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Association of Suicide Prevention Interventions With Subsequent Suicide Attempts, Linkage to Follow-up Care, and Depression Symptoms for Acute Care Settings
A Systematic Review and Meta-analysis

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IMPORTANCE To prevent suicide deaths, acute care settings need tools to ensure individuals at risk of suicide access mental health care and remain safe until they do so.

OBJECTIVE To examine the association of brief acute care suicide prevention interventions with patients' subsequent suicide attempts, linkage to follow-up care, and depression symptoms at follow-up.

DATA SOURCES Ovid MEDLINE, Scopus, CINAHL, PsychINFO, Embase, and references of included studies using concepts of suicide, prevention, and clinical trial to identify relevant articles published January 2000 to May 2019.

STUDY SELECTION Studies describing clinical trials of single-encounter suicide prevention interventions were included. Two reviewers independently reviewed all articles to determine eligibility for study inclusion.

DATA EXTRACTION AND SYNTHESIS Two reviewers independently abstracted data according to PRISMA guidelines and assessed studies' risk of bias using the Cochrane Risk of Bias tool. Data were pooled for each outcome using random-effects models. Small study effects including publication bias were assessed using Peter and Egger regression tests.

MAIN OUTCOMES AND MEASURES Three primary outcomes were examined: subsequent suicide attempts, linkage to follow-up care, and depression symptoms at follow-up. Suicide attempts and linkage to follow-up care were measured using validated patient self-report measures and medical record review; odds ratios and Hedges *g* standardized mean differences were pooled to estimate effect sizes. Depression symptoms were measured 2 to 3 months after the encounter using validated self-report measures, and pooled Hedges *g* standardized mean differences were used to estimate effect sizes.

RESULTS A total of 14 studies, representing outcomes for 4270 patients, were included. Pooled-effect estimates showed that brief suicide prevention interventions were associated with reduced subsequent suicide attempts (pooled odds ratio, 0.69; 95% CI, 0.53-0.89), increased linkage to follow-up (pooled odds ratio, 3.04; 95% CI, 1.79-5.17) but were not associated with reduced depression symptoms (Hedges *g* = 0.28 [95% CI, −0.02 to 0.59).

CONCLUSIONS AND RELEVANCE In this meta-analysis, breif suicide prevention interventions were associated with reduced subsequent suicide attempts. Suicide prevention interventions delivered in a single in-person encounter may be effective at reducing subsequent suicide attempts and ensuring that patients engage in follow-up mental health care.

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Supplemental content

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Suicide rates have been rising for 2 decades in the US.[1] In response to this crisis, the National Action Alliance for Suicide Prevention has called for health care organizations to incorporate suicide prevention into routine practice. Health care organizations are well positioned to prevent suicide deaths because more than one-third of people who die by suicide have a health care encounter in the week before their death[2] and half within a month before their death.[3] Emergency department visits for suicidal ideation and suicide attempts have doubled in recent decades.[4,5] However, acute health care settings including hospitals, emergency departments, and urgent care centers as well as other settings that deliver acute suicide prevention services, such as jails and shelters, are not well staffed with specialty mental health clinicians and may not have the capacity to offer continuity of mental health care. Nevertheless, these settings are at the front line of suicide prevention and require effective tools to reduce patients' risk of morbidity from suicide ideation and attempts and their risk of suicide death.

National suicide prevention best practices recommend that individuals identified as being at risk of suicide receive treatment specifically directed to reduce their risk of suicide and services to ensure they remain engaged in mental health care.[6] To achieve these goals, clinical teams need evidence-based interventions to directly address suicide risk and to ensure that patients transition to ongoing, longitudinal mental health care. Brief interventions are used in acute care to identify and provide initial management for a number of mental health and other problems and offer several practical advantages.[7] Brief interventions can be delivered in a single time-limited encounter by trained professionals and include an emphasis on ongoing treatment. Some of these interventions are augmented by care coordination or follow-up after the patient leaves the acute encounter. Brief interventions that focus on immediate suicide risk reduction and transition to ongoing mental health care are well suited for settings not equipped to offer ongoing, longitudinal mental health care.

To establish evidence for brief acute care suicide prevention interventions, we conducted a systematic review of clinical trials of brief suicide prevention interventions delivered in a single in-person encounter (in some cases, with telephone follow-up) that directly addressed suicide risk, promoted continuity of mental health care, or both. Among interventions included in the review, we conducted a meta-analysis of the 3 suicide prevention outcomes reported by the largest number of studies: subsequent suicide attempts, linkage to follow-up care (ie, attending at least 1 follow-up visit), and depression symptoms at follow-up. The objectives of the research were to (1) describe the contents, resource intensity, and target populations for brief acute care suicide prevention interventions and (2) examine the association of brief acute care suicide prevention interventions with patient outcomes.

Key Points

Question Are brief interventions delivered in a single encounter to individuals at risk of suicide effective at improving patient outcomes?

Findings In this systematic review and meta-analysis of 14 studies, brief acute care suicide prevention interventions were associated with reduced subsequent suicide attempts and increased chances of linkage to follow-up care. Most interventions included multiple components; the most common components were care coordination, safety planning, brief follow-up contacts, and brief therapeutic interventions.

Meaning The evidence supports incorporating brief suicide prevention interventions into routine acute care practice.

Methods

We conducted and reported the systematic review and meta-analysis in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline.[8] Our protocol was registered with PROSPERO International Prospective Register of Systematic Reviews (CRD42019114964).

Search Strategy

We searched Ovid MEDLINE, Scopus, CINAHL, PsychINFO, and Embase for English language studies published between January 1, 2000, and December 31, 2019. We based search terms on the following key concepts: suicide, prevention, and clinical trial. Keywords were developed using database-specific vocabularies. eTable 1 in the Supplement shows the complete database search strategy for Ovid MEDLINE. References of included studies were reviewed for possible inclusion.

Study Selection

Two study authors (E.M. and E.E.) independently reviewed titles and abstracts of retrieved studies to identify studies eligible for inclusion. Studies were eligible for inclusion if they (1) examined an intervention delivered in a single in-person encounter to patients with identified suicide risk; (2) included a comparison group; (3) measured patient outcomes; and (4) were available in English. Interventions consisting solely of a brief follow-up contact were ineligible for inclusion, as these have been reviewed previously.[9] If the intervention or study design could not be ascertained from title and abstract review, 2 authors (D.W. and C.F.B.) reviewed the full text to determine eligibility. We held team meetings to discuss and resolve discrepancies and reach consensus on all inclusion decisions.

Among included studies, the most commonly reported outcomes were subsequent suicide attempts, linkage to follow-up care, and depression symptoms at follow-up. We selected these outcomes for meta-analysis. All studies reported sufficient data to examine intervention effects on at least 1 outcome.

Data Abstraction, Evaluation, and Synthesis

Two study authors (either E.M. or E.E. and either D.W. or C.F.B.) independently abstracted relevant data for each study using a structured form, including study setting, intervention description, characteristics of the sample, inclusion/exclusion criteria, and study outcomes. We abstracted raw event numbers

for subsequent suicide attempt and linkage to follow-up care to estimate pooled odds ratios (ORs) and raw depression scores on the validated scales used in each of the studies to calculate standardized mean differences (SMDs) in depression score means at follow-up.

Study design and threats to inference were evaluated by applying the Cochrane Risk of Bias tool.[10] Each study's risk of bias was assigned low, medium, or high risk in each of the tool's 9 domains.

Meta-analysis

For each of the 3 outcomes, we developed a random-effects model to calculate pooled effect size estimates weighted for the inverse of the variance of the individual effects (ie, accounting for the size of the sample). For the outcomes of subsequent suicide attempt and linkage to follow-up care, we compared pooled ORs and Hedges *g* statistic, a technique for pooling SMDs in studies with small sample sizes. We used the formula: SMD = ln(OR) × ($\sqrt{3}/\pi$) to convert ORs to SMDs. To take into account small sample sizes, we multiplied SMD by a correction factor $J = 1 - (3 / [4 \times (N - 2) - 1])$ to calculate Hedges *g*.[11] For depression symptoms at follow-up, we examined pooled effect sizes using Hedges *g*. We conducted sensitivity analyses to determine whether any study had a large influence on the pooled-effect estimates and subgroup analyses to investigate sources of heterogeneity.

We used I^2 statistics to assess how much of the observed heterogeneity in effect sizes was due to differences in intervention characteristics. A higher I^2 statistic suggests that interventions have different effect sizes, whereas a lower I^2 statistic suggests that the variation in estimated effect sizes is more likely due to chance.[12]

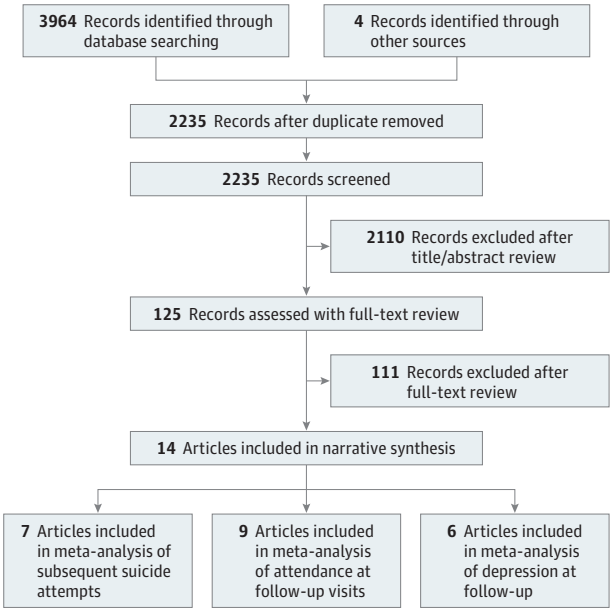
We examined for evidence of small study effects, such as publication bias, using the Peter regression test for binary outcomes (suicide attempt and linkage to follow-up care) and the Egger test for the continuous outcome of depression symptoms at follow-up. Although these tests are a widely used method for estimating small study effects, there is known risk of false-positive detection of small study effects when fewer than 10 studies are included in the analysis or there is substantial between-study heterogeneity.[13,14] We also generated contour-enhanced funnel plots to help evaluate for publication bias as a source of small-study effects. Two-sided *P* values had a significance threshold of .05. We conducted analyses using Stata, version 15 (StataCorp). Analysis began October 2019.

Results

Evidence Synthesis

Database searches returned 3968 articles. After removing duplicates, we screened titles and abstracts for 2235 records, and of those, we reviewed the full article for 125 studies. We identified 4 additional eligible articles from review of references of included studies. Ultimately, we identified 14 studies eligible for inclusion in the narrative synthesis (**Figure 1**), representing outcomes for 4270 patients. All 14 contributed data to a meta-analysis of at least 1 outcome. The **Table** outlines selected characteristics of included studies.

Figure 1. PRISMA Flow Diagram



Description of Brief Suicide Prevention Interventions

Included studies evaluated brief suicide prevention interventions to promote ongoing mental health care and reduce subsequent suicide attempts. We identified 4 main components of interventions delivered in the study: brief contact interventions, care coordination, safety planning interventions, and other brief therapies.

Brief contact interventions include telephone calls, postcards, and letters, and these interventions alone have been reviewed elsewhere.[9] Brief contact was included as a component of a suicide prevention intervention for 6 of 14 included studies (42.9%). In 5 studies (35.7%), the brief contact included telephone calls, and of those studies, patients also received handwritten mailed notes.[22] The schedules and focus for the follow-up telephone calls varied, ranging from 1 appointment reminder to a schedule of telephone calls at 1, 2, 4, and 8 weeks after the encounter.[26] One study[18] used text messaging to provide brief caring contacts at 1 day, 1 week, and 9 other times throughout 12 months, and trained counselors responded to recipients' replies either with supportive statements or to ensure the recipient engaged with mental health treatment.

We defined care coordination as bidirectional communication between the clinical team referring the patient for mental health care and the team receiving the patient for follow-up mental health care. Of the 14 included studies, 3 (21.4%) included care coordination.[17,19,20] Care coordination included scheduling an outpatient mental health appointment,[17] scheduling a mobile crisis response team evaluation,[19] or scheduling an outpatient mental health appointment and collaborating with the patient's family to reduce barriers to

Table. Selected Characteristics of 14 Studies of Single-Encounter Suicide Prevention Interventions

Source	Setting	Patients	Intervention					
			Components					
			BC	CC	OBT	SPI	Description	Duration
Armitage et al,[15] 2016	1 Urban hospital in Malaysia	226 Adolescents and adults (aged 15-64 y) hospitalized for suicide attempt	No	No	Yes	No	Participants completed if/then planning for self-harm scenarios	1 Encounter during hospitalization
Asarnow et al,[16] 2011	2 Urban EDs in the US	181 Adolescents (aged 10-18 y) with suicide ideation or attempt	Yes	No	No	Yes	Family Intervention for Suicide Prevention: a crisis therapy session that uses most of the elements of SPI for adolescents and their families in ED, followed by telephone calls to support outpatient treatment attendance	1 Encounter during hospitalization; 1 telephone call 48 h after discharge with optional additional telephone calls as needed (typically 1, 2, and 4 wk postdischarge)
Bryan et al,[17] 2017	1 Military ED and 2 military mental health clinics on 1 Army base in the US	97 US Army personnel with suicide ideation in the past 7 d or lifetime suicide attempt	No	Yes	No	Yes	Crisis Response Plan: collaboration with a therapist to identify warning signs, coping skills, and sources of support, which were documented on an index card. Follow-up appointment with a mental health care clinician was scheduled. Enhanced crisis response plan added a discussion of reasons for living	1 Encounter during hospitalization
Comtois et al,[18] 2019	3 Military installations in the US	657 Active duty/reserve/ National Guard members with current suicide ideation	Yes	No	No	No	Caring contacts: text messages were sent to participants by study clinicians at regular intervals during a 12-mo period expressing care, concern, and requesting no response	Texts sent at 1 d, 1 wk, and at 9 other times throughout a 12-mo period
Currier et al,[19] 2010	1 Urban psychiatric ED in the US	120 Adults with suicide attempt in previous 24 h	No	Yes	No	No	Community-based assessment conducted by a mobile crisis team within 48 h of discharge compared with treatment as usual (referral to an outpatient clinic appointment within 5 business d)	1 Encounter within 48 h of discharge
Grupp-Phelan et al,[20] 2012	1 Pediatric ED in the US	24 Adolescents (aged 12-17 y) with nonpsychiatric chief complaint and positive screening for suicide ideation or attempt; not receiving mental health services	Yes	Yes	Yes	No	TeenScreen-ED: short interview with adolescents and their families to provide screening results and clinical recommendations, reduce barriers to treatment, and gather information to coordinate adolescent's treatment, including scheduling appointments, coordinating with new treatment professionals, and providing reminder calls	1 Encounter during hospitalization
Grupp-Phelan et al,[21] 2019	2 Urban children's hospital EDs in the US	168 Adolescents (aged 12-17 y) with nonpsychiatric chief complaint and positive screening for suicide ideation or attempt; not receiving mental health services	Yes	Yes	Yes	No	Brief motivational interviewing for parents and adolescents targeted at increasing mental health care-seeking behavior, reducing barriers, and referring to treatment; follow-up case management in the form of 1-4 telephone calls to address treatment seeking barriers also occurred	1 Encounter during hospitalization plus 1-4 follow-up telephone calls postdischarge
King et al,[22] 2015	1 General ED in the US	49 Adolescents (aged 14-19 y) seeking nonpsychiatric ED services with suicide ideation, suicide attempt, or depression with substance abuse	Yes	No	Yes	No	Teen Options for Change: personalized feedback on screening, adapted motivational interview with a mental health professional, and handwritten notes and follow-up telephone calls from their therapist 2 and 5 d after their visit. Adolescents were also provided with a crisis card with telephone numbers for suicidal emergency support, written information about depression, suicide risk, firearm safety, and local mental health services	1 Encounter during hospitalization plus a handwritten follow-up note and telephone call between 2 and 5 d postdischarge

(continued)

Table. Selected Characteristics of 14 Studies of Single-Encounter Suicide Prevention Interventions (continued)

Source	Setting	Patients	Intervention Components				Description	Duration
			BC	CC	OBT	SPI		
Miller et al,[23] 2017	8 Geographically diverse general EDs in the US	1376 Adults with suicide ideation or attempt in past 2 wk	Yes	No	Yes	No	SAFTI: secondary risk assessment by ED physicians to further evaluate screening results, a self-administered safety plan, and telephone calls with the option to include a significant other on the calls to provide elements of case management and supportive counseling for up to 52 wk after the ED visit	1 Encounter during hospitalization plus up to 7 structured telephone calls with patient and up to 4 structured telephone calls with patient's significant other postdischarge
O'Connor et al,[24] 2020	1 General hospital psychiatry consult service in the US	48 Adults hospitalized for physical injury due to suicide attempt	No	No	Yes	Yes	TMBI: 30- to 60-min encounter with 9 components: establish rapport, validate recent suicide attempt, understand why suicide attempt, curiously and collaboratively discover drivers of suicide attempt, examine functionally why suicide attempt occurred, discuss gains and losses as a result of suicide attempt, short-term safety plan, ongoing care plan, summary and discussion of next steps	1 Encounter during hospitalization
Ougrin et al,[25] 2011	4 Urban EDs and 2 mental health urgent care centers in the UK	70 Adolescents (aged 12-18 y) with suicide attempt; not engaged in psychiatric services	No	No	Yes	No	Therapeutic assessment: includes a basic psychosocial assessment, a 30-min therapeutic intervention to identify targets and motivations for change, and disposition planning; a copy of the assessment results was sent to the relevant community team	1 Encounter during hospitalization
Spirito et al,[26] 2002	1 Children's hospital ED and inpatient medical service in the US	76 Adolescents (aged 12-18 y) hospitalized for suicide attempt	Yes	No	Yes	No	1-h Session to increase engagement: therapists reviewed expectations for outpatient treatment, discussed barriers to treatment, and made a verbal contract for participant to attend 4 outpatient sessions; participants received a telephone call at 1, 2, 4, and 8 wk postdischarge to problem solve about barriers to treatment attendance	1 Encounter during hospitalization plus 4 telephone calls over 8 wk postdischarge
Stanley et al,[27] 2015	5 VA EDs in the US	96 Adult VA patients with ≥2 suicide-related ED visits in 6 mo	No	No	Yes	Yes	2-Stage behavioral intervention including safety plan to help patients identify warning signs for a suicidal crisis, strategies to cope with subsequent suicidal feelings, professional and personal supports, ways to reduce access to lethal means, and brief structured telephone follow-up calls after ED discharge to provide support, facilitate treatment engagement, and mitigate risk	1 Encounter during hospitalization plus follow-up structured telephone calls
Stanley et al,[28] 2018	5 VA EDs in the US	1179 Adult VA patients with ED visit for suicide-related concern, not requiring hospitalization	No	No	Yes	Yes	A brief clinical intervention in which patients worked with a clinician to (1) identify warning signs for a suicidal crisis, (2) identify coping strategies, (3) identify family, friends, and social places that distract from suicidal thoughts and urges, (4) identify individuals who can support during a suicidal crisis, (5) list emergency mental health services to contact during a suicidal crisis, and (6) lethal means counseling for making the environment safer	1 Encounter during hospitalization plus telephone contact within 72 h of postdischarge and weekly until patient attended a behavioral health visit or no longer wished to be contacted

Abbreviations: BC, brief contact (ie, letters or telephone calls); CC, care coordination; ED, emergency department; OBT, other brief therapeutic intervention; SAFTI, safety assessment and follow-up telephone intervention; SPI, Safety Planning Intervention; TMBI, teachable moments brief intervention; VA, veterans affairs.

attending the appointment.[20] In 1 study, staff monitoring responses to caring contact text messages gave a warm handoff to mental health clinician colleagues when a study participant's response indicated they were in distress.[18]

Brief therapeutic interventions were defined as interventions aiming to prevent patients from engaging in future suicidal behaviors or promote ongoing mental health treatment engagement and were delivered to the patient during the single in-person encounter or in brief telephone calls. Of the 14 included studies, all but 1 study[19] provided a brief therapeutic intervention. The most common brief therapeutic intervention was the Safety Planning Intervention, which was delivered in 5 studies.[16,18,24,27,28] Safety Planning Intervention[29] components include (1) identifying personalized warning signs for an impending suicidal crisis, (2) determining internal coping strategies that distract from suicidal thoughts and urges, (3) identifying family, friends, and social places that can distract from suicidal thoughts and urges, (4) identifying individuals who can help provide support during a suicidal crisis, (5) listing mental health professionals and urgent care services to contact during a suicidal crisis, and (6) lethal means counseling for making the environment safer. For the purposes of this systematic review, any intervention that included at least 4 of 6 components above was categorized as having delivered a Safety Planning Intervention.

Ten studies delivered brief therapeutic interventions other than a Safety Planning Intervention.[15,18,20,22-28] These other brief therapeutic interventions used a variety of therapeutic techniques to reduce a patient's likelihood of self-harm, including functional analysis,[24] therapeutic assessment,[25] and the development of implementation intentions,[15] as well as techniques informed by motivational interviewing[22,23] and therapies focused on improving patients' problem-solving skills.[23] These interventions also used techniques to increase the likelihood of outpatient mental health treatment engagement.[20,21,23,26-28]

Many eligible studies included a combination of interventions. For example, 3 studies (21.4%) included a brief therapeutic intervention plus a brief contact intervention.[16,23,26] One study included a brief therapeutic intervention, care coordination, and a brief contact intervention.[20] Finally, 3 studies (21.4%) included the Safety Planning Intervention enhanced with another brief therapeutic intervention such as treatment engagement.[24,27,28]

Risk of Bias

The most common domain in which studies were assigned a high risk of bias was in incomplete outcomes data, in some cases owing to handling of missing data. Studies reporting complete data were assigned a low risk score.[27,28] Studies that described a standard method for handling missing data during analysis, such as multiple imputation or last observation carried forward, were assigned a medium risk score.[15,16,18,19,24,25] Studies that did not mention how missing data were analyzed were assigned a high risk score on the incomplete outcome data domain.[17,20-23,26] eTable 2 in the Supplement details risk of bias scores for each study.

Meta-analysis Results

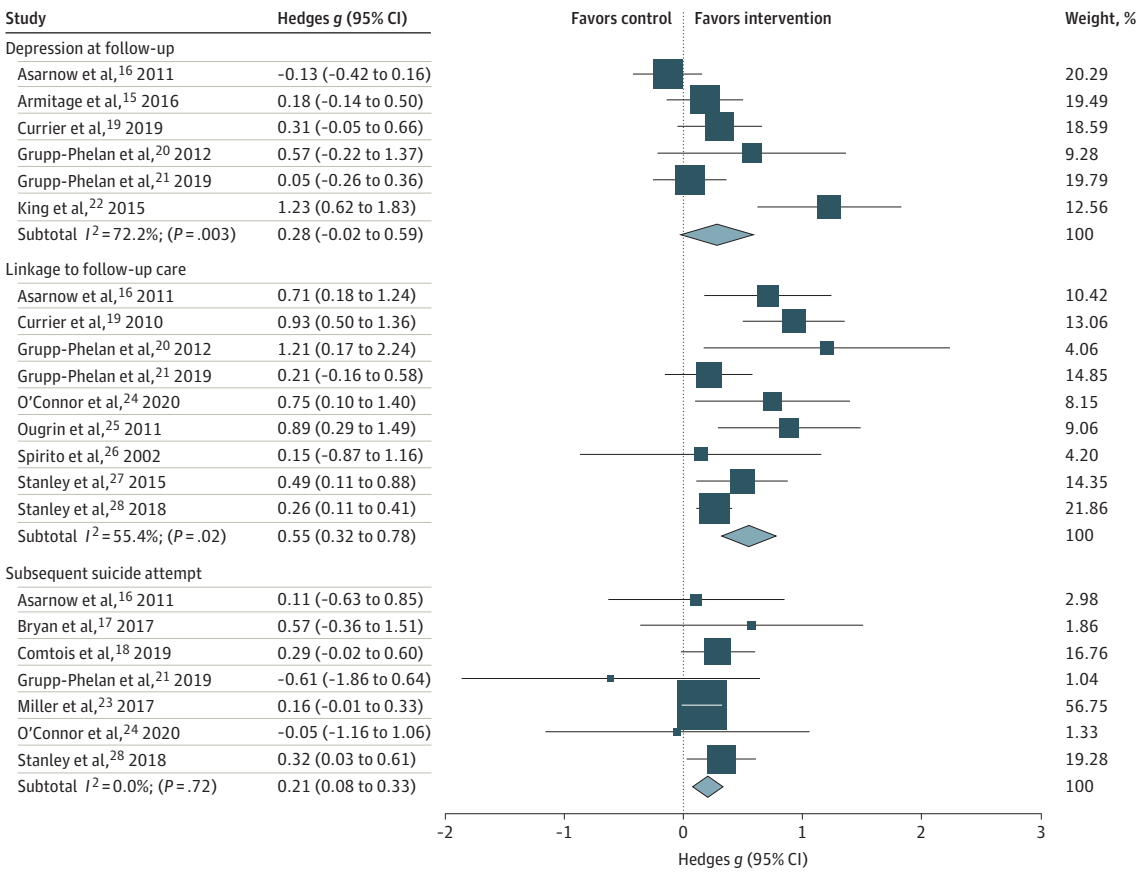
Seven studies (50%) examined subsequent suicide attempts as an outcome,[16-18,21,23,24,28] 9 (64.3%) examined link to follow-up care as an outcome,[16,19-21,24-28] and 6 (42.9%) examined depression as an outcome.[15,16,19-22] Forest plots shown in **Figure 2** demonstrate the associations of the interventions with each outcome, and eTable 3 in the Supplement displays the raw numbers used to calculate effect size estimates.

The pooled effect size of suicide prevention interventions was toward fewer subsequent suicide attempts (pooled OR, 0.69 [95% CI, 0.55-0.87]; Hedges g = 0.21 [95% CI, 0.08-0.33]). We did not find statistically significant heterogeneity in the studies' associations with subsequent suicide attempts (I^2 = 0%; P = .72), suggesting that included interventions had a similar effect in reducing subsequent suicide attempts. Studies followed up study participants for 2 months to 1 year after the intervention to identify subsequent suicide attempts and used either medical record review[28] or validated patient self-report measures[16-18,21,23,24] to ascertain suicide attempts. We conducted sensitivity analyses excluding each study from the pooled-effect estimate. We found that the pooled effect of the interventions was consistently toward a reduction in subsequent suicide attempts regardless which study was excluded, suggesting that no individual study disproportionately affected findings.

We found that the pooled effect size of included interventions was toward an increase in linkage to follow-up mental health care (pooled OR, 2.74 [95% CI, 1.80-4.17]; Hedges g = 0.55 [95% CI, 0.32-0.78]). We found that heterogeneity between studies was statistically significant (I^2 = 55.4%; P = .02), suggesting that the included interventions varied in their associations with patients' likelihood of linkage to follow-up care. Studies measured follow-up visit attendance at an outpatient appointment from 1 week to 3 months after the intervention. Studies ascertained follow-up visit attendance using either a validated patient self-report measure[16,19-21,24,26] or electronic health record information.[25,27,28] We conducted sensitivity analyses excluding each study from the pooled-effect estimate. The pooled effect of the interventions consistently showed higher odds of linkage to follow-up care regardless of which study was excluded from the analysis, suggesting that no individual study had an outsize influence on the findings. We also conducted subgroup analyses for adult-only and adolescent-only populations. The subgroup analysis of adults showed no difference in effect size or heterogeneity compared with the main analysis. The subgroup analysis including only adolescent populations had no difference in effect size from the main analysis; however, there was no statistically significant heterogeneity (I^2 = 39%; P = .18).

The pooled effect size of included interventions on depression symptoms at follow-up was not significantly significant (Hedges g = 0.28 [95% CI, −0.02 to 0.59]). The intervention groups had nonsignificantly lower depression scores (ie, fewer depression symptoms) at follow-up compared with the control groups at follow-up. Studies measured follow-up depression symptoms between 2 and 3 months after the intervention using validated patient self-report measures. We found that heterogeneity between studies was statistically signifi-

Figure 2. Forest Plots for 3 Study Outcomes: Depression, Linkage to Follow-up Care, and Subsequent Suicide Attempts



Studies were weighted according to sample size using random effects models. The vertical line shows the pooled odds ratio across all 3 outcomes. The boxes vary in size according to the weight of each study (proportional to the study's sample size), and horizontal black lines represent the confidence intervals for each study. The diamond at the bottom of each outcome plot represents the pooled odds ratio and CI for the individual outcome.

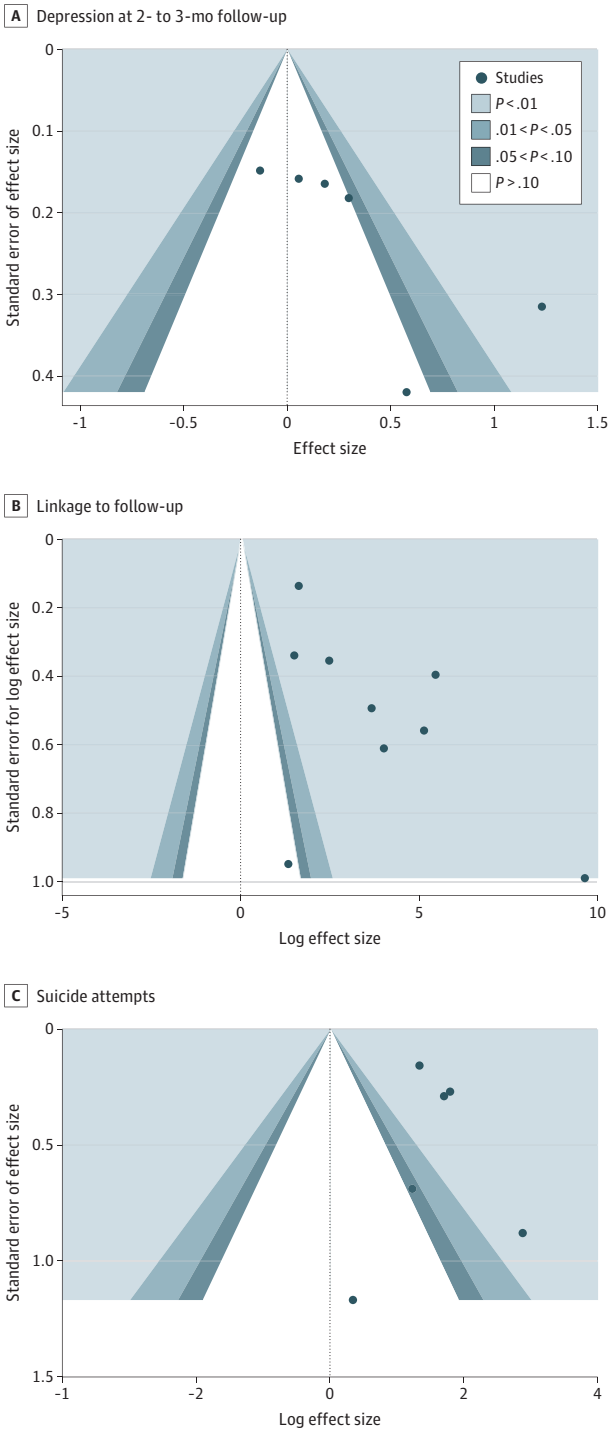
cant (I^2 = 72.2%; P = .003), suggesting that true differences existed between the studies' associations with patients' depression symptoms 2 to 3 months after the index encounter. We conducted sensitivity analyses excluding each study from the pooled-effect estimate. Excluding the study by Asarnowet al[16] resulted in the pooled effect size for the remaining studies being statistically significant (Hedges g = 0.38 [95% CI, 0.05-0.71]). For the remaining studies, exclusions did not result in a change in the direction or statistical significance of the findings.

Small Study Effects and Publication Bias

For depression symptoms at follow-up, the Egger test did not show evidence of small study effects (regression coefficient, −0.62 [95% CI, −1.49 to 0.25]; P = .06). For subsequent suicide attempts, the Peter test did not show evidence of small study effects (regression coefficient, −3.67 [95% CI, −93.45 to 86.10]; P = .79). However, sample sizes were small for both outcomes, so there is insufficient information to exclude small study effects. For linkage to follow-up care, the Peter test showed statistically significant evidence of small study effects (regression coefficient, 53.07 [95% CI, 10.47-95.66]; P = .02). Given known risk of false positives when a small number of publications are included in the analysis and when there is substantial heterogeneity of effects between studies, this finding could be a false positive. If a true positive, small study effects could be explained by publication bias (ie, studies with nonsignificant findings are not published in the literature), selective reporting (ie, studies only reported those outcomes with statistically significant differences), or true heterogeneity (ie, the interventions have a different effect in studies with small samples).

For each outcome, we generated a contour-enhanced funnel plot to visually evaluate for publication bias by identifying whether areas of asymmetry in the funnel plot (ie, missing studies) correspond with the area representing statistically nonsignificant findings (**Figure 3**). For depression at follow-up, although asymmetrical, the funnel plot shows 4 studies with nonsignificant P values. For subsequent suicide attempts, the funnel plot appears symmetrical and shows 2 studies with nonsignificant P values. Therefore, for the depression and suicide attempt outcomes, funnel plots do not show strong evidence of publication bias, which is consistent with the Egger test showing no evidence of small study effects. For linkage to follow-up mental health care, the funnel plot is asymmetrical and only 1 study had a nonsignificant P value, indicating that there could be publication bias (ie, suppression of studies with nonsignificant findings) for this outcome.

Figure 3. Contour-Enhanced Funnel Plots for 3 Study Outcomes: Depression, Linkage to Follow-up Care, and Subsequent Suicide Attempts



The vertical axis shows the standard error of the natural logarithm of the effect size for each study, and the horizontal axis shows the natural logarithm of the effect size of each study. If no publication bias is present, dots are expected to be distributed symmetrically.

Discussion

In this systematic review, we identified 14 brief suicide prevention interventions that included 4 main components: brief contact, care coordination, safety planning, and other brief therapies. The 3 most common outcomes were subsequent suicide attempts, linkage to follow-up care, and depression symptoms at follow-up. Meta-analyses showed that the pooled effect of the interventions was to reduce subsequent suicide attempts and increase linkage to follow-up care. Reduction in depression symptoms at follow-up was not statistically significant. The US National Action Alliance for Suicide Prevention has specifically prioritized research to prevent suicide-related behavior after an initial suicide attempt and identify strategies to retain patients in care.[30] Our findings help advance these research goals by providing evidence that brief interventions may reduce risk of subsequent suicide attempt and increase continuity of mental health care.

The pooled OR for subsequent suicide attempts was 0.69, corresponding to a risk difference of −0.035, a 3.5% reduction or 78 fewer suicide attempts in 2241 patients in the pooled intervention groups. For linkage to follow-up care, the pooled OR was 2.74, which corresponds to a 22.5% absolute increase in rates of completed follow-up in patients receiving the intervention. Because other brief interventions have not shown statistically significant reductions in suicide attempts or examined linkage to follow-up care, these effect sizes have important clinical implications.

The evidence base in support of other brief suicide prevention interventions suited for acute care has been mixed. Brief contact interventions reduce the number of suicide attempts per person but not the total number of suicide attempts or suicide deaths.[9] Smartphone applications for self-management of suicide risk were associated with reduced suicide ideation but not subsequent suicide attempts or deaths.[31] Consistent with our findings, a small meta-analysis of 2 studies of interventions involving active follow-up after emergency department discharge found that these interventions reduced subsequent suicide attempts.[32] Our study builds on these previous findings by evaluating a broader range of interventions, including those focused on safety planning and care coordination, and a broader range of outcomes, including successful linkage to follow-up care. Our findings provide important evidence that brief suicide prevention interventions may be effective at targeting important end points that reduce risk of suicide deaths.

The most common component among all interventions was to promote connectedness via engagement with health care clinicians and with the patient's community. Safety planning interventions explicitly focused on these goals during the in-person encounter. Other interventions promoted connectedness by providing care coordination or brief follow-up contacts to improve connectedness with health care clinicians. Finally, many of the suicide prevention interventions included a brief therapeutic component that addressed patients' coping or engagement during their in-person acute care encounter, thereby addressing their connection to a commu-

nity and to mental health care. Nevertheless, in the US and many other countries, mental health care remains difficult to access, and care coordination was likely included as a component of many interventions due to the complexity of navigating mental health care systems.

An important future direction in integrating brief suicide prevention interventions into acute care encounters is to identify and test implementation strategies. Numerous barriers exist to integrating these potentially lifesaving interventions into general medical care. First, health care settings need robust systems to identify patients with suicide risk. The Joint Commission's 2016 mandate to identify patients at risk of suicide[33] has increased the number of health care settings screening for suicide risk; however, the success of screening initiatives likely varies, particularly in settings with limited mental health expertise. Second, teams seeking to implement suicide prevention interventions need champions who have the skills and knowledge to deliver them. In many cases, social workers have the right combination of skills and expertise to offer brief in-person therapy, brief follow-up contacts, and care coordination. However, many settings have limited access to social workers and may rely on other professionals including nurses, physicians, or case managers to deliver components of the interventions. Settings with limited access to mental health professionals may consider using telehealth solutions to improve access to mental health specialists, and telehealth mental health care professionals should consider whether their services could comprise the follow-up and care coordination that were a key component of many of the included suicide prevention interventions. To assure appropriate resources, health care systems need to identify mechanisms to reimburse the time and resources required to deliver evidence-based suicide prevention interventions. Finally, these interventions likely have applications outside of traditional health care settings, and their implementation in other settings providing acute care, such as jails and crisis homeless shelters, warrants future study.

Limitations

This study should be interpreted in the context of several important limitations. Our literature search was limited to published articles and reports available in English. We did not include unpublished findings about suicide prevention interventions, such as findings from local quality improvement initiatives or unpublished research. The systematic review identified only 14 studies, and only the subsets with relevant outcomes were included in each meta-analysis. One large study[23] accounted for a large proportion of the study participants and was therefore heavily weighted in the meta-analyses. We were not able to examine whether brief suicide interventions ultimately reduced suicide deaths because most studies in the review did not include death as an outcome. Nevertheless, we were able to examine 3 important outcomes from the published literature, and for 2 of the 3 outcomes we found no evidence of publication bias using a conservative test.

Conclusions

Suicide prevention interventions delivered during and after a single in-person acute care encounter may be effective at reducing subsequent suicide attempts and improving patients' odds of linkage to follow-up mental health care. Future efforts to implement brief suicide prevention interventions in acute care are likely to reduce patients' risk of future suicide attempts and improve their continuity of mental health care.

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