Title:

Global Trends in Suicide Epidemiology

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ABSTRACT

Purpose of review: Suicide is a major cause of mortality accounting for nearly 1 million deaths globally per year. Suicide occurs throughout the lifespan; therefore, large epidemiological samples are needed to identify patterns in suicide death. This review examines emerging evidence relating to risk and protective factors as well as preventive measures for suicide.

Recent findings: The global financial crisis, natural disasters, air pollution and second-hand smoke have all been associated with increased suicide rates. At an individual level, past self-harm, parental loss or separation, and younger age relative to classmates all confer risk. There is mixed evidence for religious affiliation and lithium levels in drinking water as protective factors.

Means restriction strategies including barriers at suicide hotspots, firearms restrictions and limiting access to both pesticides and charcoal have all prevented suicide. Other interventions with recent evidence include improvements in mental health systems, SSRI and lithium treatment in youth and mental health awareness in schools.

Summary: The evidence for risk/protective factors for suicide continues to grow and, more importantly, numerous prevention efforts continue to demonstrate positive outcomes. Public policy experts should attend to the environmental and social determinants of health when devising suicide prevention programs and the evidence-based prevention strategies identified here should be implemented more broadly.

Keywords: suicide, epidemiology, means restriction, risk factors, prevention

INTRODUCTION

According to the World Health Organization (WHO), the worldwide rate of suicide death is 15.0 per 100,000 people per year in males and 8.0 per 100,000 per year in females.¹ In absolute numbers, this translates to more than 800,000 deaths from suicide every year and this figure is likely an underestimate. Suicide is unique amongst causes of death from illness by virtue of the fact that it is a behavioural endpoint. Its causes are complex and multifaceted and include underlying mental illness, stressful life events, and personality factors such as coping styles.² It can occur at any point in the lifespan after early childhood.¹

High quality epidemiological data has been identified as one of the key ingredients for improving our understanding of suicide and ultimately preventing it.¹ The goal of this review was to highlight some of the major advances in our understanding of the epidemiology of suicide over the 18 month period from the beginning of 2015 to mid-2016. The focus was on studies that improved our understanding of risk and/or protective factors for suicide as well as intervention studies to prevent it. Our searches of MEDLINE and PSYCHINFO identified 2,420 unique articles related to suicide epidemiology over the review period.

Note that this review focused on studies concerning suicide deaths with some reference to studies on suicide attempts, particularly where mortality data was unavailable. We excluded studies on suicidal ideation, on the grounds that this is a poor proxy for suicidal behaviour and death, the outcomes of greatest interest.

RISK AND PROTECTIVE FACTORS

A range of well-established risk and protective factors for suicide has been established in the scientific literature. Risk factors include population-level factors (e.g. social fragmentation, economic crises, rurality, media reporting), distal individual-level factors (e.g. family history, early life adversity, personality traits) and proximal individual-level factors (e.g. a major depressive episode, psychosis, substance intoxication, stressful life events).² Protective factors include social support networks, strong reasons for living and effective problem-solving skills.² This section highlights research that identifies new risk/protective factors or augments our knowledge about previously established ones.

Economic Factors

Numerous recent articles have focused on economic factors, in particular the global financial crisis, and their impact on suicide rates. A study of 63 countries estimated an excess of nearly 5,000 suicide deaths worldwide in 2009 were related to the global financial crisis with the effect of unemployment on suicide rates being stronger in countries with lower pre-crisis unemployment rates.³ An increase in unemployment levels from 3% to 6% was associated with a 6.1% rise in suicide rates.³ In the U.S., economic downturns such as the 2007/8 recession were associated with an increase of 1.22 deaths per 100,000 population among those with lower education levels compared to an increase of 0.17 per 100,000 in those with >12 years of education.⁴ The degree to which unemployment itself contributed to suicide death versus other related factors such as housing loss that occurred in the U.S. during the financial crisis is unknown⁵ although suicide deaths related to eviction/foreclosure have also risen since the crisis.⁶ In Greece and other European countries, governmental austerity measures were associated with increasing suicide rates.⁷⁻⁸ Across studies, males were more greatly impacted^{4,7,9-13} with one study also showing a disproportionate effect on those in manual labour professions.⁹ In Europe, the impact of unemployment rates on suicide death was higher in countries with the lowest levels of social and financial protection for the unemployed.¹⁰ A systematic review of suicide in low- and middle-income countries generally demonstrated positive relationships between poverty,

unemployment and suicide but concluded that further high-quality research is needed in these regions.¹⁴

Natural Disasters

Two studies investigated the effect of earthquakes on suicide rates. In the three month period after the 2015 earthquake in Nepal, there was a 41% rise in suicide deaths.¹⁵ In the two years following the 2011 earthquake and tsunami in Japan, suicide deaths in affected regions declined on the order of 10-20%.¹⁶ By the third year, rates had returned to pre-disaster levels except in Fukushima, the location of the nuclear power plant disaster, where rates exceeded previous levels.

Environmental Exposures

Three studies, conducted in the US, Korea and Japan, demonstrated an association between air pollution and suicide death.¹⁷⁻¹⁹ Levels of fine particulate matter were higher in the days preceding suicide deaths across the studies. Other pollutants including nitrogen dioxide and sulfur dioxide were associated with suicides in some cases. The one study examining ozone levels found a 7.8% increase in suicide deaths in weeks when ozone was one standard deviation above the annual mean compared to weeks when ozone was one standard deviation below the mean.¹⁹ Although the mechanism by which pollutants may increase suicide is unknown, their role in altering levels of serotonin, pro-inflammatory cytokines and stress hormones have all been proposed.¹⁷⁻¹⁹

A Taiwanese study following 162,682 adolescents who had answered questionnaires about smoking in the 1990s, found that the 12-year risk of suicide death was elevated for those who endorsed cigarette smoking or were exposed to second-hand smoke.²⁰ The latter relationship was characterized by a dose-response pattern. Although this study had several limitations, most importantly that it could not control for the relationship between cigarette smoking and mental illness, the positive association with exposure to second-hand is a novel and important finding that deserves further attention.

Lithium use in clinical settings may have anti-suicide properties and there has been recent interest in whether trace amounts of lithium in drinking water may affect suicide rates. Two recent studies have conflicting results. Analysis of data from 153 cities in Japan, showed a clear inverse relationship between trace lithium levels in drinking water and suicide rates although only for males.²¹ However, a similar study in Italy found no consistent relationship.²²

Religion

Religion has generally been considered a protective factor against suicide. A meta-analysis of nine studies in the USA, China, Indonesia and Hungary demonstrated a lower risk of suicide for those with religious affiliation and/or attendance (pooled OR of 0.38; 95% CI: 0.21–0.71) although, notably, subanalyses did not demonstrate significance for younger populations (defined as less than 45 years of age) or for Eastern cultures.²³ The authors speculated that the difference in results may be partially due to differing cultural notions of suicide whereby suicide has historically been stigmatized in Western culture and romanticized in the East. Religious homogeneity was also associated with lower suicide rates. In contrast, a study of more than 1 million respondents to a census in Northern Ireland found that stated affiliation with Catholicism

or Protestantism was not associated with lower rates of suicide than those identifying with no religion although rates were lower in those identifying as Conservative Christian than for Catholics.²⁴ These findings suggest that the protective effects of religion are highly culturally specific.

History of Self-harm

A history of self-harm, regardless of intent, is known to be one of the most important risk factors for subsequent suicide death. A cohort study of nearly 4,000 people presenting to the emergency department with self-harm in the U.K. identified self-cutting at a site other than the arms/wrists as a marker of increased risk of suicide compared to other forms of self-harm.²⁵

Parental Factors

A cross-sectional study in Sao Paulo Brazil found a dose-response relationship between parental psychopathology and suicidal behaviour.²⁶ Both generalized anxiety disorder and panic disorder in parents was associated with suicide attempts in their offspring.²⁶ In Sweden, a large cohort study found that parental separation/divorce in childhood was positively associated with suicide attempts in both sexes.²⁷ Another Scandinavian cohort study found that the death of a parent, particularly if the parent died by suicide, before a child reached six years of age or for boys who lost mothers, conferred a two to three fold increased risk of suicide.²⁸

Age relative to classmates

A Japanese study examined suicide deaths in youth born just prior to and after the cut-off date for school entry, thus comparing students who were oldest and youngest in their class.²⁹ The younger students were significantly more likely to die from suicide than their classmates.

PREVENTIVE INTERVENTIONS

There is now a robust evidence base that allows for ecological study of the impact of population-wide suicide prevention strategies. Zalsman and colleagues recently published the most comprehensive review in a decade of suicide prevention interventions.³⁰ Their systematic review of evidence from 2005-2014 examined means restriction, treatment interventions and other population-level strategies. The interventions with the best evidence were specific means restriction strategies. These were limiting analgesic package sizes and/or withdrawing particularly toxic analgesics from the market as well as erecting barriers at suicide hotspots given that these have consistently resulted in reductions in suicide rates with limited substitution of suicide by other methods.³⁰ Other interventions with promising evidence include two other means restriction strategies (restricting access to firearms and pesticide regulation) as well as two other population-level interventions (mental health literacy in schools and media guidelines for responsible reporting on suicide).³⁰ Here we focus on Evidence published since 2015 lends weight to these findings.

Means Restriction

Evidence supporting the use of barriers at suicide hotspots has increased in recent years. A meta-analysis examining 11 barriers as both standalone interventions found them to be highly

effective in reducing suicide (0.07, 95% CI 0.02–0.19; $p < 0.0001$).³¹ Additional interventions at these locations, specifically those that encourage help-seeking and increase the likelihood third party intervention were also effective.³¹ Two studies examined the impact of platform screen doors (PSDs) to prevent suicide in Seoul and Tokyo respectively.³²⁻³³ Both showed that PSDs prevented the majority of suicide deaths, however neither examined method substitution or non-railway locations.³²⁻³³ Both studies showed that half-height PSDs were less effective than full-height PSDs at preventing deaths.³²⁻³³

Studies investigating the role of firearm restriction on suicide death may be of particular importance given that people who die from suicide by firearms are more likely than other suicide decedents to do so on their first attempt.³⁴ Laws restricting access to firearms and buyback programs in Australia were associated with an accelerated decline in firearm suicides although similar declines were also seen in suicide deaths by other methods.³⁵ U.S. studies have found that universal background checks, in particular a firearm permit process involving law enforcement, were associated with fewer suicides by firearms and overall.³⁶⁻³⁸ One of these studies also found the reverse trend in a state that repealed permit laws.³⁸

In 2011, South Korea prohibited distribution of the herbicide paraquat.³⁹ After the prohibition, suicides by this method were nearly halved and there was a 10% reduction in suicide by all methods in South Korea.³⁹

In 2012, New Taipei City implemented a means restriction program where barbeque charcoal had to be kept in locked storage in major retail stores.⁴⁰ This intervention resulted in fewer suicide deaths by charcoal burning and overall in that city but not in two other control cities.⁴⁰

Treatment Interventions

The use of antidepressant drugs in youth has generated considerable controversy in recent years because of evidence that SSRI antidepressants are associated with increased suicidal ideation compared to placebo. One recent study examined the population-level impact of SSRIs and lithium on children and adolescents aged 19 and under in Hungary. Notably, prescriptions for SSRIs and lithium were inversely associated with suicide rates.⁴¹

Systems-level changes to the provision of mental healthcare would also be expected to reduce suicide rates and this was recently shown in England. Improvement in services, most particularly the introduction of 24-hour community treatment teams, concurrent treatment of major mental illness and substance use disorders, review of care after suicide deaths, formal transfer of care from youth to adult services, and implementation of depression guidelines all led to significant reductions in suicide death.⁴²

Other population-level interventions

The Saving and Empowering Young Lives in Europe (SEYLE) trial used a cluster randomization scheme to compare three school-based interventions with a control condition in more than 11,000 adolescents.⁴³ The experimental conditions included teacher gatekeeper training, a mental health awareness program delivered in the classroom and questionnaires that could prompt a referral to mental health services while the control group was only exposed to educational posters and contact information for mental health services. Only the mental health awareness program, a manualized intervention aimed at imparting information about depression

and anxiety and at enhancing positive coping skills, separated from the control condition for suicide attempts at 12-month follow up (OR 0.45, 95% CI 0.24–0.85, $p=0.014$).⁴³

DISCUSSION

Many well-designed studies relating to suicide epidemiology have been published recently and this is welcome news. There is an increasing convergence of evidence and opinion relating to the need for comprehensive suicide-prevention programs worldwide that attend to means restriction, refinement of mental health care services as well as engagement of the public through responsible media discussions of suicide. This evidence has important practical implications. For example, Krysinaka and colleagues have recently used these findings to create a list of priorities for optimal suicide prevention in Australia⁴⁴ and this sort of model could be applied in other countries as well.

The impact of restricting access to charcoal in Taiwan described above⁴⁰ is particularly noteworthy given the emergence of novel means to die by suicide, particularly in Southeast Asia where there has been a substantial rise in suicide death by charcoal and helium asphyxia.^{40,45} This is thought to have occurred as a result of prominent media reports that glamorised these causes of death and provided specific details about how they were carried out.⁴⁶ Hong Kong and Taiwan have seen significant increases in suicide death by both methods in the past decade.^{45,47} In England and Wales, there was a 17-fold increase in suicide deaths by helium between 2001 and 2011.⁴⁸ People using this method tended to be younger, more affluent and may have learned about it online.⁴⁸ This last finding is notable, given recent evidence from Taiwan that a 10% increase in Google searches about charcoal burning in a given week was associated with a 4% increase in suicide deaths both that week and the following week whereas no association was

found for other suicide-related Google searches.⁴⁹ Efforts to identify and restrict access to novel methods of suicide as well as to limit their spread through the media are important areas of further intervention and study.

Recent findings related to risk/protective factors for suicide may not immediately translate into suicide prevention programs but they underscore an important message for health advocates and governments. Population-based efforts to improve the biological and psychosocial determinants of health, including those to improve employment and housing and to limit air pollution, can be viewed as an important component of a comprehensive suicide prevention strategy. Likewise, future studies should focus on high-risk populations identified here such as those with early parental loss/separation or who present to the emergency department with self-harm by cutting in places other than wrists/arms.

Despite recent increases in the global population, the WHO reports a 9% reduction in the absolute number of suicide deaths from 2000 to 2012.¹ Comprehensive suicide prevention programs attending to the factors described here should help us continue to make that number smaller.

Key Points

1. There are more than 800,000 deaths from suicide worldwide every year and this figure is likely an underestimate.
2. It has been estimated that nearly 5,000 suicide deaths worldwide in 2009 were related to the global financial crisis with an increase in unemployment levels from 3% to 6% associated with a 6.1% rise in suicide rates.

3. Higher levels of air pollution, particularly fine particulate matter, is higher in the days preceding suicide.
4. Interventions with the best evidence for suicide prevention include limiting analgesic package sizes and/or withdrawing particularly toxic analgesics from the market as well as erecting barriers at suicide hotspots.
5. A school-based mental health awareness program decreased suicide attempts by half in adolescents.

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Conflicts of Interest

There are no conflicts of interest.

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