

Evidence Check

Programs and services for suicide prevention

An **Evidence Check** rapid review brokered by the Sax Institute
for Beyond Blue. December 2018.

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This report was prepared by:

Myfanwy Maple, Sarah Wayland, Tania Pearce, Phuong Hua.

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This **Evidence Check Review** was produced using the Evidence Check methodology in response to specific questions from the commissioning agency.

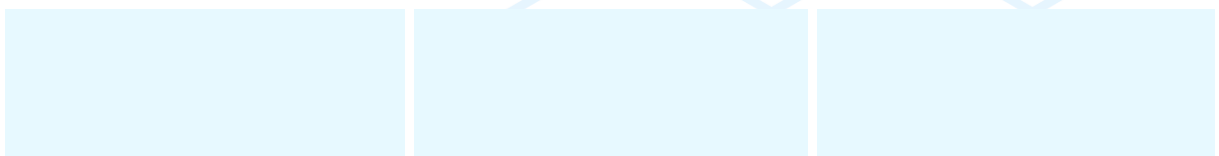
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Glossary and abbreviations

Glossary

After care	Follow up care post suicide attempt or disclosure of suicidal behaviours.
Brief contact interventions	Low resource, non-intrusive interventions that seek to maintain contact with people without offering additional therapies.
Cochrane Review	Cochrane Reviews are internationally recognised as the highest standard in evidence-based health care and are published online in the Cochrane Library.
Comorbidity	The presence of one or more additional diseases or disorders that co-occur with a primary disease or disorder
Digitally-enhanced programs	In this report this term refers to use of technology (apps, online platforms, connecting with people via the internet) as well as upscaling programs from face to face connection, to ongoing connection via a digital platform.
E-health interventions	Interventions delivered via an online platform including web-based engagement, both guided or unguided.
Gatekeeper training	Training that teaches specific groups of people to identify people at high risk for suicide and then to refer those people for treatment.
Grey literature	Publications that may include reports, theses, conference proceedings, technical specifications and standards, non-commercial translations, bibliographies, technical and commercial documentation, and official documents not published commercially.
Heterogeneity	Referring to a degree of similarity
Individualised therapy	Therapeutic interventions designed to address a person's needs, delivered by a health professional to an individual.
Lived experience	People with lived experience are individuals who have experienced a suicide attempt, suicidal thoughts and feelings, or a suicide loss (as defined by the US-based Suicide Prevention Resource Center)
Mixed methods studies	Using both quantitative and qualitative research methods.
Post-secondary settings	Settings after the cessation of high school/formal schooling for children and young people.
Postvention	Activities which reduce risk and promote healing after a suicide death.
Psychoeducation	Education that allows a person to better understand their health condition.
Public health	In this report, the authors use the term public health, in a context of suicide prevention, to refer to the efforts made by society (including the general population, and the health systems that respond to people) as a way to protect, promote and restore people's mental health and emotional wellbeing.

Public health interventions	Promotion of behaviour that addresses the health and wellbeing of the community, usually focussed on prevention strategies.
Qualitative studies	Research that gains insight and understanding of phenomena through intensive collection of narrative data.
Quantitative studies	Research that seeks to explain, predict or control phenomena through the collection of numerical data.
Selection bias	The bias introduced when proper randomisation is not achieved, meaning that the sample of participant results are not representative of the population intended to be analysed.
Selective interventions	Selective interventions focus on priority groups who are more vulnerable to suicide due to a variety of contextual factors, including but not limited to race, gender, age, or sexuality.
Self-harm	The deliberate taking of one's life or self-injurious behaviour.
Suicidal ideation	A range of thoughts and/or plans that centre upon suicide.
Systematic review	Literature review that uses systematic methods to collect secondary data, critically appraise research studies, and synthesise studies.
Targeted	Targeted interventions, also referred to as indicated interventions, focus specifically on targeting individuals who are at increased risk of suicide. These targeted interventions specifically address high-risk individuals including those who exhibit early signs of suicide risk or have made a suicide attempt.
Technology-based interventions	See e-health interventions.
Universal	Universal programs are those that offer interventions designed to reach an entire population.

Abbreviations

AACODS	Authority, Accuracy, Coverage, Objectivity, Date and Significance. (A checklist used to assess grey literature)
ABS	Australian Bureau of Statistics
CALD	Culturally and Linguistically Diverse
CASP	Critical Appraisal Skills Programme (a systematic review checklist and qualitative checklist)
CBT	Cognitive Behavioural Therapy
DBT	Dialectical Behavioural Therapy
EPHPP	Effective Public Health Practice Project quality assessment tool
LGBTIQ+	Lesbian, gay, bisexual, transgender, intersex and queer
MBCT	Mindfulness Based Cognitive Therapy
MeSH	Medical Subject Headings
NHMRC	National Health and Medical Research Council (Australia)
PST	Problem Solving Therapy
QPR	Question, persuade, refer – suicide prevention gatekeeper training
RCT	Randomised controlled trial
SOS	Signs of suicide program
WHO	World Health Organization
YAM	Youth Aware of Mental Health

Executive summary

Background and purpose of the review

Suicide prevention remains a priority in Australia and internationally. The rate of suicide in Australia is at a 10-year high with 3128 people dying by intentional self-harm in 2017, a preliminary death rate of 12.6 per 100,000. This represents approximately 8.6 deaths per day. Suicide is particularly high among certain groups, notably young people, older adults and Aboriginal and Torres Strait Islander people. Moreover, in the past year 80% of people who died by suicide had a comorbidity, with mood disorders (including depression) being the most common (43%).¹

The purpose of this literature review is to provide a foundation for the commissioning agency, Beyond Blue, to inform the future development of a strategic agenda for its policy work in suicide prevention. The context for the review is the Australian political and policy context of the Fifth National Mental Health and Suicide Prevention Plan², the Australian Bureau of Statistics Causes of Death Data¹ outlined above, and the rapidly increase in Federal and State/Territory investments in suicide prevention over the last few years, particularly in multilevel community programs.

The World Health Organization's report, '*Preventing Suicide: A Global Imperative*'³, highlighted the need for a systematic, multisectoral national response to suicide through strategies such as training for gatekeepers and crisis intervention services, and postvention. Although there may be many strategies in place, the report suggested there was increased need for evaluation and improvement of services. An overview of the approaches to prevent mental ill-health in OECD countries and the evidence base for their effectiveness similarly revealed that there is an uneven distribution of programs and services among countries, particularly for vulnerable subgroups such as unemployed and older populations and also found that pilot programs often failed to be expanded.⁴

Most recently, in a review of the mental health system, the National Mental Health Commission concluded: *"Suicide prevention initiatives currently being implemented in Australia may have a significant impact on the future directions of suicide prevention planning and investment ... The trial sites are an important development, but they do not cover the whole country and do not have the capacity or responsibility to address issues such as data gaps."*⁵ (p.8).

Against the background of this rapid expansion in investment and program design in suicide prevention in Australia, analysis is required to understand the quality of the existing evidence, assess the existing and new promising programs and identify the gaps in the literature, in order to ensure funding is strategically targeting areas of need.

Review question

This review aimed to address the following question: What programs or services have been effective in preventing suicide?

Summary of methods

This rapid review involved searching the peer-reviewed literature and the grey literature (including technical and evaluation reports) to determine where programs or services had been shown to effectively reduce suicide (including death, attempt, ideation). A rapid review protocol was developed in consultation with Beyond Blue to identify, evaluate and describe the existing evidence base on the effectiveness of suicide

prevention programs and services. A systematic and targeted search of five electronic databases was conducted for peer-reviewed literature published between 1 January 2014 and 16 September 2018. The electronic search was supplemented with a desktop search for relevant grey literature. Seventy-seven articles containing either primary (n=46) or secondary data (n=31) met the eligibility criteria and were included in the review. Primary sources report on original data collected by the authors of the paper. Meanwhile, the purpose of secondary sources is to interpret and review the findings contained in primary sources.

Evidence grading

Each paper meeting the inclusion criteria was quality assessed according to the National Health and Medical Research Council guidelines.⁶ To further understand the quality of the research design, an additional assessment was conducted on methodological strength of the included programs using the Effective Public Health Practice Project (EPHPP)⁷ or the Critical Appraisal Skills Program (CASP)⁸, depending on methodological design. These tools rate the overall level and quality of the evidence produced by the study. However, they do not give an indication of the quality of the program or outcomes from the intervention. Given that this review aimed to evaluate the effectiveness of the identified programs, a narrative review of the retrieved records was also undertaken, by assessing the program focus, component parts and outcomes.

The findings presented in this report are grouped to present similar papers together. Records retrieved that present secondary data are presented first. This refers to those papers where the authors pool previously reported data and where this is analysed in a rigorously defined method, for example, as meta-analyses or systematic reviews. Retrieved records presenting primary data sources are presented next. Within these sections, we used Haggerty and Mrazek's⁹ framework of the spectrum of interventions for mental health problems and mental disorders, which categorises program types into universal (whole of population), selective (defined priority groups), or targeted interventions (those at risk of suicide). These three domains are used to provide a structure to the review to determine the focus of the programs and to assess whether the programs prevented suicide. Programs that show promise but are yet to be published or did not meet the inclusion criteria are then described.

Results

There were 31 secondary sources that reviewed a wide range of interventions across multiple priority groups, most commonly examining e-health or mobile interventions and psychoeducation, with an emerging focus on mindfulness, and a lesser focus on gatekeeper training, diversion from emergency departments, peer support and brief contact interventions. The most common population group studied in the secondary sources was young people within secondary school settings. There was surprisingly little focus on other priority populations or risk groups. Programs examined ranged from programs with individuals and/or families, multicomponent or integrated programs, technology-based interventions, and aftercare programs. The secondary sources included a variety of review publication types ranging from systematic reviews and meta-analysis to narrative and scoping reviews. Only those secondary sources relating to a systematic review were assessed for quality. Overall the level of evidence and methodological quality of the systematic reviews was moderate to weak, with three programs rated as strong.

Forty-three primary records utilising new, empirical data were included in the review. Nine papers reviewed programs that were universal in focus. These interventions were conducted in community or school settings, with a primary focus on young people, older people (generally 60 years or older) or people with depression and/or reporting hopelessness. The NHMRC level of evidence⁶ was primarily Level II, however, in applying the EPHPP⁷ only one study was rated as strong and five moderate, with the remainder of weak methodological strength.

Eleven of the included reviews included interventions that were selective. The selective programs covered digital interventions across selected groups, with three specifically for Aboriginal and Torres Strait Islander people and several focused on young people. Overall, the level of evidence and quality of the selective interventions was moderate to weak, with only one achieving a strong rating and three achieving a moderate rating.

Targeted interventions were the focus of 23 reviews. These focused on a variety of vulnerable populations such as inpatients, individuals with mental illness, young people and older adults. All programs were rated as NHMRC⁶ Level II. In applying EPHPP⁷ or CASP¹⁰ to assess methodological quality, the evidence levels were predominately weak or moderate, with only one rated as strong. The remaining three papers were unable to be assessed for methodological strength as they were evaluations of national suicide plans, funding and availability mental health services in schools. The quality of these was assessed as NHMRC⁶ Level III and, when assessed using EPHPP⁷, two were found to be weak, with only one rated as strong.

Discussion of key findings

The findings of the review reinforced that different populations have differing suicide prevention needs. For example, community and family-based interventions may not be effective for preventing suicide in people with severe mental health conditions, and technology-based interventions may have a stronger capacity to target individual-specific risk and protective factors. Young people within school settings were the most commonly included population group, however, there was a growing focus on programs targeting veterans and older adults. This finding is not unexpected given the high rates of suicide among this age group in high income countries where the research originates. There was surprisingly little emphasis in the literature on other priority populations including Aboriginal and Torres Strait Islander peoples, people discharged from emergency department/psychiatric units, and other population groups including healthcare students and healthcare professionals, prisoners and primary prevention in the workplace.

There was a diverse range of settings for suicide prevention programs covered in the literature, including online and school-based programs and programs delivered via education, healthcare, workplace and community settings. It is clear that support for interventions is a key to the success of programs, as is ongoing funding.

The population group most commonly included in the literature was young people within school settings, however, there was a growing focus on veterans and older adults.

Presentations to health services, as well as institutional settings, were explored alongside a focus on aftercare programs that targeted people discharged from emergency departments or psychiatric services post-suicide attempt. Evaluations of community-based, multifaceted interventions that incorporated education, gatekeeper training, depression screening, group activities and referral for treatment had only been conducted for programs involving older adults.

The review found outcome differences between individual participants and group and family programs. For example, programs targeting individuals demonstrated reduction in suicidal ideation, while group and family programs only had effects on suicide attempts. The effect of interventions varied depending on the suicide-related outcome (deaths, attempts, or ideation). For instance, psychosocial treatments and coordinated/assertive/brief aftercare were reported to significantly decrease the prevalence of suicide attempts, whereas GP training, psychosocial treatments, gatekeeper training and reducing access to means led to the biggest reductions in suicide deaths. The review found that support for the intervention within the setting it is being applied is key to the success of interventions, as is ongoing funding. Findings showed that after funding ceased for some programs that had demonstrated a reduction in suicide, there was a subsequent increase in suicide rates.

What works to reduce suicide?

There is evidence for programs that work to reduce suicide ideation, attempts and deaths.

Programs that targeted a priority population – young people within the school setting and college students on university campuses – demonstrate a reduction in suicide. These programs involved students undertaking psychoeducation to better understand mental health and wellbeing, and developing help-seeking skills. These activities, combined with gatekeeper training and availability of acceptable support services, also reduced suicide ideation and attempts.

Programs that accessed and utilised the expertise of those with lived experience demonstrated a cost effective and accessible method of supporting survivors of suicide attempts, particularly through increasing opportunities for social connection, individual resilience and reducing stigma. The impact of the social determinants of health are rarely taken into consideration, yet holistic programs report reductions in suicide through healing activities which increase opportunities for engagement, social interaction and cultural reconnection.

Vast opportunity exists for utilisation of digitally-enhanced programs and brief contact interventions. The evidence shows that these programs are particularly effective in reducing suicide among people who have been receiving medical care and are thus contactable following discharge. The review also identified that alongside digital interventions, those that included psychosocial treatment and coordinated, assertive, and/or brief aftercare, resulted in the strongest reduction in suicide attempts.

Gaps in the evidence

The review highlighted many gaps in suicide prevention evidence. In summary, there was a heavy emphasis in the literature on preventing suicide in the short term and a lack of sensitivity to the broad range of social, contextual and public health factors that lead to a person being suicidal, including the social determinants of health. In addition to this historical and contextual situation of a person's lived experience of suicide, and the longer-term presentation of people with suicidal behaviour, there was also a lack of longitudinal research that might provide insight into the risks and protective factors of periods of life-stage transition, change, illness, trauma and the ongoing effects of adverse childhood experiences.

The review also identified a considerable selection bias, with many studies relying on voluntary participants who were not suicidal at the time of study, given ethical considerations preventing the inclusion of people currently experiencing suicidality and potential or perceived risk of harm. Many studies also relied primarily on self-report, and retrospective accounts to collect data, methods that are vulnerable to recall bias, stigma and social acceptability effects. The results of the research were generally limited by methodological design as well as reliance on predominantly treatment-seeking samples in English-speaking countries that are not generalisable to other countries or populations. Importantly, the research informing these evaluations was atheoretical (that is, not including a theoretical foundation, and thus not considering how people come to be in suicidal crisis and/or the factors that contribute) and alignment to priority populations (including LGBTIQ+, rural and remote, Aboriginal and Torres Strait Islanders, CALD communities) and national suicide prevention strategies was not evident.

Some perspectives were almost, or entirely, absent from this review. First-hand accounts, providing rich qualitative descriptions to complement the quantitative research were rare. While quantitative methods are generally viewed as methodologically superior to qualitative research, well-designed qualitative research adds significant context regarding the lived experience of those who are, or have been suicidal. Evidence on suicide contagion and clustering of suicides was not located in the literature, and suicide bereavement was the focus of only two programs. Importantly the role and needs of those who provide informal support to

people who are suicidal – their carers, who are often family members – was completely absent. Yet, exposure to the suicide (death or attempt) of another person is known to be a risk factor for future suicide among kin and non-kin. Evidence on non-clinical respite and retreats for those experiencing suicidal distress was not found in the literature. Few examples of these types of services exist at present, yet there is anecdotal evidence that such services meet the needs of people who have access to them. While there is interest in non-clinical interventions, or those where the intensity of the intervention can be adjusted for the individual (such as step-up/step-down models), no evidence was located for these.

The gaps in evidence stem both from the challenges in conducting research on suicide, as well as limitations imposed by the political and funding environment in which the research is performed. There are inherent issues with studying suicide, given that it is a statistically rare event, yet contributes significantly to preventable morbidity and mortality. There are methodological challenges in designing robust, high quality research in suicide prevention, due mainly to the heterogeneity of the experiences of suicide that are vital to consider when developing suicide prevention strategies across groups and communities. The investigator-initiated research that dominates the field is clinically focused within the medical model. However, suicide involves a complex interplay of intra-individual and environmental stressors that must be understood in more intricate ways. Thus, broader focused research utilising lived experience is vital to expand the knowledge base and produce programs that are effective in preventing suicide.

The review focused on answering the questions: “What programs or services have been effective in preventing suicide?” The analysis of the literature demonstrated that some niche programs have shown effectiveness in reducing suicide ideation, behaviours or deaths among specific groups or across populations. Yet, these are vulnerable to the fluctuation of research directions and funding and do not appear to sustain long-term outcomes. More attention could be drawn to priority populations including Aboriginal and Torres Strait Islanders, LGBTIQ+ and older adults. Methodological limitations such as variability in outcome measures and study design, as well as reliance on mainly clinical, heterogeneous samples and self-reported suicidal behaviour, made comparisons of studies difficult. These limitations also reduced the impact of findings and the enduring effects of interventions are largely unknown due to the absence of long-term, follow-up studies.

Policy implications and recommendations

This report reviewed the existing evidence for programs aimed at reducing suicide that were published within a defined time period of January 2014 to September 2018. While 77 studies were found and there is currently unprecedented activity in the suicide prevention sector in Australia, the evidence for what “works to prevent suicide” is lacking. The following recommendations address these limitations:

Do no harm

First, the principle of “do no harm” must always be applied in suicide prevention. While this appears obvious in that the focus of this report is to reduce suicide, it requires moving beyond short-term or one-off programs. While the commencement of a program may be to determine effectiveness, all programs should have sustainability factored into the initial design.

Recommendation 1: Ensuring effective program sustainability

All projects require a sustainability plan, including in-principle ongoing funding, if demonstrated to be effective.

The changing nature of suicide

The experience of suicide is individual and can change over time. While there is yet to be consistent language to explain this, suicide can be thought of as a collection of behaviours ranging in severity,

frequency and fluidity (including ideation, planning and attempting) that occur in response to a wide variety of life factors. New systems provide opportunities to consider data integration from healthcare delivery systems, health insurance systems and other population-wide data sources to develop a national health research database. There is emerging, albeit currently inconsistent evidence, for brief contact and follow up interventions. The evidence for these differs depending on population groups. Yet, these programs offer a low-cost way in which service providers can remain in contact with those who have experienced suicide rather than relying on these individual's re-accessing services when their help-seeking mechanisms may be compromised by declining mental health.

Recommendation 2: Explore programs that are flexible to individuals' changing suicide experiences

Outcome measures embedded within programs need to be matched to the proposed program and incorporate the changing nature of suicide experienced by the participants, as described above.

Recommendation 3: Utilise routine data

Overcome the limitations of short-term projects by investing in using big data to identify those at risk of changing suicide status.

Recommendation 4: Explore further brief contact or follow-up interventions

Further evaluations of interventions that keep individuals in contact with services should be continued and expanded across suicide (from ideation to postvention).

Top-down versus bottom-up approaches to suicide prevention

In the present review, there is an abundance of investigator-led research. Shared ownership and/or input from stakeholders invested in suicide prevention as intended is rarely reported. Models of co-design or co-creation would be welcomed in suicide prevention to ensure that programs are initially developed to meet the needs of those for whom the program will be delivered and can be reviewed and amended as needed over time. These collaborative approaches, which utilise the lived experience of people in the development, delivery and evaluation of programs, need to become routine. This ensures ownership by all players in the complex ecosystem of suicide, and thus increases buy-in and results in both bottom-up or grassroots solutions that benefit from expertise that is currently being expended in top-down approaches.¹¹

Recommendation 5: Routinely incorporate lived experience through collaborative design

People with lived experience are experts in suicide and its prevention, and inclusion of this perspective in all aspects of service delivery should become routine.

Recommendation 6: Require publication of research protocols

Published research protocols are required to ensure all suicide prevention work is published and the evidence base for what works and what does not work is growing.

Multicomponent programs for priority populations

Within the evidence included in this review, by far the majority of programs referred to suicide prevention in the setting of schools and targeted young people. What can be learned from this focus on a priority population for are the overlapping and multiple ways in which suicide prevention can occur in a relatively closed population group. While not so comprehensive, a US-based campus program also showed effect in reducing suicide among college students. Such multicomponent models could be applied to other settings where there are stable populations, including for inpatients, prisons and within small or closed communities: geographic (such as rural and remote locations), cultural (such as CALD and Aboriginal and Torres Strait Islander), and gender diverse (LGBTIQ+). The exploration of longer-term outcomes from these multicomponent interventions, such as whether the young people attending schools with incorporated interventions continue to have reduced rates of suicide over time, is encouraged. An additional focus on

young people who are not engaged in school systems, and therefore do not benefit from these programs, would also be beneficial.

Recommendation 7: Invest in multicomponent programs

Utilise multiple components to target increased individual resilience and help-seeking while providing appropriate access to support.

Recommendation 8: Follow up people who have received in-school programs

Prioritise the long-term follow-up of those who received in-school suicide prevention programs, to assess the longer-term outcomes of psychoeducation and help-seeking training into adulthood.

Conclusion

Overall, the evidence that programs or services that reduce suicide is weak. There appears to be no strategic focus in the research being undertaken, which is investigator-led and lacking in service user involvement. Many national and state suicide prevention plans have been developed across different countries to put focus on the need to address suicide deaths within a geographic locality. The way in which it is determined whether these strategies, or the programs and services that are funded within them, are effective is by measuring suicide death data or identification that an individual wishes to die. However, there is also a need to focus on the impact of suicide on the broader community, and on those more closely affected, to reduce harms associated with that exposure.

With more than 3000 Australians, and close to one million people internationally³, dying by suicide each year, suicide is clearly a public health challenge. Yet, according to this review, the programs and services being offered are rarely designed to take a public health approach, in which mental health is protected, promoted and restored. This results in programs that are atheoretical, not aligned with national or state strategies, focused within a clinical or medical model, and not sensitive to the complicated contextual factors (intra-individual and social) that influence suicide.

To overcome these limitations, recommendations are provided. These focus on all programs being grounded in the premise of 'do no harm,' taking into account the changing nature of suicide at the individual level while also acknowledging changing external pressures and stressors, moving to bottom-up over top-down approaches, and incorporating more sophisticated and targeted multicomponent programs for priority populations. To facilitate this, approaches that routinely incorporate lived experience, are co-created with the communities in which the program intends to function, and operate across multiple levels are essential in preventing suicide. These recommendations require a change in policy focus, away from short-term funding cycles, to a longer-term view of reducing distress within the community.

Background

Suicide is a major public health challenge and its prevention is a key priority for mental health reform. Intentional self-harm is a leading cause of premature death in Australia. In 2017, 3128 deaths were recorded as intentional self-harm (the coding category for deaths by suicide), representing a preliminary death rate of 12.6 per 100,000.¹ This equates to approximately 8.6 deaths per day and an increase of 9% from the previous year.¹ With the exception of Tasmania, Victoria and South Australia, all jurisdictions recorded increases in deaths by suicide compared with the previous year, with Queensland reporting the largest increase (804 deaths in 2017, compared with 674 deaths in 2016). In 2017, the highest proportion of suicide deaths occurred in the 45–49-year age group for both males and females. Suicide death was more than three times greater for males than females, with males representing 75.1% of all deaths. Suicide remains the leading cause of death among young people¹; on average a person who died by suicide in 2017 lost 34.5 years from their life.¹ In addition, older adults have one of the highest suicide rates in many regions of the world,³ with a growing body of evidence relating to suicide among older population groups, such as those in nursing homes.¹² This is particularly concerning given Australia's ageing population.¹³

Globally, close to one million people die by suicide annually, with many countries including Australia, Japan, the UK and Netherlands identifying suicide prevention as one of the top national health priorities.³ In 2014, suicide was recorded as the 15th most common cause of death worldwide, with low- and middle-income countries overrepresented in suicide death prevalence. However, most suicide prevention activities and research occur in high income countries.¹⁴ Culture, age and location all play important roles in suicide and its prevention. For example, adolescents and young people aged 13–35 have the highest rates recorded in Eastern Europe.¹⁵ Meanwhile, New Zealand has the highest rate of youth suicide among mid- to high-income countries.¹⁶ Further, in many locations (and particularly low- and middle-income countries), the quality of suicide mortality data is limited by religious, cultural or political influences or differences in the ways data on suicide deaths is collected.³ This suggests the true number of deaths attributable to suicide could be considerably higher than officially reported. There are additional difficulties in accurately recording suicide attempts, where only those attempts requiring medical attention are recorded, which likely only represent around 30% of all suicide attempts.¹⁷ There is still limited data on the number of people experiencing thoughts of suicide, and how frequently or regularly those thoughts occur.

The personal experience of suicide is individual and can change over time. While there is yet to be consistent language to explain this, suicide can be thought of as a collection of behaviours that range in severity, frequency and fluidity in response to a wide variety of factors. Thus, suicidal behaviours and thinking are difficult to measure in terms of size and scope.

Several priority populations for suicide prevention have been identified in Australia. Young people are shown to be particularly at risk. Other risk groups, or populations vulnerable to suicide, include those from gender and sexuality diverse groups (LGBTIQ+), those living in rural and remote locations, men (of all ages), and those bereaved by suicide.² In 2017, suicide was the leading cause of death among children and young people aged 5–17: at 98 deaths, this represented a 10.1% increase from the previous year.¹ Suicide was also the leading cause of death among individuals aged between 15 and 44. Aboriginal and Torres Strait Islander peoples have been identified as another at-risk population. Suicide among Indigenous Australians, at 25.5 deaths per 100 000, was nearly twice as high as the rate for non-Indigenous Australians. In 2017, suicide remained the leading cause of death for Indigenous children and young people, accounting for 40% of all Indigenous child deaths.

Older Australians have also emerged as an at-risk age group due to risk factors such as increased rates of depression, chronic illnesses, disability and various social factors leading to bereavement and isolation.¹⁸ Individuals with existing comorbidities or risk factors have also been increasingly prioritised in suicide prevention efforts. In 2017, approximately 80% of suicide deaths were associated with comorbidities – mood disorders, including depression, were the most commonly mentioned condition and were present in 43% of deaths. Individuals who have attempted suicide have also emerged as a vulnerable group, with the Fifth National Mental Health and Suicide Prevention Plan² making it a priority strategy to ensure consistent and timely follow-up care post suicide attempt. Since then, a wide range of suicide prevention services have been commissioned across Australia in response to an influx of government investment at both Federal and State/Territory level.

This Evidence Check report was commissioned by Beyond Blue in September 2018 to determine what programs have evidence for a reduction in suicide (death, attempt and/or ideation). The question driving this evidence check was: What programs or services have been effective in preventing suicide?

Methods

This rapid review involved searching the peer-reviewed literature and the grey literature to determine where programs or services have been shown to be effective in reducing suicide (death, attempt, and ideation).

Peer-reviewed literature

A rapid review protocol was developed to identify, evaluate and describe the existing evidence base on the effectiveness of suicide prevention programs and services. In developing the search strategy, the keywords were drawn from the purpose and scope of the review proposal. Following discussions with the commissioning agency (Beyond Blue), one modification was made to the search strategy. Although specific countries (Australia, Japan, US, Canada, New Zealand, France, Germany, Ireland, Netherlands, United Kingdom, Denmark, Norway, and Sweden) had been nominated in the rapid review proposal, the authors decided against limiting the search to specific countries. This decision was made to guard against missing relevant records where the country was either not mentioned in the title and/or abstract or another name was being used for a country (for example, the Netherlands versus Holland). Instead, records from the nominated countries were identified as part of the screening process, and if they otherwise did not meet the eligibility criteria, they were reported in the 'promising program' section of the report.

Database search

Before completing formal searches of the electronic databases, we trialled several test searches of the databases using a combination of keywords and subject headings. Testing of the search strategy in each of the databases offered two benefits. First, it provided evidence of which keywords would maximise the retrieval of relevant material. Second, the test searches helped to inform the selection of databases. As a result, we formulated a search strategy based on five databases: PubMed(NLM), PsycINFO(ProQuest), Scopus, Web of Science and Informit (Health and Indigenous). The searches were completed on 16 September 2018.

Search strategy

Keywords were searched across title and abstract fields along with their corresponding subject OR Medical Subject Headings (MeSH) (or where thesauri was available). The search string table is provided in Appendix 1.

Eligibility criteria

The following eligibility criteria was used to screen papers identified in the literature review.

Inclusion criteria

- Published between 1 January 2014 and September 2018
- Human subjects
- Original data (qualitative, quantitative, mixed) or review of original data
- Program or intervention to reduce suicide
- Program was located in Australia, Japan, US, Canada, New Zealand, France, Germany, Ireland, Netherlands, UK, Denmark, Norway and Sweden

Exclusion criteria

- Euthanasia, assisted dying focus
- Public health campaign
- Individualised therapy

- Clinical trials
- Program was outside defined countries

The checklist used for screening records retrieved through the database search is located in Appendix 1

Procedure and quality assessment

Study selection

Members of the review team searched the peer-reviewed databases (TP) and grey literature (SW) following the search strategy outlined above. Titles and abstracts of peer-reviewed and grey literature records were imported into Endnote X8 (bibliographic software) and duplicates removed using Endnote's de-duplication tool. The records underwent a two-stage screening process where records were firstly screened by title (TP) and then by title and abstract (PH). Full text of eligible studies were assessed by both TP and PH against the inclusion criteria. MM screened those lacking agreement, and discussed with TP and PH until consensus was reached.

Data extraction

Eligible studies were divided between three team members (TP, PH, MM) and data were extracted regarding aims, participants, design, procedures and outcomes. Each study received a level of evidence rating based on the NHMRC 2008 guidelines⁶ and a methodological quality assessment. As outlined below, following initial quality assessment, a second coder (not involved in the original coding) assessed the quality of each included paper using the EPHPP⁷ or the CSAP.¹⁰

Evidence grading

The quality of the included records was assessed using the two tools outlined below.

NHMRC Hierarchy of Evidence (2009)

The National Health and Medical Research Council (NHMRC) Hierarchy of Evidence⁶ assigns levels of evidence based on study design, ranging from I (highest) to IV (lowest). This tool specifies broad principles of evidence-based science that can be used for quality assessments of studies. The NHMRC Evidence Statement Form⁶ describes the basis for rating the five key components of the 'body of evidence' for each recommendation which includes:

- The evidence base, in terms of number of studies, level of evidence and quality of studies (risk of bias)
- The consistency of its findings to other similar studies
- Clinical impact and generalisability of results to the target population
- The applicability of results to the Australian and/or local health care setting

Level I studies typically consist of systematic reviews of randomised controlled trials while Level IV studies largely refer to case series with post-test or pre/post-test outcomes (see Table 1 below).

Table 1 NHMRC (2009) Levels of evidence

Level of Evidence	Study Design
I	A systematic review of Level II studies.
II	A randomised controlled trial.
III-1	A pseudo-randomised controlled trial (i.e. alternate allocation or some other method).
III-2	A comparative study with concurrent controls (i.e. non-randomised experimental trials, cohort studies, case-control studies and interrupted time series studies with a control group).
III-3	A comparative study without concurrent controls (i.e. historical control study, two or more single arm studies and interrupted time series studies without a parallel control group).
IV	Case series with either post-test or pre-test/post-test outcomes.

To further understand the quality of the reported programs, an additional quality assessment was conducted on methodological quality using the Effective Public Health Practice Project (EPHPP)⁷ or the Critical Appraisal Skills Program (CASP)⁸ depending on methodological design.

Effective Public Health Practice Project (EPHPP; 1998)

The EPHPP⁷ tool was used to provide a quality assessment of included quantitative studies. This tool is primarily used for knowledge synthesis and provides an overall methodological rating of 'strong', 'moderate' or 'weak' for the following eight sections: selection bias, study design, confounders, blinding, data collection methods, withdrawals and dropouts, intervention integrity and analysis. The EPHPP⁷ has been evaluated for content and initial construct validity as well as inter-rater reliability, has met accepted standards of validity and reliability and is considered to provide robust methodological ratings.¹⁹ For the purposes of this rapid review, an overall rating for each paper is provided.

Critical Appraisal Skills Programme Systematic Review Checklist and Qualitative Checklist (CASP; 2018)

The CASP⁸ provides checklists for both systematic reviews and qualitative research, thus systematic reviews were rated according to the CASP Systematic Review checklist²⁰ while qualitative studies were assessed using the CASP Qualitative Checklist.¹⁰ The CASP checklists⁸ are designed to be used as educational pedagogic tools and consist of 10 questions which evaluate the studies systematically. Overall, the CASP⁸ considers the following three broad issues when appraising studies: what the results are, whether the results are valid, and whether they will help locally (i.e. the value of the research/contribution to existing knowledge or understanding/applicability to other populations and settings). For each checklist, a group of experts were involved in the development and piloting of the checklist. A recent survey of checklist users confirmed that they are considered useful and appropriate tools for quality assessment. Ratings are ranked 'weak', 'moderate', and 'strong'. For the purposes of this rapid review, overall rating for each paper is provided.

Together, these guidelines and scales provide systematic analysis of evidence on resources, tools and programs in terms of:

- Quantity of studies (i.e. number of studies included);
- Level of evidence (i.e. best study types for the specific question; risk of bias); and,
- Quality of evidence (i.e. how well the studies eliminate bias)

Specifically, the quantity of evidence was defined as the final number of the studies included as the evidence base for the review. Level of evidence refers to the risk of bias in the presented results that is related to study design. The quality of evidence reflects how well the studies were conducted in order to eliminate bias, including how the subjects were selected, allocated to groups, managed and followed up and how the study outcomes were measured.

Included studies

A total of 46 primary and 31 secondary papers met the criteria for inclusion in the review and were quality assessed. Primary sources report on original data collected by the authors of the paper while the function of secondary sources is to interpret and review the findings contained in primary sources. These 77 records are identified in the reference list with an asterix (*) and are contained within the Endnote library provided. In consultation with the commissioning agency, nineteen 'promising programs' and an update on a prior Churchill fellowship were also included.

Grey literature

Alberani et al. ²¹(p.358) defined grey literature as publications that may include, but are not limited to the following types of materials: reports (pre-prints, preliminary progress and advanced reports, technical reports, statistical reports, memoranda, state-of-the art reports, market research reports, etc.), theses, conference proceedings, technical specifications and standards, non-commercial translations, bibliographies, technical and commercial documentation, and official documents not published commercially (primarily government reports and documents). Given the evaluation of community-based programs, or the emergence of promising programs, it was important to explore additional repositories in collected information relevant to suicide prevention programs.

For this review, the grey literature was searched for evaluated suicide prevention programs originating in the countries identified for the review. This refers to published or unpublished information that is reported outside of the peer-reviewed, academic literature and includes government reports and policy statements. Grey literature searches used broader terms than those applied to the scientific database given no controlled vocabulary of terms of keywords used between organisation clearinghouses, grey literature databases and agencies involved in programs or services related to suicide prevention. The use of date range was consistent with the search of the scientific literature (2014 – September 2018). The scope of literature sourced was intentionally broad to complete the concurrent search being conducted of the scientific literature.

Using keyword search of 'suicide prevention + evaluation', and application of date exclusion period and geographic location searches were conducted across DARE (Database of Abstracts of Reviews of Effects), WorldCAT, OPENgrey, Google Scholar and Google (advanced search) to identify reports, program evaluations or strategic framework documents that could be used in answering the review question. Searching was limited to the first 10 Google strings, to identify programs that had not yet been scientifically valued.

In addition to these searches, the research team also hand-searched reference lists, or reviewed programs mentioned within reports and papers and these were included as promising programs. A further web search was conducted of the countries identified by the commissioning agency to examine the political context driving health and human service delivery, and reports originating from this via government departments and nongovernment or third sector services.

Critical analysis of the grey literature was completed using the Tyndall checklist.²² This is a tool that seeks to critically evaluate non-scientific literature that is not published in traditional scientific journals but complements or communicates findings to wider audiences. The tool also allowed the research team to

identify current strategies in the community that may not yet have been scientifically evaluated but may be effective in the future. The tool identified the authority of the source, accuracy, the coverage or spread of the publications in addition to questions regarding objectivity and significance.

In total 68 documents were located. As with the peer-reviewed literature, where full text documents did not meet the inclusion criteria but contained information of interest, these were reviewed for inclusion in the 'Promising program' section of the report, which includes programs outside of the countries defined by the review, or where evaluation is yet to occur or is currently underway.

Results

A total of 4235 studies were located during the peer-review database search, with an additional 68 grey literature records retrieved. After removing 1636 duplicates, 2667 were screened by title and abstract, resulting in a further 2568 being excluded. Reasons for exclusion at this stage of the screening process included: papers unrelated to suicide prevention (n=1771), papers focused on clinical treatments (n=235), public health campaigns (n=37), descriptive papers containing no data (n=236), papers where suicide was not the focus (n=224), and papers where program or service was mentioned but did not report on a suicide-related outcome (n=65). Following full text review, 77 records met the eligibility criteria and were included as shown in the PRISMA diagram (Figure 1) below.

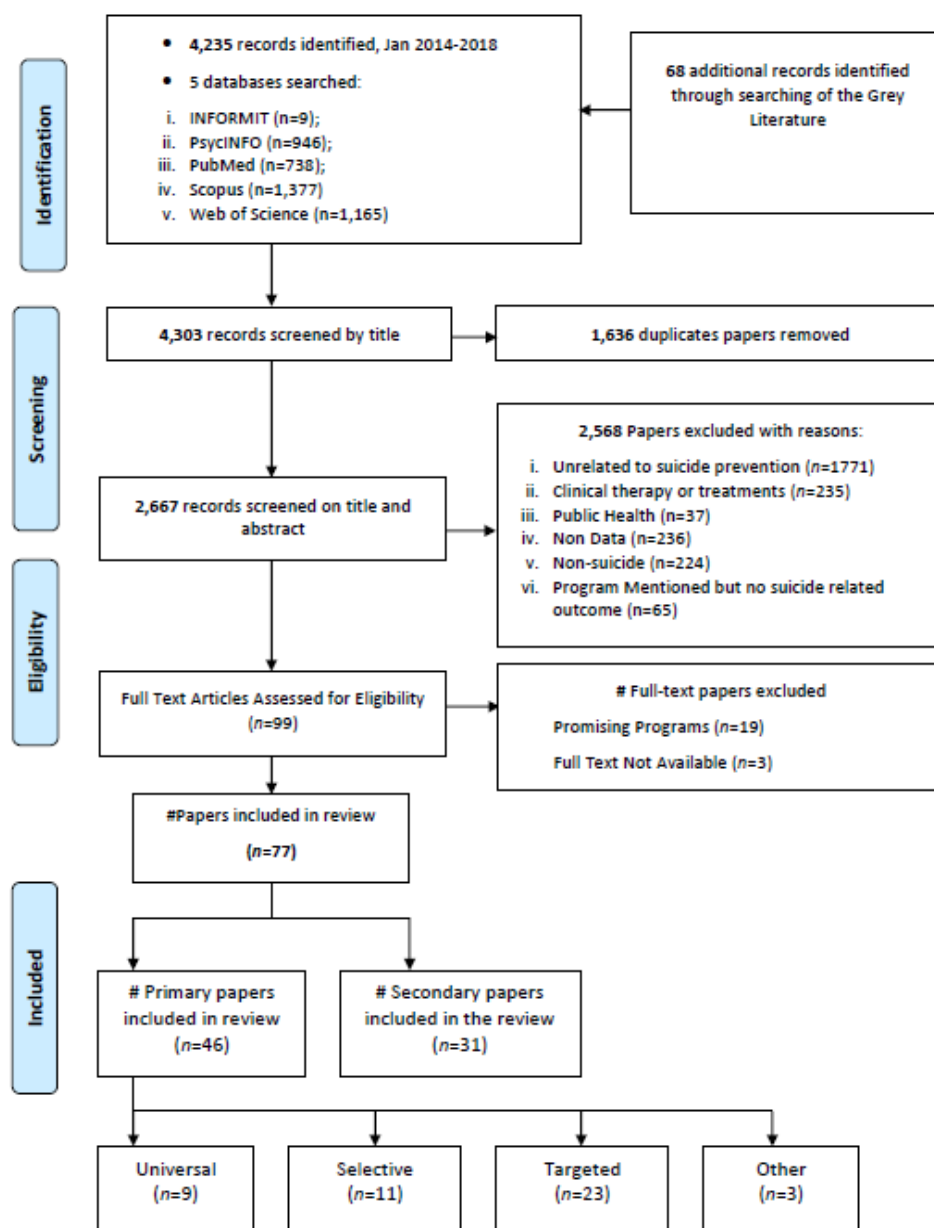


Figure 1 PRISMA flow diagram summarising rapid review search to identify published literature on the effectiveness of suicide prevention programs.

Given the variety of programs included in the review, and to answer the research question posed, the findings of the report are structured by first presenting the secondary sources, then presenting the primary sources by type of intervention as per the theoretical framework developed by Haggerty & Mrazek.⁹ Therefore, the sections below are reported firstly by analysis of systematic reviews and then into universal, selective and targeted programs or services; following are those papers that do not fit into this categorisation of programs. Within each section, the quality of the evidence is reviewed, and a table of evidence is presented followed by a summary of the effectiveness of the programs reviewed in each section.

Secondary sources (systematic and literature reviews)

A large number of secondary source papers were retrieved through the search, including meta-systematic reviews ($n = 3$); systematic reviews ($n = 11$), systematic review and meta-analysis ($n = 4$), meta-analysis ($n = 1$), scoping review ($n = 1$), literature review ($n = 7$), descriptive review ($n = 1$), narrative review ($n = 2$), Cochrane review ($n = 1$).

Systematic reviews are defined as an evidence-based tool used to appraise and synthesise primary research papers. Literature reviews contain a summary of current knowledge and may or may not include a review methodology. Only systematic review papers were assessed for quality using the CASP Systematic Review tool²⁰ by two reviewers. The overall quality of systematic reviews was moderate to weak, with only three reviews meeting criteria to be assessed as strong. All secondary sources are reported in Appendix 3 including information regarding the objective of the review, what was reviewed, evidence of reduction in suicide attributed to the intervention under review and the quality assessment scores.

Overview of secondary sources

Overall, the reviews covered a diverse range of programs and services aimed at reducing suicide. Across the 31 secondary sources analysed, the most reviewed topics included: online programs and e-health or mobile-based interventions^{15, 23-30} along with psychoeducation^{14, 16, 31-36}, including mindfulness and meditation classes³⁷ and staff training, particularly gatekeeper training.³⁸⁻⁴¹ Other topics included peer support⁴², rapid response to people in suicidal crisis/crisis services⁴³, brief contact interventions⁴⁴, diversion from emergency departments after suicide attempt including follow-up care^{45, 46}, and policies/prevention strategies.⁴⁷

The most commonly studied population group was young people.^{16, 24, 25, 31, 34, 35, 41} This is not unexpected given the high rates of suicide among this age group in high-income countries where these reviews originate. There was a growing focus on veterans³² and older adults.^{14, 43} Surprisingly few reviews focused on other priority populations including Aboriginal and/or Torres Strait Islander groups,^{33, 36} people discharged from emergency department/psychiatric units,^{23, 29} and other population groups including healthcare students and healthcare professionals²⁷, prisoners⁴² and primary prevention in the workplace.^{40, 48} This is likely due to reviews generally being investigator-driven as a precursor to other projects. Many reviews did not specify a priority population in which the intervention or program being reviewed might be utilised.^{15, 26, 28, 37-40, 44, 45, 48-5}

The range of settings included in the reviews was as diverse as the areas of focus and population groups. The most popular study settings included online^{23, 24, 26, 28, 30, 49, 50} and school based/education settings.^{25, 35, 39} Healthcare²⁷, the workplace⁴⁰ and the community^{33, 36} were also featured. Only one literature review focused on the prison environment.⁴² Appendix 3 contains the data extracted from secondary sources.

Effectiveness of programs and services

Individual, family or group interventions

Some of the reviews made comment on the effectiveness and context of universal, community-level or individual-level interventions. For instance, community and family-based interventions may not be effective for preventing suicide in severely mentally ill patients²³, while technology-based interventions may have a

stronger capacity to target individual-specific risk/protective factors.²⁸ There were also differences in outcomes between programs targeting individual participants and group and family programs: programs focused on individual participants led to reduction in suicidal ideation, while group and family programs only had an effect on suicide attempts.³¹ For programs that included a mix of individual and group/family components, there were likely to be significant differences in suicidal ideation but no effects on suicidal attempts.³¹ These findings highlight that different mechanisms underpinning individual level and group interventions may account for the different effects on suicidal ideation and attempt.

The effectiveness of programs or services may depend on the suicide-related outcome (deaths, attempts, or ideation). Krysinska et al.³⁹ found psychosocial treatments and coordinated/assertive/brief aftercare significantly decreased the prevalence of suicide attempts, whereas GP training, psychosocial treatments, gatekeeper training and reducing access to means led to the biggest reductions in suicide deaths. Contextual issues may also influence outcomes. Harrod et al.⁴¹ showed a lack of support for implementing programs in post-secondary education settings (gatekeeper training programs, classroom instructions and campus-wide policies) across the eight studies included in that review. Winters et al.⁴² reported on a review which focused on inmates with serious mental illness and evaluated the Samaritans program (SAMS; Canada) where the authors found that the service significantly lowered the suicide rate during the study period, with a subsequent increase in suicide deaths following the termination of the program.

Multilevel or integrated interventions

Combined or multilevel interventions may be more effective for some populations. Integrated approaches (combining universal, selective and targeted) were recommended by Sakashita and Oyama⁴³ for reduction of suicide among older adults. Notably, selective and targeted prevention interventions tended to be administered together to reduce suicidal behaviour. In the initial stages, a universal prevention program that involved screening or interviews would be used to detect and refer at-risk individuals. Subsequently, a targeted prevention program such as regular telephone calls or emergency response services that offered follow-up support would be provided.

Reductions in risk of suicide death were reported for community-based, multifaceted interventions that incorporated education, gatekeeper training, depression screening, group activities and referral for treatment) in older adults.¹⁴ Likewise, multifaceted primary care-based depression screening and management programs and treatment interventions, incorporating pharmacotherapy and psychotherapy as well as telephone counselling for vulnerable older adults, were considered one of the most effective interventions. These multifaceted interventions appear to work by simultaneously targeting multiple risk factors associated with suicide among vulnerable older adults, such as depression and social isolation.

Falcone et al.²³ suggested interventions including training programs for GPs followed by a pharmacological intervention likely led to reduced suicide rates, however, a direct association may not exist between training and reduced suicide rates. Callear et al.³¹ also found no clear stand-out intervention when reviewing the efficacy of school, community, healthcare-based interventions in reducing and preventing suicidal ideation, attempts and deliberate self-harm among youths aged 12–25. The authors proposed that a multifaceted approach could be most effective given the various intervention programs discussed, such as psychoeducation and student assistance programs

Technology and e-health based interventions

Effectiveness of e-health interventions for suicide prevention remains unclear and most of the evidence included in the review was of medium- to low- quality.^{23-29, 49, 50} Only one study was given a strong quality rating.³⁰ There is some evidence indicating digital interventions are associated with reductions in suicidal ideation, particularly when used in follow-up support services.³⁰ Despite this positive outcome, there remains an absence of evaluative research on mobile phone-based interventions.

Several reviews reported individualised psychological intervention, such as CBT as more effective for reduction of suicidal ideation^{14, 15, 28} or attempts³⁹ compared to other interventions, such as those that are technology-based. There also appear to be more robust studies for primary care-based interventions.¹⁴ Comparisons between face-to-face interventions and technology-enhanced programs/services may be an important consideration for future research.²⁸ Interestingly, Christensen et al.²⁶ suggested online suicide prevention programs are only effective if they specifically target suicidal attempts/ideation rather than associated symptoms of depression, thus outlining the need for very specific focus on suicide rather than broader mental illness. Several technology-based interventions incorporated principles of CBT and were found to be effective in reducing suicidal ideation in non-clinical populations³⁰ and the review by Lai et al.⁵¹ identified two randomised controlled trials evaluating internet-based CBT, which reduced suicidal ideation in a clinical audit of depressed primary care patients.

Follow-up (after care) interventions

Reviews that focused on after care (programs that targeted people discharged from emergency departments or psychiatric services post suicide attempt) found significant reductions in suicide attempts and ideation.^{29, 45, 46} However, Milner et al.⁴⁴ found that for most eligible studies, there were no significant reductions in suicide risk or episodes of self-harm/suicide attempt across intervention and control groups. The authors therefore concluded that brief contact interventions could not be recommended for clinical use.

This may, however, be based on study design (factors such as whether control groups were used, and the specific individual who performed the follow-up contact). Brown and Green⁴⁵ identified three studies which showed significant reductions in repeat suicide attempts after follow-up interventions, although results varied depending on the specific individual who performed the follow-up. For instance, a study comparing follow-up by a mental health worker and a crisis volunteer only found a significant reduction ($p = 0.05$) in repeat suicide attempts among those followed-up by a mental health worker. Falcone et al.²³ found screening for depressive symptoms followed by community follow-up care may be effective in reducing suicide risk.

Summary: what did the secondary sources identify as effective?

Community-based interventions and after care strategies focused on those recently discharged from hospital have the capacity to reduce suicide deaths and suicide ideation. Other considerations include:

- In relation to individual, family and group interventions, the findings highlight that different approaches such as family or community interventions for inpatients versus technological interventions for people in the community may account for the different effects on suicidal ideation and attempt, and the effectiveness of programs or services as well as the impact on the suicide-related outcomes (deaths, attempts, or ideation).
- Technology-based interventions may have a stronger capacity than community-based interventions. This statement highlights the role of technological interventions to target specific risks and enhance protective factors for individuals. There is some evidence indicating digital interventions being associated with reductions in suicidal ideation, particularly when used post-discharge.
- Community-based, multifaceted, coordinated interventions including GP training, psychosocial engagement, gatekeeper training, group activities, screening for depression and reducing access to means, may reduce suicide deaths.
- In terms of after care (defined as programs that target people discharged from emergency departments or psychiatric services post suicide attempt) found significant reductions in suicide attempts and ideation, however more evaluation of brief clinical interventions, and who they are delivered by, is required.

Universal programs

Universal programs are those that offer interventions designed to reach an entire population. Nine articles were identified as meeting the criteria for universal programs relating to suicide prevention.

Overview of universal programs

Universal programs included RCTs, quasi-experimental cluster designs, cross-sectional surveys and one case series. The evaluations of programs included a limited number of settings identified only as either community-based interventions (which included post-discharge or after care support) or within school settings.

Universal studies measured their primary outcomes in terms of a number of measures. The papers measured population changes in suicide rates^{52, 53}, reduction in suicidal thoughts⁵⁴⁻⁵⁶ or suicidal ideation.⁵⁷ The number of lifetime suicide attempts^{58, 59} were also recorded and two included screening for depression, with one noting that the inclusion of depression rather than suicidal thoughts was due to the authors' concern about the greater possibility of social desirability bias when asking about suicidal thoughts.⁶⁰ One study also assessed shifts in perceptions of hopelessness as a way to measure effectiveness of suicide prevention programs.⁶¹

Only three of the studies had secondary outcome measures that sought to identify changes in uptake of interventions offered,⁶⁰ with the other two exploring a comparison of suicide rates in other age groups and the inclusion of outcomes measures that sought to assess symptoms of depression, as well as symptoms of hopelessness.^{53, 62}

Appendix 4 contains the extracted data from primary sources related to universal programs.

Effectiveness of universal programs and services

Community-based programs

Collings and colleagues⁵² conducted an RCT utilising a multi-level Intervention for Suicide Prevention in New Zealand (MISP-NZ). The study included a 25-month intervention strategy across four health districts using two interventions titled: Creating Opportunities for Personal Empowerment (CoPE) and Healthy Lifestyles TEEN (thinking, emotional, exercise and nutrition). The aim of the interventions was to assist participants in recognising suicidal behaviours, alongside the dissemination of print material and web resources to enhance participants' understanding of mental health, wellbeing and referral pathways. The number of participants was not reported in the evaluation of the study. The primary outcomes measure of this intervention was a change in rates of suicidal behaviours, as measured through rates of presentation to emergency departments. Results showed no significant reduction in suicidal behaviours after two years of the interventions, however there was a small shift in behaviours in terms of rates of suicide deaths between intervention and control communities. The authors noted in their concluding reflections that further evaluation of multilevel interventions for suicide prevention needed to be investigated to ascertain if they could reduce deaths.

Two community-based interventions focused on community-level health promotion strategies to effect change. Oyama and Sakashita⁵³ report on a follow up study to a previous two-year community-level RCT in Japan (2005-6), where 4918 individuals were invited for further post intervention assessment. The initial intervention included depression and suicide screening, follow up, and community educational components focused on psychoeducation and treatment adherence, while the control regions received usual care (opportunity for screening for depression and suicidal behaviours). The service, which was not named in the review, was administered by public health nurses in a community setting. The authors completed a second iteration of the program evaluation⁶⁰, that included a mailout of a screening instrument to assess, and then

provide information to people about risk factors for suicide and treatment for depression. The evaluation uncovered a significant decrease in suicidal death pre- and post- implementation of the study for older participants (43%, from 64.9 to 37.0/100 000), but a non-statistically significant change in suicide rates across the control regions and whole of country. In terms of differing outcomes for differing population groups, over the four-year follow-up period, there were only six suicides during 16,822 person-years among those who were offered the screening (using the approximate number of person-years; crude IRR group: 0.43, 95% CI [0.18, 1.01] Wald $\chi^2 = 3.79$, $df = 1$, $p = 0.052$). There were 20 suicides during 32,062 person-years among those who were not offered the screening (Wald $\chi^2 = 1.14$, $df = 1$, $p = 0.286$) in the intervention region. This compared with 45 suicides during 54,160 person-years among older adults in the control region. In the second evaluation of the program,⁶⁰ the scale to assess primary outcome measures was changed from suicide to depression to account for the social desirability bias that the researchers anticipated may arise from exploring suicide behaviours specifically. The results of the study highlighted the matching of community-based interventions with at-risk residents in areas where intervention was an identified need.

An online RCT of a self-help intervention program in the Netherlands involved a sample of 236 participants.⁶² Participants took part in an unguided self-help intervention focused on regulation of suicidal thoughts and behaviour modification through CBT in addition to dialectical behavioural therapy (DBT), problem solving therapy (PST), and mindfulness based cognitive therapy (MBCT). The control group in the study was provided with access to a website (constructed for the study) that provided information on suicidality, such as prevalence rates and risk factors, and referral pathways. When compared to the control group, the intervention group reported significant improvement in suicidal thoughts (from 15.2 to 10.7 in the intervention group versus 14.5 to 12.2 in the control: $t(98) = 22.12$, $p = 0.036$).

School-based programs

The Saving and Empowering Young Lives in Europe (SEYLE) study explored by Wasserman et al.⁵⁴ involved an RCT conducted across Sweden, France and Ireland, covering 168 schools (11,110) pupils. Participants were randomly assigned to selected intervention groups (2692 students to Question Persuade Refer (QPR); 2721 to Youth Aware of Mental Health (YAM); 2764 to ProfScreen; and, 2933 control). The primary outcome was reduction in incident of suicide attempt(s). No significant differences between intervention groups and the control group were recorded at the three-month follow-up. At the 12-month follow-up, YAM was associated with a significant reduction of incident suicide attempts, compared with the control group. No participants died by suicide during the study period.

The Aussie Optimism Program is a mental health promotion strategy from Western Australia that was evaluated in an RCT. The strategy focuses on engaging young people attending schools and involves a teacher-led program that seeks to target social, emotional and cognitive wellbeing.⁵⁷ It involved 2288 young people who either received the program, received the program with coaching, or just received the usual curriculum offered within the school system. There was no control group, just a random allocation to one of the three initiatives. The primary outcome measure for the evaluation was incidence of suicidal ideation. The study found that the incidence of suicidal ideation at the end of Grade 7, as students were making the transition to secondary school, was decreased among those who received the program and coaching.

The US-based Signs of Suicide program embeds suicide prevention into the educational curriculum to promote health awareness about suicide and depression while simultaneously screening for depression, to identify at-risk young people. Two evaluations were included that reported on outcomes from the Signs of Suicide program.^{58, 59} The SOS program was associated with significantly less risk of suicidal behaviour (ideation, planning, and/or attempts) among students reporting pre-test ideation in the intervention group, compared to the control group. This was after controlling for pre-test levels of lifetime suicide attempt ($p <$

.05), indicating that students with pre-test ideation in the intervention group were approximately 96% less likely to report suicidal behaviour in the previous three months post-test than students with pre-test ideation in the control group ($OR = e^{3.28} = .038$, $t(341) = 2.03$, $p < .05$).

The Skills for Life program in the Netherlands⁵⁶ provided services to young people aged 13–16 years through the use of an online learning tool to help develop strategies for bullying, alcohol use and managing suicidal thoughts. The randomised controlled trial of 1394 people found the program significantly reduced the frequency of suicidal thoughts, depressive symptoms, hopelessness, worry, and anxiety between baseline and six-week post-test for those from lower educational levels. The students in the experimental group (EG) reported experiencing bullying and suicidal thoughts less often.

The evaluation of Australian Reframe IT program conducted by Robinson et al.⁶¹ explored CBT-based interventions delivered via an online, module-based learning platform over a 10-week block. The intervention also included short video vignettes to identify lived experience of mental illness. The 32 young people who took part in the program completed the modules in a quiet room with the research team present. While the team were present, the participants had an opportunity to engage with a community of young people online, in addition to the content. The evaluation of the effectiveness of the program showed a statistically significant reduction in suicidal ideation, depressive symptoms and hopelessness amongst the young people involved in the study, with a moderate effect size for suicidal ideation and clinician-rated depressive symptoms (0.66 and 0.60, respectively), and a small effect size for self-rated depressive symptoms and hopelessness (0.48 and 0.46, respectively). There was no control group in the study.

Summary: what did the universal programs identify as effective?

Community- and school-based interventions, coupled with health promotion strategies, have the capacity to reduce suicide deaths and suicide ideation. It is important to consider the following:

- Multilevel interventions for suicide prevention may create change in rates of suicide deaths.
- Online programs that utilise traditional clinical interventions like CBT alongside mindfulness-based interventions can impact suicidal ideation, and potentially suicide death.
- Embedding mental health promotion to target suicidal risk and suicidal ideation within the high school curriculum may impact incidence of suicidal ideation.
- Mental health promotion coupled with screening for depression, to assist in targeting at-risk individuals, may reduce the risk of suicidal behaviour, as reported in high school students.
- Life skills training may reduce suicidal ideation, symptoms of depression and experiences of hopelessness.

Selective Interventions

Selective interventions focus on priority groups that are more vulnerable to suicide due to a variety of contextual factors, including, but not limited to, race, gender, age, or identity. While targeting priority population groups, these interventions remain focused on broader barriers or inhibitors for addressing vulnerability and promoting protective factors within select populations.

Overview of selective programs and services

Eleven papers were retrieved that evaluated selective intervention programs or impact of services aimed at reducing suicide and suicidal ideation. Four of the 11 studies investigated the effectiveness of digital interventions (mobile apps) to reduce suicidal ideation.^{36, 63-65} Other interventions studied ranged from a computer-based treatment⁶⁶ and its effect on suicidal ideation, and screening programs and their impact on suicide rates among at-risk populations.^{67, 68} Two of the selective interventions evaluated were programs aimed at reducing rates of suicide among young people.^{69, 70} Two studies tested the impact of activities such as art⁷¹, sport and health education⁷² on suicidality. Four were observational studies, four studies used RCTs, two were case series pre and post-test and one was a mixed methods design.

Appendix 5 contains the extracted data from selective interventions.

Effectiveness of selective programs and services

Surveillance and screening programs

A US observational study by Biddle et al.⁶⁷ reported on screening and referral intervention known as the Student Assistance Program (SAP). The purpose of the study was to investigate relationships between referral to SAP and substance abuse, school suspensions and suicidal behaviour of young people. During the study period there were no significant differences in rates of suicide. Cwik et al.⁶⁹ reported on the White Mountain Apache Suicide Surveillance and Prevention System which used a case series pre-test / post-test approach to examine the impact of a youth suicide surveillance program on an Indigenous (Apache Indian) community in the US. The intervention included promotion of a crisis line number and community education activities (including suicide prevention walks, door-to-door campaigns and empowerment educational workshops for 391 tribal members). In schools, young people were exposed to the Sources of Strength suicide prevention program along with 230 (7-8 graders) being enrolled in a 12-month culturally adapted coping skills curriculum. The results showed a reduction in suicide rate among adolescents, young adults and adults. As the study was not an RCT, the authors conceded that no definitive conclusion could be reached as to whether the reduction in suicide rate was due to the program.

Torcasso et al.⁶⁸ conducted an observational comparative study in a school setting to test a screening intervention known as TeenScreen. Apart from the screening component, the program also offers educational sessions on the signs of suicide, mental health stressors, and coping strategies. Results indicated a statistically significant decrease in rates of suicidal ideation and attempts among 193 ninth grade participants attending schools where the screening intervention had been implemented (effect = -1.59, $p = .015$ 95 % CI [-2.87, -.31]). More robust study designs would help to determine the effectiveness of the program in reducing ideation and behaviour, such as the addition of randomised controlled or multiple base line study designs.

Digital programs

Three digital interventions were reported in the selective interventions retrieved in this evidence review. The digital program reported in a RCT by Allan et al.⁶⁶ tested a CBT-related computer-based intervention with a sample of US veterans ($n=138$). The primary outcome measurements included caUSI risk factors for suicidal thoughts, namely perceived burdensomeness and thwarted belongingness. Results showed the intervention

had a marginal effect on reducing perceived burdensomeness and suicidal thoughts. There was no effect, however, of the intervention on thwarted belongingness or suicidal thoughts.

Bush et al.⁶⁴ conducted a study on the impact of a smartphone app, Virtual Hope Box, on a sample ($n = 58$) of US veterans. The focus of the intervention was on stress management and emotional regulation. The primary outcome measure was coping self-efficacy. The results of the intervention indicated participants did improve coping ability with unpleasant thoughts at three weeks compared to the control group (who did not access the app) and 12 weeks post-randomisation. However, there was little effect of the intervention on secondary outcome measure of suicidal ideation.

Another smartphone app intervention, iBobbly, was trialled by Tighe et al.⁷³ In this study, a small sample of participants ($n = 31$) living in remote Australian communities were required to complete three online modules and self-assessment activities on their functioning, level of suicidality, mindfulness, self-soothing exercises and activities aimed at cultural engagement. The control group ($n = 30$) were waitlisted for six weeks. A statistically significant improvement was seen in the Depressive Symptom Inventory-Suicidality Subscale (DSI-SS) in the iBobbly arm. However, when compared to the wait-list group, there was no evidence the intervention led to changes in the primary outcome of suicidal ideation.

A case series pre-test/post-test study by Melvin et al.⁶⁵ was conducted on the Beyond Now (Australia) smartphone app developed by Beyond Blue and Monash University. The app encourages individuals to create, edit, access and share a personalised safety plan and enables users to list warning signs, reasons to live, ways to limit access to lethal means, coping strategies and personal as well as professional contacts. The app includes a red emergency phone button on each page that allows quick access to preloaded Australian emergency service phone numbers. Results demonstrated significant reductions in severity and intensity of suicidal ideation from baseline (severity $M=4.33$, $SD=1.04$; intensity $M=19.64$, $SD=2.91$) to post-intervention assessment (severity $M=2.29$, $SD=1.85$; intensity $M=17.44$, $SD=5.37$). Additionally, the authors found a significant increase in the frequency of suicide-related coping strategies use between baseline and ($M = 22.29$, $SD = 4.61$) and postintervention ($M = 27.29$, $SD = 4.45$) assessments; $t(13) = -3.56$, $p < .01$.

Postvention interventions

One of two postvention programs located in the review was a retrospective cross-sectional study by Visser et al.⁷⁰ which tested the effectiveness of an Australian program, the StandBy Response Service. The primary outcome measures were health and social outcomes, including suicidality. Results showed the intervention might have a significant effect on reducing suicidality ($p = 0.006$). However, as noted by the authors, the results remained inconclusive as a more robust study design (e.g. RCT) would be needed to test the efficacy of the program.

Prisoner interventions

In the Rasumussen et al.⁷¹ Australian retrospective cohort study of an Aboriginal prison art program, the primary outcome included reduction in the incidence of assessed self-harm/suicide risk among Aboriginal prisoners. When controlling for a history of suicide self-harm, the rate of attendance reduced the incidence rate of suicide/self-harm assessment by a factor of 0.81 95% CI [0.70,0.95]. As reported by the authors, there were important limitations, including that the study design could not control for all variables relating to suicide risk/harm.

Indigenous interventions

The United Health Education and Learning Program (UHELP; Australia) comprises one-hour of physical activity (touch football, relays, traditional Indigenous games) and the sharing of a healthy meal in addition to nutritional advice. This program is based on Indigenous concept of wellbeing which emphasise holistic health and the relationship between exercise and mental health. A mixed method study (case series with pre-test/post-test and focus group) conducted by Skerrett et al.⁷² found significant reductions in suicidal ideation. However, this significance was not maintained at the two-month follow up stage. Results of the qualitative measures suggested the program increased participants' knowledge of help-seeking and coping skills. This was the first evaluated intervention for Aboriginal and Torres Strait Islander young people that reported a decrease in suicidality outcomes.

Summary: what did the selective programs identify as effective?

Psychoeducation strategies, as well as technology-driven applications, have the capacity to reduce suicide deaths and suicide ideation in selective groups. It is also important to consider the following:

- A combination of screening components within intervention programs – alongside education sessions that explore signs of suicide, mental health stressors, and coping strategies – may impact rates of suicidal ideation and attempts among high school students.
- Use of technology apps that provide person-centric opportunities to develop and personalise safety plans can reduce the severity and intensity of suicidal ideation.
- The use of art-based engagement in Indigenous groups in the justice system may impact rates of suicide and self-harm.

Targeted interventions

Targeted interventions, also referred to as indicated interventions, focus specifically on targeting individuals who are at increased risk of suicide. These targeted interventions specifically address high-risk individuals including those who exhibit early signs of suicide risk or have made a suicide attempt. These interventions typically involve the assessment, diagnosis and management of mental disorders associated with suicidal behaviours, as well as community support and psychosocial follow-up. It is anticipated that effective targeted strategies will prevent the progression of suicidal ideation to suicidal plans and acts among the most vulnerable populations, thus reducing the burden of suicide and suicide death.

There were 15 RCTs (including a proposal of an RCT), four pre-test/post-test designs, one cross-sectional, one single group trial, one qualitative study and two mixed method studies. Studies were conducted in various settings including psychiatric units^{74, 75}, via telephone⁷⁶ and the general community.^{77, 78}

Overview of targeted interventions

The targeted interventions reviewed measured their primary outcomes mainly in terms of reductions in suicidal ideation, including severity and intensity of suicidal thoughts, tendencies, attempts or suicidal self-harm and deaths. Repeated suicide attempts (recidivism) was also measured in several studies.^{75, 79} Additionally, suicide-related coping and attitudes towards help-seeking as well as treatment utilisation were measured to determine risk of suicide.^{80, 81} Changes in feelings of hopelessness, depression and anxiety have also been examined as secondary outcome measures to assess the effectiveness of suicide prevention programs.^{82, 83}

Appendix 6 contains the extracted data from targeted interventions.

Effectiveness of targeted programs and services

Programs for individuals who are inpatients or in close proximity to hospital

Several interventions identified individuals who had made previous suicide attempts including psychiatric patients in emergency departments. Two components of a US-based intervention for young people were reported by Kennard et al.⁸¹ The As Safe as Possible (ASAP) intervention comprised four modules: chain analysis – a technique that assists a person to understand their behaviour – safety planning, distress tolerance and emotion regulation, increasing positive affect throughout savouring and switching – a mindfulness technique – and review of skills, safety plan and app), which were delivered to those discharged from hospital in a motivational interviewing framework in an RCT study. Additionally, Kennard et al.⁸¹ report on BRITE, a smartphone app which provided each participant with access to distress tolerance strategies, emotion regulation skills and a safety plan, customised according to the person's preferences. The control group was assigned to treatment-as-usual, which comprised of safety assessments, stabilisation, pharmacotherapy, psychoeducation and disposition (exploration of behaviour presentation). Results showed the rate of suicide attempt among participants assigned to ASAP-plus-treatment-as-usual was half that of participants in group receiving only treatment as usual, suggesting the intervention may be effective for reducing post-discharge suicide attempts among adolescents. It was also found that participants in the ASAP-plus-treatment-as-usual group showed a higher level of social support over the study period, which may be related to lower rates of suicide attempts in the intervention group. No relationships were found between frequency of app use and the risk for suicide attempt or decline in suicidal ideation.

The organisation of suitable monitoring for people who have made suicide attempts (OSTA, France) provides a follow-up protocol developed in the psychiatry department of the University Hospital of Bicetre, which is designed to provide continued care for people after they are discharged from emergency departments. An RCT by Mouaffak et al.⁷⁹ did not find significant differences between the intervention and control groups in the number of suicide attempts post discharge.

An RCT by Miller et al.⁸⁴ in the US evaluated the outcomes of a multifaceted screening and intervention among emergency department patients who screened positive for suicide attempts or ideations. The intervention included secondary suicide risk screening by the ED physician, discharge resources and post-ED telephone calls with an emphasis on reducing suicide risk. Outcome assessments showed participants in the intervention phase had 30% fewer total suicide attempts than participants in the treatment-as-usual phase. It is noted that the screening phase of the program alone did not significantly reduce suicide attempts compared to treatment as usual.

An RCT by De Beurs et al.⁸⁵ in the Netherlands, known as the PITSTOP suicide trial, evaluated a one-day small interactive group program with e-learning modules. The intervention was designed for mental health professionals in psychiatric departments and was delivered by peers who were trained in the field of suicidology according to the PITSTOP training protocol. The study assessed changes in suicide ideation among patients within the same psychiatric departments as the trained mental health professionals were located and found no significant effects of the intervention on patient outcomes at three-month follow-up. However, individuals who were diagnosed with depression and reported suicidality showed a significant decrease in suicidal ideation as a result of the training of professionals.

Technology-driven apps and interventions are becoming more commonly reported and are being used for patients in hospital and in preparation for discharge to the community. One such intervention involves text messages which include information about social welfare services and reminders about medical appointments, sent by an automated program to ensure participants receive them at a convenient time. The pre-test/post-test case series by Kodama et al.⁷⁴ using a community sample in Japan found that the proportion of participants who had self-harmed in the previous six months significantly decreased at post-

intervention compared to baseline. The intensity of suicidal ideation also significantly reduced, according to ratings by attending psychiatrists following the intervention period.

Another potential intervention involves telephone follow-up by emergency departments post suicide attempt. A controlled follow-up study in France by Exbrayat et al.⁷⁵ evaluated the effectiveness of a protocol of telephone follow-up calls by specially-trained nurses to those who had been referred to an emergency psychiatric unit for attempted suicide in the past year. Results showed that very early follow-up calls significantly reduced repeated suicide attempts compared to the control group and provided evidence that telephone follow-ups are a protective factor against repeated suicide attempt.

O'Toole et al.⁸³ evaluated a mobile app known as LifeApp'tite (Denmark) designed to provide psychoeducation for psychiatric patients and their loved ones concerning suicidal thoughts and coping strategies. The app also provided safety plans with options for users who were having severe suicidal thoughts and impulses between therapist sessions. There was a significant decrease in self-reported suicide risk for participants who received both the LifeApp'tite and treatment-as-usual although the effects were smaller at the four-month follow-up.

Programs for young people at risk of suicide

Familias Unidas (US) is a family-based intervention that aims to prevent and reduce problem behaviours such as drug and alcohol use among Hispanic adolescents by improving family functioning. The secondary analysis in an RCT reported by Vidot et al.⁸⁶ found the program showed no significant differences in suicide ideation and attempts across intervention and control groups. An important limitation noted was that baseline parent-adolescent communication had a significant impact on the intervention effect on suicide attempt. For instance, adolescents with limited levels of parent-adolescent communication showed significantly reduced suicide attempts post-intervention.

Let's Connect (US) matches at-risk youths with trained adult mentors from the community to enhance their interpersonal and community connectedness and in turn reduce emotional distress and suicide risk. The control group were only given a receipt of community resource information. An RCT by King et al.⁸⁷ found that suicidal ideation decreased similarly in both the intervention and control groups so there were no significant differences. The intervention group reported significantly greater improvements in social connectedness compared to the control group. However, there were no statistically significant differences in the proportion of youths in the intervention and control groups who engaged in suicidal behaviour including suicide attempts and suicidal preparatory behaviour.

Life Is Precious (LIP, US) is a community-based after-school program for Latino teens, aged 12–18, aimed at reducing suicidal behaviour by targeting the multifaceted risk factors within the population. A qualitative study by Humensky et al.⁸⁸ revealed several ways participants reported a decrease in suicidal behaviour after participation in the program. For instance, some respondents said LIP provided a "safe haven" to escape from other stressors, improved their relationships with families and peers and enhanced academic performance. Participants' responses also suggested that LIP alleviated suicidal risk factors such as low self-esteem and family and peer conflicts. LIP activities such as peer support and creative expression therapies also helped reduce feelings of loneliness and gave participants an opportunity to express their negative emotions without engaging in self-harming behaviours.

The Teen Options for Change (US) intervention provides individuals with a crisis card listing phone numbers for suicidal emergency support and written information about depression, suicide risk, firearm safety and local mental health services. An RCT by King et al.⁸⁹ found no significant treatment or group effects for suicidal ideation however adolescents in the intervention group showed a decrease in suicidal ideation over the study period.

The Creating Opportunities for Personal Empowerment (COPE) Healthy Lifestyles TEEN (Thinking, Emotions, Exercise, and Nutrition) program is a US-based cognitive-behavioural skills building intervention that relates to nutrition, physical activity and healthy lifestyle beliefs.⁹⁰ Results from the outcome evaluation showed significant decreases in suicide risk as well as suicide ideation among pre-adolescents post-intervention compared to baseline via the Beck Youth Depression Inventory. Given this finding was a secondary finding (in a thesis focused on nutrition), the authors concluded that the COPE program appeared to be a promising intervention for middle school youth to improve their overall mental health outcomes, although a larger-scale RCT is required to ascertain the short- and long-term outcomes.

Van Spijker et al.⁵⁵ conducted an RCT in the Netherlands to evaluate the effects of an online unguided self-help program for adults with mild to moderate suicidal thoughts. Results showed that the effects determined at six weeks post-test in the intervention group were largely maintained at the three-month follow-up. A majority of participants in the intervention group thought their suicidal thoughts had decreased and there was a significantly greater improvement in suicidal thoughts compared to the control group. Likewise, there was a significant reduction in feelings of worry and the authors concluded that the effects of the intervention could be maintained for up to three months.

Helplines for those in suicidal distress

The Rethink Mental Illness Telephone Helpline (UK) is a free service that uses an active listening and solution-focused recovery approach to provide emotional support as well as psychoeducation on coping strategies and self-management for individuals who call due to thoughts of self-harming or suicide. A case series with a pre-test/post-test design by Tyson et al.⁷⁶ evaluated the intervention and found decreases in suicidal and self-harming ideation at the end of calls. Also observed was a significant decrease in participants' mean scores on the Suicide and Self-Harm Evaluation Scale ($p < .001$) between the beginning and end of calls, indicating a decrease in the likelihood of callers acting on their suicidal thoughts.

Programs for people with mental illness

The FitMindKit (Australia) intervention comprises 18 modules, including 10 core transdiagnostic modules and two domain-specific modules for symptoms of various mental health conditions including suicidal ideation. The two suicidal ideation modules discuss distress tolerance/self-soothing and emotion-regulation strategies. An RCT by Batterham et al.⁹¹ among Australian adults with heightened symptoms of depression, anxiety, suicidal ideation and/or substance use found no evidence of significant decreases in suicidal ideation, depression or generalised anxiety either at post-test or three-month follow-up.

The Cognitive Anxiety Sensitivity Treatment (CAST; US) is a fully computerised anxiety sensitivity intervention aimed at reducing anxiety, depression and suicidal ideation. The 45-minute intervention includes psychoeducation about anxiety symptoms and guided interceptive exposure exercise (hyperventilation). When evaluated through an RCT by Norr et al.⁸² among participants with co-occurring anxiety pathology and suicidal ideation, the authors found significant reductions in suicidal ideation at the four-month follow up after a single session of CAST. CAST was also evaluated in an RCT by Raines et al.⁹², which compared the effects of a single session of CAST with the Physical Health Education Training (PHET), a program that provides information regarding the importance and benefits of maintaining a healthy lifestyle. However, the study did not find a significant direct effect of CAST on suicidal ideation.

An intervention involving 90-minute lyengar yoga classes followed by deep relaxation and coherent breathing exercises for individuals diagnosed with major depressive disorder was evaluated in an RCT by Nyer et al.⁷⁸. The study found significant decreases in suicidal ideation for eight of the nine participants who reported suicidal ideation without suicidal intent at screening.

Postvention programs for people bereaved by suicide

The Survivors of Suicide Attempts (SOSA) program is an eight-session, weekly closed-support group, facilitated by a licensed mental health clinician and peer co-facilitator with lived experience (e.g. personal suicide attempt history). Unlike traditional therapist-directed groups centred on individual interpersonal issues, the SOSA program focuses mainly on peer-driven conversation, information sharing and psychoeducation, as well as members' emotional and practical needs. A pre-post test conducted by Hom et al.⁷⁷ found significant reductions in suicidal ideation, hopelessness, suicidal desire and suicidal intent after completing the SOSA program. Participants who completed the program also reported significant increases in resilience appraisals, although an RCT is required to examine how the outcomes of the SOSA support program compare to treatment as usual.

The Family Bereavement Program (FBP, US) was identified as another potentially promising intervention.⁹³ The FBP is a multi-component program for children and adolescents who have lost a parent to suicide, which targets risk (e.g. child depression, distressing grief, externalising behaviours and parental depression) and protective factors (e.g. child coping, positive parenting) to prevent mental health problems in children and their parents. It consists of 12 group sessions for caregivers, children and adolescents in addition to two individual sessions. The RCT by Sandler et al.⁹³ showed significant decreases in suicidal ideation and/or attempts at both the 6- and 15-year follow-up.

Programs for older people

One intervention designed specifically for older adults at risk of suicide was identified. The Depression Care for Patients at Home (Depression CAREPATH; US) integrates depression care management into the routine nursing visits of Medicare home health for those over the age of 65 who screen positive for depression. A cluster randomised effectiveness trial by Lohman et al.⁹⁴ evaluated the CAREPATH trial in six home health agencies across the US. Results showed that those under the care of nurses randomised to CAREPATH demonstrated a greater reduction in suicidal ideation after one year of receiving the intervention compared to those who received usual care (*OR* 0.51, 95% CI [0.24, -1.07]), although this was not statistically significant at the $p = 0.05$ level ($p = 0.074$). The authors concluded that CAREPATH could be considered an important

component of routine home health practices with the potential to reduce suicidal ideation in the long-term for high-risk individuals.

Summary: what did the targeted programs identify as effective?

- Aftercare interventions, that is, those that provide hospital to home-based support (often psychosocial but can include clinical components) as well as utilising traditional and technology-based interventions (such as apps or helplines), may have the capacity to reduce suicide deaths and suicide ideation for those people who exhibit signs of suicide risk. It is also important to consider the following:
- Secondary screening (proactive screening) of people who may have a risk of suicide, coupled with health promotion resources and emergency department phone calls post-discharge, may be effective for reducing suicide attempts among adolescents.
- The review highlighted multiple interventions with young people using health promotion tools, screening and specific interventions, individually and in groups. Broadening the context of interventions outside of suicide risk or ideation, to address loneliness and worry, also impacted the suicidal behaviours of young people.
- Simple interventions post-discharge such as text message information regarding services, with reminders for ongoing appointments, may reduce suicidal ideation and self-harming. In addition, text message interventions between appointments regarding safety plans and coping strategies may have similar impact.
- Reviews regarding the effectiveness of helplines was scant, however, strategies used in calls such as active listening and utilising a recovery approach provided opportunities to minimise suicide risk during the call.
- Provision of a 'safe haven' for people at risk of suicide, to explore familial relationships, conflict, enhancement of coping strategies and social connectedness, may be beneficial.
- Services that combine mental health professionals working alongside peer-facilitators with lived experience to enhance participants' capacity for resilience to suicidal thoughts, may allow people to live with their suicidal risk.
- Incorporating support regarding depression and suicide risk, alongside usual health interventions for older people, provided scope to address the vulnerabilities of this age group.

Other programs

These programs ($n = 3$) explore interventions where specific intervention-prevention categories (universal, selective, and targeted) were absent. However, they met the inclusion criteria for the evidence check having reported on programs that had an outcome measure of reduction in suicide.

Appendix 7 contains the extracted data from other interventions.

National Suicide Prevention Program

A study conducted by Baran and Kropiwnicki⁹⁵ examined the effect of a national suicide program on the rate of suicide in Sweden using death data for the period of the program. Results indicated that during the period 2008 to 2014, the national program had little or no impact on reducing suicide rates among target populations, apart from elderly males. This was despite increased spending by government on training of mental health professionals and improving the standard of care and management of at-risk individuals. It is important to note that the global economic crisis occurred during the study period, and may have contributed to increased rates of suicide.

Garrett Lee Smith Community Suicide Prevention Grant

An observational study by Godoy Garraza et al.⁹⁶ compared 466 counties implementing the US-based Garrett Lee Suicide (GLS) program between 2006 and 2009 with 1161 counties that shared specific pre-intervention characteristics but had no exposure to the GLS program. Those counties implementing GLS program activities had significantly lower suicide attempt rates among youths 16 to 23 years in the year following implementation of the GLS program than similar counties that did not implement GLS program activities (4.9 fewer attempts per 1000 youths 95% CI [1.8, 8.0] fewer attempts per 1000 youths; $p = .003$). There was, however, no evidence of longer-term differences in suicide attempt rates.

Mental Health Services in Schools

Paschall et al.⁹⁷ conducted a logistic regression analysis on survey data collected from school students. The aim of the study was to examine associations between increased availability of mental health services and suicidal ideation and behaviour. The results of the secondary data analysis showed that after the first year of study, there was an association between an increase in availability of mental health services at 14 schools and a lower likelihood of suicidal ideation. The study, however, was unable to confirm whether the lower risk of suicidal ideation and suicide attempts was a direct result of an increase in mental health services.

Summary: what did the 'other' programs identify as effective?

There was limited evidence to suggest that programs that are not defined as universal, selective or targeted (such as the effectiveness of national suicide plans) had an impact on behaviours or suicide deaths. It is also important to consider the following:

- External events influence national suicide death rates.
- Targeting school or campus-based programs facilitating access to appropriate and timely services may reduce suicide attempt and ideation, at least in the short term.

Promising programs

Promising programs reported here were identified by the peer-reviewed and grey literature search and held promise for reducing suicide, but did not meet review inclusion criteria. Nineteen journal articles or agency reports/evaluations were identified as promising programs evaluated or in pre-evaluation phase relating to suicide prevention and reduction of suicide deaths. The review of the promising programs revealed a strong allied health focus and the inclusion of multidimensional approaches regarding reduction of risk factors, including the role of family members, friends and the broader community.

Appendix 8 contains the extracted data from promising program sources.

Overview of promising programs or services

The 19 papers reported here detail evaluations or identification of programs including: RCT ($n = 7$)^{51, 62, 98 99-102}; quasi-experimental studies ($n = 3$)¹⁰³⁻¹⁰⁵; comparative study ($n = 1$)¹⁰⁶; systematic review ($n = 1$)¹⁰⁷; cohort study ($n = 1$)¹⁰⁸; cross-sectional survey ($n = 1$)¹⁰⁹; mixed methods ($n = 1$)¹¹⁰ and an observation study ($n = 1$)¹¹¹. One paper referred to a book chapter detailing an evaluation summary of a multi-language mental health promotion program.¹¹² Also included in this section is the Aboriginal and Torres Strait Islander Suicide Prevention Evaluation Project (ATSISPEP) report¹¹³ which documents the findings of a meta-evaluation of effective Indigenous programs. While the report itself does not include any specific suicide related outcome measures, it is significant as this review documents culturally-effective programs to prevent suicide in Indigenous communities.

Primary outcome measures were varied and broader than the studies which met the inclusion criteria, for example, including hopefulness and spirituality¹⁰³ as ways to identify changes in presentation of people at risk of suicide. While Law et al.¹⁰⁵ focused on the role of hopelessness being one of the most significant modifiable risk factors for suicidal behaviour among self-harm patients aged 18–34 in Hong Kong, Wang and colleagues¹⁰² highlighted the importance of expanding focus to include reattempting prevention¹⁰² as another measure of effectiveness of prevention programs. In addition to these measures, Hassanian-Moghaddam et al.⁹⁹ indicated that direct patient contact is required for measurement of suicidal behaviours like ideation, attempt and self-cutting, while hospital records are more useful for episodes of hospital treatment related to suicidal behaviour, suicide risk, or treatment of mental illness.

Promising programs included a variety of universal, selective and targeted programs, primarily focused on young people.^{98, 100, 105, 106, 109, 112} One study focused on older populations¹⁰⁴, other studies included people with a current diagnosis of depression (severe to moderate)⁵¹, older people living with dementia¹⁰⁴ and programs for diverse cultural groups^{99, 102, 103} and military personnel.¹⁰⁸ Moeller-Saxone et al.¹⁰⁷ reviewed post-hospital treatment needs in China. A variety of settings are reported, including primary healthcare, school, university and, health promotion settings with the remainder occurring in the community (including outpatient services).

Effectiveness of promising programs or services

Universal interventions – school-based programs

“Project CLAN” in Chile¹⁰⁰ utilised web-based platforms for young people to engage with health professionals, access tips and health promotion strategies and connect with other users in the online community. Project CLAN involved 428 participants who were young people from urban and rural locations in Chile. The analysis of the trial (2018) was described in the paper, however results from the study have not yet been published. This is the first clinical trial of its kind in Latin America and the first in a middle-income country.¹⁰⁰(*p*.236) The evaluation of the program will be centred on primary outcome measures of reduction of suicidal ideation and enhanced social and emotional wellbeing factors.

A universal intervention described by Till et al.¹¹⁴ was an RCT involving an internet-based intervention trialled on 161 Austrian undergraduate students, to examine the effect of exposure to educational websites on suicide prevention. Participants in the three intervention groups were asked to access and review one of three websites, with Group 1 reviewing a German language educational website on suicide prevention and the other two groups accessing websites promoting email peer counselling services. The control group were directed towards an unrelated website. Participants were asked to review the website and answer questions on suicide-related behaviour including suicidal ideation and help seeking attitudes. While no intervention effect was found, results of the study indicated preventive and educational websites had a positive impact on participants' knowledge of suicide prevention. Rates of suicidal ideation were partially reduced.

Selective interventions – school-based programs

Life skills education in Cambodia¹⁰⁶ was evaluated using a comparative study with concurrent controls, involving 321 students in an urban area. The program's primary outcome measure related to capacity for resilience, as an indirect measure of assessing changes in suicidal behaviours. The teacher- and allied health-led modules sought to offer insights to promote resilience as a way to reduce vulnerability to suicide. The control group engaged with generalist sessions regarding health at school while the intervention group received six sessions of Life Skills education. The study found that overall, the girls who took part in the study showed improvement in enhanced life skill capacity compared to the boys, who had – prior to the study – exhibited more at-risk behaviours.

Selective Interventions - Workplace based programs

Broadbent¹⁰⁹ explored the impact of a life skills training program (Incolink Life Skills, Australia) for those in the building and construction industry. The cross-sectional survey study described a workshop-style program that connected young men to services in their community by addressing social, emotional and cognitive needs. This evaluation had no identified outcome measures in relation to reduction of suicide deaths or suicidal behaviours. It is included as a promising program because of the critical element evaluated: the opportunity to connect young men to a suite of services both in the program itself and services in their community or neighbouring community. Person-centred referral pathways, rather than generic connection to youth services, were tailored to the particular needs and challenges faced by those who took part.

Selective interventions – programs specifically designed for military personnel and veterans

One study focused on the needs of active service men and women based on the suicide risk of Israeli Defence Force soldiers (male and female). As reported by Shelef et al.¹⁰⁸ the study identified practical strategies to reduce suicide (in terms of reduced access to weapons) alongside screening and management of those at risk. It did not identify the complex limitations around reliability of screening of soldiers and willingness to reveal at risk behaviours.

Targeted interventions - programs for individuals who are inpatients or are in close proximity to hospital

Jun et al.¹⁰³ explored the enhancement of people's life skills and capacity to 'emotionally change' in response to a suicide intervention strategy that involved four weeks of group work delivered by a psychiatric mental health nurse to inpatients in Korean facilities. The group work provided scope to explore three phases of content: cognitive restructuring, coping behaviour reinforcement and raising hopefulness by searching for meaning. The evaluation of the small-scale program involving 45 participants showed significant decreases in depression and suicidal ideation scores for experimental group members after participating in the program, but did not show significant changes in self-esteem and spirituality scores. The authors suggested that suicide prevention programs using an integrated approach (in terms of focus of therapeutic interventions, connection between the person and their community and challenging certain behaviours) were more effective in reducing depression and suicidal ideation for inpatients with mental

illness than applying routine treatments in the hospital. In addition, the study might contribute to the use of evidence-based nursing intervention to prevent suicide among inpatients with mental illness.

Similarly, the Life Adaption Skills Training (LAST) program in Taipei runs through an outpatient service post hospital stay. Individuals received twice-weekly phone calls from an allied health professional to explore quality of life domains, as a way to focus on how they might enhance their social and emotional wellbeing.⁵¹ The participants in the LAST program showed significant incremental improvements on their level of anxiety and level of suicidal ideation when compared to the control group, with moderate- to large- between group effect sizes. The reduction of suicidal ideations had a maintenance effect for three months after the end of intervention, with moderate between group effect sizes. Both groups showed significant improvement on overall quality of life (QOL), overall health, physical QOL, psychological QOL, level of anxiety, and level of depression. The program had a small sample size and has not been up-scaled to assess its effectiveness. The analysis of the program also suggested that person-to-person contact between the researcher and the participant may have also been a factor in the success of the intervention.

A volunteer mentorship program in Hong Kong¹⁰⁵ was developed to support young people who had been admitted to public hospitals with self-harming behaviours by sharing health-based resources and encouraging treatment compliance through real life and virtual connections on a web-based platform. The primary outcome measure of reduction in suicide deaths was not significant, however secondary outcome measures related to reductions in levels of hopelessness were noted.

Moeller-Saxone et al.¹⁰⁷ reviewed the SUPRE-MISS (multisite intervention) program which delivered mental health promotion strategies to people post-hospital treatment, with a focus on China. The review suggested that close interaction between mental health promotion and suicide prevention fields may be able to improve mental health in the population. The study identified that that brief intervention and contact after suicide attempt was more effective than treatment as usual in hospital settings, in terms of potentially reducing suicides. It is important to highlight that these findings are based on combined results for five countries involved in delivery of the program and should not be viewed as particular to China.

In addition to web-based resources, the review also revealed two studies that utilised brief contact interventions to facilitate ongoing engagement post suicide attempt. One study reported on the 'Postcards in Persia' initiative⁹⁹ in Iran which involved nine postcards being sent monthly to connect care from inpatient to outpatient after a suicide attempt. The other study by Wang et al.¹⁰² was into a project called 'crisis coping cards' in Taiwan. The cards provided information about accessing care in addition to self-awareness strategies in terms of redirecting at-risk behaviour (which increased effectiveness in comparison to an earlier study that provided only referral information).

An additional project conducted in South India with Tamil Nadu refugees involved the use of 'contact and safety planning intervention' (CASP) strategies. The study by Vijayakumar¹¹⁰ involved the use of a safety planning card detailing who to contact for help, in addition to coping strategies to assist people at risk of suicidal behaviours. The control group were only given contact numbers. Results of the study identified a statistically significant reduction in attempted suicide (number not reported) in the intervention group, but no significant reduction in completed suicide, as there was no change in the control group.

Targeted interventions – programs for people with mental illness

The Indian-based Health Activity Program (HAP) evaluated by Patel¹⁰¹ noted the need to connect psychoeducation resources and behavioural management delivered by allied health counsellors, for people with moderate to severe depression when attempting to reduce depression as a primary outcome measure. Suicidal ideation reduction was a secondary outcome measure.

Targeted interventions – programs for older people

Kim et al.¹⁰⁴ evaluated the role of group work delivered to older people with dementia in Korea through a program delivered by nurses to assist people in identifying mood and shifts in behaviour, as well as including carers and family members in awareness of behaviour. The study identified significant decreases in suicidal ideation as a result of taking part in the group. Importantly, the authors reported a number of studies that focused solely on the reduction of risk factors such as depression; only rarely have they aimed to improve protective factors such as health status and social support. The authors mentioned that a multidimensional approach to elderly suicide prevention intervention should focus both on reduction of risk factors and enhancement of protective factors by encouraging participation by family members, friends, and members of the community.

Summary: what did the promising programs identify as effective?

The review of the promising programs revealed that it may be beneficial to have a strong allied health focus, with the inclusion of multidimensional approaches that seek to reduce suicide risk factors, as well as including family members, friends and the broader community. It is also important to consider the following:

- The inclusion of additional primary outcome measures may provide clearer evidence about effectiveness of programs when exploring suicidal ideation and attempts. Measures such as hope, and spirituality may be important to explore with individuals.
- Prevention strategies that target risk of reattempting suicide may benefit those with ongoing risk factors.
- Use of integrated approaches (such as therapeutic interventions alongside understanding the person, the community they engage with and their behaviours) may be more effective than routine psychiatric treatment in hospital.
- Aftercare that combines recognition of the person's suicide risk or suicide behaviours alongside exploration of the person's quality of life domains may assist.
- The use of volunteer mentorship of people in hospitals may reduce levels of hopelessness and isolation. This may have a direct impact on future suicide death.
- Health promotion strategies such as the dissemination of therapeutic and information/support cards can enhance coping strategies surrounding suicidal behaviour, or enhance help-seeking behaviours.

Non-clinical promising programs

In 2011, Susan Beaton, an Australia-based psychologist and suicide prevention specialist, was awarded a fellowship from the Winston Churchill Memorial Trust¹¹⁵. The fellowship allowed her to travel to countries to explore the latest practices in relation to responding to suicidal crisis. Ms Beaton's report¹¹⁵ emphasises the need for post-attempt care in an environment that provides opportunities for multidisciplinary intervention in a safe and holistic way. She found that community-based strategies need to extend beyond the training of mental health professionals in the use of intervention tools, given that many people who die by suicide are not in touch with mental health services at the time of their death. By promoting broader awareness of suicidal behaviours, there is the potential for any connection between a person at risk and a person who can provide support to prevent them from dying. The analysis of programs that seek to enhance learning outside the medical system, and to promote resilience and community-capacity may reflect some of the findings of this report.

The seven programs presented in Beaton's report¹¹⁵ were followed up to determine whether they were still operating, to uncover any evaluation of the programs in the period since the report and to highlight any findings from such evaluations. Of the seven reported, two have ceased operating or lost funding.¹¹⁵ Evaluation information was located for three. The Maytree program in London, United Kingdom, Accalmie (The lull) in Quebec, Canada, and Pieta House in Dublin, Ireland are all community-based services that exemplify safe ways to navigate post-suicidal crisis care for individuals. One had been internally evaluated prior to the visit (Accalmie), with recommendations that better data collection methods be employed to assess the effectiveness of the program in reducing suicide for those who access care, as well as enhanced referral pathways to ensure continuity of care once individuals leave the facility.¹¹⁶ Maytree¹¹⁷ and Pieta House¹¹⁸ reported engagement in longer-term research agendas to explore the needs of their priority populations, effectiveness of workforce and therapeutic engagements, and provided recommendations for best practice in responding to suicide prevention.

Summary: what did the non-clinical interventions identify as effective?

The review emphasised the need for alternate post-attempt care outside of the emergency department of hospitals, or traditional psychiatric facilities. In addition, the review highlighted a greater emphasis on community-capacity building to respond to people with suicidal thoughts or behaviours.

What works to reduce suicide?

This section examines the evidence for a reduction in suicide. The existing evidence is presented across five domains, which focus on those programs that exist outside traditional clinical settings as per the specified interest of the commissioning agency, being: targeting a priority population – young people; accessing and utilising the expertise of those with lived experience; addressing the social determinants of health; innovation with brief contact and digitally-enhanced programs; and general non-clinical settings.

Targeting a priority population – young people

Many programs focused on reducing suicide among young people within the school setting. Some were single component, and others focused on targeting several components simultaneously among students, staff, or the school community.

Among students undertaking psychoeducation to better understand mental health and wellbeing and developing enhanced help seeking abilities through Youth Aware of Mental health (YAM)⁵⁴, Signs of Suicide (SOS)^{58, 59} and Skills for Life⁵⁶, there were reported reductions in suicide and psychological distress, and increase in prosocial behaviour.⁵⁷ A follow-up study of SOS also reported an increase in favourable attitudes towards help-seeking for the young person or their friends. Importantly, the authors of SOS suggested that the SOS program worked to interrupt the progression of suicidal thoughts to more serious behaviours (e.g. attempts) in non-impulsive people who had previously attempted suicide.⁵⁸ Beyond psychosocial education, alternate models also show promise with Chesin et al.³⁷ reporting evidence for culture and mindfulness practices, including students reporting suicidal ideation or self-harm decreased during the course of the intervention. Conversely, the proportion of students who reported suicidal ideation or self-harm in the comparison group increased. Fekkes et al.⁵⁶ noted a longer-term goal of health promoting behaviour becoming part of school culture, with inclusion of parents and teachers along with school social workers and health providers in programs to ensure long-term reduction in suicide.

School staff are well positioned to act as first responders to signs of suicide, psychosocial problems and risk factors such as substance abuse in school children and can screen and refer students to both in school and to external supports.⁶⁷ Although no differences in rates of suicide was found, Biddle and colleagues⁶⁷ found that a variety of services (from academic support and support groups to address life events and trauma through to referral systems and specialised therapy) were required for a whole-of-school response to reduce suicide. Paschalls et al.⁹⁷ advocated for the availability of mental health services within the school environment, such as availability of a school-based health center offering physical and mental healthcare services. It is of note that young people who are disengaged from school are completely absent from these studies, and yet have very high levels of psychological distress and suicidal ideation.¹¹⁹

Accessing and utilising the expertise of those with lived experience

Peer-led group psychoeducation and support for those who have previously attempted suicide⁷⁷ was demonstrated as a cost effective and accessible method of supporting suicide attempt survivors by increasing opportunities for social connection, increasing individual resilience and reducing stigma. This offers new opportunities to harness the motivation of those with lived experience to assist peers.⁴² However, the evidence is limited and contradictory.⁴⁵

Addressing the social determinants of health

The impact of the social determinants of health (SDoH) on suicide are detailed in this report, yet few programs focus on these broader issues in the prevention of suicide. The social theorists, such as

Durkheim¹²⁰ and Shniedman¹²¹, whose theories provoked discussion about the broader contexts in which suicide occurs, are completely absent from the research included in this review, as are contemporary psychological theories that also include the context in which a person exists.^{122, 123} In fact, there is very limited evidence of theory driving research, with the majority of studies reporting on clinical features that need to be addressed. Aboriginal and Torres Strait Islander peoples are disproportionately affected by the SDoH leading to multiple and overlapping issues.¹¹³ Among Aboriginal and Torres Strait Islander people, one prison-based arts program⁷¹ did demonstrate reduced suicide through healing activities increasing opportunities for engagement and social interaction and cultural reconnection. As noted by Skerrett and colleagues⁷², it is best practice for delivery of social and emotional programs to Aboriginal populations to ensure cultural acceptance of programs are vital, and programs should be co-designed by community members.^{73, 113}

Innovation with brief contact and digitally enhanced programs

Vast opportunity exists for utilisation of digitally enhanced programs and brief contact interventions to reduce suicide and some are demonstrating evidence for reduction in suicide, particularly among those who have been receiving care and are thus contactable following discharge.⁷⁵ Telephone contact immediately after and then regularly following discharge from emergency psychiatric departments served as an effective protective factor against future suicidal behaviour, although the intervention was more effective for those with repeated suicide attempts as opposed to first time attempts. However, there were mixed results in other studies such as reported by Kreuze et al.²⁸ who found no differences in rates of suicide re-attempts between intervention and treatment-as-usual groups, although frequency of suicidal thoughts decreased in the intervention group. Text messaging has also been shown to be effective⁷⁴ with high follow-up rates. Many brief contact interventions do not (yet) have clinical significance, but are promising and should be explored in relation to an extension of clinical support into the community.⁴⁴

Several internet self-guided interventions such as MoodGYM, T2 Mood tracker app, Virtual Hope Box, Suicide Safe treatment locator app, iCBT, LEAP (an internet self-guided program informed by Interpersonal Theory of Suicide), SUMMIT (an internet self-guided emotion coping program), Deprexis (self-guided iCBT), CATCH-IT and Thrive were mentioned in secondary papers retrieved for this review, but evidence of their effectiveness was not presented.^{27, 30} Given the ability to tailor these programs to individual need at low cost, Van Spijker and colleagues⁶³ reinforced the importance of developing an understanding of how to harness the power of internet and social media to help prevent suicidal ideation. This was supported by Krysinska et al.³⁹ who reported that – after taking prevalence of exposure to the intervention into account – psychosocial treatments and coordinated/assertive/brief aftercare were the strategies that would likely result in the strongest reduction in suicide attempts.

General non-clinical settings

There was no evidence for diversionary, non-clinical programs such as safe havens, cafes or retreats retrieved for the review, other than those specifically sought to follow up Beaton's 2012 Churchill Fellowship report.¹¹⁵ Yet, there is advocacy for these types of step-up, step-down services that are offered outside the medical setting. Without rigorous evaluation and reporting on outcomes associated with these models, they lack prominence in the suicide prevention sector.¹²⁴

Gatekeeper training was also rarely presented in this review, however, this is likely due to the restricted dates for this review, as many programs have existed for some time and been previously evaluated. Broad, campus-based suicide prevention programs funded under the US-based Garrett Lee Smith Memorial Grant program did demonstrate effective suicide prevention.⁹⁶ The programs included activities such as gatekeeper training, education and mental health awareness programs, screening activities, improved community partnerships and linkages to service, programs for suicide survivors, and crisis hotlines. However,

the evidence retrieved in this review did not specify which Garrett Lee Smith Memorial Grant programs were most effective.

Community screening may also offer promise in reducing suicide among a sub-group in the population, such as older people, as reported by Oyama et al.⁶⁰ However, the authors also suggested that rather than conducting a screening intervention of the whole population, the same effects may have been achieved by having an intervention focused on personal contact only with individuals at risk, as the intervention may have served as a form of social support for individuals. This would have been a simpler and more cost-effective option than screening large community areas.

What works – at a glance

- Targeting priority populations via the settings in which they engage, such as young people in schools, can reduce suicide ideation and attempt. The role of allied health professionals who work alongside education staff in school settings may be beneficial.
- Strategies need to both access and utilise the expertise of those with lived experience. The emerging role of the consumer workforce in exploring and responding to suicidal behaviours and recovery-oriented practices may be cost effective, as well as increasing opportunities for social connection, enhancing resilience and in reducing stigma.
- Social determinants of health need to be embedded in suicide prevention strategies to provoke discussion about the broader contexts in which suicide occurs. Cultural responsiveness, regarding the impact of intergenerational trauma, is also required.
- Enhanced innovation using brief contact interventions, and the use of digitally enhanced programs, is promising. Many brief contact interventions do not (yet) have clinical significance, but can be an extension of clinical support, into the community. This further offers pathways into support as needed.
- The capacity to impact change in non-clinical settings needs to be valued and research informed. Gatekeeper training, education and mental health awareness programs, improved community partnerships and linkages to service, programs for suicide survivors, and use of crisis hotlines can be provided. Screening of at-risk individuals or groups also allows health promotion strategies to be targeted to those who need them.

Gaps in the evidence

There are inherent limitations in this Evidence Check, most notably the short period of time being reviewed. Between 1 January 2014 and 16 September 2018, a total of 77 records were retrieved using the agreed search methodology. However, there are some well-known, evidence informed, suicide prevention programs that pre-exist and are used frequently throughout many countries, including gatekeeper training, such as Applied Suicide Intervention Skills Training (ASIST), Question, Persuade, Refer (QPR) and the Collaborative assessment and Management of suicidality (CAM) model of care. As these programs pre-date the review they are not represented in the findings, other than where one of these models is embedded within another program. However, one study reporting on the multilevel intervention for suicide prevention in New Zealand (MISP-NZ) did include using these models to train mental health care workers.⁸⁵

In a prior review of suicide prevention programs, Mann¹²⁵ found that there was evidence for physician training in suicide to better identify suicidal individuals, and restricting access to lethal means was effective in reducing suicide. Meanwhile all other programs required more evidence to determine efficacy. The current review, more focused in scope, did not retrieve evidence on access to lethal means, but did find evidence for training health and community gatekeepers as being effective in reducing suicide.³⁹ Broad screening of young people, with pathways into appropriate, early care, was also effective in one location. Our results are consistent with Mann's¹²⁵ finding that there are significant limitations in the current evidence base, with gaps in knowledge remaining. While there is interest in non-clinical interventions, or those where the intensity of the intervention can be adjusted for the individual (such as step-up / step-down models)¹²⁴, no evidence was located for these.

Overall, the evidence for programs or services that reduce suicide is weak. There appears to be no strategic focus in the research being undertaken, which is investigator-led, ill-aligned to national or state strategies (where they exist) and lacking in service user involvement. Table 2 below summarises the quality of the evidence using the two methodological assessment tools (NHMRC⁶, plus either EPHPP⁷ or CASP⁸ depending on design) of all the included studies.

Table 2 Summary of quality of evidence across all records

	NHMRC Level ⁶					EPHPP Rating ⁷				CASP Rating ¹⁰			
	I	II	III	IV	N/A	Strong	Moderate	Weak	N/A	Strong	Moderate	Weak	N/A
Primary Studies (n=46)													
Universal interventions (n=9)	0	5	3	1	0	1	5	3	0	0	0	0	0
Selected interventions (n=11)	0	3	4	3	1	1*	3	7	0	0	0	1*	0
Targeted interventions (n=23)	0	11	5	4	3	1	7	14	1	0	0	1**	0
Other (n=3)	0	0	2	0	1	0	0	3	0	0	0	0	0

*additional number refers to a mixed methods study

**represents a qualitative study

Discussion

The current Evidence Check review was driven by the question: What programs or services reduce suicide? The findings report on a variety of programs with evidence that is generally low to moderate in quality. New policy solutions should consider the many significant limitations of the existing evidence base, and consider how they can be overcome. Any recommendations for new program initiatives must take these into account, including considering where innovative policy solutions are required to overcome prior limitations and to strengthen future evidence for effective suicide prevention programs. The following section is divided into three key limitations: issues with the study of suicide, methodological and study design challenge, and lack of strategic alignment. These limitations fundamentally affect the quality of the evidence base. This section concludes with an examination of what works in preventing suicide based on the findings of this review.

Issues with the study of suicide

Suicide is a preventable death and is devastating for an individual's family and friends, yet it remains a statistically rare event. Thus, samples are often drawn from a pool of participants with pre-existing clinical contact, or among community groups where large enough samples to detect power in significant change is challenging and costly, given community populations may have very low risk of suicidal behaviour. This in turn affects generalisability of findings.^{14, 28} Despite a majority of suicide occurring in middle- to low-income countries, the majority of studies captured in the review focus on high income countries.^{14, 25, 41} Miller et al.⁸⁴ highlighted that similar to every other suicide intervention trial, their study lacked sufficient power to detect differences in actual deaths by suicide but used 'proxies' including suicide attempt to overcome this limitation.

Overwhelmingly, there appears to be an assumption that suicidal behaviours can be ceased and that underpins the aims of the research reviewed. Yet, suicidal thinking and behaviours can vary in terms of their severity and frequency, and an individual can move through a range of experiences across time in response to a variety of psychosocial situations. Thus, suicide is not static, it is fluid, and individuals can experience this from one-off suicidal ideation through to chronic suicidal thoughts and behaviours, for some leading to death. This is now considered in the new update to the Integrated Motivational-Volitional Model of Suicide¹²² which includes the cyclical nature of suicidal thinking and behaviours.

Therefore, language around suicide needs to focus not only on the cessation of these thoughts and behaviours, but also the ability to live well with suicidal thoughts, and to have strategies in place to prevent acting upon them. This aligns with the anecdotal evidence provided by those with a lived experience of suicide who have only recently begun to be heard in the field of suicide prevention (for example, through organisations such as Roses in the Ocean (Australia) and Live Through This (US)). This conceptualisation of suicide by those with lived experience – regarding the ongoing and changing nature of suicide in a person's life – is lacking in the research included in the current review. These pathways within and through suicide are important to consider in determining how interventions such as depression care management can influence suicidal ideation, or the specific factors that need to be targeted, for instance individuals' perceived burdensomeness⁹⁴ or the important role of understanding and responding to anxiety symptoms in reducing suicidal ideation.⁸² Similarly, hopelessness and worry were noted as factors in assessing effectiveness of programs and interventions.

There are many methodological issues and design challenges across the studies included in this review. Underpinning all ethical suicide research is the premise of 'do no harm.' Ostensibly, this means that any

research that risks a person's life should be limited, and yet this is a paradox when working in the suicide field given all lives are at risk of ending prematurely. This paradox is reinforced by university ethics committee requirements and restrictions on researchers, thus many of the samples included in the research actively excluded people who were currently suicidal or had a current suicide plan. This is complicated by publication bias toward publishing results demonstrating the effect of interventions, which is often necessary to obtain future funding. Publication of study protocols can ameliorate these drivers however these remain rare in suicide intervention research.

Methodological and study design challenges

The duration of suicidal behaviour assessed across studies varied, making comparison of programs difficult. Yet, there is a simultaneous need for studies to include both short and longer follow-up periods to demonstrate whether the effects of programs can be maintained over an extended length of time²⁵ In their review, Caelear et al.³¹ reported that effects for reduction in suicidal ideation were found immediately postvention or at short term follow-up, but not in studies which only included longer-term follow ups. This is also seen in brief contact or mobile app interventions, such as in the systematic review reported by Kreuze et al.²⁸, which identified brief mobile treatment interventions which incorporated texted reminders about meditation, problem solving, spiritual/philosophical ideas etc. Those in the intervention group showed significant reductions in suicidal ideation and depression at six months from baseline, however, there were no significant effects at 12 months. Newer digital interventions, such as mobile phone apps were reported with small effect size or no effect and/or effects that were not sustained over time. Similarly, a systematic review by Milner et al.⁴⁴ found only three studies that revealed a significant effect of brief contact interventions on the number of episodes of repeated self-harm or suicide attempts per person, suggesting they cannot yet be applied to clinical practice. The samples testing these interventions were limited by being treatment-seeking populations. Therefore, the authors may not have been able to assess the effects of the intervention on more serious, enduring levels of suicidal behaviour or suicidal ideations/attempts that occurred in the years following the program.

The variables influencing the cyclical nature of suicidal thinking and behaviours among individuals are often as broad and complex as those motivating suicidal behaviours in the first instance. Due to these confounders, significant findings from studies with pre-post design need to be treated with caution, as observed changes could possibly be explained by factors other than the intervention. For example, Hom et al.⁷⁷ reported that participants were able to be concurrently engaged in individual therapy or use psychiatric medications and there was a possibility that changes in suicidal behaviours were due to a placebo effect. Kodama⁷⁴ also considered that spontaneous recovery and other treatments may have contributed to self-reports of help-seeking and self-harming behaviours.

Similar to programs examining ideation, those focused on suicide attempt also reported short-term reduction in attempts (among smaller samples), but these effects were lost at longer-term follow-up or not distinguishable in larger samples. Caelear et al.³¹ found that those studies which reported significant effects for suicidal ideation did so immediately postvention or at short-term follow-up. Studies that only included longer-term follow-ups did not find effects for suicidal ideation. Likewise, studies that included longer-term follow-ups (16- and 18-months) tended to find effects for suicide attempts, while those without longer follow-ups did not. On the other hand, Robinson and Caelear¹⁶ identified a study by Wasserman et al.⁽⁵⁰⁾ which showed that although there was no significant differences in suicidal ideation found at the three-month follow-up of a psychoeducation program, significant differences were identified at the 12-month follow-up. Overall, the lack of longitudinal research and/or follow up, without consideration of other variables and the possibly changing nature of a participant's suicidal status, affects claims of effectiveness.

The reliance on self-reported symptoms is another common limitation across many studies, and is complicated by using proxies for suicidal behaviours and/or attempts. Many of the studies in the review

used self-report diagnostic tools rather than structured diagnostic assessments for collecting data on suicidal ideation and behaviour⁸¹. Although self-report measures are often used to assess psychopathological constructs, Norr et al.⁸² suggested the addition of behavioural measures such as Implicit Association Tasks (tapping into suicide risk that is held unconsciously) or psychophysiological/neurophysiological measures, which can help overcome problems with self-presentation bias and self-stigma. Furthermore, the common use of a single measurement of suicidal behaviour may not provide a comprehensive assessment of suicide risk.⁹⁴

Heterogeneity of samples also limits the cross-study findings. As Exbrayat et al.⁷⁵ highlighted, the effectiveness of certain interventions may depend on the demographic characteristics of individuals who receive it. For instance, telephone follow-up may be less effective for those who have attempted suicide for the first time, compared to those who have made more than one suicide attempt. Selection bias was addressed as a limitation in several studies and may have accounted for significant differences between intervention and control groups. Results by Aquin et al.¹²⁶ were limited as individuals who were approached by interviewers to take part in the study either refused to participate or were excluded from participation. Importantly, those lost to follow up may hold important keys to better understand the intervention and the role of the intervention in suicide over time, as De Beurs et al.⁸⁵ highlighted – patients lost to follow-up were more likely to have been allocated to the intervention group as these participants tended to have higher levels of psychopathology.

Exbrayat et al.⁷⁵ found individuals who initially presented with a major depressive episode may have more willingly participated in the program than those without depression, and thus there was also a higher rate of depression among study group members than controls. Humensky et al.⁸⁸ mentioned that focus groups used to assess the Life is Precious program were voluntary and therefore may have comprised of participants who felt more positively about the intervention or were more willing to make the time and effort to attend. Similarly, several studies with pre-post-test designs were impacted by high attrition rates, which could have led to nonresponse bias whereby participants who are less satisfied with the intervention are less likely to complete follow-up assessments^{65, 72}. Hom et al.⁷⁷ suggested a detailed assessment of demographic (i.e. sexual orientation) and clinical characteristics (i.e. psychiatric diagnoses) could be considered in further analyses to examine whether their intervention can be delivered to a broad range of suicide attempt survivors or only select groups. Future studies could statistically control for the effects of differences in samples and time using covariates and analyses of seasonality.⁸⁴

Given funding and political environments in many countries favour short term outcomes to meet political needs and limited funding pools, there is growing interest in low intensity programs, given the cost of high intensity interventions. This, along with growing reliance on digital interaction, has produced fertile ground for alternative formats for treatment delivery, such as via email or apps.⁷⁹ However, it may be necessary to control for confounders that arise from reliance on different assessment modalities (e.g. paper vs. app questionnaire) as well as issues related to timing, dosing and content⁸³ and accessibility and acceptability among minority populations, such as the low uptake in Tighe et al.'s⁷³ app with Indigenous Australians. Further, with short-term programs dominating the field, service protocols and budgets largely influence the magnitude and impact of service delivery. Services with limited staff and resources may struggle to implement proposals developed to improve programs.⁷⁶

Lack of generalisability was also an issue raised by multiple studies. For example, Lohman et al.⁹⁴ recruited participants from six home care agencies and although they were from different regions and of different sizes, they were not representative of all home care agencies. There was also heterogeneity in the populations that were used in studies focused on interventions post-discharge from emergency departments. For instance, Norr et al.⁸² only included individuals with a diagnosed anxiety disorder who exhibited suicidal ideation, limiting the relevance of findings to other sample populations. Similarly, Nyer et

al.⁷⁸ recruited a sample of individuals with severe depression, suicidal ideation with intent and a history of suicide attempts within the past year. Future studies could consider tailoring programs to ascertain whether treatment effects remain similar across different clinical populations (i.e. whether those with a personality disorder experience similar effects of a treatment compared to those who are depressed and suicidal).⁸⁵

Lack of strategic alignment

In the global context of the WHO global suicide report³ and the OECD working report⁴ demonstrate that most countries included in this review have national suicide frameworks, programs or reduction targets. It is surprising, therefore, that the studies found in the review are primarily investigator-led research and appear not to align with strategic foci of the location, nor are they developed in partnership with people with lived experience. There is a notable absence of priority populations. For example, in Australia, priority populations including Aboriginal and Torres Strait Islander, LGBTIQ+ individuals, people from culturally and linguistically diverse backgrounds, older people and men are almost or wholly absent as priority groups in the research included in this review. Further, among those with mental illness, there is a lack of community care, or low intensity options, available with the focus primarily on clinical care following suicide attempt. Interestingly, suicide attempt survivors were not nominated as a priority population in the commissioning document and yet this is the group most studied in after care scenarios following ED admission, with deliberate self-harm being repeatedly demonstrated to be the strongest risk factor for future suicide, for instance, in the study by Hawton, Zahl, & Weatherall.¹²⁷ For those exposed to, or bereaved by suicide, where suicide risk is known to be at increased levels^{128, 129} there is very little evidence on interventions or their effectiveness, with only two program evaluations located.^{70, 93}

While on the surface, alignment between suicide death rates and national strategies appear logical, Baran and Kropiwnicki⁹⁵ reported that the Swiss national suicide prevention program had little to no effect. Whether or not a strategic plan for program implementation or research accompanied this national strategy is unknown. Past evaluations of the success of nationally targeted (and funded) suicide prevention plans had poor results, including the Australian youth suicide prevention strategy of the 1990s where Page et al.¹³⁰ reported that suicide rates did decline in target areas, but that when controlling for sociodemographic differences, these were no longer statistically significant. Alignment between death rates, priority populations, intervention evaluation and inclusion of people with lived experience is needed over time to fully assess effectiveness of such alignment. The recently released Strategic Framework for Suicide Prevention in NSW 2018-2023¹²⁴ aspires to this, by funding new and expanded initiatives that address after-care needs, alternative support options away from hospital emergency departments, outreach services, training and community capacity building. However, how and by whom this strategy (and programs funded within it) will be evaluated is currently unknown.

Aspirational multi-component, community-based prevention programs, such as the current Australian national trial sites, Victoria place-based trials and LifeSpan have significant funding invested in them, but are yet to report outcomes. However, similar models have reported variable outcomes. This review included a study on the outcome of the Multi-level Intervention for Suicide Prevention in New Zealand (MISP-NZ)⁵², which revealed that the multicomponent program did not show a significant effect on the rate of suicidal behaviours (self-harm or death) in intervention compared with control communities (rate ratio = 1.07, 95% CI 0.82, 1.38). A process evaluation of the MISP-NZ intervention⁵² found that uptake of the intervention components varied. Print resources had the greatest uptake followed by training and workshops in suicide prevention. Less effective were attempts to engage the media in safe suicide reporting. Clinical staff (nurses and GPs) were less likely to engage in suicide prevention activities. While the individual interventions within these multicomponent trials may be assessed as having evidence of outcome effectiveness, without alignment to community needs or country contexts, there may be less than favourable results for the funding investment.

Finally, there is very little consideration of the social determinants of suicide. The only explicit examples of this are The Life is Precious intervention which does focus on social and economic context⁸⁸ in which people live, and Sandler et al.⁹³, who focused on building protective factors for parentally bereaved children. Without considering the contextual factors, which are confounding variables in diverse samples and limit individuals' access to services and influence help-seeking behaviours, there remains large gaps in understanding of how programs work, when, and for whom. Furthermore, the onus of responsibility is generally put on the individual to 'ask for help', and while there is available literature on help seeking among people who are suicidal, there are also barriers to them doing so. These include an autonomy barrier among people who may want to deal with their own problems (cited in¹³¹) or as reported by Frey et al.¹³², people carefully considering to whom and when they disclose their suicidal thinking. Individuals may not have the language or skills to voice their suicidal thoughts and therefore cannot identify the help they need. This is in the context of a recent meta-review finding that found there was no risk in asking an individual about suicide¹³³ and a coalition of Australian organisations (including Beyond Blue) launching the #youcantalk initiative to remind people that they can both ask, and talk, about suicide with people they are concerned about to overcome these barriers to seeking help at a time of crisis, or before suicidal thinking becomes a crisis.

Discussion – at a glance

- The review identified that despite the majority of suicide death and attempt occurring in middle to low income countries, studies captured in the reviews continue to originate in high income countries
- There is a lack of longitudinal research and/or follow up in terms of exploring claims of effectiveness of included programs.
- Due to ethical considerations many of the studies excluded people who were currently suicidal or had a current suicide plan.
- A publication bias may exist regarding the effectiveness, or not, of interventions and must be addressed in terms of future suicide intervention research.
- The studies highlight a reliance on self-reported symptoms rather than structured diagnostic assessments for collecting data on suicidal ideation and behaviour.
- Funding and political environments in many countries favour short term outcomes to meet political needs and low funding pools. This may limit an understanding of the longer-term impact of interventions.
- Research is generally investigator led, atheoretical and not strategically aligned with suicide prevention strategies resulting in a reduced capacity to map fluctuations in suicide rates and attribute them to research investment.
- Finally, there is very little consideration of the social determinants of suicide as well as the stigma regarding asking for help, talking about suicide and alternate crisis intervention strategies when a person discloses intent to die by suicide that exists outside of the emergency response in a hospital setting.

Policy implications and recommendations

This report has reviewed the existing evidence for programs that reduce suicide within a defined time period of January 2014 to September 2018. While 77 studies were included and there is unprecedented activity in the suicide prevention sector in Australia, the evidence for what ‘works to prevent suicide’ is lacking. This is further hampered by the challenges in studying suicide as noted in the previous section. This section will focus on policy implications and recommendations, with a view to what can be done in the immediate, short and medium term based on the findings of the review.

Do no harm

First, the principle of do no harm must always be applied in suicide prevention. While this appears obvious in that the focus of this report is to reduce suicide, this requires moving beyond short term or one-off programs, for example, Winters et al.⁴² report an increase in suicide death when the program they reported on which was shown to reduce death ceased to operate. While the commencement of a program may be to determine effectiveness, all programs should have sustainability factored into the initial design.

Recommendation 1: Ensuring effective program sustainability

All projects require a sustainability plan, including in-principle ongoing funding, if demonstrated to be effective.

The changing nature of suicide

The experience of suicide is individual and can change over time (from rapidly to rarely). While there is yet to be consistent language to explain this, suicide can be thought of as a collection of behaviours of varying severity and frequency — including occasional ideation, planning, attempt and death — where any individual can experience these behaviours fluidly in response to a wide variety of factors. The lack of sustained evidence for effective programs over time is affected by the outcome measures of the research design.³⁹ However, this does not consider changes to an individual’s suicidality over time, and can account for the inconsistent evidence for different interventions among differing populations. Thus, the review of the evidence shows inconsistent evidence based on different sub-group outcomes (such as reduction in suicidal ideation versus behaviour in clinical versus non-clinical groups). For instance, Kennard et al.⁸¹ evaluated the effectiveness of the ASAP and BRITE smartphone app for reducing suicidal ideation and attempts. The study found that although participants who attended one or more treatment sessions in the ASAP plus treatment-as-usual group reported significantly lower suicidal ideation, over time there was no effect on suicide attempts.

New data systems provide new opportunities to consider data integration from health care delivery systems, health insurance systems and other population-wide data sources to develop a national health research database. This could also expand electronic medical records and increase access to data on hospital visits involving suicidal thoughts and behaviours.¹³⁴ There is some evidence for using proxies for suicide (e.g. hopelessness, depressions, social isolation) which have the potential to be utilised as early alerts to indicate additional support might be needed.

There is emerging, albeit currently inconsistent evidence for brief contact and follow up interventions. The evidence for these differ depending on population groups. Yet, these offer a low-cost way in which service

providers can remain in contact with those who have experienced suicide (across the severity continuum) and offer promise beyond waiting for these individuals to re-access services when their help-seeking mechanisms may be compromised by declining mental health.

Recommendation 2: Explore programs that are flexible to individuals' changing suicide experiences

Outcome measures embedded within programs need to be matched to the proposed program and incorporate the changing nature of suicide within the participants.

Recommendation 3: Utilise routine data

Overcome the limitations of short-term projects by investing in using big data to identify those at risk of changing suicide status.

Recommendation 4: Explore further brief contact or follow up interventions

Further evaluations of interventions that keep individuals in contact with services should be continued and expanded across suicide (from ideation to postvention).

Top-down versus bottom-up approaches to suicide prevention

In the present review, there is an abundance of investigator-led research, where a researcher utilises the current evidence base to acquire funding to deliver a new innovation to a community or group. This appears to be mostly atheoretical, meaning that the programs described are not grounded in theory, and thus not informed by what is known about why and how people come to, move through, suicide. This also results in research evidence that is not aligned to national suicide prevention strategies. Shared ownership and/or input from stakeholders invested in suicide prevention is rarely reported. Models of co-creation would be welcomed in suicide prevention to ensure that programs are initially developed to meet the needs of those for whom such programs will be delivered and can be reviewed and amended as needed over time. These collaborative design approaches, utilising the lived experience of people, in the development, delivery and evaluation of programs needs to become routine to overcome these challenges. Embedding research in programs and services which are developed in a collaborative fashion with end users and funders will assist in overcoming the issues with non-publication of negative results, or non-significant results, and commencing with a published protocol informs others of current activities being undertaken. This collaborative design ensures ownership across all players in the complex ecosystem of suicide, and thus increases buy in and results in both bottom-up or grassroots solutions that benefit from the expertise that is currently being expended in top-down approaches.¹¹

Recommendation 5: Routinely incorporate lived experience through collaborative design

People with lived experience are experts in suicide and its prevention, and inclusion of this perspective in all aspects of service delivery should become routine.

Recommendation 6: Require publication of research protocols

Published research protocols are required to ensure all suicide prevention work is published and the evidence base for what works and what does not work is growing.

Multicomponent programs for priority populations

Within the evidence included in this review, by far the majority of programs referred to suicide prevention in the setting of schools and targeted at young people. Given suicide rates rise sharply during adolescence, this is not surprising. What can be learnt from this focus on a priority population is the overlapping and multiple ways in which suicide prevention can occur in a relatively closed population group. That is, individual psychoeducation to help young people identify changes in themselves and others, resilience promotion, and help-seeking skill development is effective in reducing suicide. So too is providing

gatekeeper training to teachers and other school staff, and ensuring access to appropriate and timely support in the school environment. While not so comprehensive, the campus programs funded by Garrett Lee Smith Memorial Grants have also shown effect in reducing suicide among college students. Such multicomponent models could be applied to other settings where there are stable populations, including inpatient, prisons and within small or closed communities, for example, geographic (such as rural and remote locations), cultural (such as CALD and Aboriginal and Torres Strait Islander), and gender diverse (LGBTIQ+) communities. Longer term outcomes from these multicomponent interventions, such as to explore whether the young people attending these schools with incorporated interventions continue to have reduced suicide over time are encouraged. An additional focus on young people who are not engaged in school systems, and therefore do not benefit from these programs, is encouraged.

Recommendation 7: Invest in multicomponent programs

Utilise multiple components to target increased individual resilience and help-seeking while providing appropriate access to support.

Recommendation 8: Follow up people who have received in-school programs

Prioritise the long-term follow-up of those who have received in-school suicide prevention programs to assess the longer-term outcomes of psychoeducation and help-seeking training into adulthood.

Conclusion

More than 800,000 people die by suicide globally each year. Suicide is still a statistically rare event, and it is very difficult to determine where and when a person may become suicidal given the complexities of the multiple vulnerabilities that can lead a person to suicide. The WHO report³ aims to increase awareness of the public health significance of suicide, as well as making suicide prevention a high priority on the global public health agenda. Understanding the political and economic approaches to suicide prevention, in addition to the psychological or therapeutic approaches to suicide and suicidal behaviour, provides an opportunity to create social change to achieve suicide prevention goals across and within countries. The WHO³ recognises that in order to achieve prevention goals or targets, there must be sufficient and sustained funding, capacity building within workforce, collaboration, access to data and political will by those countries invested in reducing the incidence of suicide. It further recognises the multicausality (defined as the connection between biological, psychological, social, environmental and cultural factors in suicidal behaviours) of suicide. Culturally and geographically, it is important to note that the WHO report³ identifies that suicide rates in low- and middle-income countries far exceed those in high income countries like Australia. The evidence explaining suicide is often derived from research in high-income countries, thus, we need to consider the limitations of the evidence on suicide based on the cultural context.

The review highlights that research into suicide prevention remains methodologically challenging, in an environment where investigator-led research dominates and funding cycles result in short-term programs and research that may limit the capacity for long-term change. Yet the contextual issues that lead to vulnerability are often long-term and multifactorial. Further, there is an almost complete absence in the evidence reviewed regarding how to build protective factors across the community to improve resilience at times of distress and trauma.

The inherent assumption that suicide ideation and behaviour can be completely fixed or cured ignores the fact that people may experience ongoing suicidality, but can learn to live with this in ways that protect them from acting on these thoughts. People with lived experience do in fact describe living with ongoing suicidal ideation, but learn not to act on these thoughts, as is evident in the anecdotal stories reported through organisations such as Live Through This (US) and Roses in the Ocean (Australia). By including people with lived experience within research and service delivery it is likely the evidence base will expand to contain new depth. This has already occurred in other fields, such as the recovery model that now dominates mental illness/wellness research and practice.¹³⁵

To overcome the limitations noted in this report, recommendations are provided. These broadly focus on all programs being grounded in the premise of 'do no harm,' taking into account the changing nature of suicide at the individual level, while also acknowledging changing external pressures and stressors. To facilitate this, approaches that routinely incorporate lived experience, are collaboratively designed with the communities in which the program intends to function, and operate across multiple levels, are essential in preventing suicide. These recommendations require a change in policy focus, away from short-term funding cycles, to a longer-term view of reducing distress within the community.

Despite 50 years of research into risk factors for suicidal thoughts and behaviours, a recent study concluded that identifying those at risk of suicide remains only slightly better than by chance alone.¹³¹ The authors stated: "Predictive ability has not improved across 50 years of research; studies rarely examined the combined effect of multiple risk factors; risk factors have been homogenous over time, with five broad categories accounting for nearly 80% of all risk factor tests; and the average study was nearly 10 years long, but longer studies did not produce better prediction".¹³¹(p.187)

The recommendations proposed in this report — drawn from the present evidence and aimed at filling weaknesses and evidence gaps — focus on life promotion, where increased individual resilience is developed simultaneously with access to appropriate services being available, and where a proactive identification safety net exists to reduce the suicide death rate over time.

Appendix 1: Screening checklist

Suicide prevention Programs and Services – Effectiveness of Outcomes – Inclusion/Exclusion Screening Checklist				
1.	Was the study published between 2014–2018?	Yes Continue to Q.2	No EXCLUDE	Unsure Check with 2nd Reviewer
2.	Is the study about humans?	Yes Continue to Q.3	No EXCLUDE	Unsure Check with 2nd Reviewer
3.	Does the study exclude euthanasia, assisted dying/assisted suicide?	Yes Continue to Q.4	No EXCLUDE	Unsure Check with 2nd Reviewer
4.	Does the study appear to contain original data (qualitative/quantitative) or review papers that were reporting original data?	Yes Continue to Q.5	No EXCLUDE	Unsure Check with 2nd Reviewer
5.	Is the study a primary or secondary (review) source?	Yes Continue to Q.6	No EXCLUDE	Unsure Check with 2nd Reviewer
6.	Does the study contain data relating to a prevention or intervention program or service? Intervention is defined as ‘an action that is deliberately applied to a selected group of persons with the intention of changing an outcome’. Examples of types of programs/services may include: mobile phone apps; e-health; crisis text messaging; crisis lines; helplines; online programs; mindfulness; gatekeeper programs (staff training); peer support and emergency department programs.	YES Continue to Q.6	NO EXCLUDE	Unsure Check with 2nd Reviewer
7.	Does the study contain descriptions of a program/intervention other than a public health campaign or clinical treatment? e.g. pharmacological intervention; psychological therapy (individual therapy like CBT; dialectical behaviour; family therapy either with individuals, couples) provided by a clinician (psychologist, GP).	Yes Continue to Q.8	No EXCLUDE	Unsure Check with 2nd Reviewer
8.	Does the study measure an outcome of reduced suicide, including suicide death, suicidal ideation, suicide attempt?	Yes Continue to Q.9	No EXCLUDE	Unsure Check with 2nd Reviewer
9.	Is the location of the research/service/program in Australia, Japan, US, Canada, New Zealand, France, Germany, Ireland, Netherlands, United Kingdom, Denmark, Norway or Sweden?	Yes Proceed to data extraction	No EXCLUDE*	Unsure Check with 2nd Reviewer

* Note: If excluded based on country only but demonstrates what might be a ‘promising program’, save to additional folder for review later.

Appendix 2: Search strings

Database and search strings	Number of Articles
<p>PubMed</p> <p>"Suicid*" [Title/Abstract] OR "Suicide" [Mesh] OR "Suicide, Attempted" [Mesh] OR "Suicidal ideation" [MeSH]</p> <p>AND "prevent*" [Title/Abstract] OR "intervention" [Title/Abstract] OR "crisis intervention" [MeSH]</p> <p>AND "outcome analysis" [Title/Abstract] OR "outcome assessment" [Title/Abstract] OR "evidence based practice" [Title/Abstract] OR "evidence based practice" [MeSH] OR "evaluat*" [Title/Abstract] OR "program evaluation" [MeSH] OR "randomized controlled trial" [MeSH] OR "randomi?ed controlled trial" [Title/Abstract] OR (randomized controlled trial [Publication Type] OR "program development" [MeSH] OR "program development" [Title/Abstract] OR RCT [Title/Abstract] OR "clinical trial" [MeSH] OR (clinical [Title/Abstract] AND trial [Title/Abstract]) OR clinical trials as topic [MeSH Terms] OR clinical trial [Publication Type] OR "evaluation studies" [MeSH] OR "treatment outcome" [MeSH] OR "treatment outcome" [Title/Abstract] OR "controlled clinical trial" [MeSH]</p> <p>Limits: human peer reviewed, publication date (2014-2018) and English language</p>	738
<p>INFORMIT: HEALTH</p> <p>(MH:suicide) OR ((TI:suicidality OR TI:suicide OR TI:suicidally OR TI:Suicidal) OR (AB:suicidality OR AB:suicide OR AB:suicidally OR AB:suicidal) OR MH_PHRASE="Suicide" OR MH_PHRASE="Suicide, Attempted")</p> <p>(TI:prevent*) OR (AB:prevent*) OR (TI:intervention) OR (AB: Intervention) OR MH_PHRASE="Crisis Intervention"</p> <p>((TI:program* %10 evaluat*) OR (AB:program* %10 evaluat*)) OR ((TI:"evidence based practice") OR (AB:"evidence based practice")) OR ((TI:program* %10 develop*) OR (AB:program* %10 develop*)) OR ((TI:RCT OR AB:RCT) OR (TI:randomi*ed controlled trial) OR (AB:randomi*ed controlled trial) OR (TI:"outcome assessment") OR (AB:"outcome assessment")) OR ((TI:"clinical trial" OR AB:clinical trial) OR (TI:"treatment outcome") OR (AB:"treatment outcome") OR (TI:"outcome analysis" OR AB:"outcome analysis")) OR MH_PHRASE="Evaluation Studies" OR MH_PHRASE="Program Evaluation" OR MH_PHRASE="Evaluation Studies [Publication Type]"</p> <p>Limits : human, journal articles, publication date (2014-2018) and English language</p>	4

INFORMIT: INDIGENOUS	5
(SU:suicide) OR ((TI:suicidality OR TI:suicide OR TI:suicidally OR TI:Suicidal) OR (AB:suicidality OR AB:suicide OR AB:suicidally OR AB:suicidal) OR SU="Suicide" OR SU="Suicide, Attempted")	
(TI:prevent*) OR (AB:prevent*) OR (TI:intervention) OR (AB: Intervention) OR SU="Crisis Intervention"	
((TI:program* %10 evaluat*) OR (AB:program* %10 evaluat*)) OR ((TI:"evidence based practice") OR (AB:"evidence based practice")) OR ((TI:program* %10 develop*) OR (AB:program* %10 develop*)) OR ((TI:RCT OR AB:RCT) OR (TI:randomi*ed controlled trial) OR (AB:randomi*ed controlled trial) OR (TI:"outcome assessment") OR (AB:"outcome assessment")) OR ((TI:"clinical trial" OR AB:clinical trial) OR (TI:"treatment outcome") OR (AB:"treatment outcome") OR (TI:"outcome analysis" OR AB:"outcome analysis")) OR SU="Evaluation Studies" OR SU="Program Evaluation" OR SU="Evaluation Studies [Publication Type]"	
Limits: human, journal articles, publication date (2014-2018) and English language	
ProQuest (PsycINFO)	946
(ab,ti(suicid[*6]) OR SU(suicide) OR SU(suicidal ideation) OR SU(Attempted Suicide) OR SU(Suicidology)	
AND ab,ti(prevent[*6]) OR ab,ti(intervention) OR SU(intervention) OR SU(suicide prevention centers) OR SU(crisis intervention) OR SU(mental health services) OR SU(crisis intervention services) OR SU(Suicide Prevention	
AND SU(evaluation) OR ab,ti(program Near/20 evaluat*) OR ab,ti(evidence based practice) OR SU(evidence based practice) OR ab,ti(program development) OR ab,ti(RCT) OR SU(randomized controlled trial) OR ab,ti(randomi?ed controlled trial) OR ab,ti(clinical trial) OR SU(clinical trial) OR ab,ti("treatment outcome") OR SU(treatment outcome) OR ab,ti(outcome analysis" OR "outcome assessment"	
Limits : human, peer reviewed, publication date (2014-2018) and English language	
Web of Science (WOS) (n.b.no controlled vocabulary available in WOS)	1,165
TS=(suicid*)	
TS=(prevent*) OR TS=(intervention)	
TS=("outcome analysis") OR TS=("outcome assessment") OR TS=("evidence based practice") OR TS=(program Near/20 evaluat*) OR TS=(randomi?ed controlled trial) OR TS=("program Near/20 development") OR TS=(RCT) OR TS=(clinical trial*) OR TS=(treatment Near/8 outcome)	

Limits : human, peer reviewed, publication date (2014-2018) and English language	
SCOPUS	
TITLE-ABS (suicid*)	1,377
TITLE-ABS-KEY (prevent* OR intervention)	
TITLE-ABS-KEY ("outcome evaluation" OR "evidence based practice" OR randomi?ed controlled trial OR (program* W/20 develop*) OR (program* W/20 evaluat*) OR RCT OR (clinical W/3 trial*) OR (treatment W/8 outcome*)) OR TITLE-ABS(evaluat*)	
Limits : human, peer reviewed, publication date (2014-2018) and English language	

Appendix 3: Summary of secondary sources

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
Meta-systematic reviews ($n=3$)					
Bennett et al. (2015)	Conduct an expedited knowledge synthesis (EKS) to facilitate evidence-informed decision making concerning youth suicide prevention, specifically school-based strategies and non-school-based interventions designed to prevent repeat attempts.	Young people Psychoeducation	No included review addressing school-based prevention ($n = 7$) reported decreased suicide death rates based on randomised controlled trials (RCTs) or controlled cohort studies (CCSs), but reduced suicide attempts, suicidal ideation, and proxy measures of suicide risk were reported (based on RCTs and CCSs). Included reviews addressing prevention of repeat suicide attempts ($n = 14$) found the following: emergency department transition programs may reduce suicide deaths, hospitalizations, and treatment non-adherence (based on RCTs and CCSs); training primary care providers in depression treatment may reduce repeated attempts (based on one RCT); antidepressants may increase short-term suicide risk in some patients (based on RCTs and meta-analyses).	N/A	Moderate
Das et al. (2016)	Review literature published up to December 2015 to identify systematic reviews on mental health	Young people School-based interventions ($n = 12$); community-based interventions ($n = 6$);	School-based suicide prevention programs suggest that classroom-based didactic and experiential programs increase short-term knowledge of suicide	N/A	Weak

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
	interventions in adolescent population.	digital platforms ($n = 8$); and individual- or family-based interventions ($n = 12$).	Standard Mean Difference (SMD): 1.51; 95% CI [0.57,2.45] and knowledge of suicide prevention SMD: 0.72; 95% CI [0.36,1.07] with no evidence of an effect on suicide-related attitudes or behaviours.		
Robinson and Callear (2018)	Synthesise the suicide prevention interventions evidence across educational settings.	Young people Psychoeducation Student assistance programs	Two of the university-based studies reported positive effects. Both universal and indicated interventions showed positive results; no iatrogenic effects (illness relating to treatment) were reported. School-based studies can have a positive impact on suicide-related behaviour and, overall, do not appear to cause harm.	N/A	Weak
Systematic reviews ($n=11$)					
Callear et al. (2016)	Examine the effectiveness of school-community- and healthcare-based interventions in reducing and preventing suicidal ideation, suicide attempts and deliberate self-harm in young people aged 12–25 years.	Young people School, community and healthcare based Interventions	The results of the review indicated that just over half of the programs identified had a significant effect on suicidal ideation (Cohen's $d = 0.16$ – 3.01), suicide attempts ($\phi = 0.04$ – 0.38) or deliberate self-harm ($\phi = 0.29$ – 0.33 ; $d = 0.42$).	N/A	Weak
Hvidt et al. (2016)	1) Provide a detailed overview of the evidence on the impact of telephone crisis services on suicidal users. 2) Determine the limitations of the outcome measures used in this evidence., 3) Suggest directions for future research.	No priority population Telephone crisis services	The majority of studies showed beneficial impact on an immediate degree of suicidal urgency, depressive mental states as well as positive feedback from users and counsellors.	N/A	Weak

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
Kreuze et al. (2017)	Explore how technology-enhanced interventions target suicide risk and protective factors, using the Centers for Disease Control and Prevention (CDC, 2015) Risk and Protective Factors Ecological Model.	No priority population Technology-enhanced interventions: interventions delivered by mobile phone application, text message, telephone, computer, web, CD-ROM and video.	Intervention effectiveness was variable, but several technology-enhanced interventions have demonstrated effectiveness in reducing suicidal ideation and mental health comorbidities.	N/A	Strong
Lai et al. (2014)	Perform a review of the published literature on Web-based suicide prevention strategies, focusing on their efficacy, benefits, and challenges.	No priority population Web-based suicide prevention strategies	Internet-based cognitive behaviour therapy (iCBT) reduced suicidal ideation in the general population in two randomized controlled trial (effect sizes, $d = 0.04-0.45$) and in a clinical audit of depressed primary care patients.	N/A	Moderate
Milner et al. (2015)	Synthesise the evidence regarding the effectiveness of brief contact interventions for reducing self-harm, suicide attempt and suicide.	No priority population Brief contact interventions: telephone contacts; emergency or crisis cards; and postcard or letter contacts	For any subsequent episode of self-harm or suicide attempt, there was a non-significant reduction in the overall pooled odds ratio (OR of 0.87 95% CI [0.74,1.04] $p = 0.119$) for intervention compared with control. The number of repetitions per person was significantly reduced in intervention v. control (incidence rate ratio $IRR = 0.66$, 95% CI [0.54, 0.80] $p = 0.0001$). There was no significant reduction in the odds of suicide in intervention compared with control (OR = 0.58, 95% CI [0.24,1.38]).	N/A	Weak
Nelson et al. (2017)	Review studies of the accuracy of methods to identify individuals at increased risk of suicide and the effectiveness and adverse effects of	US veteran and military populations Healthcare interventions: these initiatives included	Suicide rates were reduced in six of eight observational studies of population level interventions. Only two of 10 trials of individual-level	N/A	Moderate

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
	healthcare interventions relevant to US veteran and military populations in reducing suicide and suicide attempts.	components generally categorised as education, awareness, individual health, and individual risk monitoring.	psychotherapy reported statistically significant differences between treatment and usual care.		
Okolie et al. (2017)	Assess the effectiveness of interventions to prevent suicidal behaviour and reduce suicidal ideation in this age group.	Older adults Community-based programs incorporating education, gatekeeper training, depression screening, group activities, and referral for treatment	Effective interventions were multifaceted primary care-based depression screening and management programs; treatment interventions (pharmacotherapy and psychotherapy); telephone counselling for vulnerable older adults; and community-based programs incorporating education, gatekeeper training, depression screening, group activities, and referral for treatment.	N/A	Moderate
Perry et al. (2016)	The current systematic review aims to identify online and mobile psychosocial suicide prevention interventions for young people, and evaluate the effectiveness of these interventions.	No priority population Online and mobile psychosocial suicide prevention interventions	One study met inclusion criteria, and found significant reductions in the primary outcome of suicidal ideation, as well as depression and hopelessness.	N/A	Weak
Pospos et al. (2018)	Review published data on web-based and mobile applications that have been shown to mitigate stress, burnout, depression and suicidal ideation among several populations.	Healthcare students and professionals Relaxation audios and music, breathing technique videos, guided breathing audio/tutorials, timer to slow breathing rate, meditation audios,	Selected seven resources under five general categories designed to foster wellness and reduce burnout, depression, and suicide risk among healthcare workers: breathing (Breath2Relax), meditation (Headspace, guided meditation audios), web based cognitive behavioural therapy (MoodGYM, Stress Gym), and suicide prevention apps (Stay Alive, Virtual Hope Box).	N/A	Weak

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
		informative pages with visual aids and quizzes, psychoeducational content, mood tracker app, Suicide prevention Virtual Hope Box, Suicide Safe treatment locator app			
Wei et al. (2015)	Conducted a systematic review of two youth suicide prevention programs to help determine if the quality of evidence available justified their widespread dissemination.	Young people Signs of Suicide (SOS) and Yellow Ribbon (YR) suicide prevention programs	Cannot recommend that schools and communities implement either the SOS or YR suicide prevention programs. Purchasers of these programs should be aware that there is no evidence that their use prevents suicide.	N/A	Moderate
Zalsman et al. (2016)	To assess progress in suicide prevention research since 2005	No priority population Public and physician education, media strategies, screening, restricting access to suicide means, treatments, and internet or hotline support	School-based awareness programs have been shown to reduce suicide attempts ($OR\ 0.45$, 95% CI [0.24, 0.85] $p = 0.014$) and suicidal ideation (0.5, 0.27–0.92; $p = 0.025$). The anti-suicidal effects of clozapine and lithium have been substantiated but might be less specific than previously thought. Insufficient evidence exists to assess the possible benefits for suicide prevention of screening in primary care, in general public education and media guidelines.	N/A	Moderate
Systematic Review & Meta-Analysis (n=4)					
Krysinska et al. (2016)	Present estimated reductive effects on suicide attempts and deaths that might be expected in Australia if	No priority population	There was insufficient evidence available for the impact of a number of strategies, including frontline staff, gatekeeper training, on either suicide attempts	I	N/A

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
	active components of the systems approach were to be implemented.	Multilevel systems approach: reducing access to suicide means, media guidelines, public health campaigns, gatekeeper programs, school programs, general practitioner training, psychotherapy and co-ordinated/assertive after care. Interventions relevant for report include: gatekeeper programs, school programs, GP training	or deaths. Taking prevalence of exposure to the intervention into consideration, the strategies likely to bring about the strongest reduction in suicide attempts were psychosocial treatments and co-ordinated/assertive after care. The greatest impact on reductions in suicide deaths was found for psychosocial treatment, general practitioner training, gatekeeper training and reducing access to means of suicide.		
Milner et al. (2015)	The aim of this review was to provide a systematic assessment of workplace suicide prevention activities, including short-term training activities, and suicide prevention strategies designed for occupational groups at risk of suicide.	Workplace The review included a number of stand-alone, short-term training programs, such as: Working Minds, Applied Suicide Intervention Skills Training, Suicide TALK, Safe TALK, Question Persuade Refer program, Employee Assistance Program, IncoLink, Farm-link, Mates	There were 13 interventions relevant for the review after exclusions. Very few workplace suicide prevention initiatives had been evaluated. Results from those that had been evaluated suggest that prevention initiatives had beneficial effects.	I	Moderate

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
		in Construction, OzHelp Foundation			
Witt (2017)	The aim of this study was to review the effectiveness and characteristics of suicide prevention programs targeting protective and emergency service staff (police, military, ambulance, corrections, and fire services.)	Workplace Primary prevention activities included resiliency and leadership training; Secondary level activities included awareness training, gatekeeper training, monitoring and screening, suicide postvention services and annual mental health check-ups.	After exclusion criteria was applied, 13 studies met the eligibility criteria. Six of the 13 studies provided quantitative data. Results of the meta-analysis indicated that four programs post intervention were associated with a reduction in suicide rate over a period of 5.3 years (<i>SD</i> 4.2; range 1–11 years). Meanwhile, two programs post-intervention were shown to have evidence of a significant effect on suicide rates over an average follow-up period of 6.1 years (<i>SD</i> 6.9, range 1.3–11 years)	I	Strong
Witt et al. (2017)	The aim of this review was to investigate the effectiveness of digital interventions for the self-management of suicidal ideation or self-harm.	No priority population Digital interventions i.e. online resources, mobile telephone apps.	Overall, digital interventions were associated with reductions for suicidal ideation scores at post-intervention. There was no evidence of a treatment effect for self-harm or attempted suicide.	I	Strong
Meta-Analysis (<i>n</i> =1)					
Sakashita and Oyama (2016)	Conduct an overview of studies that assessed the impact of suicide prevention interventions on suicide rates in elderly people in Japan. Interpret the results of these studies, as well as prominent findings	Older adults Community-based interventions providing universal depression	Screening interventions were associated with lower suicide rates. There was also a gender difference in the response to subsequent psychiatric or primary care. Two types of interventions decreased the rate	N/A	N/A

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
	associated with other successful interventions, within a framework of the suicidal process and preventive strategies.	screening, subsequent care, and education	of suicide among elderly people: crisis helplines and screening interventions.		
Scoping Review (n=1)					
Redvers et al. (2015)	1) Undertake a scoping review of the peer-reviewed literature on suicide prevention and interventions in Indigenous communities across the circumpolar north. 2) Determine the extent and types of interventions that have been reported during past decade.	Aboriginal and Torres Strait Islanders	Search identified 95 articles that focused on suicide in distinct circumpolar Indigenous populations; 19 articles discussed specific suicide-related interventions and seven of these described program evaluation methods and results in detail. All studies that included program evaluations, except one (36), showed success in their interventions according to various methods.	N/A	N/A
Literature review (n= 7)					
Brown and Green (2014)	The aims of this article are to: 1) Briefly review the state of the science for follow-up care 2) Summarise limitations of the current research and needed breakthroughs 3) Describe both short- and long-term research objectives as well as a step-by-step research pathway to	No priority population Follow-up care for suicide prevention i.e. postcards, phonecalls	Only two RCTs have examined the effect of follow-up care on death by suicide. The first study found that the rate of suicide for the intervention condition was significantly lower than that for the control group for the first two years of follow-up. The second study enrolled suicide attempters from eight emergency departments (EDs) in five low- to middle-income countries. Follow-up over an 18-month period revealed that individuals in the intervention	N/A	N/A

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
	advance the field of providing follow-up care for suicide prevention.		condition had a significantly lower rate of suicide than those receiving treatment as usual.		
Christensen et al. (2014)	Examine research studies which focus on these three aspects of suicide and the internet: the use of online screening for suicide; the effectiveness of e-health interventions aimed to manage suicidal thoughts; and newer studies which aim to proactively intervene when individuals at risk of suicide are identified by their social media postings.	No priority population E-health interventions including social media interventions	Online screening may have a role, although there is a need for additional robust controlled research to establish whether suicide screening can effectively reduce suicide-related outcomes, and in what settings online screening might be most effective. The effectiveness of Internet interventions may be increased if these interventions are designed to specifically target suicidal thoughts, rather than associated conditions such as depression.	N/A	N/A
Falcone et al. (2017)	Provide a review regarding the role of new technologies (e.g. postcards/letters, text messages, crisis cards, telephone contacts, online interventions) in suicide prevention.	Patients discharged from ED or psychiatric units New technologies for reducing suicidal behaviour: letters, text messages, crisis cards, telephone contacts, and online interventions.	Brief contact interventions show promise in reducing the number of episodes of repeated self-harm and/or suicide attempts following discharge from the emergency department or psychiatric units.	N/A	N/A
Ridani et al. (2015)	Conduct a review of Aboriginal suicide prevention programs	Aboriginal and Torres Strait Islanders Most programs targeted the whole community and were delivered through	Twenty-eight percent of evaluated programs made mention of observed changes in suicide rates over time, although these changes were not systematically evaluated. Only one program, "You Me—Which Way", measured and reported reduced	N/A	N/A

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
		workshops, cultural activities, or creative outlets.	suicidal ideation for individuals within the intervention group.		
Sanchez-Teruel et al. (2014)	Present the latest findings on effective suicide prevention strategies in the general population as well as the most appropriate instruments for assessing the level of risk for suicidal behaviour in a clinical population.	General and clinical population Mainly biological and psychosocial interventions (therapies) but includes studies on follow-up interventions by phone etc.	Suicide prevention programs aimed at the general population and at-risk groups are few and far between. When looking at assessment tools, it has been shown that the vast majority (or at least those most frequently used by researchers and clinicians) measure very specific aspects of suicidal behaviour (ideation, attempt, lethality attempts, etc.) and fail to predict suicide in a holistic way.	N/A	N/A
Takeshima et al. (2015)	Review the developmental stages of a comprehensive policy of suicide prevention in Japan from 1998 to 2013.	No priority population Comprehensive policy of suicide prevention in Japan, facilitated by the 2006 Basic Act for Suicide Prevention and the 2007 General Principles of Suicide Prevention Policy.	Suicide prevention activities were facilitated by the 2006 Basic Act for Suicide Prevention and the 2007 General Principles of Suicide Prevention Policy. Along with the establishment of a Special Fund program for local governments, the Basic Act and General Principles led to the development of a comprehensive and multisector approach to suicide prevention. Suicide rates in Japan, especially among middle-aged men, decreased consistently after 2009, suggesting that the initiatives were effective.	N/A	N/A
Winters et al. (2017)	Review interventions designed to prevent suicide among individuals with serious mental illness in forensic settings.	Inmates with serious mental illness (SMI) Adult Reception and Diagnostic Centre (staff training), Samaritans program (peer support)	Protocols such as the RDS (referral decision scale) and the DHS (depression, hopeless, suicidal screening) should be implemented, as they have demonstrated effectiveness in evaluating inmates for SMI and the associated risk factors of hopelessness, depression, and suicidal ideation. For inmates with	N/A	N/A

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
			SMI who are identified as high risk, corrections-specific intervention strategies can be implemented to prevent suicidal thoughts and behaviours. Peer suicide intervention has been successful at reducing suicide; however, it requires a continuous regimen of willing volunteers as well as access to outside experts for training purposes (B. Hall & Gabor, 2004). Staff training and implementation of monitoring programs are also recommended procedures for detecting suicidality and providing follow-up care for inmates identified as at risk.		
Descriptive review (n=1)					
Jacob et al. (2014)	The study examines what is currently known about the operation and effectiveness of Internet programs run by professionals for suicide and self-harm prevention that are run by professionals.	No priority population Internet programs for suicide and self-harm prevention	There was no formal evaluation of program effectiveness in preventing suicide. Studies either presented strategies that supported individuals at risk of suicide (n = 8), supported professionals working with those at risk (n = 6), or attempted to improve website quality (n = 1).	N/A	N/A
Narrative review (n=2)					
Chesin et al. (2016)	Conduct a narrative review of studies testing the feasibility of mindfulness-based interventions (MBI) with individuals at risk for suicidal behaviour and the effectiveness of MBIs for reducing suicidality.	No priority population Mindfulness-based interventions (MBI): MBCT, mindfulness meditation class	Findings from the handful of available studies support targeting suicidal ideation with MBI. Additional studies show deficits associated with a suicide attempt, namely attentional dyscontrol, problem-solving deficits, and abnormal stress response, are improved by MBI.	N/A	N/A

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
Ghanbari et al. (2015)	Determine whether phone preventive interventions or other vehicles (postal cards, email and case management) are effective in reattempt prevention and health promotion after discharge by providing an overview of studies on suicide reattempts.	Individuals discharged after attempting suicide Phone preventive interventions or other vehicles (postal cards, email and case management)	A total of 26 cases related to the aim of this research were derived from 36 English articles with the aforementioned keywords. Research shows that providing comprehensive aids, social support, and follow-up after discharge can significantly prevent suicide reattempts. Several studies showed that follow-up support (phone calls, crisis cards, mails, postal cards) after discharge can significantly decrease the risk of suicide.	N/A	N/A
Cochrane review (n=1)					
Harrod et al. (2014)	Evaluate the effect on suicide and suicide-related outcomes of primary suicide prevention interventions that targeted students within the post-secondary setting.	Post-secondary students Suicide prevention self-efficacy, gatekeeper training, classroom instruction.	Eight studies met inclusion criteria. The effect on suicide prevention self-efficacy in one RCT (152 participants) was uncertain (SMD = 0.20, 95% CI [-0.13, 0.54]; low quality evidence). One controlled before-and-after study (CBA) analysed the effects of an institutional policy that restricted student access to laboratory cyanide and mandated professional assessment for suicidal students. The incidence of student suicide decreased significantly at one university with the policy relative to 11 control universities, 2.00 vs. 8.68 per 100,000 ($z = 5.90$; $p < 0.05$). Four CBAs explored effects of training gatekeepers' to recognize and respond to warning signs of emotional crises and suicide risk in students they encountered. The magnitude of effect sizes varied between studies. Gatekeeper training enhanced short-term suicide knowledge in students,	N/A	Moderate

First author, Year	Objective	Sample, setting, design (program type, priority population)	Outcomes/findings (especially in relation to reduced suicide)	NHMRC evidence	CASP
			peer advisors residing in student accommodation, and faculty and staff, and suicide prevention self-efficacy among peer advisors. There was no evidence of an effect on participants' suicide-related attitudes or behaviours.		

Appendix 4: Summary of universal programs

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Collings et al. (2018)	In the context of the recent surge in community-based multilevel interventions for suicide prevention, all of which show promising results, the review discusses the implications of the findings of such an intervention designed for and implemented in New Zealand.	$n = N/A$ Community RCT	The multilevel intervention for suicide prevention in New Zealand (MISP-NZ)	There was no significant difference between the change in rate of suicidal behaviours (ISH or self-inflicted deaths) in the intervention group compared with the control group (rate ratio = 1.07, 95% CI [0.82–1.38].	II	Medium
Fekkes et al. (2016)	Evaluate the effects of the Dutch “Skills for Life” program on students’ health behaviours, bullying behaviour and suicidal ideation.	$n = N/A$ School RCT	Skills for Life	Fewer students in lower educational levels in the EG reported suicidal thoughts compared to the control group at the end of the second year. (t_0 vs t_2 : OR = 0.43, 95% CI [0.19, 0.95].	II	Weak
Oyama and Sakashita (2016)	To explore the long-term impact of a universal screening intervention for depression on suicide rates among older community-dwelling adults,	$n = 2552$ Community	The educational component was designed to improve access and adherence to treatment by providing information regarding depression symptoms and treatment, access to mental	There was a 48% decrease in suicide rates among older adults in the intervention region from pre- to post-implementation. There was no statistically significant change in suicide rates in the three	III-2	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	with gender as an effect modifier.	RCT	health care, and the importance of depression screening. This component was implemented from 2005 to 2006 at 18 community centres (once a year per centre) in the intervention region, through 90-minute workshops taught by municipal public health nurses and open to the general public, and through local public newsletters (once every six months).	<p>comparison areas over the study period. The decrease in the suicide rate among the older adult population in the intervention region was significantly greater than that in comparison areas.</p> <p>A comparison between the pre-implementation and two-year implementation periods showed a 47% decrease in suicide rates among men in the intervention region (adjusted IRR time: 0.53, 95% CI [0.28, 1.00] $f(1,14) = 4.62, p = 0.049$) ($IRR$=incidence rate ratio) but no significant change among women ($f(1,14) = 2.35, p = 0.148$).</p> <p>Comparison between the pre-implementation and four-year follow-up period, however, showed a 76% decrease among women (adjusted IRR time: 0.24, 95% CI [0.08, 0.70] $f(1,14) = 8.24, p = 0.012$), but no significant change among men ($f(1,14) = 0.32, p = 0.583$).</p>		

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Oyama and Sakashita (2017)	Evaluate the effectiveness of a four-year community-based intervention, including universal depression screening and subsequent care and support for those identified as suffering from depression, in reducing suicide rates among middle-aged adults in rural areas with a high suicide rate.	<i>n</i> = N/A Community Quasi-experimental parallel cluster design	At-risk residents within the intervention area were invited for universal depression screening and subsequent care/support Comparison communities in other prefectures were used as comparators	Screening for depression rather than suicidality to avoid risk of social desirability bias and therefore under-reporting of suicidal thoughts. Suicide rates decreased more in the intervention group [<i>IRR</i> 0.57, 95% CI [0.41, 0.78] <i>f</i> 1,36 = 12.52, <i>p</i> = 0.001] than the control group (<i>IRR</i> proportion 1.63, 95% CI [1.06, 2.48]; <i>f</i> 1,82 = 5.20, <i>p</i> = 0.025) or the whole country (<i>IRR</i> proportion 1.64, 95% CI [1.16, 2.34]; <i>f</i> 1,42 = 8.21, <i>p</i> = 0.006).	III-2	Medium
Roberts et al. (2018)	The purpose of the study was to evaluate the efficacy of two delivery strategies of the Aussie Optimism Program: Social Life Skills and Optimistic Thinking Skills programs in combination with the self-directed AOP for parents and families.	<i>n</i> = 2288 School RCT	Aussie Optimism Program (AOP) Participants were randomly allocated to one of three groups: Aussie Optimism with teacher training; Aussie Optimism with teacher training plus coaching; or a usual care condition that received the regular Western Australian Health Education Curriculum	For suicidal ideation, there was no significant group × time interaction [<i>f</i> (2,198) = 2.84, <i>p</i> = 0.061]. There were, however, significant main effects for group and time. AOP implemented with both training and coaching decreased the incidence of suicidal ideation at the end of Grade 7 as students were making their transition to secondary school.	II	Medium
Robinson et al. (2016)	Test the effects of a specifically designed, eight-module Internet-based program on	<i>n</i> = 32	Reframe IT	A statistically significant result was seen on suicidal ideation, depressive symptoms and hopelessness, with a	IV	Strong

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	suicidal ideation among secondary school students.	School Case series with either post-test or pre-test/post-test outcomes.		moderate effect size for suicidal ideation and clinician-rated depressive symptoms (0.66 and 0.60, respectively), and a small effect size for self-rated depressive symptoms and hopelessness (0.48 and 0.46, respectively).		
Schilling et al. (2014)	The study evaluated Signs of Suicide Suicide Prevention Program (SOS) implemented in high-military-impact middle schools.	<i>n</i> = 419 School RCT	Signs of Suicide (SOS) Students in the control group completed the pre-test questionnaires but did not participate in the program	Intervention effects on post-test suicidal ideation and planning were not significant. However, in model 3, the SOS program was associated with significantly less risk of suicidal behaviour (ideation, planning, and/or attempts) among students reporting pretest ideation in the intervention group compared to the control group, controlling for pretest levels of lifetime suicide attempt ($p < .05$). Approximately 96% less likely to report suicidal behavior in the previous three months than students with pre-test ideation in the control group ($OR = e^{3.28} = .038$, $t(341) = 2.03$, $p < .05$). Students who reported pre-test suicidal ideation in the intervention	II	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				group reported fewer suicidal behaviors (ideation, planning, and/or attempts) at post-test.		
Schilling et al. (2016)	Replicate and extend evaluation of the Signs of Suicide (SOS) suicide prevention program using a rigorous pre-test post-test randomised control design.	16 technical high schools; 1302 (9th grade students) School RCT	Signs of Suicide (SOS) At control schools, students taking gym in the fall completed the pre-test survey; three months later, they completed the post-test survey before the SOS program was administered.	Controlling for pre-test reports of lifetime attempts and recent attempts (previous three months), exposure to the SOS program was associated with significantly fewer reports of suicide attempts in the past three months, but not fewer reports of planning or ideation. The ninth grade students in the intervention group were approximately 64% less likely to report a suicide attempt in the past three months compared with students in the control group. As demonstrated in previous evaluations, participation in the SOS program was associated with lower rates of suicide attempt at three months following the program but was not associated with changes in suicidal ideation	II	Weak
Wasserman et al. (2015)	Investigate the efficacy of school-based preventive	168 schools (11 110 pupils) were randomly	The Saving and Empowering Young Lives in Europe (SEYLE) study	No significant differences between intervention groups and the control group were recorded at the three-	III-1	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	interventions of suicidal behaviours.	assigned to interventions (40 schools [2692 pupils] to QPR, 45 [2721] YAM, 43 [2764] ProfScreen, and 40 [2933] control).		month follow-up. At the 12-month follow-up, YAM was associated with a significant reduction of incident suicide attempts (<i>OR</i> 0.45 95% CI [0.24, 0.85] <i>p</i> = 0.014) and severe suicidal ideation (<i>OR</i> 0.5 95% CI [0.27,0.92] <i>p</i> = 0.025), compared with the control group. 14 pupils (0.70%) reported incident suicide attempts at the 12-month follow-up in the YAM versus 34 (1.51%) in the control group, and 15 pupils (0.75%) reported incident severe suicidal ideation in the YAM group versus 31 (1.37%) in the control group.		

Appendix 5: Summary of selective programs

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Allan et al. (2018)	Examine whether an RCT focused on reducing Perceived Burdensomeness and Thwarted belonging could reduce incidence of suicidal thoughts in a high-risk sample of people reporting no suicidal thoughts at baseline.	<i>n</i> = 138 US Participants recruited from the community via newspaper advertisements, website listings, and community mail outs to local medical and mental health care providers. RCT	Cognitive Anxiety Sensitivity Treatment	Consistent with hypotheses, reductions in perceived burdensome predicted lower incidence of suicidal ideation over time. In contrast, the intervention had no effect on thwarted belongingness nor on incidence of suicidal thoughts via thwarted belongingness reductions.	II	Weak
Biddle et al. (2014)	Examine relationships between participation in Pennsylvania's Student Assistance Program (SAP); violation of school drug and alcohol policies due to use/abuse, possession, or distribution of drugs/alcohol; and suspensions from school	<i>n</i> = 347,626 referrals to SAP US Secondary college	SAP (Student Assistance Program)	Non-participants had a suicide rate that was double that of participants (129.25 compared to 65.20 suicides per 100,000 persons). The difference in rates was not statistically significant. Both participants and non-participants however, did have statistically	N/A	Weak*

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	<p>or school activities for students at risk for suicide.</p> <p>It examined the incidence of suicide for students referred to the SAP as well.</p>	No study design		significant higher rates of suicide compared to both participants (11.43 suicides per 100,000 persons) and non-participants (4.39 suicides per 100,000 persons) in the SAP population referred for reasons other than suicide risk.		
Bush et al. (2017)	Assess the impact of the Virtual Hope Box (VHB), a smartphone app to improve stress coping skills, suicidal ideation, and perceived reasons for living among patients at elevated risk of suicide and self-harm.	<p>Control condition ($n = 60$)</p> <p>Intervention condition ($n = 58$)</p> <p>US</p> <p>Treatment programs VA Portland</p> <p>Healthcare System (VAPORHCS)</p> <p>RCT</p>	A Virtual Hope Box: randomised controlled trial of a smartphone spp for emotional eegulation and coping with distress	VHB users reported significantly greater ability to cope with unpleasant emotions and thoughts (Coping Self-Efficacy Scale) at three ($b = 2.41$, 95% CI [0.29, 4.55] and 12 weeks ($b = 2.9995$ CI [0.08, 5.90] compared with the control group.	II	Weak
Cwik et al. (2016)	Evaluate the impact of a comprehensive, multitiered youth suicide prevention program among the White	<p>N/A</p> <p>US</p>	Multicomponent program with universal, targeted and selective interventions	Overall, Apache suicide death rates dropped from 40.0 to 24.7 per 100 000, a 38.3% decrease.	IV	Moderate

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	Mountain Apache of Arizona since its implementation in 2006.	Apache lands, Arizona Case series with either post-test or pre-test/post-test outcomes		<p>From 2001 to 2012, the rate ratio of suicide deaths among Apache persons compared with the United States (all races) decreased from 3.7 to 2.1; compared with all AI/AN persons, it decreased from 3.9 to 2.4.</p> <p>Apache suicide rates decreased in every age group except for those aged 10 to 14 years (17.1–23.6/100 000).</p> <p>Despite some fluctuations, the pattern appears to represent a general overall downward trend, with a similar number of attempts and relative decreases for males and females from 2001 to 2014.</p> <p>The annual number of attempts also decreased from 75 individuals in 2007 to 35 in 2012. Among those aged 25 years or younger, female deaths ($n = 4$) increased from 16% of all suicide deaths in the period 2001 through 2006 to 44% ($n = 10$) in 2007 through 2012.</p>		
Melvin et al. (2018)	Examine the feasibility and effectiveness of a suicide	$n = 36$	BeyondNow app	Significant reductions in severity and intensity of suicidal ideation	IV	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	prevention smartphone application.	Australia Tertiary mental health service Single group trial		from baseline (severity $M = 4.33$, $SD = 1.04$; intensity $M = 19.64$, $SD = 2.91$) to post-intervention assessment (severity $M = 2.29$, $SD = 1.85$; intensity $M = 17.44$, $SD = 5.37$). Additionally, the authors found a significant increase in the frequency of suicide-related coping strategies use between baseline and ($M = 22.29$, $SD = 4.61$) and postintervention ($M = 27.29$, $SD = 4.45$) assessments; $t(13) = -3.56$, $p < .01$.		
Rasmussen et al. (2018)	Aboriginal art is an effective, culture-specific therapy for Aboriginal people. This may have important implications for Aboriginal prisoners at risk of suicide/self-harm. This project aimed to evaluate the potential positive effects of Aboriginal art activities on the suicide/self-harm risk behaviours of Aboriginal prisoners.	$N = 335$ Australia Maximum security prison in Queensland Retrospective cohort study	Aboriginal art program	Adjusting for suicide/self-harm history, there was strong evidence that an increase in attendance the Aboriginal art program was associated with reduced incidence of suicide/self-harm risk assessment ($IRR = 0.81$, CI 95% [0.75, 0.88] $z = -4.92$, $p < 0.0001$)	III-3	Weak**
Skerrett et al. (2018)	Describe the design and implementation of a group-	$n = 75$	"United Health Education and Learning Program" (UHELP)	There was a decrease in mean score from pre- to post-program (and a	IV	Strong/Weak***

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	based intervention, as well to report the results of the various qualitative and quantitative measures.	Australia Community Mixed method		slight increase at follow-up), but the differences were not statistically significant, $t(57) = 0.39, p = .693$ and $t(43) = .18, p = .858$		
Tighe et al. (2017)	Evaluate the effectiveness of a self-help mobile app (ibobbly) targeting suicidal ideation, depression, psychological distress and impulsivity among Indigenous youth in remote Australia.	Sixteen participants without recent suicidal ideation but meeting all other criteria were included (n=16) in the trial from 19/09/2013, shortly after trial initiation. Seven participants older than 35 years with high distress and high motivation to be included were also included from 19/09/2013. Remote and very remote communities in	iBobbly	Although pre-intervention and post-intervention changes were significant in the ibobbly arm ($t = 2.40; df = 58.1; p = 0.0195$), the interaction of intervention arm by time (pre-intervention vs post-intervention) was not significant ($t = 1.05; df = 57.8; p = 0.2962$).	III-3	Moderate

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
		the Kimberley region of North Western Australia. RCT				
Torcasso et al. (2017)	Evaluate outcomes of a multi-stage screening program implemented over three school years in a moderately-sized Midwestern high school.	<i>n</i> = 193 9th-grade students US Secondary school Non-randomised trial with matched control	TeenScreen	Analyses revealed a significant School X Time interaction for predicting the number of students who considered suicide and who attempted suicide two or more times. The change in number of students considering suicide was only significant for those in the school where screening took place, effect = -1.59, <i>p</i> = .015 (5 % CI [2.87, -0.31] and suggests a decrease from 2011 to 2013.	III-2	Weak
van Spijker et al. (2018)	Examine the effectiveness of an online self-help intervention for suicidal thinking compared to an attention-matched control program.	<i>n</i> = 418 Community US Randomised controlled trial	Living with Deadly Thoughts	Intention-to-treat analyses showed significant reductions in the severity of suicidal thinking at postintervention, six, and 12 months. However, no overall group differences were found. Living with Deadly Thoughts was of no greater effectiveness than the control group.	II	Moderate

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Visser et al. (2014)	Evaluate the effectiveness of a suicide bereavement support service in reducing adverse health and social outcomes for people bereaved by suicide.	<i>n</i> = 90 Australia Community Comparative retrospective cross-sectional	StandBy	Analysis comparing the proportion of StandBy clients and control group participants at high risk for suicidality (SBQ-R score above 7; 48% and 64% respectively) (SBQ-R = suicide behaviours questionnaire) showed that StandBy clients were significantly less likely to be at high risk ($p = 0.005$). Both groups showed high levels of suicidality	III-3	Weak

Appendix 6: Summary of targeted programs

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Aquin et al. (2017)	Determine if Housing First (HF) decreased suicidal ideation and attempts compared to treatment as usual (TAU) among homeless adults with mental disorders, a population with a demonstrably high-risk of suicidal behaviour.	330 homeless adults Canada Urban setting Cross-sectional	Structured, comprehensive interview	Of those who were homeless or on their own before age 18, 71% reported suicidal ideation, compared with 53.8% of those who had not experienced childhood homelessness, $\chi^2 = 9.873$, $df = 1$, $p = 0.002$; covariate-adjusted OR = 1.90 (1.12, 3.23), $p = 0.017$. When controlling for covariates in the multiple logistic regression analysis, psychotic disorders, covariate-adjusted OR = 2.90 (1.24, 6.67), $p = .017$ and mood disorders covariate-adjusted OR = 3.61 (2.08, 6.25), $p = .000$ again remained significant predictors of lifetime suicidal ideation.	N/A*	Weak
Batterham et al. (2018)	FitMindKit was designed to overcome the gaps of existing e-mental health programs, providing tailored,	194 Australia Community	FitMindKit	No effects were detected for specific decreases in depression, generalized anxiety, social anxiety,	II	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	transdiagnostic therapeutic content to address a range of comorbid mental health symptoms. A trial was conducted to test the program's efficacy.	RCT		panic, suicidal ideation or alcohol/substance use.		
de Beurs et al. (2016)	To assess whether patients benefited from the training of professionals in adherence to suicide guidelines.	484 Netherlands Community RCT	PITSTOP suicide trial	Multilevel analysis showed no effect of the intervention on change in suicide ideation ($b = 70.68$, 95% CI [70.66, 1.21] $p = 40.05$) or on frequency of self-reported attempted suicide between baseline and follow-up ($OR = 1.18$, 95% CI [0.62, 2.57] $p = 40.05$). However, in a subgroup of patients with a diagnosis of depression that also scored 51 on the Beck Scale for Suicidal Ideation at baseline ($n = 154$; intervention, 75, control, 79), a significant effect on change in suicide ideation between conditions was found: scores on the BSS decreased 8.4 points between baseline and follow-up in the intervention group, compared with a decrease of 4.8 in the control group ($b = 3.41$, 95% CI [0.38–5.93] $p = 0.008$, effect size 0.4)	II	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Exbrayat et al. (2017)	Evaluate the effectiveness of telephone follow-up of patients referred to an emergency psychiatric unit for attempted suicide on any further attempt/s over the following year.	823 study and control patients – 436 in study group and 387 in the control group France Department of Emergency Physician Single-centre controlled study	Protocol of telephone follow-up of 436 patients at 8, 30, and 60 days after they were treated for attempted suicide. Controls were patients with similar social and demographic characteristics referred to the emergency psychiatric unit in the year prior to the study, who did not receive telephone follow-up after their initial hospitalisation.	Repeated suicide attempts were significantly fewer among study (55/436) than control (69/387) patients after the initial index episode ($p = 0.037$). For the 244 patients who responded to all telephone follow-up calls, the OR of recidivism was even lower: 0.50 95% CI [0.62, 0.80].	III-2	Weak
Ghahramanlou-Holloway et al. (2014)	Test the efficacy of a brief, readily-accessible, and personalised treatment called the Safety Planning Intervention (Stanley and Brown, 2012).	$n = 218$ US Walter Reed National Military Medical Centre RCT	Protocol for Safety Planning for Military (SAFE MIL) treatment	Primary outcome measures (suicide ideation, suicide-related coping, and attitudes toward help-seeking [acceptability and initiation of services])	II	Weak
Hom et al. (2018)	Evaluate changes in suicidal symptoms and resilience appraisals following attempt survivors' participation in the	$n = 92$ US Community Pre-post test	Survivors of Suicide Attempts (SOSA) support group	Based on the RCI (Reliable Change Index) criteria for the BSS (Beck Scale of Suicidal Ideation) and BHS (Beck Hopelessness Scale), 25.9% of participants demonstrated clinically	IV	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	Survivors of Suicide Attempts (SOSA) support group.			significant reductions in BSS suicidal ideation severity		
Hoying et al. (2017)	Determine the feasibility, acceptability, and preliminary effects of the COPE Healthy Lifestyles TEEN intervention, a theory-based reproducible program on the healthy lifestyle beliefs, physical activity, and mental health outcomes of 11-to-13 year-old primarily ethnic minority, urban pre-adolescents.	<i>n</i> = 31 US Inner city Pre-experimental one-group pre-post	COPE (Creating Opportunities for Personal Empowerment) Healthy Lifestyles TEEN (Thinking, Emotions, Exercise, and Nutrition) Program	Of the study participants, there were six students at baseline who answered two specific questions on the Beck Youth Depression Inventory indicating an increased risk for suicide. Following the intervention, four of these six students no longer reported increased risk for suicide utilising the same instrument. A subgroup analysis was completed on participants who reported elevated anxiety (45% of sample), depression (26%), lower than average self-concept (26%), and six students (19%) who answered positively to suicidal ideation/hopelessness at baseline, before the intervention was delivered. This subgroup of anxious, depressed, or low self-concept pre-adolescents who received the COPE intervention demonstrated increases in self-concept and decreases in anxiety and depression to scores that were within the normal range. Four of the	IV	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				six students who reported suicidal ideation at baseline were not at suicide risk post-intervention.		
Humensky et al. (2017)	Conduct an external evaluation of the Life is Precious (LIP) program through focus groups with adolescent participants and mothers to learn whether participants and families believe that the activities of LIP address risks for suicidal behavior.	<i>n</i> = 31 US Urban community Qualitative	Life is Precious	In this study, respondents identified various ways in which LIP helps to address suicidal behaviour: Feedback suggested LIP provided a “safe haven” to get away from other stressors, improved relationships with families and peers, provided support for the families in addition to the adolescents, and helped the participants to improve academic performance. Respondents shed light on specific ways that LIP helped to reduce the suicidal risk factors of self-esteem, family conflicts, school, and peer conflicts. LIP activities contributed to improving self-esteem by helping them connect with peers with similar struggles (I am not alone). The creative expression therapies (e.g., art, music, and dance) provided an outlet to express their negative emotions, such as by addressing self-harming behaviours	N/A**	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				(e.g., by writing affirming messages on their arms rather than cutting).		
Kennard et al. (2018)	Report on a pilot study of an inpatient intervention for suicidal adolescents, As Safe as Possible (ASAP), supported by a smartphone app (BRITE) to reduce suicide attempts following hospital discharge.	A total of 104 inpatients were evaluated for eligibility. US Post-discharge RCT	ASAP (As Safe as Possible) intervention and BRITE (smartphone app)	<p>The difference in the rates of suicide attempts between the two groups was not significant but was in the hypothesised direction (10.3% [$n = 3$] compared with 28.6% [$n = 8$]; $\chi^2=3.04$, $df = 1$, $p = 0.08$, $g = 20.47$), as was the difference in time to treatment (Wilcoxon: $\chi^2 = 1.66$, $df = 1$, $p = 0.20$; log-rank: $\chi^2 = 3.02$, $df = 1$, $p = 0.08$; $HR = 0.33$, 95% CI [0.09, 1.26] $z = -1.62$, $p = 0.11$). a longer time to suicide attempt ($HR = 0.19$, 95% CI [0.04, 0.85] $z = 22.18$, $p = 0.03$).</p> <p>Mixed-effects regression showed an effect of time on suicidal ideation for the entire sample ($b = -0.57$, 95% CI [-0.84, -0.30] $z = 24.09$, $p = 0.001$) but not for group or group-by-time interaction, indicating a similar decrease in suicidal ideation over time between the two groups.</p> <p>In the ASAP plus treatment as usual group, participants whose families attended one or more treatment</p>	II	Strong

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				sessions had lower ideation over time (treatment-by-time interaction: $b = -0.61$, 95% CI $[-0.12, -0.11]$ $z = 22.38$, $p = 0.02$), although there was no effect on time to attempt.		
King et al. (2018)	Examine the effectiveness of Let's Connect (LC), a community mentorship program for youths who report peer social problems, which is based on a positive youth development framework.	$n = 224$ US Urban community RCT	Let's Connect mentorship program	There were no differences between LC and control groups in baseline levels of any of the primary study variables (connectedness, depression, self-esteem, and suicidal ideation). There was no significant effect for suicidal ideation ($p = 0.95$), which declined similarly in both groups.	II	Medium
King et al. (2015)	Examine the effectiveness of Teen Options for Change (TOC), an intervention for adolescents seeking general medical emergency services who screen positive for suicide risk.	$n = 27$ US Community RCT	Teen Options for Change	Researchers did not find any significant treatment or group effects for suicidal ideation (SIQ-JR). There was a significant effect for time for suicidal ideation ($f = 57.41$, $df = 51$ and 44 , $p = .01$). Adolescents showed a decrease in suicidal ideation over the study period.	II	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Kodama et al. (2016)	Review suicide interventions sent via mobile phone text messaging technologies.	<i>n</i> = 30 Japan Community (psychiatric outpatients) Pre-post test	Participants received on their own mobile phone or smartphone two text messages per week for 6 months from the study researchers' mail server. The messages were sent automatically by a computer program at 12:30 p.m. every Monday and Thursday so that working participants could view the text messages at a convenient time.	Participants who had committed self-harm during the previous six months at baseline accounted for 27.6% of the sample (<i>n</i> = 8), whereas the proportion at six months significantly decreased to 6.9% (<i>n</i> = 2, <i>p</i> = 0.03). Further, the intensity of suicidal ideation was significantly reduced after the intervention period (<i>p</i> = 0.001).	IV	Weak
Lohman et al. (2016)	Evaluate the effectiveness of a depression care management intervention in reducing suicidal ideation (SI) among home health patients.	755 patients screened positive for depression and met other initial eligibility criteria. US Home care following hospitalisation RCT	Depression Care for Patients at Home (Depression CAREPATH)	Participants with SI had significantly higher HAM-D and perceived burdensomeness scores than those without SI. Participants with SI were also more likely to be diagnosed with MDD (Major Depressive Disorder) according to DSM-IV criteria. Participants who expressed active or passive SI at baseline did not differ significantly from participants with no SI by age, race, gender, education, marital status, or income. There were also no significant differences between those with and without SI on medical burden (CDS scores),	II	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				number of functional limitations, and referral source.		
Miller et al. (2017)	Determine whether an ED-initiated intervention reduces subsequent suicidal behaviour.	<i>n</i> = 1376 US Post-discharge RCT	Emergency Department Safety Assessment and Follow-up Evaluation (ED-SAFE) study	Overall, of 1376 participants, 288 (20.9%) made at least one suicide attempt during the 12-month period. In the treatment-as-usual (TAU) phase, 114 of 497 participants (22.9%) made a suicide attempt, compared with 81 of 377 participants (21.5%) in the screening phase and 92 of 502 participants (18.3%) in the intervention phase. Five attempts were fatal, with fatalities observed in the TAU phase (<i>n</i> = 2) and intervention phase (<i>n</i> = 3). When combined, there were 548 total suicide attempts among participants, including 224 in the TAU phase (0.45 per participant), 167 in the screening phase (0.44 per participant), and 157 in the intervention phase (0.31 per participant). Compared with the TAU phase, participants in the intervention phase showed small but meaningful reductions in suicide risk, with a relative risk	II	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				reduction of 20% and number needed to treat of 22. Participants in the intervention phase had 30% fewer total suicide attempts than participants in the TAU or screening phases		
Mouaffak et al. (2015)	Evaluate whether or not the Osta program could reduce the frequency of subsequent suicidal acts and improve the engagement in healthcare compared with a control treatment.	<i>n</i> = 320 France Community RCT	Osta (organization of a suitable monitoring for suicide attempters)	On an intention to treat basis, the proportion of patients who reattempted suicide did not differ significantly, at 12 months, between the intervention arm 14.5% (22/152) and the control arm 14% (21/150) odds ratio= 1.01 (0.52–1.97), <i>p</i> = 0.98. There was also no significant differences, between the two groups, in the number of suicide attempts (0.270.58 in the interventional group versus 0.2370.84 in the control group; <i>p</i> = 0.98).	II	Weak
Norr et al. (2018)	Examine potential mechanistic pathways for reductions in suicidal ideation (SI) due to a brief anxiety sensitivity (AS) treatment.	<i>n</i> = 74 US N/A RCT	Cognitive Anxiety Sensitivity Treatment (CAST)	Consistent with hypotheses, results revealed a significant association between suicidal ideation and anxiety symptoms but not depressive symptoms. These results are inconsistent with recent work suggesting the relationship between anxiety symptoms and	II	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				suicidal ideation is due to depressive symptoms (Norr et al., 2016), but does align with work linking AS to anxiety symptoms and anxiety symptoms to SI (Olatunji and Wolitzky-Taylor, 2009; Sareen et al., 2005). No simple mediation effects were found for reductions in SI via reductions in AS in any of the models. These results substantially build on prior analyses of computerised AS interventions (Schmidt <i>et al.</i> , 2014, 2017) by further elucidating how reducing AS leads to reductions in SI. The results from the current study suggest that treatment for anxiety symptoms may be effective in reducing suicidal ideation if it also works to reduce symptoms of anxiety.		
Nyer et al. (2018)	Evaluate the safety of a randomised controlled dose-finding trial of lyengar yoga plus coherent breathing for individuals with major depressive disorder (MDD), as well as the potential effects of the intervention on suicidal ideation (SI) without intent.	n = 30 US Community setting RCT	Homework consisted of 15 minutes of lyengar yoga followed by 15 minutes of coherent breathing. Each 90-minute class included approximately 60 minutes of lyengar yoga postures, 10 minutes of transition including deep relaxation, and 20 minutes of coherent breathing, paced by	Participation in the intervention was associated with decreases in SI for 8 of the nine participants who reported SI without intent at screening. Out of the 30 participants, only one reported a transient increase in rating of SI at week four.	III-2	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
			a chime tone recording on a compact disc. Iyengar yoga emphasises correct alignment while performing postures.			
O'Toole et al. (2018)	The primary objective of this study was to compare the effect between treatment as usual (TAU) with (TAU + APP) and without (TAU) the assistance of the mobile app (i.e., LifeApp'tite) on individuals referred to outpatient suicide prevention treatment.	<i>n</i> = 129 US RCT	Mobile application: LifeApp'tite	<p>A significant main effect of time on scores on the Suicide Status Form was found across the whole intervention period, where self-reported suicide risk decreased, $f(1, 173.1) = 104.4, p = .001, d = 1.55$, corresponding to a large effect size.</p> <p>A significant between-group effect was found immediately following therapy, indicated by a significant Time \times Group interaction term in predicting SSF, $f(1, 138.7) = 7.2, p = .008, d = 0.46$, 95% CI [0.86, 5.67], corresponding to a medium effect size.</p> <p>At the four-month follow-up, the interaction effects was only borderline significant, $f(1, 168.2) = 3.7, p = .057, d = 0.30$, 95% CI [-0.05, 3.37], again favoring the TAU group and corresponding to a small effect size. At this follow-up point, 20 participants (30%) in the TAU</p>	II	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				group and 13 participants (22%) in the TAU + APP group experienced reliable change. This difference was not significant either, $\chi^2 (1) = 0.9, p = .342$		
Raines et al. (2015)	A subgroup analysis to determine whether anxiety sensitivity cognitive concerns could be reduced among those with elevated obsessive compulsive disorder (OCD) symptoms.	$n = 54$ US Community Pseudo-RCT	Cognitive Anxiety Sensitivity Treatment (CAST) Comparator: Physical Health Education Training (PHET).	Treatment condition accounted for 0.9% of the variance in changes in suicidality ($f (1, 51) = .44, p = .51$). Results revealed there was not a direct effect of treatment condition on changes in suicidality ($\beta = -.09, t = -.67, p = .51, sr^2 = .01$)	III-1	Weak
Sandler et al. (2016)	Examine the intervention effects of the Family Bereavement Program (FBP) on suicide ideation and/or attempts as assessed through multiple sources.	$n = 244$ children and adolescents US Pseudo-RCT	Family Bereavement Program (FBP) The literature control (LC) program consisted of three books about adaptation to grief and a study guide for parents, children and adolescents	The intervention effects were marginally significant at six years ($t = -1.94, p = .053$), significant at 15 years ($t = -2.039, p = .041$), and significant for the combined 6-year and 15-year follow-up ($t = -2.344, p = .019$).	III-1	Weak
Tyson et al. (2016)	To evaluate the efficacy of a UK-based helpline from a service user and helpline worker perspective.	$n = 87$ UK Telephone crisis line in Gloucestershire. Mixed method	Rethink mental illness telephone helpline	Significant decrease in likelihood of callers acting on self-harming thoughts (3.4 vs 2.3; $t = 7.33, df = 43, p = .00$). A paired-samples t-test found that the mean score of self-harming callers was significantly higher,	IV	Medium

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
				indicating better mood, at the end of the call compared with the beginning (1.9 vs. 2.8; $t = -7.40$, $df = 54$, $p = .00$).		
van Spijker et al. (2015)	Test the effectiveness of unguided online self-help to reduce suicidal thoughts.	$n = 236$ Australia Community RCT	Web-based self-help intervention to reduce suicidal thoughts. Participants in the control condition received access to a website constructed for this study providing information on suicidality such as prevalence rates and risk factors, taking about 15 minutes to read.	The intervention group improved significantly on suicidal thoughts, depressive symptoms, hopelessness, worry, and anxiety between baseline and 6-week post-test. These effects were generally maintained at 3-month follow-up. Participant evaluation showed that the majority (two thirds) of participants reported that their suicidal thoughts troubled them less over the course of the study.	II	Weak
Vidot et al. (2016)	1) Assess whether or not Familias Unidas, a family-based, culturally specific, preventive intervention has an impact on suicide ideation and attempts among Hispanic youth. 2) Examine whether parent-adolescent communication moderates intervention effectiveness.	The study included 746 Hispanic eighth-grade adolescents (Familias Unidas $n = 376$; Prevention as Usual $n = 370$) and their primary caregivers.	Familias Unidas Comparator – preventive treatment as usual	The results of growth curve models indicated that there were no significant differences by condition on suicide ideation ($b = .129$, $p = .130$) or suicide attempts ($b = .024$, $p = .744$); however, there was a significant interaction effect of baseline parent-adolescent communication ($b = .01$, $p = .01$) on the intervention effect on suicide attempt. In particular, Familias Unidas had a significant impact on	III-1	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
		US Classroom setting RCT		suicide attempts for adolescents with low levels of parent–adolescent communication.		

Appendix 7: Summary of other programs

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
Baran and Kropiwnicki (2015)	Answer the question about the impact of the suicide prevention program in Sweden (2008) on the total suicide rate as well as the age- and gender-specific suicide rates in the subsequent years.	N/A Sweden Community Provides overview of suicide prevention program	National suicide prevention program in Sweden. Data from National Board of Health and Welfare was used to calculate the average suicide rates and trends.	Launch of the National Suicide Prevention Program in Sweden in 2008 was followed by an increase in national suicide rates in all studied age groups (0–65+, 0–24, 25–44, 45–64 and 65+) in 2009. The total average suicide rate three years after the introduction of the program (2009–2011) decreased from 12.99 (in 2005–2007) to 12.41. The total average suicide rate six years after the introduction of the program (2009–2014) decreased (from 12.9 to 12.3) in comparison to 2002–2007.	III-3	Weak
Godoy Garraza et al. (2015)	Determine whether a reduction in suicide attempts among youths occurs following the implementation of the Garrett Lee Smith Memorial Suicide Prevention Program (hereafter referred to as the GLS	84,000 in the control group and 57 000 in the intervention group US	Garrett Lee Smith Community Suicide Prevention Grants outcomes	Counties implementing GLS program activities had significantly lower suicide attempt rates among youths 16 to 23 years of age in the year following implementation of the GLS program than did similar counties	III-2	Weak

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)	NHMRC	EPHPP, CASP
	program), consistent with the reduction in mortality documented previously.	Community Observational study		that did not implement GLS program activities. There was no significant difference in suicide attempt rates among individuals older than 23 years during that same period. There was no evidence of longer-term differences in suicide attempt rates.		
Paschall et al. (2018)	Examine whether an increase in the availability of mental health services at school-based health centres (SBHCs) in Oregon public schools was associated with the likelihood of suicidal ideation, suicide attempts and substance use behaviours among adolescents who experienced a depressive episode in the past year.	168 Oregon public middle and high schools and 9073 students US School No research design mentioned	Increase in mental health services through school-based health centres. SBHCs provide comprehensive, convenient health care services for school children and adolescents in all 50 states and the District of Columbia, often serving disadvantaged students who have less access to health care services.	Analysis results indicated that students at SBHC schools that increased mental health services were less likely to report any suicidal ideation (<i>OR</i> 0.66 95% CI [0.55, 0.81]), suicide attempts (<i>OR</i> 0.71 95% CI [0.56, 0.89]) and cigarette smoking (<i>OR</i> 95% CI [0.63, 0.94] from 2013 to 2015 compared to students in all other schools.	N/A	Weak

Appendix 8: Summary of promising programs

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
Broadbent et al. (2014)	Highlight the efficacy of the Incolink Life Skills program in increasing participants' knowledge about mental health and improving help-seeking behaviour.	N/A Australia Vocational colleges Cross-sectional survey	Incolink Life Skills Program	The research that was undertaken uncovered some of the impact of a universal program on improving the protective factors of young men in this industry. Young men can present themselves in a very positive light as robust and resilient, contrary to much of the research that has been undertaken with a focus on young men in building and construction and living in rural and remote communities.
Carli et al. (2016)	Test the effectiveness of the intervention website for reducing mental health-related outcomes such as depression, anxiety and stress, suicidal thoughts and ideation.	<i>n</i> = 2286 School RCT	Suicide Prevention by Internet and Media-Based Mental Health Promotion (SUPREME) Project Control subjects only received the minimal intervention	A statistically significant decline in nearly all mental health-related outcomes, such as depression, anxiety and stress, suicidal thoughts and ideation was observed in the total sample (all <i>p</i> -values < 0.01 or <0.001).
Chen et al. (2015)	Examine the incremental efficacy of the 24-session LAST program on the quality of life (QOL), symptom reduction, and occupational and environmental improvement for persons with depression.	<i>n</i> = 35 Taiwan Psychiatric outpatient clinic in Taipei city RCT	Life Adaption Skills Training (LAST) program	The subjects who participated in the LAST program showed significant incremental improvements with moderate- to large – between-group effect sizes on their level of anxiety and level of suicidal ideation when compared to the control group. The reduction of suicidal ideations had a maintenance effect for three months after the end of intervention, with moderate between-group effect sizes.
Dudgeon et al. (2016)	This report summarises the evidence-base for Aboriginal and Torres Strait Islander Suicide	N/A		Success factors for meta-evaluation of 16 program evaluations, case studies of 19 promising practice programs, and an overview of 37 evaluated promising programs.

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
	Prevention Evaluation Project (ATSISPEP) and through a meta-evaluation, reviews what works in Indigenous community-led suicide prevention. It includes responses to the social determinants of health that are 'upstream' risk factors for suicide. It also presents tools to support Indigenous suicide prevention activity developed by the project. NB: Data for the report was taken from the report "Suicide Prevention Meta-Evaluation" (2016).	Indigenous Australians		Eight of the promising programs were found to be effectively evaluated and success factors of those eight included: peer to peer mentoring/education; connecting with young people through sport; gatekeeper training and postvention.
Gijzen et al. (2018)	Test a multimodal school-based approach to suicide and depression prevention, which integrates universal and targeted approaches and includes various stakeholders (schools, adolescents, parents, and mental health professionals) simultaneously.	<i>n</i> = 1844 Secondary school in the US Cluster RCT	School-based multimodal stepped-prevention program for depression and suicidal behaviors	No specific findings provided. If the school-based multimodal stepped-prevention program proves to be effective, it could be implemented in schools on a large scale.
Hassanian-Moghaddam et al. (2017)	Test the efficacy of a postcard intervention plus treatment as usual (TAU) versus TAU in a randomised controlled trial	<i>n</i> = 2300 Iran	The intervention was nine postcards over 12 months (plus usual treatment) versus usual treatment.	There was a significant reduction in any suicidal ideation (<i>RRR</i> 0.20 95% CI [0.13, 0.27], (NNT 8, 6–13), and any suicide attempt (<i>RRR</i> 0.31, 95% CI [0.06–0.50], (NNT 35, 19–195), in this non-western

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
	(RCT) for three binary primary outcomes during 12–24-month follow-up: 1. Any suicidal ideation 2. Any suicide attempt 3. Any self-cutting (or self-mutilation)	The Loghman-Hakim Hospital Poison Center (LHHPC) in Tehran RCT		population. However, there was no effect on self-cutting (<i>RRR</i> - 0.01 95% CI [-1.05–0.51]).
Jegannathan et al. (2014)	Evaluate the outcome of a school-based intervention to reduce risk factors for suicide among young people in Cambodia by promoting life skills.	<i>n</i> = 299 Secondary college in Cambodia Comparative Study	Healthy Activity Program (HAP) Participants were randomly allocated (1:1) to enhanced usual care (EUC) alone or EUC combined with HAP	The female participants showed improvement in human relationship (<i>ES</i> = 0.57), health maintenance (<i>ES</i> = 0.20) and the Total Life Skills Dimensions (<i>ES</i> = 0.24), whereas boys with high-risk behaviour improved on human relationship (<i>ES</i> = 0.48), Purpose in Life (<i>ES</i> = 0.26) and Total Life Skills Dimensions (<i>ES</i> = 0.22). Among high-risk individuals boys had a small to moderate effect size from intervention on Withdrawn/Depressed (<i>ES</i> = 0.40), attention problems (<i>ES</i> = 0.46), rule-breaking behavior (<i>ES</i> = 0.36), aggressive behavior (<i>ES</i> = 0.48) and externalising syndrome (<i>ES</i> = 0.64).
Jun et al. (2014)	Investigate the effects of a suicide prevention program on the levels of depression, self-esteem, suicidal ideation and spirituality in patients with mental illness.	<i>n</i> = 45 Psychiatric unit in a university hospital in South Korea Quasi-experimental study with a non-equivalent control group, non-	Suicide prevention program on the levels of depression, self-esteem, suicidal ideation and spirituality in patients with mental illness.	The experimental group that participated in the program had significantly decreased mean scores for depression and suicidal ideation compared with the control group.

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
		synchronised design		
Kim and Yang (2017)	Develop a small-group-focused suicide prevention program for elders with early-stage dementia and to assess its effects.	<i>n</i> = 62 Daycare centers in J City Korea control group pretested post-test design. Experimental study with a control group pre-test-post-test design.	Small-group-focused suicide prevention program for elders	The developed suicide prevention program had a significant effect on the perceived health status, social support, depression, and suicidal ideation of elders with early-stage dementia. This community-based program in geriatric nursing practice can be effective in preventing suicide among elders with early-stage dementia.
Law et al. (2016)	Investigate the efficacy of volunteer support in preventing repetition of self-harm.	<i>n</i> = 74 Emergency departments in Hong Kong Quasi-experimental design	Volunteer support program	The intervention group showed significant improvements in hopelessness and depressive symptoms. However, the number of cases of suicide ideation and of repetition of self-harm episodes was similar for both groups at the postintervention period.
Lung et al. (2017)	Compare the socioeconomic characteristics and methods of suicide by using crude suicide rates data. The effectiveness of the suicide prevention programme during 2005–2013	N/A Taiwan Suicide Prevention Centre Observational study	Suicide prevention programs	The results show that unemployment increased the suicide rate in men aged 45–64 years and in women older than 65 years of age in Taiwan. High divorce and unemployment rates resulted in increased suicide rates in men in the city, whereas emotional distress was the main cause of suicides in men in rural areas.

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
	was also investigated in this study.			
Mascayano et al. (2018)	Evaluate a program based on information and communication technologies (ICT) to prevent suicide and enhance mental health among adolescents in Chile.	<i>n</i> = 428 Two regions of Chile Cluster RCT	Program based on information and communication technologies	No specific findings reported. A description of the novel program based on technological devices aimed to target youth suicide in Chile is provided. This is the first clinical trial of such a program in Latin America, and to our knowledge, the first of its kind in any middle-income country.
Moeller-Saxone et al. (2015)	Search in the English language peer-reviewed literature for reviews of mental health promotion interventions in the Asia-Pacific region. A global rapid review by Barry and colleagues indicated a paucity of publications on this topic in the peer-reviewed literature.	No priority population Asia-Pacific region Mental health promotion activities	The review found one relevant study, a WHO multi-site study of suicide prevention.	There was little evidence in either country of interventions focused on health equity or modifying the social determinants of mental health.
Patel et al. (2017)	Assess the effectiveness and cost-effectiveness of a brief psychological treatment (Healthy Activity Program [HAP]) for delivery by lay counsellors to patients with moderately severe to severe depression in primary health-care setting.	<i>n</i> = 495 Primary health centres in Goa RCT	Healthy Activity Program (HAP)	Participants in the EUC plus HAP group had significantly lower symptom severity (Beck Depression Inventory version II in EUC plus HAP group 19.99 [SD 15.70] vs 27.52 [13.26] in EUC alone group; adjusted mean difference -7.57 95% CI [-10.27, -4.86]; <i>p</i> < 0.0001) and higher remission (147 [64%] of 230 had a PHQ-9 score of <10 in the HAP plus EUC group vs 91 [39%] of 236 in the EUC alone group; adjusted prevalence ratio 1.61 [1.34–1.93]) than did those in the EUC alone group. EUC plus HAP showed better results than did EUC alone for the secondary outcomes of disability (adjusted mean difference -2.73 [-4.39 to -1.06]; <i>p</i> = 0.001), days out of work (-2.29 [-3.84 to -0.73]; <i>p</i> = 0.004),

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
				intimate partner physical violence in women (0.53 [0.29–0.96]; $p = 0.04$), behavioural activation (2.17 [1.34–3.00]; $p < 0.0001$), and suicidal thoughts or attempts (0.61 [0.45–0.83]; $p = 0.001$).
Shelef et al. (2016)	Evaluate the effectiveness of the IDF Suicide Prevention Program, implemented since 2006.	$n = 1,171,359$ Israel Quasi-experimental (before and after) cohort study.	The IDF Suicide Prevention Program	Trend analysis showed lower suicide rates in the cohort after intervention. The hazard ratio for the intervention effect on time to suicide was 0.44 95% CI [0.34, 0.56] $p < .001$ among males. Lower risk was associated with: male gender; born in Israel; higher socio-economic status; higher intelligence score; and serving in a combat unit ($HR = 0.43$ 95% CI [0.33–0.55])
Till et al. (2017)	Examine the effects of educative websites and the moderating effect of participant vulnerability.	$n = 161$ University of Vienna and the Medical University of Vienna, Austria Single-blinded RCT	Educative website on suicide prevention	No significant intervention effect was identified for the entire intervention group with regard to suicidal ideation, but a significant and sustained increase in suicide-prevention related knowledge ($t3$ v. $t1$, $p50.001$, $d = 1.12$, 95% CI [0.96, 1.28] and a non-sustained worsening of mood ($p50.001$, $t2$ v. $t1$, $d = 70.59$, 70.75 to 70.43) were observed. Participants with increased vulnerability experienced a partially sustained reduction of suicidal ideation ($t3$ v. $t1$, $p50.001$, $d = 70.34$, 70.50 to 70.19)
van Spijker et al. (2014)	Test the effectiveness of unguided online self-help to reduce suicidal thoughts.	$n = 236$ The Netherlands Community RCT	Web-based self-help intervention	The intervention group improved significantly on suicidal thoughts, depressive symptoms, hopelessness, worry, and anxiety between baseline and six-week post-test. These effects were generally maintained at three-month follow-up. Participant evaluation showed that the majority (two thirds) of participants reported that their suicidal thoughts troubled them less over the course of the study.

First author, year, country	Objective	Sample size, setting, design	Intervention/methods	Outcomes, Findings (including different outcomes for different groups)
Vijayakumar et al. (2017)	Assess the feasibility of regular contact and use of safety planning cards (CASP) by community volunteers (CVs) in reducing suicidal behaviour among Sri Lankan refugees residing in camps in Tamil Nadu, South India.	<i>n</i> = 1303 Sri Lankans from Refugee camps in Tamil Nadu, South India Mixed-methods design	CASP (safety planning cards)	Of the 288 high-risk refugees in intervention camp, 139 completed the intervention. In the control camp, 187 were categorised as high risk. Prevalence of suicide attempts was 6.1%. Following intervention, differences between sites in changes in combined suicide (attempted suicides and suicides) rates per 100,000 per year were 519 (95% CI [136–902]; <i>p</i> <.01).
Wang et al. (2016)	Evaluate the effectiveness of using crisis coping cards in the case management of suicide prevention compared with case management without the use of coping cards over a three-month intervention period.	<i>n</i> = 64 Taiwan Database population consisted of all individuals aged 18 and older reported to Chia-Yi City Health Bureau by gatekeepers situated in medical or non-medical organisations RCT	Crisis coping cards	Results indicated that subsequent suicidal behaviors, severity of suicide risk, depression, anxiety, and hopelessness were reduced more in the coping card intervention group compared to the case management-only group. Moreover, for the survival curves of time to suicide reattempt, the coping card group showed a significantly longer time to reattempt than the case management-only group at two-month and three-month intervention periods.

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** Denotes 77 studies that met criteria for inclusion in the review and were quality assessed.*

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