RESEARCH ON SUICIDE AND ITS PREVENTION:

What the current evidence reveals and topics for future research

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Mental Health Commission of Canada | Commission de la santé mentale du Canada

The following is an interpretation of a literature review commissioned by the Mental Health Commission of Canada and the Public Health Agency of Canada and produced by the Quebec Network on Suicide, Mood Disorders, and Related Disorders.

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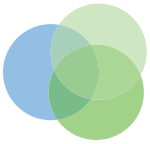


I. Terminology of suicide and suicidal behaviours

Several terms have been used to describe suicidal and self-harming behaviours in the scientific literature. To allow meaningful comparisons, consensus definitions of international terminology are important.

Definitions of terms used in the literature to describe thoughts of suicide and suicidal behaviours are outlined in the table below. Due to the lack of an accepted and standardized international terminology, articles included in this report have used varying terms and for accuracy purposes, results were described using the terminology used by original study authors.

Category	Definition
Suicide	A fatal self-injurious act with some evidence of intent to die
Suicidal behaviour	Ranges from thoughts of suicide to suicide attempts to death by suicide
Suicide attempt	A potentially self-injurious behaviour associated with some intent to die
Active thoughts of suicide	Thoughts about taking action to end one's life, which may include: identifying a method, having a plan, and/or having intent to act
Passive thoughts of suicide	Thoughts about death, or wanting to be dead, without any plan or intent
Non-suicidal self-injury	Self-injurious behaviour with no intent to die
Suicidal events	The onset or worsening of thoughts of suicide or an actual suicide attempt or an emergency referral for thoughts of suicide or suicidal behaviour
Deliberate self-harm	Any type of self-injurious behaviour, including thoughts of suicide without the intent to die

II. Executive Summary

What does the current evidence tell us about suicide, and what can be done to prevent suicidal behaviours? Where are the evidence gaps when it comes to fully understanding the complex and often interacting factors that drive individuals to self-harming behaviours, and what are the most appropriate and effective tools to assist them? To help answer these questions, the Mental Health Commission of Canada (MHCC) and the Public Health Agency of Canada (PHAC) commissioned the Quebec Network on Suicide, Mood Disorders and Related Disorders to conduct a review of the scientific literature on suicide and suicide prevention as part of MHCC and PHAC's co-lead initiative aimed at building a shared Canadian research agenda on suicide and its prevention.

An extensive international literature search from 2000-2016 on suicide and its prevention was conducted drawing on published scientific papers produced by researchers internationally, including Canada. Articles published in 2017 were excluded as this represents a partial year and would skew the interpretation of results. An initial review of the literature pertaining to any aspect of research on suicide and its prevention yielded nearly 2.8 million articles. The search was narrowed by using three databases (MEDLINE-PubMed, PsycINFO and CINAHL) and including just two types of articles recognized for generally providing higher quality and relevant results:

- systematic reviews which incorporate findings from several primary studies, and
- meta-analyses which combine the results of multiple studies identified in a systematic review

Using this approach, 867 scientific studies published between 2000 and 2016 were selected and a 446-page report detailing the findings was produced. A limitation of the international literature search is the exclusion of knowledge not captured in systematic reviews or meta-analyses (e.g. emerging fields, non-scientific evidence, unpublished or non-peer reviewed knowledge and qualitative studies). The MHCC has chosen some main findings to highlight by way of this summary paper, and the following represents an interpretation of the main findings from the scoping review. To access the full report (currently available in English only), please contact **mhccinfo@mentalhealthcommission.ca**.

Research on suicide at the international level: Where are we today, and where do we need to go?

Research on suicide and suicidal behaviour has increased over the last 15 years on many fronts, from the clinical, social and psychological aspects to the greater environment and population-level influences, such as access to mental health care.

Canada has been a significant contributor to research on suicide and its prevention internationally, with the country's share of scientific publications increasing from just over 2% in 2000 to more than 6% in 2015. In specific areas of expertise including genetics, epigenetics, Indigenous mental health, and others, Canadian researchers are responsible for over a third of international research. Canadian research has strength in sub-specialities within the field of research on suicide and its prevention.

Both the factors that contribute to suicide and suicidal behaviour, as well as potential solutions, are complex and multifaceted.[i] While there is no solution that guarantees the prevention of suicide, a review of Canadian and international scientific literature identified the most relevant current knowledge about the factors associated with suicide and strategies for its prevention. The review also highlighted programs and recommendations with regards to addressing research gaps that could help to inform future policies and procedures aimed at reducing the risk of suicide among different populations.

Summary of Risk Factors for Suicide and/or Suicidal Behaviour * Note: The following are not ranked in order
Male (suicide)
Female (suicidal behaviour)
Adolescent
History of suicidal behaviour
Exposure to violence (bullying, child abuse)
Season (spring, summer)
People receiving inpatient care
Family history of psychiatric disorder/suicide
Alcohol/substance use
Incarceration
Social factors: Loneliness, recent life events
Occupation: > Physician (especially female) > Police > First responder
Internet and media information (i.e., exposure to sensationalized celebrity suicide)

Summary of Risk Factors for Suicide and/or Suicidal Behaviour * Note: The following are not ranked in order
Comorbid disease
Psychiatric disorders: > Affective disorders (depression) > Substance use disorders > Psychotic disorders > Personality disorders (borderline personality disorder) > Anorexia > Post-traumatic stress disorder > Bipolar disorder (children and youth) > Attention deficit hyperactivity disorder (ADHD; children and youth) > Conduct disorder (children and youth)
Somatic conditions: > Underweight > Physical pain (any type) (suicidal ideation and behaviour) > Previous abortion (suicidal behaviour) > HIV+ (suicidal ideation and self-harm)
Socio-economic situation: > Marital status – young, unmarried (suicidal behaviour) > Socio-economic insecurity > Unemployment > Lower education > Family structure > Maternal emotional unavailability > Separated or divorced

Summary of Risk Factors for Suicide and/or Suicidal Behaviour * Note: The following are not ranked in order
Other brain disorders: > Traumatic brain disorder > Intellectual disabilities > Autism spectrum disorders > Multiple sclerosis > Epilepsy > Cognitive deficit or decline (elderly)
Minority groups: > Among immigrant populations, suicide risk is closely associated with country of origin > Lesbian, gay, and bisexual (articles reviewed did not include transgender or questioning populations) > Indigenous (especially youth)
Personality and psychological traits: > Hopelessness > Impulsivity > Neuroticism > Anxiety

Summary of Protective Factors * Note: The following are not ranked in order
Country of origin among immigrants, if country of origin has lower suicide/suicidal behaviour risk

Summary of Protective Factors * Note: The following are not ranked in order
Social factors: > Socio-economic situation > Loving parent-child relationship > Having reasons for living > Social connectedness > Sense of belonging > Religion
Treatment: > Selective serotonin reuptake inhibitors > Ketamine > Lithium for mood disorders > Dialectical-behaviour therapy > Internet-based Cognitive Behavioural Therapy (CBT) in depression > Follow-up interventions > Active contact and follow-up

Recommendations for future research:

There are many promising findings in research on suicide, particularly in the areas of prevention and intervention trials. However, some researchers have been reluctant to recommend adopting or scaling up many of these approaches because of inconsistencies in the research methodologies or inadequate reporting of trial information (e.g., people who have suicidal behaviours may be excluded from clinical trials). As a result, systematic reviews and meta-analyses—the types used in the literature review and this summary report—do not draw firm conclusions.

Collaborative research models: Some researchers have suggested that collaborative research models may yield more useful findings and help improve the quality of the systematic reviews and suicide prevention/interventions. Collaborative centres may also facilitate changes in the allocation of resources and in norms and research values by focusing on combined, rather than competitive, interactions.[ii]

More longitudinal studies: Many authors highlighted the need for more longitudinal studies to validate findings.

Harmonize approaches to research on suicide and its prevention: Methodology across studies would benefit from being harmonized, including procedures for definition, assessment and evaluation of suicidality. Harmonization would enable meaningful comparisons and conclusions to be formed.

More data: More evidence is needed to support appropriate treatment and follow-up of youth, ethnic/cultural minorities, sexual minorities, seniors, people with disabilities and or chronic health conditions, and cultural subgroups that are more vulnerable to suicide and suicidal behaviour.

Evaluation of community-based interventions: Interventions that have been tailored for use in Indigenous communities, for example, have shown promise but, like many population/community-level prevention studies, insufficient evaluative work has been conducted to allow strong recommendations.

Prediction of suicide risk: Several factors, including study design differences between subpopulations are difficult to distinguish (e.g., differences in suicide and suicidal behaviour, characteristics between individuals living with schizophrenia and individuals living with major depression). Many biological and clinical factors have been identified and assessed for their predictive value, and there have been some successes on small scales, but more rigorous testing and follow-up on initial results is required. Future research should look to build on the current evidence to create continuity.

Today	Future
Knowledge creation: Uncoordinated and fragmented research resulting in gaps in knowledge	Research focused on key priority areas and balanced among populations, including those in Canada
Knowledge translation: Existing knowledge on effective approaches not always shared broadly, including with communities most affected	Increased knowledge translation of existing research findings; ensure knowledge is informed by the perspectives of people with lived experience
Knowledge implementation: Research findings exist, people know about them, but no there is no implementation or scaling up	Accelerated implementation and scale up of existing knowledge and innovation into practice

III. Summary Report

Why was the scoping review commissioned?

Suicide is the ninth leading cause of death overall in Canada, with approximately 4,000 people dying by suicide in Canada every year[iii]. Certain individuals are at much higher risk than others.[iv] Men, for example, are three times more likely to die by suicide than women, but women are three-to-four times more likely to attempt suicide. Women are also hospitalized for attempted suicide at 1.5 times the rate of men.[v] Data from the Canadian Community Health Survey reveal that 14.7% of Canadians have thought about suicide and 3.5% have attempted suicide in their lifetime.[vi]

The evidence is also clear that mental illness, depression in particular, is the most significant risk factor for suicide. More than 80% of people who die by suicide were living with a mental illness or substance use disorder (> 90% for 15-29 year old's). The evidence shows that it is often the influence of multiple factors that leads someone to die by suicide. Other determinants may include: marital breakdown, economic hardship, a change in physical health, a major loss, or a lack of social support.[vii]

The federal government's role in suicide prevention

The Government of Canada plays an important role in suicide prevention by supporting programs that improve mental health and well-being and prevent suicide, conducting surveillance on suicide, and conducting and funding research to better understand suicide. The federal government also funds some mental health services for specific populations, including Indigenous people living on reserve or in Inuit communities, serving members of the Canadian Armed Forces, Veterans, current and former members of the Royal Canadian Mounted Police, newcomers, and federally incarcerated individuals. Federal public health activities focus on the most vulnerable populations and are aimed at all ages and life spans.

Both the factors that contribute to suicide and suicidal behaviour, as well as the solutions, are complex and multifaceted. Accounting for these multiple levels of interaction is essential to developing an effective suicide prevention strategy that can adequately respond to the unique needs of populations with higher rates of suicide and recommend the best evidence-based care responses.

Internationally, research prioritization has been an effective approach to address research challenges and seize opportunities to prevent suicide. Several countries have undertaken priority-setting exercises, including the United States and Australia.

Many countries have also adopted national suicide prevention strategies that attempt to reduce deaths by suicide through multipronged approaches: increasing awareness about suicide and safe/best practices (general population, school settings, professionals, including media), training initiatives around the most promising intervention practices (medical professionals, community members and "gatekeepers" such as parents, spouses/ partners, friends, teachers, caseworkers), and improving care for people at

increased risk (through screening and treating underlying psychiatric disease, improving organization of services).

In 2016, the Public Health Agency of Canada published the Federal Framework for Suicide Prevention[viii], which aims to provide guidance on how different actors in suicide prevention can work together to optimize their efforts and meaningfully prevent suicide in Canada. While this is an important step, further action needs to be informed by sound evidence, and a shared national research and knowledge translation agenda could foster activity in areas where actions would be the most impactful.

Coordinating research and integrating expertise from various fields is a crucial step toward better understanding what drives individuals to harm themselves and finding the most appropriate and effective tools to help them.

To address these needs, the Mental Health Commission of Canada and the Public Health Agency of Canada jointly commissioned the Quebec Network on Suicide, Mood Disorders, and Related Disorders (Réseau québécois sur le suicide, les troubles de l'humeur et troubles associés) to provide a summary of current evidence concerning suicide risk factors and suicide prevention. The report seeks to outline the key research topics in the field, while highlighting areas where Canadian researchers have been actively contributing to the international literature.

How was the scoping review conducted?

An extensive international literature search from 2000-2017 on suicide and its prevention was conducted, drawing on published scientific papers produced by researchers internationally, including Canada.

The objectives were to:

1. Define the state of research on suicide and its prevention in Canada and internationally
2. Identify Canadian gaps and strengths in scientific research
3. Inform future stakeholder engagement activities

The highest quality studies: An initial review of the literature pertaining to any aspect of research on suicide and its prevention yielded nearly 2.8 million articles. The search was narrowed by using three databases (MEDLINE-PubMed, PsycoINFO and Cumulative Index to Nursing and Allied Health Literature (CINAHL) and including just two types of articles recognized for generally providing higher quality and relevant results that are more useful for decision-making:

- systematic reviews which incorporate findings from several primary studies, and
- meta-analyses which combine the results of multiple studies identified in a systematic review

Using this approach, 867 scientific studies published between 2000 and 2017 were selected and a 446-page report detailing the findings was produced. The purpose of this summary report is to highlight the main findings of the literature review. A limitation with this methodology is the exclusion of knowledge not captured in systematic reviews or meta-analyses (e.g. emerging fields, non-scientific knowledge, unpublished or non-peer reviewed knowledge and qualitative studies).

Focusing on priority populations: Searches for studies that include research on population groups who are at higher risk of suicide and suicidal behaviour were conducted, including: Indigenous peoples, individuals who are in inpatient psychiatric care, military personnel, minority groups, incarcerated individuals, and other groups (e.g., Lesbian, gay, bisexual, transgender, and queer/ questioning [LGBTQ] individuals).

Research themes of interest: Categories defined for the scope of the report included: epidemiology; clinical, demographic, and social factors; biological factors; prevention and screening; treatment and interventions; follow-up care and postvention; and services research.

Limitations of the research

Emphasis on synthesized research: Due to the large number of articles returned by the literature search, the project limited its review to articles that synthesized original research in a systematic way (meta-analyses and systematic review). This excluded expert reviews or the body of primary publications in any given area of expertise. As well, meta-analyses and systematic reviews tend to focus on more established research areas, as opposed to emerging fields such as epigenetics.

The prevalence of quantitative research: Despite conducting searches in complementary databases, the methodology biased results toward quantitative research published in scientific journals. However, several studies did use qualitative approaches and specifically mentioned the inclusion of grey literature.

Meta-analysis versus systematic reviews: Major findings and recommendations of only meta-analysis were included when there were many articles for a specific theme, and meta-analysis and systematic reviews were included when there were few articles for a specific topic. This approach was used to address the varying numbers of articles in each subtheme. In addition, some articles were omitted if they did not specifically use the terms “meta-analysis” or “systematic review” in the title, abstract or keywords.

Inclusion of Canadian data: Country of origin was listed if at least one of the studies involved Canadian data. It is possible that important Canadian data was included in some of the systematic reviews and meta-analyses but were not formally identified as Canadian in origin. Preference was given to North American studies to improve relevance to the Canadian context.

Canadian-authored studies: Literature compiled in the Canadian suicide research library represents a snapshot of research that originated in Canada, including primary research articles, and could help to identify key researchers in the field. This information is highlighted in the graphs but is not included in the literature review portion of the paper.

What the current evidence reveals

See Study Highlights table in Appendix I for greater detail on each theme.

Understanding Suicide: Epidemiology studies are primarily focused on identifying the incidence and prevalence of suicide, suicide attempt and thoughts of suicide.

What the evidence revealed:

- Suicide and mental disorders are connected (> 80% of suicides), with specific disorders being disproportionately represented: affective disorders, substance use disorders, psychotic disorders and personality disorders
- Particularly high risk of clustering among Indigenous communities and young people, or in specific environments, such as in a correctional facility
- Vulnerable groups at risk include pregnant women, LGBTQ individuals, physicians, police, inpatients and incarcerated individuals
- Socio-economic insecurity linked with increased risk of mental health problems and suicide, especially during the first five years of unemployment

Clinical factors associated with suicide: Identifying individuals most at risk of dying by suicide or experiencing suicide-related harm is a priority for clinicians and policymakers. It is also a priority in the global research community where identifying risk and protective factors has emerged as one of the most active areas in research on suicide. The clinical factors most widely studied are: the exposure to violence, suicide and suicidal behaviour; personal history of prior self-harm or suicidal behaviour; mood disorders; psychosis and schizophrenia; substance disorders; other psychiatric disorders; other brain disorders; somatic conditions; personality and psychological traits; and neurocognitive function.

What the evidence revealed:

- Increased risk of suicidal behaviour in people who have experienced interpersonal violence, including child maltreatment, bullying, dating violence, and community violence
- History of self-injury/suicidal behaviour seems to confer a risk of future suicidal behaviour and even suicide
- Many mental illnesses and substance use (including tobacco) and substance use disorders have high association with suicide

- Increased risk of suicide among traumatic brain injury survivors compared to those with no history of traumatic brain injury
- Individuals with any type of physical pain were at higher risk for thoughts of suicide/suicidal behaviour
- Impulsivity, hopelessness, neuroticism, extroversion, feelings of defeat or entrapment, and psychological distress have all been associated with increased suicide risk

Demographic and social factors associated with suicide: This broad category of risk factors is mainly distributed among the themes of: seniors; youth; family context; spirituality or religion; Indigenous peoples; minority groups; military personnel; people who are in inpatient treatment; people who are incarcerated; and other social factors (primarily economic stability and occupation).

What the evidence revealed:

- Peer victimization, particularly cyberbullying, is associated with increased risk of thoughts of suicide and attempts in youth
- Most significant risk factors for adolescent suicidal behaviour may include: age, family structure, history of family, life events
- Seniors are vulnerable to psychological difficulty following physical injury or disease
- Establishing close, involved, loving parent-child relationships, family connectedness, perceived caring is protective against suicide
- Strong evidence links religious involvement with decreased risk of suicide, depression, and substance use
- Within First Nations, Inuit or Métis Nation communities: Multiple approaches and interventions have shown protective effects but should be studied in more controlled, evaluative studies
- Minority groups (including sexual minorities) often face higher suicide risk, but the risk among immigrants is closely associated with country of origin
- Higher rates of suicidal behaviour among military veterans than general population, but lower rates for actively serving military personnel (UK and US exceptions)
- Inpatient suicides represent 1-1.5% of all suicides (including psychiatric, long-term care and other medical settings), and specific risk is likely linked to underlying diagnosis; patients are also at heightened risk of suicide immediately following discharge from psychiatric inpatient care (see Services research)
- Based on available literature, approximately 8% of incarcerated individual deaths globally are due to suicide. Recently released individuals have increased rates of suicide; risk decreases by 1.5-fold over the first 5 years following release

Biological factors associated with suicide: There has been a shift in our understanding of suicide as not only a social, moral, or philosophical construct, but also because of distinct and measurable biological factors. The biological factors associated with suicide that were most studied included: imaging studies; stress response; epigenetic changes (the influence of stress and environmental changes on gene expression); genetics (to identify family history of risk factors); and biological pathways (e.g., inflammation). This field of research could lead to useable biomarkers to predict suicidal behaviour and improved understanding of the biological mechanisms underlying suicidal behaviour is likely to inform therapeutic approaches.

What the evidence revealed:

- Imaging has revealed structural changes in the brain of people who have died by suicide or experienced a suicide attempt or thoughts of suicide
- Adolescents and young adults may have different hormonal responses to stress than older adults
- There is strong evidence to support the hereditary nature of suicide and suicidal behaviour
- There is growing evidence linking brain inflammation to suicidal thoughts
- Low cholesterol has been linked to suicide though confirmation is required
- Low levels of the omega 3 fatty acid are linked to depression/bipolar disorder
- Low levels of the neurotransmitter serotonin in the brain may point to an increased risk for suicide (potential biomarker)

Suicide prevention and screening: Effective strategies for prevention of suicide and early detection of individuals at risk of suicide or suicidal behaviour are essential. Some of the prevention and screening strategies adopted have included: public health policies to reduce access to lethal means; encouraging responsible media reporting on suicide; education initiatives aimed at the public; improved detection of suicidality; and facilitated access to care for individuals at risk of suicide. In addition, prevention strategies can be adapted to fit the needs of certain groups and can be implemented at the community level or in specific environments such as schools or in the workplace.

What the evidence revealed:

- Consensus among most studies that means restriction is an effective method of preventing suicide, including: control of analgesics and structural barriers where multiple suicides have occurred
- Media reporting of suicide can influence suicide-related behaviour; responsible reporting may decrease risks whereas reports of celebrity suicides may increase risks (up to 24 weeks after the incident)

- Community interventions focused on seniors (depression screening and treatment, decreasing isolation) are effective, especially among women
- There is insufficient evidence on the reduction of death by suicide from school-based interventions; though some have reported decreased suicide attempts and thoughts of suicide, improved knowledge, attitudes, and help-seeking behaviours
- Workplace prevention strategies are beneficial
- Workplace-related factors linked to increased risk of suicide: low control over work, monotony of work, and high psychological demands
- Physician education and gatekeeper education are among some of the most effective suicide prevention measures
- Currently there is insufficient evidence to determine the benefits of screening in primary care settings; tools may help identify some adults at risk of suicide but there is lower accuracy for youth and older adults
- Some communities are developing successful suicide prevention training programs to meet their specific needs
- Interventions at sites where multiple suicides have occurred, including providing on-site care teams are a promising practice

Treatment/interventions: Once the risk of a death by suicide has been identified it is important to address both the immediate symptoms of suicidality and the underlying issues. To determine which treatments have proven effective, the review examined studies that focused on: the delivery of crisis interventions; contributions of nursing care; psychotherapy; pharmacotherapeutic treatment approaches (e.g., with antidepressants); and other types of treatment.

What the evidence revealed:

- People who use telephone crisis services benefit from services with decreased urgency of suicidal crisis and improved mental state. Both users and counsellors give positive feedback
- Although follow-up interventions are likely to be effective in decreasing self-harm, the specific components that are effective are not clear. In particular, studies evaluating brief contact interventions (telephone, postcard, letter, emergency or crisis cards) showed reduced subsequent episodes of self-harm or suicide attempts, though effects were non-significant
- Moderate evidence suggests that cognitive behavioural therapy and dialectical-behavioural therapy significantly reduce suicidal behaviour, attempts and self-injury, but it is unclear if these effects can be sustained
- Some antidepressants (selective serotonin reuptake inhibitors) decrease the risk of suicidality in adults and older adults. Despite ecological and large-scale

observational studies showing decreased rates of suicide with increased usage of antidepressants (especially selective serotonin reuptake inhibitors), studies examining direct evidence of antidepressant effects on suicide deaths have yielded conflicting results

- Strong evidence (consensus among all studies) suggests that the risk of suicide and suicide attempt among people living with mood disorders is significantly lower with lithium treatment
- Good evidence supports the reduction of suicidal behaviours with the antipsychotic clozapine while some evidence suggests increased suicidal behaviours with other second-generation antipsychotics (lanzapine, risperidone, quetiapine, aripiprazole, and asenapine)
- Some studies suggest that deep brain stimulation may increase risk for suicide and self-harm. However, further research is required to confirm this finding.

Follow-up care and postvention: The risk of suicide can be high for individuals following thoughts of suicide or suicide attempt or for people who have had a loved one die by suicide. Different approaches have been considered for follow-up care of individuals who are having thoughts of suicide (e.g., intensive case-management and indirect follow-up). In addition, postvention—intervention following a death by suicide—offers support to individuals bereaved by suicide, decreasing the risk of them having thoughts of suicide.

What the evidence revealed:

- Weak evidence of transient (12 month) advantage of intensive follow-up care after a suicide attempt
- Guided (but not unguided) internet-based therapy is a promising postvention approach
- Efficacy or effectiveness of telephone-based interventions is unclear
- Many apps are available, but few are based on evidence and some may be harmful
- Self-help support groups for people bereaved by suicide contribute to positive outcomes
- Level of functioning of the surviving parent after a death by suicide and self-esteem of the surviving adolescent are protective factors for adolescents bereaved by suicide

Services research: Access to and use of services is an area that has received some attention in recent years. The frequency of use, as well as the availability of appropriate care and the organization of services may all influence the ability of the healthcare system to intervene before a suicide attempt or death by suicide. For example, the evidence suggests that more than three-quarters of individuals who die by suicide

contact some level of healthcare services within one year of their death. As such, there may be a window of opportunity to help individuals between their contact with healthcare services and their subsequent suicide attempt or suicide. The research themes examined were: repeat emergency room visits; specialized care; treatment and discharge; and organization of care post-discharge.

What the evidence revealed:

- Emergency department visits can be a useful indicator of an unmet need in mental health services
- Follow-up interventions may decrease risk of repeating self-harm behaviours
- One-third of people who seek mental health help at the emergency department are discharged without follow-up
- Training, policy and guidelines improve knowledge and confidence of emergency workers when treating people who engage in self-harming behaviours
- Nearly one-quarter of deaths by suicide occur within three months of discharge from health services

Recommendations for future research

There are many promising findings in research about suicide, particularly in the areas of prevention and intervention. However, some researchers are reluctant to recommend adopting or scaling up many of these approaches because of inconsistencies in the research methodologies or inadequate reporting of trial information (e.g., people who have suicidal behaviours may be excluded from clinical trials). As a result, systematic reviews and meta-analyses cannot draw firm conclusions from the results.

Several approaches were suggested to overcome these limitations.

- **Produce more data**
  - To better understand mechanisms leading to suicidal behaviour
  - To support appropriate treatment and follow-up of youth, ethnic/cultural minorities, sexual minorities, and seniors
  - To better understand cultural subgroups that are more vulnerable to suicide and suicidal behaviour (e.g., evaluations of promising interventions in Indigenous communities)
- **Prediction of risk**
  - Further characterize differences in subpopulations of individuals within groups that are at higher risk of suicide (e.g., individuals living with schizophrenia compared to individuals living with major depression)

- More rigorous testing and follow-up on biological and clinical factors associated with suicide that have been identified and assessed for predictive value (particularly epigenetics and biomarkers)

> **Treatment and intervention:**

- Various pharmacotherapeutic approaches, particularly antidepressants and mood stabilizers, were extensively covered by the literature, as well as psychotherapy, but there have been few studies on nursing approaches and crisis interventions
- Promising findings when it comes to prevention and intervention, but it is often inconclusive due to methodologic inconsistencies or inadequate reporting of trial information. Some researchers have suggested that collaborative research models or centres may yield more useful findings

> **More postvention and services research on:**

- Cost-effectiveness and efficacy of internet-based therapies
- Long-term follow-up studies
- Efficacy of brief-contact and telephone interventions
- Bereavement and postvention, especially from non-Western countries
- Evaluation of gatekeeper training protocols

> **Randomized controlled studies focused on:**

- Means reduction
- School- and community-based interventions, including in Indigenous communities
- Gatekeeper training
- Repeat emergency room visits
- Treatment and discharge

> **More rigorous evaluations on:**

- Promising suicide prevention programs on small scales
- Programs for military personnel
- Programs for seniors
- Online psychological counselling
- Gatekeeper training

> **Improved research methodologies**

- Harmonize methods across studies, regardless of research theme
- Adopt collaborative research models
- Form collaborative research centres
- More longitudinal studies are needed and for over longer periods of time

- Longitudinal studies that incorporate bio-psychosocial variables would be beneficial (e.g., exposure to violence, suicide and suicidal behaviour; personal and psychological traits; antidepressants; suicide methods; mood disorders)

Canadian and international contributions to research on suicide and its prevention

Canada is a major contributor to international research on suicide, and Canada's contribution is growing: Canadian research in suicide represents about 4% of the total international literature on suicide, which is significant considering the relative size of Canada's population (articles published between 2000 and 2016). Canada's share of international publications on suicide increased from 2.16% in 2000 to 6.12% in 2015. In specific areas of expertise, Canadian researchers are responsible for over a third of international research, with strengths in:

Suicide research areas with the most Canadian studies

Treatment & intervention

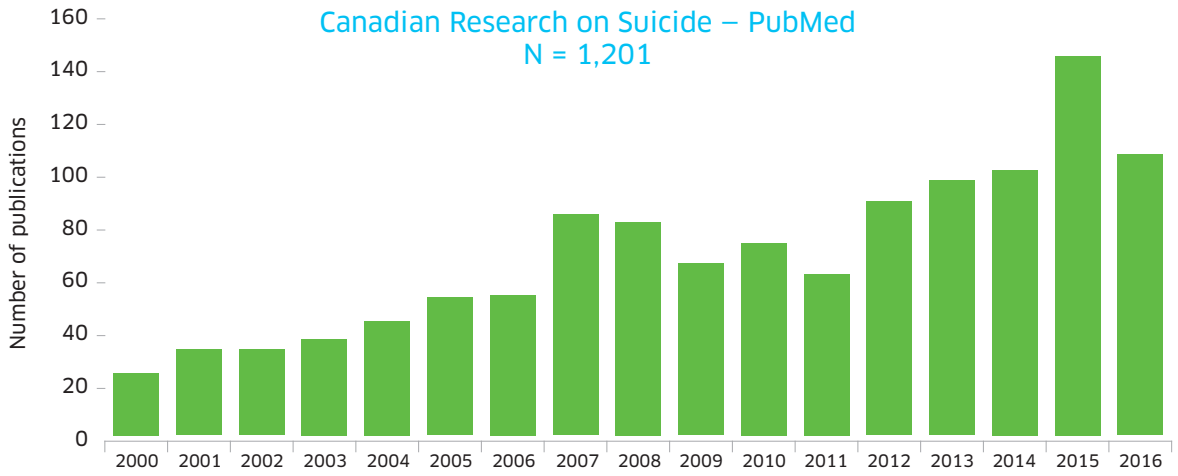
Clinical & sociodemographic

Epidemiology

Prevention & screening

- Epigenetics: 44% of total articles
- Research on Indigenous peoples: 12.3% of total articles
- Genetics related to suicide: 10.85% of total articles
- Social factors associated with suicide: 4.92% of the total articles
- Biological sciences: 4.28% of total articles

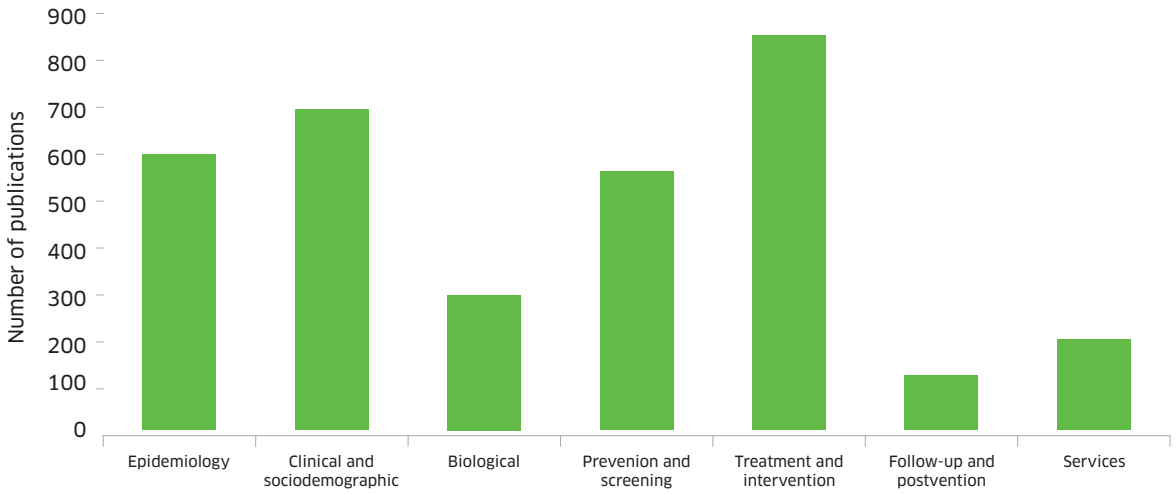
DISTRIBUTION OF CANADIAN RESEARCH ON SUICIDE BY YEAR PUBMED, 2000-2016



Funding of Canadian research in suicide: A review of funding of research on suicide by the three federal research funding agencies found that the broad category of clinical and sociodemographic factors received by far the largest share of grant money, with the least amount of investment going to follow-up and postvention.

Canadian researchers are well represented in terms of their overall publications in proportion to the population size. It is, however, relevant to note that some specialized areas may be better represented than others (e.g. postvention alone retrieves only three articles authored by Canadian researchers, whereas emergency alone retrieves 97 articles authored by Canadians).

CANADIAN PUBLICATION TOPICS



Canadian Research Funding Agencies Funding Research on Suicide and its Prevention: 2000-2016	
Clinical and sociodemographic factors	$33,922,270
Prevention and screening	$10,333,637
Biological factors	$8,961,028
Epidemiology	$3,641,057
Treatment and interventions	$3,518,277
Health services	$2,752,306
Follow-up and postvention	$627,939

** The three federal research funding agencies are the Canadian Institutes of Health Research, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council. Many grants are assigned to more than one category (e.g., epidemiology and health services). The total amount invested in research on suicide and its prevention is $43,751,828.*

Distribution of funds per type of award: The majority of the tri-agency funding went for grants and training (51% and 37% respectively) with knowledge transfer projects receiving significantly less (8%).

Internationally, well-established research areas include the following:

- Epidemiology
- Clinical and sociodemographic factors: mood disorders, psychotic disorders, substance disorders related to suicide
- Biological factors: genetic contributors to suicide
- Prevention and screening
- Treatment and intervention: antidepressants, mood stabilizers and psychotherapy

Internationally, the following research areas are emerging:

- Follow-up and postvention
- Health services
- Clinical and sociodemographic factors: suicide in cultural, ethnic and sexual minorities
- Biological factors: epigenetics and biomarkers
- Treatment and intervention: nursing approaches and crisis interventions

Conclusion and recommendations for future research

Authors of the systematic reviews and meta-analyses made several recommendations, some of which were repeated by several authors:

- There is a need for better follow-up of research and for more thorough evaluation of prevention programs
- Among the suicide prevention strategies that have been developed and tested, several are interesting and promising. Formal recommendations cannot be made due to the lack of adequate evaluation
- More research is needed by way of the development of prediction models for suicide, using combinations of biological and clinical factors
- In many aspects of suicide research, including research on prevention and intervention trials; there are promising findings, but findings are often inconclusive because of methodologic inconsistencies or inadequate reporting of trial information (e.g. demographic information)
- Collaborative research models may yield more useful findings in the field and help improve the quality of the scientific research and suicide prevention/interventions.

Collaborative centres may also facilitate changes in the allocation of resources and in norms and research values by focusing on collaborative, rather than competitive interactions

- More longitudinal studies are required, and these should be conducted over longer periods of time
- Cultural subgroups that are more vulnerable to suicide and suicidal behaviour should be more closely studied. In particular, interventions that have been tailored for use in, for example, Indigenous communities, have shown promise but like many population/community-level prevention studies, insufficient evaluative work has been conducted to allow strong recommendations to be made.

Prediction of suicide risk remains elusive; this may be due in part to differences in subpopulations whose specific characteristics have not been adequately characterized (e.g. differences in suicide and suicidal behaviour characteristics between individuals living with schizophrenia and individuals living with major depression). Many biological and clinical factors have been identified and assessed for predictive value; although there are some successes on small scales, more rigorous testing and follow-up on initial results are required.

APPENDIX 1: STUDY HIGHLIGHTS

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Epidemiology: Identifying the incidence and prevalence of suicide, suicide attempt and thoughts of suicide (82 studies)	
General *(7 studies: 5 contained Canadian data)* More males than females died by suicide in all regions Nearly one-third of emergency department mental health attendance is due to self-harm and repeat self-harm is very likely Adolescents are at a heightened risk of thoughts of suicide Geographical and ethnic factors influence risk Suicidal behaviour more prevalent among women and young, unmarried individuals or people living with a psychiatric disorder	**Program gaps:** Focus on priority populations **Research gaps:** More reliable international suicide statistics and accuracy of suicide reporting to enable inter-country comparisons of suicide rates and factors; improve/harmonize methodology across studies; study gender differences in suicide
Geographical specificities *(7 studies: 3 contained Canadian data)* Methods used to end one's life by suicide vary by region and over time	**Program gaps:** Cultural, social and legal barriers can affect disclosure of psychiatric disorders and suicide **Research gaps:** Regional patterns of suicide methods
Seasonal/environmental contributors *(6 studies/3 excluded: 1 contained Canadian data)* Most work suggests that suicide and suicide attempts follow a season-specific pattern with peak in spring/summer, regardless of sex	**Program gaps:** Prevention efforts could be informed by data on seasonality in suicide **Research gaps:** Biological mechanism of seasonality unclear

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Associations with mental illness *(26 studies/7 excluded: 10 contained Canadian data)* Suicide and mental health disorders are connected (> 80% of suicides), with specific disorders being disproportionately represented: depression, anxiety, substance use disorders, psychotic disorders and personality disorders	**Program gaps:** Conduct studies to measure the impact of policies (e.g., availability of firearms and alcohol, and youth use of antidepressants) on suicide and suicidal behaviour Identification of priority population groups could lead to tailored prevention strategies and decreased barriers to accessing mental health care **Research gaps:** Suicide in the absence of a diagnosable mental disorder could be investigated in different geographical and sociocultural contexts Further study of co-factors: sex differences in suicide risk, influence of alcohol use Need for large-scale longitudinal studies (e.g., role of risk and protective factors)
Exposure to suicide/suicidal behaviour *(6 studies: 4 reported on Canadian studies)* Professional exposure to suicide and suicidal behaviour is frequent among medical students, nurses, paramedics, emergency department personnel "Suicide clusters" occur in various settings (e.g., psychiatric hospitals, schools, prisons, Indigenous communities)	**Program gaps:** Training and support of medical professionals required to improve attitudes and confidence when confronted with individuals who self-harm **Research gaps:** Better understanding of "suicide clusters"
Suicide methods *(9 studies: 3 referred to Canadian data)* Self-poisoning prevalent among adolescents (irrespective of ethnicity) Alcohol consumption associated with use of firearms as means for self-harm, suicide attempt or suicide	**Program gaps:** Better prevention of suicide in controlled environments (hospitals, prisons, custody) **Research gaps:** Data on adolescents; data on efficiency of gun-control policies; prospective, population-based research

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Identification of minority/vulnerable groups *(13 studies/4 excluded: 2 referred to Canadian data)* Priority populations include: youth, LGBTQ individuals, physicians (especially female), certain police groups, inpatients and incarcerated individuals	**Program gaps:** Screen for and measure suicide risk in LGBTQ communities **Research gaps:** Better data on minority ethnic groups and risk factors for suicide among female physicians and inpatients Prospective, population-based research
Socio-economic contributors *(8 studies/2 excluded: 1 included Canadian data)* Socio-economic insecurity linked with increased risk of mental health problems and death by suicide, especially first 5 years of unemployment	**Research gaps:** How to mitigate the impact of economic hardship on mental health outcomes
Clinical Factors: Identifying measurable risk and protective factors (317 studies)	
Exposure to violence, suicide and suicidal behaviour *(39 studies/10 excluded)* Increased risk of suicide or suicidal behaviour among victims of interpersonal violence; people with a history of self-harm/suicidal behaviour; individuals exposed to a family member's death by suicide; individuals hearing about a celebrity suicide (especially in first week following)	**Research gaps:** Population-based longitudinal studies; standardized assessments; prevention/rapid detection of interpersonal violence (especially early ages); biological mechanisms of psychiatric disease in victims of sexual abuse
Personal history *(14 studies/3 excluded: 6 included Canadian content)* Prior self-harm or suicidal behaviour is one of the most consistently noted contributing factors for suicide	**Research gaps:** Psychological aspects of repeat self-harm

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Mood disorders *(45 studies/14 excluded: 12 using Canadian data)* 42% of people who died by suicide were diagnosed with an affective disorder (especially depression) Suicide risk concentrates early in the course of illness and soon after hospital discharge Significant risk factors: male gender, family history of psychiatric disorder, previous suicide attempt, more severe depression, hopelessness and comorbid disorders, including anxiety and misuse of alcohol and drugs	**Program gaps:** Identified risk factors could be used in clinical assessments; focus suicide prevention efforts on recently or repeatedly hospitalized individuals **Research gaps:** Future studies could detail study design, sample selection, sample illness characteristics, suicide attempt characteristics; more longitudinal and large-scale studies; risk of under-reported suicidal behaviour in clinical and epidemiological studies
Psychosis and schizophrenia *(28 studies/8 excluded: 11 included Canadian data)* 9.2% of people who died by suicide experienced psychosis (including schizophrenia) People receiving treatment as inpatients have the highest risk for suicide early after admission Potential risk factors: younger age of onset of psychosis, history of alcohol/substance addiction, duration of untreated psychosis	**Research gaps:** Distinguish between people diagnosed with schizoaffective disorder and those diagnosed with schizophrenia (to identify subgroups with varying degrees of risk)

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Problematic substance use disorders *(31 articles/5 excluded: 12 included Canadian data)* 25.7% of suicide cases were diagnosed with problematic substance use (40.8% in 15-29 year old's) Significant association between alcohol use disorder and increased risk of thoughts of suicide, suicide attempt, and suicide Increased thoughts of suicide and suicide attempt with any cannabis use; risk increases more with heavy cannabis use Cigarette smoking significantly increased the risk of suicide	**Research gaps:** Whether acute cannabis use increases imminent risk for suicidality; mental health of young Indigenous people in the Arctic and underlying causes; whether smoking is a true risk factor
Other psychiatric disorders associated with suicide *(45 articles/9 excluded: 22 included Canadian data)* Most frequent is depression. Others include: anxiety, problematic alcohol use and attention deficit hyperactivity disorder/conduct disorder (younger people), body dysmorphic disorder, anorexia nervosa, post-traumatic stress disorder, sleep disturbance	**Program gaps:** Suicide prevention strategies may be most effective if focused on the treatment of mental disorders (beyond depression) **Research gaps:** Longitudinal studies on the progression in psychiatric disorders
Other brain disorders *(26 articles/3 excluded: 14 included Canadian content)* Increased risk of suicide among people with traumatic brain injury, autism spectrum disorders (adults), migraine with aura, multiple sclerosis, epilepsy	**Research gaps:** Prevalence of post-traumatic brain injury, thoughts of suicide and suicide attempt and establishment of prevention practices; link between epilepsy and suicide

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Somatic conditions *(48 articles/14 excluded: 17 included Canadian content)* Individual with any type of physical pain (e.g., headache, back, arthritis) were at higher risk for thoughts of suicide/suicidal behaviour Other risk factors: being underweight (being overweight associated with decreased risk of suicide), people with HIV (thoughts of suicide/self-harm reported in almost 25% of people with HIV)	**Program gaps:** Body mass index may be useful measure in assessing suicide risk **Research gaps:** Prospective cohort studies needed to confirm findings; available evidence difficult to interpret (e.g., other influencing factors)
Personality and psychological traits *(30 articles/6 excluded: 12 included Canadian content)* Suicide and suicidal behaviour associated with: impulsivity, neuroticism, hopelessness, borderline personality disorder (youth), perceptions of defeat and entrapment, stressful life experiences Social factors (reasons for living, sense of belonging, social connectedness) were protective factors against thoughts of suicide, suicidal behaviour and suicide	**Program gaps:** Screen people who self-harm for such disorders and treat with appropriate interventions; the Iowa Gambling Task (which measures impulsivity) could be a helpful test for assessing the long-term suicidal risk of people with mood disorders **Research gaps:** Longitudinal studies of the progress of these disorders
Neurocognitive function *(11 articles/4 excluded: 4 included Canadian content)* People who have attempted suicide have lower performance on neuropsychological tests (e.g., Iowa Gambling Task) Evidence from imaging studies indicate that suicidal behaviour correlates with altered decision-making, fluency, problem-solving	**Research gaps:** Need for general research, including prospective studies of link between executive function (mental processes that help us get things done) and suicidality; link between impaired memory and people who have attempted suicide

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Sociodemographic Factors: Identifying measurable risk and protective factors (194 studies)	
Youth *(66 studies/14 excluded: 23 included Canadian content)* Peer victimization (particularly in the form of cyberbullying) is associated with increased risk of thoughts of suicide and suicide attempts in youth Most significant risk factors: age, family structure, family history, life events School connectedness protects against thoughts of suicide/suicide attempt, yet school-based prevention efforts seem to have no demonstrated effect on suicide rates Pediatric individuals who self-harm benefit from post-discharge follow-up	**Research gaps:** Investigating suicide risk factors together (not in isolation) to identify combined effects; effective follow-up approaches with clear outcome measures; impact of antidepressants on youth
Seniors *(22 articles/10 excluded: 7 included Canadian data)* Increased suicide risk associated with physical injury or disease (males at higher risk), depression, social isolation, functional decline, cognitive defects In residences for seniors (e.g., nursing homes), thoughts of suicide are very common, but suicide is rare Effective interventions: collaborative care, community-based follow-up by a psychiatrist (twice as effective for women if delivered by a general practitioner)	**Program gaps:** Suicide prevention strategies (e.g., aimed at improving resiliency, engaging family/community); universal prevention programs involving community depression screening and health education **Research gaps:** Gender-specific characteristics among seniors; suicide risk in assisted living (non-residential care facilities) settings

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Family context *(8 articles/2 excluded: 5 included Canadian content)* Protective factors include having close, loving parent-child relationships and family connectedness Higher rates of suicide in people who have experienced a divorce than people who are married (especially middle-aged and older males)	**Program gaps:** Relationships could be a component assessed in suicide risk assessment **Research gaps:** Research on parent-based interventions, parent perspectives and family support (especially among ethnic and sexual minority youth)
Spirituality and religion *(6 articles/3 excluded: all contained some Canadian content)* Strong evidence links religious involvement with decreased risk of suicide, depression, and substance use (especially among seniors)	**Research gaps:** Distinguish between protective effects on thoughts of suicide and suicide attempt **Program gaps:** Consider social and religious environment when designing suicide prevention strategies for specific populations
Indigenous peoples *(8 articles/1 excluded: 5 included Canadian data)* Suicide prevention programs for Indigenous communities (e.g., gatekeeper training) have potential to meaningfully impact suicidal behaviours, but lack rigorous evaluation and randomized controlled trials Among Inuit seniors, connections with family members and being on the land are protective, whereas disconnection from family, violence, problematic drug or alcohol use, and sexual abuse are risk factors	**Program gaps:** Targeted interventions in both urban and rural settings; including Inuit suicide prevention concepts (e.g., restoring cultural pride) as complement to western models **Research gaps:** Better study designs for suicide prevention interventions targeting Indigenous communities so suicidal behaviour measures can be accurately evaluated; engage Indigenous peoples as equal partners in the research process; underlying causes for mental health problems in the Arctic; mental health needs of young Indigenous peoples in the Arctic

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Minority groups *(24 articles/4 excluded: 10 included Canadian data)* Minority groups (including sexual minorities) may face higher suicide risk, but risk of suicide amongst immigrants is closely associated with country of origin	**Research gaps:** Factors leading to heightened risk in minority groups (especially discrimination, victimization); the intersect between ethnic and sexual minorities; greater efforts to include sexual minorities in studies
Military *(10 articles/5 excluded: 2 included referred Canadian data)* Higher rates of suicidal behaviour among military veterans than general population, but lower rates for actively serving military personnel (UK and US exceptions) Risk factors associated with suicide: failed intimate relationships, financial problems, legal/disciplinary problems, work stress	**Program gaps:** Ongoing thoughts of suicide and suicidal behaviour could be adequately assessed in veterans; more robust evaluation of interventions in active military personnel **Research gaps:** Assess specific combat events (exposure to killing and atrocities) and interventions in veterans
People in inpatient treatment *(11 articles/4 excluded: 2 reported on Canadian data)* Represent 1-1.5% of all suicide deaths and more likely to be female Highest risk for suicide is early in admittance	**Program gaps:** Improve system of care and safety of environment **Research gaps:** Characteristics of individuals who die by suicide while in inpatient treatment. Planning and intent among people who are in inpatient treatment (differences between suicide on the ward, during agreed leave or while absconded)

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Incarceration *(8 articles: 3 reported Canadian data)* About 8% of incarcerated individuals die by suicide globally Risk factors: occupying a single cell; past suicidal behaviour, psychiatric disorders or problematic alcohol use; initial release from prison Protective factor: Using trained incarcerated individuals to provide social support	**Program gaps:** Avoiding single cells for incarcerated individuals at risk of suicide; treating psychiatric and substance use disorders; coordinated support in transition to community **Research gaps:** Other contributing factors (e.g., attention deficit hyperactivity disorder, comorbidities, hopelessness, life events, discontinuation of medication) that may inform effective prevention strategies
Other social factors *(31 articles/5 excluded: 11 reported on Canadian data)* Risk factors include: unemployment, certain occupations (physicians [especially women], medical trainees, agricultural workers, police/first responders, low-skilled jobs)	**Program gaps:** Suicide prevention strategies focusing on lower socioeconomic populations; better access to mental health resources for medical students **Research gaps:** Better controlled studies of link between suicide risk and occupations
Biological Factors: Identifying distinct and measurable biological changes (62 studies)	
Imaging *(4 articles)* Identified structural changes in the brains of people who have died by suicide or experienced suicide attempt or thoughts of suicide (e.g., hyperintensities, reduced grey matter volume)	**Research gaps:** Differentiate between thoughts of suicide, suicide attempt and intention with at-risk populations; brain hyperintensities in unipolar and bipolar disorders may be helpful biological marker of suicidality; confirm whether anatomical changes in the brain are consistently associated with suicidal behaviour across sexes and diagnoses
Stress response *(3 articles/1 excluded)* Adolescents have a different hormonal response to stress Conflicting results concerning stress response and history of suicide attempt	**Research gaps:** More standardization needed in studies; classify results by age to distinguish between altered stress responses; link between suicidal behaviour and altered glucocorticoid pathways in the brain of adolescents

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Genetics *(37 articles/5 excluded: 11 included Canadian data)* Strong evidence to support the hereditary nature of suicide and suicidal behaviour and that genetic factors account for at least a portion of the transmitted suicide risk The neurotransmitter, serotonin, continues to be a key focus of study Studies of other genes have had limitations: no consistent association between gene expression and suicidal behaviour; associations rarely reached genome-wide significance; findings not reproducible across studies	**Research gaps:** Larger population-based studies with matched controls; report suicide, suicide attempt and thoughts of suicide distinctly; improve acceptance of biological contribution to suicidal behaviour among medical professionals
Immunology *(7 studies: 2 included Canadian data)* Growing evidence of an immunological involvement in suicide deaths, with a particular focus on the link between inflammatory markers and suicidal behaviour Increased levels of inflammatory proteins (IL-1β, IL-6, IL-10) in individuals living with thoughts of suicide and tumor necrosis factor (pro-inflammatory) in people who died by suicide Microglial (cells that mediate immune response) and monocyte (detects foreign invading material in the blood) activation may be markers of suicidality Plasma of individuals who are having thoughts of suicide contained lower levels of IL-2	**Research gaps:** Longitudinal studies to evaluate cytokine and chemokine levels; whether inflammatory markers are specific to psychiatric disorders

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Lipids *(5 studies/2 excluded)* Low cholesterol may be linked to suicide attempt and suicide deaths, particularly using violent methods Indication of decreased omega 3 fatty acid DHA in frontal cortex of individuals with depression or bipolar disorder	**Research gaps:** Link between low cholesterol and suicide risk; link between dietary supplements of fatty acids (e.g., omega 3) and suicide prevention
Neurotrophic factors *(5 articles/2 excluded)* Science is conflicted on link between the brain-derived neurotrophic factor (BDNF) protein (helps stimulate and control the creation of new neurons) on suicide attempt and stress-fighting neuropeptides on suicidal behaviour	**Research gaps:** The biological function of brain-derived neurotrophic factor gene variants; how individuals express neuropeptides could assist in the choice of treatment
Biomarkers *(1 study)* Molecules of the serotonergic system as potential biomarker	**Research gaps:** Refining biological predictors and integration with clinical predicators to optimize a model to predict suicide in the clinic
Prevention and Screening: Early detection (172 studies)	
Means reduction *(32 articles/7 excluded: 17 referred to Canadian data)* Means restriction is the single most effective method of suicide prevention, including control of analgesics (e.g., opioids) and structural barriers at hotspots of suicide deaths	**Program gaps:** Educate family regarding access to means for discharged individuals; consider limiting combined access to alcohol and firearms (e.g., limiting access to firearms for those with prior impaired driving convictions) **Research gaps:** Randomized controlled trials in preventative interventions

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Media portrayal *(13 studies/1 excluded: 4 included Canadian data)* Media portrayal can influence risks: responsible reporting may decrease risks whereas reports of celebrity suicides may increase risks (up to 24 weeks)	**Program gaps:** Controlling reporting of suicide as a component of prevention strategies; training journalists in responsible reporting **Research gaps:** Overall effects of access to online information surrounding self-harm and suicide; the impact of online media coverage of suicide
Community-based *(15 articles/5 excluded: 5 included Canadian data)* Community interventions focusing on senior populations (depression screening and treatment, decreasing isolation) are effective, especially among women There are barriers to implementing prevention strategies in certain environments, particularly in prisons	**Program gaps:** Interventions adapted to the needs of Indigenous people are needed (including urban areas), and need to be consistently and robustly evaluated; training correctional personnel (e.g., improving self-harm prevention and coping skills) **Research gaps:** Randomized controlled studies for interventions (e.g., gatekeeper training) in Indigenous communities; online communities for self-harm discussions; evaluation of interventions for seniors
School-based (*22 studies /4 excluded: 6 included Canadian data)* No school-based study has clearly demonstrated a reduction of death by suicide and few have reported decreased suicide attempt and thoughts of suicide Very few studies were conducted with First Nations, Inuit and Métis youth	**Program gaps:** Interventions could be locally designed and culturally tailored; a national research-to-practice network to implement and evaluate promising interviews **Research gaps:** The prevention of repeat suicide attempts in youth who do not seek care; more randomized controlled trials to clarify impact of school-based programs

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Workplace-based programs *(5 studies: 3 referred to Canadian data)* Workplace prevention strategies are beneficial (e.g., multifaceted interventions for military personnel, including omega-3 supplements) Workplace-related factors linked to increased risk of suicide: low control over work, monotony of work and high psychological demands	**Program gaps:** General awareness programs could be applied in different settings; avoid adapting strategies for military environments based on research on civilians **Research gaps:** Better quality evaluations of interventions; impact of diet on psychiatric distress
Training and awareness *(20 studies/4 excluded: 8 included Canadian content)* Mental Health First Aid program is effective in increasing knowledge surrounding mental health problems Culturally-specific training beneficial but few randomized controlled trials investigating this	**Program gaps:** Better characterize the Mental Health First Aid program's effects on suicidal behaviour; general practitioner education about suicide prevention as component of prevention strategies **Research gaps:** Public education and screening programs; randomized controlled trials to validate benefit of gatekeeper and general practitioner training
Detection of suicidality *(49 studies/19 excluded: 15 included Canadian data)* Currently there is insufficient evidence to determine the benefits of screening in primary care settings; tools may help identify some adults but lower accuracy for youth and older adults Gatekeepers provide opportunity to identify priority populations Nursing personnel often lack confidence in assessing suicide risk	**Program gaps:** The core responsibility of doctors to reducing the rates of death by suicide remains the identification and treatment of mental health problems **Research gaps:** Prediction of suicidal behaviour that combines biological and clinical markers; further validation of gatekeeper training and Short-Term Assessment of Risk and Treatability (START) clinical guide; screening tools and approaches in adolescents and older adults; content of communication about suicide (from those who die by suicide) to identify warning signs

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Organization and access to care *(16 studies/8 excluded: 5 reporting on Canadian data)* Some communities are developing successful suicide prevention training programs to meet their specific community needs Providing care teams at sites where multiple suicides have occurred Suicide risks: absence of support, supervision, transitional community services (from hospital), inadequate mental health services	**Program gaps:** Mandatory training in suicide assessment for nurses and nursing students; for incarcerated individuals, routinely evaluate suicide risk, improve mental health services, decrease isolation; suicide assessment 24-48 hours after hospital discharge **Research gaps:** Many aspects of routine care for individuals at risk of suicide; prevention efforts at suicide hotspots
Treatment and Interventions: Addressing immediate symptoms and underlying illness (175 studies)	
Crisis interventions *(6 studies/2 excluded: 2 contained Canadian data)* Users of telephone crisis services and online counselling benefit from them Less benefit with brief contact interventions (e.g., postcard, letter, emergency or crisis cards)	**Program gaps:** Long-term follow up of people who use crisis hotlines **Research gaps:** Evaluation of online psychological counselling; qualitative research on crisis hotline usage; brief contact interventions
Nursing care *(7 studies/3 excluded: 1 referred to Canadian data)* Students more likely to confide in school nurse Nurses ability to foster hope depended on having the time to speak with and listen to individuals at risk of suicide	**Research gaps:** Culturally sensitive knowledge to understand the meaning of suicide in specific contexts

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Psychotherapy *(55 studies/10 excluded: 14 referred to Canadian data)* Moderate evidence supporting effectiveness of cognitive behavioural therapy and dialectical-behavioural therapy, but unclear if these effects can be sustained	**Program gaps:** Psychological therapy may be protective against children and adolescents having thoughts of suicide and could always accompany drug treatment **Research gaps:** Cost-benefit analysis of longer treatments; inconsistent reporting of suicidal behaviours
Pharmacotherapy – antidepressants *(62 studies/24 excluded: 9 referred to Canadian data)* Some antidepressants (selective serotonin reuptake inhibitors) decrease the risk of suicidality in adults and older adults/ seniors; conflicting data exists for children and adolescents, as well as for direct causal effect on suicide deaths	**Program gaps:** Psychotherapy could be a beneficial add-on for antidepressant therapy to decrease thoughts of suicide **Research gaps:** Analyze unpublished clinical trial data to reduce the likelihood of bias; longitudinal studies with more representative subjects to assess effect of antidepressant treatment on suicidality
Pharmacotherapy – mood stabilizers *(20 studies/10 excluded: 1 referred to Canadian data)* Strong evidence suggesting that the risk of suicide and suicide attempt among individuals living with a mood disorder is significantly lower with lithium treatment	**Research gaps:** Randomized trials regarding suicidal behaviour

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Pharmacotherapy – other agents *(22 studies/10 excluded: 2 referred to Canadian data)* Good evidence to support reduction of suicidal behaviours with the use of antipsychotic clozapine while some evidence indicates an increase in deaths by suicide with other second-generation antipsychotics Evidence suggests the reduction of thoughts of suicide with ketamine treatment Risk of self-harm significantly decreased after treating first-episode psychosis and up to 7 years of follow-up	**Research gaps:** Clinical trials may not be representative of population with suicidal behaviour (individuals with history of suicidal behaviour are generally excluded from clinical trials)
Other treatment approaches *(3 studies: 1 referred to Canadian data)* Deep brain stimulation increases risk for suicide and self-harm Weak evidence of electroconvulsive therapy on suicide risk	**Research gaps:** Lengthy follow-up studies to demonstrate efficacy of deep brain stimulation and its effects on suicide risk

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Follow-up Care and Postvention: Decreasing the risk of further suicidal behaviour (28 studies)	
Intensive case management *(5 studies: 4 reported on Canadian data)* Weak evidence of transient (12 month) advantage of intensive follow-up care after an attempt to die by suicide Intensive care may help reconnect individuals to friends and family Several studies conclude that intensive case management is not more effective than standard care at reducing suicide	**Program gaps:** Redeveloping supportive relationships
Indirect follow-up approaches *(10 studies/1 excluded: 2 included Canadian data)* Guided (but not unguided) internet-based therapy is a promising postvention approach Efficacy of telephone-based interventions unclear Many apps available but few based on evidence and some may be harmful	**Program gaps:** Judgement should be used before recommending apps **Research gaps:** Cost-effectiveness and efficacy of internet-based therapies; long-term follow-up studies; efficacy of brief-contact and telephone interventions
Bereavement *(13 studies/4 excluded: 4 included Canadian content)* Self-help support groups for bereavement from suicide contribute to positive outcomes Level of functioning of remaining parent important for positive outcomes of bereaved adolescents	**Program gaps:** Wider availability of social and professional bereavement support with tailored interventions to individual situations **Research gaps:** Bereavement and postvention; evaluation of gatekeeper training protocols

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Services Research: Access to and use of services (25 studies)	
Repeat emergency room visits *(5 studies: 3 reported on Canadian data)* Self-poisoning most frequent method of self-harm Older individuals, males, at higher risk of repeat self-harm using methods other than self-poisoning Follow-up interventions may decrease risk of repeat self-harm Previous self-harm consistently reported as one of the strongest predictors of future self-harm	**Program gaps:** Prevention strategies could target high-risk individuals **Research gaps:** Impact of follow-up interventions; large randomized controlled trials; psychological aspects of repeat self-harm; impact of other factors (e.g., gender, mood disorder)
Specialized care *(2 studies/1 excluded)* No association between repeat self-harm and differing levels of hospital admission or specialist follow-up	**Research gaps:** Whether routine care strategies and hospital admission are protective
Treatment and discharge *(9 studies: 3 included Canadian data)* Training, policy and guidelines improve knowledge and confidence of emergency workers in treatment of individuals who engage in self-harming behaviours Follow-up seems effective for decreasing deaths by suicide for 12 months following an attempt to die by suicide, but one-third of people discharged without follow-up Effective risk assessment measures: Manchester Self-Harm Project, Implicit Association Test, Violence and Suicide Assessment Form	**Program gaps:** Community-based care to address needs of people who engage in self-harming behaviours and use emergency department services repeatedly; follow-up post-discharge; improved training for nurses, paramedics and other emergency workers **Research gaps:** Nursing interventions; paramedics' attitudes toward individuals who self-harm; large randomized controlled trials to evaluate interventions

What the Evidence Reveals Some Key Findings	Research and Program Gaps Some Key Recommendations
Organization of care post-discharge *(9 studies/4 excluded: 2 included Canadian data)* Increased rate of suicide in all people with criminal justice history (one-quarter within 3 months of discharge) Community mental health teams may decrease risk in people living with a serious mental health illness Post-discharge treatment in children very effective (parental involvement protective)	**Program gaps:** Adequate post-discharge care; assessment of suicide risk 24-48 hours prior to discharge **Research gaps:** Predicting post-discharge suicide; identifying most effective post-discharge care; impact of community mental health teams

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To access the full scoping review, including the list of references, please contact mhccinfo@mentalhealthcommission.ca. Please note that the full review is currently only available in English.

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