Suicide Prevention Strategies: A Systematic Review

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Suicide Prevention Strategies
A Systematic Review

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Context In 2002, an estimated 877 000 lives were lost worldwide through suicide. Some developed nations have implemented national suicide prevention plans. Although these plans generally propose multiple interventions, their effectiveness is rarely evaluated.

Objectives To examine evidence for the effectiveness of specific suicide-preventive interventions and to make recommendations for future prevention programs and research.

Data Sources and Study Selection Relevant publications were identified via electronic searches of MEDLINE, the Cochrane Library, and PsychINFO databases using multiple search terms related to suicide prevention. Studies, published between 1966 and June 2005, included those that evaluated preventative interventions in major domains; education and awareness for the general public and for professionals; screening tools for at-risk individuals; treatment of psychiatric disorders; restricting access to lethal means; and responsible media reporting of suicide.

Data Extraction Data were extracted on primary outcomes of interest: suicidal behavior (completion, attempt, ideation), intermediary or secondary outcomes (treatment seeking, identification of at-risk individuals, antidepressant prescription/use rates, referrals), or both. Experts from 15 countries reviewed all studies. Included articles were those that reported on completed and attempted suicide and suicidal ideation; or, where applicable, intermediate outcomes, including help-seeking behavior, identification of at-risk individuals, entry into treatment, and antidepressant prescription rates. We included 3 major types of studies for which the research question was clearly defined: systematic reviews and meta-analyses (n=10); quantitative studies, either randomized controlled trials (n=18) or cohort studies (n=24); and ecological, or population-based studies (n=41). Heterogeneity of study populations and methodology did not permit formal meta-analysis; thus, a narrative synthesis is presented.

Data Synthesis Education of physicians and restricting access to lethal means were found to prevent suicide. Other methods including public education, screening programs, and media education need more testing.

Conclusions Physician education in depression recognition and treatment and restricting access to lethal methods reduce suicide rates. Other interventions need more evidence of efficacy. Ascertaining which components of suicide prevention programs are effective in reducing rates of suicide and suicide attempt is essential in order to optimize use of limited resources.

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SUICIDE IS A SIGNIFICANT PUBLIC health issue. In 2002, an estimated 877 000 lives were lost worldwide through suicide, representing 1.5% of the global burden of disease or more than 20 million disability-adjusted life-years (years of healthy life lost through premature death or disability).[1] The highest annual rates are in Eastern Europe, where 10 countries report more than 27 suicides per 100 000 persons. Latin American and Muslim countries report the lowest rates, fewer than 6.5 per 100 000.[2] In the United States, in 2002, suicide accounted for 31 655 deaths, a rate of 11.0 per 100 000 per year,[3] and general population surveys document a suicide attempt rate of 0.6% and a suicide ideation rate of 3.3%,[4] representing a huge human tragedy and an estimated $11.8 billion in lost income.[5]

Suicidal behavior has multiple causes that are broadly divided into proximal

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stressors or triggers and predisposition.[6] Psychiatric illness is a major contributing factor, and more than 90% of suicides have a *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*) psychiatric illness,[7-13] with some exceptions, such as in China.[14] Mood disorders, principally major depressive disorder and bipolar disorder, are associated with about 60% of suicides.[7,8,10,15,16] Other contributory factors include availability of lethal means, alcohol and drug abuse, access to psychiatric treatment, attitudes to suicide, help-seeking behavior, physical illness, marital status, age, and sex.[6] To address these causes, suicide prevention involves a multifaceted approach with particular attention to mental health. The FIGURE illustrates the multiple factors involved in suicidal behavior[6] and indicates where specific preventive interventions are being directed. Suicide prevention is possible because up to 83% of suicides have had contact with a primary care physician within a year of their death and up to 66% within a month.[17,18] Thus, a key prevention strategy is improved screening of depressed patients by primary care physicians and better treatment of major depression. This review considers what is known about this and other prevention strategies to permit integration into a comprehensive prevention strategy.

Suicide experts from 15 countries met in Salzburg, Austria, in August 2004 to review efficacy of suicide prevention interventions. The 5-day workshop identified 5 major areas of prevention: education and awareness programs for the general public and professionals; screening methods for high-risk persons; treatment of psychiatric disorders; restricting access to lethal means; and media reporting of suicide.

DATA SOURCES

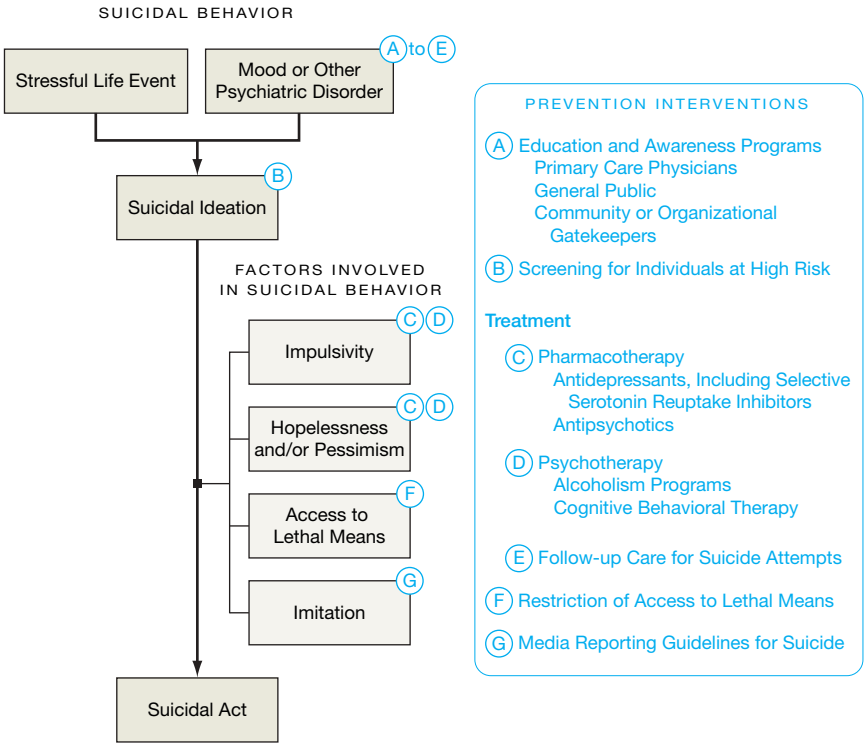
An electronic literature search of all articles published between 1966 and June 2005 was conducted via MEDLINE, the Cochrane Library, and PsychINFO to identify reports evaluating suicide prevention interventions. An initial search used the MEDLINE identifier *suicide* (including the subheading *suicide, attempted*) and the subheading *prevention and control*, following that *suicide* was combined with the following identifiers: *depression*, *health education*, *health promotion*, *public opinion*, *mass screening*, *family physicians*, *medical education*, *primary health care*, *antidepressive agents*, *psychotherapy*, *schools*, *adolescents*, *methods*, *firearms*, *overdose*, *poisoning*, *gas poisoning*, and *mass media*. We identified 5020 articles, which were not bound by the 5 major areas identified during the workshop. Abstracts were reviewed and full-text articles that met inclusion criteria were retrieved. All reports were reviewed by at least 2 authors.

Study Selection

Studies were included if they reported on either the primary outcomes of interest, namely completed and attempted suicide and suicidal ideation; or, where applicable, intermediate outcomes, including help-seeking behavior, identification of at-risk individuals, entry into treatment, and antidepressant prescription rates.

We included 3 major types of studies for which the research question was clearly defined as assessment of efficacy or effectiveness of prevention programs in terms of the above primary or secondary outcomes; (1) systematic reviews and meta-analyses (n=10) for which the search strategy was comprehensive and the methodological quality of primary studies was critically appraised; (2) quantitative studies, either randomized controlled trials (n=18), or cohort studies (n=24); and (3) ecological or population based studies (n=41). TABLE 1 and TABLE 2 detail study type, study population, and preventive intervention tested and rate the studies according to the scheme proposed by the Oxford Centre for Evidence Based Medicine.[112] Randomized controlled trials provide the most compelling evidence of efficacy while findings of naturalistic studies are largely correlational, indicating that their outcomes need further testing.

Figure. Targets of Suicide Prevention Interventions



Circled letters refer to relevant prevention interventions listed on right.

Table 1. Study Type, Level of Evidence, Population, and Prevention Strategy

Source	Study Type	Level*	Population	Prevention Strategy
Gunnell et al,[19] 2005	Meta-analysis	1A	RCTs in UK psychiatric patients	Antidepressant use
Fergusson et al,[20] 2005	Meta-analysis	1A	RCTs in psychiatric patients	Antidepressant use
Khan et al,[21] 2003	Meta-analysis	1A	RCTs in US psychiatric patients	Antidepressant use
Ploeg et al,[22] 1996	Systematic review	2A	Adolescents	Curriculum-based programs
Guo and Harstall,[23] 2002	Systematic review	2A	Adolescents	Curriculum-based program
Pignone et al,[24] 2002	Systematic review	2A	Primary care patients	Screening for depression in primary care
Feightner,[25] 1994	Systematic review	2A	Primary care patients	Screening for depression in primary care
Gaynes et al,[26] 2004	Systematic review	2A	Primary care patients	Screening for suicide risk in primary care
Gilbody et al,[27] 2003	Systematic review	2A	Primary care patients	Detecting and treating depression in primary care
Hawton et al,[28] 2000	Systematic review	2A	Patients who attempted suicide	Psychotherapy
Aseltine and DeMartino,[29] 2004	RCT	1B	Adolescents	Curriculum-based program
Thompson et al,[30] 2000	RCT	1B	Primary care patients	Detecting and treating depression in primary care
Bruce et al,[31] 2004	RCT	1B	Older primary care patients	Detecting and treating depression in primary care
Glick et al,[32] 2004	RCT	1B	Adults with schizophrenia spectrum disorders	Clozapine
Meltzer et al,[33] 2003	RCT	1B	Adults with schizophrenia spectrum disorders	Clozapine
Thies-Flechtner et al,[34] 1996	RCT	1B	Adults with affective disorders	Lithium
Brown et al,[35] 2005	RCT	1B	Suicide attempters	Psychotherapy
Guthrie et al,[36] 2001	RCT	1B	Suicide attempters	Psychotherapy
Bateman and Fonagy,[37] 2001	RCT	1B	Borderline personality disorder patients	Psychotherapy
Motto and Bostrom,[38] 2001	RCT	1B	Suicide attempters	Follow-up care: postal contact program
Cedereke et al,[39] 2002	RCT	1B	Suicide attempters	Follow-up care: telephone contact program
Allard et al,[40] 1992	RCT	1B	Suicide attempters	Follow-up care
Morgan et al,[41] 1993	RCT	1B	Suicide attempters	Follow-up care: green card
Asarnow et al,[42] 2005	RCT	1B	Adolescents	Primary care physician education: quality improvement
Orbach and Bar-Joseph,[43] 1993	RCT	1B	Adolescents	Curriculum-based program
Eggert et al,[44] 1995	RCT	1B	Adolescents	Curriculum-based program
Thompson et al,[45] 2001	RCT	1B	Adolescents	Curriculum-based program
Huey et al,[46] 2004	RCT	1B	Psychiatric crisis in adolescents	Follow-up care
Rihmer,[47] 2001	Cohort study (quasi-experimental)	2B	Primary care patients in Hungary	Primary care physician education
Marusic et al,[48] 2004	Cohort study (quasi-experimental)	2B	Primary care patients in Slovenia	Primary care physician education
Kelly et al,[49] 1998	Cohort study (quasi-experimental)	2B	Primary care physicians	Primary care physician education
Oyama et al,[50] 2004	Cohort study (quasi-experimental)	2B	Primary care patients in Japan	Primary care physician education
Mann et al,[51] 2004	Cohort study (quasi-experimental)	2B	General population in Hungary	Antidepressants
Knox et al,[52] 2003	Cohort study (quasi-experimental)	2B	US Air Force personnel	Gatekeeper programs
Motto,[53] 1970	Quasi-experimental	2B	General US population	Media blackout
Loftin et al,[54] 1991	Cohort study (quasi-experimental)	2B	General US population	Firearm restriction
Hegerl et al,[55] 2003	Cohort study (quasi-experimental)	2B	General population in Germany	Public education campaign
Jorm et al,[56] 2005	Cohort study (quasi-experimental)	2B	General population in Australia	Public education campaign
Paykel et al,[57] 1998	Cohort study	2B	General UK population	Public education campaign
Akroyd and Wyllie,[58] 2002	Cohort study	2B	General population in New Zealand	Public education campaign
Lehfeld et al,[59] 2004	Cohort study	2B	General population in Germany	Public education campaign
Naismith et al,[60] 2001	Cohort study	2B	Primary care physicians in Australia	Primary care physician education
Hannaford et al,[61] 1996	Cohort study	2B	Primary care physicians in UK	Primary care physician education
Lin et al,[62] 2001	Cohort study	2B	Primary care physicians in US	Primary care physician education
Valentini et al,[63] 2004	Cohort study	2B	Primary care physicians and patients in Brazil	Primary care physician education
Pfaff et al,[64] 2001	Cohort study	2B	Primary care physicians in Australia	Primary care physician education
Takahashi et al,[65] 1998	Cohort study	2B	Primary care patients	Primary care physician education
Rutz,[66] 1989	Cohort study	2B	Primary care patients	Primary care physician education
Mehlum and Schwebs,[67] 2000	Cohort study	2B	Norwegian Army	Gatekeeper education
Dieserud et al,[68] 2000	Cohort study	2B	General population in Norway	Chain of care
Aoun,[69] 1999	Cohort study	4	High-risk adults	Follow-up care
Rotheram-Borus et al,[70] 2000	Cohort study	4	Suicide attempters	Follow-up care

Abbreviation: RCT, randomized controlled trial.
*Oxford Centre for Evidence Based Medicine, levels of evidence: 1A, systematic review of RCTs; 1B, individual RCT; 2A, systematic review of cohort studies; 2B, individual cohort study, low-quality RCT; 2C, ecological studies; 3A, systematic review of case-control studies; 3B, individual case-control study; 4, case series, poor-quality cohort and case-control studies.

DATA SYNTHESIS

Heterogeneity in study methodology and populations limited formal meta-analysis, thus we present a narrative synthesis of the results for the key domains of suicide prevention interventions.

Awareness and Education

General Public. Public education campaigns are aimed at improving recognition of suicide risk and help seeking through improved understanding of the causes and risk factors for suicidal behavior, particularly mental illness. Public education also seeks to reduce stigmatization of mental illness and suicide and challenges the acceptance of suicide as inevitable, as a national character trait, or as an appropriate solution to life problems, including serious medical illness. Despite their popularity as a public health intervention, the effectiveness of public awareness and education campaigns in reducing suicidal behavior has seldom been systematically evaluated.

Studies in Germany,[55] the United Kingdom,[57] Australia,[56] and New Zealand[58] suggest modest effects of public education campaigns on attitudes regarding the causes and treatment of depression. Such public education and awareness campaigns, largely about depression, have no detectable effect on primary outcomes of decreasing suicidal acts or on intermediate measures, such as more treatment seeking or increased antidepressant use.[57,58,113] The German study showed an 18% decrease in suicide attempts in an intervention region after 9 months of a depression awareness campaign.[59] However, the decline in suicide attempts occurred without a greater improvement in attitudes in the intervention region compared with the control region.[55]

Other specific education strategies are aimed at youth, including school and community-based programs.[114,115] Few such programs are evidence-based, reflect the current state of knowledge in suicide prevention, or evaluate effectiveness and safety for preventing suicidal behavior.[114] A systematic review of studies published from 1980-1995 found that knowledge about suicide improved but there were both beneficial and harmful effects in terms of help-seeking, attitudes, and peer support.[22] A later review of studies published from 1990-2002 also found that curriculum-based programs increase knowledge and improve attitudes to mental illness and suicide but found insufficient evidence for prevention of suicidal behavior.[23] A subsequent controlled trial reported lower suicide attempt rates, greater knowledge, and more adaptive attitudes about depression and suicide in the intervention group compared with in the 3 months after the intervention, but no significant benefits for rates of suicide ideation or help-seeking.[29] In adolescents, several studies found that improving problem solving, coping with stress, and increasing resilience enhance hypothesized protective factors but effects on suicidal behavior were unevaluated.[43-45]

Primary Care Physicians. Depression and other psychiatric disorders are underrecognized and undertreated in the primary care setting.[116,117] Prevention is possible because most suicides have had contact with a primary care physician within a month of death.[17,18] Primary care physicians' lack of knowledge about or failure to screen patients for depression may contribute to nontreatment seen in most suicides. Therefore, improving physician recognition of depression and suicide risk evaluation is a component of suicide prevention.

Some studies in the United Kingdom,[61] Australia,[60] the United States,[24] and Northern Ireland,[49] showed that programs aimed at educating primary care physicians improved detection and increased treatment of depression, but that was not shown in other studies in the United States,[62] Brazil,[63] and the United Kingdom.[30] Nurse case management, collaborative care, or quality improvement initiatives can further improve the recognition and management of depression[27] and has application where education alone may be insufficient.

A controlled trial comparing a treatment algorithm plus depression care management with treatment as usual for late-life depression in primary care in the United States demonstrated greater improvement in patient suicidal ideation and a more favorable course of illness in the intervention group compared with the treatment-as-usual group.[31] An adolescent depression treatment quality improvement intervention with care managers supporting primary care physicians resulted in a 50% decrease in suicide attempts in the intervention group that was not statistically different from the control group (18%) due to the low base rate.[42] An Australian program that trained primary care physicians to recognize and respond to psychological distress and suicidal ideation in young people increased identification of suicidal patients by 130% (determined by the Depressive Symptom Inventory–Suicidality Subscale score), without changes in treatment or management strategies.[64] Studies examining suicidal behavior in response to primary care physician education programs, mostly targeting depression recognition and treatment, in specific regions in Sweden,[66,118] Hungary,[47] Japan,[65] and Slovenia[48] have all reported increased prescription rate for antidepressants and often substantial declines in suicide rates and represent the most striking known example of a therapeutic intervention lowering suicide rates.

Gatekeepers. Suicide prevention includes a range of interventions focused on community or organizational gatekeepers whose contact with potentially vulnerable populations provides an opportunity to identify at-risk individuals and direct them to appropriate assessment and treatment.[5] *Gatekeepers* include clergy, first responders, pharmacists, geriatric caregivers, personnel staff, and those employed in institutional settings, such as schools, prisons, and the military. Education covered awareness of risk factors, policy changes to encourage help-seeking, availability of resources, and efforts to

reduce stigma associated with help-seeking. In addition to gatekeeper training, these programs also promoted organization-wide awareness of mental health and suicide and facilitated access to mental health services.

To date, systematic evaluation of impact on suicidal behavior has largely been limited to multilevel programs conducted in institutional settings, such as the military where programs in the Norwegian Army[67] and the US Air Force[52] have reported success in lowering suicide rates.

Screening

Screening aims to identify at-risk individuals and direct them to treatment.

Table 2. Ecological Studies, Level of Evidence, Population, and Prevention Strategy

Source	Study Type	Level*	Population	Prevention Strategy
Etzersdorfer and Sonneck,[71] 1998	Ecological	2C	General population in Austria	Media blackout
Bridges and Kunselman,[72] 2004	Ecological	2C	General population in Canada	Firearm restrictions
Lester and Leenaars,[73] 1993	Ecological	2C	General population in Canada	Firearm restrictions
Snowdon and Harris,[74] 1992	Ecological	2C	General population in Australia	Firearm restrictions
Ludwig and Cook,[75] 2000	Ecological	2C	General US population	Firearm restrictions
Ohberg et al,[76] 1995	Ecological	2C	General population in Finland	Pesticide restriction
Bowles,[77] 1995	Ecological	2C	General population in Samoa	Pesticide restriction
Carrington,[78] 1999	Ecological	2C	General population in Canada	Firearm restriction
Kreitman,[79] 1976	Ecological	2C	General UK population	Domestic gas detoxification
Lester,[80] 1990	Ecological	2C	General population in Switzerland	Domestic gas detoxification
Gunnell et al,[81] 2000	Ecological	2C	General UK population	Domestic gas detoxification
Crome,[82] 1993	Ecological	2C	General population	Barbiturate restrictions
Nielsen and Nielsen,[83] 1992	Ecological	2C	General population	Barbiturate restrictions
Yamasawa et al,[84] 1980	Ecological	2C	General population in Japan	Barbiturate restrictions
Hawton,[85] 2002	Ecological	2C	General UK population	Analgesic packaging changes
McClure,[86] 2000	Ecological	2C	General population in England and Wales	Catalytic converters
Kelly and Bunting,[87] 1998	Ecological	2C	General population in England and Wales	Catalytic converters
Shelef,[88] 1994	Ecological	2C	General US population	Catalytic converters
Carlsten et al,[89] 2001	Ecological	2C	General population in Sweden	Antidepressants
Beautrais,[90] 2001	Ecological	2C	General population in New Zealand	Barriers to jumping
Gibbons et al,[91] 2004	Ecological	2C	General US population	Antidepressant use plus introduction of lower-toxicity antidepressants
Olfson et al,[92] 2003	Ecological	2C	US adolescents	Antidepressants
Hall et al,[93] 2003	Ecological	2C	General population in Australia	Antidepressants
Helgason et al,[94] 2004	Ecological	2C	General population in Iceland	Antidepressants
Takahashi,[95] 1999	Ecological	2C	General population in Japan	Antidepressants
Guaiana et al,[96] 2005	Ecological	2C	General population in Italy	Antidepressants
Simon et al,[97] 2005	Ecological	2C	General US population	Antidepressants
Valuck et al,[98] 2004	Ecological	2C	US adolescents	Antidepressants
Ludwig and Marcotte,[99] 2005	Ecological	2C	General population in 27 countries	SSRIs
Cantor and Slater,[100] 1995	Ecological	2C	General population in Australia	Firearm restrictions
Whitlock,[101] 1975	Ecological	2C	General population in Australia	Barbiturate restriction
Lester,[102] 1991	Ecological	2C	General population in the Netherlands	Domestic gas detoxification
Wiedenmann and Weyerer,[103] 1993	Ecological	2C	General population in Germany	Domestic gas detoxification
Lester,[104] 1990	Ecological	2C	General US population	Domestic gas detoxification
Oliver and Hetzel,[105] 1972	Ecological	2C	General population in Australia	Barbiturate restrictions
Retterstol,[106] 1989	Ecological	2C	General population in Norway	Barbiturate restrictions
Carlsten et al,[107] 1996	Ecological	2C	General population in Sweden	Barbiturate restrictions
Mott et al,[108] 2002	Ecological	2C	General US population	Catalytic converters
Kapur et al,[109] 1992	Ecological	2C	General US population	Introduction of lower-toxicity antidepressants
Wasserman and Varnik,[110] 1998	Ecological	2C	General population in former USSR	Alcohol restriction
Lester,[111] 1999	Ecological	2C	General population in Iceland	Alcohol restriction

Abbreviation: SSRIs, selective serotonin reuptake inhibitor.
*For the definition of the Oxford Centre for Evidence Based Medicine, Levels of Evidence, see Table 1.

The focus may be on suicidal behavior directly or risk factors, such as depression or substance abuse. Screening instruments for depression, suicidal ideation, or suicidal acts administered to high school students,[119] juvenile offenders,[120] and youth in general[121] have reliability and validity in identifying individuals at increased risk for suicidal behavior and are reported to double the number of known at-risk individuals.[122] There is no evidence that screening youth for suicide induces suicidal thinking or behavior.[123] Acceptance of the need for treatment by identified at-risk youth and actual treatment implementation are understudied as potential barriers to the effectiveness of screening programs.

The US Preventive Services Task Force (USPSTF) review of studies of depression screening in adults in primary health care settings found a 10% to 47% increase in rates of detection and diagnosis of depression with the use of screening tools.[24] The effect on treatment was mixed, due to differences in study methodology. In contrast, a Canadian review of depression screening studies did not find routine screening in primary care to improve depression care.[25] Neither report commented on effects on suicidal behavior. In contrast, screening in localized geographic areas results in more treatment of depression and lower suicide rates.[50,51,66] The 2004 USPSTF[26] review of evidence on screening for suicide risk, as opposed to depression, found no published studies in English evaluating the effectiveness of screening for suicide risk in primary care.

Treatment Interventions

Pharmacotherapy. Psychiatric disorders are present in at least 90% of suicides and more than 80% are untreated at time of death.[124,125] Depression is untreated or undertreated in general,[116,126] even after suicide attempt.[127] Thus, treating mood and other psychiatric disorders is a central component of suicide prevention.[5]

Antidepressant medications alleviate depression and other psychiatric disorders.[128] However meta-analyses of RCTs have generally not detected benefit for suicide or suicide attempts in studies of antidepressants in mood and other psychiatric disorders,[19-21] perhaps due to the low base rate of suicidal behavior and insufficient systematic screening for suicidal behavior since reliance on spontaneous reporting underestimates rates of suicidal behavior.[129] Randomized controlled trials can be informative when higher-risk patients are studied and indicate an antisuicidal effect for lithium in major mood disorders[34] and clozapine in schizophrenia.[32,33] Few studies prospectively identified suicidal behavior as an outcome measure and systematically assessed it throughout the RCT.

Higher prescription rates of antidepressants correlate with decreasing suicide rates in adults or youth in Hungary,[47] Sweden,[89] Australia,[93] and the United States.[91,92] Geographic regions or demographic groups with the highest selective serotonin reuptake inhibitor prescription rates have the lowest suicide rates in the United States[91] and Australia.[93] Although Iceland,[94] Japan,[95] and Italy[96] do not show such correlations, potential reasons include lack of compliance; pre-existing low-suicide rate, resulting in a floor effect; and high rates of alcoholism that may elevate suicide rates or the effect may be confined to women because too few men seek and comply with treatment with antidepressants. Suicide rates in 27 countries fell most markedly in countries that had the greatest increase in selective serotonin reuptake inhibitor prescriptions.[99] Patient population studies report lower suicide attempt rates in adults treated with antidepressant medication[97] and in adolescents after 6 months of antidepressant treatment compared with less than two months of treatment.[98] The risk of an ecological fallacy, that is, inferring causality from group correlations, prevents attributing decreases in suicide rates solely to antidepressant use. Nevertheless, there is a striking correlation and plausible mechanism linking antidepressant use to declining rates of untreated major depression and therefore suicide.

Concerns about higher rates of suicide-related adverse event reports in depressed children and adolescents taking selective serotonin reuptake inhibitors compared with placebo in RCTs have prompted regulatory bodies in the United States, the United Kingdom, and Europe to issue warnings urging clinicians to monitor suicide risk and adverse effects carefully when prescribing antidepressants to youth. Such concerns need to be weighed against the risk of untreated depression because suicide is the third leading cause of death in youth and more than 90% of suicides in depressed youth are untreated at the time of death.[130]

Psychotherapy. Promising results in reducing repetition of suicidal behavior and improving treatment adherence exist for cognitive therapy,[35] problem-solving therapy,[28] intensive care plus outreach,[28] and interpersonal psychotherapy,[36] compared with standard aftercare. Cognitive therapy halved the reattempt rate in suicide attempters compared with those receiving usual care.[35] In borderline personality disorder, dialectical behavioral therapy[28] and psychoanalytically oriented partial hospitalization[37] improved treatment adherence and reduced suicidal behavior compared with standard after care. Intermediate outcomes such as hopelessness and depressive symptoms improve with problem solving therapy, and suicidal ideation is decreased with interpersonal psychotherapy, cognitive behavior therapy, and dialectical behavioral therapy.[26]

Follow-up Care After Suicide Attempts. Many psychiatric disorders, including depression, are chronic and recurrent[131] and compliance with maintenance medication is often poor. Interventions for depression provided by primary care physicians are more effective when a case manager follows up with patients who miss appointments or need prescription renewals.[132] Many depressed patients who survive a suicide attempt will make further suicide

attempts,[133] particularly in the period shortly following psychiatric hospitalization[134,135] or during future major depressive episodes.[136] Thus, improved acute, continuation, and maintenance care, including psychiatric hospitalization, where necessary, of those with recurrent or chronic psychiatric disorders,[137-139] particularly patients who attempt suicide with mood disorders, has potential for prevention. Reduction of the number of psychiatric inpatient beds in Norway as part of a program of deinstitutionalization of psychiatric inpatients resulted in an increased suicide rate in the year after discharge with a standardized mortality ratio of 133(95% confidence interval, 90.1-190.7) in men and 208.5 (95% confidence interval, 121.5-333.9) in women.[140]

The Norwegian multidisciplinary chain-of-care networks provide follow-up care after hospital care to those who attempt suicide. Regions with chain-of-care programs have lower treatment dropout rates and fewer repeat attempts.[68] Intervention studies of those who attempt suicide to prevent future suicidal behavior have produced mixed results, including fewer suicides compared with a control group after regular mailings,[38] and fewer suicide attempts after issuing an emergency contact green card[41]) or use of a suicide intervention counselor to coordinate assessment and long-term treatment.[69] Other interventions for those who attempt suicide, including telephone follow-up, intensive psychosocial follow-up, and video education plus family therapy, resulted in no difference between standard aftercare and intervention groups in rate of reattempt or reemergent suicidal ideation.[39,40,70]

Means Restriction

Suicide attempts using highly lethal means, such as firearms in US men, or pesticides in rural China, India, and Sri Lanka, result in higher rates of death. Suicides by such methods have decreased after firearm control legislation,[54,72-75,100] restrictions on pesticides,[76,77] detoxification of domestic gas,[79-81,101-103] restrictions on the prescription and sale of barbiturates,[82-84,101,105-107] changing the packaging of analgesics to blister packets,[85] mandatory use of catalytic converters in motor vehicles,[86-88,108] construction of barriers at jumping sites,[90] and the use of new lower toxicity antidepressants.[91,109]

Where the method is common, restriction of means has led to lower overall suicide rates: firearms in Canada[78] and Washington, DC,[54] barbiturate restriction in Australia,[105] domestic gas detoxification in Switzerland[80] and the United Kingdom,[79] and vehicle emissions in England.[87] Restrictions on access to alcohol have coincided with decreases in overall suicide rates in the former Union of Soviet Socialists Republics[110] and Iceland.[111]

Substitution of method may obscure a change in overall suicide rates, as has been observed for domestic gas detoxification among men in the United Kingdom,[81] in Germany,[103] and in the United States[104] and for banning the pesticide parathion in Finland.[76] Despite unresolved questions about method substitution, these studies demonstrate the life-saving potential of restricting lethal means. Gauging the extent to which declining overall suicide rates are directly attributable to restriction in access to particular means requires consideration of long-term trends and confounding factors such as increased antidepressant use.

Media

The media can help or hinder suicide prevention efforts by being an avenue for public education or by exacerbating suicide risk by glamorizing suicide or promoting it as a solution to life's problems. The latter may encourage vulnerable individuals to attempt suicide or to be attracted to suicide hot spots portrayed in the media as discussed by Pirkis et al[141,142] and Gould.[143] Media blackouts on reporting suicide have coincided with decreases in suicide rates.[53] A 1987 campaign to decrease media coverage of subway suicides in Austria cut subway suicides by 80%.[71] The Internet is of increasing concern, particularly the effects of suicide chat rooms, the provision of instruction in methods for suicide, and the active solicitation of suicide-pact partners.

Educating journalists and establishing media guidelines for reporting suicide have had mixed results.[144] The American Foundation for Suicide Prevention and Annenberg Public Policy Center,[145] and The Centers for Disease Control and Prevention[146] in the United States have produced guidelines for the responsible reporting of suicide; however, no published studies have evaluated their impact.

Table 3. Postintervention Decrease in Total Suicide Rates

Intervention	Suicides, % Decline in Annual Rate
Education	
Public	Not available
Primary care physician	22-73[66,47,65]
Gatekeeper	
US Air Force	40[52]
Norwegian Army	33[67]
Increasing antidepressant prescriptions*	3.2[91]
Chain of care	Not available
Restricting lethal means	
Guns	1.5-9.5[78,147]
Domestic gas	19-33[79,80]
Barbiturates	23[105]
Vehicle emissions	Not available
Analgesics	Not available
Media blackouts	Not available

*There was a 414% increase in antidepressant prescriptions 1987-1999.

Conclusions and Future Directions

National suicide prevention strategies have been proposed despite knowledge deficits about the effectiveness of some common key components. The relative impact of different strategies on national suicide rates is important for planning but difficult to estimate. TABLE 3 summarizes estimates of impact of different interventions on national suicide rates showing that the most promising interventions are physician education, means restriction, and gatekeeper education. Many universal or targeted educational interventions are multifaceted, and it is not known which components produce the desired outcome, or there may be longer-term trends in suicide rates that are not captured by the studies.

Physician Education. This increases the number of diagnosed and treated depressed patients with accompanying reductions in suicide although booster programs appear necessary. Videoconferencing and other teleconferencing consulting methods are possibilities where expert help is not available locally. However, the effect on suicide rates must be measured, as well as effects on intermediate outcomes, such as primary care physician–diagnosed cases of major depression and antidepressant prescription rates.

Pharmacotherapy. Randomized controlled trials are needed to prove that selective serotonin reuptake inhibitors decrease suicide rates. Their efficacy is established for major depression, the main risk factor for suicide. Education programs targeting primary care physicians should include instruction on use of antidepressants. The relationship between antidepressant use and emergent suicidal ideation and behavior in depressed children and adolescents needs further study. Because most depressed youth who attempt suicide are untreated, it is important not to prematurely discourage the use of effective antidepressants such as fluoxetine.

Gatekeeper Education. Where the roles of gatekeepers are formalized and pathways to treatment are readily available, such as in the military, educating gatekeepers helps reduce suicidal behavior. Demonstration projects for other gatekeepers with intermediate outcome measures, such as referral rates and psychiatric treatment rates, should be conducted.

Means Restriction. Restricting access to lethal methods decreases suicides by those methods. Priority should be given to the most commonly used methods in each country. The possibility of substitution of methods requires ongoing monitoring, as does compliance with restrictions such as firearm access.

Screening. Although screening programs have reported some success in identifying individuals with known risk factors for suicide, particularly among high school and college student populations, further consideration needs to be given to determining the cost-effectiveness of screening general populations vs identified at-risk populations for reducing suicide rates, the predictive validity and reliability of specific screening instruments, and the appropriateness of standard suicide screening instruments across different cultures.

Psychotherapy. Psychotherapy alone or in combination with some antidepressants can be an effective treatment for depression, for suicidal ideation, for suicide attempts in borderline personality disorder, and for preventing new attempts after a suicide attempt. More needs to be known about the combinations of psychotherapeutic and pharmacologic interventions for short-and long-term outcomes for suicidal patients.

Chain of Care. After a suicide attempt, better structured collaboration between hospitals and teams providing follow-up care may improve compliance with treatment and decrease new attempts, but essential elements of postsuicide attempt interventions are yet to be identified.

Media. Strategies for influencing how the media reports suicide need to be implemented and evaluated.

Suicide prevention interventions should be multimodal, evidence-based, guided by specific testable hypotheses, and implemented among populations of sufficient size to yield generalizable and reliable results. Programs must include outcome measures. Finally, because most studies have been conducted in developed nations, many issues facing underresourced developing nations have not been addressed and require future studies specifically focused on suicide prevention.

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A good writer, and one who writes with care, often finds that the expression he's spent a long time hunting for without finding it, and which he finds at last, turns out to be the simplest and most natural one, which looks as if it ought to have occurred to him at the beginning, without any effort.
—Jean de la Bruyère (1645-1696)

