were treated in the ED and discharged (34.8% vs. 35.8%, p=0.890), referred to a short stay medical unit (23.6% vs. 29.1%, p=0.359), and referred to ICU or high care (6.7% vs. 7.5%, p=0.842). CSU was significantly associated with a referral to a long stay medical or surgical ward (χ^2=5.76, df=1, p=0.016, OR=3.34 95% CI 1.09-10.6). This finding did not remain significant in the logistic regression analysis, when controlling for gender, age, SES and suicidal intent (see Table 5.4).

Table 5.3
Details of Admission required, by Chronic Substance Use

Variable	Yes †n=89 (%)	No ‡n=149 (%)	χ^2	df	*p*-value	Odds Ratio (CI)
Time of presentation to ED	-	-	0.205	1	0.651	-
Day shift (7am to 5pm)	40 (44.9)	63 (42.3)	-	-	-	-
Night shift / after hours	46 (51.7)	82 (55)	-	-	-	-
Not known	3 (3.4)	4 (2.7)				
Day of presentation to ED			1.589	1	0.207	-
Weekday	64 (71.9)	94 (63.1)				
Weekend day	25 (28.1)	53 (35.6)				
Not known	0	2 (1.3)				
Referral for hospital admission	-	-	-	-	-	-
Treated in casualty and discharged	31 (34.8)	53 (35.8)	0.023	1	0.890	1.04 (0.580-1.88)
Admitted to short stay medical unit	21 (23.6)	43 (29.1)	0.840	1	0.359	1.326 (0.695-2.540)
ICU or high care	6 (6.7)	11 (7.5)	0.040	1	0.842	1.11 (0.362-3.52)
Admitted to long-stay medical or surgical ward	11 (12.4)	6 (4.1)	5.76	1	0.016	3.34 (1.09-10.6)
Admitted to emergency psychiatric unit	34 (38.2)	56 (37.6)	0.009	1	0.924	1.027 (0.576-1.83)

Note: N = 238; Chi-square statistics were calculated for categorical variables: treated in casualty and discharged; admitted to short stay medical unit; ICU or high care; admitted to long-stay

medical or surgical ward; admitted to emergency psychiatric unit; transferred to tertiary psychiatric hospital. Mann-Whitney U test was used for between-group analyses of continuous variables with nonnormal distribution: Mean number of days spent in each unit.
[†]n = 89 patients with chronic use of substances; [‡]n = 149 of other self-harm patients.

Table 5.4
Binary Logistical Regression Analysis: Summary of Predictors in Each Model

Model	Predictor	Outcome	B (SE)	Wald X^2	*p*-value	OR	CI
1	Gender	CSU	2.12 (0.470)	20.4	0.000	8.33	3.19-20.9
	Age		-0.009 (0.018)	0.216	0.642	0.991	0.956-1.03
	SES		0.443 (0.461)	0.922	0.337	1.56	0.630-3.85
	Dependents		0.467 (0.498)	0.880	0.348	1.60	0.601-4.23
	History of self-harm		1.31 (0.482)	0.739	0.007	3.71	1.44-9.54
	Impulsive self-harm		1.07 (0.519)	4.27	0.039	2.92	1.06-8.08
2	CSU	Self-poison vs. damage to bodily tissue	1.49 (0.470)	10.1	0.001	4.45	1.77-11.2
3	CSU	[†]PSIS	-0.126 (0.577)	0.047	0.828	0.882	0.285-2.73
4	CSU	Psychiatric referral	0.133 (0.508)	0.068	0.794	1.14	0.422-3.09
5	CSU	Impulsive act	-0.711 (0.390)	3.32	0.068	0.491	0.229-1.06
6	CSU	ED and Discharge vs. long stay medical ward	-0.171 (0.311)	0.301	0.583	0.843	0.458-1.55

Note: OR = odds ratio; CI = confidence intervals; CSU = chronic substance use; SES = socio-economic status; ED = emergency department.
Model 1: Gender, age, SES, having dependents, previous self-harm, and impulsive self-harm predict CSU.
Model 2: CSU predict the method of self-harm, while controlling for gender, age, and SES.
Model 3: CSU predict suicidal intent, while controlling for gender, age, previous self-harm, and SES.
Model 4: CSU predict referral for psychiatric assessment, while controlling for gender, age, SES, and suicidal intent.
Model 5: CSU predict impulsive self-harm, while controlling for gender, age, and SES.
Model 6: CSU predict being treated in the ED and discharged or referral to hospital, while controlling for gender, age, and SES.

[†]Low to moderate suicide intent = a PSIS of 11 or lower; high suicide intent = PSIS score of 12 or more.

Discussion

More than a third of the self-harm patients presenting at the ED of an urban hospital in SA reported CSU. This finding is similar to results reported in studies from high-income countries[20] and other Sub-Saharan African countries.[43] Findings from other LMICs correspond with our finding that a greater proportion of men, compared to women, who self-harm also report CSU.[44] Our data are also consistent with international studies showing that CSU is associated with repetition of self-harm.[22] Our findings further supports epidemiological data that CSU is associated with greater medical service utilisation from ED care settings.[45] which highlights the need for psychiatric services to be an integral component of ED care.[12]

Our findings are congruent with other studies that report self-poisoning as a leading method of self-harm.[29,30,32] Despite high rates of self-poisoning as the method of self-harm among both groups, a statistically significant greater proportion of the subgroup of CSU patients used damage to body tissue as their method of self-harm. This is a noteworthy finding given that damage to body tissue (e.g. hanging or cutting of body tissue) is typically associated with increased risk of adverse outcomes,[33] and causes severe injury requiring hospital based care and longer hospital admissions.[46]

Patients with a history of self-harm were approximately four times more likely to be in the subgroup of CSU patients, when compared to other self-harm patients. There is an abundance of literature showing strong associations between CSU and repetition of self-harm.[25,47,48]

Furthermore, our results showed that the association between CSU and self-harm was not influenced by gender, age, SES, having dependents or not, and impulsive self-harm. However, the available literature suggest that other factors such as impulse-control disorders, personality disorders and symptoms of depression contribute to the increased risk for repetition of self-harm among people with CSU.[25,49] A psychiatric assessment among CSU self-harm patients treated in ED care settings is one potentially useful way of identifying other factors such as comorbid psychopathology that increase the risk for repetition of self-harm.

The finding that not all patients who present to the ED following self-harm receive a psychiatric assessment or referral is consistent with international practices.[30] Likewise, a smaller proportion of CSU patients, compared to other patients, received a psychiatric assessment. The lack of psychiatric assessment is worrying given that a greater proportion of CSU patients compared to other self-harm patients reported a history of self-harm. The lack of a psychiatric assessment is a

lost opportunity for intervention or for putting these patients in contact with substance abuse treatment facilities such as arranging referrals to specialists' alcohol and drug treatment services. Integrating a psychiatric assessment within ED care could be an important component of preventing repetition of self-harm by ensuring that adequate treatment strategies are followed; psychiatric assessments also provide an opportunity to refer self-harm patients to available mental health services.[32,50]

Psychiatric assessment or screening to detect CSU among self-harm patients within ED care will need to be planned carefully in SA to ensure that patients receive the care that they need without further exacerbating the burden on the already strained health care system.[35] Health care providers may be disinclined to screen for CSU among self-harm patients when adequate treatment or referral resources are limited or not available. A study among substance-using patients attending ED care services, propose that future research is required to investigate effective ways of improving resources that address substance use among ED care patients presenting for suicidal behaviour.[51]

In LMICs people with mental health problems do not typically have access to specialised health care services and therefore frequently seek help in primary health care settings, such as EDs.[52] Larkin and Beautrais argue that providing psychiatric services in the ED is vital in suicide prevention as patients often do not attend or adhere to treatment post discharge.[53] These studies highlight the need to utilise ED visits as a vital opportunity to provide necessary care for self-harm patients with CSU. Although psychiatric services are generally thought of as specialised services (i.e. secondary or tertiary care), they also have a place as a subspecialty in primary health care within low resource settings.[12] This is particularly important given that poor mental health directly affects the treatment outcome of medical illness that in turn increases the use of health care services.[12] For the patients in our study this could mean that simply treating the medical injury following self-harm may not be enough if the underlying issue of CSU is not also treated. Research is needed to explore how psychiatric services can be included in ED care to ensure that patients have access to the necessary help without exacerbating limited health care resources.

Limitations

Data were collected in one ED in an urban city of SA, making it difficult to generalize the findings. Furthermore data collection relied on self-report measures of CSU. Future studies will

be strengthened by including a range of other ED care settings and including more objective measures of substance use.

Conclusion

The findings from this study demonstrate that more than a third of the self-harm patients visiting this ED setting had a history of CSU. Our study also showed that a smaller proportion of CSU patients received a psychiatric assessment, despite the finding that half of the CSU patients (50.6%) reported a history of self-harm. These findings are particularly concerning in LMICs, like SA, where ED care settings are often poorly resourced, understaffed, overcrowded, and open for limited hours.[14,15] A visit to ED services that includes a psychiatric assessment could ensure that self-harm patients receive the care that they need, as it provides an opportunity to reinforce health behaviour patterns, to make appropriate referrals and to prevent repetition of self-harm.[22,33] Despite the benefit of a psychiatric assessment in reducing self-harm, such assessments are not routinely done before discharge from the ED.[34] In SA, early detection and necessary care is not always feasible or available to everyone, as limited skills and resources hinder adequate and timeous treatment or referral.[35] More research is required to determine ways of improving resources available to ED services or integrating psychiatric services in ED care that effectively address CSU and self-harm, as this would seem to be an important component of suicide prevention.

Declarations

Authors' contributions

EB participated in study design, data collection and data analysis, data interpretation, wrote the first draft of the manuscript, and critically revised subsequent drafts. JB participated in the conception of the study, data interpretation, critical revision of the manuscript, and provided funding for the study. IL assisted in the interpretation of the data and critically revised the manuscript/tables. All authors read and approved the final manuscript.

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Competing interest

The authors declare that they have no competing interest. The authors alone are responsible for the content and writing of the article.

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CHAPTER 6: Substance use and self-harm: Case studies from patients admitted to an urban hospital following medically serious self-harm

Preface to ARTICLE 4

Focus of this article

In this chapter, I present qualitative data, from the fourth article of this PhD study, to demonstrate the different ways in which substance use was implicated in self-harm from the viewpoint of patients admitted to an urban SA hospital following medically serious self-harm.

Why I needed to include this article in the dissertation

In Chapters 3 and 4, I demonstrated the prevalence rates and correlates of self-harm at the hospital. A number of authors emphasise that there is a need for more qualitative research in suicidology, as valuable insight on self-harm could be gained from those individuals who engage in the behaviour. In this chapter, I made use of a qualitative analysis to demonstrate how patients thought substance use played a role in their self-harm, while also identifying important sociocultural factors that influenced this relationship. I conducted this leg of the study to answer the third and final research question of this PhD study.

Submission details

The article was submitted to the journal Qualitative Health Research on 23rd March 2017 and was accepted for publication on 19th July 2017. This journal was deemed appropriate for the submission of this article because the journal provides an international, interdisciplinary forum to contribute to the improvement of health care and to further the development and understanding of qualitative research in health-care settings. The article has been formatted

according to guidelines for authors for the journal. The references are formatted in adherence to the guidelines contained in the Publication Manual of the American Psychological Association ("APA"), 6th edition. The impact factor of the journal at the time of the study was 2.036.

Author contribution

Elsie Breet was responsible for managing the data, data analysis, interpreting the results, drafting the article, and preparing the final article for submission to the journal. Jason Bantjes was involved in the design of the study, assisted in the interpretation of the results, and critically revising the article.

Article

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Elsie Breet[1] **and Jason Bantjes**[1]

Abstract

Few qualitative studies have explored the relationship between substance use and self-harm. We employed a multiple-case study research design to analyze data from 80 patients who were admitted to a hospital in South Africa following self-harm. Our analysis revealed, from the perspective of patients, a number of distinct ways in which substance use is implicated in self-harm. Some patients reported that substance intoxication resulted in poor decision making and impulsivity, which led to self-harm. Others said substance use facilitated their self-harm. Some participants detailed how in the past their chronic substance use had served an adaptive function helping them to cope with distress, but more recently, this coping mechanism had failed which precipitated their self-harm. Some participants reported that substance use by someone else triggered their self-harm. Findings suggest that there are multiple pathways and a host of variables which mediate the relationship between substance use and self-harm.

Keywords

substance use / addiction; alcohol / alcoholism; self-harm; suicide; emergency care; Africa / Africans; South Africa; qualitative methods; thematic analysis; multiple-case study; qualitative

Substance use (World Health Organization [WHO], 2014a) and self-harm (WHO, 2014b) both account for a significant proportion of deaths and the loss of healthy life years. A full body of quantitative research has established that self-harm is associated with alcohol use (Conwell, Duberstein, & Caine, 2002; Darvishi, Farhadi, Haghtalab, & Poorolajal, 2015; Evans, Hawton, & Rodham, 2004; Stack, 2000; Yoshimasu, Kiyohara, Miyashita, & The Stress Research Group of the Japanese Society for Hygiene, 2008) and the use of illicit drugs (Poorolajal, Haghtalab, Farhadi, & Darvishi, 2016). The majority of these studies have been uncontrolled descriptive studies that report prevalence estimates (Cherpitel, Borges, & Wilcox, 2004; Poorolajal et al., 2016). Moreover, the available research has focused on a narrow range of variables (e.g., chronic substance use and the dose-effect of substance intoxication) that researchers have assumed are important. Very few studies have investigated how patients who have engaged in self-harm themselves understand possible links between substance use and self-harm. In this study, we explore how substance use was implicated in medically serious self-harm from the perspective of patients who were admitted to an urban South African hospital.

Defining Self-Harm as a Dimension of Suicidal Behavior

For the purpose of this study, we define self-harm as an intentional act of non-fatal self-injury or self-poisoning that is non-habitual behavior, regardless of the level of intent to die (Hawton et al., 2016; WHO, 2014b). The term includes suicide attempts but excludes other forms of habitual self-injurious behaviors (i.e., non-suicidal self-injury). The decision to include these terms in the definition for self-harm is based on expert consensus that suicide prevention should focus on the full range of suicidal phenomena including self-harm (O'Connor, Platt, & Gordon, 2011). The definition of self-harm as it is used in this study is in line with other studies that have investigated self-harm (Hawton et al., 2003; Hawton et al., 2016) and with the definition used by the WHO to describe non-fatal suicidal behavior (WHO, 2014b).

[1]Stellenbosch University, Stellenbosch, South Africa

Corresponding Author:
Elsie Breet, Department of Psychology, Stellenbosch University, Private Bag X1, Matieland, 7602, Stellenbosch, South Africa.
Email: elsie@sun.ac.za

Medically serious self-harm refers to any case of self-harm, as defined above, where the individual was admitted to hospital for medical treatment.

Quantitative Studies of Substance Use and Self-Harm

We conducted literature searches of four databases (i.e., CINHAL Plus [EBSCO], PubMed, Web of Science, and PsychArticles) to identify systematic reviews reporting on links between substance use and suicidal behavior, including self-harm. Searches were limited to reviews published from January 1, 2007, to July 21, 2017. We used the search terms "substance AND induced OR addiction OR dependent OR dependence OR use OR misuse OR withdrawal OR intoxication OR intoxicated." This search identified eight reviews (Bohnert, Roeder, & Ilgen, 2010; Borges & Loera, 2010; Degenhardt & Hall, 2012; Hawton, Saunders, Topiwala, & Haw, 2013; Leite et al., 2015; Matsumoto, 2010; Petit, Reynaud, Lejoyeux, Coscas, & Karila, 2012; Pompili et al., 2010; Yuodelis-Flores & Ries, 2015).

These systematic reviews all consistently show a positive association between substance use and suicidal behavior, including self-harm, in high income countries (e.g., Degenhardt & Hall, 2012; Pompili et al., 2010) and LMICs (e.g., Martinotti, Matteo, Rita, & Massimo, 2014). These systematic reviews indicate that substance intoxication (i.e., acute substance use) and chronic substance use are well-established potentially modifiable risk factors for suicidal behaviors. The majority of research has, however, explored chronic substance use and substance use disorder (e.g., alcohol use disorder) as risk factors for self-harm (Norström & Rossow, 2016). Although less attention has been paid to substance intoxication, this too has been associated with self-harm even when statistically controlling for alcohol use disorder, suggesting that it is an independent risk factor for self-harm (Borges & Loera, 2010; Conner, Bagge, Goldston, & Ilgen, 2014). A recent meta-analysis demonstrated a dose–response relationship where higher levels of drinking were associated with increased risk of suicide attempts (Borges et al., 2016). The observed dose–response relationship between acute use of substances and self-harm might be the result of increased aggressiveness and impulsivity (Conner et al., 2006) or impaired cognitive function (Bagge & Sher, 2008; Cherpitel et al., 2004). A study among a U.S. national sample demonstrated that alcohol intoxication was associated with particular potentially lethal methods of self-harm, specifically the use of firearms, hanging, and poisoning (Conner, Huguet, et al., 2014). In addition, some studies have demonstrated that alcohol intoxication plays a facilitative role in suicidal behavior (Bagge, Conner, Reed, Dawkins, & Murray, 2015). Other quantitative studies have also highlighted the role of acute (Pavarin et al., 2014) and chronic substance use (Finkelstein et al., 2016) in repetition of self-harm.

These quantitative studies have limitations in that they make explicit assumptions about which variables should be the focus of research attention to understand the relationship between substance use and self-harm. Qualitative studies could be valuable in this regard, as they have the potential to provide further insight into the ways in which substance use might be implicated in self-harm. A number of authors have argued for more qualitative research in suicidology by asserting that the true experts on suicidal behavior are those who engage in self-harm (Hjelmeland & Knizek, 2010; Mars, Burrows, Hjelmeland, & Gunnell, 2014). Therefore, we need to augment epidemiological and quantitative research on substance use and suicidal behavior by including the insider perspectives of those who engage in self-harm.

Qualitative Studies of Substance Use and Self-Harm

A small body of literature has employed qualitative methods to illustrate how patients understand the links between substance use and self-harm. For instance, among patients admitted to hospital following repeat acts of self-harm, some participants described the use of alcohol as a means of numbing the pain associated with self-harm, although others believed that self-harm was the result of being intoxicated (Hume & Platt, 2007). In another study, men who were experiencing depression commented that they made use of alcohol and illicit drugs to self-medicate or to escape physical pain and feelings of distress (Oliffe, Ogrodniczuk, Bottorff, Johnson, & Hoyak, 2012). Participants in another study added that alcohol dependence at first served as an escape from emotional pain but eventually increased feelings of low self-esteem and self-loathing that in turn triggered self-harm (Sinclair & Green, 2005).

We argue that an investigation of how participants report that their substance use was involved in their self-harm is a necessary step toward expanding our understanding of the role of substance use in self-harm. In this article, we aim to delineate a number of different ways in which substance use was implicated in self-harm from the viewpoint of patients admitted to an urban South African hospital following medically serious self-harm.

Method

Study Design

We used a multiple-case study design because this methodology allows a detailed exploration of contemporary

phenomena within a specific real-life context (Yin, 2013). In this study, a multiple-case study design forms the blueprint that underlies the way we answered the research question: "How is substance use implicated in self-harm?" A multiple-case study design was deemed appropriate as case study methodology enables researchers to explore how commonalities (literal replications) and differences (theoretical replications) across multiple cases work together to lead to an event (Yin, 2009). Furthermore, the multiple-case study design permits the use of multiple data sources (e.g., archival data, notes made in patient files, and interviews) that are integrated in the data analysis process so that the researcher can gain an overall understanding of the phenomena (Yin, 2003). This information can then be used to build hypotheses that might contribute to further research action (Yin, 2013).

Study Setting

The study was conducted at an urban hospital in the Western Cape Province of South Africa. The hospital is a large public hospital that at the time of the study provided care for as many as 560,000 referrals and in-patient admissions per year. At the time of the study, the hospital's staff consisted of more than 3,663 staff (South African State Hospitals, n.d.).

Participants

This research formed part of a broader study that aimed to investigate the sociocultural context in which self-harm occurs and document first person narratives of medically serious self-harm. We recruited, as far as possible, patients who were admitted consecutively to either a medical, surgical, or psychiatric ward following medically serious self-harm; although our intention was to recruit consecutive cases, this was not always possible as on some occasions, patients were discharged from hospital before we could make contact to enroll them in the study. The hospital where data were collected is a large busy hospital where there is considerable bed pressure which results in the rapid discharge of patients who presented to the hospital following self-harm, as soon as they are medically stable (Bantjes et al., 2016). Participants were men and women above the age of 18 years old who had the capacity to consent and who were medically stable.

Data Collection

Data were collected between June 16, 2014, and March 29, 2015. Participants were assessed by a medical officer who confirmed that they were medically stable and able to consent prior to being enrolled in the study. Participants were able to speak and understand English or Afrikaans. All isiXhosa mother-tongue speakers were given the option of having an isiXhosa-speaking interpreter. During the interview, semistructured questions were used to gather information on the circumstances that precipitated patients' self-harm. Patients were asked how they came to be in hospital and were prompted to talk about the context in which their self-harm occurred; their perception of the antecedents, precipitants, and consequences of their self-harm; substance use; health (physical and psychiatric); history of psychological distress; history of abuse; exposure to violence or trauma; and spiritual beliefs. The prompts used in the semistructured interviews were designed to illicit a thick description of the patients' perspective on the sociocultural, contextual, and individual factors that they believed contributed to their self-harm. The interviews, which were conducted by a psychologist (J.B.), adopted a free-flowing conversational style where events were explored in the way the participant presented them (Silverman, 2013). Interviews lasted between 45 and 90 minutes and were transcribed verbatim. All transcripts were checked by the E.B. to ensure that they had been accurately transcribed. The data collected via the interviews were augmented with additional demographic and clinical data from the patient discharge summaries; for example, patients' demographic characteristics, nature of the injuries sustained, and length of stay in hospital were recorded. A total of 85 patients were invited to participate in the broader study. Only one participant declined to participate; two requested that their interviews should not be audio recorded; and in three interviews, the quality of recording was so poor that the interviews could not be transcribed. Therefore, 80 interview transcripts were utilized for the initial data analysis process. No incentives were offered for participation in the study.

Data Analysis

We carefully examined the transcripts of the 80 interviews conducted in the broader study to identify all cases where patients made any reference to substance use in their narrative account of the factors that contributed to their self-harm. In total, 41 patients made reference to substance use while describing the circumstances of their self-harm. We made use of inductive thematic analysis to analyze systematically the interview transcripts and discharge summaries of the cases in which patients identified substance use as a factor contributing to their self-harm (Braun & Clarke, 2006). An inductive approach involves a process where themes are created that are strongly linked to the data (Patton, 1990). Inductive thematic analysis is a data driven process in which theoretical sense is made of the data once themes have been identified (Braun & Clarke, 2006). Data analysis began

with a process of familiarization where the cases were carefully read through a number of times to develop a detailed understanding of each case. Next, the transcripts of the interviews were imported into Atlas.ti software version 7 (ATLAS.ti, 2012) to facilitate the coding process. Codes were generated by examining each line carefully to identify or highlight meaning units (i.e., sentences or paragraphs) of information within each participant's data and across the entire dataset. These "meaning units" were then assigned a descriptive code (Côté, Salmela, Baria, & Russell, 1993). The coding process was done carefully so that the meaning of the units would not be lost. During the coding process, a cross-case synthesis was done whereby a table was created which allowed for the comparison of codes within and between cases. The similar codes and dissimilar codes were then organized into categories that were related to the aim for this study (Yin, 2009). The codes were then grouped into seven themes according to their underlying meanings. The initial themes were then reviewed in a process of checking to ensure that the themes relate to not only the identified codes but also the dataset as a whole (Braun & Clarke, 2006). In the final step of analysis, the themes were refined so that clear definitions and names were developed for each of the seven final themes (Braun & Clarke, 2006). Multiple-case study analysis was then used to illustrate the seven final themes. During the process of multiple-case study analysis, seven cases were selected so that each theme is illustrated by one case study per theme. The seven specific cases were selected based on the richness of the data provided by the participants. When selecting the seven cases, we sought cases that are as representative as possible and include useful variation on the dimensions of the phenomena under investigation (Seawright & Gerring, 2008).

We employed a number of strategies to increase the rigor and credibility of the study results. Data triangulation of multiple sources was used to augment the data (Barbour, 2001). The codes and emergent themes were discussed and interpreted by E.B. and J.B. (Barbour, 2001). Verbatim quotes were used to demonstrate reliability of the data interpretation.

Ethical Considerations

Ethics approval was gained from the Health Research Ethics Committee at Stellenbosch University (reference number N13/05/074) and the University of Cape Town (reference number 645/2013). Institutional permission for the study was obtained from the hospital authorities. All patients were informed that participation was voluntary. Prior to data collection, participants provided written informed consent and gave permission for their interviews to be recorded digitally. The identity and information of participants were treated as confidential and steps have been taken to change identifying features of patients in the reporting of case studies, to safeguard participants' privacy. Pseudonyms were used to protect patients' privacy and anonymize the data. Only a subgroup of the 80 interviews from the broader study who mentioned that substances were related to their self-harm was analyzed in this study. However, those interviews that were not analyzed in this study because they did not mention that substance use was related to their self-harm were analyzed in other parts of the broader study.

Results

Overview of the Cases

The 80 cases consisted of 34 males and 46 females whose ages ranged from 19 years to 67 years (M = 35.3, SD = 15). Each theme includes a brief case vignette to illustrate how participants narrated the involvement of substance use in their self-harm.

Impulsivity, Poor Judgment, and Aggression

Some of the participants explained that their self-harm was a consequence of intoxication that resulted in impulsive decision making, poor judgment, and aggressive behavior. All the participants that attributed their self-harm to intoxication also reported relationship difficulties (e.g., divorce, or an argument with an intimate partner), which they linked explicitly to feelings of anger and hurt which precipitated aggressive behavior. They explained that the feelings of anger and the aggressive behavior, together with the effects of intoxication, led to self-harm. For example, Angela reported that while intoxicated, she discovered her husband was having an affair and she became enraged. She then broke a bottle and stabbed herself in the neck with the jagged broken bottle before cutting her wrists. Angela added that this was an impulsive (i.e., unpremeditated) incident because at the time, she was angry and intoxicated, and was not thinking clearly.

> I wasn't thinking straight, that's why I, because I wasn't thinking straight . . . I was made into over upset while I was still in that. And I was influenced by alcohol. I wasn't thinking straight.

Auditory Hallucinations or Paranoia Related to Substance Use

Some participants explained that while they were intoxicated, they experienced auditory hallucinations or paranoia which they said precipitated their self-harm. All attributed the hallucinations or paranoia to either substance intoxication or chronic drug use. The participants

detailed that their hallucinations and paranoia were associated with intense feelings of anger, fear, irritation, and aggression that exacerbated their feelings of distress leading up to the self-harm. Alcohol intoxication further complicated this association. When asked about their method of self-harm, all participants described accounts of bodily harm (e.g., hanging or cutting of wrists and throat). For example, Joseph attributed his auditory hallucinations and intense feelings of aggression to use of methamphetamine.

> I became very aggressive . . . It's always just the voices. It comes from my use of drugs . . . So they're going to check if . . . to calm the voices down and try to see if there's something wrong in the brain.

Joseph experienced the hallucinations as intrusive and uncontrollable, making daily tasks, such as driving, difficult. Joseph explained that on the day of his self-harm, he experienced overwhelming feelings of anger, aggression, and irritation that he directly linked to his hallucinations. He considered self-harm to be the only means of making the hallucinations stop.

> I think it's just anger or aggressiveness. Or basically, anger and irritation, and being tired . . . I felt very, very irritated because I was hearing the voices. So that's all I wanted to do, I just wanted to end my life . . . I just really wanted them to stop.

Substance Use to Facilitate Self-Harm

A number of participants said that they made use of substances to facilitate their self-harm. For example, one participant believed that alcohol intoxication served as a means of boosting his courage, to numb pain or fear, so that he could act on his thoughts of self-harm. Akhona explained that his struggles to find a job motivated him to move to the Western Cape in search of employment. Although he managed to find work, this work had been on a part-time contract basis. Not able to find full-time lucrative employment and not able to see a way forward, he felt hopeless and started to think about ending his life.

> That time I just felt that things were tough now: I can't reach my, my, I can't reach the standards I tried to set myself. Around by this time I would be achieving those. So then I felt like giving up.

Prior to the self-harm, Akhona had been drinking socially with friends. He became intoxicated and believed that the alcohol numbed his constraints to self-harm and that enabled him to enact his suicide plan. Akhona believed that this is because alcohol forced him to focus on what he was experiencing at that moment and not on his future.

> But it was not just a thing that came now, but it was a thing I was running around with . . . You know, that day I woke up as usual, but maybe also the alcohol intake plays a role to give me courage, because I just took some liquor that day. It was okay. You know, when you are drunk you might think I don't know, you just think in front of you and you don't think beyond that.

Substance Use as a Method of Self-Harm

Some participants commented that they used alcohol as an integral part of their suicide plan. All three of these participants detailed a long history of alcohol use that at times served to self-medicate symptoms of physical illness (such as pain), symptoms of depression or anxiety, interpersonal conflict, and feelings of hopelessness. For example, John explained that he suffered from chronic pancreatitis and persistent severe physical pain which he found difficult to cope with despite receiving treatment. He believed that some of his physical pain related to years of substance abuse as a means of self-medicating his long history of psychiatric illness. John added that the years of substance abuse damaged his relationships, which resulted in divorce from his wife and disconnection from his daughter.

> And obviously because of alcohol misuse and all that throughout the years I mean has damaged my relationship with my ex-wife . . . And obviously it has split over to my kids. I mean I don't speak to my daughter.

Unable to turn to others for support, John was forced to live in shelters. Feeling that his situation of homelessness and chronic pain was hopeless, John attempted to drink himself to death, which resulted in alcohol poisoning and an admission to the hospital.

> And then I just thought well I have money let's, I'm going to drink myself to death now. So I just drank and drank and drank and drank.

When asked how he felt about being alive, he described that he did not enjoy living in shelters and that the poor living conditions negatively affected his self-esteem. With nowhere else to live, John knew that he would need to return to a shelter once he was discharged from the hospital. He explained that he was not willing to live in shelters and would rather again attempt to end his life than go back to a shelter.

> If I were to leave here, in this amount of pain and go out and stay you know in a place like a shelter, I would end my life, simple as that. I would never live like that again, never.

Unsuccessful Treatment for Substance Use Disorder

One participant cited the unsuccessful treatment for his substance use disorder as the precipitating factor for self-harm. David described his troubled 5-year history of compulsive cocaine use. He sought treatment from a rehabilitation center 3 months before the self-harm. During his treatment at the clinic, he made a commitment to himself that if he ever used any substance again, he would end his life.

> When I lived there at the clinic, I told myself, if I am going to do drugs again, I am going to kill myself.

Following his stay in the rehabilitation center, David sporadically used medication and attended Narcotics Anonymous meetings as part of his efforts to prevent a relapse. However, during this time, David's mother had become ill and, as the only one to care for her, he was not able to sustain his treatment. David explained that after failing to abstain from drug use, he was overcome by feelings of guilt, shame, and helplessness that then led to the decision to end his life.

> I would buy the drugs, in the night time, then I'd feel guilty . . . then I'd say no, I'm not going to do it next week or next day, but then it happens again. So, I said to myself, I, I can't go on like this.

The Breakdown of Substance Use as a Means to Cope

A number of participants reported that their pattern of chronic hazardous substance use was a coping mechanism employed to reduce negative affect (i.e., overwhelming feelings of sadness and grief) and to escape physical illness or a chaotic lifestyle. All participants explained that for some time, their substance use acted as a protective factor, making their lives bearable, and in their words, "preventing self-harm" or stopping them from killing themselves. All participants added that while in the past, their substance use had been adaptive, it was no longer serving them and they felt unable to cope with life circumstances. The inability to cope was identified as the precipitant of their self-harm. For example, Emma, who described having had a difficult life and a long history of alcohol use, cut her wrist following an upsetting dream about her mother's death. She described experiencing strong feelings of guilt and anger for not dealing with her mother's death a year before. She added that her distress was exacerbated by the burden of having to care for her father and younger brother financially, and at times physically.

> I never got to deal with anything that was happening and uhm, uhm, a couple of weeks later I broke down because I was angry with myself that I had handled it (my mother's death) so well. I felt cold, I felt heartless . . . My dad refused to go to work because he was still grieving. I carried on with life and I got three jobs and supported my dad and my brother.

Emma acknowledged that she had been drinking heavily and frequently over the weeks and months before her self-harm, but was unable to recall whether she was drinking on the day of her self-harm. She then went on to explain that she did not consider her drinking to be a problem; she said drinking was a means of escaping the difficulty that she was experiencing.

> I think it's been more, to an extent I thought it was kind of an escape mechanism.

Third-Party Substance Use

Some participants stated that the substance use of somebody else was so difficult or chaotic to live with that they did not see another way out than to end their lives. Jemma was admitted to hospital following an overdose because she felt that her husband's alcohol abuse and the drug abuse of her sons became too much to deal with.

> I would always wanting to actually not live. It's quite a while now, quite a few years. And it came to a stage where I . . . because my hubby and my children were all getting too much for me. My husband was an alcoholic, and both sons were on drugs.

She explained that she resented her sons for using drugs because she felt that she had worked hard and spent her money and resources to help them get a good education so that they could build a good life, but that one son in particular wasted the opportunities that she provided.

> I gave most of my time and my life to them. I actually lost most of my money and my home.

Jemma described that she also felt distressed and sad that her grandchildren were not being raised in a "good home" and that being exposed to their father's drug abuse had made them aggressive and violent toward each other.

Discussion

The range of themes and the variety of cases described above illustrate that the participants in the sample reported diverse experiences and described different ways in which they understood the links between substance use and their self-harm. Even though the cases described

above all demonstrate how substances can be implicated in individual's decisions to self-harm, the cases also highlight the role of other contextual factors, such as physical illness, psychopathology, interpersonal conflict, and predisposing stressful life events (e.g., death of a loved one), in further complicating the association between substance use and self-harm. Furthermore, the cases draw attention to the role of emotions (such as sadness, shame, guilt, anger, and hopelessness) which also seem to interact with the use of substances to precipitate self-harm. A strength of employing a qualitative methodology is that it permits an exploration from the perspective of the participants to illustrate how they make sense of the numerous complex ways in which substance use is mentioned in medically serious self-harm. Clearly, the participants in this study do not see a simple linear cause-and-effect relationship between their substance use and self-harm; they describe a web of causality in which substance use is only one of the factors implicated.

Findings from the case studies and the literature (Bagge & Sher, 2008; Cherpitel et al., 2004; Conner et al., 2006) show that substance intoxication might directly affect cognitive functioning thus increasing the risk of self-harm. In this study, cases detailed accounts of how substance intoxication directly served to impair judgment or decision-making processes which then triggered unpremeditated self-harm.

A number of participants also indicated that substance intoxication enabled unplanned and impulsive behaviors that led to self-harm. For these participants, intoxication narrowed their ability to think of alternative ways of coping with the perceived stressor. Participants experience of this phenomenon is echoed in the findings of other studies, see, for example, Cherpitel et al. (2004) and Hufford (2001).

Participants described how substance intoxication numbed the constraints to self-harm. The participants in this study expressed that although it was not necessarily a intentional behavior, substance intoxication provided the courage needed to enact thoughts of self-harm by concentrating attention on the perceived hopelessness about the problems faced in that moment. The finding that a proportion of individuals might engage in intoxication prior to self-harm is in line with available research (Reyes-Tovilla et al., 2015). There is also a proportion of individuals who deliberately become intoxicated prior to planned self-harm. The motivation to become intoxicated deliberately prior to premeditated self-harm is grounded in lowering inhibitions and fear of pain associated with self-harm (Bagge & Sher, 2008; Conner, Bagge, et al., 2014; Hufford, 2001). Bagge and colleagues (2015) suggest that it is necessary to explore in more detail the stated motivation or reason for substance intoxication prior to self-harm.

The adaptive function of substance use that was reported by some participants is an interesting finding. For participants who reported an adaptive function of substance use, their substance use allowed them to cope with stressful life events. Although they also reported that this way of coping eventually failed them and that this precipitated their self-harm, these participants explained that substance use, initially to some extent, helped them to regulate negative emotions and to deal with difficult life events. However, all participants reported that the substance use was limited in its long-term effectiveness, which then led to self-harm. The finding that substance use might improve positive affect and offer a short-term reduction of negative feelings is congruent with available research (Creighton, Oliffe, Matthews, & Saewyc, 2016; Ehrmin, 2002; Kasi et al., 2012; Kassel, Bornovalova, & Mehta, 2006). Likewise, a rich body of quantitative (Cooper, Hildebrandt, & Gerlach, 2014; Leeies, Pagura, Sareen, & Bolton, 2010) and qualitative (Roberts, 1999; True, Rigg, & Butler, 2015) research have established that individuals with issues related to poor mental health or mental health disorder(s) might self-medicate using substances. Our findings suggest that it might be necessary to consider first, how individuals make use of substances to cope with life adversity, and second, what prevented their efforts to access other more sustainable means of support and coping.

A number of participants reported that the challenges associated with dealing with the substance use of someone else was a factor that contributed to their self-harm. In the current study, participants reported that feelings of hopelessness or anger, financial difficulty, and domestic violence related to the substance use of someone else triggered their own self-harm. The finding is consistent with the findings reported by Kizza, Hjelmeland, Kinyanda, and Knizek (2012) and Norström and Rossow (2016). Crucially, this finding draws attention to the harmful effects of substance use on third parties and the potential role this might have in self-harm.

Limitations

We recruited participants from a single medical site. Other studies might want to consider multiple sites and include community samples. We considered both alcohol use and illicit drug use in this study, but did not consider the role of tobacco or caffeine because participants did not identify this as a precipitating factor in their self-harm. Case study research cannot be used to make generalizations or to produce evidence of the association between different variables. Nonetheless, studies such as this one help to illuminate the role of factors that might hitherto not have been adequately acknowledged.

Conclusion

The insights offered by the cases of self-harm described in our study suggest that there might be a range of ways in which substance use is directly and indirectly associated with self-harm. The findings from this study suggest that it might be necessary to expand studies that explore the association between substance use and self-harm beyond simply investigating the well-established variables such as the effect of substance use disorder or a dose-response effect of intoxication. Importantly, our findings also highlight how substance use cannot be separated from other factors (such as strong emotions and situational stressors) in the etiology of self-harm. We need studies in this field that allow for a more complex exploration of how a wide variety of factors interact with substance use to precipitate self-harm.

Authors' Note

E. B. was responsible for managing the data, data analysis, interpreting the result, and drafting the article. J.B. was involved in the design of the study, and assisted in the interpretation of the results and critically revising the article. Opinions expressed or conclusions arrived at in this work are those of the author and should not necessarily be regarded as those of the Medical Research Council and the National Research Foundation.

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Author Biographies

Elsie Breet, MSc, is a doctoral student at the University of Stellenbosch, Department of Psychology, South Africa.

Jason Bantjes, PhD, serves as the director of the Welgevallen Community Psychology Clinic and is a senior lecturer in the Psychology Department at Stellenbosch University, South Africa.

CHAPTER 7: Substance use and self-harm at an urban South African hospital: recommendations for future suicide prevention and concluding thoughts

7.1 Introduction

In this chapter, I describe recommendations for future research and action in the field of substance use and self-harm at an urban hospital in SA, based on the findings of the research presented in this thesis. To do this, I: reflect on the broad aim of the PhD study and main findings from the respective chapters in this dissertation; consider what my research has contributed, or not contributed to the field; offer recommendations for future research at the hospital; suggest what action might be taken at the hospital to advance the goals of suicide prevention in this setting; and highlight some limitations to the study. The topics detailed in this chapter are not meant to be conclusive, rather to propose a starting point and stimulate conversation about suicide prevention at the hospital. In discussing future research and action at the hospital, I continue to highlight the importance of considering the sociocultural characteristics and context of individuals who engage in substance use and self-harm. By neglecting these influences, we perpetuate the inadequate responses to substance use and self-harm reported in studies from HICs and LMICs.

7.2 Discussion

7.2.1 Before we set off: What has this research contributed and does it achieve its aim?

7.2.1.1 The aim and objective for this research

In my general introduction Chapter 1, I provided a motivation and the main aim for the study. The aim of this PhD study was to investigate the association between substance use and self-harm, and to consider the sociocultural context in which this behaviour occurred, among patients who presented for treatment to an urban hospital in SA. The objective was to analyse

and discuss the findings from the articles to provide information that might guide policy and future research or action at the hospital. To achieve the aim and objective for this PhD study, I made use of a mixed methods approach in order to collect quantitative and qualitative data to generate a holistic overview of the association between substance use and self-harm as well as the sociocultural context for this behaviour. In the next sections, I explain how the different aspects of the dissertation link together to form a broad picture of substance use and self-harm at the hospital.

Knowledge gained from the articles that constitute this dissertation has contributed to the available published literature that show the importance of considering substance use in suicide prevention and intervention among patients who present to the hospital following self-harm. Throughout the articles, I also illustrated how the sociocultural characteristics and context played some role in this association. More research is needed, however, to understand the mechanisms by which such factors mediate the association between substance use and self-harm.

7.2.1.2 A look back on a decade of research on substance use and suicidal behaviour in low-income and middle-income countries

The first sub-aim of this study was to explore the association between substance use and SIB in LMICs in order to establish what is known about this situation, what remains unknown about this association, and where researchers should focus their attention (see Chapter 3). We conducted a systematic review to identify English quantitative studies published between January 2006 and February 2016. We searched five databases (i.e. PubMed/MEDLINE, CINHAL Plus, DARE, Web of Science, and PsycINFO) using a comprehensive combination of search terms related to substance use and SIB across all LMICs as identified on the list of LMICs from the World Bank. During the search strategy we adhered to the Preferred Reporting Items

for Systematic Reviews and Meta-Analyses checklist (PRISMA). Two authors completed the literature search independently. The data extraction was completed by a student and then I checked it for errors and consistency. Two authors independently assessed the quality and appropriateness of the included studies using a set of predetermined criteria derived from the Scottish Intercollegiate Guidelines Network checklist. Although I took the lead in this phase of the study, the data analysis and interpretation were discussed with the co-authors for their input.

The findings from this systematic review confirmed that a consistent positive association exists between substance use and SIB in LMICs. Therefore, AUS and CSU should be investigated among individuals who engage in SIB in LMICs in order to advance suicide prevention and reduce the morbidity and mortality associated with SIB. The majority of studies included in the review made use of a cross-sectional study design and risk-factor paradigm, which provides little information about how substance use is implicated in suicidal behaviour along with other factors (e.g. interpersonal conflict or social isolation) that may play a role. The bulk of research in LMICs has focused on alcohol, while studies investigating other substances such as methamphetamine (also known as Tik) and methcathinone (also known as Kat) are scarce. The available studies did not allow a discussion of the comparison between types of substances to ascertain if perhaps a certain illicit drug serves as a greater risk for SIB compared to other illicit drugs or alcohol. The findings highlighted the need for context specific research with some areas having more research than other areas. Specifically, the systematic review identified a relative scarcity of research from low-income and lower-middle-income countries as well as from regions such as SAS and MNA. Only nine studies in the systematic review had been conducted in SA. For this reason, I set out to explore both AUS and CSU as important constructs in my broader research objective to reduce SIB in SA. Furthermore, only seven studies explored

the association between substance use and suicide. As discussed in section 7.2.1.2, future research should include psychological autopsy studies for a deeper understanding of the relationship between substance use and suicide. The review concluded by suggesting that future research should employ more sophisticated methods or research designs, should be theory-driven, and include qualitative studies.

7.2.1.3 What a review of patient files taught us about substance use and self-harm

The second sub-aim of this study was to explore the demographic, medical service utilisation, and sociocultural differences between patients who report AUS or CSU and other patients (i.e. patients who report no substance use) among 238 self-harm patients presenting for treatment at an urban hospital in SA. In line with the findings from the systematic review, both AUS and CSU were found to be potentially modifiable risk factors of self-harm.

In Chapter 4, I found that one in five patients who presented to the hospital following self-harm reported AUS. A greater proportion of AUS patients were found to have used violent methods of self-harm; depressed LOC on admission; utilised more medical resources; required a longer stay in the hospital; stated that relationship issues or financial concerns were the reasons for their self-harm; engaged in previous acts of self-harm; and intended to die as a result of their self-harm. The findings from this study highlight the importance of addressing AUS as a significant public health problem, specifically in the light of the economic burden and use of scarce medical resources in this context.

In Chapter 5, I established that more than a third of patients presenting to the hospital following self-harm reported CSU. Our findings showed that CSU was associated with being male, with practicing self-harm by inflicting damage to their body tissue, and a history of self-harm. A smaller proportion of CSU patients, compared to other self-harm patients, received

psychiatric assessment. The finding that fewer CSU patients received a psychiatric assessment is concerning given that a greater proportion of CSU patients reported a history of self-harm. Treatment at a hospital or ED setting offers a window of opportunity to intervene and ensure that patients receive adequate treatment for substance use and self-harm.

I concluded Chapters 4 and 5 by arguing that substance use is a public health issue that share similarities with studies from HICs and other LMICs. Based on these findings, the association between substance use and self-harm deserves more focused research attention to understand the nature of this association in the context of reducing the utilisation of scarce medical resources. I present a more detailed discussion of what this research might look like in section 7.2.2. Given that a greater proportion of patients who reported AUS and CSU, compared to other self-harm patients, reported a history of self-harm, it is pivotal that suicide intervention at the hospital includes strategies and referrals focusing on substance use. Findings from these two chapters emphasise that hospital staff should be made aware of and be equipped with skills and knowledge on how to address unhealthy patterns of substance use among self-harm patients. In section 7.2.3.1, I discuss some specific suggestions of what these efforts might look like, while also emphasising that patients with substance-related self-harm should receive psychiatric assessments before being discharged from the hospital.

7.2.1.4 The insider perspective of substance use and self-harm

Given that the systematic review (see Chapter 3) and increasing literature in the field highlights the need for more rigorous qualitative research, this PhD study would not be complete without a qualitative component. The third, and final, sub-aim of this study explored the insider perspective of how substance use was implicated in self-harm among patients at the hospital as well as investigating the sociocultural context in which this behaviour occurred. I used semi-

structured interviews to explore patients' subjective experiences of substance use and self-harm. The interviews were transcribed by students, which I then checked for errors. I used a multiple-case study design because it enabled me to explore how similarities and differences across multiple cases work together to lead to self-harm that was in some way related to substance use (Yin, 2009). I used data driven inductive thematic analysis to identify the themes for this study. I identified seven themes, namely: impulsivity, poor judgment, and aggression; auditory hallucinations or paranoia related to substance use; substance use to facilitate self-harm; substance use as a method of self-harm; unsuccessful treatment for substance use disorder; the breakdown of substance use as a means of coping; and third-party substance use.

What is not yet clear from the chapters that make up this dissertation is what recommendations I can make for suicide prevention research and action at the hospital going forward. Recommendations for future research at the hospital are discussed in section 7.2.2. A brief description of possible future action in suicide prevention at the hospital is provided in section 7.2.3.

7.2.2 Future research at the hospital in light of critique for mainstream suicidology

In this section, I describe some recommendations for future research at the hospital, based on my findings in Chapters 3 to 6. It is important to note that suggestions made here are set against the backdrop of the discussion in Chapter 2.

7.2.2.1 Risk factor studies

In conducting future studies at the hospital, we should consider the role of potential mediating or moderating factors that include but are not limited to age, level of education, socioeconomic status, feelings of sadness or loneliness, impulsivity, poor decision-making and

reasoning skills, interpersonal problems, parental physical abuse or neglect, and comorbid psychiatric disorder among patients presenting to the hospital following self-harm.

Future studies at the hospital might employ more sophisticated research methods that contribute to our understanding of what factors serve as risk or mediating factors for some individuals but not others, or how factors vary across sociocultural context. As stated in Chapter 3, longitudinal studies may be conducted at the hospital to explore the course and temporal sequencing of substance use in self-harm among patients who present to the hospital. These studies might contribute to the development of a broad framework such as the matrix of risk and protective factors by Mościcki (2001) that could in turn inform the development and implementation of suicide prevention at the hospital (see Table 7.1). For example, based on the findings of this PhD study, the identified risk factors might include: family history of self-harm; childhood trauma; loss (i.e. employment, a significant relationship, or income); barriers to health care or mental health treatment; impulsive or aggressive qualities; feelings of hopelessness; easy access to means of self-harm; and a sense of isolation. On the other hand, potential protective factors that are identified might include: knowledge of or past positive experiences of treatment (e.g. for substance use disorder); skills in problem solving or conflict resolution; support from family or community members; access to local clinical intervention or other forms of mental health support services; and cultural beliefs that support instincts for self-preservation. Based on these findings, a comprehensive psychiatric assessment could be developed that is then used among patients who present for treatment to the hospital in order to plan effective intervention and treatment that decrease the likelihood for repetition of self-harm (see Chapter 5).

Likewise, more sophisticated statistical analyses (e.g. structural equation modelling) may be used to explicate at least to some extent which other factors (e.g. gender, employment status,

relationship status, social integration, community violence, poverty, lifestyle changes, chronic illness, and stressful life events) mediate the association between substance use and self-harm among patients who present to the hospital. Again, understanding the nature of this association could inform the decision of which context specific risk factors to consider during psychiatric assessment of patients at the hospital. For example, the hospital might serve an area that is plagued by high levels of community violence, lack of transport to other more appropriate services of support or mental health care, and easy access to harmful substances that together increase the risk for engaging in self-harm. Furthermore, we need to consider whether the psychiatric assessment currently used at the hospital is adequate to identify increased risk for repetition of self-harm, and if not, what feasible changes can be made to these assessments. In making any changes to assessment and treatment, it is necessary to take into account that the hospital is limited with regard to time, resources, and trained staff.

Table 7.1
Matrix of risk and protective factors for suicide

Context	Distal Risk	Proximal Risk	Protection
Individual	Mental disorder Substance use/abuse disorder Comorbidity Neurochemical vulnerability Family history of mental disorder/suicidality History of physical/sexual abuse Previous suicide attempt	Intensely stressful life events • Argument with parents, girlfriend/boyfriend • Incarceration • Perceived loss of independence • Other life event, loss Hopelessness Intoxication Panic attack Stroke	Enhancement of coping skills Early identification of mental/substance use disorder Appropriate treatment for mental/substance use disorder Appropriate medication management
Environmental	Disruptive/dysfunctional, family environment Easy availability of firearms Stigma against mental illness Environment with a few protective factors Community violence Cultural depression/cultural grief	Contagion, e.g. death of acquaintance Firearm in home	Family cohesion Social support Access to mental health and substance abuse services Responsible firearm storage Appropriately trained front line providers

Note. Reprinted from "Epidemiology of completed and attempted suicide: toward a framework for prevention," by E. K. Mościcki, 2001, *Clinical Neuroscience Research*, 319. Elsevier Science B.V.

7.2.2.2 Qualitative and theory driven research

Further qualitative research might provide a deeper understanding of the relationship between substance use and self-harm among hospital patients which randomized controlled trials and other types of quantitative studies do not provide. Psychological autopsy studies have been highlighted in the literature as an important source of information in future research (Bertolote, 2014). In this regard, future research may benefit from using psychological autopsy studies or qualitative studies to explore how substance use is implicated in medically serious self-harm

among patients at the hospital, while also identifying potential risk and protective factors that mediate this association. For example, in a psychological autopsy study using a matched-pair-case-control method, Khan and colleagues demonstrated that psychiatric disorders (e.g. depression), being married, being unemployed, and experiencing stressful life events were associated with suicides in Karachi, Pakistan (Khan, Mahmud, Karim, Zaman, & Prince, 2008). In a more recent psychological autopsy study from Nepal, geographic migration, harmful use of alcohol, and family history of suicide were reported as factors that increased the risk of suicide (Hagaman, Khadka, Lohani, & Kohrt, 2017). In the same study, authors explained that data where a third of married women also reported physical or spousal violence in their lifetime might be explained by qualitative findings from other studies that suggest Nepali women commonly attribute intimate partner violence to a spouse's substance use (Hagaman et al., 2017). As such, support groups and trauma counselling for women who experience intimate partner violence could be helpful to reduce the risk of self-harm. Findings from qualitative psychological autopsy interviews with bereaved relatives in Northern Uganda, demonstrated that alcohol was directly (e.g. alcohol played a facilitative role) and indirectly (e.g. drinking behaviour of a significant other) implicated in suicidal behaviour (Kizza, Hjelmeland, Kinyanda, & Knizek, 2012).

The use of qualitative theory-driven research could also be helpful to explain why some patients who engage in substance use engage in self-harm, while others do not. Suggestions of what these studies might look like are provided in Table 7.2. Perhaps another step at the hospital could be to build on the PhD study by continuing to employ mixed methods research, as was done in this PhD study (Kral, Links, & Bergmans, 2012). Such an approach could use quantitative methods to identify possible barriers to care, and also explore health care needs among patients who use substances and engage in self-harm. Rigorous qualitative research might

then be used to explore from the perspective of patients, and health care professionals, possible solutions to these barriers and needs.

Table 7.2
Description and Comparison of Clinical Features by Acute Use of Substances

Theoretical models of suicidal behaviour	Basic premise or psychological construct at play in the association between substance use and suicidal behaviour	Variables to be studied	Example of the contribution such a study could make to suicide prevention at the hospital
Diathesis-stress-hopelessness model of suicidal behaviour (Schotte & Clum, 1987)	Diathesis (e.g. genetic, psychosocial, biological, or situational factors) + Environmental stress (e.g. community violence, or lack of social connection) + Life events stress (e.g. trauma, or divorce).	Subjective perception of how impulsivity, disinhibition, or impaired judgement associated with substance use may interact with environmental stress or stressful life events that lead to suicidal behaviour.	Train staff (e.g. doctors, nurses, and social workers) to identify impulsive or aggressive tendencies among patients who engage in substance-related self-harm, while making suggestions for helpful interventions (e.g. propose strategies to strengthen skills in problem solving and proposing nonviolent ways of dealing with disputes).

Table 7.2
Examples of variables to explore in future theory driven qualitative studies at the hospital that aim to understand the relationship between substance use and suicidal behaviour (Continued)

Theoretical models of suicidal behaviour	Basic premise or psychological construct at play in the association between substance use and suicidal behaviour	Variables to be studied	Example of the contribution such a study could make to suicide prevention at the hospital
Interpersonal-psychological theory (Joiner, 2005)	Feelings of not being connected with others (i.e. thwarted sense of belonging). Thoughts and feelings of being a burden to others (i.e. perceived burdensomeness).	Subjective experience of thwarted belonging and perceived burdensomeness as a result of substance use. Subjective experience of substance use in response to thwarted belonging and perceived burdensomeness.	Equip staff (e.g. social workers or counsellors at the hospital and other primary care settings around the hospital) with skills to conduct group or couple counselling in order to meet with the patient and significant family members or their spouse to address feelings of isolation or burdensomeness associated with substance-related self-harm. Plan and agree on strategies of resolving the related issues (i.e. refer to substance use treatment and further family or couple counselling).

Table 7.2
Examples of variables to explore in future theory driven qualitative studies at the hospital that aim to understand the relationship between substance use and suicidal behaviour (Continued)

Theoretical models of suicidal behaviour	Basic premise or psychological construct at play in the association between substance use and suicidal behaviour	Variables to be studied	Example of the contribution such a study could make to suicide prevention at the hospital
Social theory (Durkheim, 1897)	Individual's level of perception of social integration or regulation.	Subjective experience of substance use that negatively affects social integration, and hampers social regulation, which in turn leads to suicidal behaviour.	Information gathered might inform collaborative efforts between the hospital and the surrounding communities to decrease harmful substance use and increase support for patients following discharge by enhancing connection and emotional closeness in order to prevent repetition of self-harm.
Ecosocial theory and related multi-level dynamic perspective (Krieger, 2001)	Interplay between biological, ecological, and social organisation.	Subjective experience of substance use and the interplay between personal experiences, cultural (i.e. positive values, norms, and traditions), economic, as well as social and environmental factors that lead to suicidal behaviour.	Information gathered will be useful in developing comprehensive psychiatric or psychosocial assessments that are completed for every patient presenting with substance-related self-harm in order to plan effective holistic post-discharge intervention.

7.2.2.3 Shifting the focus from the individual to the sociocultural context

I maintain that future research should look at the relationship between individual pathology and suicidal behaviour through a critical lens to establish the usefulness and constraints of adopting such a narrow view that excludes the sociocultural context in suicide prevention. In doing this, we might also consider the potential alternatives for suicide theory, research, and prevention that exist if we think of suicide as something other than primarily pathological (Marsh, 2016). Through more focused research we might realise that by focusing only on substance use among self-harm patients when planning interventions, other aspects of self-harm might be neglected such as chronic pain, illness (e.g. HIV), or distress related to the death of a loved one (see Chapter 6).

In this PhD study, I did not consider how doctors understand suicide or the social context in which this behaviour takes place. This information is necessary to ascertain whether awareness of social context does or does not assist clinicians in using or changing intervention styles. In-depth interviews could be conducted among doctors at the hospital to learn how they perceive patients who present for treatment following self-harm as well as the care that these patients need. For example, information generated from these interviews should include but should not be limited to health care professionals' views on: whether psychopathology is the main issue in suicidal behaviour among patients; suicide related stigma (e.g. patients who engage in suicidal behaviour have a mental disorder or are looking for attention); reasons for substance use among patients; patients' needs for care (i.e. related to pathology but also other issues related to their suicidal behaviour); and potential barriers to care.

In order to address the issue of context, an overarching theme throughout my PhD study was to explore the sociocultural context in which substance use and self-harm occurred among

patients at the hospital. Future qualitative research at the hospital could build on the findings from this study by gaining a deeper understanding of the role of sociocultural context as a risk but also as a protective factor in self-harm; for example, gaining insight into the way in which culture influences patterns of substance use or stigma impacts on health seeking behaviour. In conducting this research we could also explore cost-effective and sustainable strategies that can be implemented in this specific context, as has been suggested by authors such as Vijayakumar (2017). Examples of what these strategies might entail are discussed in section 7.2.3.2.

7.2.2.4 Language in suicide prevention

Efforts to improve mental health care in LMICs should also consider the role that language plays in accessing and delivering effective care (Patel & Prince, 2010), especially in SA where there are 11 official languages. Referral for substance use following discharge from the hospital will be difficult, if not impossible, in the absence of staff (i.e. doctors, nurses, psychologists, psychiatrists, or social workers) or interpreters who are able to speak the local languages. As far as possible, staff employed at the hospital should reflect the diversity of the surrounding communities. The bulk of evidence on interpreter services and increasing language accessibility in health care comes from HICs (Brisset, Leanza, & Laforest, 2013). Although much can be learnt from services utilised in HICs, these services are costly and might not be feasible within LMICs (Swartz, Kilian, Twesigye, Attah, & Chiliza, 2014). Swartz and colleagues (2014) go on to suggest that those currently working toward developing locally delivered mental health programmes should also report on how they have dealt with issues of linguistic complexity in their research.

Despite the potential benefit of employing interpreters as bridges in communication, through their knowledge of language and in some cases culture of the patient, some caution is

necessary when making decisions based on the information gathered. In this PhD research, confidential and sensitive issues related to substance use and self-harm might have been especially difficult to discuss by those participants who are not English or Afrikaans speaking. Some emotional and cultural nuances might have been lost in translation. Even though participants were offered the opportunity to ask for an interpreter during interviews, none of the patients did so. Patients might have been reluctant to ask for an interpreter to be used given the personal nature of the issues discussed. Future research at the hospital should investigate whether making use of an interpreter poses any difficulty for patients to discuss personal issues.

7.2.3 Future suicide prevention action at the hospital

As stated in section 1.1.2, the broader context of this PhD study was to make some suggestions for future suicide prevention action with a focus on the hospital. In this section, I describe some suggestions for future suicide prevention action at the hospital. Recommendations made throughout this section are underpinned by findings from this PhD study and literature on suicide prevention from HICs and LMICs. In making recommendations for future suicide prevention action at the hospital, I continue to stress that all strategies should be culturally and socially appropriate.

Even though the focus of this PhD study is on the hospital, a tertiary health care setting, I also briefly highlight some other important suicide prevention and intervention settings. The decision to include different settings is partly based on the reasoning that a proportion of individuals who engage in SIB may die from their first attempt without having a history of SIB that necessitated a visit to the hospital. For these patients it would not be helpful to focus our attention solely on hospital or ED settings. As such, in LMICs it is important to think through carefully about where to target prevention activities, that is, primary or secondary settings or

ideally, they should complement each other. Furthermore, the scarcity of human and economic resources in developing countries necessitate integrated suicide prevention and intervention efforts (Vijayakumar, 2004) that include primary health care services, specialised services, voluntary and community organisations, teachers, social workers, and cultural or traditional healers (Vijayakumar, 2017; WHO, 2014a). By employing an integrated approach we strengthen the future action taken at the hospital. In planning and implementing suicide prevention at the hospital, we also need to think about ways of testing these strategies for appropriateness and efficacy. Some suggestions for future research have been discussed in section 7.2.2. In addition, I propose that pre- and post-testing, pilot studies, and follow-up strategies should be incorporated in all suicide prevention efforts at the hospital. Information collected from these efforts will contribute to our ability to implement evidence-based suicide prevention and to identify strengths as well as areas that need to be improved.

7.2.3.1 Hospital or emergency department setting

In Chapter 5, I suggested that ED care providers and hospital staff are uniquely positioned to complete proactive episodic assessment or offer support and intervention for health care needs related to substance use and suicidal behaviour. I based this premise on findings that large proportions of individuals who engage in suicidal behaviour interact with primary care providers in the months before self-harm, while a smaller proportion interact with psychiatric services (Comtois et al., 2015). This is especially true for patients who use substances, as substance use disorder is often accompanied by health problems (Reid, Fiellin, & O'Connor, 1999). For example, findings from a US national Comorbidity Survey suggested that individuals with substance use disorder were twice as likely to seek treatment from general medical

providers, when compared to visits to speciality mental health providers, in the 12 months preceding suicidal behaviour (Wang, Lane, Olfson, Pincus, Wells, & Kessler, 2005).

Following a thorough physical assessment and management by medical staff, patients should receive a psychiatric or psychosocial assessment. The relevant staff should receive sufficient training to ensure that psychiatric or psychosocial assessments are completed properly and for every patient. In Chapter 5, I reported that an issue of concern at the hospital is that not all patients receive psychiatric or psychosocial assessments or that these assessments were often not complete. For example, in Chapters 4 and 5, the PSIS was not consistently completed across all patients who presented to the hospital. Inconsistent assessment might be due to inadequate training, lack of appropriate screening or assessment instruments, and limited trained staff especially among those patients who are admitted at night. Future work at the hospital should investigate what the reasons are for incomplete assessments and address these accordingly. Task shifting of screening activities to lay workers in low-income settings could contribute to more efficient use of health care staff (Kagee, Tsai, Lund, & Tomlinson, 2013) and resources.

The objective of psychiatric or psychological assessments should be to identify significant mental health problems and other factors that played a role in the self-harm act. Specifically, based on the findings from this PhD study, doctors should be sensitised to the role of and need to screen for substance use among self-harm patients. Additional information that should be collected might include psychiatric history or a mental state examination, social issues or recent life events (e.g. job loss, relationship problems, death of a loved one), parental substance use history, and risk assessment for future self-harm. The risk assessment might include four components namely: suicidal intent (e.g. suicidal intent or actual and perceived adverse outcome of the act); psychiatric state (e.g. depressive symptoms, substance use, auditory

hallucinations or paranoia related to substance use, continued thoughts of self-harm); social support (e.g. housing, employment, family, or social isolation); and epidemiological risk factors (e.g. gender, history of self-harm, or lower social class) (Kapur, 2009). Information gathered from this assessment will be useful to decide what further action is required in order to provide effective care or referral.

Medical staff should be educated with regard to treatment or referral options for patients presenting with substance-related self-harm. During training, medical staff should be equipped with information leaflets containing a list, and contact details, of relevant substance use resources and referrals. A copy of these information leaflets should also be handed to patients. For example, the details for Cape Town Drug Counselling Center, Ramot Treatment Center, Montrose Foundation, Alcoholics Anonymous, and sober living homes in the area could be included in the leaflets. Potential substance use services that may be partnered with are discussed further in section 7.2.3.2. Some participants in Chapter 6 reported that their self-harm was related to unsuccessful treatment for substance use. Therefore, medical staff should also be made aware of the importance of inquiring about previous unsuccessful treatment for substance use. Knowledge of treatment history or previous intervention(s) might shed light on why these efforts were unsuccessful. Where possible, factors related to unsuccessful treatment or intervention should be addressed before new referrals are made.

Motivational interviewing might reduce substance use among patients at the hospital. The objective during brief interventions using motivational interviewing is to give structured information about substance use, to provide guidance on how to change substance use behaviour, and to develop a personal plan to reduce substance use (Kaner et al., 2009). Increasingly, motivational interviewing is being blended with other evidence-based interventions to reduce

harmful use of substances (Barrowclough et al., 2010; Cooper, 2012). A study among 335 patients from emergency departments in SA assessed the feasibility and acceptability of using a blended motivational interviewing and problem solving brief intervention to reduce risky substance use among patients (Sorsdahl et al., 2015). The study concluded that a blended motivational interviewing and problem solving brief intervention reduced substance use more than a motivational interviewing and control group intervention (Sorsdahl et al., 2015). Future suicide prevention action at the hospital should replicate this randomized controlled trial study at the hospital to determine if a blended motivational interviewing and problem solving intervention offered by counsellors could reduce risky substance use and repetition of self-harm at this hospital. Furthermore, the problem solving therapy component could also be used to address other behaviour related to self-harm. For example, patients could receive advice on how to manage impulsive decision-making, aggressive behaviour, and relationship conflict (see Chapter 6). Likewise, those patients who expressed that the breakdown of substance use as a means to cope with difficult life situations was the reason for their self-harm could be equipped with problem solving skills to deal with the difficulties they face (e.g. death of a loved one). In addition, patients having trouble related to joblessness could be put into touch with appropriate services that could assist them in finding a job.

It is not well established whether admission to a medical or psychiatric bed in a hospital reduces the risk of repetition of self-harm. Findings from a national self-harm registry in Ireland suggests that admission to a medical bed did not reduce rates of repetition of self-harm, while admission to a psychiatric bed served to increase the risk of repetition of self-harm (Carroll et al., 2016). It was not clear from the study findings whether the heightened risk associated with psychiatric inpatient admission was influenced by other factors. For example, patients admitted

to psychiatric inpatient care commonly have more severe mental health needs and have a higher risk of poor outcome (Kapur et al., 2015). It is possible that psychiatric in-patient care alone does not reduce the risk for repetition of self-harm.

During the semi-structured interviews for this PhD study, some patients mentioned that they did not feel that an admission to a psychiatric unit was helpful. Patients expressed that they often waited long periods before being examined by a doctor, that there were no activities to keep them busy with, that they were not allowed to have access to their phones, and that the nurses were not sympathetic toward patients. It might be worthwhile assessing how patients at the hospital experience the care provided by psychiatric inpatient admission. Bantjes and colleagues (2017) have partly explored experiences of care received at the hospital from which the patients who participated in this PhD study were recruited. The ethnographic study suggested that some patients admitted to the emergency psychiatric unit of the hospital experienced the care they received as counter-therapeutic since they were not provided with an opportunity to talk about the issues related to their self-harm act (Bantjes et al., 2017). Another participant reported that nurses had told her that they were not trained to talk to patients about the difficulties that patients face (Bantjes et al., 2017). Future suicide prevention efforts at the hospital should address the mismatch between care provided at the hospital and the needs of patients with substance-related self-harm. Nurses should receive training that allow them to feel more equipped in their interactions with patients. Sessions with psychologists or counsellors should be available to patients. During these session, patients might discuss interpersonal and family conflict, or solve situational problems (e.g. financial or legal issues) (see Chapter 6). Without such services, patients might experience an admission to the psychiatric unit as something that aggravates their current distress instead of something that is helpful.

In LMICs, patients are often discharged from hospital after being treated for their injuries without any further intervention or referral to secondary and tertiary mental health services. By providing brief interventions at the hospital that include information of potential mental health services and follow-up contact, it is possible to prevent repetition of self-harm. For example, a US based Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE) study reported that the group of patients who received the brief intervention, compared to patients who received treatment as usual, showed a 5% absolute risk reduction for repetition of self-harm. The brief intervention consisted of: a suicide risk screening; discharge resources (i.e. potential helpful services) from nurses; and a series of post emergency department telephone calls with the objective of reducing the risk for repetition of self-harm (Miller et al., 2017). In another example, the Multisite Intervention Study on Suicidal Behaviours (SUPRE-MISS) programme that included patients from SA, demonstrated that the treatment that the brief intervention patient group received, compared to the treatment as usual patient group, effectively reduced the likelihood of repetition of suicide attempt during the 18-month study period. In this study, the brief intervention consisted of a one-hour counselling session before discharge and telephonic or personal contact on multiple occasions in the weeks and months following discharge from the hospital (Naidoo, Gathiram, & Schlebusch, 2014).

The findings from these studies suggest that a multifaceted intervention could be a cost-effective addition to primary care treatment to reduce the risk of repetition of self-harm among patients discharged from the hospital. However, for such interventions to be effective at the hospital, we need to address some contextual factors that serve as barriers for these efforts. In the retrospective review of patients' files, I found that patients often did not list any contact details, stating that they did not have a telephone number, or were temporarily living with family or

friends at the time of the event. Those facts would hinder follow-up efforts after discharge. Therefore, only those patients with a reliable address or contact information would be included in the brief intervention, while excluding patients who are experiencing factors (e.g. homelessness) that in turn increase the risk for SIB. Brief intervention as described here might be an effective strategy but considering some of these limitations, it is necessary to also plan interventions that are suitable for those who would be excluded. In section 7.2.3.2, I discuss how the community might be utilised to offer support for patients, and their families, following self-harm.

Even if suicide prevention efforts at the hospital are strengthened, patients might still prefer other forms of support and treatment. Findings from semi-structured interviews among 14 patients who presented for treatment to a UK hospital following self-harm, were that although some patients with a psychiatric illness at times preferred receiving intervention from a hospital setting, the majority of patients preferred to utilise integrated community-based interventions. The study concludes that in planning intervention, it is important to consider the heterogeneity within the self-harming population, as personal circumstances and life history might influence which settings are appropriate for prevention and intervention (Hume & Platt, 2007). In the next section, I describe the need for a multi-sectoral and multidisciplinary approach in suicide prevention and intervention received at the hospital.

7.2.3.2 Community-based and non-specialised action

Given that the hospital has limited staff, resources, and time, there is a need to incorporate services outside of the hospital to support the care provided by the hospital. For example, trained lay counsellors and community health workers could offer carefully planned psychosocial intervention packages aimed at specific health issues (e.g. substance use and self-

harm), while being supervised by mental health specialists (e.g. BPsych Counsellors) (Lund et al., 2012). Community-based initiatives and non-specialised services such as mental health centres, self-help support groups, and educational or training programmes might also play a critical role in the efficacy of prevention and intervention efforts at the hospital. Providing information and non-specialised services or resources within the communities that are served by the hospital would also provide an opportunity to intervene with those individuals engaging in suicidal ideation prior to a medically serious act of self-harm or with those individuals who engaged in self-harm that did not require a visit to the hospital (Khan, 2005). The target group for this training should include but should not be limited to hospital staff, community members, police, the legal profession, religious leaders, and school personnel or parents (Burrows & Schlebusch, 2009; Schlebusch, 2012). This section will describe some non-specialised services that could be implemented in the areas around the hospital.

Provision of community support, and education or training of non-specialized health workers on issues related to substance use and SIB might offer additional support to patients after discharge from the hospital. For example, a partnership could be formed with the Cape Town Drug Counselling Center (CTDCC) who offer specialised training around substance use, addiction, and how to assist those individuals who use substances. The range of courses offered can be tailored for the workplace, schools, families, communities, and as additional training for professionals (e.g. doctors or counsellors working in the communities). The CTDCC also provide several resources such as posters and a ‘families and drugs’ booklet that might be distributed within the communities. The counsellors at CTDCC are also trained to work with individuals to form a suitable treatment plan for substance related problems but may also offer

support for other issues such as relationship difficulties (Cape Town Drug Counselling Center, 2017).

Additionally, partnerships could be formed with crisis centres in the area who might provide immediate emotional support to individuals who might be thinking about engaging in self-harm or provide specific support for issues related to suicidal behaviour such as HIV/AIDS, rape, trauma, or abuse. For example, patients could be provided with information on and contact details of Life Line South Africa who offers free 24 hour crisis intervention service to all levels of the community. Appointments may also be made for face-to-face individual and couple counselling. Similarly, the South African Depression and Anxiety Group (SADAG), offer free telephonic counselling and referral for individuals who are suffering from a range of psychiatric disorders. Specifically, the 24 hour suicide crisis line offers access to counsellors who are trained to support those individuals who engage in SIB. Furthermore, SADAG provides informational resources for community members to increase awareness related to SIB including ways of identifying those at risk for engaging in SIB, guidance on how to help individuals who engage in SIB, and a range of self-help suggestions for individuals who engage in SIB. These services might not be readily available to individuals who do not have access to a phone or those who are not able to carry the expenses of lengthy telephone conversations. There is a need for information and services within communities that do not rely on a telephone or access to the internet.

Based on findings from Chapter 6, a number of patients cited life and social stressors as factors that played a role in their substance-related self-harm. Future suicide prevention at the hospital might also form a partnership with Hope House counselling center who offer addiction

support and training, as well as counselling related to grief, divorce or relationship problems, and family conflict.

This section provides some suggestions of educational and training services that could be incorporated with primary health care suicide prevention. Educational and training programmes within communities are important as they might help to reduce stigma related to SIB, provide information on suicidal behaviour that enables early recognition, offer skills development on how to support individuals who engage in SIB, and offer guidance on how to assist individuals and their family members to access care for SIB (Vijayakumar, 2017). Furthermore, promoting skills development and providing knowledge about SIB and how to support patients, and their families, following self-harm might play an important role in sustaining the care that patients received at the hospital. The target group for this training should include but should not be limited to hospital staff, community members, police, the legal profession, religious leaders, and school personnel or parents (Burrows & Schlebusch, 2009; Schlebusch, 2012).

7.2.3.3 Multisectoral and multidisciplinary approach to suicide prevention

As mentioned in section 1.1.7, suicide prevention efforts in SA require a comprehensive multisectoral and multidisciplinary approach that consists of collaboration between health care and non-health care sectors (Goldstone & Bantjes, 2017; Kapur, 2009; Khan, 2007; Schlebusch, 2012; WHO, 2014a). Even though the focus of this PhD study is on the hospital, I will use this section to highlight diverse disciplines and multiple sectors of society that should collaborate with primary health care services to make an indirect contribution to suicide prevention at the hospital.

Findings from a SA study using interviews with patients at the hospital where this PhD study took place, reported on patients' requests for psycho-social support to be integrated into

primary health care offered in their area (Bantjes, 2017). The patients expressed the need for community day-hospitals or counselling services to be available in their communities (Bantjes, 2017). In the literature, task sharing counselling interventions for perinatal depression have been found to be a feasible and acceptable way of filling the treatment gap in SA (Nyatsanza, Scheider, Davies, & Lund, 2016). Similarly, Goldstone and Bantjes state that task shifting that is carefully planned could help to achieve the goal of meeting the health care needs of self-harm patients in this area (Goldstone & Bantjes, 2017). In this respect, suicide prevention efforts at the hospital should be supplemented with health care service delivery of lay health workers in the communities surrounding the hospital. In some instances, lay individuals delivering mental health care have been found to be more effective in this regard than trained professionals (Swartz et al., 2014). This is possible, but not necessarily so, because trained community workers delivering such services share a similar cultural and social background with the individuals being helped (Rahman et al., 2012; Swartz et al., 2014). Key factors related to the successful involvement of lay health workers include appropriate and continuous training, clinical supervision, and availability of psychiatric or psychological opinion in cases of doubt (Kapur, 2009).

It is noteworthy that a participant in the interviews discussed in Chapter 6, expressed a need for help to prevent the substance use of someone else. The government and community sector should also work together to develop strategies aimed at reducing the number of establishments that serve alcohol (i.e. legal and illegal establishments) (Vijayakumar & Vijayakumar, 2011) especially given the findings from Chapters 4 and 5 reporting high prevalence rates of substance use among patients. Police and community members could work together to identify and report individuals selling illicit drugs in the area, while police need to

increase their efforts to address such reports. Local media (e.g. newspapers or radio broadcasting) in the area served by the hospital might be useful tools in raising awareness among the public regarding mental health issues, reducing stigma around suicide (Khan & Hyder, 2006), and providing information on where to seek help or how to support individuals who are engaging in SIB.

There are a number of barriers that have hampered intersectoral collaboration in LMICs (Brooke-Sumner et al., 2016). In SA, intersectoral efforts to treat mental illness have been impeded by weak policy implementation at the provincial level (Lund et al., 2010), a lack of dedicated funding aimed toward such approaches (Petersen & Lund, 2011), inadequate leadership and management with regard to implementing policies (Jenkins et al., 2011), and a shortness of relevant political will (Brooke-Sumner et al., 2016). In planning and implementing intersectoral collaboration for suicide prevention, we will also need to consider issues such as scarcity of resources, lack of adequate communication, problems related to allocating specific roles of individuals involved, and insufficient organisational structures (Bantjes, 2017).

7.2.3.4 Culture and traditional African medicine

As discussed in Chapter 2, the renewed focus on situated meanings, social context, and the role of culture in suicide prevention, challenges the medicalized and acontextual approaches that serve to characterise suicide as a symptom of pathology (Marsh, 2016). In doing so, we expand our thinking about the role of context and culture in suicide research and practice to consider potential protective resources in these settings. Traditional healers are still largely considered to be secondary to biomedicine in their relevance within SA health care. To date, there has not been substantial evidence to illustrate whether focusing on cultural or social factors would significantly reduce rates of SIB among patients at the hospital. However, given that

scarce resources and inaccessibility weaken health care in SA, it is important to explore all possible useful role players in suicide prevention. Based on this premise, I suggest that it is worth investigating what role, if any, traditional healers might play in suicide prevention among patients who present for treatment at the hospital.

Estimates across parts of Sub-Saharan Africa suggest that up to 80% of the individuals in these areas consult traditional healers (King & Homsy, 1997). In SA, studies suggest that between 60% and 80% of individuals will consult a traditional healer before seeking treatment from a primary health care practitioner (Setswe, 1999; Truter, 2007). Some studies have documented the role of traditional healers in treatment of illness such as epilepsy (Keikelame & Swartz, 2015), HIV/AIDS (Flint, 2015), diabetes (Deutschländer, Lall, & van de Venter, 2009), and mental health (Sorsdahl et al., 2009). For example, in-depth semistructured interviews among traditional healers from semiurban areas in Cape Town found that traditional healers believe that they play some role in suicide prevention and that they attribute SIB to social disconnection and cultural discontinuity. These findings suggest that there is some congruence between the way that traditional and biomedical systems make sense of SIB (Bantjes, Swartz, & Cembi, 2017).

Although the role of traditional healers within primary health care is gaining traction, some caution is necessary. Bantjes and colleagues warn against idealizing cultural approaches by adopting an exclusively cultural approach and in doing so discarding the strengths that biomedical models offer suicide prevention. Instead, it is necessary to establish the ways in which cultural systems in suicide prevention could complement some of the limitations of biomedical systems (Bantjes et al., 2017). Additionally, Flint contests that the objective among policymakers and public health spheres should not be to create equivalence between the

biomedical and traditional healer approach but rather to accept each approach on its own merits in order to give way to a wider range of culturally appropriate, affordable, and accessible health care (Flint, 2015). Therefore, careful consideration is needed in working toward in integrated biomedical and traditional model.

Difference in opinion about traditional healers is perhaps one obstacle standing in the way of effective collaboration. A thematic analysis of perceptions on integrating Western and tradition health care demonstrated that health care professionals commonly view traditional healers as illiterate, not adequately regulated in their practice, and not suitable for integration into practices such as accessing medical aid schemes or issuing sick-leave certificates (Hopa, Simbayi, du Toit, 1998). A more recent study exploring SA western-trained health care practitioners about traditional healers showed that psychiatrists and psychiatric nurses had more positive opinions compared to general practitioners and general nurses. The authors concluded that this finding might be explained by the fact that the training curricula for psychiatrists and psychiatric nurses include a comprehensive overview of health care (i.e. general, community, and mental health) in a SA context (Mokgobi, 2014). This finding suggests that psychiatry practitioners and psychiatric nurses might be a good starting point for integrating health care at the hospital.

Findings from the studies cited in this section suggest that if traditional and biomedical systems pool their strengths, the combined approach might contribute to suicide prevention that is holistic, accessible, and culturally appropriate. Future actions at the hospital that strive toward collaboration between traditional healers and the hospital might benefit from further research that can guide best practice in suicide prevention. For example, individual and focus group interviews among primary health care professionals, traditional leaders, and individuals who engage in

substance use and self-harm could provide insight into reasons for seeking care (i.e. from primary health care or traditional leaders) and reasons for not seeking care (i.e. from primary health care or traditional leaders). Primary health care professionals and traditional healers could be asked what they perceive to be obstacles and possible solutions in working toward integrated health care in SA. A better understanding of these insights might resolve some of the debate regarding to what extent traditional care could form an integral part of formal primary health care.

7.2.3.5 Restricting access to methods of self-harm

Managing access to common methods of suicide has been somewhat successful in reducing suicide rates in LMICs (Khan, 2005). For example, a number of oral presentations at a suicide prevention conference I attended in Oviedo, Spain reported the feasible and successful reduction of suicide rates in Sri Lanka by providing locked boxes for storage of pesticides (Vijayakumar, 2017). In SA, common household products (e.g. paraffin or rat poison), pesticides, over-the-counter medication, and firearms are often used as the method of suicidal behaviour (Schlebusch, 2005). As part of suicide prevention at the hospital, some consideration should be given toward action in the surrounding communities with regard to means restriction, particularly among those patients discharged following self-harm or to prevent repetition of self-harm. In Chapters 4 and 5, I reported that the majority of patients employed self-poisoning as their method of self-harm. Therefore, family and community members should be educated on safe storage and restricting access to prescription medication especially among patients discharged from hospital following self-harm and those with a history of self-harm. This suggestion is in line with other recommended strategies for means restriction that include: modification of policies to control the production, distribution, and storage of medication;

legislation that restricts the size of prescription medication; and education of community members on how to reduce the risk for SIB (Burrows & Schlebusch, 2009). Likewise, some participants in Chapter 6 explained that substance use facilitated self-harm by numbing the participant's fear of engaging in self-harm. Therefore, patients who have been discharged from hospital, as well as individuals who engage in suicidal ideation and have a history of self-harm should be restricted in their access to substances (e.g. alcohol).

7.2.4 Generalisability of the study findings

Some evidence exists in support of the universality of risk factors across settings and cultures (Vijayakumar & Rajkumar, 1999), while differences in methodology and limitation related to study design of available risk-factor literature in suicidology serves as a barrier to consider the findings outside of context (Franklin et al., 2017). Inconsistent definition and classification of SIB further complicate generalisability of findings across settings (Silverman, 2011). As stated in section 1.1.4, I employed the broadest possible definition of self-harm in an attempt to address issues related to inconsistency in definitions used. Through the findings from this PhD study, I showed some similarities with the prevalence and correlates reported in HICs and LMICs (see Chapters 4 and 5). Likewise, patients described similarities in the way they understood their substance use to be implicated in self-harm, when compared to a small body of qualitative studies from other sociocultural settings (see Chapter 5).

Before generalising factors between settings, it is necessary to consider how unique local factors, such as population characteristics, and the social, cultural, and economic context might influence suicide resilience and prevention (Goldston, et al., 2008). For example, even though social support is associated with decreased likelihood of self-harm globally, there may be unique aspects of social support that need to be improved within a specific setting. A community might

experience sufficient levels of support within families who form part of the community but might lack social integration or cohesion between members of the community who in turn need to work together in an effort to reduce community violence or harmful substance use practices (see Chapter 5). This is because SIB is a result of complex interactions that include a variety of risk and protective factors. For example, in Chapters 4 and 5, I demonstrated that being male, unemployed, and having a lower level of education were risk factors for substance use and self-harm, while being in a relationship and having dependents were protective factors. Consequently, suicide prevention at the hospital, and in other settings, should address risk and protective factors at multiple levels.

As discussed in section 1.1.7, a main component of this PhD study is to recommend suicide prevention research and actions unique to this urban SA hospital setting that are not simply transplanted from findings in the Western world (Schlebusch, 2012). However, it is not to say that exchanging research findings across LMICs cannot be mutually beneficial. Sharing or exchanging information among nations such as South Asia, Africa, and South America, which have similarities in culture, social characteristics, and economical conditions might be helpful if that sharing it is done with the necessary caution (Khan, 2005).

Careful consideration of the unique contextual factors in play at the hospital is necessary before hospital-based prevention and intervention strategies developed in other settings may be employed. Currently most research has been conducted in countries that are not challenged by poverty and have greater government involvement in issues related to substance use and self-harm. A steady increase in evidence suggests that cultural and societal factors play a unique role in the aetiology of suicidal behaviour that cannot be shared across settings (Chan, 2013; Kral, 2016; WHO, 2014a). If we intend to adopt prevention strategies that have been developed in

other settings, it is important that they are tailored to this specific setting by considering the epidemiological distribution of self-harm and substance use, perceived stigma in the area, potential government involvement, and resource availability to allow delivery of appropriate and effective suicide prevention.

Likewise, I argue that the findings of a recommendation made in this dissertation may be transferred to other HICs and LMICs but only if they are tailored to the specific sociocultural issues and needs within that context. Moreover, with the use of analytic generalisation, some findings from qualitative studies or theory-driven studies may be transferred between different settings (Polit & Beck, 2010). Therefore, research conducted in other settings might be used to develop suicide prevention at the hospital. Similarly, findings and recommendations from the qualitative study in Chapter 5 might be directive or instructive of the association between substance use and self-harm in another HIC or LMIC setting based on how appropriate these findings are within the situation or context to which they are transferred (Hjelmeland & Knizek, 2011).

7.2.5 Potential pitfalls to consider

There are some potential pitfalls to consider that might hinder suicide prevention at the hospital. In LMICs, communicable diseases are commonly considered a higher priority than non-communicable diseases and maternal or child health care with the result that only limited funding and resources allocated to issues such as substance use and suicide (Khan, 2005). Effective prevention and intervention necessitates a dramatic increase in effort that is continued over a long period (Hoven, Tyano, & Mandell, 2009). Before undertaking suicide prevention at the hospital, we need to assess the feasibility of such efforts by taking stock of the availability of funding, and different forms of social safety nets, cultural or social capital, and family or

community cohesion. Developing and implementing holistic suicide prevention at the hospital will take resources and might be expensive.

Moreover, the cost of treating suicidal behaviour in LMICs is high. For example, findings from a large peri-urban hospital in SA showed that admissions to a critical care unit following self-harm, cost over R1 000 000 ($76 108.81) annually (Favara, 2012). Therefore, other more pressing health issues such as HIV/AIDS, tuberculosis, and major depressive disorder might instead be the focus of future research and prevention efforts at the hospital. For example, as stated in section 1.1, self-harm is the 27th leading contributor to disease burden in southern Sub-Saharan Africa, but other health issues are higher ranked, namely HIV/AIDS as 1st, drug use disorders as 18th, and major depressive disorder as the 10th leading contributor to disease burden in Sub-Saharan Africa (Murray et al., 2012). Perhaps a good strategy for future suicide prevention at the hospital would be to integrate efforts that target a variety of prevention priorities at the hospital to ensure that time and resources are used optimally.

Furthermore, it is important to keep in mind those individuals who did not present to the hospital following self-harm and the potential barriers to care that they might have experienced. It is well established in epidemiology that it is not only the illness or health condition which determines who presents to a tertiary hospital. Health system factors, including health provider behaviour, play a major role in pathways to care, probably especially in the mental health field.

Findings from Chapter 3 and 4 further show that 72.9% of AUS patients and 76.4% of CSU group were unemployed. Although age distribution is not given, with mean age of 32.9 years and 32.4 years respectively, the majority were in the employment age group. In addition, two other variables would be relevant to consider along with employment status, i.e. SES and level of education. Moreover, 43.8% and 52.8% were in the low to moderate SES class and

77.1% and 83.2% had a primary or secondary education only. Both the latter variables are associated with employment status. As such, in addition to addressing factors in hospital setting, social factors would need to be addressed as part of broad based suicide prevention strategy. Furthermore, the hospital data only serves as a proxy indicator of the extent of the problem in the wider community, which the hospital serves. Without addressing the upstream factors, which includes social factors, it will not be adequate to prevent self-harm and suicide.

A key challenge is that the patients present with self harm at this tertiary hospital setting, yet the risk factors for substance related self-harm are largely located outside the hospital setting. Therefore some prevention interventions are not likely to be delivered by the hospital. Future research should consider a study that include samples from various settings (hospital, primary care, and community) in order to conduct a comparison of the potential risk factors in these settings as well as their impact on the planning and implementation of suicide prevention.

7.3 Limitations of this research

Considering the above discussion, there are a number of limitation to this study that need to be acknowledged. First, there are fewer medical staff during the nightshift and as a result there is less time and a greater rush to complete paperwork and assessment of patients. Therefore, some information in the patient file might be incomplete.

Second, the findings from the PhD study were not intended for generalisation beyond this population. In this PhD study, I included one hospital setting, which makes it difficult to generalise the findings to other primary health care settings. Likewise, patients with medically serious self-harm presenting to a public hospital might be different from patients presenting to private hospital or those patients who did not engage in self-harm that required hospital

treatment. Future research could build on this work by including more research sites across different settings (e.g. primary care, hospital, clinical, schools, and community) and provinces.

Third, pertaining to the quantitative component of this PhD study, AUS and CSU were measured using single-item questions (i.e. Evidence of alcohol/drug intoxication during the act of self-harm), which limited my ability to demonstrate that substance use is a complex and multifaceted psychiatric condition. Future research could include additional questions to investigate the age when substance use began, substance use context, substance use pattern, and diagnosis or past treatment of substance use disorder.

Fourth, during the qualitative phase of this study, I incorporated steps to enhance trustworthiness of the data analysis by involving my supervisor in the coding process and the data interpretation. It was not possible to conduct member checks by asking patients to review their transcripts before data analysis since patients were discharged from the hospital before the transcriptions were complete. However, the findings in Chapter 5 were in line with other studies from HICs and LMICs suggesting that this omission did not significantly impact the results.

Finally, this PhD study focused on suicidal behaviour, including self-harm, but not suicide. Findings from the systematic review showed that more research is needed to explore the association between substance use and suicide. Future studies should include suicide in the focus, since it is possible that some variables associated with self-harm are differently related with suicide.

7.4 Conclusion

Despite increasing research in the field of suicidology, rates of suicidal behaviour, including self-harm, have not decreased appreciably. The field of critical suicidology offers some suggestions of areas that need improvement in future research. In light of these suggestions, I

discuss what my PhD study has contributed to the available research, while also making recommendations for future research at the hospital. Strengths of the study include the use of patients from an understudied urban primary health care setting to demonstrate the psychosocial context. Completing this PhD study by publication allowed timeous dissemination of the findings from the study. Furthermore, by utilising a mixed methods research approach, I conducted this study as a first step to add to a holistic understanding of the association between substance use and self-harm among these patients, as well as the sociocultural context of this behaviour.

Future studies could employ sophisticated study designs or statistical methods that identify mediating factors; explore subjective experiences of substance use and SIB; utilise theory driven research; employ mixed methods approaches for a holistic approach to suicide prevention; and contribute in the development or evaluation of suicide prevention that is feasible, accessible, and effective. In this chapter, I also describe possible future action at the hospital to highlight the important role of primary health care in the development and implementation of effective hospital-based prevention and intervention for self-harm that is in some way associated with substance use. Furthermore, I argue that SIB is complex or multifaceted and not exclusively a mental health issue. Effective evidence-based prevention at the hospital relies, in part, on collaboration with the surrounding communities, multiple levels of society, culture, traditional healers, and restricting access to common means of self-harm. To conclude this chapter, I share my thoughts on how the specific suggestions I have made for this hospital may or may not apply to other settings (i.e. SA and LMICs).

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APPENDIX A Self-harm hospital data capture form

Sex:

Male	Female

Age:

Ethnicity:

Black	Asian	Coloured	White	Unknown

Home language:

Afrikaans	isiXhosa	English	Other (Specify)

Nationality:

South African	Other

Religion

Christian	Islam	Hindu	Catholic	Other	Not known

Marital status:

Single	Married	Separated	Divorced	Widowed

Number of dependents (children):

Completed level of education:

Primary schooling	Secondary schooling	Tertiary Education (Under graduate qualification)	Post graduate qualification

Employment status:

Unemployed	Employed

Living circumstances:

Income level (SES):

Method of self-harm:

		Quantity:
Prescription medication	Benzodiazepines	
	Barbiturates	
	Tricyclics	
	Anti-psychotics	
	SSRIs	
	Analgesics	
	anti-hypertensives	
	iron tablets	
	antiepileptics,	
	antibiotics	
	oral hypoglycemic agents	
	Unknown	
	Other meds (specify)	
Non-prescription medication	Aspirin	
	Paracetamol	
	Other meds (specify)	
Ingestion or inhalation of poison	Organophosphate	
	Rat poison	
	Corrosive substance (Acid)	
	Bleach	
	Carbon monoxide	
	Other (specify)	
Gun shot		Site of wound(s):
Laceration		Site of wound(s):
Immolation		
Hanging		
Asphyxiation		

Severity of the act:

		Duration of admission
Level of admission	Seen in casualty and discharged	
	Admitted to C13 (short stay medical unit)	
	Admitted to another medical unit	
	Admitted to high care	
	Admitted to ICU	

Level of intervention	None
	Sutured
	Activated charcoal
	Oral medical treatment
	IV medical treatment
	Intubation and ventilation
	Dialysis
	Surgical procedure

GCS on admission	

Stated intention:

To Die	
To regulate the behaviour of someone else	
To regulate emotional state	
To escape a situation	
Implosive act	
To communicate something (eg. distress)	
Mistake	
Not known	
Other (specify)	

Stated reason for the attempt:

Financial concerns	
Marital / romantic relationship issues	
Family conflict	
Medical illness	
Psychiatric illness	
Bereavement	
Academic concerns (exams or performance at school/university)	
Other (specify)	
Not known	

Previous attempts:

Not known	
No previous attempts	
One previous attempt	
Multiple (2 or more) previous attempts	

History of psychiatric illness (Has the patient received a psychiatric Dx prior to this act of self-harm?):

Unipolar mood disorder	
Bi-polar mood disorder	
Anxiety Disorder	
Personality Disorder	
Psychotic Illness (Schizophrenia)	
Substance dependence	
Post-Traumatic Stress Disorder	
Adjustment disorder	
No psychiatric Dx	
Not known	
Other (specify)	

Current Psychiatric Dx (On assessment following the act of self-harm):

Unipolar mood disorder	
Bi-polar mood disorder	
Anxiety Disorder	
Personality Disorder	
Psychotic Illness (Schizophrenia)	
Substance dependence	
Post-Traumatic Stress Disorder	
Adjustment disorder	
No psychiatric Dx	
Not known	
Other (specify)	

Receiving psychiatric treatment prior to admission:

Yes	No	Not-known

Receiving psychological treatment (psychotherapy) prior to admission:

Yes	No	Not-known

Medical Dx not related to the incident of self-harm:

HIV status:

HV+	HIV-	Not-known

Evidence of alcohol/drug intoxication during the act of self-harm:

Yes	Alcohol	
	Cannabis	
	Methaqualone (Mandrax)	
	Cocaine	
	Methamphetamine (Tik)	
	Heroin	
	Solvents	
	Other (specify)	
No		
Not know		

History of substance abuse:

Alcohol abuse	
Cannabis Abuse	
Benzodiazepines	
Methaqualone (Mandrax)	
Cocaine Abuse	
Methamphetamine (Tik) Abuse	
Heroin	
Solvents	
MDMA (Ecstasy)	
Flunitrazipam (Rohypnol)	
Ketamine	
Wellconal (Pinks)	

Psychiatric Plan:

Assessed by psychiatric registrar	Yes	No

Psychotropic meds initiated	No
	Yes (specify)

Psychotropic meds adjusted	No
	Yes (specify)

Input from psychologist	No
	Yes (specify)

Input from social worker	No
	Yes (specify)

Discharged	Discharged without follow-up	
	Discharged with follow-up at community clinic	
	Discharged follow-up at DCAP	
	Discharged with follow-up with drug/alcohol rehab	
	Discharged with follow-up in J2	psychiatry
		psychology
	Discharged with referral made to therapeutic unit	G22
		VBH ward 1
		LGH ward 15

Admission	C23 (emergency unity)	voluntary	assisted	involuntary
	G22 (therapeutic unit)	voluntary	assisted	involuntary

APPENDIX B Interview schedule for narrative interviews with self-harm patients with acute or chronic substance use

1. Demographic information

- Gender
- Age
- Ethnic group
- Religion
- Household composition (who are they living with?/do they have children?)
- Housing (type of house)
- Type of neighbourhood
- Type of community (urban/semi-urban/rural)
- Years of school/education
- Occupation
- Employment status

2. Experience of family, community and school/work:

2.1 Please can you tell me about yourself and how your life has been?

2.2 How would you describe your family?

- Constitution of family?
- Quality of relationship with wife/husband/children/parents/ sisters/brothers?
- Experience of being part of the family?

2.3 How do you feel about your community?

- Can you tell me about your friends and social life?
- Do you feel important / appreciated in your community? How?

2.4 Can you tell me about school/work?

- Relationship with your colleagues/classmates?
- Problems at work/in school?

3. Health (physical and psychiatric) and history of psychological distress:

3.1 Can you tell me about your health?

3.2 Do you have any illnesses?

- What kind of illnesses do you have?
- Current treatment?
- Experience of receiving medical attention?

3.3 Have you ever been assessed and/or treated by mental health care worker?

- When? Why? How long?
- Experience of receiving help?

3.4 Were you receiving any psychological support/care prior to this act of self-harm?

3.5 Have you ever done anything like this before?

- When, how, how often?
- What if any help did you receive?
- What was your experience of receiving this help?

4. Narrative of self-harm

4.1 In your own words, please tell me the story about what happened that lead to you being admitted to the hospital?

- When, why and how did you try to end your life?
- What precipitated this event?
- How did others react?

4.2 Can you please describe your feelings before the act of self-harm?

- Sad/frustrated/angry/shameful/guilty?
- Did you feel any pain? How would you describe this pain?

4.3 How did you feel after you harmed yourself?

- Relieved/guilty/shameful/sorry/afraid?

4.4 How are you feeling now?

5. Intentionality

5.1 Can you say something about why you tried to kill/harm yourself?

- What were you hoping for?
- Did you want to die/get away for a while/escape from something/someone/punish someone?

5.2 At the time you harmed yourself what did you think the consequences this act might have?

6. Precipitating events and consequences:

6.1 Can you tell me what, if anything, happen during the last few days/weeks/months that made you hurt yourself in this way?

- Any recent upsets/pressures/tensions/anticipation of trouble?

6.2 How did your family and close friends treat you when they found out that you had harmed yourself?

- What did they do?
- Did they treat you in the way you expected or wanted them to?

6.3 When you were admitted to the hospital after you hurt yourself, how did the hospital staff treat you?

- What was your experience of the staff and the help you received?

7. Current suicidal ideation and intention:

7.1 What are your thoughts about wanting to hurt/kill yourself now?

7.2 What might make you want to do it again?

7.3 What has changed since you tried to kill yourself?

8 Experience of suicidal behaviour:

8.1 Has anyone in your family ever attempted or completed suicide?

- Did this influence your own suicide attempt in any way?

8.2 Do you know of anyone in your community who has attempted or completed suicide?

- Did this influence your own suicide attempt in any way?

9 History of substance use

9.2 Can you tell me about alcohol and drugs in your family?

9.3 Can you tell me about your own experience of alcohol/drugs?

9.4 Tell me about what, if any, the relationship is between alcohol/drugs and your act of self-harm?

10 History of physical / emotional abuse and exposure to violence and trauma

10.1 Tell me about your experience of abuse?

- Physical?
- Emotional?
- Sexual?
- Abandonment?

10.2 Tell me about your experience of violence?

10.3 Tell me about your experience of trauma?

11 Religion/spirituality

11.1 How would you describe your religious beliefs?

11.2 How do you feel about your church/mosque/religious institution?

11.3 How would you describe your relationship to god?

- Nature and quality of relationship?
- Influence of relationship on life?

11.4 What (if any) was the relationship between your act of self-harm and your religious/spiritual beliefs?

11.5 In what way do you think your act of self-harm will influence your relationship with god?

12. De-briefing questions

12.1 Is there anything else that you think is important that might help me understand your situation and why you tried to kill yourself?

12.2 Can you tell me what it was like to take part in this interview?

- Anything that you would like to have been different?

APPENDIX C Ethical approval from Stellenbosch University

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jou kennisvennoot • your knowledge partner

Approval Notice
Response to Modifications- (New Application)

23-Sep-2013
Bantjes, Jason JR

Ethics Reference #: N13/05/074
Title: **An investigation of the epidemiology , physcho-social correlates , and cultural context of deliberate self harm in South Africa**

Dear Doctor Jason Bantjes,

The **Response to Modifications** - ***(New Application)*** received on , was reviewed by members of **Health Research Ethics Committee 2** via Expedited review procedures on **30-Aug-2013** and was approved.
Please note the following information about your approved research protocol:

Protocol Approval Period: **23-Sep-2013 -23-Sep-2014**

Please remember to use your **protocol number** (**N13/05/074**) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:
Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired.
The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.
Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372
Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.
For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389207.

APPENDIX D Ethical approval from University of Cape Town

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

Room E52-24 Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492 • Facsimile [021] 406 6411
Email: Sumayah.ariefdien@uct.ac.za
Website: www.health.uct.ac.za/research/humanethics/forms

05 February 2014

HREC/REF: 645/2013

Ms L Frenkel
Psychiatry & Mental Health
J-block
GSH

Dear Ms Frenkel

Project Title: AN INVESTIGATION OF THE EPIDEMIOLOGY, PSYCHO-SOCIAL CORRELATES, AND CULTURAL CONTEXT OF DELIBARATE SELF-HARM IN SOUTH AFRICA

Thank you for your letter dated 31 January 2014, addressing the issues raised by the Human Research Ethics Committee.

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

Approval is granted for one year until the 28 February 2015.

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.

Please note that the on-going ethical conduct of the study remains the responsibility of the principal investigator

Please quote the HREC REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.

Institutional Review Board (IRB) number: IRB00001938

APPENDIX E Hospital approval for the study

GROOTE SCHUUR HOSPITAL
Enquiries: Dr Bhavna Patel
E-mail : *Bhavna.Patel@westerncape.gov.za*

To: Dr Jason Bantjes
Psychology Department
Stellenbosch University
Room 2007
Wilcocks Building

E-mail: jbantjes@sun.ac.za

Dear Dr Bantjes,

RESEARCH PROJECT: AN INVESTIGATION OF THE EPIDEMIOLOGY, PSYCHO-SOCIAL CORRELATES, AND CULTURAL CONTEXT OF DELIBERATE SELF-HARM IN SOUTH AFRICA.

Your recent letter to the hospital refers.

You are hereby granted permission to proceed with your research.

Please note the following:

a) Your research may not interfere with normal patient care
b) Hospital staff may not be asked to assist with the research.
c) No hospital consumables and stationary may be used.
d) **No patient folders may be removed from the premises or be inaccessible.**
e) Please introduce yourself to the person in charge of an area before commencing.
f) Please discuss the study with the Head of Psychiatry, Prof D. Stein, before commencing.
g) Please provide the research assistant/field worker with a copy of this letter as verification of approval.
h) Confidentiality must be maintained at all times.

I would like to wish you every success with the project.

Yours sincerely

Batel

DR BHAVNA PATEL
CHIEF EXECUTIVE OFFICER
Date: 02 December 2013

G45 Management Suite, Old Main Building,
Observatory 7925

Tel: +27 21 404 3178/9 fax: +27 21 404 3121

Private Bag X,
Observatory, 7935

www.capegateway.go.v.za

APPENDIX F Participant information leaflet and consent form

TITLE: **The relationship between acute or chronic substance use and deliberate self-ham among patients receiving treatment at an urban South African hospital.**

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: Ms. Elsie Breet

ADDRESS: Department of Psychology; Stellenbosch University; Private Bag X1; Matieland; 7602; South Africa

CONTACT NUMBER: 076 04 84 289

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or doctor any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** (021 938 9677) and the **Faculty of Health Sciences, Human Research Ethics Committee at the University of Cape Town** (021 406 6338). You may contact either of these two committees if you have any questions or concerns regarding your rights or the welfare of the research participants. Furthermore the study will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

We are trying to find out more about why people in South Africa hurt themselves and what role substance abuse plays in this behaviour. In particular we want to understand the context in which this behaviour occurs and how people understand it.

Why have you been invited to participate?

You are being asked to take part in the study because you have been admitted to hospital as a result of injuries which were self-inflicted.

What will your responsibilities be?

If you agree to take part in this study you will be interviewed and asked to tell the story about how you came to injure yourself. The interview will be recorded but your identity will be protected and the information you share will treated confidentially. This will be a single interview.

Where will the interview take place?

The interview will take place in the hospital before you are discharged. It will be conducted in a private space.

How long will the interview take?

The interview will take approximately 50 mins.

Will you benefit from taking part in this research?

There is no direct benefit for taking part in this study although you may feel some emotional relief after talking about your experiences and the events that lead to you being admitted to hospital.

Are there any risks involved in your taking part in this research?

You will be asked to answer questions about the events that lead to your admission to hospital or about past self-harm and substance abuse; this could be overwhelming and may cause you some distress.

If you do not agree to take part, what alternatives do you have?

This study will not have any impact on the treatment you receive.

Who will have access to your medical records?

Only the researchers and clinical staff in the hospital will have access to your records.

What will happen in the unlikely event of some form injury occurring as a direct result of your taking part in this research study?

There is no danger of physical injury by participating in this study. You may however become emotionally upset as a result of answering the questions. If you do become upset or uncomfortable you may withdraw from the interview at any time.

What will happen if I do become emotionally upset as a result of the interview?

In the event that you are emotionally upset as a result of participating in this interview, you will be referred to a psychologist or psychiatrist at the hospital who will attend to you and provide the necessary support and/or treatment.

Will you be paid to take part in this study and are there any costs involved?

There is no financial reward for taking part in this study.

Is there anything else that you should know or do?

- You can contact Ms. Elsie Breet (at 076 04 84 289) or Dr Jason Bantjes (at 083 2345 554) if you have any further queries or encounter any problems.
- You can contact the Stellenbosch University Health Research Ethics Committee at 021-938 9207 or the Human Research Ethics Committee at the University of Cape Town at 021-406 6338 if you have any concerns or complaints that have not been adequately addressed by your study doctor.
- You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I ……..……. agree to take part in a research study entitled, An investigation of the epidemiology, psycho-social correlates, and cultural context of deliberate self-harm in South Africa.
I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) .....…..……. on (*date*) ……...…….. 2014.

....

Signature of participant **Signature of witness**

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....….....…….. on (*date*) ……...…….. 2014.

....

Signature of investigator **Signature of witness**

APPENDIX G Supplementary files for article 1

G.1 Search strategy

Pubmed/MEDLINE (Searched 10 February 2016)

1. self-injurious behav* [Mesh]

2. ("suicide, assisted"[Mesh] OR “euthanasia” [Mesh] OR “assisted dying”)

3. (“suicide” [Mesh] OR parasuicide* OR "self-killing" OR self-injur* OR self-mutilat* OR self-harm* OR self-immolat* OR self-poison* OR self-drowning OR self-hang* OR "deliberate overdose")

4. (#1 OR #3) NOT #2

5. substance AND (induced OR addiction OR dependen* OR use OR misuse OR withdraw* OR intoxicat*)

6. (alcohol OR caffeine OR cannabis OR cocaine OR crack OR drug OR ecstasy OR hallucinogen OR heroin OR hypnotics OR inhalant OR marijuana OR methamphetamine OR amphetamine OR morphine OR opioid OR opiate OR pain medication OR phencyclidine OR sedative OR solvent OR steroid OR stimulant OR tobacco) AND (substance-induc* OR addict* OR dependen* OR use OR misuse OR withdraw* OR intoxicat* OR chronic use OR acute use OR illicit use OR drug abuse)

7. (substance-related disorder* [Mesh])

8. (Afghanistan OR Benin OR "Burkina Faso" OR Burundi OR "Central African Republic" OR Chad OR Comoros OR "Democratic Republic of the Congo" OR DRC OR Zaire OR Eritrea OR Ethiopia OR Gambia OR Guinea OR Guinea-Bissau OR "Guinea Bissau" OR Haiti OR

"Democratic Republic of Korea" OR "North Korea" OR DPRK OR Liberia OR Madagascar OR Malawi OR Mali OR Mozambique OR Nepal OR Niger OR Rwanda OR Senegal OR "Sierra Leone" OR Somalia OR "South Sudan" OR Tanzania OR Togo OR Uganda OR Zimbabwe)

9. (Armenia OR Bangladesh OR Bhutan OR Bolivia OR Cameroon OR Cambodia OR "Cape Verde" OR "Cabo Verde" OR Democratic Republic of the Congo OR DR Congo, DRC, DROC, RDC, Congo-Kinshasa OR Congo OR "Cote d Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt OR "El Salvador" OR Ghana OR Guatemala OR Honduras OR India OR Indonesia OR Kenya OR Kiribati OR Kosovo OR Kyrgyz Republic OR Lao OR Laos OR Lesotho OR Mauritania OR Micronesia OR Moldova OR Mongolia OR Morocco OR Myanmar OR Nicaragua OR Nigeria OR Pakistan OR "Papua New Guinea" OR Philippines OR Samoa OR "Sao Tome" OR Principe OR "Solomon Islands" OR "Sri Lanka" OR Sudan OR Swaziland OR Syria OR "Syrian Arab Republic" OR Tajikistan OR Timor-Leste OR "Timor Leste" OR "East Timor" OR Tonga OR Tunisia OR Ukraine OR Uzbekistan OR Vanuatu OR Vietnam OR "Viet Nam" OR "West Bank" OR Gaza OR Yemen OR Zambia)

10. (Albania OR Algeria OR "American Samoa" OR Angola OR Azerbaijan OR Belarus OR Belize OR Bosnia OR Herzegovina OR Botswana OR Brazil OR Bulgaria OR China OR Colombia OR "Costa Rica" OR Cuba OR Dominica OR "Dominican Republic" OR Ecuador OR Equatorial Guinea OR Fiji OR Gabon OR Georgia OR Grenada OR Guyana OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Lebanon OR Libya OR Macedonia OR Malaysia OR Maldives OR "Marshall Islands" OR Mauritius OR Mexico OR Montenegro OR Namibia OR Palau OR Panama OR Paraguay OR Peru OR Romania OR Russian Federation OR Serbia

OR "South Africa" OR "St Lucia" OR "Saint Lucia" OR "St Vincent" OR "Saint Vincent" OR Grenadines OR Suriname OR Thailand OR Turkey OR Turkmenistan OR Tuvalu OR Venezuela)

11. developing countries OR africa OR asia, central OR asia, southeastern OR asia, western OR central america OR south america OR middle east

12. ("developing country" OR "developing countries" OR "low-income country" OR "low-income countries" OR "low income country" OR "low income countries" OR "middle-income country" OR "middle-income countries" OR "middle income country" OR "middle income countries" OR "third world" OR Africa OR "Central Asia" OR "South Asia" OR "Southeast Asia" OR "South-East Asia" OR "Central America" OR "Latin America" OR "South America" OR "Middle East")

13. #5 OR #6 OR #7

14. #8 OR #9 OR #10 OR #11 OR #12

15. #4 AND #13 AND #14

16. limit 15 to yr="2006 -Current"

CINHAL Plus (EBSCO) (Searched 10 February 2016)

1. (MH “Suicide +”)

2. (MH "Suicide, Assisted") OR (MH "Euthanasia+") OR “assisted dying”

3. (parasuicide* OR "self-killing" OR self-injur* OR self-mutilat* OR self-harm* OR self-immolat* OR self-poison* OR self-drowning OR self-hang* OR "deliberate overdose")

4. S1 NOT S2

5. S3 NOT S2

6. substance NEAR (induced OR addiction OR dependen* OR use OR misuse OR withdraw* OR intoxicat*)

7. (alcohol OR caffeine OR cannabis OR cocaine OR crack OR drug OR ecstasy OR hallucinogen OR heroin OR hypnotics OR inhalant OR marijuana OR methamphetamine OR amphetamine OR morphine OR opioid OR opiate OR pain medication OR phencyclidine OR sedative OR solvent OR steroid OR stimulant OR tobacco) AND (substance-induc* OR addict* OR dependen* OR use OR misuse OR withdraw* OR intoxicat* OR chronic use OR acute use OR illicit use OR drug abuse)

8. (MH "Substance Use Disorders+")

9. (Afghanistan OR Benin OR "Burkina Faso" OR Burundi OR "Central African Republic" OR Chad OR Comoros OR "Democratic Republic of the Congo" OR DRC OR Zaire OR Eritrea OR Ethiopia OR Gambia OR Guinea OR Guinea-Bissau OR "Guinea Bissau" OR Haiti OR "Democratic Republic of Korea" OR "North Korea" OR DPRK OR Liberia OR Madagascar OR Malawi OR Mali OR Mozambique OR Nepal OR Niger OR Rwanda OR Senegal OR "Sierra Leone" OR Somalia OR "South Sudan" OR Tanzania OR Togo OR Uganda OR Zimbabwe)

10. (Armenia OR Bangladesh OR Bhutan OR Bolivia OR Cameroon OR Cambodia OR "Cape Verde" OR "Cabo Verde" OR Democratic Republic of the Congo OR DR Congo, DRC, DROC, RDC, Congo-Kinshasa OR Congo OR "Cote d Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt OR "El Salvador" OR Ghana OR Guatemala OR Honduras OR India OR Indonesia

OR Kenya OR Kiribati OR Kosovo OR Kyrgyz Republic OR Lao OR Laos OR Lesotho OR Mauritania OR Micronesia OR Moldova OR Mongolia OR Morocco OR Myanmar OR Nicaragua OR Nigeria OR Pakistan OR "Papua New Guinea" OR Philippines OR Samoa OR "Sao Tome" OR Principe OR "Solomon Islands" OR "Sri Lanka" OR Sudan OR Swaziland OR Syria OR "Syrian Arab Republic" OR Tajikistan OR Timor-Leste OR "Timor Leste" OR "East Timor" OR Tonga OR Tunisia OR Ukraine OR Uzbekistan OR Vanuatu OR Vietnam OR "Viet Nam" OR "West Bank" OR Gaza OR Yemen OR Zambia)

11. (Albania OR Algeria OR "American Samoa" OR Angola OR Azerbaijan OR Belarus OR Belize OR Bosnia OR Herzegovina OR Botswana OR Brazil OR Bulgaria OR China OR Colombia OR "Costa Rica" OR Cuba OR Dominica OR "Dominican Republic" OR Ecuador OR Equatorial Guinea OR Fiji OR Gabon OR Georgia OR Grenada OR Guyana OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Lebanon OR Libya OR Macedonia OR Malaysia OR Maldives OR "Marshall Islands" OR Mauritius OR Mexico OR Montenegro OR Namibia OR Palau OR Panama OR Paraguay OR Peru OR Romania OR Russian Federation OR Serbia OR "South Africa" OR "St Lucia" OR "Saint Lucia" OR "St Vincent" OR "Saint Vincent" OR Grenadines OR Suriname OR Thailand OR Turkey OR Turkmenistan OR Tuvalu OR Venezuela)

12. (MH "Developing Countries") OR (MH "Africa+") OR (MH "Asia, Central+") OR (MH "Asia, Southeastern+") OR (MH "Asia, Western+") OR (MH "Central America+") OR (MH "South America+") OR (MH "Middle East+")

13. ("developing country" OR "developing countries" OR "low-income country" OR "low-income countries" OR "low income country" OR "low income countries" OR "middle-income country" OR "middle-income countries" OR "middle income country" OR "middle income countries" OR "third world" OR Africa OR "Central Asia" OR "South Asia" OR "Southeast Asia" OR "South-East Asia" OR "Central America" OR "Latin America" OR "South America" OR "Middle East")
14. S4 OR S5
15. S6 OR S7 OR S8
16. S9 OR S10 OR S11 OR S12 OR S13
17. S14 AND S15 AND S16
18. Limit 17 to yr=”2006-Current

DARE (Database of Abstracts of Reviews of Effectiveness) (The Cochrane Library)

1. MeSH DESCRIPTOR Self-Injurious Behavior EXPLODE ALL TREES
2. MeSH DESCRIPTOR Suicide, Assisted
3. MeSH DESCRIPTOR Euthanasia EXPLODE 1
4. #2 OR #3
5. #1 NOT #4
6. (parasuicide* OR "self-killing" OR self-injur* OR self-mutilat* OR self-harm* OR self-immolat* OR self-poison* OR self-drowning OR self-hang* OR "deliberate overdose")
7. (("assisted suicide" or euthanasia or "assisted dying")) IN DARE

8.#6 NOT #7

9.#5 OR #8

10. (substance AND (induced OR addiction OR dependen* OR use OR misuse OR withdraw* OR intoxicat*)) IN DARE

11. ((alcohol OR caffeine OR cannabis OR cocaine OR crack OR drug OR ecstasy OR hallucinogen OR heroin OR hypnotics OR inhalant OR marijuana OR methamphetamine OR amphetamine OR morphine OR opioid OR opiate OR pain medication OR phencyclidine OR sedative OR solvent OR steroid OR stimulant OR tobacco) AND (substance-induc* OR addict* OR dependen* OR use OR misuse OR withdraw* OR intoxicat* OR chronic use OR acute use OR illicit use OR drug abuse)) IN DARE

12. ((substance-related disorder*)) IN DARE

13. ((Afghanistan OR Benin OR "Burkina Faso" OR Burundi OR "Central African Republic" OR Chad OR Comoros OR "Democratic Republic of the Congo" OR DRC OR Zaire OR Eritrea OR Ethiopia OR Gambia OR Guinea OR Guinea-Bissau OR "Guinea Bissau" OR Haiti OR "Democratic Republic of Korea" OR "North Korea" OR DPRK OR Liberia OR Madagascar OR Malawi OR Mali OR Mozambique OR Nepal OR Niger OR Rwanda OR Senegal OR "Sierra Leone" OR Somalia OR "South Sudan" OR Tanzania OR Togo OR Uganda OR Zimbabwe)) IN DARE

14. ((Armenia OR Bangladesh OR Bhutan OR Bolivia OR Cameroon OR Cambodia OR "Cape Verde" OR "Cabo Verde" OR Democratic Republic of the Congo OR DR Congo, DRC, DROC, RDC, Congo-Kinshasa OR Congo OR "Cote d Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt

OR "El Salvador" OR Ghana OR Guatemala OR Honduras OR India OR Indonesia OR Kenya OR Kiribati OR Kosovo OR Kyrgyz Republic OR Lao OR Laos OR Lesotho OR Mauritania OR Micronesia OR Moldova OR Mongolia OR Morocco OR Myanmar OR Nicaragua OR Nigeria OR Pakistan OR "Papua New Guinea" OR Philippines OR Samoa OR "Sao Tome" OR Principe OR "Solomon Islands" OR "Sri Lanka" OR Sudan OR Swaziland OR Syria OR "Syrian Arab Republic" OR Tajikistan OR Timor-Leste OR "Timor Leste" OR "East Timor" OR Tonga OR Tunisia OR Ukraine OR Uzbekistan OR Vanuatu OR Vietnam OR "Viet Nam" OR "West Bank" OR Gaza OR Yemen OR Zambia)) IN DARE

15. ((Albania OR Algeria OR "American Samoa" OR Angola OR Azerbaijan OR Belarus OR Belize OR Bosnia OR Herzegovina OR Botswana OR Brazil OR Bulgaria OR China OR Colombia OR "Costa Rica" OR Cuba OR Dominica OR "Dominican Republic" OR Ecuador OR Equatorial Guinea OR Fiji OR Gabon OR Georgia OR Grenada OR Guyana OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Lebanon OR Libya OR Macedonia OR Malaysia OR Maldives OR "Marshall Islands" OR Mauritius OR Mexico OR Montenegro OR Namibia OR Palau OR Panama OR Paraguay OR Peru OR Romania OR Russian Federation OR Serbia OR "South Africa" OR "St Lucia" OR "Saint Lucia" OR "St Vincent" OR "Saint Vincent" OR Grenadines OR Suriname OR Thailand OR Turkey OR Turkmenistan OR Tuvalu OR Venezuela)) IN DARE

16. (developing countries OR africa OR asia, central OR asia, southeastern OR asia, western OR central america OR south america OR middle) IN DARE

17. (("developing country" OR "developing countries" OR "low-income country" OR "low-income countries" OR "low income country" OR "low income countries" OR "middle-income country" OR "middle-income countries" OR "middle income country" OR "middle income countries" OR "third world" OR Africa OR "Central Asia" OR "South Asia" OR "Southeast Asia" OR "South-East Asia" OR "Central America" OR "Latin America" OR "South America" OR "Middle East")) IN DARE

18. #10 OR #11 OR #12

19. #13 OR #14 OR #15 OR #16 OR #17

20. #9 AND #18 AND #19

21. limit 20 to yr="2006 -Current"

Web of Science (Web of Science) (Searched 10 February 2016)

1. (TS=(suicide* OR parasuicid* OR "self-killing" OR self-injur* OR self-mutilat* OR self-harm* OR self-immolat* OR self-poison* OR self-drowning OR self-hang* OR "deliberate overdose")) OR (TI=(suicide* OR parasuicid* OR "self-killing" OR self-injur* OR self-mutilat* OR self-harm* OR self-immolat* OR self-poison* OR self-drowning OR self-hang* OR "deliberate overdose"))

2. (TS=(euthanasia OR "assisted suicide" OR "assisted dying")) OR (TI=(euthanasia OR "assisted suicide" OR "assisted dying"))

3. #1 NOT #2

4. (TS=(substance) AND TS=(induced OR addiction OR dependen* OR use OR misuse OR withdraw* OR intoxicat*)) OR (TI=(substance) AND TI=(induced OR addiction OR dependen* OR use OR misuse OR withdraw* OR intoxicat*))

5. (TS=(alcohol OR caffeine OR cannabis OR cocaine OR crack OR drug OR ecstasy OR hallucinogen OR heroin OR hypnotics OR inhalant OR marijuana OR methamphetamine OR amphetamine OR morphine OR opioid OR opiate OR pain medication OR phencyclidine OR sedative OR solvent OR steroid OR stimulant OR tobacco) AND TS=(substance-induc* OR addict* OR dependen* OR use OR misuse OR withdraw* OR intoxicat* OR chronic use OR acute use OR illicit use OR drug abuse)) OR (TI=(alcohol OR caffeine OR cannabis OR cocaine OR crack OR drug OR ecstasy OR hallucinogen OR heroin OR hypnotics OR inhalant OR marijuana OR methamphetamine OR amphetamine OR morphine OR opioid OR opiate OR pain medication OR phencyclidine OR sedative OR solvent OR steroid OR stimulant OR tobacco) AND TI=(substance-induc* OR addict* OR dependen* OR use OR misuse OR withdraw* OR intoxicat* OR chronic use OR acute use OR illicit use OR drug abuse))

6. (TS=(substance-related disorder*)) OR (TI=(substance-related disorder*))

7. (TS=(Afghanistan OR Benin OR "Burkina Faso" OR Burundi OR "Central African Republic" OR Chad OR Comoros OR "Democratic Republic of the Congo" OR DRC OR Zaire OR Eritrea OR Ethiopia OR Gambia OR Guinea OR Guinea-Bissau OR "Guinea Bissau" OR Haiti OR "Democratic Republic of Korea" OR "North Korea" OR DPRK OR Liberia OR Madagascar OR Malawi OR Mali OR Mozambique OR Nepal OR Niger OR Rwanda OR Senegal OR "Sierra Leone" OR Somalia OR "South Sudan" OR Tanzania OR Togo OR Uganda OR Zimbabwe)) OR

(TI=(Afghanistan OR Benin OR "Burkina Faso" OR Burundi OR "Central African Republic" OR Chad OR Comoros OR "Democratic Republic of the Congo" OR DRC OR Zaire OR Eritrea OR Ethiopia OR Gambia OR Guinea OR Guinea-Bissau OR "Guinea Bissau" OR Haiti OR "Democratic Republic of Korea" OR "North Korea" OR DPRK OR Liberia OR Madagascar OR Malawi OR Mali OR Mozambique OR Nepal OR Niger OR Rwanda OR Senegal OR "Sierra Leone" OR Somalia OR "South Sudan" OR Tanzania OR Togo OR Uganda OR Zimbabwe))

8. (TS=(Armenia OR Bangladesh OR Bhutan OR Bolivia OR Cameroon OR Cambodia OR "Cape Verde" OR "Cabo Verde" OR Democratic Republic of the Congo OR DR Congo, DRC, DROC, RDC, Congo-Kinshasa OR Congo OR "Cote d Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt OR "El Salvador" OR Ghana OR Guatemala OR Honduras OR India OR Indonesia OR Kenya OR Kiribati OR Kosovo OR Kyrgyz Republic OR Lao OR Laos OR Lesotho OR Mauritania OR Micronesia OR Moldova OR Mongolia OR Morocco OR Myanmar OR Nicaragua OR Nigeria OR Pakistan OR "Papua New Guinea" OR Philippines OR Samoa OR "Sao Tome" OR Principe OR "Solomon Islands" OR "Sri Lanka" OR Sudan OR Swaziland OR Syria OR "Syrian Arab Republic" OR Tajikistan OR Timor-Leste OR "Timor Leste" OR "East Timor" OR Tonga OR Tunisia OR Ukraine OR Uzbekistan OR Vanuatu OR Vietnam OR "Viet Nam" OR "West Bank" OR Gaza OR Yemen OR Zambia)) OR (TI=(Armenia OR Bangladesh OR Bhutan OR Bolivia OR Cameroon OR Cambodia OR "Cape Verde" OR "Cabo Verde" OR Democratic Republic of the Congo OR DR Congo, DRC, DROC, RDC, Congo-Kinshasa OR Congo OR "Cote d Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt OR "El Salvador" OR Ghana OR Guatemala OR Honduras OR India OR Indonesia OR Kenya OR Kiribati OR Kosovo

OR Kyrgyz Republic OR Lao OR Laos OR Lesotho OR Mauritania OR Micronesia OR Moldova OR Mongolia OR Morocco OR Myanmar OR Nicaragua OR Nigeria OR Pakistan OR "Papua New Guinea" OR Philippines OR Samoa OR "Sao Tome" OR Principe OR "Solomon Islands" OR "Sri Lanka" OR Sudan OR Swaziland OR Syria OR "Syrian Arab Republic" OR Tajikistan OR Timor-Leste OR "Timor Leste" OR "East Timor" OR Tonga OR Tunisia OR Ukraine OR Uzbekistan OR Vanuatu OR Vietnam OR "Viet Nam" OR "West Bank" OR Gaza OR Yemen OR Zambia))

9. (TS=(Albania OR Algeria OR "American Samoa" OR Angola OR Azerbaijan OR Belarus OR Belize OR Bosnia OR Herzegovina OR Botswana OR Brazil OR Bulgaria OR China OR Colombia OR "Costa Rica" OR Cuba OR Dominica OR "Dominican Republic" OR Ecuador OR Equatorial Guinea OR Fiji OR Gabon OR Georgia OR Grenada OR Guyana OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Lebanon OR Libya OR Macedonia OR Malaysia OR Maldives OR "Marshall Islands" OR Mauritius OR Mexico OR Montenegro OR Namibia OR Palau OR Panama OR Paraguay OR Peru OR Romania OR Russian Federation OR Serbia OR "South Africa" OR "St Lucia" OR "Saint Lucia" OR "St Vincent" OR "Saint Vincent" OR Grenadines OR Suriname OR Thailand OR Turkey OR Turkmenistan OR Tuvalu OR Venezuela)) OR (TI=(Albania OR Algeria OR "American Samoa" OR Angola OR Azerbaijan OR Belarus OR Belize OR Bosnia OR Herzegovina OR Botswana OR Brazil OR Bulgaria OR China OR Colombia OR "Costa Rica" OR Cuba OR Dominica OR "Dominican Republic" OR Ecuador OR Equatorial Guinea OR Fiji OR Gabon OR Georgia OR Grenada OR Guyana OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Lebanon OR Libya OR Macedonia OR

Malaysia OR Maldives OR "Marshall Islands" OR Mauritius OR Mexico OR Montenegro OR Namibia OR Palau OR Panama OR Paraguay OR Peru OR Romania OR Russian Federation OR Serbia OR "South Africa" OR "St Lucia" OR "Saint Lucia" OR "St Vincent" OR "Saint Vincent" OR Grenadines OR Suriname OR Thailand OR Turkey OR Turkmenistan OR Tuvalu OR Venezuela))

10. (TS=(developing countries OR africa OR asia, central OR asia , southeastern OR asia, western OR central america OR south america OR middle east)) OR (TI=(developing countries OR africa OR asia, central OR asia , southeastern OR asia, western OR central america OR south america OR middle east))

11. (TS=("developing country" OR "developing countries" OR "low-income country" OR "low-income countries" OR "low income country" OR "low income countries" OR "middle-income country" OR "middle-income countries" OR "middle income country" OR "middle income countries" OR "third world" OR Africa OR "Central Asia" OR "South Asia" OR "Southeast Asia" OR "South-East Asia" OR "Central America" OR "Latin America" OR "South America" OR "Middle East")) OR (TI=("developing country" OR "developing countries" OR "low-income country" OR "low-income countries" OR "low income country" OR "low income countries" OR "middle-income country" OR "middle-income countries" OR "middle income country" OR "middle income countries" OR "third world" OR Africa OR "Central Asia" OR "South Asia" OR "Southeast Asia" OR "South-East Asia" OR "Central America" OR "Latin America" OR "South America" OR "Middle East"))

12. 4 OR 5 OR 6

13. 7 OR 8 OR 9 OR 10 OR 11

14. #3 AND #12 AND #13

15. limit 14 to yr="2006-2016"

PsycINFO (OvidSP) (Searched 15 February 2016)

1. self destructive behavior

2. euthanasia OR assisted suicide

3. 1 NOT 2

4. (suicid* OR parasuicid* OR "self-killing" OR self-injur* OR self-mutilat* OR self-harm* OR self-immolat* OR self-poison* OR defenestrat* OR self-drowning OR self-hang* OR "deliberate overdose")

5. ("assisted suicide" OR euthanasia OR "assisted dying")

6. 4 NOT 5

7. substance AND (induced OR addiction OR dependen* OR use OR misuse OR withdraw* OR intoxicat*)

8.(alcohol OR caffeine OR cannabis OR cocaine OR crack OR drug OR ecstasy OR hallucinogen OR heroin OR hypnotics OR inhalant OR marijuana OR methamphetamine OR amphetamine OR morphine OR opioid OR opiate OR pain medication OR phencyclidine OR sedative OR solvent OR steroid OR stimulant OR tobacco) AND (substance-induc* OR addict* OR dependen* OR use OR misuse OR withdraw* OR intoxicat* OR chronic use OR acute use OR illicit use OR drug abuse)

9.substance use disorder

10. (Afghanistan OR Benin OR "Burkina Faso" OR Burundi OR "Central African Republic" OR Chad OR Comoros OR "Democratic Republic of the Congo" OR DRC OR Zaire OR Eritrea OR Ethiopia OR Gambia OR Guinea OR Guinea-Bissau OR "Guinea Bissau" OR Haiti OR "Democratic Republic of Korea" OR "North Korea" OR DPRK OR Liberia OR Madagascar OR Malawi OR Mali OR Mozambique OR Nepal OR Niger OR Rwanda OR Senegal OR "Sierra Leone" OR Somalia OR "South Sudan" OR Tanzania OR Togo OR Uganda OR Zimbabwe)

11. (Armenia OR Bangladesh OR Bhutan OR Bolivia OR Cameroon OR Cambodia OR "Cape Verde" OR "Cabo Verde" OR Democratic Republic of the Congo OR DR Congo, DRC, DROC, RDC, Congo-Kinshasa OR Congo OR "Cote d Ivoire" OR "Ivory Coast" OR Djibouti OR Egypt OR "El Salvador" OR Ghana OR Guatemala OR Honduras OR India OR Indonesia OR Kenya OR Kiribati OR Kosovo OR Kyrgyz Republic OR Lao OR Laos OR Lesotho OR Mauritania OR Micronesia OR Moldova OR Mongolia OR Morocco OR Myanmar OR Nicaragua OR Nigeria OR Pakistan OR "Papua New Guinea" OR Philippines OR Samoa OR "Sao Tome" OR Principe OR "Solomon Islands" OR "Sri Lanka" OR Sudan OR Swaziland OR Syria OR "Syrian Arab Republic" OR Tajikistan OR Timor-Leste OR "Timor Leste" OR "East Timor" OR Tonga OR Tunisia OR Ukraine OR Uzbekistan OR Vanuatu OR Vietnam OR "Viet Nam" OR "West Bank" OR Gaza OR Yemen OR Zambia)

12. (Albania OR Algeria OR "American Samoa" OR Angola OR Azerbaijan OR Belarus OR Belize OR Bosnia OR Herzegovina OR Botswana OR Brazil OR Bulgaria OR China OR Colombia OR "Costa Rica" OR Cuba OR Dominica OR "Dominican Republic" OR Ecuador OR

Equatorial Guinea OR Fiji OR Gabon OR Georgia OR Grenada OR Guyana OR Iran OR Iraq OR Jamaica OR Jordan OR Kazakhstan OR Lebanon OR Libya OR Macedonia OR Malaysia OR Maldives OR "Marshall Islands" OR Mauritius OR Mexico OR Montenegro OR Namibia OR Palau OR Panama OR Paraguay OR Peru OR Romania OR Russian Federation OR Serbia OR "South Africa" OR "St Lucia" OR "Saint Lucia" OR "St Vincent" OR "Saint Vincent" OR Grenadines OR Suriname OR Thailand OR Turkey OR Turkmenistan OR Tuvalu OR Venezuela)

13. developing countries OR africa OR asia, central OR asia, southeastern OR asia, western OR central america OR south america OR middle east

14. ("developing country" OR "developing countries" OR "low-income country" OR "low-income countries" OR "low income country" OR "low income countries" OR "middle-income country" OR "middle-income countries" OR "middle income country" OR "middle income countries" OR "third world" OR Africa OR "Central Asia" OR "South Asia" OR "Southeast Asia" OR "South-East Asia" OR "Central America" OR "Latin America" OR "South America" OR "Middle East")

15. S3 OR S6

16. S7 OR S8 OR S9

17. S10 OR S11 OR S12 OR S13 OR S14

18. S15 AND S16 AND S17

19. limit 18 to yr="2006-2016"

G.2 Country classification (list of low-income and middle-income countries)

Low-income countries

Afghanistan, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Congo, Dem. Rep., Eritrea, Ethiopia, Gambia, The, Guinea, Guinea-Bissau, Haiti, Korea, Dem Rep., Liberia, Madagascar, Malawi, Mali, Mozambique, Nepal, Niger, Rwanda, Senegal, Sierra Leone, Somalia, South Sudan, Tanzania, Togo, Uganda, Zimbabwe.

Lower-middle-income countries

Armenia, Bangladesh, Bhutan, Bolivia, Cabo Verde, Cambodia, Cameroon, Congo, Rep., Côte d'Ivoire, Djibouti, Egypt, Arab Rep., El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, Kenya, Kiribati, Kosovo, Kyrgyz Republic, Lao PDR, Lesotho, Mauritania, Micronesia, Fed. Sts., Moldova, Mongolia, Morocco, Myanmar, Nicaragua, Nigeria, Pakistan, Papua New Guinea, Philippines, Samoa, São Tomé and Principe, Solomon Islands, Sri Lanka, Sudan, Swaziland, Syrian Arab Republic, Tajikistan, Timor-Leste, Tonga, Tunisia, Ukraine, Uzbekistan, Vanuatu, Vietnam, West Bank and Gaza, Yemen, Rep., Zambia.

Upper-middle-income country

Albania, Algeria, American Samoa, Angola, Argentina, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, China, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, Equatorial Guinea, Fiji, Gabon, Georgia, Grenada, Guyana, Iran, Islamic Rep., Iraq, Jamaica, Jordan, Kazakhstan, Lebanon, Libya, Macedonia, FYR, Malaysia, Maldives, Marshall Islands, Mauritius, Mexico, Montenegro, Namibia, Palau, Panama, Paraguay, Peru, Romania, Russian Federation, Serbia, South Africa, St. Lucia, St. Vincent and the

Grenadines, Suriname, Thailand, Turkey, Turkmenistan, Tuvalu, Venezuela, RB.

G.3 Quality assessment criteria

Table S3.1
Quality assessment criteria

Study design	Criteria
All study designs	Appropriate research question, valid results, generalizable results.
Cross-sectional	Participation rate, clearly defined outcomes, validity and reliability of exposure and outcome measures, and identification of potential confounders and confidence intervals.
Cohort study; interrupted-time series	Comparable baseline, participation rate, outcome presents at baseline, losses to follow-up, impact of losses to follow-up, clearly defined outcomes, blind outcome assessment, acknowledgment of impact of non-blind assessment, reliable exposure assessment, validity of outcome assessment, validity of exposure measure, identification of potential confounders and confidence intervals, and use of control group.
Case-control study	Comparable case and controls, same exclusion criteria, participation rate, similarities at baseline, clear case and control definitions, blind outcome assessment, reliability of exposure measure, and identification of potential confounders and confidence intervals.
Overall ratings	
High quality (++)	The majority of criteria are met with little or no risk of bias.
Acceptable quality (+)	The majority of criteria are met with some risk of bias.
Low quality (-)	The majority of criteria are not met with significant risk of bias.

G.4 Study quality

Table S3.2
Study quality

	Low-quality studies	Acceptable-quality studies	High-quality studies
Cross-sectional study (n=83)	11 [35, 43, 60, 76, 106, 113, 115, 119, 120, 134, 135]	15 [40, 49, 59, 65, 72, 79, 95, 101, 102, 105, 117, 124, 129, 138]	57 [32-34, 37-39, 42, 44, 46, 47, 50, 52, 54-56, 61-64, 66, 70, 77, 81-85, 87-89, 94, 96, 97, 99, 100, 103, 107-110, 112, 116, 118, 122, 123, 125, 126-128, 130-133, 136, 137, 139]
Cohort study (n=13)	1 [86]	6 [58, 73, 78, 91, 93, 111]	6 [36, 45, 53, 67, 90, 121]
Case-control study (n = 10)	3 [48, 69, 92]	2 [71, 80]	5 [41, 51, 57, 68, 98]
Interrupted-time series (n=2)	2 [74, 75]	0	0
Total	17	23	68

APPENDIX H Supplementary files for article 2

H.1 Level of Admission required and length of stay in hospital by Acute Use of Substances

Table S4.1
Level of Admission required and length of stay in hospital by Acute Use of Substances

	Number of patients		χ^2	df	*p*-value	Total number of days spent in each ward		Mean number of days (standard deviation)	
	[a]n(%)	[b]n(%)				[a]n	[b]n	[a]n	[b]n
Treated in casualty and discharged	16 (33.3)	68 (35.8)	0.101	1	0.750	-	-	-	-
Admitted to short stay medical unit	9 (18.8)	55 (28.9)	2.03	1	0.155	31	145	3.44 (2.06)	2.64 (1.54)
ICU or high care	4 (8.3)	13 (6.84)	0.128	1	0.720	25	60	6.25 (3.27)	4.62 (3.69)
Admitted to long-stay medical or surgical ward	6 (12.5)	11 (5.79)	2.60	1	0.107	150	166	25 (34.1)	15.1 (22.4)
Admitted to emergency psychiatric unit	20 (41.7)	70 (36.8)	0.379	1	0.538	136	452	6.80 (5.89)	6.46 (5.54)
Transferred to tertiary psychiatric hospital	5 (10.4)	12 (6.32)	0.972	1	0.324	-	-	-	-

Note: N = 238; Chi-square statistics were calculated for categorical variables: treated in casualty and discharged; admitted to short stay medical unit; ICU or high care; admitted to long-stay medical or surgical ward; admitted to emergency psychiatric unit; transferred to tertiary psychiatric hospital. Mann-Whitney U test was used for between-group analyses of continuous variables with nonnormal distribution: Mean number of days spent in each unit.
[a]n = 48 patients with acute use of substances; [b]n = 190 of other self-harm patients.

H.2 Binary Logistical Regression Analysis: Summary of Predictors in Each Model

Table S4.2

Binary Logistic Regression Analysis: Summary of Predictors in Each Model

Model	Predictor	Outcome	B (SE)	Wald X^2	*p*-value	OR	CI
1	Gender	AUS	.694 (0.478)	2.11	0.146	2.00	0.785-5.11
	SES	AUS	-0.494 (0.486)	1.03	0.310	0.610	0.235-1.58
	Dependents	AUS	0.401 (0.533)	0.565	0.452	1.49	0.525-4.24
	Stated intention (die or other)	AUS	-0.465 (0.469)	0.984	0.321	0.628	0.250-1.58
	Previous episode of self-harm	AUS	-0.387 (0.499)	0.600	0.439	0.679	0.255-1.81
2	AUS	Self-poison vs. damage to bodily tissue	-0.247 (0.444)	0.311	0.577	0.781	0.327-1.86
3	AUS	[a]GSC (No or minimal depression of LOC)	-0.169 (0.539)	0.098	0.754	0.845	0.294-2.43
		[a]GCS (Moderately depression of LOC)	-0.163 (0.822)	0.039	0.843	0.850	0.170-4.26
4	AUS	Intervention received	-0.241 (0.347)	0.483	0.487	0.786	0.398-1.55
5	AUS	[b]PSIS	0.046 (0.447)	0.009	0.923	1.05	0.411-2.67
6	AUS	Assessed by a Psychiatrist	-0.013 (0.397)	0.001	0.975	0.987	0.454-2.15
7	AUS	ED& Discharge vs. long stay medical ward	0.084 (0.337)	0.063	0.802	1.09	0.562-2.11
8	AUS	Admitted to emergency psychiatry	-0.203 (0.329)	0.379	0.538	0.817	0.428-1.56
9	AUS	Admitted to ICU or high care medical unit	0.213 (0.596)	0.128	0.720	1.24	0.385-3.98

Table S4.2

Binary Logistic Regression Analysis: Summary of Predictors in Each Model *(Continued)*

Model	Predictor	Outcome	B (SE)	Wald X^2	p-value	OR	CI
10	AUS	Suicidal self-injury vs. non suicidal self-injury	-0.630 (0.344)	3.356	0.067	0.533	0.272-1.05
11	AUS	Impulsive act	0.304 (0.412)	0.546	0.460	1.36	0.605-3.04

Note: OR = odds ratio; CI = confidence intervals; AUS = acute use of substances; SES = socio-economic status.

[a]No or minimal depression in level of consciousness = a score of 13 to 15 on the Glasgow Coma scale; moderately depressed level of consciousness = a score of 9 to 12 on the Glasgow Coma scale; significantly depressed level of consciousness = a score of 8 or less on the Glasgow Coma scale. [b]Low to moderate suicide intent = a PSIS of 11 or lower; high suicide intent = PSIS score of 12 or more.

Supplementary appendix

Appendix A: Characteristics of included studies, by substance type and dimension (N=108)

Appendix B: Figures to illustrate Word Bank region, World Bank income group, study setting, substance type and substance dimension, suicide dimension, and study design

Appendix A: Characteristics of included studies, by substance type and dimension (N=108)

Substance investigated	Substance dimension	Authors / study	Study (setting)	*Target population: adult vs adolescent (age)	Study design (sample size)	Gender (%)	Suicide dimension	Statistical analysis	Finding	Association	Study quality
Alcohol											
Alcohol	Intoxication	Eddleston, Gunnell et al, 2009[111]	Sri Lanka Hospital based	N/A	Cohort study	Male= 55 (76.4%) & female=17 (23.6%)	Fatal suicide	Bivariate	Median alcohol concentration in patients who died (0·94 g l-1·94 mg dl-1, IQR 0·52–1·30) was higher compared to survivors (0·0 g l-1, IQR 0.00–1·04; Mann– Whitney p=0·018).	Positive	+
								Multivariate	Risk of death by suicide was associated with drinking alcohol (OR=4·3, 95% CI 1·2-16·4, p<0·05). Remained associated when only men were studied (OR=4·8, 95% CI 1·2-19·3, NO p-value); amongst women, there was only one death and she had not consumed alcohol.	Unclear	
								Multivariate	The risk of death by suicide associated with alcohol ingestion was weakened by controlling for age (aOR=4·1, 95% CI 1·0-17·8, p<0·05).	Positive	

								Multivariate	The risk of death associated with alcohol ingestion was not significant by additionally controlling for dimethoate (OR=0·3, 95% CI 0·0-8·8, p>0·05). This indicates that the deaths were not due to the direct toxic effects of alcohol.	Null	
Alcohol	Intoxication	Mahfoud et al, 2011[101]	Lebanon School based	Adolescents (11 to 16 years old)	Cross-sectional study	Male (47.7%) female (52.3%)	Suicidal ideation	Bivariate	Having gotten drunk (OR=2·61, 95% CI 1·99-3·42, p<0·05) was associated with suicidal ideation.	Positive	+
								Multivariate	Having gotten drunk (aOR=2·28, 95% CI 1·68-3·09, p<0·05) remained associated with suicidal ideation, while controlling for age, gender, and type of school.	Positive	
Alcohol	Intoxication	Muula et al, 2007[127]	Zambia School based	Adolescents (14 to 16 years old)	Cross-sectional study	Males 919 (54.0%) & female 964 (46%)	Suicidal ideation	Bivariate	Ever having been drunk (OR=1·40, 95% CI 1·39-1·41, p<0·05) was significantly associated with suicidal ideation.	Positive	++
								Multivariate	This association remained significant (aOR=1·28, 95% CI 1·27–1·29, p<0·05), while controlling for	Positive	

									age, sex, worry, loneliness, ever smoked marijuana, felt sad or hopeless.		
Alcohol	Intoxication	Myint et al, 2014[45]	Thailand Hospital based	Both (10 to 79 years old)	Cohort study	Male 136 (91.3%) & 13 (8.7%)	Fatal suicide	Bivariate	Blood alcohol concentrations (6 vs. 32 participants) (x^2=0·527, df=1, p=0·468) were not significantly different when the suicide and non-suicide groups were compared.	Null	++
Alcohol	Intoxication	Page et al, 2011[46]	China; Philippines School based	Adolescent 11 to 17 years old)	Cross-sectional study	China: male 4356 (51.2%) & female 4537 (48.8%). Philippines: male 3094 (43.2%) & female 4188 (56.8%).	Suicidal ideation	Multivariate	Among Philippine students, ever been drunk was significantly associated with suicide ideation (aOR=1·34, 95% CI 1·31-1·36, p<0·001) and making a suicide plan (aOR=1·29, 95% CI 1·27-1·31, p<0.001), while controlling for age, grade level, and greater distribution in the two samples.	Positive	++
									Among Chinese students, ever been drunk was significantly associated with suicide ideation (aOR=28·2, 95% CI 24·7-31·8, p<0·001) and making a suicide plan (aOR=1·09, 95% CI	Positive	

									1·05-1·13, p<0·001), while controlling for age, grade level, and greater distribution in the two samples.		
Alcohol	Intoxication	Sitdhiraksa et al, 2014[49]	Thailand School based	Both (12 to 21 years old)	Cross-sectional study	Male 1054 (40.2%) & female 1568 (59.8%)	Suicidal ideation: Thoughts of self-harm Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Being drunk within the last 12 months was significantly associated with thoughts of harming yourself or attempted suicide (OR=3·36, 95% CI 2·74-4·12, p<0·01).	Positive	+
Alcohol	Intoxication	de Mattos Souza et al, 2010[96]	Brazil National/ regional registers (e.g. not clinical-based registers)	Adolescents (11 to 15 years old)	Cross-sectional study	Male 501 (48.2%) & female 538 (51.8%)	Suicidal ideation	Multivariate	Getting drunk in the last month was not associated with suicidal ideation (aOR=1·94, 95% CI 0·86-4·36, p=0·109), while controlling for gender, age, socioeconomic status, level of education, grade retention, religious practice, sexual activity, alcohol consumption, illicit drug use, conduct disorder and high CDI scores for depressive symptoms.	Null	++

Alcohol	Intoxication	Swahn et al, 2012[136]	Uganda Other	Both (14 to 24 years old)	Cross-sectional study	Male 142 (31.1%) & female 315 (68.5%)	Suicidal ideation	Bivariate	Any drunkenness (OR=1·95, 95% CI 1·29-2·97, p<0·05), significantly associated with suicide ideation.	Positive	++
							Suicidal ideation	Multivariate	The association between any drunkenness and suicidal ideation disappeared (aOR=0·93, 95% CI 0·49-1·75, p<0·05), while controlling for: gender, school attendance, whether one or both parents were dead, parental physical abuse, parental neglect due to alcohol use, apprenticeship skills, any drug use, any STD/HIV, any traded sex, any rape, sadness, lonely, expect to die early.	Null	
							Non-fatal suicidal behaviour: suicide attempt	Bivariate	Any drunkenness (OR=1·97, 95% CI 1·22-3·18, p<0·05), significantly associated with suicide attempt.	Positive	
							Non-fatal suicidal behaviour: suicide attempt	Multivariate	The association between any drunkenness and suicidal attempt disappeared while controlling for the other variables in the model (aOR=1·00,	Null	

									95% CI 0·51-1·95, p<0·05), while controlling for gender, school attendance, whether one or both parents were dead, parental physical abuse, parental neglect due to alcohol use, apprenticeship skills, any drug use, any STD/HIV, any traded sex, any rape, sadness, lonely, expect to die early.		
Alcohol	Intoxication	Wei et al, 2013[53]	China Hospital based	Both (15 to 60 years old)	Cohort study	Male 53 (22.2%) & female 186 (77.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	A greater proportion of those who reported alcohol use at the time of the episode or up to 12 hours before reported impulsive suicide attempt when compared to nonimpulsive suicide attempt. This was not a statistically significant difference (14% vs. 9·8%), (x^2=0·994, df=1, p=0·319).	Null	+
Alcohol	Intoxication	Zhu et al, 2015[59]	China; Vietnam; Taiwan Community based	Adolescents (15 to 24 years old)	Cross-sectional study	N/A	Suicidal ideation	Multivariate	Drunkness predicted suicidal ideation when controlling for city (Hanoi, Shanghai, Taipei) (aOR=2·12, 95% CI 1·33–3·38, p<0·01).	Positive	+

									Suicidal ideation was significantly associated with drunkness in Hanoi (aOR=2·12, 95% CI 1·33–3·38, p<0·01), Shanghai (aOR=2·18, 95% CI 1·47–3·23, p<0·001), Taipei (aOR=1·97, 95% CI 1·57–2·47, p<0·001).	Positive	
Alcohol	Use	Ahmad et al, 2014[32]	Malaysia School-based	Adolescents (12 to 17 years old)	Cross-sectional study	Male (49.6%) & female (50.4 %)	Suicidal ideation	Multivariate	Current drinking was associated with suicidal ideation (aOR=1·55, 95% CI 1·28-1·87, p<0·01), while controlling for gender, ethnicity, parental marital status, current smoking, current drug use, were bullied, physically abused at home, verbally abused at home, stress, anxiety, depression, have close friend, supportive peers, parental supervision, parental connectedness, parental bonding, parental respect for privacy)	Positive	++
Alcohol	Use	Alvarado-Esquivel et al, 2014[80]	Hospital-based	Adults [sample: 18-61 years old	Case-control study	Male 85 (30.8%) & female	Non-fatal suicidal behaviour:	Multivariate	Alcohol consumption (OR=2·39, 95% CI 1·21-4·70, p=0·01) was	Positive	+

				(mean 34.14+/- 10.24 years old). Control: 18-69 years old (mean 38.23+/- 11.76 years old)]		191 (69.2%)	Suicide attempt		associated with suicide attempts.		
Alcohol	Use	Arenliu et al, 2014[60]	Kosovo School-based	Adolescents (15-19 years old)	Cross-sectional study	Male (43.7%) & female 55.1%; not responded 1.2%	Suicidal ideation	Bivariate	Alcohol usage over 30 days was associated with suicidal ideation among both males (OR=2·36, 95% CI 1·43–3·82, p<0·001), and females (OR=3·24, 95% CI 1·93–5·28, p<0·001).	Positive	-
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol usage over 30 days was associated with suicide attempt for both males (OR=2·90, 95% CI 1·51–5·4, p<0·05), for females (OR=2·34, 95% CI 0·92–5·15, p<0·05).	Positive	
Alcohol	Use	Blum et al, 2012[33]	Vietnam, and Taiwan Community based (15 to 24 years old)	Both (15 to 24 years old)	Cross-sectional study	Hanoi (Vietnam): male 3 251 (52.5%) & female 2 940 (47.5%)	Suicidal ideation	Bivariate	Alcohol use in the past month was associated with suicidal ideation in Hanoi (OR=1·82, 95% CI 1·21-2·74, p<0·01) and Taipei (OR=1·54, 95% CI 1·26-1·88, p<0·01) respectively.	Positive	++

						Taipei (Taiwan) : male 2398 (51%) & female 2308 (49%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol use in the last month was not associated with suicide attempts in Hanoi, (OR=1·1·58, 95% CI 39-6·41, p<0·05).	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol use in the last month was associated with suicide attempts in Taipei (OR=1·50, 95% CI 1·04 -2·17, p<0·05).	Positive	
Alcohol	Use	Chan et al, 2013[35]	Malaysia National/ regional registers (e.g. not clinical-based registers)	Adolescent (18 to 76 years old)	Cross-sectional study	Male 2407 (47.5%) & female 2174 (52.5%)	Non-fatal suicidal behaviour: deliberate self-harm	Multivariate	Alcohol use (aOR=1·34, 95% CI 1·00-1·79, p<0·048) was significantly associated with DSH, while controlling for history of sexual abuse, illicit drug use, and female gender.	Positive	-
Alcohol	Use	Chaveepojnkamjorn et al, 2011[37]	Thailand School-based	Adolescents (15 to 18 years old)	Cross-sectional study	Male (100%)	Suicidal ideation: thought and plan	Multivariate	Current drinkers, when compared to non-drinkers, were more likely to report serious thoughts about suicide (aOR=2·07, 95% CI 1·38-3·11) and making a suicide plan (aOR=2·10, 95% CI 1·43-3·08, p<0·001), while controlling for socio-demographic factors (age, educational level, residence, cohabitants, GPA, having a part	Positive	++

									time job, and having family members with alcohol/drug problems).		
Alcohol	Use	Diehl & Laranjeira, 2009[86]	Brazil Hospital based	Adult (18 to 41 years old)	Cohort study	Male 22 (27.5%) & female 58 (72.5 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Suicide attempt method was not associated with alcohol use within six hours prior to the event (p=0·346). No other statistical results were reported.	Null	-
Alcohol	Use	Jaisoorya et al, 2015[112]	India School based	Adolescents (12 to 19 years old)	Cross-sectional study	Male 865 (23.2%) & female 235 (6.5%)	Suicidal ideation: Suicidal thoughts Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Suicidal thoughts (aOR=1·7, 95% CI 1·4-2·1, p<0·05) and suicide attempts (aOR=0·9, 95% CI 0·7-1·4, p<0·05) predicted lifetime use of alcohol, while controlling for socio-demographic variables, academic performance, other substance use, self-reported psychological distress scores, suicidality, sexual abuse and ADHD scores.	Positive	++
Alcohol	Use	Khan, Sulaiman, & Hassali, 2012[43]	Malaysia Clinic-based (e.g. mobile clinic,	Both (15 to 84 years old)	Cross-sectional study	Male 128 (43%) & female 170 (57%)	Suicidal ideation	Bivariate	Those depressive disorder patients disclosing alcohol use (x^2=73·3, df=1, p< 0·01) were more likely to report suicidal ideation	Positive	-

			free clinic)						Those depressive disorder patients with alcohol use (OR=3·69, 95% CI 1·99-6·85, p<0·01) had the highest risk of suicidal ideation in comparison to others (i.e., those with a history of medical complications and social problems)		
Alcohol	Use	Khasakhala et al, 2013[125]	Kenya Hospital based	Both (13 to 25 years old)	Cross-sectional study	Male 447 (48.7%) & female 471 (51.3%)	Non-fatal suicidal behaviour: Suicidal behaviour	Multivariate	Any drug abuse (OR=6·66, 95% CI 2·81–15·75, p<0·001), and alcohol use (OR=6·69, 95% CI 2·69–16·6, p<0·001) was associated with suicidal behaviour.	Positive	++
									Any drug use was associated with suicidal behaviour (aOR=5·23, 95% CI 1·88–13·9, p<0·001), while controlling for major depressive disorder, any anxiety disorder, and alcohol use.	Positive	
Alcohol	Use	Miller et al, 2011[88]	Mexico Community based	Adolescents (12 to 17 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Lifetime use of any alcohol beverages (OR=2·13, 95% CI 1·63-2·78, p<0·01) and lifetime use of 12 or more drinks in a year (OR=2·06, 95% CI 1·56-2·73, p<0·01) was	Positive	++

									associated with suicidal ideation.		
							Suicidal ideation	Bivariate	Lifetime use of any alcohol beverages (OR=3·87, 95% CI 2·15-6·98, p<0·01) and lifetime use of 12 or more drinks in a year (OR=2·25, 95% CI 1·35-3·74, p<0·01) was associated with suicide plan.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Lifetime use of any alcohol beverages (OR=3·43, 95% CI 1·88-6·29, p<0·01) and lifetime use of 12 or more drinks in a year (OR=2·26, 95% CI 1·32-3·86, p<0·01) was associated with suicide attempt.	Positive	
							Suicidal ideation	Multivariate	Lifetime use of any alcohol beverages (OR=1·21, 95% CI 0·91-1·62, p<0·05) and lifetime use of 12 or more drinks in a year (OR=1·02, 95% CI 0·58-1·81, p>0·05) was not associated with suicidal ideation, while controlling for psychiatric disorder or drug use/disorder and tobacco use/disorder.	Null	
							Suicidal ideation	Multivariate	Lifetime use of any alcohol beverages	Positive	

									(OR=1·85, 95% CI 1·18-2·90, p<0·01) was associated with suicide plan, while controlling for psychiatric disorder or drug use/disorder and tobacco use/disorder.		
							Suicidal ideation	Multivariate	Lifetime use of 12 or more drinks in a year (OR=0·79, 95% CI 0·30-2·12, p>0·05) was not associated with suicide plan, while controlling for psychiatric disorder or drug use/disorder and tobacco use/disorder.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Lifetime use of any alcohol beverages (OR=1·66, 95% CI 1·01-2·73, p>0·05) and lifetime use of 12 or more drinks in a year (OR=0·56, 95% CI 0·29-1·09, p>0·05) was not associated with suicide attempt, while controlling for psychiatric disorder or drug use/disorder and tobacco use/disorder.	Null	
Alcohol	Use	Nojomi et al, 2007[103]	Iran Community based	Both 14 years old and older	Cross-sectional study	Male 809 (35.2%) & Female	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcoholic beverages were higher among suicide attempters than nonattempters (31·6% vs. 8·8%, p<0·0005).	Positive	++

						1491 (64.8 %)			Alcohol use was associated with lifelong suicide attempts (OR=3·80, 95% CI 1·82-7·95, p<0·001).	Positive	
Alcohol	Use	Page et al, 2011[139]	Philippines; China; Namibia School based	Adolescents (11 to 16 years old)	Cross-sectional study	Philippines: male 3094 (43.2%) & female 4188 (56.8%). China: male 4356 (51.2%) & female 4537 (48.8%). Namibia: male 2931 (45.2%) & female 3352 (54.8%).	Suicidal ideation	Bivariate	Current drinking was associated with suicide plan across gender and the three countries (Philippine, China, Namibia): Philippine boys %(n) drinker=22·7 (210); %(n) nondrinker=16·8 (269); (OR=1·39, 95% CI 1·12-1·72, p<0·05); Philippine girls %(n) drinker=26·3 (188); %(n) nondrinker= 15·9 (477); (OR=1·93, 95% CI 1·58-2·36, p<0·05); China boys %(n) drinker=11·8 (84); %(n) nondrinker= 5·2 (166); (OR=2·50, 95% CI 1·88-3·30, p<0·05); China girls %(n) drinker=21·5 (92); %(n) nondrinker= 7·9 (300); (OR=3·12, 95% CI 2·40-4·06, p<0·05); Namibia boys %(n) drinker=36·6 (301); %(n) nondrinker= 27·0 (438); (OR= 1·52, 95% CI 1·26-1·83, p<0·05);	Positive	++

									Namibia girls %(n) drinker=37·9 (323); %(n) nondrinker= 27·3 (558); (OR=1·64, 95% CI 1·37-1·95, p<0·05).		
Alcohol	Use	Page, West, et al, 2011[46]	China; Philippines School based	Adolescent 11 to 17 years old)	Cross-sectional study	China: male 4356 (51.2%) & female 4537 (48.8%). Philippines: male 3094 (43.2%) & female 4188 (56.8%).	Suicidal ideation	Multivariate	Use of alcohol in the past 30 days was associated with suicide ideation (OR=1·67, 95% CI 1·63-17·1, p<0·001) and making a suicide plan (OR=2·46, 95% CI 2·39-2·53, p<0·001) in Chinese students, while controlling for age, grade level, and greater distribution in the 2 samples.	Positive	++
									Use of alcohol in the past 30 days was associated with suicide ideation (OR=1·10, 95% CI 1·08-1·12, p<0·001) and making a suicide plan (OR=1·03, 95% CI 1·02-1·05, p<0·001) , while controlling for age, grade level, and greater distribution in the 2 samples.	Positive	
Alcohol	Use	Peltzer, 2008[128]	South Africa	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: suicide risk	Multivariate	Past month frequency of beer or wine (OR=1·23, 95% CI 0·85-1·84, p>0·05) and	Null	++

			School based				related behaviours		hard liquor (OR=1·36, 95% CI 0·92-2·09, p>0·05) not significantly associate with high vs. low suicide risk.		
Alcohol	Use	Peltzer, 2009[129]	Kenya; Namibia; Swaziland; Uganda; Zambia; Zimbabwe School based	Adolescents (13 to 15 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Risky drinking was associated with suicidal ideation (OR=2·37, 95% CI 2·34–2·41, p<0·001).	Positive	+
							Suicidal ideation	Multivariate	Suicidal ideation was associated with risky drinking (aOR=1·66, 95% CI 1·63–1·69, p<0·001), while controlling for confounding factors.	Positive	
							Suicidal ideation	Bivariate	Risky drinking was associated with suicide plan (OR=2·52, 95% CI 2·48–2·55, p<0·001).	Positive	
							Suicidal ideation	Multivariate	Risky drinking was associated with suicide plan (aOR=1·59, 95% CI 1·56–1·62, p<0.001), while controlling for confounding factors.	Positive	
Alcohol	Use	Peltzer & Pengpid, 2015[47]	Oceania (Kiribati, Samoa, Solomon Islands,	Adolescents (13 to 16 years old)	Cross-sectional study	Male 2846 (43.5%) & female 3534 (54%)	Suicidal ideation Non-fatal suicidal behaviour:	Bivariate	Alcohol use initiation was associated with suicidal ideation: **<u>Among the total sample</u>**	Positive	++

			and Vanuatu) School based				Suicide attempt		Non-initiators 1.00 <12 years (OR=4·14, 95% CI 3·52-4·86, p<0·001); ≥12 years (OR=2·48, 95% CI 2·01-3·06, p<0·001). **<u>Among boys</u>** Non-initiators 1.00 <12 years (OR=3·55, 95% CI 2·6–4·74, p<0·001); ≥12 years (OR=2·12, 95% CI 1·5–2·92, p<0·001). AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (OR=4·89, 95% CI 3·63–6·59, p<0·001); ≥12 years (OR=3·14, 95% CI 2·41–4·09, p<0·01).		
								Bivariate	Current alcohol use was associated with suicidal ideation (OR=2·69, 95% CI 2·3-3·12, p<0·001). **<u>Among boys</u>** (OR=2·37, 95% CI 1·9-2·87, p<0·001);	Positive	

									Among girls (OR=3·20, 95% CI 2·54-4·03, p<0·001).		
								Bivariate	Alcohol use initiation was associated with suicide attempt: **Among the total sample** Non-initiators 1·00 <12 years (OR = 8·48, 95% CI 6·51-11·1, p<0·001); ≥12 years (OR=2·89, 95% CI 2·26-3·70, p<0·001). **Among boys** Non-initiators 1.00 <12 years (OR=7·63, 95% CI 5·18–11·2, p<0·001); ≥12 years (OR=2·37, 95% CI 1·75–3·20, p<0·001). AND **Among girls** Non-initiators 1·00 <12 years (OR=4·89, 95% CI 3·63–6·59, p<0·001); ≥12 years OR=3·14, 95% CI 2·41–4·09, p<0·001).	Positive	

								Bivariate	Current alcohol use was associated with suicide attempt (OR=2·69, 95% CI 2·3-3·12, p<0·001). **<u>Among boys</u>** (OR=2·37, 95% CI 1·9-2·87, p<0·001); **<u>Among girls</u>** (OR=3·20, 95% CI 2·54-4·03, p<0·001).	Positive	
								Multivariate	Alcohol use initiation was associated with suicidal ideation: **<u>Among the total sample</u>** Non-initiators 1·00 <12 years (aOR=3·39, 95% CI 2·44-4·71, p<0·001); ≥12 years (aOR=1·95, 95% CI 1·32-2·89, p<0·001). **<u>Among boys</u>** Non-initiators 1.00 <12 years (aOR=3·37, 95% CI 2·16-5·27, p<0·001); ≥12 years (aOR=1·88, 95% CI 1·14-3·10, p<0·05). AND	Positive	

									Among girls Non-initiators 1·00 <12 years (aOR=3·12, 95% CI 1·95-4·90, p<0·001); ≥12 years (aOR=2·12, 95% CI 1·34-3·34, p<0·01). (Adjusted for age, psychological distress and current alcohol use)		
								Multivariate	Alcohol use initiation was associated with suicide attempt: **Among the total sample** Non-initiators 1·00 <12 years (aOR=4·55, 95% CI 3·34-6·21, p<0·001); ≥12 years (aOR=1·64, 95% CI 1·16-2·32, p<0·01). **Among boys** Non-initiators 1.00 <12 years (aOR=3·94, 95% CI 3·46-6·32, p<0·001); but not ≥12 years (aOR=1·19, 95% CI 0·77-1·85, p>0·05). AND	Positive	

									<u>Among girls</u> Non-initiators 1·00 <12 years (aOR=5·76, 95% CI 3·84-8·64, p<0·001); ≥12 years (aOR=1·84, 95% CI 1·05-3·22, p<0·05). (Adjusted for age, psychological distress and current alcohol use)		
Alcohol	Use	Pillai et al, 2009[116]	India Community based	Adolescents (16 to 24 years old)	Cross-sectional study	Male 1780 (49.6%) & females 1882 (51.4%)	Non-fatal suicidal behaviour: Suicide behaviour	Multivariate	Alcohol use (aOR=2·7, 95% CI 1·7-4·4, p<0·05) and was associated with suicidal thinking/planning/attempts during past 3 months.	Positive	++
Alcohol	Use	Pumariega et al, 2014[72]	Turkey School based	Adolescents (14 to 18 years old)	Cross-sectional study	Male 14 477 (46.6%) & female 16581 (53.4%)	Suicidal ideation	Bivariate	Suicidal ideation was a was associated with alcohol use (OR=0·878, NO CI, p=0·043).	Positive	+
Alcohol	Use	Reyes-Tovilla et al, 2015[93]	Mexico Hospital based	Both (13 to 60 years old)	Cohort study	Male 52 (36.1%) & female 92 (63.9%)	Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol consumption was associated with suicide attempt (OR=7·48, 95% CI 1·64-34·2, p=0·009), while controlling for past number of attempts, intake of alcohol prior to	Positive	+

									attempt, cannabis use, intake of cannabis prior to attempt.		
									Intake of alcohol prior to attempt was not associated with whether an attempt was impulsive or premeditated (OR=2·78, 95% CI 0·52-14·9, p=0·23), while controlling for past number of attempts, alcohol consumption, cannabis use, intake of cannabis prior to attempt.	Null	
Alcohol	Use	Rudatsikira et al, 2007[134]	Uganda School based	Adolescents (11 to 17 years old)	Cross-sectional study	Male 784 (53.3 %) & female 676 (46.7%)	Suicidal ideation	Bivariate	Alcohol Drinking in the past 12 months was not associated with suicidal ideation among the total sample (OR=1·40, 95% CI 0·99-2·00, p>0·05).	Null	-
								Multivariate	Alcohol drinking in the last 12 months did not significantly predict suicidal ideation (OR=1·27, 95% CI 0·80-2·01, p>0·05), while controlling for age, gender, loneliness, worry, smoking and being bullied.	Null	

Alcohol	Use	Rudatsikira et al, 2007[135]	Zimbabwe School based	Adolescents (11 to 17 years old)	Cross-sectional study	Male 873 (49.3%) & female 1111 (50.7%)	Suicidal ideation	Bivariate	Drinking alcohol in the past 12 months was associated with suicidal ideation among the total sample (OR=2·24, 95% CI 1·57- 3·19, p<0·05), men (OR=2·28 95% CI 1·34-3·86, p<0·05) and women (OR=2·21, 95% CI 1·36-3·60, p<0·05).	Positive	-
Alcohol	Use	Ruengorn et al, 2012[48]	Thailand Hospital based	Both (13 to 60 years old)	Case-control study	Male 354 (32.2%) & female 746 (67.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Current alcohol use was associated with suicide attempt (OR=2·78, 95% CI 1·91-4·03, p<0·001).	Positive	-
Alcohol	Use	Sharma et al, 2015[94]	Peru School based	Adolescents (12 to 18 years old)	Cross-sectional study	Male 425 (46.4%) & female 491 (53.6%)	Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol consumption was associated with increased likelihood of suicide attempts (aOR=1·59, 95% CI 1·04-2·44, p<0·05), while controlling for psychological, and behavioural factors.	Positive	++
									Alcohol consumption was significantly associated with increased likelihood of suicide attempts (aOR=1·52, 95% CI 1·00–2·33, p<0·05), while controlling for psychological, socio-	Positive	

									environmental, and demographic factors.		
Alcohol	Use	Shooshtary et al, 2008[108]	Iran Community based	Both (15 years old and older)	Cross-sectional study	Male 187 (37.1%) & female 317 (62.9%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol use was not associated with lifetime suicide attempts (OR=0·67, 95% CI 0·15-2·91, p>0·05).	Null	++
Alcohol	Use	Silva et al, 2014[95]	Brazil School based	Adolescents (13 to 18 years old)	Cross-sectional study	Male 836 (37.9%) & female 1371 (62.1%)	Suicidal ideation Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol consumption, association was found with suicide ideation (OR=1·93, CI 95% 1·47-2·54, p<0·01), planning (OR=2·22, CI 95% 1·61–3·08, p<0·01), and attempt (OR=1·73, CI 95% 1·15–2·59, p<0·01).	Positive	+
Alcohol	Use	Sitdhiraksa et al, 2014[49]	Thailand School based	Both (12 to 21 years old)	Cross-sectional study	Male 1054 (40.2%) & female 1568 (59.8%)	Suicidal ideation: Thoughts of self-harm Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol use within the last 12 months was associated with thoughts of harming yourself or attempted suicide (OR=2·90, 95% CI 2·36-3·56, p<0·01).	Positive	+
Alcohol	Use	Souza et al, 2010[96]	Brazil National/ regional registers (e.g. not	Adolescents (11 to 15 years old)	Cross-sectional study	Male 501 (48.2%) & female 538 (51.8%)	Suicidal ideation	Multivariate	Alcohol use in the last month was associated with suicidal ideation (aOR=1·64, 95% CI 1·04-2·58, p=0·033), while controlling for	Positive	++

			clinical-based registers)						gender, age, socioeconomic status, level of education, grade retention, religious practice, sexual activity, tobacco use, getting drunk, conduct disorder and high CDI scores for depressive symptoms.		
Alcohol	Use	Thanh et al, 2006[50]	Vietnam Community based	Both (14 to 65 years old)	Cross-sectional study	Male 1093 (48.4%) & female 1167 (51.6%)	Suicidal ideation: Suicidal thoughts	Multivariate	Having ever used alcohol was associated with suicidal thoughts (aOR=1·6, 95% CI 1·1-2·2, p<0·01), while controlling for age, gender, marital status, education level, income, religion, religiousness, employment status, use of alcohol, sedatives, and pain relief medication.	Positive	++
Alcohol	Use	Togay et al, 2015[76]	Turkey Hospital based	Both (15 to 45 years old)	Cross-sectional study	Suicide attempt vs. no suicide attempt before admission: Male [12 (41.4%) vs. 91 (63.6%)]	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol use was associated with suicide attempts before first admission (OR=0·040, NO CI, p=0·045).	Positive	-

						& female [17 (58.6%) vs. 52 (36.4%)]. Suicide attempt vs. no suicide attempt after admission: Male [8 (72.7%) vs. 59 (67.4%)] & female [3 (27.3%) vs. 28 (32.6%)].					
Alcohol	Use	Wan et al, 2011[52]	China School based	Both (12 to 24 years old)	Cross-sectional study	Male 8599 (48.8%) & female 9023 (51.2%)	Non-fatal suicidal behaviour: Deliberate self-harm	Bivariate	Among those with alcohol use, a total of 77% reported no DSH, 6% reported a single-incident DSH, 17% reported repeat-incident DSH. There was a significant difference between those with and those without alcohol use among DSH (x^2=36·6, df=1, p<0·001).	Positive	++
									Alcohol use significantly predicted	Positive	

									a single-incident DSH (OR=1·79, 95% CI 1·46–2·20, p<0·001), and repeat-incident DSH when controlling for single-incident DSH (OR=0·79, 95% CI 0·63–0·99, p=0·041).		
Alcohol	Use	Xiao et al, 2013[54]	China Community based	Both (15 to 65 years old)	Cross-sectional study	Male 144 (33.8%) & female 282 (66.2%)	Non-fatal suicidal behaviour: Self-harm	Bivariate	A greater proportion of light self-harm patients reported preceding alcohol intake when compared to severe self-harm (77·9% vs. 22·1%) (x^2=7·4, df=1, p<0·05).	Positive	++
								Multivariate	Preceding alcohol drinking was inversely related to severe self-harm, (OR=-0·40, 95% CI 0·22-0·74, p<0·01), while adjusting for the other factors in the model: gender, age, place of residence, and method of self-harm.	Negative	
Alcohol	Use	Xing et al, 2010[55]	China School based	Adolescents (11 to 19 years old)	Cross-sectional study	Males 6216 (49.8%) & female 6254 (50.2%)	Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Being an alcohol user was associated with being a suicide attempter (x^2=83, df=1, p<0·001).	Positive	++

Alcohol	Misuse	Fekadu et al, 2014[123]	Ethiopia Community based	Adults (18 years old and older	Cross-sectional study	Male 743 (49.6%) & female 754 (50.4%)	Non-fatal suicidal behaviour: suicidality	Bivariate	Hazardous alcohol use was not associated with suicidality (OR=1·19, 95% CI 0·85-1·65, p=0·305).	Null	++
Alcohol	Misuse	Peltzer & Louw, 2013[131]	South Africa Clinic-based (e.g., mobile clinic, free clinic)	Adults (18 years old and older)	Cross-sectional study	Male 2631 (54.5%) & female 2194 (45.5%)	Suicidal ideation Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Harmful alcohol use was associated with suicide ideation (aOR=1·97, 95% CI 12·5-3·09, p<0.01) and suicide attempts (aOR=3·01, 95% CI 1·83-4·95, p<0·001), while controlling for age, education, marital status, geolocality and poverty index.	Positive	++
Alcohol	Misuse	Randall et al, 2014[133]	Republic of Benin, West Africa School based	Adolescents (11 to 16 years old)	Cross-sectional study	Male 1798 (67.1%) & female 882 (32.9%)	Suicidal ideation Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Among alcohol misuse individuals: 15.3% (314) reported no suicidal ideation; 10·1% (13) reported ideation only; 26·7% (116) reported ideation with a plan, p<0·0001.	Positive	++
								Bivariate	Alcohol misuse was significantly associated with number of suicide attempts p=0·002; no attempt=14·4% (281), one attempt =18·7%(65), 2 or more attempts =28·6% (95).	Positive	
								Multivariate	Alcohol misuse was not associated with suicidal ideation	Null	

									(aOR=0·57, 95% CI 0·31–1·05, p=0·069), while controlling for age, psycho-social symptoms, and socio-environmental factors.		
								Multivariate	Alcohol misuse was associated with suicidal ideation with a plan (aOR=1·52, 95% CI 1·02–2·27, p=0·043), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Positive	
								Multivariate	Alcohol misuse, was not associated with having one past suicide attempt (aOR=1·11, 95% CI 0·65–1·90, p=0·672), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Null	
								Multivariate	Alcohol misuse, was not associated with having two or more past suicide attempt (aOR=1·62, 95% CI 0·97–2·70, p=0·063), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Null	
Alcohol	Misuse	Razvodovsky, 2009[73]	Belarus	N/A	Cohort study	N/A	Fatal suicide	Bivariate	The specification of the bivariate ARIMA	Positive	+

			Hospital based						model and outcome of the analysis are presented. The estimated effects of fatal alcohol poisoning rate (as a proxy for binge drinking) on total suicides number and number of BAC-positive suicides are statistically significant: Suicide total: (Model=0,1,1*; Estimates=0·088, p<0·000); Suicide BAC+: (Model=0,1,1*; Estimates=0·111, p<0·000).		
Alcohol	Misuse	Razvodovsky, 2007[75]	Belarus Hospital based	N/A	Interrupted time-series	N/A	Fatal suicide	Bivariate	The results of time series analysis suggests close relationship between suicide and fatal alcohol poisoning rate at aggregate level.	Positive	-
Alcohol	Misuse	Razvodovsky, 2009[75]	Russia Hospital based	N/A	Interrupted time-series	N/A	Fatal suicide	Bivariate	Binge drinking was correlated with suicide rate for males (r=0·88; p<0·000) and a less strong one for females (r=0·67; p<0·000).	Positive	-
Alcohol	Abuse	Peltzer, 2008[128]	South Africa	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour:	Multivariate	Level of problem alcohol use control:	Positive	++

			School based				suicide risk related behaviours		Did not stop at one drink (0 to 6), predicted higher suicide risk (OR=1·17, 95% CI 1·00-1·35, p<0·05).		
								Multivariate	Level of problem alcohol use control: Kept drinking/using even though had plenty already, predicted higher suicide risk (OR=1·23, 95% CI 1·07-1·40, p<0·01).	Positive	
Alcohol	Abuse	Altamura et al, 2007[120]	Hospital-based	Adults [South African Attempters = 31.2 (9.0); South African non-attempters = 39.3 (17.7)]	Cross-sectional study	Attempters: male 20 (64.5%) & female 11 (35.5%) Non-attempters: male 3 (50%) & female 3 (50%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Lifetime comorbid alcohol abuse was not associated with a suicide attempt during the course of their illness among schizophrenia spectrum disorder patients at high risk for suicide (x^2=1·32, df=1, p>0·2).	Null	++
Alcohol	Abuse	Barbosa et al, 2014[80]	Brazil Population-based	Both (14 to 35 years old)	Cross-sectional study	Male 594 (43.0 %) & female 786 (57.0 %)	Non-fatal suicidal behaviour: Suicide risk (ideation, behaviour)	Multivariate	Alcohol abuse was associated with suicide risk (aOR=2·5, 95% CI 1·4-4·2, p<0·001), while controlling for gender, age, ethnicity, socioeconomic class, working, marital status,	Positive	++

									emotional neglect, physical neglect, sexual abuse, physical abuse, emotional abuse.		
Alcohol	Abuse	Hooman et al, 2013[100]	Iran Hospital based	Adults (Mean = 45.31; SD=13.7)	Cross-sectional study	Male 594 (43.0 %) & female 786 (57.0 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol abuse was associated with suicide attempt across both genders: males (OR=21·8, 95% CI 2·37-200·3, p=0·006) and females (OR=3·91, 95% CI 2·61-5·86, p<0·001).	Positive	++
Alcohol	Abuse	Menezes et al, 2012[114]	Nepal University students	Adults (18 to 27 years old)	Cross-sectional study	Males 112 (54.4%) & females 94 (45.6%)	Suicidal ideation	Bivariate	A greater proportion of suicidal ideation students reported consuming alcohol compared to those who did not consume alcohol (14·3% vs. 9·3%) but this was not a statistically significant difference (OR=1·62, 95% CI 0·64-4·09, p=0·309).	Null	++
Alcohol	Abuse	Miller et al, 2011[88]	Mexico Community based	Adolescents (12 to 17 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Alcohol abuse or dependence was associated with suicidal ideation (OR=3·10, 95% CI 1·70-5·63, p<0·01).	Positive	++
							Suicidal ideation	Bivariate	Alcohol abuse or dependence was associated with a suicide plan (OR=4·21,	Positive	

									95% CI 1·83-9·6, p<0·01).		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol abuse or dependence was associated with a suicide attempt (OR=2·58, 95% CI 1·05-6·34, p<0·05).	Positive	
							Suicidal ideation	Multivariate	Alcohol abuse/dependence was not associated with suicidal ideation (aOR=2·42, 95% CI 0·89–6·61, p>0·05), while controlling for drug use/disorder and tobacco use/disorder.	Null	
							Suicidal ideation	Multivariate	Alcohol abuse/dependence was not associated with suicide plan (aOR=1·54, 95% CI 0·36-6·50, p>0·05), while controlling for psychiatric disorder and drug use/disorder and tobacco use/disorder.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol abuse/dependence was not associated with suicide attempt (aOR=1·79, 95% CI 0·37-8·65, p>0·05), while controlling for psychiatric disorder and drug use/disorder	Null	

									and tobacco use/disorder.		
Alcohol	Abuse	Pridemore, 2013[71]	Russia Other	Adults (25 to 54 years old)	Case-control study	Male (100%)	Fatal suicide	Bivariate	Relative to moderate drinkers, heavier drinkers are not at greater risk of suicide until the 20 (or more) litres category (OR=2·7, 95% CI 1·5–5·0, p<0·05).	Positive	+
								Bivariate	Relative to men who never or almost never drank non-beverage alcohols, men who drank them one to two times and more than three times per week were (OR=3·9, 95% CI 1·3–11·0, p<0·05) and (OR=7·3, 95% CI 4·3–12·5, p<0·05) times more likely to die from suicide, respectively. Note. Non-beverage alcohol refers to e.g. colognes, medicines, cleaning fluids.	Positive	
								Bivariate	Problem drinking was associated with suicide (OR=3·7, 95% CI 2·5–5·6, p<0·05).	Positive	
Alcohol	Abuse	Singh et al, 2013[117]	India Other	Both (13 to 19 years old)	Cross-sectional study	Male 114 (52.3%) & female 104 (47.7%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcoholism was not associated with suicide attempts (aOR=0·015, 95% CI -0·151-0·121, p=0·829), while	Null	+

									controlling for gender, age, depression, symptoms of anxiety and eating disorders.		
Alcohol	Abuse	Toprak et al, 2011[77]	Turkey Others	Both (16 to 22 years old)	Cross-sectional study	Male 293 (46.1%) & female 343 (53.9%)	Non-fatal suicidal behaviour: Self-harm	Bivariate	Frequent alcohol consumption was associated with self-harm in the chi-square analysis (OR=4·99, 95% CI 2·13–11·67, p<0·05).	Positive	++
							Suicidal ideation	Bivariate	Frequent alcohol consumption was not associated with suicidal ideation in the chi-square analysis (OR=2·52, 95% CI 0·97-6·53, p>0·05).	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Frequent alcohol consumption was not associated with suicide attempt (OR=2·55, 95% CI 0·84-7·77, p>0·05).	Null	
							Non-fatal suicidal behaviour: Self-harm	Multivariate	Frequent alcohol consumption was not associated with self-harm (OR=2·97, 95% CI 1·04–8·45, p=0·04).	Positive	
Alcohol	Addiction	Lavania et al, 2012[114]	India Hospital based	Adults (18 to 60 years old)	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Deliberate self-harm	Bivariate	Alcohol, mean (SD): group I with deliberate self-harm 2·20 (2·81); group II without deliberate self-harm 4·00 (3·30). Those	Negative	-

									patients without DSH reported a significantly higher mean for alcohol addiction severity compared to patients with DSH (t=-2·28, p<0·03).		
Alcohol	Dependence	Armstrong et al, 2014[111]	India Community-based	Adults (18 years old and older)	Cross-sectional study	Male 100%	Suicidal ideation	Multivariate	Frequency of alcohol use was not associated with suicidal ideation (aOR=1·43, 95% CI 0·82-2·51, p=0·198), while controlling for current age, place of birth, literacy, place slept most of the time in past 3 months, daily income, current marital status, personal rating of relationship with family, beaten up in last 6 months, ever been forced or coerced into sex, rating of overall personal health, no of times injected in past week, length of injecting drug use, depressive symptom severity scale, anxiety symptom severity scale this.	Null	++
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Frequency of alcohol use was not associated with suicide attempt in the preceding 12 months, among those reporting suicidal	Null	

									ideation (aOR=2·46, 95% CI 0·88-6·91, p=0·084), while controlling for current age, place of birth, literacy, place slept most of the time in past 3 months, daily income, current marital status, personal rating of relationship with family, beaten up in last 6 months, ever been forced or coerced into sex, rating of overall personal health, no of times injected in past week, length of injecting drug use, depressive symptom severity scale, anxiety symptom severity scale this association remained nonsignificant (aOR=2·46, 95% CI 0·88-6·91, p=0·084).		
Alcohol	Dependence	Borges et al, 2010[82]	Mexico National/ regional registers (e.g. not clinical-based registers)	Adult (18 to 65 years old)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: suicide attempt	Multivariate	Among the total sample: lifetime suicide attempt was associated with alcohol abuse or dependence (aOR=6·6, 95% CI 2·8-15·3, p<0·05), while controlling for age, age-squared, sex, cohorts, and initial categories.	Positive	++

							Suicidal ideation		Among the total sample: lifetime suicidal ideation was associated with alcohol abuse or dependence (aOR=2·9, 95% CI 1·6-5·2, p<0·05), while controlling for age, age-squared, sex, cohorts, and initial categories.	Positive	
							Suicidal ideation		Alcohol abuse or dependence was associated with a plan among ideators (OR=4·6, 95% CI 2·1-10·0, p<0·05).	Positive	
							Non-fatal suicidal behaviour: suicide attempt		Alcohol abuse or dependence did was not associated with a planned attempt (OR=2·2, 95% CI 0·8-6·0, p>0·05).	Null	
							Non-fatal suicidal behaviour: suicide attempt		Alcohol abuse or dependence was not associated with an unplanned attempt (OR=2·9, 95% CI 0·8-10·8, p>0·05).	Null	
Alcohol	Dependence	Botega et al, 2010[83]	Mexico Hospital-based	Adult (18 to 63 years old)	Cross-sectional study	Male 4336 (56.6%) & female 1883 (43.4%)	Suicidal ideation	Bivariate	Alcohol use disorders (OR=2·3, 95% CI 1·3-3·6, p=0·002) predicted suicidal ideation.	Positive	++
Alcohol	Dependence	Bromet et al, 2007[61]	Ukraine			Male 123 (31.9%)	Suicidal ideation	Multivariate	Alcoholism (aOR=2·0, 95% CI 1·2-3·4,	Positive	++

			Populatio n-based	Adult (18 years old and older)	Cross-sectional study	& female 264 (68.4%)			p<·01); and alcohol abuse/dependence (aOR=2·8, 95% CI 1·7–4·7, p<0·01) were associated with suicidal ideation among the total sample, while controlling for sex and person-years and for the other risk factors.		
							Suicidal ideation	Multivariate	Alcoholism (aOR=1·2, 95% CI 0·6-2·5, p>0·05); and alcohol abuse/dependence (aOR=2·4, 95% CI 1·2-4·9, p<0·05) were associated with suicide plans among ideators, while controlling for sex and person-years and for the other risk factors.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcoholism (aOR=1·2, 95% CI 0·4-3·4, p>0·05); and alcohol abuse/dependence (aOR=2·8, 95% CI 1·3-6·0, p<0·01) were associated with suicide attempt among suicidal ideators, while controlling for sex and person-years and for the other risk factors.	Positive	
							Suicidal ideation	Multivariate	Co-morbid alcoholism (aOR=3·4, 95% CI 2·0-5·6), p<0·001) was associated with increased risk of	Positive	

									lifetime suicidal ideation, while controlling for person years and gender.		
							Suicidal ideation	Multivariate	Co-morbid alcoholism (aOR=3·6, 95% CI 1·8-7·2, p<0·001) was associated with increased risk of plans among ideators, while controlling for person years and gender.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Co-morbid alcoholism (aOR=3·6, 95% CI 1·7-7·9, p<0·01) was associated with increased risk of attempts among ideators, while controlling for person years and gender.	Positive	
Alcohol	Dependence	Cardoso et al, 2008[84]	Brazil Hospital-based	Adult [BD patients with no alcohol comorbidity (N=125)= mean= 43.9, SD=11.92, BD patients with alcohol abuse (N=23) Mean= 37.7 SD= 9.51, BD patients with alcohol dependence	Cross-sectional study	Male 54 (29%) & female 132 (71%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	In the sample of BD outpatients, they found that, for both the comorbid abuse and the dependence groups, there was a higher percentage of consumers in the group of lifetime suicide attempters than in the group of nonattempters: (1) 65·3% of alcohol-abuse patients in the group of attempters, and 34·7% in the group	Positive	++

				(N=30) mean 42.1, SD= 9.40]					of nonattempters (x^2=5·39, df=1, p=0·015); and (2) 67·7% of alcohol-dependent patients in the group of attempters, and 32·3% in the group of nonattempters (x^2=4·13, df=1, p=0·032).		
Alcohol	Dependence	Coêlho et al, 2010[85]	Brazil Community based	Adult (18 years old and older)	Cross-sectional study	N/A	Suicidal ideation: Thoughts of death, Desire of death, Suicide thought	Bivariate	Alcohol use disorder was associated with thoughts of death (OR=2, 95% CI 1·5-2·7, p<0·0001), desire of death (OR=2·5, 95% CI 1·7-3·6, p<0·0001), suicide thought (OR=2·9, 95% CI 1·9-4·3, p<0·0001).	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol use disorder was associated with suicide attempt (OR=2·5, 95% CI 1·3-4·9, p<0·005).	Positive	
							Suicidal ideation: Thoughts of death, Desire of death, Suicide thought	Multivariate	Alcohol use disorder was associated with thoughts of death (aOR=2·7, 95% CI 1·7-4, p<0·0001), desire of death (aOR=2·5, 95% CI 1·5-4·1, p<0·0006), suicide thoughts (aOR=2·5, 95% CI 1·5-4·1, p<0·0005),	Positive	

									while controlling for gender, marital status, age group, education level, major depressive disorder, controlled by all demographic variables and the interaction with gender, and considering AUD as effect modification, and two-way interaction of major depressive episode and AUD, and gender with other socio-demographic variables, and major depressive episode and AUD. Also three-way interaction of major depressive episode, AUD, and gender.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol use disorder was associated with suicide attempt (aOR=4, 95% CI 1·7-9·6, p<0·002), while controlling for gender, marital status, age group, education level, major depressive disorder, controlled by all demographic variables and the interaction with gender, and considering AUD as effect modification, and two-way interaction of major	Positive	

									depressive episode and AUD, and gender with other socio-demographic variables, and major depressive episode and AUD. Also three-way interaction of major depressive episode, AUD, and gender.		
Alcohol	Dependence	Evren et al, 2011[64]	Turkey Hospital based	Both	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Self-mutilative behaviour	Multivariate	Among the total sample (alcohol dependent men with and without PTSD): age at onset of regular alcohol use was associated with self-mutilation (OR=0·942, 95% CI 0·889-0·998, p=0·044).	Positive	++
							Non-fatal suicidal behaviour: Self-mutilative behaviour	Multivariate	Among alcohol dependent men without PTSD: age at onset of regular alcohol use (OR=0·912, 95% CI 0·842-0·988, p=0·024), predicted self-mutilation. No statistical result among men with PTSD were reported.	Positive	
Alcohol	Dependence	Evren et al, 2008[67]	Turkey Hospital based	Adults (Mean = 43.1; SD=8.3)	Cohort study	Male 100%	Non-fatal suicidal behaviour: Self-	Bivariate	Number of self-mutilative episodes was associated with early onset of alcohol	Positive	++

							mutilative behaviour		use (B=-0·174, SE= 0·084, beta=-0·252, t= -2·068, p=0·044).		
									Early onset of alcohol use was associated with early onset of self-mutilation among male patients with alcohol dependency (B=0·789, SE=0·164, beta=0·551, t=4·82, p <0·001).	Positive	
Alcohol	Dependence	Hong et al, 2007[40]	Hong Community based	Adults (Mean = 23.5; SD = 5.1)	Cross-sectional study	Female 100%	Suicidal ideation	Bivariate	Alcohol intoxication within the last six month was reported among female sex workers who reported suicidal ideation (47·7% vs. 30·3%, p<0·01).	Positive	+
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol intoxication within the last six month was reported among female sex workers in China who reported suicide attempts (55·3% vs. 30·8%, p<0·005).	Positive	
Alcohol	Dependence (injecting drug users)	Jin et al, 2013[41]	China Clinic-based (e.g. mobile clinic, free clinic)	Adults (18 to 55 years old)	Case-control study	Male 397 (65.4%) & female 210 (34.6%)	Suicidal ideation	Multivariate	Alcohol use disorder was associated with current suicidal ideation (OR=3·44, 95% CI 1·58-23·6, p<0·01).	Positive	++

Alcohol	Dependence	Neves et al, 2009[91]	Brazil Hospital based	Adults (Mean = 38.1; SD = 12.2)	Cohort study	Male 68 (28.5%) & female 171 (58.4%)	Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Comorbid alcoholism was associated with history of suicide attempt (x^2=12·8, df=1, p=0·001).	Positive	+
								Multivariate	Comorbid alcoholism was not associated with a history of suicide attempts in bipolar patients (aOR=1·36, NO CI, p=0·410), while controlling for confounding factors.	Null	
								Multivariate	Comorbid alcoholism was associated with a history of violent suicide attempts in bipolar patients (aOR=3·11, NO CI, p=0·031), while controlling for confounding factors.	Positive	
Alcohol	Dependence	Neves et al, 2010[92]	Brazil Clinic-based (e.g. mobile clinic, free clinic)	Adult (Non suicide group Mean = 44.6; SD = 13, suicide group Mean = 38.8; SD = 12.1)	Case-control study	Male 62 (30.9%) & female 139 (69.1%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcoholism was associated with suicide attempt (45·3% vs. 18·8%, p=0·0001).	Positive	-
									Alcohol dependence was associated with violent suicide attempts (63·6% vs. 34%, x^2=7·23, df=1, p=0·007).	Positive	
									Alcohol dependence was not associated with a lifetime history of violent suicide attempts	Null	

									(OR=5·76, NO CI, p=0·059).		
Alcohol	Dependence	Nock et al, 2009[138]	Brazil; Bulgaria; Colombia; India; Lebanon; Mexico; Nigeria; China (Beijing & Shanghai & Shenzhen); Romania; South Africa; Ukraine Community based	Adult (18 years old and older)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol abuse or dependency was associated with lifetime suicide attempt (OR=4·4, 95% CI 3·7–5·3, p<0·05).	Positive	+
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol abuse or dependency was associated with suicide attempt (OR=4·8, 95% CI 3·7–6·1, p<0·05).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol abuse or dependency was associated with lifetime suicide attempt (aOR=2·1, 95% CI 1·6–2·6, p<0·05), while controlling for age, age-squared, age cohorts, sex, and person-year.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol abuse or dependency was associated with lifetime suicide attempt (aOR=2·6, 95% CI 1·9–3·5, p<0·05), while controlling for age, age-squared, age cohorts, sex, and person-year.	Positive	
							Non-fatal suicidal behaviour:	Multivariate	Alcohol abuse or dependency was associated with suicide attempt (aOR=2·5,	Positive	

							Suicide attempt		95% CI 1·8–3·6, p<0.05), while controlling for age, age-squared, age cohorts, sex, and personyear.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Alcohol abuse or dependency was associated with suicide attempt (aOR=3·7, 95% CI 2·6–5·4, p<0·05), while controlling for age, age-squared, age cohorts, sex, and person-year.	Positive	
							Non-fata suicidal behaviour: Suicide attempt	Multivariate	Among the total sample, alcohol abuse or dependency was associated with suicidal attempt (OR=2·5, 95% CI 2·0–3·2, p<0·05). Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Among the total sample, Alcohol abuse or dependency was associated with suicide attempt (OR=3·7, 95% CI 2·6–5·4, p<0·05).	Positive	

									Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Among the total sample, alcohol abuse or dependency was associated with suicide attempt (OR=3·7, 95% CI 2·6–5·4, p<0·05). Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries.	Positive	
							Suicidal ideation	Multivariate	Among ideators, alcohol abuse or dependency was associated with suicide pan (OR=1·4, 95% CI 1·0–2·0, p<0·05). Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries.	Positive	

							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Among ideators, alcohol abuse or dependency was not associated with a planned attempt (OR=1·4, 95% CI 0·9–2·1). Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Among ideators, alcohol abuse or dependency was associated with an unplanned attempt (OR=1·9, 95% CI 1·1–3·5, p<0·05).	Positive	
Alcohol	Dependence	Uzun et al, 2009[78]	Turkey Hospital based	Adult (Age Mean = 36.7; SD = 11.8 years old)	Cohort study	Male 195 (65%) & female 105 (35%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Attempted suicide was associated with comorbid alcohol abuse or dependence (24·0% vs. 9·2%), (Fishers' exact test, df=3, p=0·001).	Positive	+
Alcohol	Dependence	Yur'yev et al, 2015[79]	Ukraine Population based	N/A	Cross-sectional study	N/A	Fatal suicide	Multivariate	A medium-strength (0·3– 0·7) positive, statistically significant association was revealed between the prevalence of drug	Positive	+

									addiction and the rates of suicide mortality among both males and females.		
Alcohol	Disorder	Chan et al, 2014[36]	Malaysia Clinic-based (e.g. mobile clinic, free clinic)	Adults (18 to 76 years old)	Cohort study	Male 33 (44%) & female 42 (56%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Current alcohol use disorder (OR=3·14, 95% CI 0·83-11·97, p=0·09), previous alcohol use disorder (OR=7, 95% CI 1·14-42·97, p=0·04) were associated with future suicide attempt among depressed inpatients.	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt		Current alcohol use disorder (OR=2, 95% CI 0·52-7·76, p=0·32), and previous alcohol use disorder (no odds ratio calculated) was not associated with the transition from suicidal ideation to future suicide attempt among depressed inpatients.	Null	
Alcohol	Disorder	Nery et al, 2014[90]	Brazil Other	Adults (18 to 74 years old)	Cohort study	Male 139 (28.8%) & female 344 (71.2%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	History of at least one suicide attempt was associated with lifetime alcohol use disorder diagnosis (OR=1·8, 95% CI 1·07-3·05, p=0·03).	Positive	++
Alcohol	Disorder	Suttajit et al, 2013[118]	Thailand	Adults (18 years old and older)	Cross-sectional study	Male 150 (39.2%) & female	Non-fatal suicidal behaviour:	Bivariate	Alcohol use disorders was associated with suicide risk (t=3·11,	Positive	++

			Hospital based			233 (60.8%)	Suicide risk		β=2·65, 95% CI 0·97-4·33, p<0·001).		
Alcohol	Disorder	Yee, Loh, & Ng, 2013[56]	Malaysia Hospital based	Adults (18 to74 years old)	Cross-sectional study	Male 139 (28.8%) & female 344 (71.2%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Those with alcohol-use disorder had a significantly higher rate of suicidal attempt when compared to those with no-alcohol use disorder (31·8% vs. 13·1%, p<0·01).	Positive	++
								Multivariate	Alcohol-use disorder was associated with suicidal attempt, (OR=3·09, 95% CI 1·75-55·6, p<0·01), while controlling for gender, race, and other substance use.	Positive	
Alcohol	Disorder	Zhang et al, 2010[58]	China National/ regional registers (e.g. not clinical-based registers)	Adults (34 to 60 years old)	Cohort study	Male 100%	Fatal suicide	Bivariate	Previous suicide attempt was associated with alcohol use disorder (OR=1·63, 95% CI 0·92-2·89, p<0·10).	Positive	+
							Fatal suicide	Bivariate	Previous suicide attempt was not associated with acute alcohol use (OR=0·74, 95% CI 0·38-1·42, NS).	Null	
							Fatal suicide	Bivariate	Alcohol use disorder suicide males were more likely than the acute alcohol group to have made previous suicide attempts	Positive	

									(OR=2·21, 95% CI 1·01-4·84, p<0·05).		
							Fatal suicide	Multivariate	Alcohol use disorder was associated with previous suicide attempts (aOR=1·94, 95% CI=1·94, 1·07–3·53, p<0·005).	Positive	
							Fatal suicide	Multivariate	Alcohol use disorder was associated with having made a previous suicide attempt (aOR=2·14, 95% CI 0·96-4·78, p<0·10).	Positive	
Alcohol	Multiple: abuse & dependence	Chan et al, 2011[34]	Malaysia Hospital-based	Adult (18 to 76 years old)	Cross-sectional study	Male 23 (44%) & Female 42 (56%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Current alcohol abuse or dependence was associated with suicide attempt (x^2=4·164, df=1, p=0·041).	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Past alcohol abuse or dependence was not associated with suicide attempt (39·1% vs. 21·2, p>0·05).	Null	
Alcohol	Multiple: abuse & dependence	Lückhoff et al, 2014[126]	South Africa Other	Adults (Mean age years old =35; SD=10.5)	Cross-sectional study	Male 784 (80.5%) & females 190 (19.5%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Alcohol abuse (11·8% vs. 13·6%) (x^2=0·30, p=0·583) and alcohol dependence (5·1% vs. 2·2%) (x^2=3·54, p=0·060) was associated with suicide attempt.	Positive	++
							Non-fatal suicidal behaviour:	Multivariate	Alcohol dependence was not associated with suicide attempts (OR=1·34, 95% CI	Null	

							Suicide attempt		0·85-2·10, p=0·207), while controlling for cannabis use, marital status, global alogia, and bizarre behaviour (lifetime).		
Tobacco											
Tobacco	Use	Ahmad et al, 2014[32]	Malaysia School-based	Adolescents (12 to 17 years old)	Cross-sectional study	Male 12486 (49.6%) & female 12688 (50.4 %)	Suicidal ideation	Multivariate	Current smoking was associated with suicidal ideation (aOR=1·63, 95% CI 1·36-1·96, p<0·01), while controlling for the other factors in the model (gender, ethnicity, parental marital status, current smoking, current drinker, were bullied, physically abused at home, verbally abused at home, stress, anxiety, depression, have close friend, supportive peers, parental supervision, parental connectedness, parental bonding, parental respect for privacy).	Positive	++
Tobacco	Use	Altamura et al, 2007[120]	Hospital-based	Adults [South African Attempters = 31.2 (9.0); South	Cross-sectional study	Attempters: male 20 (64.5%) & female	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Current smoking was not associated with a suicide attempt during the course of their illness among schizophrenia spectrum	Null	-

				African non-attempters = 39.3 (17.7)]		11 (35.5%) Non-attempters: male 3 (50%) & female 3 (50%)			disorder patients at high risk for suicide (x^2=0·676, df=1, p>0·4).		
Tobacco	Use	Blum et al, 2012[33]	Vietnam, and Taiwan Community based	Both (15 to 24 years old)	Cross-sectional study	Hanoi (Vietnam): male 3 251 (52.5%) & female 2 940 (47.5%) Taipei (Taiwan): male 2398 (51%) & female 2308 (49%)	Suicidal ideation	Bivariate	Cigarette smoke in the last month, In Hanoi (Vietnam), was not associated with suicidal ideation (OR=1·63, 95% CI 0·54-4·89, p>0·05).	Null	++
							Suicidal ideation	Bivariate	Cigarette smoke in the last month, in Taipei, was associated with suicidal ideation (OR=1·70, 95% CI 1·27-2·29, p<0·01).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Cigarette smoke in the last month, in Hanoi (Vietnam), was not associated with suicide attempts (OR=0·79, 95% CI 0·09-6·59, p>0·05).	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Cigarette smoke in the last month (in Taipei) was associated with suicidal attempt (OR=1·88, 95% CI 1·30-2·70, p<0·01).	Positive	

Tobacco	Use	Dewing et al, 2013[122]	South Africa Community based	Adults (23 to 29 years old)	Cross-sectional study	Female 100%	Non-fatal suicidal behaviour: suicidal ideation, suicide plan, suicide attempt	Multivariate	Smoking was not associated with suicidality (aOR=0·48, 95% CI 0·02-10·1, p>0·05), while controlling for age, self-reported diagnosis of HIV that was newly ascertained during the pregnancy, self-reported cigarette smoking status, marital status (married vs. other), employment status (any vs. none), employment status of the baby's father, and type of housing (informal vs. other).	Null	++
Tobacco	Use	Evren et al, 2014[65]	Turkey School-based	Adolescents (15 to 17 years old)	Cross-sectional study	Male 2614 (52.7%) & female 2343 (47.3%)	Non-fatal suicidal behaviour: Self-mutilation	Bivariate	Among 10th grade school pupils, self-mutilation was associated with smoking more frequently: •never smoked/1-2 times lifetime=10·2%, •few times a month/week=22·6% •everyday=44·5% x^2=320·00, df=1, p<0·001.	Positive	+
							Non-fatal suicidal behaviour: suicide attempt	Bivariate	Among 10th grade school pupils, suicide attempt was associated with smoking more frequently:	Positive	

									•never smoked/1-2 times lifetime=10·1%, •few times a month/week=19·7% •everyday=38·3% x^2=225·8, p<0·001		
Tobacco	Use	Khan et al, 2012[43]	Malaysia Clinic-based (e.g. mobile clinic, free clinic)	Both (15 to 84 years old)	Cross-sectional study	Male 128 (43%) & female 170 (57%)	Suicidal ideation	Bivariate	Smoking habit was associated with risk of suicidal ideation (OR=7·10, 95% CI 3·94-2·83).	Positive	-
							Suicidal ideation	Bivariate	Smoking habit was associated with risk for suicidal ideation (OR=7·10, 95% CI 3·94-2·83).	Positive	
Tobacco	Use	Miller et al, 2011[88]	Mexico Community based	Adolescents (12 to 17 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Lifetime use of tobacco (OR=3·76, 95% CI 2·86-4·93, p<0·01), weekly use of tobacco (OR=3·36, 95% CI 2·12-5·31, p<0·01) and daily use of tobacco (OR=2·96, 95% CI 1·85-4·74, p<0·01) was associated with suicidal ideation.	Positive	++
							Suicidal ideation	Bivariate	Lifetime use of tobacco (OR=5·27, 95% CI 3·42-8·12, p<0·01), weekly use of tobacco (OR=4·15, 95% CI 2·69-6·40, p<0·01) and daily use of tobacco (OR=3·19, 95% CI	Positive	

									1·98-5·15, p<0·01) was associated with suicide plan.		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Lifetime use of tobacco (OR=5·91, 95% CI 2·72-12·85, p<0·01), weekly use of tobacco (OR=4·92, 95% CI 2·90-8·35, p<0·01) and daily use of tobacco (OR=4·05, 95% CI 2·33-7·05, p<0·01) was associated with suicide attempt.	Positive	
							Suicidal ideation	Multivariate	Lifetime use of tobacco (OR=2·16, 95% CI 1·66-2·81, p<0.01), weekly use of tobacco (OR=3·07, 95% CI 1·76-5·35, p<0·01) and daily use of tobacco (OR=2·50, 95% CI 1·30-4·82, p<0·01) was associated with suicidal ideation, while controlling for psychiatric disorder or drug use/disorder or alcohol use/disorder.	Positive	
							Suicidal ideation	Multivariate	Lifetime use of tobacco (OR=2·20, 95% CI 1·25-3·87, p<0·01), weekly use of tobacco (OR=4·55, 95% CI 1·96-10·6, p<0.01) and daily use of tobacco (OR=3·75, 95% CI 1·67-8·41, p<0·01) was associated with suicide	Positive	

									plan, while controlling for psychiatric disorder or drug use/disorder or alcohol use/disorder.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Lifetime use of tobacco (OR=2·59, 95% CI 1·21-5·56, p<0·05), weekly use of tobacco (OR=5·74, 95% CI 2·45-13·4, p<0·01) and daily use of tobacco (OR=5·46, 95% CI 1·92-15·51, p<0.01) was associated with suicide attempt, while controlling for psychiatric disorder or drug use/disorder or alcohol use/disorder.	Positive	
Tobacco	Use	Nojomi et al, 2007[103]	Iran Community based	Both (14 years old and older)	Cross-sectional study	Male 809 (35.2%) & Female 1491 (64.8 %)	Non-fatal Suicidal behaviour: Suicide attempt	Bivariate	Tobacco use were higher among suicide attempters than nonattempters (50% vs. 21·9%, p<0·0005)	Positive	++
Tobacco	Use	Page et al, 2011[139]	Philippines; China; Namibia School based	Adolescents (11 to 16 years old)	Cross-sectional study	Philippines: male 3094 (43.2%) & female 4188 (56.8%). China: male 4356	Suicidal ideation	Bivariate	Current smoking was associated with suicide plan across gender and the three countries (Philippine, China, Namibia): Philippine boys % (n) smoker=25·1 (162); % (n) nonsmoker=17·3	Positive	++

						(51.2%) & female 4537 (48.8%). Namibia: male 2931 (45.2%) & female 3352 (54.8%).			(361); (OR=1·50, 95% CI 1·20-1·88, p<0·05); Philippine girls % (n) smoker=32·0 (79); % (n) nonsmoker=17·4 (649); (OR=2·27, 95% CI 1·71-3·03, p<0·05); China boys % (n) smoker=13·2 (59); % (n) nonsmoker= 5·7 (207); (OR= 2·61, 95% CI 1·90-3·60, p<0·05); China girls % (n) smoker=31·3 (26); % (n) nonsmoker= 8·8 (380); (OR=4·86, 95% CI 3·00-7·89, p<0·05); Namibia boys % (n) smoker=40·1 (163); % (n) nonsmoker= 22·9 (561); (OR=1·63, 95% CI 1·29-2·04, p<0·05); Namibia girls % (n) smoker=39·2 (153); % (n) nonsmoker= 28·5 (710); (OR=1·59, 95% CI 1·26-2·00, p<0·05).		
Tobacco	Use	Page et al, 2011[46]	China; Philippines School based	Adolescent (11 to 17 years old)	Cross-sectional study	China: male 4356 (51.2%) & female 4537 (48.8%). Philippines: male 3094 (43.2%)	Suicidal ideation	Multivariate	Smoked cigarettes in past 30 days was associated with suicide ideation (OR=1·11, 95% CI 1·07-1·14, p<0·001).	Positive	++
							Suicidal ideation	Multivariate	Among Chinese students: Smoked cigarettes in past 30 days was associated with making a suicide	Positive	

						& female 4188 (56.8%).			plan (OR=1·81, 95% CI 1·74-1·89, p<0·001).		
							Suicidal ideation	Multivariate	Among Philippine students: Smoked cigarettes in past 30 days was associated with suicide ideation (OR=1·51, 95% CI 1·48-1·54, p<0·001).	Positive	
							Suicidal ideation	Multivariate	Among Philippine students: Smoked cigarettes in past 30 days was associated with making a suicide plan (OR=2·45 95% CI 2·41-2·49, p<0·001).	Positive	
Tobacco	Use	Peltzer, 2009[129]	Kenya; Namibia; Swaziland; Uganda; Zambia; Zimbabwe School based	Adolescents (13 to 15 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Predict tobacco use: Suicide ideation: (OR=2·25, 95% CI 2·22–2·78, p<0·001); (aOR=1·55, 95% CI 1·53–1·57, p<0·001) Suicide plan (OR=2·68, 95% CI 2·65–2·70, p<0·001); (aOR=2·13, 95% CI 2·10–2·16, p<0·001).	Positive	+
							Suicidal ideation	Bivariate	Predict tobacco use: Suicide plan (OR=2·68, 95% CI 2·65–2·70, p<0·001); (aOR= 2·13 95% CI 2·10–2·16, p<0·001).	Positive	

Tobacco	Use	Peltzer, 2011[130]	Botswana National/ regional registers (e.g. not clinical-based registers)	Adolescents (13 to 15 years old)	Cross-sectional study	N/A	Suicidal ideation	Multivariate	Smoking initiation at younger than 14 years old was associated with suicide ideation in the past 12 months among girls (aOR=2·05, 95% CI 1·15-3·66, p<·02) but not boys (No statistical results provided), while controlling for grade, alcohol and other drug use, parental tobacco use, poverty, mental distress, unintentional injuries and violence, ever had sex, physical activity.	Unclear	++
Tobacco	Use	Peltzer & Louw, 2013[131]	South Africa Clinic-based (e.g. mobile clinic, free clinic)	Adults (18 years old and older)	Cross-sectional study	Male 2631 (54.5%) & female 2194 (45.5%)	Suicidal ideation	Multivariate	Current tobacco use was not associated with suicidal ideation (OR=1·19, 95% CI 0·93-1·54, p>0·05).	Null	++
							Non-fatal suicidal behaviour: suicide attempt	Multivariate	Current tobacco use was not associated with suicide attempt (OR=1·34, 95% CI 0·91-1·97, p>0·05).	Null	
Tobacco	Use	Peltzer & Pengpid, 2015[47]	Oceania (Kiribati, Samoa, Solomon Islands, and Vanuatu)	Adolescents (13 to 16 years old)	Cross-sectional study	Male 2846 (43.5%) & female 3534 (54%)	Suicidal ideation	Bivariate	Cigarette smoking initiation was associated with suicidal ideation: **<u>Among the total sample</u>** Non-initiators 1·00	Positive	++

			School based						<12 years (OR = 2·74, 95% CI 2·12-3·53, p<0·001); ≥12 years (OR= 2·75, 95% CI 2·19-3·48, p<0·001). **<u>Among boys</u>** Non-initiators 1·00 <12 years (OR=2·04, 95% CI 1·4-2.87, p<0.001); ≥12 years (OR=2·60, 95% CI 1·9-3·49, p<0·001). AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (OR=4·41, 95% CI 2·98-6·52, p<0·001); ≥12 years (OR=2·84, 95% CI 2·06-3·90, p<0·001).		
							Suicidal ideation	Bivariate	Current smoking was associated with suicidal ideation (OR=2·73, 95% CI 2·2-3·31, p<0·001). **<u>Among boys</u>** (OR=2·48, 95% CI 1·9-3·15, p<0·001); **<u>Among girls</u>**	Positive	

									(OR=3·08, 95% CI 2·40-3·95, p<0·001).		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Cigarette smoking initiation was associated with suicide attempt: **<u>Among the total sample</u>** Non-initiators 1·00 <12 years (OR=5·81, 95% CI 4·41-7·65, p<0·001); ≥12 years (OR=3·69, 95% CI 2·75-4·95, p<0·001). **<u>Among boys</u>** Non-initiators 1·00 <12 years (OR=5·84, 95% CI 4·15-8·22, p<0·001); ≥12 years (OR=3·13, 95% CI 2·22-4·41, p<0·001). AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (OR=5·77, 95% CI 3·75-8·88, p<0·001); ≥12 years OR=4·34, 95% CI 3·26-5·80, p<0·001).	Positive	

							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Current smoking was associated with suicide attempt (OR=4·29, 95% CI 3·41-5·41, p<0·001). **<u>Among boys</u>** (OR=4·66, 95% CI 3·25-6·68, p<0·001); **<u>Among girls</u>** (OR=4·29, 95% CI 3·39-5·42, p<0·001).	Positive	
							Suicidal ideation	Multivariate	Smoking initiation was associated with suicidal ideation: **<u>Among the total sample</u>** Non-initiators 1·00 <12 years (aOR=1·65, 95% CI 1·07-2·53, p<0·05); Not ≥12 years (aOR=1·53, 95% CI 0·96-2·42, p>0·05). **<u>Not among boys</u>** Non-initiators 1·00 <12 years (aOR=1·04, 95% CI 0·56-1.94, p>0·05); ≥12 years (aOR=1·08, 95% CI 0·57-2·07, p>0·05).	Unclear	

									AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (aOR=2·79, 95% CI 1·64-4·76, p<0·001); ≥12 years (aOR=1·83, 95% CI 1·08-3·10, p<0·05). (Adjusted for age, psychological distress and current alcohol use).		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Smoking initiation was associated with suicide attempt: **<u>Among the total sample</u>** Non-initiators 1·00 <12 years (aOR=2·12, 95% CI 1·40-3·22, p<0·001); Not ≥12 years (aOR=1·21, 95% CI 0·78-1·89, p>0·05). **<u>Among boys</u>** Non-initiators 1·00 <12 years (aOR=1·87, 95% CI 1·13-2·95, p<·05);	Unclear	

									Not ≥12 years (aOR=0·91, 95% CI 0·52-1·61, p>0·05). AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (aOR=2·64, 95% CI 1·67-4·16, p<0·001); Not ≥12 years (aOR=1·56, 95% CI 0·94-2·58, p>0·05). (Adjusted for age, psychological distress and current alcohol use).		
Tobacco	Use	Pillai et al, 2009[116]	India Community based	Adolescents (16 to 24 years old)	Cross-sectional study	Male 1780 (49.6%) & females 1882 (51.4%)	Non-fatal suicidal behaviour: Suicide behaviour	Multivariate	Tobacco use at least once a week was associated with suicidal thinking/planning/attempts during past 3 months in young adults (aOR=2·3, 95% CI 1·2-4·2, p<0·05).	Positive	++
							Non-fatal suicidal behaviour:	Multivariate	Tobacco use less than once a week was not associated with suicide behaviour (aOR=0·5,	Null	

							Suicide behaviour		95% CI 0·1-2·2, p>0·05).		
Tobacco	Use	Pumariega et al, 2014[72]	Turkey School based	Adolescents (14 to 18 years old)	Cross-sectional study	Male 14477 (46.6%) & female 16581 (53.4%)	Suicidal ideation	Bivariate	Suicidal ideation was not associated with tobacco use (OR=1·075, NO CI, p=0·311).	Null	+
Tobacco	Use	Randall et al, 2014[133]	Republic of Benin, West Africa School based	Adolescents (11 to 16 years old)	Cross-sectional study	Male 1798 (67.1%) & female 882 (32.9%)	Suicidal ideation	Bivariate	Among Benin adolescents who reported tobacco use, 2.7% (54) reported no suicidal ideation, 6.1% (8) reported ideation only, 6.7% (31) reported ideation with a plan, p=0·0004.	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Tobacco use was associated with number of suicide attempts p<0·0001; no attempt=2·7%(50), one attempt =4%(14), 2 or more attempts =8·4%(29).	Positive	
							Suicidal ideation	Multivariate	Tobacco use was not associated with suicidal ideation (OR=0·98, 95% CI 0·37–2·61, p=0·963), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Null	
							Suicidal ideation	Multivariate	Tobacco use was not associated with suicidal	Null	

									ideation with a plan (OR=1·24, 95% CI 0·58–2·63, p=0·560), while controlling for age, psycho-social symptoms, and socio-environmental factors.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Tobacco use was not associated with one past suicide attempt (OR=0·64, 95% CI 0·31–1·31, p=0·200), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Tobacco use was not associated with two or more past suicide attempts (OR=0·89, 95% CI 0·39–2·03, p=0·766), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Null	
Tobacco	Use	Rudatsikira et al, 2007[135]	Uganda School based	Adolescents (11 to 17 years old)	Cross-sectional study	Male 784 (53.3 %) & female 676 (46.7%)	Suicidal ideation	Bivariate	Cigarette smoking in the past 12 months was associated with suicidal ideation among the total sample (OR=1·75, 95% CI 1·01-3·04, p<0·05), but not among males (OR=1·2, 95% CI 0·68-1·85, p>0·05) and females respectively (OR=1·81,	Unclear	-

									95% CI 1·05-3·13, p>0·05).		
							Suicidal ideation	Multivariate	Cigarette smoking in the last 12 months was not associated with suicidal ideation (OR=1·29, 95% CI 0·55-3·01, p>0·05), while controlling for age, gender, loneliness, worry, drinking and being bullied.	Null	
Tobacco	Use	Rudatsikira et al, 2007[135]	Zimbabwe School based	Adolescents (11 to 17 years old)	Cross-sectional study	Male 873 (49.3%) & female 1111 (50.7%)	Suicidal ideation	Bivariate	Tobacco cigarette smoking in the past 12 months was associated with suicidal ideation among the total sample (OR=2·34, 95% CI 1·61-3·39, p<0·05), males (OR=2·70, 95% CI 1·61-4·65, p<0·05), and females(OR=1·90, 95% CI 1·07-3·38, p<0·05).	Positive	-
Tobacco	Use	Ruengorn et al, 2012[48]	Thailand Hospital based	Both (13 to 60 years old)	Case-control study	Male 354 (32.2%) & female 746 (67.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Smoking was not associated with suicide attempts (OR=1·38, 95% CI 0·89-2·15, p=0·147).	Null	-
Tobacco	Use	Sharma et al, 2015[94]	Peru School based	Adolescents (12 to 18 years old)	Cross-sectional study	Male 425 (46.4%) & female 491 (53.6%)	Suicidal ideation	Multivariate	Smoking was associated with suicidal ideation (aOR=1·70, 95% CI 1·08–2·66, p<0·05), while	Positive	++

									controlling for psychological, socio-environmental, and demographic factors.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Smoking was not associated with suicide attempt (aOR=1·41 95% CI 0·89-2·22, p>0·05), while controlling for psychological, and behavioural factors.	Null	
Tobacco	Use	Shooshtary et al, 2008[108]	Iran Community based	Both (15 years old and older)	Cross-sectional study	Male 187 (37.1%) & female 317 (62.9%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Tobacco use was not associated with lifetime suicide attempts (OR=2·3, 95% CI 0·81-7·31, p=0·09).	Null	++
Tobacco	Use	Silva et al, 2014[95]	Brazil School based	Adolescents (13 to 18 years old)	Cross-sectional study	Male 836 (37.9%) & female 1371 (62.1%)	Suicidal ideation Non-fatal suicidal behaviour: Non-fatal: Suicide attempt	Bivariate	For cigarette consumption, association was found with suicide ideation (OR=1·62, CI 95% 1·03-2·55, p<0·05), planning (OR=1·88, CI 95% 1·15-3·08, p<0·05), and attempt (OR = 2·35, CI 95% 1·37 to 4·03).	Positive	+
Tobacco	Use	Sitdhiraksa et al, 201)[49]	Thailand School based	Both (12 to 21 years old)	Cross-sectional study	Male 1054 (40.2%) & female 1568 (59.8%)	Non-fatal suicidal behaviour: Thoughts of self-harm	Bivariate	Smoking within the last 12 months was associated with thoughts of harming yourself or attempted suicide (OR=2·04, 95% CI 1·64- 2·54, p<0·01).	Positive	+

							Suicide attempt				
Tobacco	Use	de Mattos Souza et al, 2010[96]	Brazil National/ regional registers (e.g. not clinical-based registers)	Adolescents (11 to 15 years old)	Cross-sectional study	Male 501 (48.2%) & female 538 (51.8%)	Suicidal ideation	Multivariate	Tobacco use was not associated with suicidal ideation (aOR=1·09 95% CI 0·56 - 2·14, p>0·05), while controlling for gender, age, socioeconomic status, level of education, grade retention, religious practice, sexual activity, tobacco use, getting drunk, conduct disorder and high CDI scores for depressive symptoms.	Null	++
Tobacco	Use	Thakur et al, 2014[119]	India School based	Adolescents (14 to 19 years old)	Cross-sectional study	Males 367 (51%) & females 353 (49%)	Non-fatal suicidal behaviour: Self-harm	Multivariate	Self-harm was associated with smoking behaviour (aOR=2·3, 95% CI 1·2-4·4, p<0·05), while adjusting for age, gender, mothers education and fathers education.	Positive	-
Tobacco	Use	Wan et al, 2011[52]	China School based	Both (12 to 24 years old)	Cross-sectional study	Male 8599 (48.8%) & female 9023 (51.2%)	Non-fatal suicidal behaviour: Deliberate self-harm	Bivariate	Among those with cigarette use, a total of 76·9% reported no DSH, 4.8% reported a single-incident DSH, 18·3% reported repeat-incident DSH. There was a significant	Positive	++

									difference between those with and those without cigarette use among DSH (x^2=36·6, df=1, p<0·001).		
							Non-fatal suicidal behaviour: Deliberate self-harm	Bivariate	Cigarette use did not significantly predict a single-incident DSH (OR=1·07, 95% CI 0·80–1·45, p=0·646), and repeat-incident DSH when controlling for single-incident DSH (OR=1·38, 95% CI 0·99–1·91, p=0·057).	Null	
Tobacco	Use	Xing et al, 2010[55]	China School based	Adolescents (11 to 19 years old)	Cross-sectional study	Males 6216 (49.8%) & female 6254 (50.2%)	Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Suicide attempters were significantly more likely than nonattempters to be current smokers (x^2=42·45, df=1, p<0·001), and alcohol users (x^2=83·00, p<0·001).	Positive	++
Tobacco	Use	Zarrouq et al, 2015[109]	Morocco School based	Adolescents (11 to 23 years old)	Cross-sectional study	Males 1602 (53 %) & females 1418 (47 %)	Suicidal ideation	Bivariate	Among smokers, Death wish 34·1% (95% CI 29·8–38·7, p<0·05), Self-harm wish 27% (95% CI 23–31·4, p<0·001), Suicide ideation 25·1% (95% CI 21·2–29·4, p<0·001).	Positive	++

									Among nonsmokers, Death wish 25·2% (95% CI 23·5–27, p<0·001), Self-harm wish 12·4, (95% CI 11·1–13·8, p<0·001), Suicide ideation 14% (95% CI 12·6–15·4, p<0·001) .		
							Suicidal ideation	Bivariate	Among smokers, Suicide plan 10·9% (95% CI 8·2–14·2, p<0·001), Among nonsmokers, Suicide plan 5·4% (95% CI 4·6–6·4, p<0·001).	Positive	
							Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Among smokers, suicide attempt in the past month 12·2% (95% CI 9·4–15·6, p<0·001), Lifetime suicide attempts 16·2 (13–20). Among nonsmokers, Suicide attempt in the past month 5·4% 95% CI 4·5–6·4, p<0·001), Lifetime suicide attempts 9·5% (95% CI 8·3–10·7, p<0·001).	Positive	
Tobacco	Misuse	Arenliu et al, 2014[60]	Kosovo School-based	Adolescents (15-19 years old)	Cross-sectional study	Male (43.7%) & female (55.1%);	Suicidal ideation	Bivariate	Daily smoking was associated with reported suicidal ideation among males	Unclear	-

						not responded (1.2%)			(OR=2·88, 95% CI 1·39–5·66, p<0·05) but not females (OR=1·91, 95% CI 0·48-6·00, p>0·05). No statistics were reported for the total sample.		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Daily smoking was not associated with reported suicide attempt among male (OR=2·23, 95% CI 0·90-5·12, p>0·05) and female adolescents (OR=1·54, 95% CI 0·14-7·88, p>0·05).	Null	
Tobacco	Dependence	Barbosa et al, 2014[81]	Brazil Population-based	Both (14 to 35 years old)	Cross-sectional study	Male 594 (43.0 %) & female 786 (57.0 %)	Non-fatal suicidal behaviour: Suicide risk (ideation, behaviour)	Multivariate	Suicide risk was associated with individuals who smoked when compared to individuals who did not smoke (aOR=2·7, 95% CI 1·8-4, p<0·001), while controlling for gender, age, ethnicity, socioeconomic class, working, marital status, emotional neglect, physical neglect, sexual abuse, physical abuse, emotional abuse.	Positive	++
Tobacco	Dependence	Botega et al, 2010[83]	Mexico Hospital-based	Adult (18 to 63 years old)	Cross-sectional study	Male 4336 (56.6%) & female	Suicidal ideation	Bivariate	Smoking predicted suicidal ideation (OR=1·9, 95% CI 1·3-2·9, p=0·0008).	Positive	++

						1883 (43.4%)					
Tobacco	Dependence	Bromet et al, 2007[61]	Ukraine Population-based	Adult (18 years old and older)	Cross-sectional study	Male 123 (31.9%) & female 264 (68.4%)	Suicidal ideation	Multivariate	Smoking was not associated with lifetime suicidal ideation among the total sample (aOR=1·7, 95% CI 1·0-3·0, p>0·05), while controlling for sex and person-years and for the other risk factors in each set.	Null	++
							Suicidal ideation	Multivariate	Smoking was associated with suicide plans among ideators (aOR=2·3, 95% CI 1·2-4·3, p<0·05), while controlling for sex and person-years and for the other risk factors in each set.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Smoking was a significant predictor of suicide attempts among ideators (aOR=3·6, 95% CI 1·6-8·0, p<0·01), while controlling for sex and person-years and for the other risk factors in each set.	Positive	
Tobacco	Dependence	Hong et al, 2007[40]	Hong Community based	Adults (Mean = 23.5; SD = 5.1)	Cross-sectional study	Female 100%	Suicidal ideation	Bivariate	Significantly higher proportions of daily smoking in the past 6 months was reported	Positive	+

									among female sex workers in China who reported suicidal ideation (26·2% vs. 13·6%, p<0·05).		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Significantly higher proportions of daily smoking in the past 6 months was reported among female sex workers in China who reported suicide attempts (36·8% vs. 13·5%, p<0·001).	Positive	
Tobacco	Dependence	Menezes et al, 2012[114]	Nepal University students	Adults (18 to 27 years old)	Cross-sectional study	Males 112 (54.4%) & females 94 (45.6%)	Suicidal ideation	Bivariate	A greater proportion of suicidal ideation students reported smoking cigarettes compared to those who did not smoke cigarettes (22·2% vs. 9·6%) but this was not a statistically significant difference (OR=2·69, 95% CI 0·8-9·07, p=0·109).	Null	++
Tobacco	Dependence	Miller et al, 2011[88]	Mexico Community based	Adolescents (12 to 17 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Tobacco dependence was associated with suicidal ideation (OR=3·79, 95% CI 1·17-12·3, p<0·05).	Positive	++
							Suicidal ideation	Bivariate	Tobacco dependence was associated with suicide plan (OR=5·34, 95% CI 1·60-17·8, p<0·01).	Positive	

							Non-fatal Suicidal behaviour: Suicide attempt	Bivariate	Tobacco dependence was associated with suicide attempt (OR=7·65, 95% CI 2·05-28·6, p<0·01).	Positive	
							Suicidal ideation	Multivariate	Tobacco dependence was associated with suicidal ideation (aOR=4·79, 95% CI 1·05-21·8, p<0·05), while controlling for psychiatric disorder or drug use/disorder or alcohol use/disorder.	Positive	
							Suicidal ideation	Multivariate	Tobacco dependence was not associated with suicide plan (OR=1·80, 95% CI 0·15-21·6, p>0·05), while controlling for psychiatric disorder or drug use/disorder or alcohol use/disorder.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Tobacco dependence was associated with suicide attempt (OR=16·4, 95% CI 2·74-98·4, p<0·05), while controlling for psychiatric disorder or drug use/disorder or alcohol use/disorder.	Positive	
Tobacco	Dependence	Neves et al, 2009[91]	Brazil Hospital based	Adults (Mean = 38.1; SD = 12.2)	Cohort study	Male 68 (28.5%) & female 171 (58.4%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Comorbid smoking was associated with history of suicide attempt (x^2=9·07, df=1, p=0·003).	Positive	+

							Non-fatal suicidal behaviour: suicide attempt	Multivariate	Comorbid smoking was not associated with a history of suicide attempts in bipolar patients (aOR=1·66, NO CI, p=0·114), while controlling for confounding factors.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Comorbid smoking was not associated with a history of violent suicide attempts in bipolar patients (aOR=1·21, NO CI, p=0·693), while controlling for confounding factors.	Null	
Tobacco	Disorder	Nojomi et al, 2007[103]	Iran Community based	Both (14 years old and older)	Cross-sectional study	Male 809 (35.2%) & Female 1491 (64.8 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Lifelong tobacco use significantly predicted lifelong suicide attempts (OR=3·043, 95% CI 1·67-5·54, p<0·001).	Positive	++
Tobacco	Dependence	Osama et al, 2014[115]	Pakistan Others	Adults (18 to 29 years old)	Cross-sectional study	135 Males 135 (41.2%) & female 193 (58.8%)	Suicidal ideation	Multivariate	Smoking (90·5% vs. 9·5%) significantly predicted suicidal ideation (aOR=3·18, 95% CI 1·49-6·82, p<0·003), while controlling for parental neglect, demanding parents, dissatisfied with college, ragging, assault, breakup, and psychiatric disorder.	Positive	-

Tobacco	Dependence	Toprak et al, 2011[77]	Turkey Others	Both (16 to 22 years old)	Cross-sectional study	Male 293 (46.1%) & female 343 (53.9%)	Non-fatal suicidal behaviour: Self-harm	Bivariate	Daily smoking was associated with self-harm (OR=3·19, 95% CI 1·99-5·11, p<0·05).	Positive	++
							Suicidal ideation	Bivariate	Daily smoking was associated with suicidal ideation (OR=1·75, 95% CI 1·00–3·06, p<0·05).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Daily smoking was not associated with suicide attempt (OR=1·75, 95% CI 0·89-3·44, p>0·05).	Null	
							Non-fatal suicidal behaviour: Self-harm	Multivariate	Daily smoking was associated with self-harm (OR=2·72, 95% CI 1·46–5·06, p=0·002).	Positive	
Tobacco	Multiple: abuse & dependence	Chan et al, 2014[36]	Malaysia Clinic-based (e.g. mobile clinic, free clinic)	Adults	Cohort study	Male 2407 (47.5%) & Female 2174 (52.5%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Nicotine abuse or dependence was not associated with future suicide attempt among depressed inpatients (OR=2·60, 95% CI 0·72-9·34, p=0·14). Nicotine abuse or dependence was not associated with the transition from suicidal ideation to future suicide attempt among depressed inpatients	Null	++

									(OR=4·13, 95% CI 0·52-7·16, p=0·33).		
Tobacco	Multiple: use or dependence	Hooman et al, 2013[100]	Iran Hospital based	Adults (Mean = 45.31; SD=13.7.)	Cross-sectional study	Male 695 (73.2%) & female 255 (26.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Cigarette smoking was associated with suicide attempt among males (OR=2·24, 95% CI 1·05-4·80, p=0·037), and females (OR=2·09 95% CI 1·29-3·41, p<0·001).	Positive	++
Cannabis											
Cannabis	Use	Arenliu et al, 2014[60]	Kosovo School-based	Adolescents (15-19 years old)	Cross-sectional study	Male (43.7%) & female (55.1%); not responded (1.2%)	Suicidal ideation	Bivariate	Cannabis use in the last 30 days for males (OR=3·51, 95% CI 1·51–7·91, p=0·05) and for females (OR=6·79, 95% CI 1·67–25·4, p=0·05) were associated with suicidal ideation.	Positive	-
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Cannabis use in the last 30 days for males (OR= 6·17, 95% CI 2·37–15·5, p=0·001) and for females (OR=16·1, 95% CI 3·96–60·98, p=0·001) were associated with suicide attempt.	Positive	
Cannabis	Use	Muula et al, 2007[127]	Zambia School based	Adolescents (14 to 16 years old)	Cross-sectional study	Males 919 (54.0%) & female 964 (46%)	Suicidal ideation	Bivariate	Ever having smoked marijuana was associated with suicidal ideation (OR=1·34, 95% CI 1·33-1·35, p<0·05).	Positive	+

Cannabis	Use	Nojomi et al, 2007[103]	Iran Community based	Both (14 years old and older)	Cross-sectional study	Male 809 (35.2%) & Female 1491 (64.8 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Cannabis use were higher among suicide attempters than nonattempters (2·6% vs. 0·50%, p>0·05).	Null	++
Cannabis	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Past month frequency of cannabis use was associated with a higher suicide risk (OR=2·63, 95% CI 1·54-4·49, p<0·001).	Positive	++
Cannabis	Use	Peltzer & Pengpid, 2015[47]	Oceania (Kiribati, Samoa, Solomon Islands, and Vanuatu) School based	Adolescents (13 to 16 years old)	Cross-sectional study	Male 2846 (43.5%) & female 3534 (54%)	Suicidal ideation	Bivariate	Current cannabis use associated with suicidal ideation (OR=3·18, 95% CI 2·5-3·91, p<0·001).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Current cannabis use was associated with suicide attempt (OR=7·33, 95% CI 5·47-9·82, p<0·001).	Positive	
Cannabis	Use	Pumariega et al, 2014[72]	Turkey School based	Adolescents (14 to 18 years old)	Cross-sectional study	Male 14 477 (46.6%) & female 16581 (53.4%)	Suicidal ideation	Bivariate	Suicidal ideation was not associated with cannabis/marijuana use (OR=1·22, NO CI, p=0·130).	Null	+
Cannabis	Use	Reyes-Tovilla et al, 2015[93]	Mexico Hospital based	Both (13 to 60 years old)	Cohort study	Male 52 (36.1%) &	Non-fatal suicidal behaviour:	Multivariate	Intake of cannabis prior to suicide attempt was inversely associated with an impulsive or	Negative	+

						female 92 (63.9%)	Suicide attempt		premeditated suicide attempt (OR=0·25, 95% CI 0·78-0·82, p=0·02), while controlling for past number of attempts, intake of alcohol prior to attempt, cannabis use, alcohol consumption.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Cannabis use was not associated with an impulsive or premeditated suicide attempt (OR=0·64, 95% CI 0·09-3·71, p=0·60), while controlling for past number of attempts, alcohol consumption, intake of alcohol prior to attempt, intake of cannabis prior to attempt.	Null	
Cannabis	Use	Rudatsikira et al, 2007[135]	Zimbabwe School based	Adolescents (11 to 17 years old)	Cross-sectional study	Male 873 (49.3%) & female 1111 (50.7%)	Suicidal ideation	Bivariate	Cannabis smoking in the past 12 months was associated with suicidal ideation among the total sample (OR=1·50, 95% CI 1·04-2·16, p<0·05), and males (OR=1·65, 95% CI 1·03-2·64, p<0·05), but not females (OR=1·35, 95% CI 0·71-2·57, p>0·05).	Unclear	-

Cannabis	Use	Silva et al, 2014[95]	Brazil School based	Adolescents (13 to 18 years old)	Cross-sectional study	Male 836 (37.9%) & female 1371 (62.1%)	Suicidal ideation	Bivariate	Marijuana consumption was not associated with suicidal ideation, suicide planning or suicide attempt: No statistical results provided.	Null	+
							Suicidal ideation	Bivariate	Marijuana consumption was not associated with suicidal ideation, suicide planning or suicide attempt: No statistical results provided.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Marijuana consumption was not associated with suicidal ideation, suicide planning or suicide attempt: No statistical results provided.	Null	
Cannabis	Abuse	Toprak et al, 2011[77]	Turkey Others	Both (16 to 22 years old)	Cross-sectional study	Male 293 (46.1%) & female 343 (53.9%)	Non-fatal suicidal behaviour: Self-harm	Bivariate	Cannabis abuse was significantly associated with self-harm (aOR=6·65, 95% CI 2·54-17·4, p<0·05), while controlling for age and gender.	Positive	++
							Suicidal ideation	Bivariate	Cannabis abuse was not significantly associated with suicidal ideation (OR=0·84, 95% CI 0·19-3·73, p>0·05).	Null	
							Non-fatal suicidal behaviour:	Bivariate	Cannabis abuse was not significantly associated with suicide	Null	

							Suicide attempt		attempt (OR=1·60, 95% CI 0·35-7·20, p>0·05).		
Cannabis	Composite substance measure: use, abuse, dependence	Lückhoff et al, 2014[126]	South Africa Other	Adults (Mean age years old =35; SD=10.5)	Cross-sectional study	Male 784 (80.5%) & females 190 (19.5%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	When the suicide group was compared to the group without suicide: cannabis use or abuse (31·3% vs. 27·2) (x^2=1·02, p=0.0313); or dependency (11% vs. 4·7%) (x^2=8·49, p=0·004); use or abuse or dependence (47·5% vs. 35·5%) (x^2=7·15, p=0·008) was risk factors for suicidal behaviour.	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Cannabis use or abuse or dependence was associated with suicide attempts (aOR=1·22, 95% CI 1·01-1·47, p=0·038), while controlling for alcohol dependence, marital status, global alogia, and bizarre behaviour (lifetime).	Positive	
Cannabis and Mandrax (consumed together)											
Cannabis and Mandrax	Use	Peltzer, 2008[128]	South Africa	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour:	Multivariate	Past month frequency of cannabis & mandrax use predicted higher	Positive	++

(consumed together)			School based				Suicide risk		suicide risk (aOR=8·35, 95% CI 2·58-26·99, p<0·001), while controlling for age and gender.		
Opioid											
Opioid	Use	Juan et al, 2015[42]	China School based	Adolescents (12 to 19 years old)	Cross-sectional study	Male 37,753 (45.3%) & female 45,523 (54.7%)	Non-fatal suicidal behaviour: Deliberate self-harm	Multivariate	Lifetime, past-year, and past-month non-medical use of opioids was associated with DSH across gender, when adjusting for family economic status, and the educational background of parents: **<u>Among males:</u>** Lifetime (aOR=1·59, 95% CI 1·38–1·83, p<0·05), past-year (aOR=1·89, 95% CI 1·42–2·52, p<0·05), and past-month (aOR=3·76, 95% CI 3.05–4·64, p<0·05) non-medical use of opioids. **<u>Among females:</u>** Lifetime (aOR=2·25, 95% CI 1·97-2·56, p<0·05), past-year (aOR=2·66, 95% CI 2·00-3·55, p<0·05), and past-month	Positive	++

									(aOR=4·32, 95% CI 3·44-5·41, p<0·05) non-medical use of opioids.		
							Suicidal ideation	Multivariate	Lifetime, past-year, and past-month non-medical use of opioids was associated with suicidal ideation across gender, when adjusting for family economic status, and the educational background of parents: **<u>Among males:</u>** Lifetime (aOR=1·34, 95% CI 1·17-1·55, p<0·05), past-year (aOR=1·81, 95% CI 1·37-2·39, p<0·05), and past-month (aOR=2·49, 95% CI 2·00-3·11, p<0·05) non-medical use of opioids. **<u>Among females:</u>** Lifetime (aOR=1·41, 95% CI 1·25-1·60, p<0·05), past-year (aOR=1·48, 95% CI 1·13-1·95, p<0·05), and past-month (aOR=1·83, 95% CI	Positive	

									1·45-2·31, p<0·05) non-medical use of opioids.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Lifetime, past-year, and past-month non-medical use of opioids was associated with suicide attempt across gender, when adjusting for family economic status, and the educational background of parents: **<u>Among males:</u>** Lifetime (aOR=2·05, 95% CI 1·60-2·63, p<0·05), past-year (aOR=3·33, 95% CI 2·18-5·08, p<0·05), and past-month (aOR=8·97, 95% CI 6·91-11·7, p<0·05) non-medical use of opioids. **<u>Among females:</u>** Lifetime (aOR=2·54, 95% CI 2·07-3·13, p<0·05), past-year (aOR=2·78, 95% CI 1·77-4·36, p<0·05), and past-month (aOR=4·79, 95% CI 3·49-6·56, p<0·05)	Positive	

									non-medical use of opioids.		
Opioid	Use	Nojomi et al, 2007[103]	Iran Community based	Both (14 years old and older)	Cross-sectional study	Male 809 (35.2%) & Female 1491 (64.8 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Heroin / morphine use were higher among suicide attempters than nonattempters (39·5% vs. 36·2%, p>0·05).	Null	++
Opioid	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Higher past month frequency of opiate use predicted higher suicide risk (OR=5·28, 95% CI 1·20-23·3, p<0·05), while controlling for age and gender.	Positive	++
Opioid	Use	Shooshtary et al, 2008[108]	Iran Community based	Both (15 years old and older)	Cross-sectional study	Male 187 (37.1%) & female 317 (62.9%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Opioid use was not associated with lifetime suicide attempts (OR=1·05, 95% CI 0·007-163·8, p>0·05).	Null	++
Opioid	Dependence	Ahmadi et al, 2015[98]	Iran Hospital-based	Both (16 to 25 years old)	Case-control study	Male (24%) & female (76%)	Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Opium dependence was a significant risk factor associated with self-immolation (aOR=17·33, 95% CI 5·40–55·6, p<0·001), while controlling for adjustment disorders, major depression, individual history of suicide attempts.	Positive	++

Sedatives											
	Use	Arenliu et al, 2014[60]	Kosovo School-based	Adolescents (15-19 years old)	Cross-sectional study	Male (43.7%) & female (55.1%); not responded (1.2%)	Suicidal ideation	Bivariate	The reported usage of tranquilizers was associated with reported suicide ideation for females (OR=9·39, 95% CI 5·28–16·63, p=0·001) but not for males (OR=1·15, 95% CI 0·39-2·97, p>0·05).	Unclear	-
							Non-fatal suicidal behaviour: suicide attempt	Bivariate	Tranquillizers were associated with reported suicide attempts for both males (OR=2·82, 95% CI 0·95–7·40, p<0·001) and females (OR=4·69, 95% CI 1·81–10·6, p<0·05).	Positive	
Sedatives	Use	Juan et al, 2015[42]	China School based	Adolescents (12 to 19 years old)	Cross-sectional study	Male 37,753 (45.3%) & female 45,523 (54.7%)	Non-fatal suicidal behaviour: Deliberate self-harm	Multivariate	Lifetime, past-year, and past-month non-medical use of sedatives was associated with DSH across gender, when adjusting for family economic status, and the educational background of parents: **<u>Among males:</u>** Lifetime (aOR=1·70, 95% CI 1·41-2·06,	Positive	++

									p<0·05), past-year (aOR=2·64, 95% CI 1·84-3·78, p<0·05), and past-month (aOR=5·80, 95% CI 4·53-7·43, p<0·05) non-medical use of sedatives. **<u>Among females:</u>** Lifetime (aOR=2·40, 95% CI 2·06-2·81, p<0·05), past-year (aOR=3·03, 95% CI 2·30-4·00, p<0·05), and past-month (aOR=3·67, 95% CI 2·83-4·77, p<0·05) non-medical use of sedatives.		
							Suicidal ideation	Multivariate	Lifetime, past-year, and past-month non-medical use of sedatives was associated with suicidal ideation across gender, when adjusting for family economic status, and the educational background of parents: **<u>Among males:</u>** Lifetime (aOR=1·53, 95% CI 1·31-1·90, p<0·05), past-year	Positive	

									(aOR=1·89, 95% CI 1·30-2·75, p<0·05), and past-month (aOR=2·85, 95% CI 2·19-3·71, p<0·05) non-medical use of sedatives. **<u>Among females:</u>** Lifetime (aOR=1·57, 95% CI 1·33-1·77, p<0·05), past-year (aOR=1·58, 95% CI 1·21-2·08, p<0·05), and past-month (aOR=2·18, 95% CI 1·68-2·82, p<0·05) non-medical use of sedatives.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Lifetime, past-year, and past-month non-medical use of sedatives was associated with suicide attempt across gender, when adjusting for family economic status, and the educational background of parents: **<u>Among males:</u>** Lifetime (aOR=2·57, 95% CI 1·90-3·48, p<0·05), past-year (aOR=4·26, 95% CI	Positive	

									2·57-7·06, p<0·05), and past-month (aOR=10·8, 95% CI 8·02-14·4, p<0·05) non-medical use of sedatives. **<u>Among females:</u>** Lifetime (aOR=2·92, 95% CI 2·31-3·70, p<0·05), past-year (aOR=3·36, 95% CI 22·23-5·04, p<0·05), and past-month (aOR=5·19, 95% CI 3·69-7·29, p<0·05) non-medical use of sedatives.		
Sedatives	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Higher past month frequency of tranquilizer use predicted higher suicide risk (OR=6·32, 95% CI 1·62-24·7, p<0·01) when controlling for age and gender.	Positive	++
Sedatives	Use	Shooshtary et al, 2008[108]	Iran Community based	Both (15 years old and older)	Cross-sectional study	Male 187 (37.1%) & female 317 (62.9%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Sedatives use did not significantly predicted lifetime suicide attempts (OR=1·1 95% CI 0·86-8·27, p>0·05).	Null	++

Sedatives	Use	Thanh et al, 2006[50]	Vietnam Community based	Both (14 to 65 years old)	Cross-sectional study	Male 1093 (48.4%) & female 1167 (51.6%)	Suicide ideation: Suicidal thoughts	Multivariate	Having ever used sedatives was associated with suicidal thoughts (aOR=2·7, 95% CI 1·7-4·3, p<0·01), while controlling for age, gender, marital status, education level, income, religion, religiousness, employment status, use of alcohol, sedatives, and pain relief medication.	Positive	++
Sedatives	Abuse	Toprak et al, 2011[77]	Turkey Others	Both (16 to 22 years old)	Cross-sectional study	Male 293 (46.1%) & female 343 (53.9%)	Non-fatal suicidal behaviour: Self-harm	Bivariate	Tranquilizer abuse (OR=7·53, 95% CI 3·32–17·1, p<0·05) was associated with self-harm.	Positive	++
							Suicidal ideation	Bivariate	Tranquilizer abuse (OR=4·60, 95% CI 2·09–10·1, p<0·05) was associated with suicide ideation.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Tranquilizer abuse (OR=5·43, 2·24–13·2, p<0·05) was associated with suicide attempt.	Positive	
							Non-fatal suicidal behaviour: Self-harm	Multivariate	Tranquilizer abuse (yes/no) (OR=5·51, 95% CI 2·02–15·05, p=0·001) predicted self-harm.	Positive	
							Suicidal ideation	Multivariate	Tranquilizer abuse (yes/no) predicted	Positive	

									suicidal ideation (OR=4·79, 95% CI 2-11·5, p=0·000).		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Tranquilizer abuse (yes/no) predicted suicide attempt (OR=6·03, 95% CI 2·35-15·5, p=0·000).	Positive	
Stimulants											
Stimulants	Use	Du et al, 2014[38]	China Clinic-based (e.g. mobile clinic, free clinic)	Both (16 to 60 years old)	Cross-sectional study	Males 305 (81.1) & females 71 (18.9)	Non-fatal suicidal behaviour: Suicide behaviour	Multivariate	Participants who ever had suicide behaviour were associated with a higher likelihood of being in the high ATS use trajectory group (OR= 3·30, 95% CI 1·35-8·06, p<0·005).	Positive	++
Stimulants	Use	Narvaez et al, 2014[89]	Brazil National/ regional registers (e.g. not clinical-based registers)	Young adults (18 to 24 years old)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Crack use was associated with suicide risk (OR=3·03, 95% CI 1·22 –7·50, p=0·017), while controlling for lifetime cocaine use.	Positive	++
Stimulants	Use	Nojomi et al, 2007[103]	Iran Community based	Both (14 years old and older)	Cross-sectional study	Male 809 (35.2%) & Female 1491 (64.8 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	ATS use was higher among suicide attempters than nonattempters (1·3% vs. 0·3%, p>0·05)	Null	++

Stimulants	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Higher past month frequency of cocaine use predicted higher suicide risk (OR=8·35, 95% CI 2·58-26·99, p<0·05), while controlling for age and gender.	Positive	++
Unspecified prescription medication											
Unspecified prescription medication	Use	Guo et al, 2015[39]	China School based	Adolescents (Mean = 16.7; SD = 1.2)	Cross-sectional study	Male 5465 (45.9%) & female 6441 (54.1%)	Suicidal ideation	Multivariate	Considered suicide behaviour was associated with non-medical use of prescription pain relievers (OR=3·47, 95% CI 2·34-5·15, p<0·05).	Positive	++
							Non-fatal suicidal behaviour: suicide behaviour	Multivariate	Attempted suicidal behaviour was associated with non-medical use of prescription pain relievers (OR=2·08, 95% CI 1·29-3·35, p<0·05).	Positive	
Unspecified prescription medication	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Higher past month frequency of over-the-counter drug use predicted higher suicide risk (OR=2·20, 95% CI 1·07-4·51, p<0·01), while controlling for age and gender.	Positive	++

Unspecified prescription medication	Use	Thanh et al, 2006[50]	Vietnam Community based	Both (14 to 16 years old)	Cross-sectional study	Male 1093 (48.4%) & female 1167 (51.6%)	Suicidal ideation: Suicidal thoughts	Multivariate	Having ever used pain relief medication was associated with suicidal thoughts respectively (aOR=2·6, 95% CI 1·6-4·1, p<0·01), while controlling for age, gender, marital status, education level, income, religion, religiousness, employment status, use of alcohol, sedatives, and pain relief medication.	Positive	++
Inhalants											
Inhalants	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: Suicide risk	Multivariate	Higher past month frequency of inhalant use was associated with higher suicide risk (aOR=5·41, 95% CI 1·30-22·5, p<0·05), while controlling for age and gender.	Positive	++
Inhalants	Abuse	Toprak et al, 2011[77]	Turkey Others	Both (16 to 22 years old)	Cross-sectional study	Male 293 (46.1%) & female 343 (53.9%)	Non-fatal suicidal behaviour: Self-harm	Bivariate	Inhalant abuse was associated with self-harm (OR=8·05, 95% CI 3·32-19·5, p<0·05).	Positive	++
							Suicidal ideation	Bivariate	Inhalant abuse was not associated with suicidal ideation (OR=0·64, 95% CI 0·14-2·82, p>0·05).	Null	

							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Inhalant abuse was not associated with suicide attempt (OR=0·53, 95% CI 0·07-4·09, p>0·05).	Null	
							Non-fatal suicidal behaviour: Self-harm	Multivariate	Inhalant abuse was associated with self-harm (aOR=4·51, 95% CI 1·49-13·7, p<0·008), while controlling for income, good family relationships, frequent alcohol consumption, daily smoking, and tranquilizer abuse.	Positive	
Hallucinogens											
Hallucinogens	Use	Nojomi et al, 2007[103]	Iran Community based	Both (14 years old and older)	Cross-sectional study	Male 809 (35.2%) & Female 1491 (64.8 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Hallucinogens use were higher among suicide attempters than nonattempters (1·3% vs. 0·1%, p>0·05)	Null	++
Hallucinogens	Use	Peltzer, 2008[128]	South Africa School based	Adolescents (15 to 18 years old)	Cross-sectional study	Male	Non-fatal suicidal behaviour: suicide risk	Multivariate	Higher past month frequency of hallicinogens use predicted higher suicide risk (OR=4·76, 95% CI 1·61-14·1, p<0·05), while controlling for age and gender.	Positive	++
Unspecified substance											

Unspecified substance)	Intoxication	Evren et al, 2012[62]	Turkey Hospital based	N/A	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Self-mutilation	Bivariate	Substance intoxication before the act was associated with self-mutilation. The rate of intoxication before self-mutilation was higher among alcohol dependents when compared to drug dependents (79·6% vs. 54·7%) (x^2=8·04, df=1, p=0·005).	Positive	++
Unspecified substance	Use	Arenliu et al, 2014[60]	Kosovo School-based	Adolescents (15-19 years old)	Cross-sectional study	Male (43.7%) & female (55.1%); not responded (1.2%)	Suicidal ideation	Bivariate	Usage of drugs other than cannabis (amphetamines, hallucinogens or ecstasy) was associated with reported suicide ideation for males (OR=4·78, 95% CI 2·15–10·18, p<0·001) but not for females (OR=0·67, 95% CI 0·18-2·1, p>0·05).	Unclear	-
							Non-fatal suicidal behaviour: suicide behaviour	Bivariate	The usage of drugs other than cannabis and tobacco was not associated with reported suicide attempts for males (OR=2·26, 95% CI 0·79-5·88, p>0·05) and females (OR=1·05, 95% CI 0·17-4·44, p>0·05).	Null	

Unspecified substance	Use	Chan et al, 2013[35]	Malaysia National/ regional registers (e.g. not clinical-based registers)	Adolescent (18 to 76 years old)	Cross-sectional study	Male 2407 (47.5%) & female 2174 (52.5%)	Non-fatal suicidal behaviour: deliberate self-harm	Multivariate	Illicit drugs was associated with DSH, while controlling for history of sexual abuse, alcohol use, and female gender (aOR=2·06, 95% CI 1·05-4·04, p<0·035).	Positive	-
							Suicidal ideation	Multivariate	Illicit drugs was associated with suicidal plans, while controlling for history of sexual abuse, and female gender (aOR=2·62, 95% CI 1·05-6·53, p<0·038).	Positive	
							Suicidal ideation	Multivariate	Illicit drugs was associated with suicidal ideation, while controlling for history of sexual abuse, and female gender (aOR=4·04, 95% CI 2·14-7·66, p<0·001).	Positive	
Unspecified substance	Use	Diehl & Laranjeira, 2009[86]	Brazil Hospital based	Adult (18 to 41 years old)	Cohort study	Male 22 (27.5%) & female 58 (72.5 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Drug use was not associated with the method of suicide attempt (p=0·205). No other statistical results provided.	Null	-
Unspecified substance	Use	Ekramzadeh et al, 2012[99]	Iran Hospital based	Adults (Mean = 70.5; SD = 7.5)	Cross-sectional study	Male 349 (61.2%) & female 221 (38.8%)	Suicidal ideation	Bivariate	History of substance use was associated with harmful behaviours (β=0·087, t=2·25, p<0·05).	Positive	++

							Suicidal ideation	Bivariate	History of substance use was not associated with suicidal ideation. No statistical results provided.	Null	
Unspecified substance	Use	Kalyoncu et al, 2007[68]	Turkey Clinic-based (e.g. mobile clinic, free clinic)	Adults (18 to 24 years old)	Case-control study	Male 78 (72.2%) & female 30 (27.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Both the male (mean=6·32, SD= 1·15) and the female (mean=6.08, SD=0·66) suicide attempters had significantly higher drug use scores on the ASI measure than did the male (mean=4·58, SD=1·26) and the female (mean=4·33, SD=1·18) nonattempters (t=6·02, p<0·001; t=4·62, p<0·001, respectively).	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Both the male (mean=2·82, SD=0·71) and the female (mean=3·25, SD=1·13) suicide attempters had significantly higher drug use scores on the ASI measure than did the male (mean=1·84, SD=0·73) and the female (mean=1·61, SD=0·69) nonattempters (t=6·31, p<0·001; t= 4·90, p<0·001, respectively).	Positive	

Unspecified substance	Use	Mahfoud et al, 2011[101]	Lebanon School based	Adolescents (11 to 16 years old)	Cross-sectional study	Male 2333 (47.7%) & female 2776 (52.3%)	Suicidal ideation	Multivariate	Using drugs was associated with suicidal ideation (aOR=2·07, 95% CI 1·33-3·20, p<0·05), while controlling for age, gender, and type of school.	Positive	+
							Suicidal ideation	Bivariate	Using drugs was associated with suicidal ideation (OR=5·42, 95% CI 3·83-7·67, p<0·05).	Positive	
Unspecified substance	Use	Miletic et al, 2015[70]	Serbia Other	Adults (18 to 34 years old)	Cross-sectional study	Male 500 (38.6%) & female 794 (61.3 %)	Non-fatal suicidal behaviour suicidal behaviour: suicide attempt	Bivariate	Drug use (p=0·007) was a significant predictor of future suicide attempts. No other statistical results provided.	Positive	++
Unspecified substance	Use	Miller et al, 2011[88]	Mexico Community based	Adolescents (12 to 17 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Lifetime use of illicit drugs was associated with suicidal ideation (OR=3·77, 95% CI 2·74-5·19, p<0·01).	Positive	++
							Suicidal ideation	Bivariate	Lifetime use of illicit drugs was associated with suicide plan (OR=6·29, 95% CI 3·58-11·2, p<0·01).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Lifetime use of illicit drugs was associated with suicide attempt (OR=5·11, 95% CI 2·68-9·71, p<0·01).	Positive	

							Suicidal ideation	Multivariate	Lifetime use of illicit drugs was not associated with suicidal ideation (aOR=0·43, 95% CI 0·13-1·45, p>0·05), while controlling for psychiatric disorder or alcohol use/disorder or tobacco use/disorder.	Null	
							Suicidal ideation	Multivariate	Lifetime use of illicit drugs was not associated with suicide plan (OR=0·50, 95% CI 0·11-2·33, p>0·05), while controlling for psychiatric disorder or alcohol use/disorder or tobacco use/disorder.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Lifetime use of illicit drugs was not associated with suicide attempt (OR=0·47, 95% CI 0·12–1·89, p>0·05), while controlling for psychiatric disorder or alcohol use/disorder or tobacco use/disorder.	Null	
Unspecified substance	Use	Page, Dennis, et al, 2011[139]	Philippines; China; Namibia School based	Adolescents (11 to 16 years old)	Cross-sectional study	Philippines: male 3094 (43.2%) & female 4188 (56.8%).	Suicidal ideation	Bivariate	Lifetime drug use was associated with suicide plan across gender in Philippine and Namibia: Philippine boys % (n) lifetime drug	Positive	++

						China: male 4356 (51.2%) & female 4537 (48.8%). Namibia: male 2931 (45.2%) & female 3352 (54.8%).			users=24·8 (96); %(n) nonusers= 19·0 (475); (OR=1·30 95% CI 1·00-1·70, p<0·05) Philippine girls % (n) lifetime drug users=37·9 (55); %(n) nonusers= 17·9 (701); (OR=2·55, 95% CI 1·79-3·65, p<0·05); Namibia boys % (n) lifetime drug users=46·0 (323); %(n) nonusers= 26·8 (535); (OR=2·12, 95% CI 1·76-2·54, p<0·05); Namibia girls % (n) lifetime drug users=49·6 (348); %(n) nonusers= 26·4 (641); (OR=2·47, 95% CI 2·06-2·97, p<0·05).		
							Suicidal ideation	Bivariate	Lifetime drug use was not consistently associated with suicide plan across both genders in China: China boys % (n) lifetime drug users=16·3 (15); %(n) nonusers= 6·5 (273); (OR=2·82, 95% CI 1·59-5·00, p>0·05); China girls % (n) lifetime drug users=16·7 (8); %(n) nonusers= 9·4 (414);	Unclear	

									(OR=2·04, 95% CI 0·94-4·43, p>0·05).		
Unspecified substance	Use	Page et al, 2011[46]	China; Philippines School based	Adolescent (11 to 17 years old)	Cross-sectional study	China: male 4356 (51.2%) & female 4537 (48.8%). Philippines: male 3094 (43.2%) & female 4188 (56.8%).	Suicidal ideation	Multivariate	Among Chinese students, ever used drugs was significantly associated with suicide ideation (OR=1·36, 95% CI 1·27-1·46, p<0·001).	Positive	++
							Suicidal ideation	Multivariate	Among Chinese students, ever used drugs was associated with making a suicide plan (OR=1·64, 95% CI 1·05-1·13, p<0·001).	Positive	
							Suicidal ideation	Multivariate	Among Philippine students, ever used drugs was associated with suicide ideation (OR=1·71, 95% CI 1·48-1·96, p<0·001).	Positive	
							Suicidal ideation	Multivariate	Among Philippine students, ever used drugs was associated with making a suicide plan (OR=1·31, 95% CI 1·28-1·34, p<0·001).	Positive	
Unspecified substance	Use	Peltzer, 2009[129]	Kenya; Namibia; Swaziland; Uganda; Zambia;	Adolescents (13 to 15 years old)	Cross-sectional study	N/A	Suicidal ideation	Multivariate	Illicit drug use was not associated with suicidal ideation (aOR=0·95, 95% CI 0·93-0·96, p>0·05).	Null	+
							Suicidal ideation	Multivariate	Predict illicit drug use:	Positive	

			Zimbabwe School based						Suicide plan (aOR=1·53, 95% CI 1·51–1·58, p>0·05).		
Unspecified substance	Use	Peltzer & Pengpid, 2015[47]	Oceania (Kiribati, Samoa, Solomon Islands, and Vanuatu) School based	Adolescents (13 to 16 years old)	Cross-sectional study	Male 2846 (43.5%) & female 3534 (54%)	Suicidal ideation	Bivariate	Drug use (illicit) initiation was associated with suicidal ideation: **<u>Among the total sample</u>** Non-initiators 1.00 <12 years (OR=3·26, 95% CI 2·57-4·12, p<0·001); ≥12 years (OR=2·62, 95% CI 2·09-3·27, p<0·001). **<u>Among boys</u>** Non-initiators 1.00 <12 years (OR=3·31, 95% CI 2·5-4·27, p<0·001); ≥12 years (OR=2·29, 95% CI 1·6-3·27, p<0·001). AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (OR=3·22, 95% CI 2·14-4·85, p<0·001);	Positive	++

									≥12 years (OR=2·98, 95% CI 2·21-4·02, p<0·001).		
							Non-fatal suicidal behaviour: S uicide attempt	Bivariate	Drug use (illicit) initiation was associated with suicide attempt: **<u>Among the total sample</u>** Non-initiators 1.00 <12 years (OR=6·66, 95% CI 4·25-10·4, p<0·001); ≥12 years (OR=3·89, 95% CI 2·86-5·28, p<0·001). **<u>Among boys</u>** Non-initiators 1.00 <12 years (OR=5·74, 95% CI 3·26-10·1, p<0·001); ≥12 years (OR=3·56, 95% CI 2·45-5·18, p<0·001). AND **<u>Among girls</u>** Non-initiators 1.00 <12 years (OR=7·30, 95% CI 4·43-12·0, p<0·001); ≥12 years (OR=4·46, 95% CI 3·07-6·49, p<0·001).	Positive	

							Suicidal ideation	Multivariate	Drug use (illicit) initiation was associated with suicidal ideation: **<u>Among the total sample</u>** Non-initiators 1.00 <12 years (aOR=2·21, 95% CI 1·48-3·30, p<0·001; ≥12 years (aOR=1·88, 95% CI 1·34-2·63, p<0·001). **<u>Among boys</u>** Non-initiators 1·00 <12 years (aOR=1·04, 95% CI 0·56-1·94, p>0·05); ≥12 years (aOR=1·08, 95% CI 0·57-2·07, p>0·05). AND **<u>Among girls</u>** Non-initiators 1.00 <12 years (aOR=1·90, 95% CI 1·09-3·70, p<0·05); ≥12 years (aOR=1·82, 95% CI 1·04-3·18, p<0·05). (Adjusted for age, psychological distress and current	Positive	

									alcohol use)		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Drug use (illicit) initiation was associated with suicide attempt: **<u>Among the total sample</u>** Non-initiators 1·00 <12 years (aOR=2·57, 95% CI 1·47-4·48, p<0·001); ≥12 years (aOR=1·94, 95% CI 1·29-2·94, p<0·01). **<u>Among boys</u>** Non-initiators 1.00 <12 years (aOR=2·39, 95% CI 1·21-4·74, p<0·05); ≥12 years (aOR=2·07, 95% CI 1·37-3·13, p<0·01). AND **<u>Among girls</u>** Non-initiators 1·00 <12 years (aOR=2·87, 95% CI 1·63-5·07, p<0·001); ≥12 years (aOR=1·84, 95% CI 1·05-3·22, p<0·01). (Adjusted for age, psychological distress and current	Positive	

									alcohol use)		
							Suicidal ideation	Bivariate	**Among the total sample** Substance use initiation with one, two and three substances at younger than 12 years old was associated with suicidal ideation among the total sample and girls but not boys: One substance (OR=1·78, 95% CI 1·2-2·62, p<0·01); Two substances (OR=4, 95% CI 2·9-5·39, p<0·001); Three substances (OR=3·46, 95% CI 2·2-5·31, p<0·001). **Among boys** One substance (OR=1·41, 95% CI 0·4-2·19, p>0·05); Two substances (OR=3·17, 95% CI 2·1-4·72, p<0·001); Three substances (OR=3·03, 95% CI 1·7-5·28, p<0·001). AND **Among girls**	Unclear	

									One substance (OR=2·31, 95% CI 1·23-4·33, p<0·01); Two substances (OR=6·87, 95% CI 3·99-11·8, p<0·001); Three substances (OR=4·98, 95% CI 2·38-10·4, p<0·001).		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Substance use initiation with one, two, or three substances at younger than <12 years old was not consistently associated with suicide attempt: **<u>Among the total sample</u>** One substance (OR=2·29, 95% CI 1·58-3·32, p<0·001); Two substances (OR=9·33, 95% CI 5·69-15·3, p<0·001); Three substances (OR=12·4, 95% CI 7·24-21·4, p<0·001). **<u>Among boys</u>** Not One substance (OR=1·73, 95% CI 0·97-3·11, p>0·05); But yes	Unclear	

									Two substances (OR=7·25, 95% CI 4·01-13·1, p<0·001); Three substances (OR=10·9, 95% CI 5·96-19·8, p<0·001). AND **<u>Among girls</u>** One substance (OR=2·84, 95% CI 1·72-4·69, p<0·001); Two substances (OR=13·5, 95% CI 7·16-21·4, p<0·001); Three substances (OR=32·9, 95% CI 14·1-76·9, p<0·001).		
							Suicidal ideation	Multivariate	Substance use initiation with one, two, or three substances at younger than <12 years old was not consistently associated with suicidal ideation, while adjusting for age, psychological distress, current smoking, alcohol, and cannabis use: **<u>Among the total sample</u>** One substance (aOR=1·49, 95% CI 1·01–2·16, p<0·05);	Unclear	

									Two substances (OaR=2·11, 95% CI 1·38-3·24, p<0.001); Three substances (aOR=1·70, 95% CI 0·92-3·14, p>0·05). **<u>Among boys</u>** One substance (aOR=1·41, 95% CI 0·92-2·15, p>0·05); Two substances (aOR=1·94, 95% CI 1·15-3·28, p<0·05); Three substances (aOR=1·93, 95% CI 0·86-4·35, p>0·05). AND **<u>Among girls</u>** One substance (aOR=1·59, 95% CI 0·79-3·17, p<0·05); Two substances (aOR=3·16, 95% CI 1·46-6·83, p<0·01); Three substances (aOR=1·18, 95% CI 0·52-2·66, p>0·05). (Adjusted for age, psychological distress and current alcohol use)		
							Non-fatal suicidal behaviour:	Multivariate	Substance use initiation with one, two, or three	Unclear	

							Suicide attempt		substances at younger than <12 years old was not consistently associated with suicide attempt, while adjusting for age, psychological distress, current smoking, alcohol, and cannabis use: **<u>Among the total sample</u>** One substance (aOR=1·39, 95% CI 0·92-2·12, p>0·05); Two substances (aOR=2·86, 95% CI 1·79-4·57, p<0·001); Three substances (aOR=3·46, 95% CI 2·01-5·95, p<0·001). **<u>Among boys</u>** One substance (aOR=1·11, 95% CI 0·65-1·88, p>0·05); Two substances (aOR=2·98, 95% CI 1·65-5·37, p<0·001); Three substances (aOR=3·31, 95% CI 1·63-6·73, p<0·001). AND **<u>Among girls</u>**		

									One substance (aOR=1·97, 95% CI 1·16-3·36, p<0·05); Two substances (aOR=3·35, 95% CI 1·32-8·46, p<0·05); Three substances (aOR=5·44, 95% CI 1·94-15·3, p<0·01). (Adjusted for age, psychological distress and current alcohol use)		
Unspecified substance	Use	Pumariega et al, 2014[72]	Turkey School based	Adolescents (14 to 18 years old)	Cross-sectional study	Male 14 477 (46.6%) & female 16581 (53.4%)	Suicidal ideation	Bivariate	Suicidal ideation was associated with any illicit drug use (except cannabis/marijuana) (OR=1·28, NO CI, p=0·000).	Positive	+
							Suicidal ideation	Bivariate	Suicidal ideation was associated with polysubstance use (any 2 of 9 illicit substances other than cannabis/marijuana) (OR=1·61, NO CI, p=0·000).	Positive	
Unspecified substance	Use	Randall et al, 2014[133]	Republic of Benin, West Africa School based	Adolescents (11 to 16 years old)	Cross-sectional study	Male 1798 (67.1%) & female 882 (32.9%)	Suicidal ideation	Bivariate	Among Benin adolescents who reported substance use, 2·8% (51) reported no suicidal ideation, 7·8% (9) reported ideation only, 9% (36) reported	Positive	++

									ideation with a plan, p<0·0001.		
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Substance use was associated with number of suicide attempts p<0·0001; no attempt=1·9% (35), one attempt =7.6%(24), 2 or more attempts =13·5%(38).	Positive	
							Suicidal ideation	Multivariate	Substance use was associated with suicidal ideation only (OR=3·06, 95% CI 1·12–8·34, p=0·031), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Positive	
							Suicidal ideation	Multivariate	Substance use was associated with suicidal ideation with a plan (OR=1·69, 95% CI 1·05–2·72, p=0·032), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Substance use was not associated with having one past suicide attempt (OR=2·70, 95% CI 0·93–7·85, p=0·066), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Null	

							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Substance use was associated with having two or more suicide attempts (OR=5·73, 95% CI 2·99–11·0, p=0·001), while controlling for age, psycho-social symptoms, and socio-environmental factors.	Positive	
Unspecified substance	Use	Sharma et al, 2015[94]	Peru School based	Adolescents (12 to 18 years old)	Cross-sectional study	Male 425 (46.4%) & female 491 (53.6%)	Suicidal ideation	Multivariate	Illicit drug use was not associated with increased likelihood of suicidal ideation, while controlling for psychological (aOR=1·54, 95% CI 0·84-2·83, p>0·05), and behavioural factors.	Null	++
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Illicit drug use was associated with increased likelihood of suicide attempts (aOR=2·91, 95% CI 1·51–5·61, p<0·05), while controlling for psychological, socio-environmental, and demographic factors.	Positive	
Unspecified substance	Use	Sitdhiraksa et al, 2014[49]	Thailand School based	Both (12 to 21 years old)	Cross-sectional study	Male 1054 (40.2%) & female 1568 (59.8%)	Non-fatal suicidal behaviour: Thoughts of self-harm +	Bivariate	Illicit drug use within the last 12 months was associated with thoughts of harming yourself or attempted	Positive	+

							Suicide attempt		suicide (OR=2·08, 95% CI 1·61-2·69, p<0·01).		
Unspecified substance	Use	Souza et al, 2010[96]	Brazil National/ regional registers (e.g. not clinical-based registers)	Adolescents (11 to 15 years old)	Cross-sectional study	Male 501 (48.2%) & female 538 (51.8%)	Suicidal ideation	Multivariate	Illicit drug use was associated with suicidal ideation (OR=2·89, 95% CI 1·33 to 6·28, p<0·05), while controlling for gender, age, socioeconomic status, level of education, grade retension, religious practice, sexual activity, tobacco use, getting drunk, conduct disorder and high CDI scores for depressive symptoms.	Positive	++
Unspecified substance	Use	Swahn et al, 2012[136]	Uganda Other	Both (14 to 24 years old)	Cross-sectional study	Male 142 (31.1%) & female 315 (68.5%)	Suicidal ideation	Multivariate	Any drug use was not associated with suicide ideation (aOR=1·96, 95% CI 0·90-4·28, p>0·05), while controlling for gender, school attendance, whether one or both parents were dead, parental physical abuse, parental neglect due to alcohol use, apprenticeship skills, any drug use, any drunkenness, any STD/HIV, any traded sex, any rape, sadness,	Null	++

									lonely, expect to die early.		
Unspecified substance	Use	Zarrouq et al, 2015[109]	Morocco School based	Adolescents (11 to 23 years old)	Cross-sectional study	Males 1602 (53 %) & females 1418 (47 %)	Suicidal ideation Non-fatal suicidal behaviour: Suicide attempts & behaviour	Bivariate	Being a psychoactive substance user was associated with death wish (OR=36·8, 95% CI 30·9–43·1, p<0·001), self-harm wish (OR=31·7, 95% CI 26.1–37·8, p<0.001), suicide ideation (OR=26·7, 95% CI 21·4–32·6, p<0.001), suicide plan (OR=14·9, 95% CI 10·8–19·9, p<0·001), suicide attempt in the past month (OR=16·5, 95% CI 12·1–21·6, p<0.001), and lifetime suicide attempts (OR=19·6, 95% CI 14·9–25·1, p<0·001).	Positive	++
Unspecified substance	Misuse	Cluver et al, 2015[121]	South Africa Community based	Adolescents (10 to 18 years old)	Cohort study	Male 1475 (44%) & female 1926 (56%)	Non-fatal suicidal behaviour: suicide attempt, suicide plan	Mediation regression (multivariate)	There were no associations between drug/alcohol misuse and suicide behaviors (r=0·08, p>0·05).	Null	++
Unspecified substance	Abuse	Ahmad et al, 2014[32]	Malaysia School-based	Adolescents (12 to 17 years old)	Cross-sectional study	Male (49.6%) & female (50.4 %)	Suicidal ideation	Multivariate	Current drug abuse was associated with suicidal ideation (aOR=1·12, 95% CI 0·72-1·74, p=0·61), while	Null	++

									controlling for gender, ethnicity, parental marital status, current smoking, current drug use, were bullied, physically abused at home, verbally abused at home, stress, anxiety, depression, have close friend, supportive peers, parental supervision, parental connectedness, parental bonding, parental respect for privacy.		
Unspecified substance	Abuse	Altamura et al, 2007[120]	Hospital-based	Adults [South African Attempters = 31.2 (9.0); South African non-attempters = 39.3 (17.7)]	Cross-sectional study	Attempters: male 20 (64.5%) & female 11 (35.5%) Non-attempters: male 3 (50%) & female 3 (50%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	The presence of lifetime comorbid substance abuse was not associated with a suicide attempt during the course of their illness among schizophrenia spectrum disorder patients at high risk for suicide (x^2=0·676, df=1, p>0·4).	Null	-
Unspecified substance	Abuse	Alvarado-Esquivel et al, 2014[80]	Hospital-based	Adults [sample: 18-61 years old (mean 34.14+/-	Case-control study	Male 85 (30.8%) & female 191 (69.2%)	Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Drug abuse was not associated with suicide attempts (OR=1·10, 95% CI 0·46-2·64, p=0·81).	Null	+

				10.24 years old). Control: 18-69 years old (mean 38.23+/- 11.76 years old).							
Unspecified substance	Abuse	Govender et al, 2013[124]	South Africa School based	Adolescents (13 to 17 years old)	Cross-sectional study	Male 112 (46.9%) & female 127 (53.1%)	Suicidal ideation	Bivariate	Suicide ideation was positively correlated with substance abuse (r=·36, p<·01).	Positive	+
Unspecified substance	Abuse	Khasakhala et al, 2013[125]	Kenya Hospital based	Both (13 to 25 years old)	Cross-sectional study	Male 447 (48.7%) & female 471 (51.3%)	Non-fatal suicidal behaviour: Suicidal behaviour	Multivariate	Any drug abuse was associated with suicidal behaviour (aOR=5·23, 95% CI 1·88–13·9, p<0·001).	Positive	++
								Multivariate	Any drug abuse was associated with suicidal behaviour (aOR=6·66, 95% CI 2·81–15·8, p<0.001), while controlling for other mental health status.	Positive	
Unspecified substance	Abuse	Maraš et al, 2013[69]	Serbia Hospital based	Adolescents (15 to 18 years old)	Case-control study	Male 12 (19%) & female 20 (81%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Suicide attempt was associated with substances abuse (x^2=7·398, df=1, p<0·01).	Positive	-
Unspecified substance	Abuse	Menezes et al, 2012[114]	Nepal	Adults (18 to 27 years old)	Cross-sectional study	Males 112 (54.4%) &	Suicidal ideation	Bivariate	A greater proportion of suicidal ideation students reported substance abuse	Null	++

			University students			females 94 (45.6%)			compared to those who did not report substance abuse (50% vs. 9·9%) but this was not a statistically significant difference (OR=9·1, 95% CI 1·22-68·2, p=0·032).		
Unspecified substance	Abuse	Monsef Kasmaee et al, 2015[102]	Iran Hospital based	Both (12 to 80 years old)	Cross-sectional study	Male 49 (83%) & female 10 (17%)	Fatal suicide	Bivariate	Substance abuse status was not significantly different between the outcome death (11·1% vs. 38%) and survive (88·9% vs. 62%), (p=0·12).	Null	+
Unspecified substance	Abuse	Myint et al, 2014[45]	Thailand Hospital based	Both (10 to 79 years old)	Cohort study	Male 136 (91.3%) & 13 (8.7%)	Fatal suicide	Bivariate	Suicide was not associated with substance abuse (x^2=0·486, df=1, p=0·486).	Null	++
Unspecified substance	Abuse	Osama et al, 2014[115]	Pakistan Others	Adults (18 to 29 years old)	Cross-sectional study	135 Males 135 (41.2%) & female 193 (58.8%)	Suicidal ideation	Multivariate	Indulging in substance abuse was associated with suicidal ideation (OR=28, 95% CI 3·703-220·1, p<0·001).	Positive	-
Unspecified substance	Abuse	Ruengorn et al, 2012[48]	Thailand Hospital based	Both (13 to 60 years old)	Case-control study	Male 354 (32.2%) & female 746 (67.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Any substance abuse was not associated with suicide attempt (OR=1·76, CI 0·92-3·36, p<0·001).	Null	-

Unspecified substance	Abuse	Sadr et al, 2013[105]	Iran Hospital	Both (15 to 60 years old)	Cross-sectional study	Male 175 (43.8%) & female 225 (56.6%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Substance abuse was associated with multiple attempts of suicide in men (OR=1·020, NO CI, p=0·033) and women (OR=1·012, NO CI, p=0·045).	Positive	+
Unspecified substance	Abuse	Seghatoleslam et al, 2012[106]	Iran Hospital based	Both (15 to 60 years old)	Cross-sectional study	Female 100%	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Substance abuse was associated with multiple suicide attempts (OR=1·020, NO CI, p=0·033).	Positive	-
Unspecified substance	Abuse	Shakeri et al, 2015[107]	Iran Hospital based	Adults (Mean = 27.7; SD = 9.49)	Cross-sectional study	Female 100%	Non-fatal suicidal behaviour: suicide attempt, past suicide attempts	Bivariate	History of drug abuse was not associated with repeated suicide attempts (p=0·290).	Null	++
Unspecified substance	Addiction	Lavania et al, 2012[113]	India Hospital based	Adults (18 to 60 years old)	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Deliberate self-harm	Bivariate	Drugs, mean (SD): group I with DSH 6·83 (2·55); group II without DSH 3·13 (3·49). Those patients with DSH reported a significantly higher mean for drug addiction severity compared to patients without DSH (t=4·69, p<0·001).	Positive	-

Unspecified substance	Addiction	Neves et al, 2009[91]	Brazil Hospital based	Adults (Mean = 38.1; SD = 12.2)	Cohort study	Male 68 (28.5%) & female 171 (58.4%)	Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Other drug addiction was associated with a history of suicide attempts (x^2=10·1, df=1, p<0·02).	Positive	+
							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Other drug addiction was not associated with a history of suicide attempts in bipolar patients (OR=1·73, NO CI, p=0·243), while controlling for confounding factors.	Null	
							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Other drug addiction was not associated with a history of violent suicide attempts in bipolar patients (OR=1·26, NO CI, p=0·706), while controlling for confounding factors.	Null	
Unspecified substance	Addiction	Neves et al, 2010[92]	Brazil Clinic-based (e.g. mobile clinic, free clinic)	Adult (Non suicide group Mean = 44.6; SD = 13, suicide group Mean = 38.8; SD = 12.1)	Case-control study	Male 62 (30.9%) & female 139 (69.1%)	Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Other drug addiction was associated with lifetime history of suicide attempt (23·3% vs. 8%), (x2=9·01, df=1, p=0·003).	Positive	-
							Non-fatal suicidal behaviour: Suicide attempts	Bivariate	Other drug addiction was not significantly associated with violent suicide attempt (27·3% vs. 20·8%), (x^2=0·484, df=1, p=0·487).	Null	

Unspecified substance	Abuse/dependence	Miller et al, 2011[88]	Mexico Community based	Adolescents (12 to 17 years old)	Cross-sectional study	N/A	Suicidal ideation	Bivariate	Illicit drug abuse/dependence was associated with suicidal ideation (OR=6·24, 95% CI 2·73-14·3, p<0·01).	Positive	++
							Suicidal ideation	Bivariate	Illicit drug abuse/dependence was associated with suicide plan (OR=13·3, 95% CI 5·44-32·5, p<0·01).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Illicit drug abuse/dependence was associated with suicide attempt (OR=6·79, 95% CI 2·15-21·5, p<0·01).	Positive	
							Suicidal ideation	Multivariate	Illicit drug abuse/dependence was not associated with suicidal ideation (OR=1·11, 95% CI 0·19-6·44, p>0·05), while controlling for psychiatric disorder or alcohol use/disorder or tobacco use/disorder.	Null	
							Suicidal ideation	Multivariate	Illicit drug abuse/dependence was associated with suicide plan (OR=3·32, 95% CI 1·05-10·5, p<0·05), while controlling for psychiatric disorder or alcohol use/disorder or tobacco use/disorder.	Positive	
							Non-fatal suicidal	Multivariate	Illicit drug abuse/dependence	Null	

							behaviour: Suicide attempt		was not associated with suicide attempt (OR=0·94, 95% CI 0·15-5·70, p<0·01), while controlling for psychiatric disorder or alcohol use/disorder or tobacco use/disorder.		
Unspecified substance	Dependence	Chan et al, 2011[34]	Malaysia Hospital-based	Adult	Cross-sectional study	Male 23 (44%) & Female 42 (56%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Other (amphetamine, opiates, sedatives) (8·7% vs. 7·7%, p>0·05) and any substance abuse or dependence (47·8% vs. 38·5%, p>0·05) was not associated with suicide attempt.	Null	++
Unspecified substance	Dependence	Diehl & Laranjeira, 2009[86]	Brazil Hospital based	Adult (18 to 41 years old)	Cohort study	Male 22 (27.5%) & female 58 (72.5 %)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Substance dependence was not associated with suicide attempt (p=0·204). No other statistical results provided.	Null	-
Unspecified substance	Dependence	Evren et al, 2012[62]	Turkey Hospital based	N/A	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Self-mutilation	Bivariate	Drug dependence, when compared to alcohol-dependence, was associated with self-mutilative behaviour (x^2=14·4, df=1, p<0·001).	Positive	++
							Non-fatal suicidal behaviour: Self-mutilation	Bivariate	Risk of self-mutilation was higher in drug-dependent inpatients, when compared to alcohol-dependent	Positive	

									inpatients (OR=3·12, 95% CI 1·72–5·68, p<0·05).		
							Non-fatal suicidal behaviour: Self-mutilation	Bivariate	Risk of self-mutilation was higher among substance-dependent inpatients with prominent borderline features (PBF) than those without PBF (OR=4·2, 95% CI 2·23-7·82).	Positive	
Unspecified substance	Dependence	Evren et al, 2012[63]	Turkey Hospital based	N/A	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Self-mutilation	Bivariate	The rate of self-mutilation was higher among drug dependents than the alcohol dependents (75·0% vs. 49%), (x^2=14·4, df=1, p<0·001), and the risk was 3·12 (95% CI 1·72-5·68) times higher.	Positive	++
Unspecified substance	Dependence	Evren et al, 2006[66]	Turkey Hospital based	Adults (18 years old and older)	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Self-mutilation	Bivariate	Self-mutilation behavior was more prevalent in drug dependents than alcohol dependents (53·6% vs. 12·5%) (x^2=21·35, df=1, p<0·001), (OR=8·08, 95% CI=3·1–20·9, p<0·05).	Positive	++
Unspecified substance	Dependence	Uzun et al, 2009[78]	Turkey	Adult (Age Mean =	Cohort study	Male 195 (65%) &	Non-fatal suicidal	Bivariate	Those who had attempted suicide did	Null	+

			Hospital based	36.7; SD = 11.8 years old)		female 105 (35%)	behaviour: Suicide attempt		not have a significantly higher rate of comorbid substance abuse or dependence than that of those who had not (5·8% vs. 3·6%), (Fishers' exact test, df=4, p=0·112). No other statistical results provided.		
Unspecified substance	Disorder	Chan et al, 2014[36]	Malaysia Clinic-based (e.g. mobile clinic, free clinic)	Adults (18 to 76 years old)	Cohort study	Male 33 (44%) & female 42 (56%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Any type of substance use disorder was associated with future suicide attempt (OR=6·95, % CI 1·45-24·9, p=0·01).	Positive	++
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Any type of substance use disorder was associated with the transition from suicidal ideation to future suicide attempt (OR=4·13, 95% CI 0·96-17·7, p=0·06).	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Any type of substance use disorder was associated with future suicide attempt (OR=7·82, 95% CI 1·50–40·8, p=0·02), while controlling for previous psychiatric hospitalization, and major personal injury or illness.	Positive	

Unspecified substance	Disorder	Coêlho et al, 2010[85]	Brazil Community based	Adult (18 years old and older	Cross-sectional study	N/A	Suicidal ideation	Multivariate	Substance use disorder was associated with thoughts of death (OR=2·5, 95% CI 1·5-4·3, p<0.0004), desire of death (OR=2·1, 95% CI 1·1-4·1, p<0·03), suicide thought (OR=2·7, 95% CI 1·4-5·3, p<0·0002).	Positive	++
							Non-fatal suicidal behaviour: suicide attempt	Multivariate	Substance use disorder was not associated with suicide attempt (OR=0·6, 95% CI 0·1-3·9, p=0·60).	Null	
							Suicidal ideation	Multivariate	Substance use disorder was associated with thoughts of death (aOR=2·8, 95% CI 1·4-5·6, p<0·003), while controlling for gender, marital status, age group, education level, major depressive disorder, controlled by all demographic variables and the interaction with gender, and considering alcohol use disorder as effect modification, and two-way interaction of major depressive episode and substance use disorder, and gender with other socio-demographic variables, and major depressive episode and	Positive	

									substance use disorder. Three-way interaction of major depressive episode, substance use disorder, and gender could not be calculated.		
Unspecified substance	Disorder	Kittirattanapaiboon et al, 2014[44]	Thailand Community based	Both (15 to 59 years old)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicidal attempts	Multivariate	Illicit drug use was associated with risk of suicide (aOR=2·09, 95% CI 1·55-2·81, p<0·001).	Positive	+
Unspecified substance	Disorder	Nock et al, 2009[138]	Brazil; Bulgaria; Colombia; India; Lebanon; Mexico; Nigeria; China (Beijing & Shanghai & Shenzhen); Romania; South Africa; Ukraine Community based	Adult (18 years old and older)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Any substance use disorder was associated with lifetime suicide attempt (OR=4·8, 95% CI 4·0–5·8, p<0·05).	Positive	+
							Non-fatal suicidal behaviour: Suicide attempt	Bivariate	Any substance use disorder was associated with subsequent suicide attempt (OR=5·4, 95% CI 4·3–6·8, p<0·05).	Positive	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Any substance use disorder was not associated with lifetime suicide attempt, while controlling for age, age-squared, age cohorts, sex, and personyear. No statistical results provided.	Null	
							Non-fatal suicidal behaviour:	Multivariate	Any substance use disorder was not associated with lifetime suicide attempt p>0·05,	Null	

							Suicide attempt		while controlling for age, age-squared, age cohorts, sex, and person-year. No statistical results provided.		
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Substance use disorder was not associated with suicide attempt, while controlling for age, age-squared, age cohorts, sex, and personyear. No statistical results provided.	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Substance use disorder was not associated with subsequent suicide attempt, while controlling for age, age-squared, age cohorts, sex, and person-year. No statistical results provided.	Null	
Unspecified substance	Disorder	Tong & Phillips, 2010[51]	China National/ regional registers (e.g. not clinical-based registers)	Both	Case-control study	Male 986 (61.8%) & female 610 (38.2%)	Fatal suicide	Multivariate	Substance use disorders was associated with suicide risk (OR=2·71, 95% CI 1·81-4·07, p<0·05), while controlling for gender, age, urban versus rural residence and five diagnostic groups (mood disorders, anxiety disorders, psychotic	Positive	++

									disorders, substance use disorders, organic mental disorders, other mental disorders).		
							Fatal suicide	Multivariate	Suicide risk associated with substance misuse among men males (OR=1·79, 95% CI 1·22-2·62, p<0·05) and women (OR=1·77, 95% CI 0·49-6·31, p<0·05), while adjusting for age, and urban versus rural residence, substance use disorders.	Positive	
Unspecified substance	Disorder	Torres et al, 2011[97]	Brazil Clinic-based (e.g. mobile clinic, free clinic)	N/A	Cross-sectional study	Male 254 (43.6%) & female 328 (56.4%)	Suicidal ideation: suicide thought	Multivariate	Substance use disorder was associated with current suicidal thought (aOR=3·33, 95% CI 1·44-7·68, p=0·005), lifetime suicidal thoughts (aOR=2·56, 95% CI 1·21-5·45, p=0·014), while controlling for other psychiatric disorders.	Positive	++
							Non-fatal suicidal behaviour: suicide plan	Multivariate	Substance use disorder was associated with lifetime suicidal plans (aOR=2·06, 95% CI 1·01-4·23, p=0·048), while controlling for other psychiatric disorders.	Positive	

Unspecified substance	Disorder	Uwakwe & Gureje, 2011[137]	Nigeria Community based	Adults (18 years old and older)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicide behaviour	Bivariate	Any substance use disorder was associated with suicide attempt (OR=6·3, 95% CI 1·9-20·5, p<0·05).	Positive	++
							Non-fatal suicidal behaviour: Suicide behaviour	Multivariate	Substance use disorder was not associated with suicide attempt (OR=2·4, 95% CI 0·4-14·4, p=0·11), while controlling for any anxiety disorder, any mood disorder, any impulse disorder, and any disorder.	Null	
							Non-fatal suicidal behaviour: Suicide behaviour	Multivariate	Substance use disorder was not associated with suicide attempt (OR=2·4, 95% CI 0·4-14·4, p=0·11), while controlling for any anxiety disorder, any mood disorder, any impulse disorder, and any disorder, age, age-squared, sex, cohorts, and int categories.	Null	
							Suicidal ideation	Multivariate	Any substance use was associated with suicidal ideation (OR=3·3, 95% CI 1·0-10·4, p<0·05), while controlling for any anxiety disorder, any mood disorder, any impulse disorder, and number of other disorders.	Positive	

							Non-fatal suicidal behaviour: Suicide behaviour	Multivariate	Any substance use was not associated with suicide attempt (OR=3·0, 95% CI 0·6–15·7, p=0·19), attempt among ideators with a lifetime plan (OR=0·6, 95% CI 0·1–2·9, p=0·53), attempt among ideators without a lifetime plan (no statistical results provided), and plan among ideators (OR=0·9, 95% CI 0·2–3·3, p=0·83).	Null	
Unspecified substance	Disorder	Wei et al, 2013[53]	China Hospital based	Both (15 to 60 years old)	Cohort study	Male 53 (22.2%) & female 186 (77.8%)	Non-fatal suicidal behaviour: Suicide attempt	Bivariate	A greater proportion of substance-related disorder patients reported impulsive suicide attempt when compared to nonimpulsive suicide attempt (5·6% vs. 0%), (x^2=5·47, df=1, p=0·019).	Positive	++
Unspecified substance	Disorder	Zhang, Xiao, & Zhou, 2010[57]	China Community	Both (15 to 34 years old)	Case-control study	Male 214 (51.5%) & female 178 (48.5%)	Fatal suicide	Bivariate	A greater proportion of substance use disorder individuals were suicide victims when compared to the control group (6·4% vs. 0·9%), no other statistical results provided).	Positive	++

Unspecified substance	Multiple: abuse & dependence	Borges et al, 2010[82]	Mexico National/ regional registers (e.g. not clinical-based registers)	Adult (18 to 65 years old)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Lifetime suicide attempt was not associated with drug abuse or dependence (OR=2·6, 95% CI 0·6-11·1, p>0·05), while controlling for age, age-squared, sex, cohorts, and initial categories.	Null	++
							Suicidal ideation	Multivariate	Lifetime suicidal ideation was associated with drug abuse or dependence (OR=4·8, 95% CI 1·8-12·7, p<0·05), while controlling for age, age-squared, sex, cohorts, and initial categories.	Positive	
							Suicidal ideation	Multivariate	Among the subgroup of ideators: drug abuse or dependence was not associated with a plan among ideators (OR=0·3, 95% CI 0·1-1·1, p>0·05).	Null	
							Non-fatal suicidal behaviour: Suicide attempt	Multivariate	Drug abuse or dependence was not associated with a planned attempt (OR=1·2, 95% CI 0·1-9·4, p>0·05).	Null	
							Non-fatal suicidal behaviour:	Multivariate	Drug abuse or dependence was not associated with an unplanned attempt	Null	

							Suicide attempt		(OR=0·7, 95% CI 0·1-3·8, p>0·05).		
Unspecified substance	Multiple: abuse & dependence	Guimarães et al, 2014[87]	Brazil Hospital based	Adults (18 years old and older)	Cross-sectional study	Male 45 (36%) & female 80 (64%).	Non-fatal suicidal behaviour: Suicide risk	Bivariate	Abuse/dependence of alcohol /other drugs was not associated with suicide risk (OR=1·73, 95% CI 0·73-4·08, p>0·05).	Null	++
Unspecified substance	Multiple: dependence & addiction	Lavania et al, 2012[113]	India Hospital based	Adults (18 to 60 years old)	Cross-sectional study	Male 100%	Non-fatal suicidal behaviour: Deliberate self-harm	Bivariate	Deliberate self-harm among patients was associated with substance dependence (x^2=8·40, df=1, p=0·02).	Positive	-
Unspecified substance	Multiple: abuse & dependence	Nock et al, 2009[138]	Brazil; Bulgaria; Colombia; India; Lebanon; Mexico; Nigeria; China (Beijing & Shanghai & Shenzhen); Romania; South Africa; Ukraine	Adult (18 years old and older)	Cross-sectional study	N/A	Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Multivariate interactive model (all disorders together in a discrete time survival model controlling for number of disorders as interactions) includes the following covariates: age, age-squared, age cohorts, sex, and person-year. Drug abuse or dependency was associated with suicide attempt (OR=7·5, 95% CI 5·4–10·4, p<0·05), while controlling for age, age-squared, age cohorts, sex, and person-year.	Positive	+

			Community based				Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries. Among the total sample, drug abuse or dependency predicted suicidal attempt (OR=2·1, 95% CI 1·2–3·6, p<0·05).	Positive	
							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries. Among the total sample, drug abuse or dependency was associated with suicide attempt (OR=4·0, 2·5–6·4, p<0·05).	Positive	
							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries.	Positive	

									Among the total sample, drug abuse or dependency was associated with suicide attempt (OR=3·0, 95% CI 2.2–4·2, p<0·05).		
							Suicidal ideation	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries. Among ideators, drug abuse or dependency was associated with suicide pan (OR=4·0, 95% CI (2·5–6·4, p<0·05).	Positive	
							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries. Among ideators, drug abuse or dependency was associated with a plan (OR=1·7, 95% CI 1·1–2·6, p<0·05).	Positive	
							Non-fatal suicidal behaviour:	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV	Null	

							Suicide attempts		disorders and subsequent suicidal behavior—developing countries. Among ideators, drug abuse or dependency was not associatedwith a planned attempt (OR=1·5, 95% CI 0·9–2·8, p>0·05).		
							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Multivariate survival models of associations between type/number of prior DSM-IV disorders and subsequent suicidal behavior—developing countries. Among ideators, drug abuse or dependency was not associated with an unplanned attempt (OR=1·4, 95% CI 0·5–4).	Null	
Unspecified substance	Multiple: Use & abuse	Noori et al, 2013[104]	Iran Others	Adults (Mean=36; SD=8)	Cross-sectional study	Female 100%	Suicidal ideation	Multivariate	Personal history of drug use was associated with suicidal ideation among women whose partners are drug users (OR=9·22, 95% CI 1·73-49·2, p=0·009), while controlling for age, years of marriage, and physical	Positive	+

							Non-fatal suicidal behaviour: Suicide attempts	Multivariate	Personal history of drug use was associated with suicide attempt among women whose spouses are drug users (OR=7·24, 95% CI 1·671-31·3, p=0·008), while controlling for age and years of marriage did not.	Positive	
Unspecified substance	Multiple: Use & abuse	Peltzer et al, 2008[132]	South Africa School based	Adolescents (14 to 19 years old)	Cross-sectional study	Male 358 (30.9%) & female 799 (69.1%)	Non-fatal suicidal behaviour: Suicide risk	Bivariate	Drug use patterns among suicide risk and nonsuicide risk students were similar, with the most commonly used drugs being alcohol [mean=1·57 (SD=1·6) vs. mean 1·11 (SD=1·4), t=-4·01, p<0·001], tobacco [mean=0.34 (SD=0·4) vs. mean=0·21 (SD=0·1), t=-4·10, p<0·001], cannabis [mean=0·26 (SD=0·4) vs. mean=0.14 (SD=0·3), t=-4·11, p<0·001] (dagga) and, in a small percentage, hard drugs [mean=0·19 (SD=0·7) vs. mean=0·05 (SD=0·2), t=-4·34, p<0·001]. Compared to suicide risk students, however, nonsuicide risk	Positive	++

									students reported significantly less tobacco use, alcohol use, cannabis use, combined hard drug use, and fewer drug use control problems [suicide risk mean=0·88 (SD=1) vs. nonsuicide risk mean=0·56 (SD=0·8), t=-4·37, p<0·001], and drug use consequences [suicide risk mean=1·05 (SD=0·9)] vs. nonsuicide risk mean=0.46 (SD=0·7), t=-8·24, p<0·001] than did suicide risk students.		

Note: *The parameters of the World Health Organisation is used: child = 0 to 9 years old, adolescent = 10-19 years old, and adult = 20 years old and older. †Study quality: high= (++), acceptable= (+), low (-).

Appendix B: Figures to illustrate Word Bank region, World Bank income group, study setting, substance type and substance dimension, suicide dimension, and study design

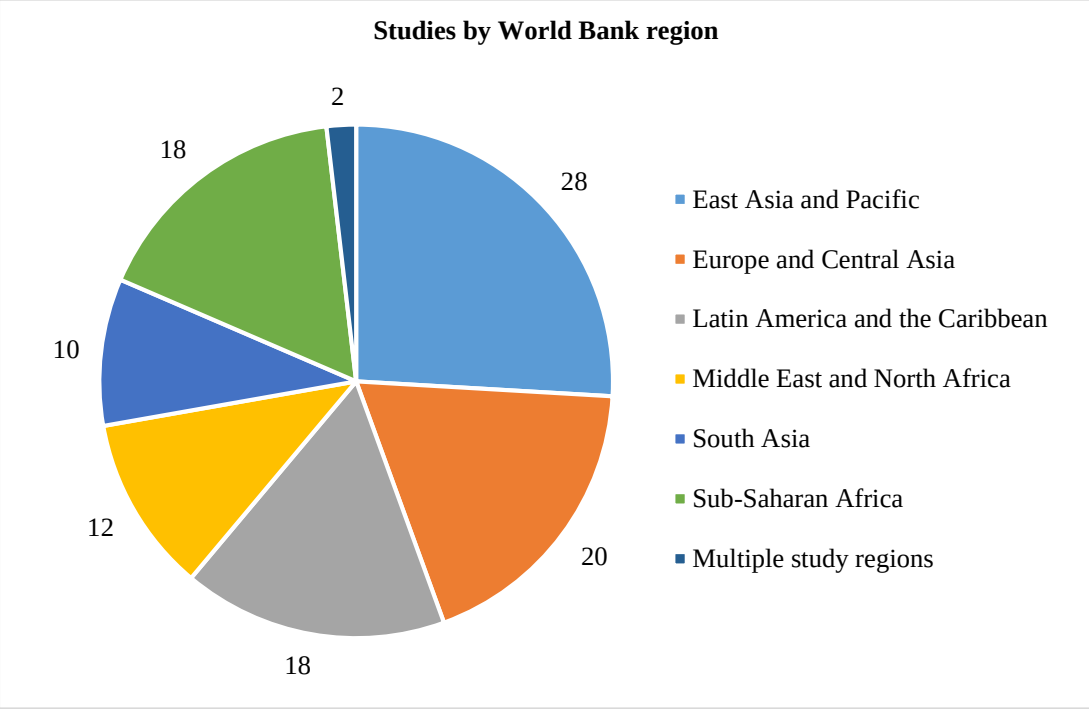

Fig. 2 Number of studies by World Bank region, as per the World Bank list of Country and Lending Groups.[28]

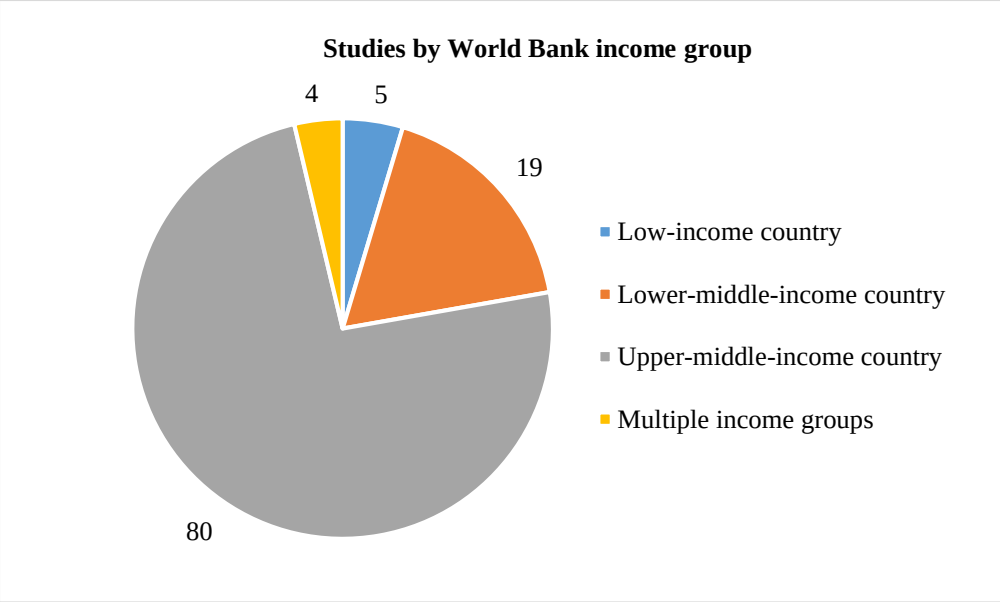

Fig. 3 Number of studies by World Bank income group, as per the World Bank list of Country and Lending Groups.[28]

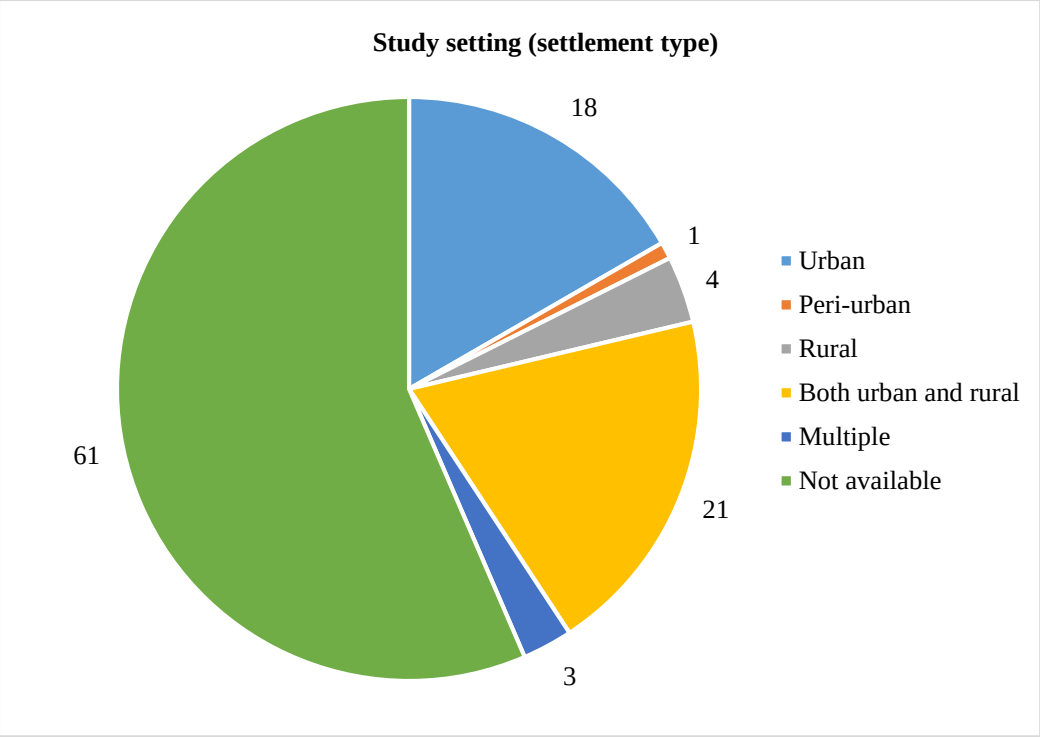

Fig. 4 Number of studies that were conducted in each type of settlement.

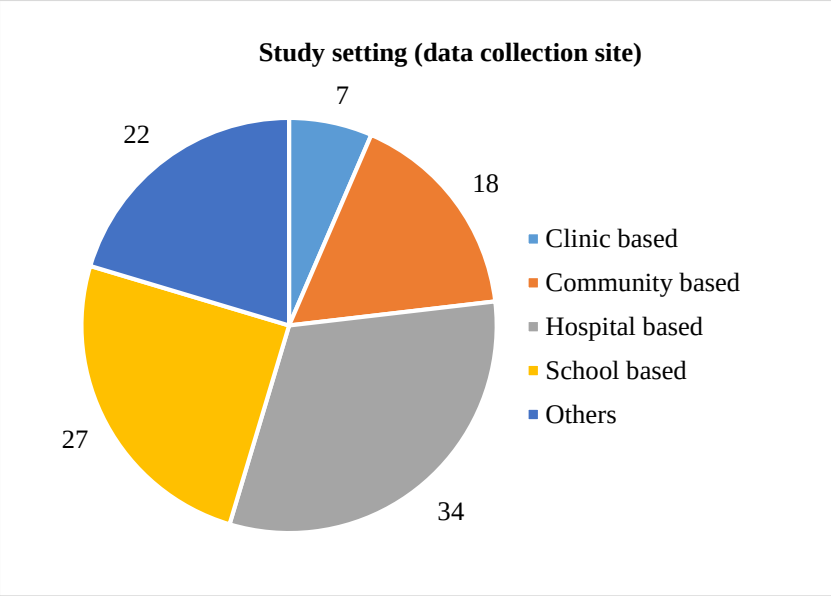

Fig. 5 Number of studies that collected data from each type of setting.

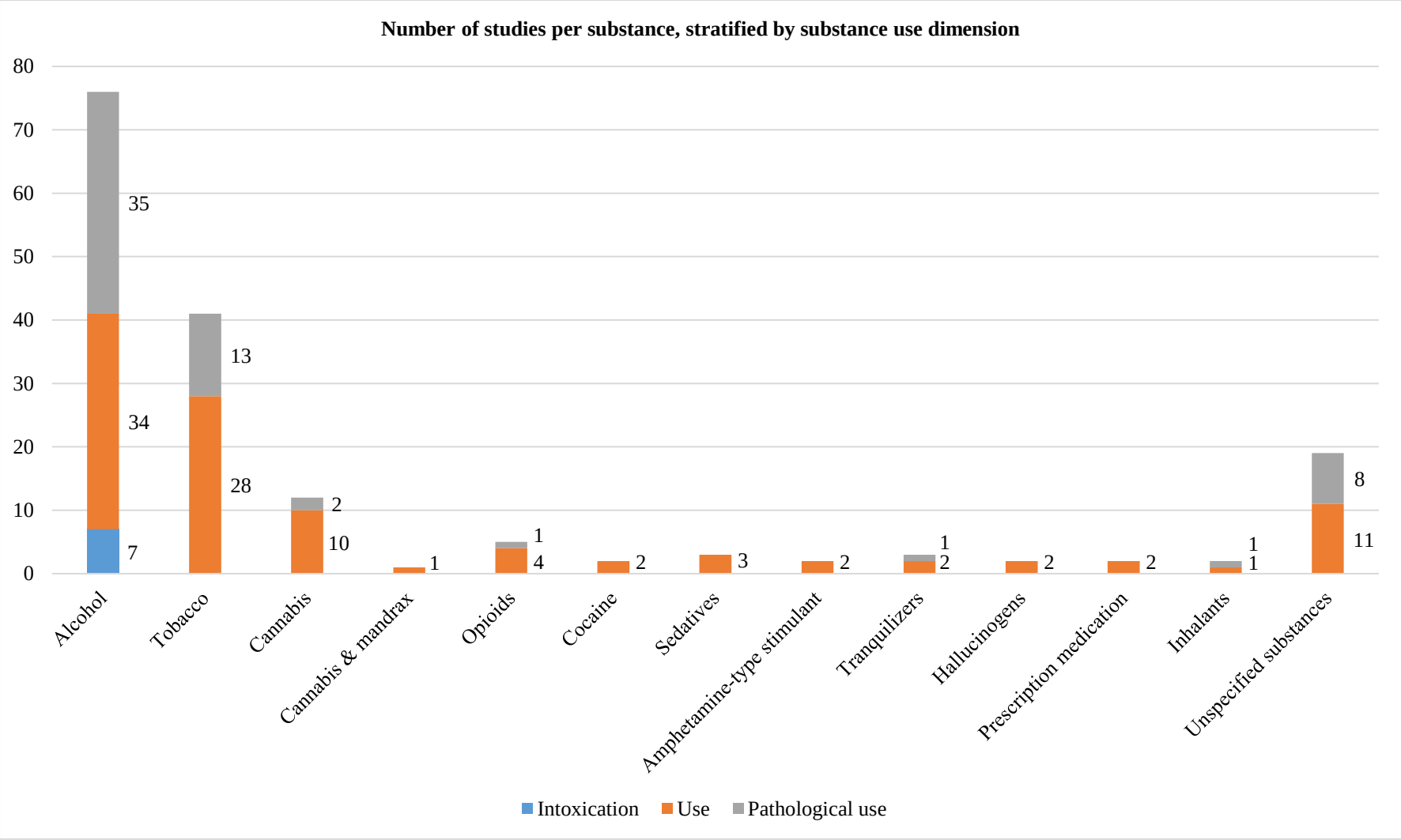

Fig. 6 Number of studies that investigated each substance and its relationship with suicidal ideation and behaviour, stratified by dimension of substance use.

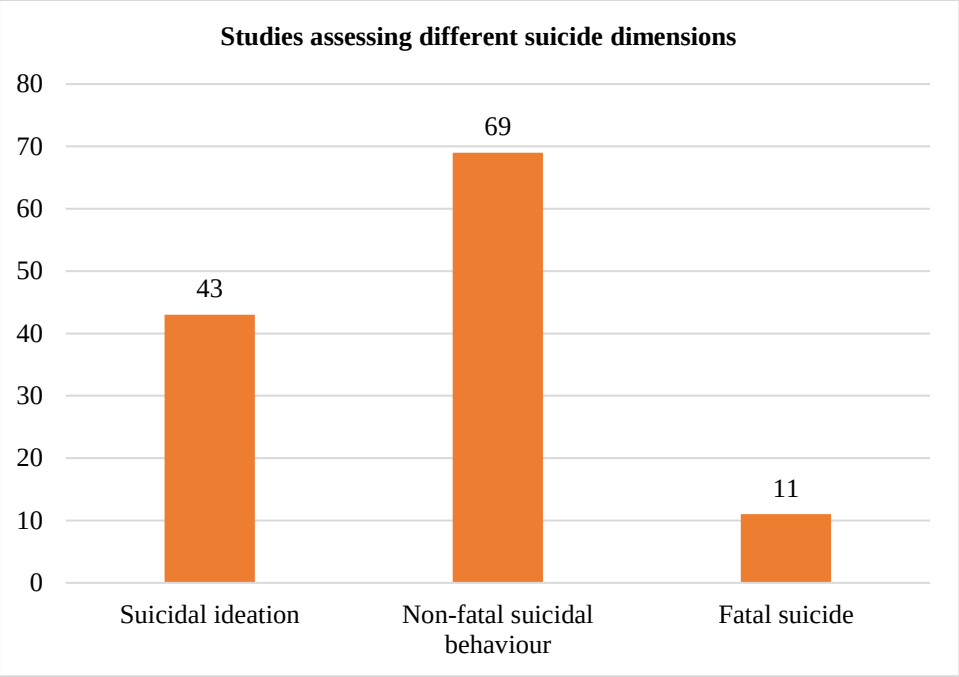

Fig. 7 Number of studies that assessed each dimension of suicidal ideation and behaviour and its relationship to substance use.

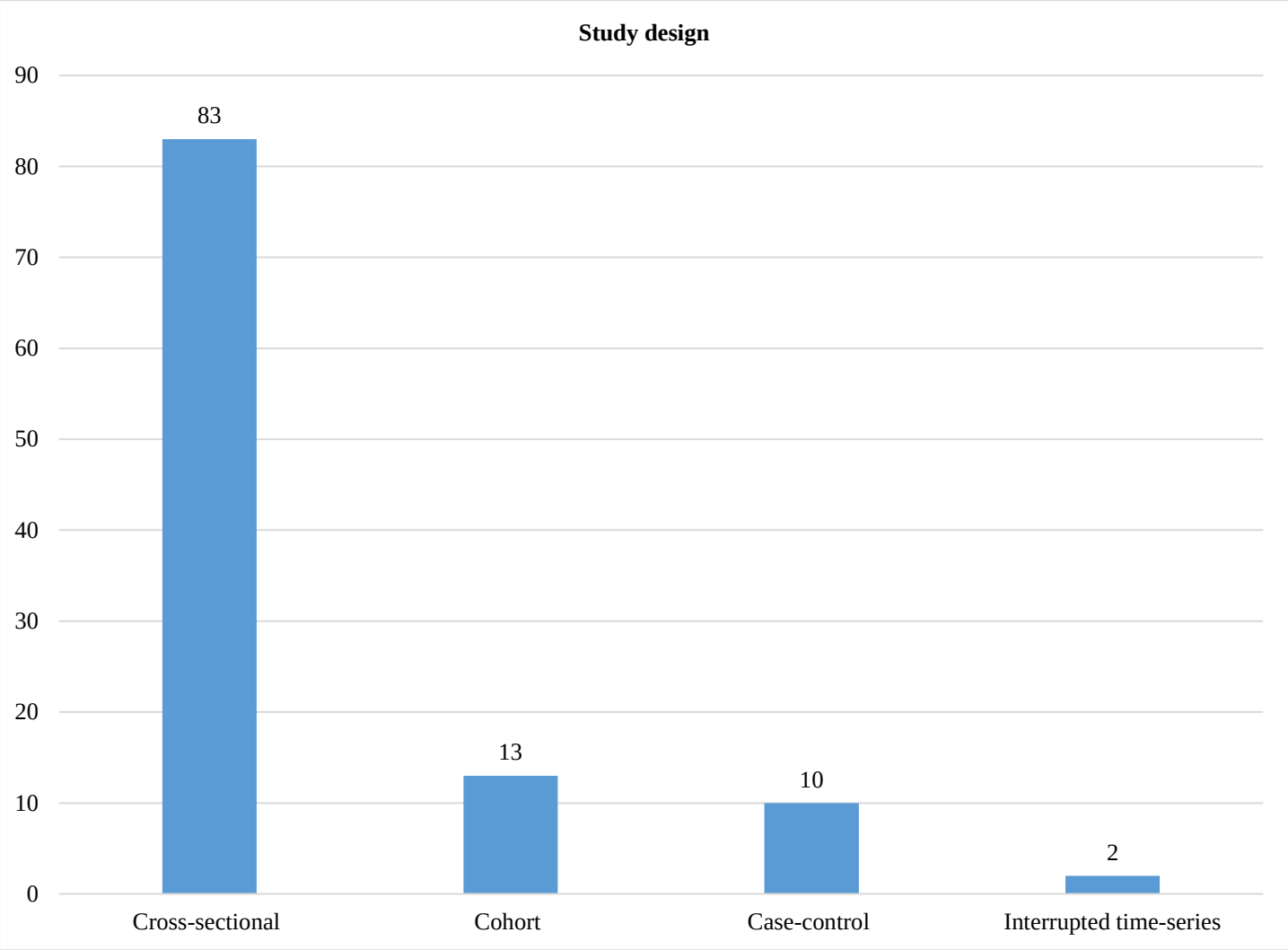

Fig. 8 Number of studies that utilised each type of study design.