THE UNIVERSITY OF SYDNEY

# The role of alcohol and other drugs in suicidal behaviour and effective interventions to reduce suicidal thoughts and behaviours

Evidence check prepared for the National Suicide Prevention Task Force and commissioned through the Suicide Prevention Research Fund, managed by Suicide Prevention Australia - July 2020

The Matilda Centre for Research in Mental Health and Substance Use

Fisher A, Marel C, Morley K, Teesson M, Mills K.

# Contact

The Matilda Centre for Research in Mental Health and Substance Use

Level 6 Jane Foss Russell Building
City Rd,
Darlington, NSW, 2006

Dr Alana Fisher (Project lead):
a.fisher@sydney.edu.au

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# 1. Executive summary

Alcohol and other drug (AOD) use are prevalent within the Australian society and are implicated in an increased risk of suicidal thoughts (i.e., ideation) and behaviours (including suicide attempts and completed suicides) [1-3]. Furthermore, there is often an interplay between problematic AOD use and other risk factors of suicide at the individual, interpersonal/relational and community levels [4-6]. In order to guide Australian national-level strategy and initiatives on suicide prevention, there is a need to better understand the role of AOD use in suicidal outcomes as well as discern which interventions focussing on AOD use have been found to be effective in reducing suicidal thoughts and behaviours.

In April 2020, The National Suicide Prevention Taskforce commissioned The University of Sydney's Matilda Centre for Research in Mental Health and Substance Use to undertake a Rapid Review and Evidence Check. The overall objective of this Rapid Review and Evidence Check was to outline the role of alcohol/other drugs as a risk factor for suicidal behaviour, and to review interventions focussed on alcohol/ other drugs for their effectiveness in reducing suicide attempts and suicide deaths (as opposed to suicidal ideation only). This knowledge synthesis was to form the basis for evidence- and consensus-based recommendations, which will in turn inform the National Suicide Prevention Adviser's advice to the Australian Government.

To direct the scope of the review, three questions were posed:

> Question 1: What role does alcohol and/or other drugs play in suicidal behaviour and how does it interact with other risk factors for suicide?
>
> Question 2: What alcohol and other drug interventions have been shown to be effective in reducing suicidal thoughts and behaviours?
>
> Question 3: What recommendations could be made about interventions that may be most appropriate and feasible within the Australian context?

To address these questions, the review team undertook a systematic search of key databases in public health, medicine, and psychology, i.e., Medline, PsycINFO, EMBASE, and Scopus. To supplement the empirical research, the review team also performed searches of the grey literature (e.g., via Google) and consulted with field experts for their suggestions on additional literature to include. Returned articles were screened for relevance according to an a priori set of eligibility criteria, based on the PI(E)COS framework and iteratively refined by the project team and field experts.

Given the short time frame for undertaking this Rapid Review and Evidence Check (May – June 2020), this review primarily comprised a review of reviews (i.e., a meta-review) of the recent literature from 2010 onwards. The meta-review included a narrative synthesis of the best available secondary research (i.e., systematic and meta-analytic reviews where available) as well as key primary research which is unlikely to be captured within existing reviews due to its recency (e.g., post 2018) or due to its research design/methodology (e.g., not randomised controlled trials [RCT]).

Findings for Question 1 revealed that AOD use has a complex and multidimensional role in the development of suicidal thoughts and behaviours. The literature demonstrated a consistently robust relationship between AOD use and risk of suicidality. The presence of chronic AOD use (incl. AOD use disorders) and acute AOD intoxication, were both implicated in increased risk for suicide and were common amongst people who had attempted and/or died by suicide. Problematic AOD use appeared to interact with other life stressors and contextual factors to influence suicide risk, including sex, age, minority or Indigenous/First Nations identity, and co-occurring mental health conditions. AOD use also appeared to play a role in the transition from suicidal ideation to suicidal acts, and acute AOD intoxication was implicated in suicidal attempts which were more likely to result in death. Adolescence and young adulthood were shown to be a critical risk period for suicide, as both problematic AOD use and suicidality often emerge for the first time during this period, and risk factors present in adolescence led to increased suicide risk in adulthood.

For Question 2, the evidence base appeared considerably smaller and less developed compared to that for Question 1. Searches revealed a variety of individual and population-level interventions focussing on AOD use which targeted different levels of risk for suicide. Interventions included Government policies (e.g., alcohol legislation, outlet density), community-based and primary care initiatives (e.g., awareness-building and gatekeeper training, alcohol restrictions in at-risk communities), school-based interventions, interventions targeting high priority groups (e.g., psychoeducation), and psychosocial and other clinical interventions for adults and adolescents in treatment (e.g., Cognitive Behaviour Therapy, brief interventions). Research in this area is nascent as most suicide prevent interventions do not include AOD use as a focus. Research is also limited by a scarcity of evaluation data for implemented interventions, reliance on self-report measures of suicidality, and insufficient sample sizes to detect meaningful reductions in suicidal behaviours. Furthermore, the research is mainly investigator-led and is not clearly aligned to national policy and strategic frameworks.

With reference to key findings for Question 1 and 2, Question 3 findings outline the following broad guidelines. These guidelines are for interventions to be: i) informed by an understanding of how AOD use contributes to suicidal behaviours; ii) informed by the best available empirical evidence; and iii) to be aligned with existing policy and strategic frameworks.

Within these broad guidelines, a number of preliminary recommendations are proposed.

Recommendations include having AOD-focussed suicide prevention interventions which:

- take a multicomponent and multi-layered approach to addressing risk for suicide;
- aim both to prevent the development of new cases and to manage existing cases of problematic AOD use and/or suicidality;
- are part of larger, sustainable programs with ongoing funding to permit successful implementation and evaluation of long-term effectiveness;
- are flexible enough to accommodate and proactively respond to changes in a person's problematic AOD use and suicidality;
- include school-based interventions, gatekeeper training, integrated psychosocial treatments with appropriate aftercare and frontline clinician training, government led-policy such as

alcohol pricing and taxes, and community-led initiatives such as awareness building and routine screening and brief interventions in the GP setting;
- effectively 'bridge the gap' between primary and secondary prevention strategies and simultaneously address universal, selected, and targeted levels of prevention.

Finally, AOD specific initiatives for suicide prevention are proposed, which align with the widely-advocated systems approach to suicide prevention.

# 2. Background

Suicide is a major and complex health and societal challenge with far reaching impacts on the individual, their family, community and broader society. In Australia, suicide was responsible for the premature death of over 3,046 people in 2018 [7]; it was also the leading cause of death for people aged 15 to 44 years and the third leading cause of death for those aged 45 to 55 years [7].

Moreover, suicide claims the lives of Australians when they are relatively young and realising their potential as productive citizens. It accounts for one in three deaths among people aged 15 to 24 years and more than one in four deaths among people aged 25 to 34 years [7]. It is unsurprising then that, in 2018-2019, suicide attempts deaths by suicide resulted in an estimated economic cost of between $1.6 to $6 billion, which includes both direct and indirect costs through lost productivity [8].

Despite the significant efforts and investment by the Australian Government in advancing suicide prevention efforts, including the National Mental Health and Suicide Prevention plans (currently in its fifth iteration) [9], there have not been accompanying reductions in suicide attempts or suicide deaths. In fact, one of the strongest predictors of death by suicide remains prior suicide attempt/s and self-injurious behaviours [10]. Clearly there is a need to better delineate the risk factors for suicidal behaviours in order to inform more effective prevention interventions which target those most at risk.

Alcohol and other drug (AOD) use is consistently associated with increased risk of suicide. It is one of the strongest predictors of suicidal thoughts and behaviours, even after accounting for other psychiatric and sociodemographic determinants [11-13]. A comprehensive body of literature from longitudinal and cohort studies and psychological autopsies finds both acute AOD intoxication, and more chronic AOD use, encompassing chronic heavy drinking and/or clinically diagnosed AOD use disorders, increase a person's risk of suicidal thoughts (i.e., ideation) as well as suicidal behaviours (i.e., attempts and completed suicides) [14]. Alcohol is implicated in approximately one third of suicide deaths [15], and between 19 to 63% of people who complete suicide have a history of diagnosed AOD use disorder/s [16]. Problems relating to AOD use may also compound the effects of co-existing mental health conditions or stressful life events, such as financial hardship and relationship breakdown, which are other known risk factors for suicide [17].

Given the widespread and highly burdensome nature of AOD use in Australia, and evidence pointing to AOD use increasing the risk of suicidal ideation and behaviours [11-13], a national and coordinated effort is needed across government agencies, community-based organisations and treatment services. This effort will facilitate effective responses to the confluence of risk factors, including AOD use, which lead to suicide in Australia. In July 2019, the Australian Government appointed Ms Christine Morgan as the first National Suicide Prevention Adviser to report directly to the Prime Minister, with the aim of working towards a proactive, whole-of-government approach to suicide prevention [18]. The National Suicide Prevention Adviser is supported by the National Suicide Prevention Taskforce and aims to keep people healthy and address the reasons that lead to suicide, ensure people in distress have immediate access to effective support, and build the capacity of communities and service providers to identify and respond to people who are at risk of suicide [18].

To inform the National Suicide Prevention Adviser's advice to the Government, The National Suicide Prevention Taskforce commissioned a Rapid Review and Evidence Check in April 2020. With references to the available secondary literature (i.e., reviews and reports in the published and grey literature) as well as recent primary literature (i.e., high-quality empirical studies), this review sought to address three key questions centred on AOD use and suicide.

Specifically, these questions were:

> Question 1: What role does alcohol and/or other drugs play in suicidal behaviour and how does they interact with other risk factors for suicide?
>
> Question 2: What alcohol and other drug interventions have been shown to be effective in reducing suicidal thoughts and behaviours?
>
> Question 3: What recommendations could be made about interventions that may be most appropriate and feasible within the Australian context?

In addressing these questions, the review provided a comprehensive synthesis of the available evidence, with a particular focus on the psychological, sociodemographic, and clinical risk factors for suicidal behaviours along with a focus on population-based (i.e., public health) interventions which can be delivered in community and be targeted towards at-risk groups. In addition, in light of plans to use recommendations to guide policy and other strategic initiatives, the project team was to provide comment on the quality and strength of the available evidence, and its applicability to the Australian context.

The information in this review to be provided to the National Suicide Prevention Adviser:

- is current and evidence-informed;
- aligns with co-existing policy priorities;
- considers feasibility and implementation of interventions alongside their effectiveness.

# 3. Methods

The current Rapid Review and Evidence Check undertook a scoping review approach, however, to ensure comprehensive coverage of the literature, a systematic search protocol was employed. The protocol was developed by the project team in line with the PI(E)COS and PRISMA frameworks, and in consultation with experts in suicide prevention and the Suicide Prevention Australia/National Suicide Prevention Task Force. Given its scoping nature and limited timeframe for completion (May – June 2020), this review focussed on identifying and synthesising secondary literature sources (2010 onwards) including systematic and other literature reviews, as well as recent primary literature sources (2018 onwards). Additional key articles from empirical and grey literature sources were also included at the project team's discretion.

*Database search strategies*

Key electronic databases were searched for relevant literature sources: MEDLINE, EMBASE, PsycINFO, and Scopus. Search results were limited to studies published in the English language, comprising human subjects, between the start of January 2010 (2018 for primary research literature) to 18 May 2020. No other limits were applied to secondary literature searches; searches for primary research were restricted by article type ('Article' or 'Article in Press').

Initial keyword search strategies were developed based on Suicide Prevention Australia/National Suicide Prevention Task Force proposal specifications, and Google Scholar keyword searches of reviews focussing on AOD use and suicide. Strategies were further developed through discussions with project team members and collaborators, which included researchers and clinicians with expertise in suicide prevention and AOD interventions. Search strategies were refined via consultation and iterative review with a specialist academic librarian.

Separate search strategies were developed for Questions 1 and 2, given their different foci. These strategies were similar except that Question 1 included a concept related to 'risk factors' whereas Question 2 included a concept related to 'interventions'. Search strategies utilised a combination of free text/ keyword terms and MEdical Subject Headings (MeSH). Since different databases utilise different search terms, these were adapted to each database as required.

The full search strategies for each question and for each database are provided in Appendices A and B.

In brief, variations of search terms pertaining to the following key conceptual domains were used:

1) Questions 1 and 2: Alcohol and other drug/substance use-related terms (e.g., alcohol intoxication, alcohol abuse, drug abuse, substance abuse);
2) Question 1: Risk factors ('at risk', predisposing factors, antecedents, longitudinal, male, indigenous); Question 2: Interventions (early intervention, prevention, health promotion, mass media, treatment);
3) Questions 1 and 2: Suicide (exp. suicide attempt, completed suicide)
4) Questions 1 and 2: Systematic and literature review-related terms (review, synthesis, meta-analysis).

Note that Concept 4) was removed when searching for recent primary research studies. Adjacency terms were also used, to enhance the flexibility and comprehensiveness of the search and accommodate variations in the wording of relevant terms and phrases.

*Grey literature searches*

Grey literature was used to supplement published reviews/recent primary empirical studies identified through database searches. To ensure comprehensive coverage of the grey literature, a number of strategies were used, including searches of:

i) Google and Google Scholar (incognito mode; first 10 pages of search results) using combination of the terms "suicide", "prevention", "intervention", "alcohol", "substance", and "drug";
ii) Australian State and Territory Ministry of Health government websites;
iii) Australian, Canadian, UK, and US Departments of Health (e.g., NIH, NHS) and other government agency websites (e.g., SAMHSA, NICE guidelines);
iv) Non-government organisations and research centres in the AOD (e.g., NADA, ADF, Turning Point) and mental health sectors (e.g., CRESP, Black Dog Institute, Beyond Blue);
v) Agency for Clinical Innovation Suicide Prevention and Mental Health News listserv articles (NSW Health), 24 May 2020 onwards.

Grey literature was sourced, selected and added to on an iterative basis in consultation with field experts, and decided on by the review team. In this way, the grey literature was used to:

- inform/build on the published empirical evidence in instances where there are significant gaps/limitations in the published literature (e.g., lag in the published literature, some special populations not well covered), as well as
- contextualise the final report findings in terms of the current policy priorities and the Australian clinical landscape.

*Data screening*

Screening and selection procedures was based on PRISMA guidelines (See Figure 1 below) [19]. Given the increased flexibility afforded by a scoping review, articles were added and/or removed based on relevance to the review questions (crf. Background).

The data screening process (i.e., removal of duplicates, title/abstract screening, full text screening) was done using the Covidence online data management software. After removing all duplicates, the Project Lead screened titles and abstracts for relevance and potential inclusion in the review, according to specified eligibility criteria derived from PI(E)COS (i.e., Participants, Intervention/Exposure, Comparison, Outcomes, Setting, Study type/design; see Appendix C).

Uncertainties regarding inclusion were discussed and resolved in consultation with the project team. Once uncertainties were resolved and any amendments to the eligibility criteria made, those returned articles judged as potentially eligible were retained for the subsequent step involving independent, full-text screening by the Project Lead.

The project team reviewed the articles retained for final inclusion and again, added and/or removed articles based on their relevance to the review questions. Final included articles were then used as the basis of the review results.

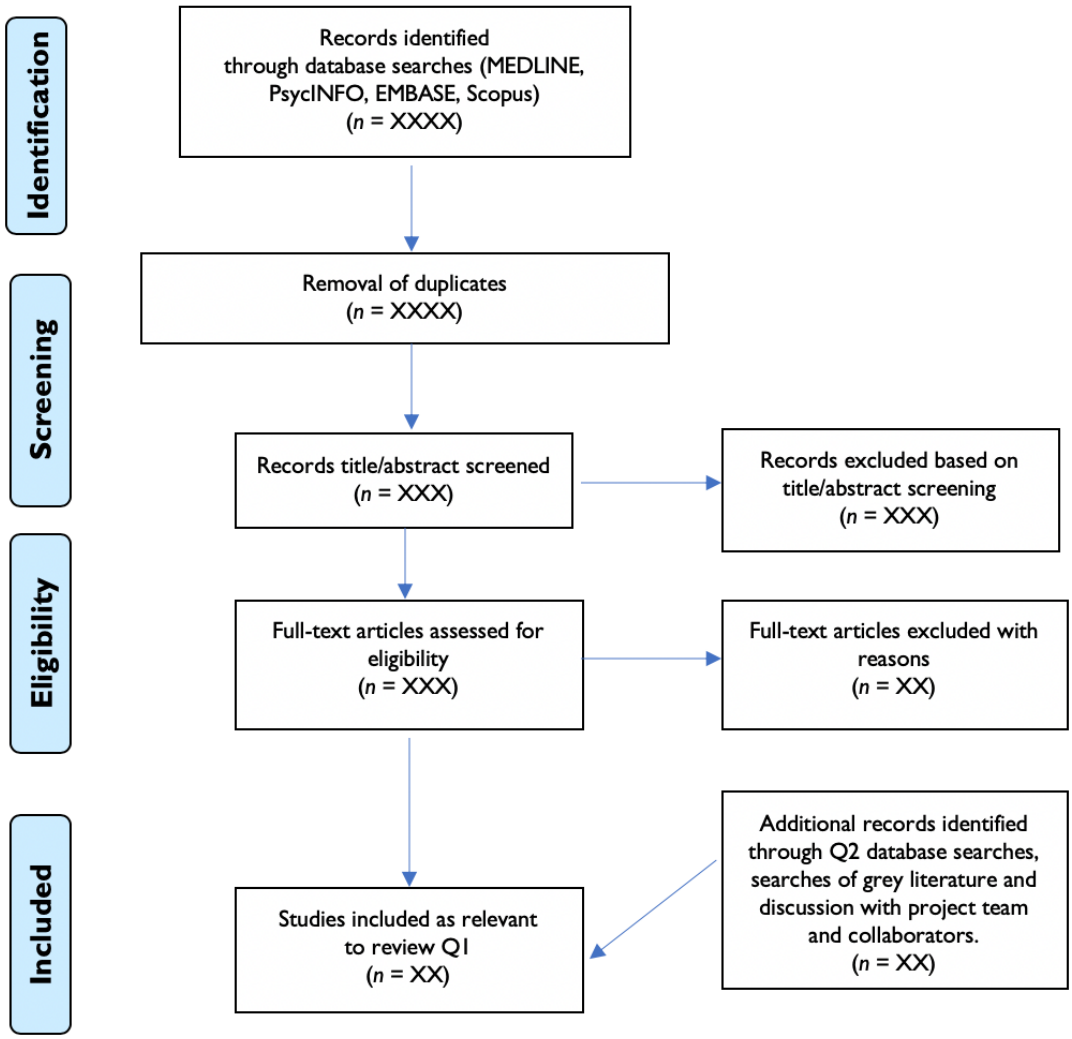


*Figure 1.* PRISMA flow diagram.

*Quality of evidence assessment*

Due to time restrictions, the review team did not undertake a full assessment of the quality of the evidence. Quality assessment is typically beyond the 'scope' of a scoping review [20], however, given that this review will be used to inform recommendations and advice to government, the current evidence should be considered in light of its quality. In reporting on the quality of the evidence, the review team relied on the article authors' own assessment and provided additional comments as needed on components such as study design/rigor, consistency of findings, health impact, generalisability and applicability as per the NHMRC Body of Evidence Matrix.

# 4. Key findings

Search results

For Question 1, database searches returned a total of 4473 articles. Of these, 1656 duplicates and 2702 irrelevant articles were removed based on title and abstract screening (see Figure 2 for PRISMA flow chart). Full-text screening of the remaining 115 articles excluded a further 77, mostly due to: not being suitable to a high-level literature synthesis (e.g., observational study with small sample; n=43), and exposure type (e.g., not related to AOD or risk factors for suicide; n=10). An additional 37 unique articles were added based on database searches for Q2, searches of the grey literature, and consultation with field experts and external collaborators. This left 75 articles deemed potentially relevant in answering Question 1. As the current Evidence Check rapid review was designed to be a comprehensive rather than exhaustive search of the literature, articles referenced in the sections below were those of greatest relevance.

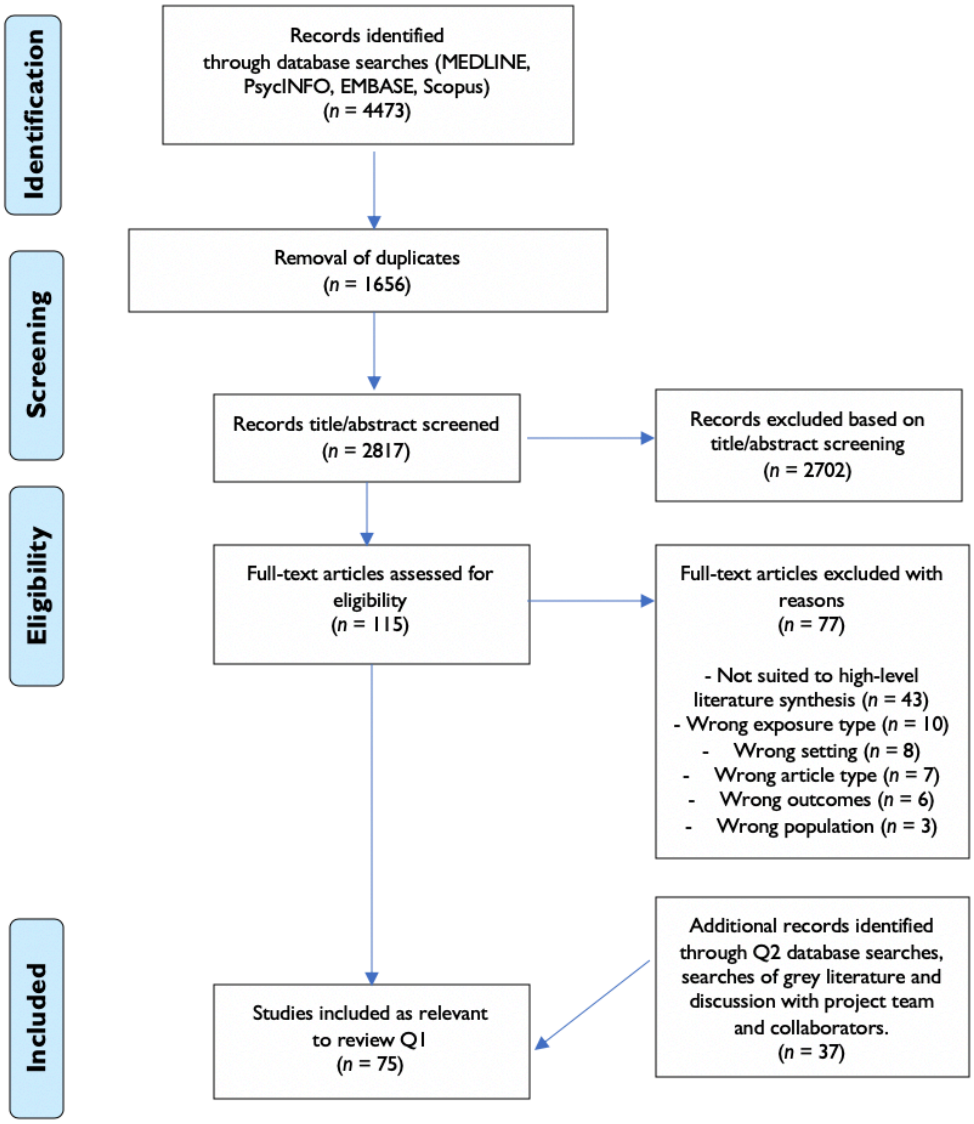


*Figure 2.* PRISMA flow diagram for Question 1.

For Question 2, separate database searches returned a total of 4997 articles. Of these, 2126 duplicates and 2574 irrelevant articles were removed based on title and abstract screening (see Figure 3 for PRISMA flow chart). Full-text screening of the remaining 115 articles excluded a further 92, mostly due to: intervention type (e.g., not related to AOD or suicidality; n = 45), outcomes (e.g., suicidal ideation or self-harm without link to suicidal behaviours; n= 23), and article type (e.g., conference proceedings, editorial, unpublished dissertation; n = 19). An additional 51 unique articles were added based on database searches for Q1, searches of the grey literature, and consultation with field experts and external collaborators. This left 74 articles deemed potentially relevant in answering Question 2. As the current Evidence Check rapid review was designed to be a comprehensive rather than exhaustive search of the literature, articles referenced in the sections below were those of greatest relevance.

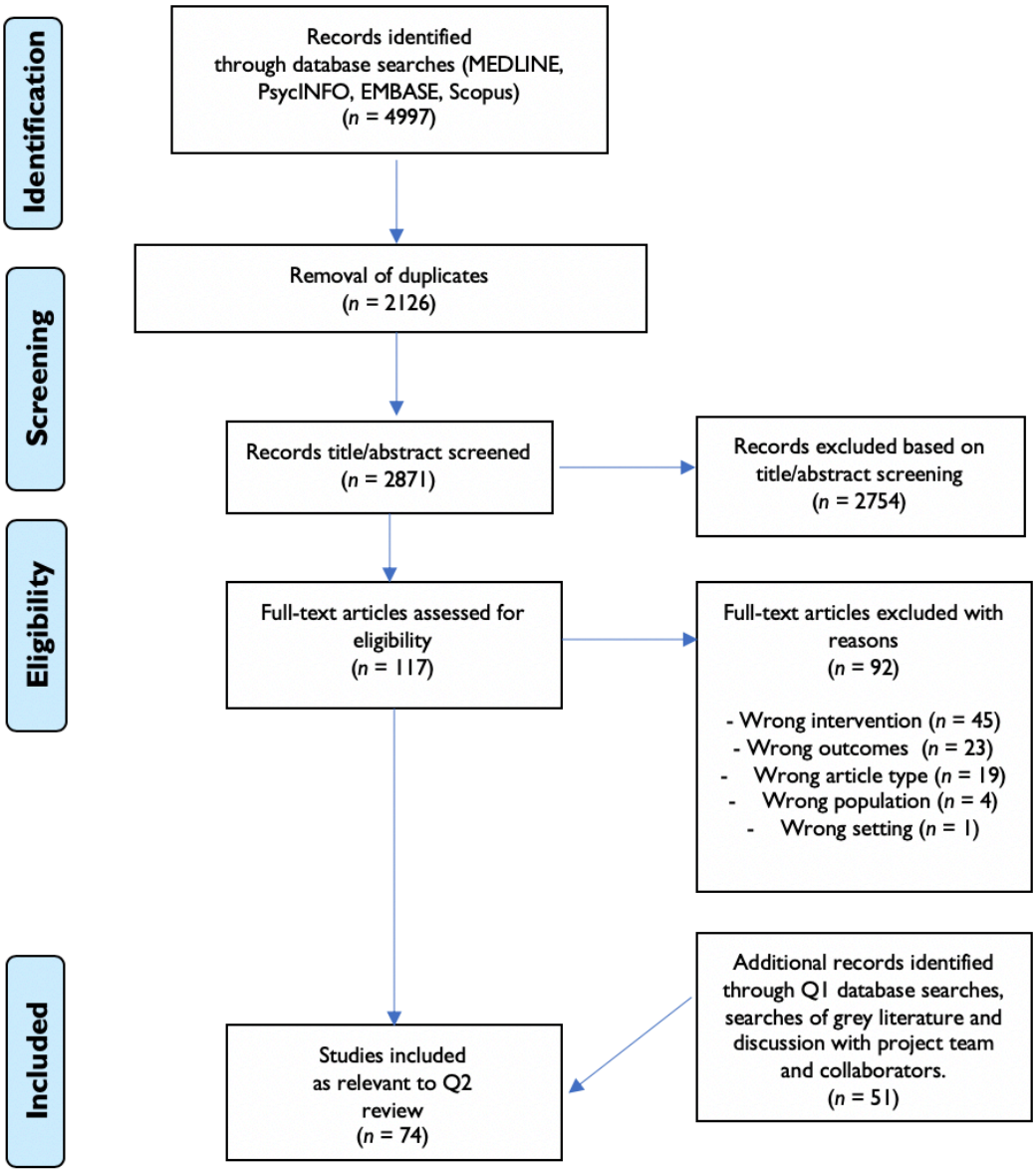


*Figure 3.* PRISMA flow diagram for Question 2.

## Question 1 key findings

*What role does alcohol and/or other drugs play in suicidal behaviour and how does it interact with other risk factors for suicide?*

Question 1 aimed to synthesise the literature on the role AOD has in suicidal behaviours, and how they interact with other risk factors for suicide. In line with the brief provided by SPA, a high-level synthesis was provided in answering Question 1.

*Overall associations between AOD use and suicide risk*

A meta-analytic literature published since 2010 showed a consistent and robust association between AOD use and the presence of AOD use disorders (according to established diagnostic or other clinical criteria) and increased risk of suicide [1, 11, 21, 22]. Evidence for this association is derived from various types of research including cohort studies, longitudinal studies, psychological autopsies, and nationally representative surveys [2]. The majority of evidence has been focused on the role of alcohol in increasing the risk of suicide (e.g., [1, 23]); however, recent literature has also examined whether the role of other drugs increase this risk (e.g., cannabis, tobacco, poly-drug use [3, 22]). For example, a 2020 meta-analysis of cohort studies found that general alcohol consumption is associated with 65% increased risk of suicidal behaviours (RR 1.65, 95% CI:1.33, 2.05), defined as suicidal ideation, suicide attempts, and suicide death [1]. Alcohol-related increases in suicide risk in the general population mirrored earlier meta-analytic findings that AOD use disorders increased the risk of suicidal ideation (OR 2.04, 95% CI: 1.59, 2.50), suicide attempt (OR 2.49, 95% CIs: 2.00, 2.98) and suicide death (OR 1.49, 95% CI: 0.97, 2.00) [21]. Of note, however, the increased risk associated with suicide death was non-significant.

Positive associations between AOD use and suicide emerge across all categories of AOD use disorders (alcohol only, tobacco only, drug only, and their combinations), but there is considerable variability between the different categories of disorder and associated suicide risk. For example, a recent US population case control study using electronic health records found the risk of completed suicide for people with tobacco use disorders was 3.5 times higher compared to case-controls. Meanwhile, while this risk increased 30.7 times for people with multiple AOD use disorders (alcohol, tobacco, other drug)[3]. Of note, positive associations still held after adjusting for other social and clinical factors such as age, education attainment, poverty level, medical comorbidities, and co-occurring psychiatric diagnoses [3].

In addition, both acute AOD use (i.e., intoxication) and diagnosed AOD use disorders are commonly implicated in individual suicide attempts and deaths. In their 2020 review of psychological autopsy studies, Connery et al report that 19 – 63% of people who die by suicide have a personal history of diagnosed AOD use disorder/s [2]. Furthermore, 26 – 44% of people who present to emergency departments (incl. in Australia) after a suicide attempt have acute alcohol intoxication [22]. A dose-dependent relationship also exists, such that higher levels of intoxication are associated with even greater increases in risk of suicide attempt compared to lower levels of intoxication [22].

Several explanations have been posited to explain the relationship between AOD use and increased risk of suicide. Firstly, AOD use may be indirectly rather than directly linked to increased risk of suicide, insofar as a person may use AOD as a means of coping with psychological distress [24]. Overtime, chronic AOD use may maintain or exacerbate the person's psychological distress and in turn, increase the likelihood that they will engage in suicidal behaviours [24]. As well as interacting with pre-existing psychological vulnerabilities, chronic AOD use may trigger or exacerbate events which precipitate suicidal behaviours (i.e., life stressors), such as intimate relationship breakdown, divorce/separation, unemployment and financial hardship [25].

A second explanation shifts the focus from chronic to acute AOD use, acute alcohol intoxication may lead to reduced inhibitions and a concomitant increase in impulsivity, making it more likely that a person will act on suicidal thoughts [25], and resort to more violent and lethal suicide means [2]. This latter explanation, that alcohol intoxication facilitates a person's transition from suicidal thoughts to suicidal behaviour, is consistent with research showing that the presence or history of an AOD use disorder (incl. abuse and dependence) distinguishes between people who ideate about suicide versus those who attempt or re-attempt suicide [11, 26, 27]. The research is mixed with regards to whether the association between AOD use disorders and suicide (re-)attempts is mainly driven by other risk factors, such as mental health disorders, with only some studies indicating an independent association [11, 26]. The higher lethality of suicide attempts among people with acute alcohol intoxication also aligns with findings that AOD use disorders have the lowest ratio of suicide attempts to suicide deaths of 12 prevalent DSM-5 psychiatric diagnoses [28].

Taken together, it is apparent in the literature that the role of AOD use in suicide is complex and multidimensional; AOD use operates both as a distal risk factor (i.e., chronic heavy AOD use, AOD use disorders) and as a proximal or immediate risk factor for suicidality (i.e., acute AOD use and intoxication)[29]. AOD use also reinforces the relationship between suicidal thoughts/ideation, suicide attempts, and suicide deaths, making it more likely that a person will transition from one to the next.

In addition to the overall findings above, the literature searches highlighted a number of contextual factors related to the role of AOD use in suicide, as well as its interaction with other risk factors for suicide. Contextual factors encompassed specific populations, such as adolescents and youth; socio-demographic factors, such as sex and age; clinical factors, such as the presence of co-existing mental health conditions; and belonging to a vulnerable or higher-risk population, such as indigenous or LGBTIQ communities. Key findings, as they pertain to each theme, are discussed below.

*Sex and age across the lifespan*

Recent reviews, general population-based studies, and empirical studies have revealed differences in suicidal behaviours as a function of both sex and age. The presence of AOD use disorders is associated with increased risk of suicide for both males and females [3]. However, compared to females, males are more likely to engage in risky AOD use and to die by suicide [4, 28]. By contrast, females have higher rates of suicidal ideation and suicide attempts compared to males [4, 28]. Sex differences in rates of suicide attempts versus suicide deaths, may in part be explained by evidence showing that males are more likely to employ more lethal suicide methods (e.g., shootings and hangings) than females (e.g., self-poisoning) [28]. More violent suicide attempts by males also occur after overconsumption of AOD [30], which is a more common psychological coping strategy for men than

women [31]. The relatively higher ratio of suicide attempts to suicide deaths amongst females, may also be driven by a small group of females who frequently engage in suicide attempts [32]. These 'multiple attempters' often attempt suicide in the absence of clear suicidal intent, and the key driving force behind their attempts is emotion dysregulation and borderline-type personality traits [32].

As well as sex differences in the rates of suicide attempts and suicide deaths, sex also influences the relationship between alcohol use disorders and suicide [24]. In a recent cross-sectional study of young adults (aged 18 – 25 years old), alcohol abuse/dependence was directly associated with increased risk of suicidal ideation, planning and attempts for females, but only suicidal ideation and attempts for males. Alcohol abuse/dependence was also indirectly associated suicidal ideation, planning and attempts for females, via increases in psychological distress [24]. For males, this indirect association was only seen for increased risk of suicide ideation and planning, not attempts [24].

These findings support the idea that problematic AOD use and psychological distress may play a more direct consistent role to overall suicide risk among young females compared to young males. Similarly, studies conducted among adults show that AOD use disorders and mental health conditions (incl. depressed mood, depressive/bipolar-related disorders) account for greater increases in suicide risk for females than for males [3, 5, 33]. Compared to females, AOD use may interact with other extraneous social factors responsible for suicide risk in males, such as divorce/separation, unemployment and financial hardship, and criminal/legal issues [4]. These sex differences hold even after controlling for sociodemographic factors, such as age, education level, and marital status [4]. Of note, these life stressors often co-occur with problematic AOD use [29]. Considering which combination of life stressors confer the highest suicide risks, problematic AOD use combined with mental health issues confers the highest suicide risk for males (RR 6.85, 95% CI: 5.34, 8.79) and third highest risk for females (RR 8.31, 95% CI: 5.56, 12.42).

Regarding age-related differences in AOD use and suicide, there is recent evidence to show that problematic AOD use and/or AOD use disorders are associated with increased suicide risk for people of all age groups (15 – 64 and 65 years +) [3, 5]. That said, US population-based studies show that older age was negatively associated with problematic AOD use, whilst first suicide attempts occurring before age 18 were less likely to have a prior history of AOD use disorders compared to first suicide attempts occurring between 18 – 34 years and 35 years and over [34]. These data implicate AOD use/AOD use disorders as a stronger contributor to attempted suicide in younger and middle-aged adults compared to adolescents and older adults.

Interactive effects between age and sex on AOD use and suicide are also apparent. Australian suicide register data shows that the association between problematic AOD use and increased suicide risk is weaker for older adults (aged 65 years +) and young females (aged 15 – 24 years), with a more robust association for males (aged 15 – 64 years), and female adults (aged 25 – 44 years) [5]. Similarly, analyses of nationally-representative datasets in the US revealed that, with age, males were less likely to have non-alcohol substance use issues preceding suicide compared to their younger counterparts [4]. In sum, it appears that AOD use/AOD use disorders play a less prominent role in suicidal behaviour in the youngest and oldest age groups, with the exception of young males aged 15 – 24 years.

*Adolescence and youth specific*

Both problematic AOD use/AOD use disorders and suicidality tend to emerge for the first time during adolescence and young adulthood [35]. Binge drinking is the common pattern and can have significant neurodevelopment impacts which may in turn be implicated in suicidal behaviours through abnormal or delayed development of key frontal executive-control regions [36]. In their literature reviews, Pompili et al [35] and Clarke et al. [37] identify several research studies which consistently support a link between a high(er) prevalence of problematic AOD use/AOD use disorders and increased risk of suicide deaths and suicide attempts amongst adolescents. Quantifying this relationship, a 2019 systematic review and meta-analysis of population-based longitudinal studies considering non-clinical samples of young people (aged 12 – 26 years) found that previous alcohol abuse and other drug abuse increased the likelihood of suicide attempts (OR 2.14 – 4.44) [38]. Drug use was a risk factor for suicide death among males but not females, increasing their risk of suicide death by over 5 times [38].

Data from a representative sample of >30,000 US high school students (grades 9 – 12) sought to stratify the cohort according to their risk of suicide ideation and attempts [39]. Amongst students at high risk for suicide ideation and highest risk for suicide attempts (7% of the total cohort), the vast majority were engaging in problematic AOD use (41.4% problematic alcohol use up to 87.6% cannabis use) [39]. Meanwhile, students at highest risk for suicide ideation and high risk of suicide attempts (22% of the total cohort) had more limited problematic AOD use overall (1% problematic alcohol use up to 28.5% unprescribed prescription medication use)[39]. By contrast, amongst students at moderate risk (i.e., the lowest risk) for both suicidal ideation and suicide attempts (52% of the total cohort), only a small proportion were engaging in problematic AOD use (0.4% problematic alcohol use up to 9.3% cannabis use)[39]. Based on these findings, there was no positive linear relationship between greater severity of AOD use and increased suicidality amongst adolescents. Rather, other risk factors such as sexual orientation, bullying and early sexual intercourse play a prominent role [39]. That said, high and low levels of AOD use are implicated in the highest and lowest risk groups of adolescents, respectively.

US-based longitudinal research has mapped the trajectory between difficulties in high school and later suicide risk. A 2020 study using CDC data (2015, 2017) showed significant correlations between problematic AOD use while at school and increased rates of suicide death by age 35 for both males ($r = 0.53$, $p < 0.001$) and females ($r = 0.36$, $p = 0.04$) [40]. Of note too, problematic AOD use in school was also significantly associated with other risk factors for suicide death before age 35: Individuals with problematic AOD use at school were more likely to have a mental health condition, and for males, also more likely to experience difficulties at school (e.g., low grades, repeating a school year) [40]. These data suggest that problematic AOD use during high-school years may serve as an important "early marker" for increased risk for early suicide death; further, problematic AOD use is likely to co-occur and interact with other risk factors for early suicide death.

Given that problematic AOD use often co-occurs with other risk factors for youth suicidal behaviours, a cross-sectional survey of almost 30,000 US college students sought to characterise these interactive effects [41]. Firstly, findings revealed that drug use, but not problematic alcohol use was associated with increased likelihood of suicide ideation, plan and attempts in the previous 12 months. The study authors argue that the lack of association between problematic alcohol use and suicidality may be

attributable to the fact that a relatively high proportion of the sample engaged in problematic alcohol use (~40.5%)[41]. Findings also confirmed that psychological risk factors interact to influence these young adults' suicide risk, such as problematic alcohol use and other drug use, depression and problematic alcohol use, and depression and other drug use. [41]. Interaction effects were explained in terms of psychological risk factors having shared elements, such as stress and emotion dysregulation.

*Co-occurring mental health conditions and trauma*

Both mental health and AOD use disorders represent independent risk factors for suicide [42]. A 2014 community-based survey of Australian adults confirmed that common mental disorders (incl. AOD use disorders) were associated with increased risk of suicidal ideation, however, only alcohol use disorder, post-traumatic stress disorder (PTSD), obsessive compulsive disorder (OCD) and attention deficit hyperactivity disorder (ADHD) were associated with increased risk of suicide attempts [42]. Further, a clear relationship between comorbidity and suicide ideation was identified, such that increasing numbers of comorbid mental disorders (incl. AOD use disorders) were associated with increased risk of suicide ideation, but not for suicide attempts [42]..

Other literature has examined suicide risk in regard to specific mental health and AOD use comorbidities. Across a number of different mental health disorders, the presence of problematic of AOD use or alcohol use/other drug use disorders is linked with greater likelihood of suicidal behaviours. For example, in one systematic review and meta-analysis of suicide amongst people with bipolar disorder, those with a current or past history of AOD use disorders were ~1.5 – 2 times more likely to attempt suicide [43]. Similar findings are observed for patients with mood disorders who misuse of alcohol, other drugs, or tobacco; any problematic AOD use at intake doubled patients' risk of suicidal acts (attempts or suicide) [44].

Recent empirical findings provide insight into the relationship between AOD use, co-occurring mental health symptoms, and subsequent suicide risk. Firstly, problematic AOD use may increase suicide risk due to its association with undertreatment for mental health concerns. Irrespective of mental health diagnosis, people who also misuse drugs (other than alcohol) appear less likely to receive mental health treatment prior to their suicide [45]. Secondly, problematic AOD use may also increase suicide risk through the maintenance of co-existing mental health symptoms. Among military personnel with elevated PTSD symptoms, days using cannabis was associated with increased likelihood of suicidal behaviour and more stable PTSD symptoms over the following 12-month period [46]. Thirdly, problematic AOD use increased the impact of, and exposure to, other risk factors for suicide amongst people with mental health conditions. Based on psychological autopsies, people with depression and problematic alcohol use were found to have more stressful life events preceding their suicide (e.g., family conflict, divorce/separation, legal issues), and were more likely to be under the influence of AOD at the time of their death compared to people with depression only [47]. In this sample, rates of suicide death did not differ based on whether problematic AOD use preceded (49%) or followed depression onset (44.4%); however, people with AOD use concerns prior to depression had higher recent interpersonal conflict [47]. Taken together, these findings suggest that those with co-occurring AOD use and mental health conditions tend to have a more complex and 'loaded' profile, which combines multiple risk factors for suicide.

*Priority populations – Indigenous youth*

Limited recent empirical research has examined the role of AOD use in suicidal behaviours amongst specific populations who are disproportionately impacted by suicide, including Indigenous youth. A 2019 systematic review confirmed that, compared to non-Indigenous Australians, Aboriginal and Torres Strait Islander youth have elevated prevalence of suicidal ideation and suicide-related concerns, suicide attempts, and suicide deaths [48]. Elevated rates appear especially pronounced amongst indigenous youth who are incarcerated compared to youth in the community [48]. This review identified only two studies considering the role of AOD use and suicide risk amongst Indigenous youth, and findings were somewhat mixed. Increased risk of suicidal ideation and suicide attempts were associated with parents' AOD use problems, whilst youth who engaged in risky AOD use themselves (heavy drinking, smoking, and cannabis use) were no more or less likely to have suicidal ideation or attempt suicide (OR = 1.8, non-significant) [48]. The other study in this review also found no link between youth's own AOD use and suicidal ideation but did not consider risk of suicide attempts. Taken together, the association between AOD use and suicide risk for Indigenous youth may be explained in terms of the impact AOD use has on family functioning more generally and promoting more impulsive suicide attempts (in the absence of suicidal ideation).

*Priority populations – LGBTQI youth*

In the recent literature on suicide risk during adolescence and emerging adulthood, youth who identify as lesbian, gay, bisexual, transgender, queer or intersex (i.e., LGBTQI) are at higher risk of suicidal ideation and suicide attempts [39, 41]. A large 2020 study using US school-based survey data of ~13,000 adolescents revealed that adolescents who identify as LGBTQI have higher rates of problematic AOD use, depression and anxiety, bullying victimisation and sexual abuse [49], which are consistently found to be risk factors for suicidal behaviours [39, 41]. It has been suggested that sexual minority/LGBTQI status creates stress which negatively impacts on young people's mental health and increases their exposure to other risk factors for suicide, including problematic use of AOD [49].

*Priority populations – Incarcerated adults*

Another group at disproportionately higher risk of suicide are the prison population. In a 2015 – 2016 Belgian study of mostly male prisoners, almost half (44%) had a lifetime history of suicidal ideation and of these, almost half (47%) had also attempted suicide [27]. In this study, self-reported lifetime history of problematic (non-alcohol) drug use was more prevalent among prisoners who had attempted versus only thought about suicide. However, this association was no longer present after controlling for other variables such as lifetime history of a mental health disorder, non-suicidal self-injury, and violent offending [27].In this way, problematic drug use may interact with other factors, such as a co-occurring mental health disorder, to facilitate the transition from suicidal ideation to suicide attempts in the prison population [27].

*Other priority populations*

Literature searches did not identify any reviews or recent primary research investigating the role of AOD in suicidal behaviours in other priority populations. A 2012 synthesis of three qualitative studies investigated suicide amongst Australian men living in rural and remote areas affected by drought/flooding [50]. A common theme to emerge in the studies was men's widespread use of alcohol to 'self-medicate'. This use of alcohol accompanied a traditional view of masculinity, stoicism

in the face of adversity, and reluctance to seek help for mental health issues [50]. In this way, alcohol may contribute to high rates of suicide in this population [50].

Further highlighting this research gap in priority populations, a 2019 systematic review on suicide in culturally and linguistically diverse (CALD) populations did not identify any relevant studies in Australia [51]. This said, identified studies of CALD populations (including immigrants and refugees) in other countries, such as the US and Canada, linked a number of factors with increased risk of suicidal thoughts and behaviours. Cited risk factors for suicidality included financial hardship and unemployment, difficulties with acculturation/integration into the host country, breakdown of family structures and family conflict, social isolation, and perceived stigma (incl. self-stigma) with regards to mental illness and help-seeking [51]. Of note, many of these risk factors are stressors which commonly co-occur with problematic AOD use [5]. These co-occurring risk factors are also especially important to consider in CALD populations, given that 2019 Mental Health Commission guidelines for AOD treatment indicate that CALD populations may be reticent to seek help for problematic AOD use [52].

## Question 2 key findings

*What alcohol and other drug interventions have been shown to be effective in reducing suicidal thoughts and behaviours?*

Question 2 aimed to synthesise the literature on AOD interventions which have been shown to be effective at reducing suicidal thoughts and behaviours. In answering Question 2, the primary focus was on public health-oriented interventions, with a secondary focus on individual treatment/clinical interventions.

*Government-led policies and interventions*

Most AOD-focussed suicide prevention interventions centring on changes to policy involving changes to alcohol taxation and pricing, and accessibility. Alcohol policies aim to restrict or reduce excessive alcohol consumption at the individual and population level, and stem from evidence showing a positive association between per capita alcohol sales and deaths by suicide [53]. A 2016 systematic review involving mostly US-based studies showed that overall, increases to alcohol excise taxes (and therefore prices) were associated with decreases in deaths by suicide [53]. That said, excise tax on alcoholic beverages may have differential effects based on sex. For example… increased beer prices may have less of an impact on females (who consume these beverages less often than males) and youth suicides [53]. The effects of alcohol taxation/pricing on suicide were also explored in an earlier 2010 meta-analysis; based on four studies, increases to alcohol taxes/pricing were only effective at reducing suicide rates after removing the results of one outlier study showing a positive association [54].

Other state and national government-initiated alcohol policies which show positive impacts on suicide rates and alcohol-related suicide deaths include: i) enactment of minimum alcohol-purchasing age and higher minimum alcohol-purchasing age (e.g., 21 years old versus 18 years old), ii) lower off-premise and on-premise alcohol outlet densities, and iii) zero tolerance laws for drivers under the

minimum legal alcohol purchase age [53]. These policies appeared especially effective at reducing suicide deaths among younger males with more limited effectiveness for females and adults in general. By contrast, alcohol prohibition and enforcement of 'dry communities' under state law did not appear to be effective at reducing suicide rates in community.

Other research on initiatives to reduce suicide following economic downturn has found that government policies to control the price and availability of alcohol (e.g., increasing cost per alcohol unit) were effective at limiting the harmful effects of alcohol, including fewer alcohol-related hospital admissions [55].

*Community-based and primary-care interventions*

A 2011 literature review identified a number of community-based programs designed to target the antecedents to suicidal behaviour, including problematic AOD use [56]; however, none of the reviewed AOD-focussed programs report evaluation data, and as such there is limited evidence as to their effectiveness at reducing or preventing suicide [56].

Amongst depression-focussed suicide prevention programs which do report evaluation data, most show positive or neutral effects on suicide rates in the community [56]. One example is a 10-year community-based intervention for elderly Japanese adults, which involved initial screening and awareness-building of depression, psychoeducation and self-assessment of depression together with long-term follow-up with a primary-care clinician. In regions that implemented this intervention, there were reductions in risk of suicide death for women but not men (25 – 76% reductions) compared to non-intervention regions. Other community-based interventions reporting impacts on suicidality include a telephone helpline and emergency response service (in Italy) and a depression awareness-building campaign (in Germany), which were followed by a decrease in suicide rates (up to 70% for women) and suicide attempts (18%), respectively [56].

A 2016 review explored the role of GPs/primary care physicians in screening for and intervening in problematic AOD use and suicidal intention. In this review, identified studies showing that brief screening tools for problematic AOD use and depression and/or suicidal intention were widely available and feasible to use within the primary care setting [57]. Specifically, the 'Well Woman Visit' was presented as an opportune time to integrate this type of screening as these visits typically occurred annually and coincided with when women may be at increased risk, and the impacts of problematic AOD use and/or suicidal ideation may be the greatest, for example when becoming sexually active, during pregnancy, or postpartum [57].

*School-based interventions for adolescents*

Based on the recent literature, the majority of non-clinical interventions for suicide prevention in adolescents and youth have been conducted in high school settings. School-based interventions tend to be 'upstream' prevention focussed, insofar as they address distal factors which may predispose adolescents to poorer mental health, suicidal ideation and behaviour, such as problematic AOD use, bullying, help-seeking and social connectedness/support [58]. The majority of interventions were delivered universally (i.e., to the entire school student population), with a smaller number targeted towards adolescents who were displaying low-level symptoms, or may be at higher risk due to characteristics such as belonging to a sexual, gender or ethnic minority [58].

In terms of evaluating the efficacy of school-based interventions, most of the evidence to date has centred on self-reported suicidal ideation and/or suicide attempts rather than suicide deaths [58]. Moreover, most school-based interventions targeting AOD use do not evaluate suicide-related outcomes thus their effectiveness at suicide prevention warrants greater research attention [58]. However, from the perspective that problematic AOD use is a risk factor for youth suicidality, it is worthwhile alluding to school-based interventions that effectively prevent or delay AOD use. Australian RCTs of school-based interventions for the AOD prevention have demonstrated effects in preventing the uptake and reducing problematic AOD use, with impacts lasting up to 24 months post-intervention [59-61].

One identified school-based intervention which aims to reduce problematic AOD use and also reports suicide-related outcomes is the 'Family Check-Up' [62]. This US-based early-prevention program was delivered to 6$^{th}$ grade students as a universal and targeted intervention and focussed on parenting skills and family functioning. In a RCT with long-term follow-ups, engagement with Family Check-Up was associated with lower risk of youth suicide (incl. suicidal ideation and attempts) both at 18-19 years and at 28-30 years [62].

A second identified school-based intervention which has shown to improve both AOD use-related and suicide-related outcomes is the provision of school-based mental health services to at-risk adolescents [63]. Based on findings from a large US-based survey ('The Oregon Healthy Teens Survey' ~n=9000 students), students attending schools which had increased mental health services during the survey period were less likely to report suicidal ideation or suicide attempts, and reported lower rates of cigarette smoking , cannabis use, and unauthorised prescription drug use [63].

Another identified school-based intervention linked to improved AOD- and suicide-related outcomes is 'Preventure', a targeted intervention strategy focussed on personality traits associated with early initiation of AOD use and AOD use disorders, including hopelessness, impulsivity, anxiety sensitivity and sensation seeking [64]. Based on eight RCTs in community samples of high risk adolescents, Preventure is associated with consistent and enduring reductions in AOD use (including binge drinking and uptake of other drugs such as cocaine and cannabis up to 3 years follow-up) as well as ~25% reduced likelihood of transitioning to suicidal ideation, serious mental health and conduct issues [64]. Preventure has since been developed and tested in Australian schools in a number of cluster RCTs [59-61, 65].

Finally, another rapid review evidence check identified a school-based intervention in the Netherlands called 'Skills For Life' [66]. This multifaceted intervention targeted various health promoting and risk behaviours in adolescents aged 13 – 16 years, including alcohol consumption, cigarette smoking, bullying, and suicidal ideation. The intervention showed positive effects on alcohol consumption and cigarette smoking, however, its effectiveness at reducing suicidal thoughts was limited to students in lower year groups (grades 7 – 8 equivalent) [66].

*Interventions in priority populations – Men*

A 2019 literature review identified a number of suicide prevention interventions targeted towards men at higher risk of suicidal behaviours [67]. Although problematic AOD use was not mentioned as a

specific focus of these interventions, the review noted that interventions targeted risk factors which predisposed men to suicidal behaviours. The reviewed community-based interventions reported as effective included public awareness campaigns, 'gatekeeper' awareness campaigns, and GP education. Regarding public awareness campaigns, one involving the distribution of informative leaflets at major train stations in Japan was associated with a reduction in male suicide rates at two months follow-up. However, this was not sustained at long-term follow-up (5 months). Given the lack of control region, it is also unknown whether reductions in male suicides reflected a wider trend at the time [67].

Regarding male-focussed 'gatekeeper' awareness campaigns, these involved training members of the community such as GPs, teachers, police, pharmacists who had face-to-face contact with many people in the community in the early detection and referral of men at risk of suicide. Three identified studies involving gatekeeper training and education on suicide in-community and in military settings reported reductions in male suicides post-intervention [67]. Despite these positive findings, these interventions formed part of a broader multi-layered program, and thus the review authors acknowledged that it was not possible to attribute reductions in suicide to the interventions alone.

GP education on male suicide prevention involved the provision of targeted education through educational videos and patient case discussions, information and screening brochures, and continuing medical education events such as lectures and interactive workshops. Three reviewed studies of GP education, using pre-/post- comparisons and a control (non-intervention) region, reported consistent reductions in male suicide rates [67]. By contrast, another reviewed study evaluating a GP awareness campaign found reductions in suicidal ideation but not suicide attempts. The review authors noted that the lack of effectiveness on suicidal behaviour may in part be explained by relatively low rates of suicide attempts [67].

*Interventions in priority populations – Indigenous communities*

Another priority population which has received some attention in the literature on suicide prevention interventions are Indigenous and First Nations peoples. Recent reviews identified three community-based prevention programs targeted towards AOD use in specific Indigenous groups at higher risk of suicide, however, only one program has been subject to evaluation [68-70]. This program involved community-initiated alcohol restrictions in a Native Alaskan community; such that the community was given control over local supply of alcohol. By way of a natural experiment, levels of alcohol restrictions on suicide rates were examined. Less restrictive alcohol control measures appeared to be more effective than more restrictive measures at reducing rates of suicides in the community [68]. The other two community-based interventions were targeted towards Native Alaskan youth at-risk of suicide, and identified studies have highlighted the feasibility and acceptability of these interventions as well as the importance of sustained involvement of the community in the development of interventions and evaluation measures [69].

Literature searches did not identify any AOD-focussed suicide prevention interventions in Australian Indigenous communities. However, a recent pilot study provided the first RCT of a self-help mobile app for suicidal prevention in Australian Indigenous adults (aged 18 – 35 years). Findings revealed pre- to post-intervention reductions in suicidal ideation, depression and psychological distress.

Suicidal behaviour was not measured in this pilot study. Only reductions in depression and psychological distress were significantly greater compared to waitlist control [71].

*Psychosocial and clinical interventions for adults*

The recent empirical literature has evaluated a number of psychosocial interventions for their effectiveness at reducing suicidal thoughts and/or behaviours among adults with problematic AOD use or an established AOD use disorder.

A 2020 systematic review identified six RCTs (incl. three pilot feasibility trials) evaluating clinical interventions among people with an AOD use disorder, with suicide or self-harm as the primary outcome [72]. Patient populations were diverse and included people with problematic alcohol use (3 studies), problematic AOD use (2 studies), and severe opioid use disorder (1 study); all had a current or past history of suicidal ideation (4 studies), suicide attempts (1 study) or deliberate self-harm (1 study). Patient samples in four of the six included RCTs had co-occurring mental health conditions including major depressive disorder, borderline personality disorder, and high emotional dysregulation. All except one of the identified interventions in this review was a psychosocial treatment intervention, namely individual cognitive behavioural therapy (CBT; 1 Australian study in adults; 1 study in adolescent discussed below [73]); online dialectal behavioural therapy DBT; 1 study); deconstructive psychotherapy (DDT; 1 study); a brief emergency department intervention incorporating feedback, advice and enhancement techniques (FRAMES; 1 study); and pharmacotherapy (buprenorphine; 1 study) [72].

For suicidal ideation, interventions were associated with weak improvements (all SMDs <0.2). However, confidence interventions were wide and inconclusive, possibility due to the large variation in measurement timepoints (3 days up to 6 months) [72]. A meta-analyses of all six RCTs in this review showed that interventions led to small reductions in suicidality and self-harm at 3 days up to 18 months' follow-up (SMD = -0.20) [72]. Again, as the review authors note, the confidence intervals were wide for these meta-analytic findings, and three of the six RCTs were assessed as having high levels of bias. Therefore, no firm conclusions can be made on the basis of these findings with regards to the effectiveness of psychosocial interventions at reducing suicidal thoughts and behaviours in AOD using populations [72]. More research is needed to grow the evidence base and establish more conclusively which types of psychosocial interventions may be most effective, on which outcomes, on which timepoints, and for which clinical populations.

*Psychosocial and clinical interventions for adolescents and youth*

In light of earlier findings showing that suicidality and problematic AOD use both emerge during adolescence (see Question 1 Adolescent and youth), youth are a prominent focus for suicide prevention interventions in the literature.

Most recently, a 2020 systematic review identified a number of evidence-based therapeutic interventions for youth with current suicidal ideation and/or history of suicide attempts, however only two intervention studies focussed on concurrent problems with AOD use [73]. In the first of these reviewed studies, integrated CBT (i-CBT) combining individual CBT, family CBT, and parental training led to fewer suicide attempts over an 18-month period compared to enhanced treatment-as-usual (TAU) among 40 youth aged 13-17 years old with suicidal ideation and/or history of suicide

attempts, and alcohol or cannabis use disorder. In contrast, decreases in suicidal ideation over the same 18-month period were the same irrespective of treatment type.

Another RCT by the same research group evaluated a modified version of i-CBT with additional mental health modules, substance-use specific information (alcohol versus cannabis), and parenting components and produced contrasting findings [73]. This subsequent RCT found that modified i-CBT and enhanced TAU led to similar decreases in rates of suicide attempts amongst 147 youth aged 12 – 18 years old. There were also no differences in the effectiveness of the different treatments at reducing rates of suicide attempts or suicidal ideation at 6, 12 or 18 months follow-up [73].

A 2013 systematic review of youth suicide prevention intervention studies identified an RCT involving youth with problematic AOD use [74]. RCT findings suggested that the addition of in-person aftercare may enhance the positive impacts of group CBT on suicidal ideation among youth aged 14 – 18 years old receiving treatment for alcohol use disorder. Aftercare was either in-person or over the phone and included functional assessment (1 session), followed by four sessions of manual-guided individualised relapse prevention based on CBT and motivational interviewing approaches. Those youth who were randomly assigned to receive in-person aftercare, upon completion of group CBT, self-reported continued decreases in suicidal ideation from end-of-treatment to end-of-aftercare (12 weeks post-treatment) [74]. These continued improvements were not seen in youth randomised to no-active aftercare or telephone aftercare; in both these groups, suicidal ideation remained unchanged [74]. Suicide attempts and deaths were not measured in this study and so it is not known whether the effectiveness of active aftercare is limited to suicidal thoughts only or extends to suicidal behaviours.

Finally, emerging evidence supports the feasibility, acceptability and preliminary efficacy of a brief motivational enhancement intervention targeting alcohol use and suicidal thoughts and behaviours amongst suicidal adolescents [75]. This intervention, called the Alcohol and Suicide Intervention for Suicidal Teens (ASIST) was delivered in addition to TAU within an inpatient psychiatric treatment facility and involved an individual session and a family session. At 3-month follow-up, there were two reported suicide attempts in the TAU-only group and no reported suicide attempts in the ASIST group [75]. Due to low numbers, this difference was not significant but was indicative of a small effect. There were no differences between the ASIST and TAU-only groups in terms of suicide ideation, but again this was likely due to small numbers [75]. ASIST was found to meet its primary aim, however, insofar as the adolescents (92%) felt that the intervention was helpful in understanding the relationship between their alcohol use and suicidal thoughts and behaviours.

*Quality of the available evidence*

With regards to Question 1, a large body of high-quality evidence sources, such as systematic reviews and meta-analyses which consistently demonstrate that problematic AOD use/AOD use disorders were associated with increased risk of suicide. Findings were consistent across different study designs, settings, and populations. There was, however, substantial heterogeneity in terms of how problematic AOD use and suicide risk were defined and measured. For example, some reviews and research studies considered different categories of drugs (e.g., alcohol, cannabis, tobacco, poly-drug), and different aspects of suicidality separately (e.g., suicide ideation, planning, attempts, and deaths), whereas other reviews and studies pooled together the categories. Such pooling together makes it

difficult to tease out which category or categories of drug use are potentially driving increases in risk, and which aspect of suicidality is most impacted by AOD use. Further, some reviews and studies rely on self-report questionnaire measures of AOD use and suicidality, whereas others rely on clinical assessment, psychological autopsy reports, or coronial findings.

There is more limited evidence to discern the relationship between problematic AOD use/AOD use disorders and suicide and explain how AOD use may interact with other risk factors for suicide. A number of cross-sectional studies involving nationally representative samples highlight that problematic AOD use often co-occurs with other risk factors for suicide, however, this research precludes any conclusions about directionality or causal effects. Well-designed longitudinal research is needed to inform conclusions about how problematic AOD use impacts on or is impacted on by other factors which predispose an individual to suicidal behaviours.

Regarding Question 2, the quality of the available evidence for some interventions, including community-based, school-based and population-specific, is limited by the fact that evaluations lack a control or comparison group. As a result, improvements to suicide-related and alcohol-related outcomes cannot be attributed to the intervention alone and may instead be reflective of broader trends or spontaneous recovery. Further, attributing effects to the intervention is made more complicated because community-based, school-based and population-specific interventions tend to be multicomponent/multilayered programs, and thus it is difficult to ascertain which segments of the intervention are responsible for the observed effects. The generalisability of some community-based interventions to the Australian context may also be hampered by the cultural-specificity of some findings (e.g., depression-focussed primary care intervention in elderly Japanese people) [56].

By contrast, much of the evidence on psychosocial and clinical interventions is derived from controlled studies, involving systematic comparisons between people allocated to the intervention compared to those allocated to a comparator such as treatment as usual. Although these highly controlled studies permit more robust and reliable conclusions with regards to the effects of the interventions, it is not possible to know whether these effects generalise to the clinical population more broadly.

Finally, suicidal behaviours, in particular suicide deaths, are statistically rare occurrences and thus is it difficult to demonstrate that an intervention is effective at preventing suicide. To illustrate this,, a 2020 systematic review of suicide prevention interventions (without an AOD focus) included 16 studies of >250,000 participants, of whom 62 died by suicide and 1006 attempted suicide [76]. Thus, many individual psychosocial and clinical intervention studies identified were likely underpowered to detect an effect on suicide, which is seldom the primary outcome in this review of intervention research. Instead, suicidal ideation and to a lesser extent, suicide attempt tend to be much more common outcomes of interest. Suicide attempt remains the strongest predictor of death by suicide [77], and therefore represents a valuable outcome in intervention research.

As findings from Question 1 highlight, a number of risk factors for suicide are distal and may precede suicidal behaviour by many years. Therefore, interventions targeting adolescents and youth may have delayed effects on suicide prevention, which would only be captured by ongoing long-term follow-up.

## Question 3 key findings

*What recommendations could be made about interventions that may be most appropriate and feasible within the Australian context?*

Drawing on key findings from Questions 1 and 2, and with reference to current policy and strategic frameworks, a number of recommendations can be made about interventions that may be most appropriate and feasible within the Australian context. It is worth noting that the literature searches for Questions 1 and 2 were mostly limited a priori to country settings similar to the Australian context in terms of population-level AOD use, priority populations, school and healthcare systems, such as Canada, the USA, the UK, and Western Europe. The exception to these limits was the inclusion of settings with cultural similarities to Australia (e.g. Indigenous/First Nations peoples).

*Interventions to be informed by an understanding of how AOD use contributes to suicidal behaviours*
Question 1 confirmed that AOD use has a significant role in suicidal behaviours, both by itself and in combination with other risk factors for suicide. Almost invariably, AOD use shows a positive association with suicidal behaviours, however, the nature of this relationship is complex and less well understood.

Delineating the precise role of AOD use in suicidal behaviours is challenging, in part because AOD use represents a highly complex risk factor with somewhat unique properties. Biological, psychological, social, environmental and cultural factors influence an individual's risk of suicide, and problematic AOD use often has a role to play in all these factors [78]. Within a biopsychosocial model, AOD use operates as both as a distal (e.g., chronic heavy drinking) and as a proximal risk factor for suicide (e.g., acute alcohol intoxication); AOD use also interacts with other suicide risk factors in a dynamic and multidirectional way, including individual (e.g., impulsivity), relational/interpersonal (e.g., separation/divorce, family conflict), community (e.g., minority identity, community cohesion), and societal levels (e.g., economic downturn) [78]. Notably, some individuals with chronic heavy AOD use and/or AOD use disorder may live with fluctuating suicidal thoughts for many years without ever acting on these thoughts [66], whilst other individuals without a history of suicidal behaviours and/or AOD use disorder may, with little forewarning, transition from suicidal ideation to suicidal acts following acute AOD intoxication [11, 25].

It is critical, therefore, that suicide prevention program are cognisant of and respond to the inherent complexity of AOD use as a risk factor for suicidal behaviours. In keeping with a number of key policy and strategic framework documents at the Australian National and State/Territory Levels, it is recommended that AOD-focussed suicide prevention interventions take **a multicomponent and multilayered approac**h [66, 70, 79, 80]. To this end, suicide prevention interventions should simultaneously target multiple domains of risk and work across universal (whole population), selective (priority/vulnerable groups), and targeted/indicated (at-risk groups) levels [81].

Comprehensive multilevel suicide prevention programs work to firstly**, prevent the development of new cases, and secondly to manage existing cases** (i.e., those with current problematic alcohol use

and/or suicidality versus those with a history) [70]. In addressing the first point, interventions need to prevent problematic AOD use including early initiation and drinking to risky/hazardous levels especially amongst high-priority groups, preventing progression to more established and severe AOD use disorders. In addressing the second point, measures need to be put in place to restrict access and availability of alcohol/other drugs to reduce the likelihood of acute alcohol intoxication (and potential transition from suicidal thoughts to suicidal acts) in those with/without existing problematic AOD use/AOD use disorder. Such a comprehensive approach necessarily involves collaboration between State/Territory and Federal governments as well as their commitment to sustained investment in universal, selective, and targeted/indicated interventions.

It is clear from the findings in this review that AOD and other related factors leading to suicidal behaviours are usually multifactorial and long-term. Therefore, short-term, low-intensity interventions that are delivered in isolation are expected to have a relatively limited impact on suicide outcomes [66]. Instead, AOD-focussed suicide prevention interventions need to be a part of sustainable programs with ongoing funding, that is, across multiple consecutive funding cycles and changing political environments. Sustainable programs with ongoing funding will permit successful implementation and assessment of long-term effectiveness on suicide outcomes.

The current literature demonstrates that problematic AOD use may be a response to and/or precipitator for other life stressors [25]. As such, AOD use may be more or less prominent risk factor for suicide at different points in a person's life. Therefore, suicide prevention interventions cannot be static and delivered at a single point in time, with the expectation being they will offer current and future ongoing protection. Rather, interventions need to be flexible to accommodate and respond to changes in a person's problematic AOD use and suicidality in a proactive rather than reactive way. For example, early-prevention interventions such as the 'Family Check-Up' [62] may provide a useful foundation for (pre-)adolescents and their families. However in emerging, mid and later adulthood, individually-tailored brief interventions may be used to intercept times when a person has elevated suicidality and/or when AOD use is more problematic [66]. Within the Australian context, and in line with other recommendations, GP's are ideally placed to opportunistically screen for and deliver brief interventions to people with problematic AOD use and/or suicidality [56, 57]. The vast majority Australian population visit a GP each year (>90% each year), and GPs are often the first port-of-call for people experiencing mental health difficulties [82].

*Interventions to be informed by the best available empirical evidence*

Key findings from Question 2 related to suicide prevention interventions at all levels, including universal (government policy and initiatives, community-based, primary-care, and school-based interventions), selective (priority group specific interventions), and targeted/indicated (psychosocial and clinical interventions for adults and for youth) interventions. The interventions identified varied in the extent to which they targeted AOD use with/without other risk factors for suicide and future interventions might benefit from a more integrated AOD-suicide prevention focus.

In terms of early/primary prevention, a large proportion of the recent literature on AOD-focussed suicide prevention interventions examines the effectiveness of school-based interventions [58, 62-64]. Based on the current evidence base, multicomponent school-based interventions which address multiple risk factors for suicide – including AOD use – are likely to be appropriate and feasible for the

Australian context. Schools provide an optimal setting for delivering suicide prevention interventions, as they are a setting in which a difficult-to-engage group, adolescents, are already engaged [58, 62]. Interventions may be both universal/non-targeted and delivered to the whole school population, such as within their PDHPE curriculum. Alternatively, interventions may be targeted to groups of students who are already accessing school counselling services and/or are identified as having a number overlapping risk factors between problematic AOD use and suicidality (e.g., minority sexual orientation, gender identity, low academic attainment, social isolation and bullying, early sexual initiation, trauma history, depression) [63, 64]. As part of school-based suicide prevention programs, gatekeeper training is provided to teachers and other core school staff (e.g., librarians, school principals) may aid recognition of and responses to students who are vulnerable to or displaying early signs of suicidality and/or problematic AOD use [67].

In terms of secondary prevention strategies targeting high risk groups who have a history of AOD use, suicidal ideation and/or attempts, there is a limited evidence base yielding equivocal support for psychosocial treatments. For adults, CBT, online DBT, and ACT may be associated with improvements in suicidal ideation, yet the impact on suicidal behaviours remains unknown [72, 83]. For adolescents, integrated CBT approaches which incorporate both the adolescent and their family appears promising for reducing both suicidal thoughts and behaviours [73, 84]. Given the chronic and remitting nature of both problematic AOD use and suicidality, it is critical that adult and adolescents who complete psychosocial treatment are provided with appropriate aftercare services in the community [74, 85]. The provision of aftercare is needed not only for people who have attempted suicide but also for people who have presented with and/or been treated for problematic AOD use/an AOD use disorder and are therefore at increased risk of suicide, independent of a history of suicide attempts. It is also is recommended that frontline clinicians in AOD treatment and aftercare services receive gatekeeper training in understanding the contributing role of AOD use in suicidal thoughts and behaviours, as well as recognising and responding to the early signs of suicidality in their clients treated for AOD use [80].

In addition to the above mentioned early primary prevention and secondary prevention strategies, there is also a role for government-led policy. Recommended, evidence-supported policies include those which centre on alcohol pricing and taxes, reducing on-premise and off-premise outlet density, and zero-tolerance drink driving laws for learner and provisional drivers [53, 54]. At the population level, these alcohol-related policies are potentially impactful in light of Australia's popular drinking culture, high prevalence of harms attributable to alcohol, including self-injury, hospitalisations and death [86], and high suicide risk among male youth who use alcohol/other drugs [5].

Alongside government-led policies on alcohol, community-based initiatives are also likely to support suicide-prevention efforts. Community-based initiatives drawn from the recent empirical literature, which may be appropriate and feasible in the Australian context, include awareness-building campaigns, the promotion of telephone and web-based support services, and the implementation of routine screening and brief interventions for depression and problematic AOD use within primary care/GP services [56]. It is recommended that these initiatives have an integrated focus on suicide prevention and AOD use, as well as other risk factors for suicide which often interact with problematic AOD use (e.g., financial stress, unemployment, relationship breakdown) [29]. It should be noted that majority of community-based universal intervention studies, including the impact of alcohol restrictions and other legislation, have been conducted in the US. Therefore, there is a need to

evaluate these interventions in the Australian context in order to ensure that they are appropriate and feasible within local jurisdictions.

There are additional considerations when developing community-based AOD/suicide prevention initiatives within high-priority communities (e.g., Aboriginal and Torres Strait Islander, Culturally and Linguistically Diverse, LGBTQI+). It is important that initiatives are community led and leverage the community's unique strengths [48, 68, 69, 87]. To do this involves ongoing engagement and collaboration with community members, utilising existing suicide prevention/AOD support networks and resources within the community, and drawing on the expertise of community members with lived experience of AOD use issues and suicidality [48, 68, 69, 87]. To facilitate the implementation of initiatives within high-priority communities, there also a need to assess community's readiness for change and ensure that those engaging and collaborating with the community consider cultural competence and cultural safety [88]. This is especially the case when working with communities where there is a long history of entrenched power imbalances such as with Aboriginal and Torres Strait Islander peoples.

*Interventions to be aligned with existing policy and strategic recommendations*
To enhance the comprehensiveness and effectiveness of suicide prevention programs within the Australian context, they need to **"bridge the gap" between primary prevention and secondary prevention strategies and simultaneously address universal, selected, and targeted/indicated levels.** To do this, key suicide prevention policy and strategic framework documents propose implementing a systems approach to suicide prevention [9, 78, 80, 88]. A systems approach is a community-based approach which involves engagement and collaborations between different sectors of the community [88].

Based on a review of key suicide prevention policy and strategic framework documents [9, 78, 80, 88], a systems approach should implement nine evidence-based strategies. These are: 1) Aftercare* and crisis care; 2) Psychosocial* and pharmacotherapy treatments; 3) GP capacity building and support*; 4) Frontline staff training; 5) Gatekeeper training*; 6) School programs; 7) Community campaigns; 8) Media guidelines; and 9) Means restriction*.

Further, according to modelling by the NHMRC Centre of Research Excellence in Suicide Prevention (CRESP), the asterixed strategies (*) are expected to have the greatest impact on preventing suicide in the Australian context [88]. Of note, some of the proposed strategies overlap with strategies supported by the empirical literature on AOD-focussed suicide prevention interventions (e.g., psychosocial treatments, GP capacity building and support). There are, however, some key deviations (e.g., school-based programs targeted to AOD use and suicide prevention).

Noticeably absent from these suicide prevention policy and strategic framework documents are specific strategies with an integrated focus on problematic AOD use and suicide prevention. To address this persistent 'blind-spot', AOD specific strategies can and should be integrated into broader suicide prevention strategies. Table 1 summarises AOD specific initiatives derived from key findings in Questions 1 and 2. These initiatives have been mapped onto the abovementioned strategies, for feasibility and appropriateness within the Australian context.

**Table 1.** AOD specific initiatives for suicide prevention within a systems approach [9, 78, 80, 88].

| Broad suicide prevention strategies[a] within a systems approach [9, 78, 80, 88] | Proposed AOD specific initiatives which align with strategies | Examples from current review findings |
|---|---|---|
| Aftercare and crisis care | Proactive aftercare services for people leaving AOD treatment services and emergency departments with AOD-related self-harm and/or history of suicidal ideation. | De Silva et al., [74] |
| Psychosocial treatment | Integrated psychosocial interventions which address co-occurring mental health/AOD use and suicidality. Inclusive, 'no wrong door' care with increased collaboration across mental health and AOD treatment services. | Padmanathan et al., [b] [72]<br>Busby et al., [73]<br>De Silva et al., [74] |
| GP capacity building and support | Screening for alcohol/other drug use alongside depression and suicidality. | Fountoulakis et al., [56]<br>Pascale et al., [57]<br>Struszczyk et al., [b] [67] |
| Frontline staff training | Increasing the capacity of AOD treatment frontline staff at recognising those at increased suicide risk; showing early warning signs of suicidality | Fountoulakis et al., [56] |
| Gatekeeper training | Training members of the community who encounter people who use alcohol/other drugs (e.g., GPs, pharmacists, youth workers, teachers). Specialised gatekeeper training for specific settings, such as schools and prisons. | Fountoulakis et al., [56]<br>Struszczyk et al., [b] [67] |
| School programs | Integrate modules on AOD use to prevent early initiation of AOD use and reduce hazardous and risky AOD use. Include psychoeducation programs on the role of AOD use in suicide, and how it interacts with other risk factors for suicide. | Singer et al., [58].<br>Teesson et al.,[b] Climate Schools [59]<br>Newton, Stapinski et al.,[b] Preventure [60]<br>Newton, Conrod et al.,[b] Preventure [61]<br>King et al., [62] |

| | | |
|---|---|---|
| | | Paschall & Bersamin., [63]<br>Edalati et al., [b] [64]<br>Kelly et al.,[b] Preventure [65] |
| Community campaigns | Increasing community awareness on how AOD use contributes to suicide; and may interact with other risk factors for suicide. Encourage help-seeking and reduce stigma around seeking help for problematic AOD use (with/without co-occurring suicidal thoughts or behaviours). | Fountoulakis et al., [56]<br>Struszczyk et al., [67] |
| Means restriction/accessibility | Government policies to restrict access to/availability of alcohol through community-led alcohol restrictions, alcohol pricing/taxes, reduced outlet density, and 'zero tolerance' approaches to learner and provisionally-qualified drivers. | Xuan et al., [53]<br>Wagenaar et al., [54]<br>Clifford et al., [68]<br>Doran et al., [69]<br>Christensen et al., [70] |

*Notes.*

[a] = No research focussed on media guidelines and so this systems-based strategy does not appear.

[b] = Cites relevant intervention studies conducted in Australia.

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# Appendix A

Database search terms for Question 1

| Database name | AOD-related terms | Risk factor-related terms | Suicide-related terms | Review-related terms* *(Terms deleted from search of primary literature) | Limits* *(Limits adjusted to year 2018 onwards for search of primary literature) |
|---|---|---|---|---|---|
| **EMBASE via Ovid**<br><br>Secondary search: (310 returned results as of 14-05-2020)<br><br>Primary Search: (602 returned results as of 14-05-2020) | 1. alcohol abuse/ or binge drinking/<br>2. exp alcoholism/<br>3. exp drug abuse/<br>4. substance abuse/<br>5. ((abuse* or misuse* or dependenc* or addict* or disorder* or problem* or hazard* or harm* or risk* or intoxicat*) adj4 (substance or sud or drug* or alcohol* or amphetamine* or cannabis or marijuana or cocaine or | 7. exp risk factor/<br>8. ("risk factor*" or "at risk" or "predisposing factor*" or risk* or predispos* or antecedent* or proximal or contribut* or causal* or precursor* or predict* or correlat* or associat* or concomitant* or longitudinal* or prospective* or male or men or | 10. Suicide/ or suicidal behaviour/ or suicide attempt/<br>11. (suicid*).tw.<br>12. 10 or 11 | 13. ((review* or synthes*) adj4 (literature or systematic or evidence or rapid or narrative or integrative or scoping or concept* or state of the art or evidence)).tw.<br>14. (meta-analy*).tw.<br>15. 13 or 14<br>– | 16. 6 and 9 and 12 and 15<br>17. limit 16 to (human and english language and yr="2010 – Current") |

| | | | | | |
|---|---|---|---|---|---|
| | inhalant* or hallucinogen* or phencyclidine or heroin or morphine or opioid* or stimulant* or tobacco or sedative* or hypnotic or anxiolytic*)).tw.<br>6. 1 or 2 or 3 or 4 or 5 | homeless* or incarcerated or unemploy* or indigenous or aboriginal or "first nation*" or "mental illness*" or "mental disorder*" or "mental health*" or trauma* or PTSD or LGBT*).tw.<br>9. 7 or 8 | | | |
| **Medline via Ovid**<br><br>Secondary search: (226 returned results as of 14-05-2020)<br><br>Primary search: (257 returned | 1. alcoholism/ or binge drinking/<br>2. exp Substance-Related Disorders/<br>3. ((abuse* or misuse* or dependenc* or addict* or disorder* or problem* or hazard* or harm* or risk* or intoxicat*) adj4 (substance or sud or drug* or | 5. exp Risk Factors/<br>6. ("risk factor*" or "at risk" or "predisposing factor*" or risk* or predispos* or antecedent* or proximal* or contribut* or causal* or precursor* or predict* or correlat* or associat* or concomitant* or longitudinal* or prospective* or male or | 8. Suicide/ Suicide, attempt/ Suicide, completed<br>9. (suicid*).tw.<br>10. 8 or 9 | 11. ((review* or synthes*) adj4 (literature or systematic or evidence or rapid or narrative or integrative or scoping or concept* or state of the art or evidence)).tw.<br>12. ((meta-analy*)).tw.<br>13. 11 or 12 | 14. 4 and 7 and 10 and 13<br>15. limit 14 to (humans and english language and yr="2010 -Current") |

| | | | | | |
|---|---|---|---|---|---|
| results as of 14-05-2020) | alcohol* or amphetamine* or cannabis or marijuana or cocaine or inhalant* or hallucinogen* or phencyclidine or heroin or morphine or opioid* or stimulant* or tobacco or sedative* or hypnotic or anxiolytic*)).tw.<br>4. 1 or 2 or 3 | men or homeless* or incarcerated or unemploy* or indigenous or aboriginal or "first nation*" or "mental illness*" or "mental disorder*" or "mental health" or trauma* or PTSD or LGBT*).tw.<br>7. 5 or 6 | | | |
| **PsychINFO via Ovid**<br><br>Secondary search: (123 returned results as of 14-05-2020)<br><br>Primary search: (171 returned results as of 14-05-2020) | 1. alcohol abuse/ or binge drinking/<br>2. exp alcoholism/<br>3. exp drug abuse/<br>4. ((abuse* or misuse* or dependenc* or addict* or disorder* or problem* or hazard* or harm* or risk* or intoxicat*) adj4 (substance or sud or drug* | 6. exp risk factors/<br>7. ("risk factor*" or "at risk" or "predisposing factor*" or risk* or predispos* or antecedent* or proximal or contribut* or causal* or precursor* or predict* or correlat* or associat* or | 9. Suicide/ or suicidality/ or attempted suicide/<br>10. (suicid*).tw.<br>11. 9 or 10 | 12. ((review* or synthes*) adj4 (literature or systematic or evidence or rapid or narrative or integrative or scoping or concept* or state of the art or evidence)).tw.<br>13. ((meta-analy*)).tw.<br>14. 12 or 13 | 15. 5 and 8 and 11 and 14<br>16. limit 15 to (human and english language and yr="2010 - Current") |

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| | or alcohol* or amphetamine* or cannabis or marijuana or cocaine or inhalant* or hallucinogen* or phencyclidine or heroin or morphine or opioid* or stimulant* or tobacco or sedative* or hypnotic or anxiolytic*)).tw.<br>5. 1 or 2 or 3 or 4 | concomitant* or longitudinal* or prospective* or male or men or homeless* or incarcerated or unemploy* or indigenous or aboriginal or "first nation*" or "mental illness*" or "mental disorder*" or "mental health" or trauma* or PTSD or LGBT*).tw.<br>8. 6 or 7 | | | |
| **Scopus**<br><br>Secondary search: (1823 returned results as | 1. ( ( TITLE-ABS KEY ( ( abuse* OR misus* OR dependen* OR addict* OR disorder* OR problem* OR hazard* OR harm* | 4. ("risk factor*" OR "at risk" OR "predisposing factor*)<br>5. (risk* OR predispos* OR | 7. (suicid*) | 8. ( ( TITLE-ABS-KEY ( ( review* OR synthes* ) W/4 ( literature OR systematic OR evidence OR rapid OR | 11. #3 AND #6 AND #7 AND #10<br>12. ( LIMIT-TO ( PUBYEAR , 2020 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT- |

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| of 14-05-2020)<br><br>Primary search: (790 returned results as of 14-05-2020) | OR risk* ) W/4 ( substance* OR sud OR drug* OR alcohol* OR amphetamine* OR cannabis OR marijuana OR cocaine OR inhalant* OR hallucinogen* OR phencyclidine OR heroin OR morphine OR opioid* OR stimulant* OR tobacco OR sedative* OR hypnotic* OR anxiolytic* ) ) ) OR<br>2. ( TITLE-ABS-KEY ( alcoholi* OR "binge drink*" OR "substance related disorder*" ) ) )<br>3. #1 or #2 | antecedent* OR proximal OR contribut* OR causal* OR precursor* OR predict* OR correlat* OR associat* OR concomitant* OR longitudinal* OR prospective* OR male OR men OR homeless* OR incarcerated OR unemploy* OR indigenous OR aboriginal OR “first nation*” OR “mental illness*” OR “mental disorder*” OR “mental health” OR trauma* OR PTSD OR LGBT*)<br>6. #4 or #5 | | narrative OR integrative OR scoping OR concept* OR "state of the art" OR evidence ) )<br>9. TITLE-ABS-KEY ( "meta analys*") )<br>10. #8 or #9 | TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) OR LIMIT-TO ( PUBYEAR , 2013 ) OR LIMIT-TO ( PUBYEAR , 2012 ) OR LIMIT-TO ( PUBYEAR , 2011 ) OR LIMIT-TO ( PUBYEAR , 2010 ) AND ( LIMIT-TO ( LANGUAGE , "English" ) |

# Appendix B

Database search terms for Question 2

| Database name | AOD-related terms | Intervention-related terms | Suicide-related terms | Review-related terms* *(Terms deleted from search of primary literature) | Limits* *(Limits adjusted to year 2018 onwards for search of primary literature) |
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| **EMBASE via Ovid**<br><br>Secondary search: (782 returned results as of 14-05-2020)<br><br>Primary Search: (452 returned results as of 14-05-2020) | 1. alcohol abuse/ or binge drinking/<br>2. exp alcoholism/<br>3. exp drug abuse/<br>4. substance abuse/<br>5. ((abuse* or misuse* or dependenc* or addict* or disorder* or problem* or hazard* or harm* or risk* or intoxicat*) adj4 (substance or sud or drug* or alcohol* or amphetamine* or cannabis or marijuana or cocaine or inhalant* or hallucinogen* or phencyclidine or | 7. Early intervention/ or intervention study/<br>8. (intervention* or prevention* or trial* or policy or policies or strateg* or health education or health promotion or mass media or primary healthcare or treatment*).tw.<br>9. 7 or 8 | 10. Suicide/ or suicidal behaviour/ or suicide attempt/<br>11. (suicid*).tw.<br>12. 10 or 11 | 13. ((review* or synthes*) adj4 (literature or systematic or evidence or rapid or narrative or integrative or scoping or concept* or state of the art or evidence)).tw.<br>14. (meta-analy*).tw.<br>15. 13 or 14 | 16. 6 and 9 and 12 and 15<br>17. limit 16 to (human and english language and yr="2010 – Current") |

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| | heroin or morphine or opioid* or stimulant* or tobacco or sedative* or hypnotic or anxiolytic*)).tw.<br>6. 1 or 2 or 3 or 4 or 5 | | | | |
| **Medline via Ovid**<br><br>Secondary search: (479 returned results as of 14-05-2020)<br><br>Primary search: (186 returned results as of 14-05-2020) | 1. alcoholism/ or binge drinking/<br>2. exp Substance-Related Disorders/<br>3. ((abuse* or misuse* or dependenc* or addict* or disorder* or problem* or hazard* or harm* or risk* or intoxicat*) adj4 (substance or sud or drug* or alcohol* or amphetamine* or cannabis or marijuana or cocaine or inhalant* or hallucinogen* or phencyclidine or | 5. exp Psychotherapy/<br>6. (intervention* or prevention* or trial* or policy or policies or strateg* or health education or health promotion or mass media or primary healthcare or treatment*).tw.<br>7. 5 or 6 | 8. Suicide/ Suicide, attempt/ Suicide, completed<br>9. (suicid*).tw.<br>10. 8 or 9 | 11. ((review* or synthes*) adj4 (literature or systematic or evidence or rapid or narrative or integrative or scoping or concept* or state of the art or evidence)).tw.<br>12. ((meta-analy*)).tw.<br>13. 11 or 12 | 14. 4 and 7 and 10 and 13<br>15. limit 14 to (humans and english language and yr="2010 -Current") |

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| | heroin or morphine or opioid* or stimulant* or tobacco or sedative* or hypnotic or anxiolytic*)).tw.<br>4. 1 or 2 or 3 | | | | |
| **PsychINFO via Ovid**<br><br>Secondary search: (348 returned results as of 14-05-2020)<br><br>Primary search: (186 returned results as of 14-05-2020) | 1. alcohol abuse/ or binge drinking/<br>2. exp alcoholism/<br>3. exp drug abuse/<br>4. ((abuse* or misuse* or dependenc* or addict* or disorder* or problem* or hazard* or harm* or risk* or intoxicat*) adj4 (substance or sud or drug* or alcohol* or amphetamine* or cannabis or marijuana or cocaine or inhalant* or hallucinogen* or phencyclidine or heroin or morphine or opioid* or stimulant* or tobacco or sedative* or hypnotic or anxiolytic*)).tw.<br>5. 1 or 2 or 3 or 4 | 6. exp Intervention/<br>7. (intervention* or prevention* or trial* or policy or policies or strateg* or health education or health promotion or mass media or primary healthcare or treatment*).tw.<br>8. 6 or 7 | 9. Suicide/ or suicidality/ or attempted suicide/<br>10. (suicid*).tw.<br>11. 9 or 10 | 12. ((review* or synthes*) adj4 (literature or systematic or evidence or rapid or narrative or integrative or scoping or concept* or state of the art or evidence)).tw.<br>13. ((meta-analy*)).tw.<br>14. 12 or 13 | 15. 5 and 8 and 11 and 14<br>16. limit 15 to (human and english language and yr="2010 - Current") |

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| **Scopus**<br><br>Secondary search: (1257 returned results as of 14-05-2020)<br><br>Primary search: (807 returned results as of 14-05-2020) | 1. ( ( TITLE-ABS KEY ( ( abuse* OR misus* OR dependen* OR addict* OR disorder* OR problem* OR hazard* OR harm* OR risk* ) W/4 ( substance* OR sud OR drug* OR alcohol* OR amphetamine* OR cannabis OR marijuana OR cocaine OR inhalant* OR hallucinogen* OR phencyclidine OR heroin OR morphine OR opioid* OR stimulant* OR tobacco OR sedative* OR hypnotic* OR anxiolytic* ) ) ) OR<br>2. ( TITLE-ABS-KEY ( alcoholi* OR "binge drink*" OR "substance related disorder*" ) ) )<br>3. #1 or #2 | 4. (intervention* OR prevention* OR trial* OR policy OR policies or strateg* or health education or health promotion or mass media or primary healthcare or treatment*). | 5. (suicid*) | 6. ( ( TITLE-ABS-KEY ( ( review* OR synthes* ) W/4 ( literature OR systematic OR evidence OR rapid OR narrative OR integrative OR scoping OR concept* OR "state of the art" OR evidence ) )<br>7. TITLE-ABS-KEY ( "meta analys*") )<br>8. #6 or #7 | 9. #3 AND #6 AND #7 AND #10<br>10. ( LIMIT-TO ( PUBYEAR , 2020 ) OR LIMIT-TO ( PUBYEAR , 2019 ) OR LIMIT-TO ( PUBYEAR , 2018 ) OR LIMIT-TO ( PUBYEAR , 2017 ) OR LIMIT-TO ( PUBYEAR , 2016 ) OR LIMIT-TO ( PUBYEAR , 2015 ) OR LIMIT-TO ( PUBYEAR , 2014 ) OR LIMIT-TO ( PUBYEAR , 2013 ) OR LIMIT-TO ( PUBYEAR , 2012 ) OR LIMIT-TO ( PUBYEAR , 2011 ) OR LIMIT-TO ( PUBYEAR , 2010 ) AND ( LIMIT-TO ( LANGUAGE , "English" ) |

# Appendix C

Inclusion and exclusion criteria for Questions 1 and 2 (with iterations included)

| PI(E)COS | Included | Excluded |
|---|---|---|
| Patient/Population/Problem | - Young people and adults who use alcohol or other drugs at risky/hazardous/harmful/problematic levels; or<br>- Young people and adults who use alcohol and/or other drugs (AOD) (including those with and without clinically diagnosed abuse/dependence/disorder). | None |
| Exposure (Question 1) | Risk factors or predisposing factors for suicide, including but not limited to:<br>- relationship breakdown/dysfunction,<br>- social isolation,<br>- trauma,<br>- co-occurring mental health condition/s,<br>- homelessness,<br>- financial stress,<br>- unemployment,<br>- incarceration,<br>- minority or indigenous populations,<br>- sex,<br>- age,<br>- LGBTQI+ etc. | None |

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| **Interventions (Question 2)** | AOD interventions, including but not limited to:<br>- educational and vocational-based programs,<br>- new or stronger policies,<br>- community initiatives/programs or<br>- clinical treatments (secondary focus)<br>-<br>N.B. Population-level/public health interventions (primary focus) rather than individual, treatment-based intervention (secondary focus). | Do NOT involve an intervention or<br>Involves an intervention which does NOT focus on AOD use issues |
| **Comparison/Control group** | - Studies with and without a control group | None |
| **Outcomes** | - Suicidal behaviours, including suicidal attempts and completed/deaths by suicide (primary focus)<br>- Suicidal thoughts or ideation (within the context of suicidal behaviour, secondary focus) | - Suicidal thoughts or ideation WITHOUT any link to/discussion of suicidal behaviour<br>- Self-harm WITHOUT identified suicidal intent<br><br>Outcomes OTHER THAN effectiveness, for example those focussing on the intervention's:<br>- Feasibility,<br>- Acceptability,<br>- Engagement/Uptake,<br>- Fidelity,<br>- Cost,<br>- Efficiency,<br>- Timeliness,<br>- Safety |
| | | - |

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| **Setting/s** | - In population/In community setting (primary focus)<br>- Educational settings (i.e., schools, universities, vocational/technical colleges like TAFE)<br>- Workplace settings<br>- Healthcare settings, especially community-based<br><br>- High-income, developed countries with settings similar to those in Australia (primary focus). For example:<br>  o The US;<br>  o The UK;<br>  o Western and Northern Europe<br>  o Canada;<br>  o New Zealand<br>- Countries with settings relevant to Australia (e.g., rural and remote, include Indigenous/ First Nation cultures). | - Acute care and/or crisis intervention settings |
| **Study types** | - Systematic reviews and meta-analyses published 2010 –<br>- Other literature reviews published 2010 –<br>- Key primary empirical research studies published 2018 – including:<br>  - RCTs<br>  - Quasi-experimental (e.g., uncontrolled trials; pre/post-test designs) | - All primary research studies published prior to 2018*.<br>- Protocol and conference papers<br>- Other peer-reviewed research studies or articles<br>- Case report or series<br>- Editorials or commentaries<br>- Animal studies |

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| | - Observational studies (e.g., cross-sectional surveys, cohort, case-control)<br>- Quantitative and qualitative (incl. qualitative only) mixed-design studies.<br><br>Key grey literature 2010 - (e.g., reviews and reports from government and non-government/not-for-profit)<br><br>*Key empirical and grey literature (including pre-2018) will be decided on via consultation with experts in the suicide prevention field. |