Annals of Internal Medicine | Review

Screening for and Treatment of Suicide Risk Relevant to Primary Care: A Systematic Review for the U.S. Preventive Services Task Force

Elizabeth O'Connor, PhD; Bradley N. Gaynes, MD, MPH; Brittany U. Burda, MPH; Clara Soh, MPA; and Evelyn P. Whitlock, MD, MPH

Background: In 2009, suicide accounted for 36 897 deaths in the United States.

Purpose: To review the accuracy of screening instruments and the efficacy and safety of screening for and treatment of suicide risk in populations and settings relevant to primary care.

Data Sources: Citations from MEDLINE, PsycINFO, the Cochrane Central Register of Controlled Trials, and CINAHL (2002 to 17 July 2012); gray literature; and a surveillance search of MEDLINE for additional screening trials (July to December 2012).

Study Selection: Fair- or good-quality English-language studies that assessed the accuracy of screening instruments in primary care or similar populations and trials of suicide prevention interventions in primary or mental health care settings.

Data Extraction: One investigator abstracted data; a second checked the abstraction. Two investigators rated study quality.

Data Synthesis: Evidence was insufficient to determine the benefits of screening in primary care populations; very limited evidence identified no serious harms. Minimal evidence suggested that screening tools can identify some adults at increased risk for suicide in primary care, but accuracy was lower in studies of older adults. Minimal evidence limited to high-risk populations suggested poor performance of screening instruments in adolescents. Trial evidence showed that psychotherapy reduced suicide attempts in high-risk adults but not adolescents. Most trials were insufficiently powered to detect effects on deaths.

Limitation: Treatment evidence was derived from high-risk rather than screening-detected populations. Evidence relevant to adolescents, older adults, and racial or ethnic minorities was limited.

Conclusion: Primary care–feasible screening tools might help to identify some adults at increased risk for suicide but have limited ability to detect suicide risk in adolescents. Psychotherapy may reduce suicide attempts in some high-risk adults, but effective interventions for high-risk adolescents are not yet proven.

Primary Funding Source: Agency for Healthcare Research and Quality.

Ann Intern Med. 2013;158:741-754. www.annals.org
For author affiliations, see end of text.
This article was published at www.annals.org on 23 April 2013.

Suicide was the 10th leading cause of death in the United States in 2009, accounting for 36 897 deaths with an age-adjusted rate of 11.8 per 100 000 persons (1, 2). It accounted for more than 1.4 million years of potential life lost before age 85 years (3). Suicide attempts and death rates vary substantially by sex; age; race; and other risk factors, such as psychiatric disorders (4–7), prior suicide attempts (8–11), a history of nonsuicidal self-harm (7), and a serious adverse childhood experience (12–15). Individual risk factors have a limited ability to predict suicide in a person at a particular time, but risk for a suicide attempt and death increases with multiple risk factors (covering psychosocial, biomedical, and developmental realms) and high levels of distress (16, 17).

Thirty-eight percent of U.S. adults who completed suicide visited their primary care providers in the prior month; this rate was even higher (50% to 70%) in older adults (18). Nearly 90% of suicidal youth had primary care visits during the previous 12 months, compared with 70% to 80% of nonsuicidal youth (19, 20). Screening tools that are accurate and feasible for use in primary care could represent an important opportunity to identify persons at increased risk for suicide so that it can be prevented through appropriate treatment.

In 2004, the U.S. Preventive Services Task Force (USPSTF) concluded that evidence was insufficient to recommend for or against routine screening by primary care clinicians to detect suicide risk in the general population (I statement). That review found limited evidence that screening tests can reliably detect suicide risk in primary care populations (21). A large body of evidence (33 randomized, controlled trials and 2 cohort studies) examined the effects of treatment on suicide attempts and suicide deaths in adolescents or adults.

Few trials showed benefit of treatment, and many were underpowered for these rare outcomes. Evidence also showed that nonpharmacologic treatment could reduce depressive symptoms and suicidal ideation in high-risk older adolescents and adults. Evidence was lacking on harms of screening and treatment.

Methods

We developed an analytic framework (**Appendix Figure 1**, available at www.annals.org) with 6 key questions to

See also:

Web-Only
CME quiz

guide our work (**Appendix Table 1**, available at www.annals.org). Our full report describes the methods in detail (22).

Data Sources

We considered all studies from the previous review for inclusion. We searched MEDLINE, PsycINFO, CINAHL, and the Cochrane Central Register of Controlled Trials for studies published between January 2002 and 17 July 2012 to bridge and update from the previous review. We hand-searched bibliographies of relevant reviews and searched Web sites of government agencies and professional organizations to identify relevant research published outside of peer-reviewed journals. We also conducted a surveillance search of MEDLINE through December 2012 to identify additional screening trials.

Study Selection

Two investigators independently reviewed the abstracts and articles against specified inclusion and exclusion criteria. We resolved disagreements through consultation with the larger project team. We included English-language studies in general primary care or specialty mental health populations (or similar populations) of any age. We also included studies limited to patients with depression, substance misuse, posttraumatic stress disorder, or borderline personality disorder. We excluded studies limited to patients with other mental health conditions.

For questions related to harms and benefits of screening or treatment, we included randomized and nonrandomized clinical trials. To address effects of treatment, we included trials of behavior-based or pharmacologic treatment with a primary aim of reducing suicide deaths, suicide attempts or self-harm, or suicidal ideation. We included studies of screening instrument accuracy that reported sensitivity, specificity, or related statistics of brief screening instruments to detect current increased suicide risk (usually suicidal ideation) relative to a reference standard. The reference standard had to be a more in-depth assessment of suicide risk by a trained mental health professional or a trained interviewer using a standardized instrument to determine whether suicide risk was increased. We would have included suicide attempts in the immediate period after screening (for example, 1 month) as a gold standard if we had found any studies that did this. We also would have included comparative cohort studies addressing harms of pharmacologic treatment in suicidal populations if we had found any.

Data Extraction and Quality Assessment

One investigator abstracted data from all included studies into a standard evidence table, and a second investigator checked the data for accuracy. Two investigators independently assessed the methodological quality of each study by using predefined design-specific quality criteria based on methods developed by the USPSTF (23). We supplemented these criteria with the Quality Assessment of Diagnostic Accuracy Studies tool (24) to evaluate the quality of diagnostic accuracy (screening) studies, resulting in a rating of good, fair, or poor. We resolved disagreements in quality assessment through discussion and, if necessary, consultation with a third reviewer. We excluded poor-quality trials.

Data Synthesis and Analysis

For all key questions, we created results tables with important study characteristics. We critically examined these tables to identify the range of results and potential associations with effect size. We examined trials limited to adolescents or limited to older adults separately from other adult trials.

For key questions 4 and 5 only, we conducted random-effects meta-analyses to estimate the effect size of suicide prevention interventions on suicide attempts or self-harm, suicidal ideation, and depression. We used Stata, version 11.2 (StataCorp, College Station, Texas), for all statistical analyses. Risk ratios were analyzed for suicide attempts. All trials reported at least 1 suicide attempt or self-harm episode in each intervention group, so no correction for empty cells was needed. We analyzed standardized mean differences (SMDs) in change from baseline for the continuous outcomes (suicidal ideation and depression). We calculated SDs of change from baseline by using a standard formula (25).

We assessed the presence of statistical heterogeneity among the studies by using standard chi-square tests and the I^2 statistic (26). We applied the Cochrane Collaboration (27) rules of thumb for interpreting I^2 (probably unimportant, $<40\%$; moderate, 30% to 60%; and substantial, 50% to 90%) and Cohen (28) rules of thumb for interpreting effect sizes (small, 0.2 to 0.5; medium, 0.5 to 0.8; and large, ≥ 0.8).

Role of the Funding Source

This research was funded by the Agency for Healthcare Research and Quality (AHRQ). The AHRQ staff provided oversight for the project and assisted in external review of the companion draft evidence synthesis but had no role in study selection, quality assessment, synthesis, or development of conclusions. The investigators are solely responsible for the content of the manuscript and the decision to submit for publication.

RESULTS

We included 56 studies that reported results in 86 publications, from 3925 abstracts and 303 full-text articles (**Appendix Figure 2**, available at www.annals.org). We included 7 trials that addressed screening (key questions 1, 2, and 3): 1 examined short-term benefits of screening (29), 4 examined performance characteristics of screening instruments (30–33), and 3 examined adverse effects of screening (29, 34, 35). We included 49 trials that addressed the benefits of treatment (key questions 4 and 5)—36 were conducted in adults or mixed adolescent and adult populations (36–71), and 13 were done in adolescents (72–84).

A subset of 12 of these trials also reported on adverse events or a (statistically nonsignificant) paradoxical increase in suicide attempts, which is discussed under key question 6 (36, 40, 41, 49, 51, 55–57, 66, 73, 76, 77).

Benefits of Screening (Key Question 1)

We identified 1 short-term, fair-quality trial ($n = 443$) that addressed key question 1. This trial found no clear short-term (that is, within 2 weeks) benefit of screening (29). It was published after the 2004 USPSTF review on this topic and thus was not included in the previous review.

Screening Instrument Accuracy (Key Question 2)

Appendix Table 2 (available at www.annals.org) shows data from the 4 studies that reported the accuracy of screening instruments for identifying persons at increased risk for suicide (30–33). Two of these trials were conducted in adult or older adult primary care populations (32, 33). One study (the only diagnostic accuracy study also included in the 2004 review) examined the clinical utility of 3 suicide-related items in primary care patients aged 18 years or older with prescheduled appointments for any reason ($n = 1001$) (32).

Items had sensitivities of 83% to 100% and specificities of 81% to 98% relative to a nurse-administered structured interview on the same day. The positive predictive values were low, ranging from 6% to 30%. Accuracy was lower in the study of the Geriatric Depression Scale—Suicidal Ideation subscale in general primary care patients aged 65 years or older ($n = 626$) (33). The optimal cutoff yielded a sensitivity and specificity of 80% for suicidal ideation during the previous 2 weeks, and the positive predictive value was fairly low (33%).

Two trials reported instrument accuracy in adolescent samples (combined $n = 799$). Although these studies used different instruments and approaches to assemble their samples, both represented high-risk groups that had 22% to 27% prevalence of suicidal ideation or behavior. In these studies, sensitivity ranged from 52% to 87% and specificity ranged from 60% to 85%. These results are generalizable only to high-risk populations.

Harms of Screening (Key Question 3)

Three trials reported on potential adverse effects of screening (all published since the previous review). None identified serious adverse effects of screening (29, 34, 35).

Health (Key Question 4) and Intermediate (Key Question 5) Benefits of Treatment

Appendix Table 3 (available at www.annals.org) (36–112) lists brief population and intervention characteristics of all included trials, and **Appendix Table 4** (available at www.annals.org) (36–112) lists all outcomes reported by each trial. The previous review included only 11 of these 49 trials; almost all of the new trials were published in 2003 or later, well after the end of the search window of the 2004 review. We organized treatment trials into 3 broad intervention groups: psychotherapy, enhanced usual care, and medication.

Psychotherapy

Thirty-one trials investigated a specific psychotherapeutic treatment approach, generally compared with usual care. Nineteen were conducted in adults (37, 38, 41, 44, 47, 50–52, 54–56, 58–60, 62–65, 67), and 12 were conducted in adolescents (72–81, 83, 84). Most psychotherapy trials were done in high-risk populations, usually identified because these persons had a recent suicide attempt or selected mental health disorders (for example, borderline personality disorder) and a history of suicide attempts. The only study that identified patients through population-based screening was conducted in Sri Lanka.

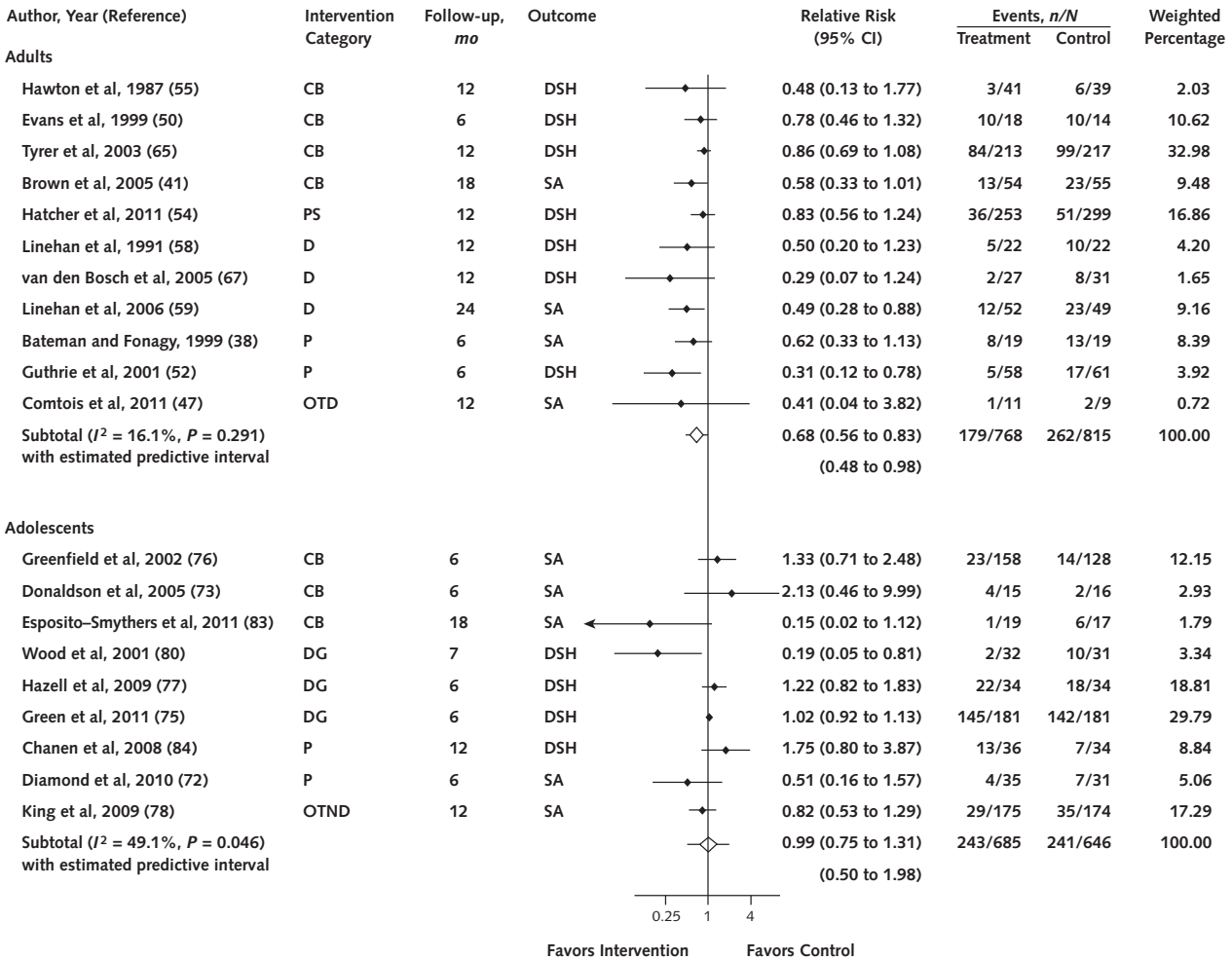
In adults, evidence was insufficient to evaluate the effect on suicide deaths, because only 6 of the 19 psychotherapy trials reported suicide deaths. Psychotherapy recipients had a 32% reduction in the likelihood of a suicide attempt or deliberate self-harm compared with usual care recipients (relative risk, 0.68 [95% CI, 0.56 to 0.83]; 11 trials; $n = 1583$; $I^2 = 16.1\%$) (**Figure 1**). However, a single estimate of absolute benefit would be misleading, given the highly variable rate of suicide attempts or self-harm (15% to 71% of control group participants had a suicide attempt or self-harm episode at follow-up). When the trials with the most extreme suicide attempt rates were excluded (38, 50, 54, 55), absolute differences ranged from a low of 46% in the control group and 39% in the intervention group (65) to a high of 47% in the control group and 23% in the intervention group (59).

Psychotherapy did not show greater improvement than usual care for suicidal ideation (SMD, −0.10 [CI, −0.27 to 0.06]; 8 trials; $n = 964$; $I^2 = 26.3\%$) (**Figure 2**), and most trials reported reduced suicidal ideation in both intervention and control groups. Psychotherapy had a small beneficial effect on depression relative to usual care (SMD, −0.37 [CI, −0.55 to −0.19]; 12 trials; $n = 1653$; $I^2 = 60.5\%$) (**Figure 3**). Other outcomes were sparsely reported and had mixed results.

In adolescents, we could not determine the effects of suicide prevention treatment on deaths because only 1 death occurred in the 3 trials reporting this outcome. Psychotherapy did not reduce suicide attempts in adolescents at 6 to 18 months (relative risk, 0.99 [CI, 0.75 to 1.31]; 9 trials; $n = 1331$; $I^2 = 49.1\%$) (**Figure 1**). The CI of the pooled effect was wide, ranging from a 25% reduction in risk to a 31% increase in risk for suicide attempts.

The absolute proportion of participants with a suicide attempt or self-harm episode varied greatly across trials, as did the difference between groups. For example, in the 3 trials reporting suicide attempts or self-harm in 20% to 23% of control group participants, the proportion of youth in the intervention groups with suicide attempts or self-harm ranged from 11.4% to 36.1% (72, 78, 84). Given

Figure 1. **Suicide attempts in psychotherapy trials.**



Weights are from random-effects analysis. CB = cognitive behavioral; D = dialectical; DG = developmental group; DSH = deliberate self-harm; ODT = other therapy, direct; OTND = other therapy, nondirect; P = psychodynamic; PS = problem solving; SA = suicide attempt.

the wide range of results, we cannot rule out the possibility of harm (or benefit) on the basis of existing evidence.

Psychotherapy had no beneficial effect on suicidal ideation beyond usual care (SMD, −0.22 [CI, −0.46 to 0.02]; 6 trials; $n = 629$; $I^2 = 41.2\%$) (**Figure 2**); both the psychotherapy and usual care groups generally showed substantial improvement. Psychotherapy had a small beneficial effect on depression (SMD, −0.36 [CI, −0.63 to −0.08]; 6 trials; $n = 631$; $I^2 = 53.6$) (**Figure 3**). Although statistical heterogeneity was high, all effects suggested that psychotherapy benefited persons with depression (but most effects were not statistically significant). Other health outcomes were sparsely reported and rarely showed beneficial effects for the interventions.

Among psychotherapy studies, we found no clear predictors of effect size other than target age (adults vs. adolescents), where trials in adults more consistently showed larger beneficial effects than those in adolescents. Among adolescent trials, limited data suggested that interventions targeting parents and youth, either separately or together, seemed to be more beneficial than those targeting only adolescents.

Enhanced Usual Care

We defined trials of "enhanced usual care" as those that attempted to improve the quality or format of recommended treatment (in primary or specialty care) or patient adherence to usual care while providing little to no direct therapeutic counseling or specific prescription for psychotherapy. Treatments varied widely, from mail-only to case management interventions, but most involved considerably less contact with patients than psychotherapy. One enhanced usual care trial was limited to adolescents and young adults (aged 15 to 24 years) (82), 2 were limited to older adult primary care patients (42, 71), and the remain-

ing trials included wide age ranges covering primarily adults.

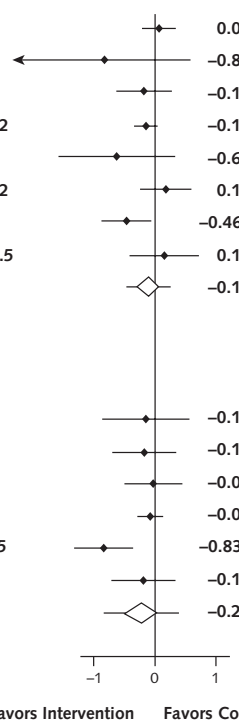
Most trials targeted participants who had an emergency department visit or inpatient stay related to a suicide attempt or self-harm. However, 3 trials were conducted in primary care settings, including both trials in older adults. PROSPECT (Prevention of Suicide in Primary Care Elderly: Collaborative Trial) addressed only depressed older adults (aged 60 to 94 years) and was the sole trial that used primary care–based screening for depression in the United States to identify eligible participants (42). The other trial of older adults was a large cluster randomized trial (patients were randomly assigned at the level of provider) that included all patients older than 60 years on the panels of participating providers; this trial thus was not limited to patients who screened positive for suicidal ideation or had known risk factors for suicide, but was representative of a general Australian primary care population (71).

The third trial with high applicability to primary care was a nonrandomized, population-based intervention trial that compared intervention and control regions of the county in Hungary with the highest suicide rates. This trial reported suicide rates per 100 000 persons as its outcome, rather than following an identified sample (70). It involved a 5-year provider-education intervention that also offered free consultation and a depression clinic for referral.

Although 7 of the 17 enhanced usual care trials reported deaths, only 1 fair-quality trial reported significant group differences. This fairly large trial ($n = 843$) sent participants 24 letters over 5 years expressing concern and encouraging treatment and reported a 49% reduction in suicide deaths at 2-year follow-up (1.8% in the intervention group vs. 3.5% in the control group; 1-tailed $P = 0.043$) (61). The large population-based trial in primary care practices seemed sufficiently powered to examine suicide deaths and found no reduction in suicide (70). Aside from this population-based trial, very few deaths occurred across the remaining trials, and deaths were frequently not reported so we could not conclude that suicide deaths decreased.

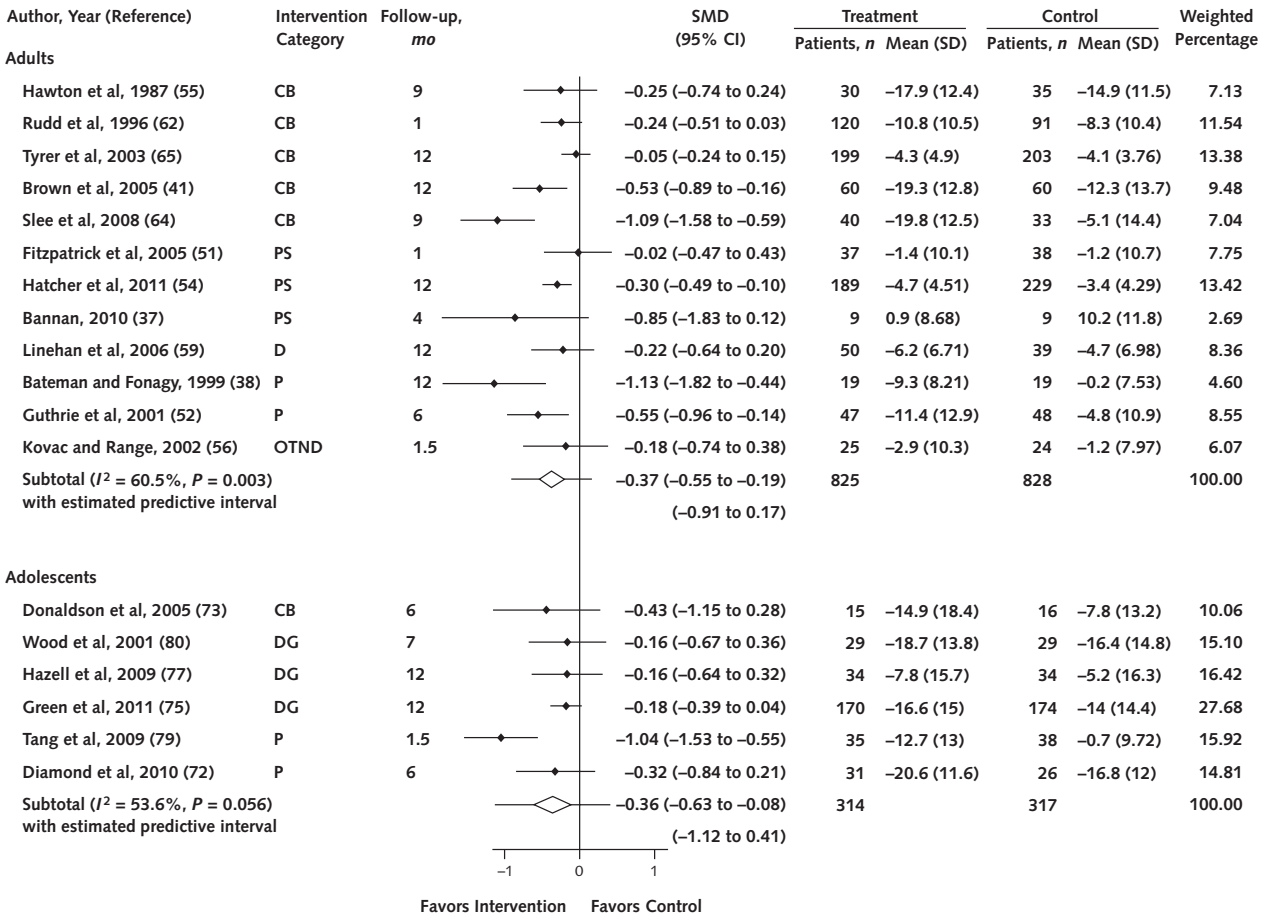
Figure 2. **Suicidal ideation in psychotherapy trials.**

Author, Year (Reference)	Intervention Category	Follow-up, *mo*	SMD (95% CI)	Treatment Patients, *n*	Treatment Mean Change in Suicidal Ideation From Baseline (SD)	Control Patients, *n*	Control Mean Change in Suicidal Ideation From Baseline (SD)	Weighted Percentage
Adults								
Rudd et al, 1996 (62)	CB	1	0.07 (–0.21 to 0.34)	120	–17.4 (12.3)	91	–18.2 (11.4)	21.79
Samaraweera et al, 2007 (63)	CB	3	–0.82 (–2.23 to 0.59)	5	–11 (9.61)	4	–2.2 (9.32)	1.38
Fitzpatrick et al, 2005 (51)	PS	1	–0.18 (–0.63 to 0.28)	37	–4.8 (8.67)	38	–3.3 (8.16)	10.80
Hatcher et al, 2011 (54)	PS	12	–0.14 (–0.34 to 0.05)	189	–7.6 (10.2)	229	–6.1 (10.4)	30.55
Bannan, 2010 (37)	PS	4	–0.62 (–1.57 to 0.33)	9	–10.8 (6.41)	9	–4.8 (11.3)	2.93
Linehan et al, 2006 (59)	D	12	0.18 (–0.24 to 0.60)	50	–21.9 (28.5)	39	–27.1 (28.6)	12.19
Guthrie et al, 2001 (52)	P	6	–0.46 (–0.87 to –0.06)	47	–8 (15.1)	48	–1.5 (12.5)	12.73
Kovac and Range, 2002 (56)	OTND	1.5	0.15 (–0.41 to 0.72)	25	–0.7 (26.4)	24	–4.3 (18.6)	7.62
Subtotal ($I^2 = 26.3\%$, $P = 0.219$) with estimated predictive interval			–0.10 (–0.27 to 0.06) (–0.46 to 0.26)	482		482		100.00
Adolescents								
Donaldson et al, 2005 (73)	CB	6	–0.15 (–0.85 to 0.56)	15	–25.4 (56.3)	16	–18.1 (38.9)	8.96
Wood et al, 2001 (80)	DG	7	–0.17 (–0.69 to 0.35)	28	–47.8 (53.3)	29	–37.9 (59.2)	14.00
Hazell et al, 2009 (77)	DG	12	–0.02 (–0.50 to 0.45)	34	–25.5 (50)	34	–24.2 (59.4)	15.74
Green et al, 2011 (75)	DG	12	–0.07 (–0.29 to 0.14)	169	–43 (54.1)	174	–39 (54.6)	31.82
Tang et al, 2009 (79)	P	1.5	–0.83 (–1.31 to –0.35)	35	–8.8 (11.6)	38	–0.5 (7.94)	15.56
Diamond et al, 2010 (72)	P	6	–0.19 (–0.71 to 0.33)	31	–3.8 (36.6)	26	3.6 (40.5)	13.92
Subtotal ($I^2 = 41.2\%$, $P = 0.131$) with estimated predictive interval			–0.22 (–0.46 to 0.02) (–0.84 to 0.40)	312		317		100.00



Weights are from random-effects analysis. CB = cognitive behavioral; D = dialectical; DG = developmental group; OTND = other therapy, nondirect; P = psychodynamic; PS = problem solving; SMD = standard mean difference.

Figure 3. **Depression in psychotherapy trials.**



Weights are from random-effects analysis. CB = cognitive behavioral; D = dialectical; DG = developmental group; OTND = other therapy, nondirect; P = psychodynamic; PS = problem solving; SMD = standard mean difference.

Thirteen of the 17 adult trials of enhanced usual care reported on suicide attempts, and all but 1 (53) found no difference in suicide attempts between 4 and 24 months (relative risk, 0.91 [CI, 0.80 to 1.02]; 13 trials; $n = 6592$; $I^2 = 0.0\%$) (**Figure 4**). These results are consistent with a small to moderate (20% at most) decrease in suicide attempts or no effect, compared with suicide attempt rates in the control groups ranging from 1% to 30% at 4 to 24 months.

Other health and intermediate outcomes were sparsely reported. The trials in older primary care patients reduced suicide attempts by 20% to 23% (42, 71), but the results were significant only in the larger trial (71).

Medication

We included 1 fair-quality, placebo-controlled trial of lithium to prevent suicide in patients with depression-spectrum disorders and a recent suicide attempt (167 randomly assigned patients) (57). Retention in this trial was low (only 31% of participants remained at the final 13-month follow-up). Although all 3 suicide deaths in the study occurred in placebo recipients, the groups did not differ in cumulative survival without a suicide attempt (hazard ratio, 0.517; $P = 0.21$, adjusted for age, sex, and prior suicide attempts) or suicidal ideation.

Harms of Treatment (Key Question 6)

Although no harms were identified in any of the adult trials, 4 of the 12 trials reporting suicide attempts in adolescents reported statistically nonsignificant increases in suicide attempts of 22% to 113% (73, 76, 77, 82). The possibility of harm cannot be ruled out in treatment of currently or recently suicidal adolescents.

The trial of lithium treatment reported that 13% of the lithium recipients withdrew from the study because of adverse effects, compared with 2% of placebo recipients. However, the statistical significance of this difference was not reported (57). Overall withdrawal rates for any reason were similar between groups. Specific adverse effects were not reported.

Discussion

Suicide risk can be difficult to accurately assess because some persons may attempt to conceal suicidal thoughts (creating false-negative results on screening) and some may express suicidal thoughts without serious intention to kill themselves (creating false-positive results on screening) (113). Even in high-risk populations, suicide is comparatively rare. Furthermore, the known risk factors associated with suicide are relatively common and individually not very strong predictors of suicide, even in persons at high risk. This combination of factors makes accurately predicting who will die by suicide on the basis of known risk factors very difficult. Nonetheless, suicide prevention is of high national importance, so it is critical to know whether primary care–based screening is likely to help reduce suicide in the United States by identifying patients in need of treatment and referring them to appropriate care. The **Table** summarizes the evidence from this review for all key questions.

Summary of Findings

Screening

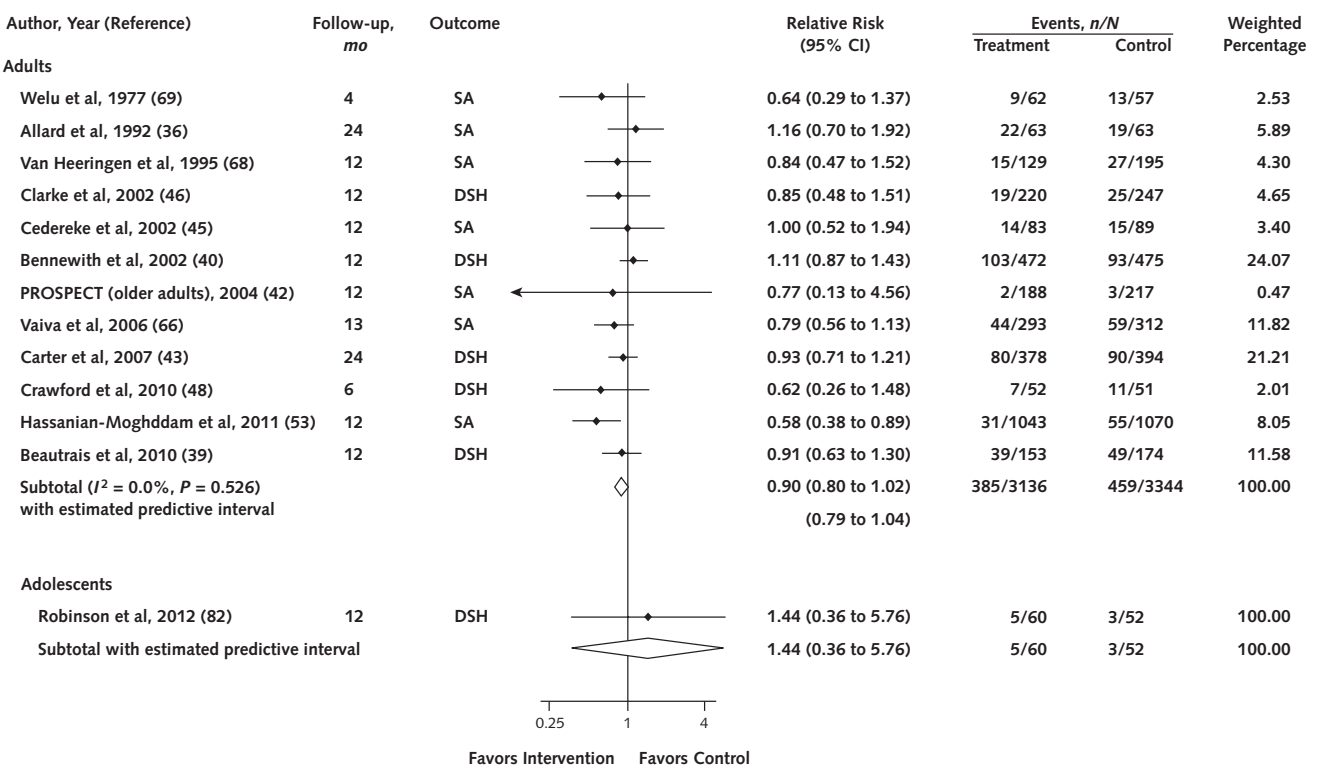
Although screening instruments have been developed for quick risk assessment, few studies have reported diagnostic accuracy characteristics of sensitivity, specificity, or related statistics relative to an interview with a clinician or other trained questioner. Minimal evidence (2 studies) suggested that screening tools can identify adults and older adults in primary care who are at increased risk for suicide, although these tools produce many false-positive results. Data on the accuracy of screening were even more limited in adolescents. Neither instrument performed well in adolescents, and the screening populations in which they were tested had relatively poor applicability to general primary care patients.

An important limitation of these data is the unknown accuracy of a full clinical interview in predicting suicide-related events, which are relatively rare and inherently difficult to predict (17). Instrument accuracy aside, we identified minimal data that examined whether suicide risk screening increased or decreased the likelihood of suicidality or other distress. Our results are consistent with those of an earlier review of suicide screening in adolescents, which concluded that data were very limited and future research was essential to determine whether and how screening can reduce suicide in young persons (114).

Treatment in Adults

Although the included studies involved too few deaths to determine whether a particular treatment reduced the risk for suicide deaths, they provided useful evidence about

Figure 4. **Suicide attempts in enhanced usual care studies.**



Weights are from random-effects analysis. DSH = deliberate self-harm; PROSPECT = Prevention of Suicide in Primary Care Elderly: Collaborative Trial; SA = suicide attempt.

Table. **Summary of Evidence**

Key Question	Population	Studies (Observations), *n*	Design	Major Limitations
Key question 1 (benefits of screening)	Adults and older adults	1 (443)	RCT	Single trial; only 2-wk follow-up; limited to adults
	Adolescents	No data	NA	NA
Key question 2 (accuracy of screening)	Adults	1 (1001)	Diagnostic accuracy	Few studies; no replication of specific screening instruments; only 1 study had brief period between screener and reference (≤24 h) (32); median time lag between tests ≥6 d in other studies
	Older adults	1 (626)	Diagnostic accuracy	
	Adolescents	2 (799)	Diagnostic accuracy	
Key question 3 (harms of screening)	Adults and older adults	1 (443)	RCT	Single trial with only 2-wk follow-up
	Adolescents	2 (2650)	RCT	Only 2 trials using different instruments; maximum follow-up of 2 d
Key questions 4 and 5 (benefits of treatment): psychotherapy	Adults	19 (2460)	RCT	Populations inconsistently described; no data specifically on racial/ethnic minority groups
	Older adults	No data specific to older adults	NA	NA
	Adolescents	12 (2392)	RCT	Little replication of interventions; populations inconsistently described; no data specifically on racial/ethnic minority groups
Key questions 4 and 5 (benefits of treatment): medication	Adults (lithium)	1 (167)	Placebo-controlled RCT	Only 1 trial with high attrition beyond 3 mo
	Older adults	No data	NA	NA
	Adolescents	No data	NA	NA
Key questions 4 and 5 (benefits of treatment): enhanced UC	Adults	13 (8555); 1 population-based study (~127 000 residents)	RCT and 1 CCT (70)	Populations inconsistently described; no data specifically for racial/ethnic minority groups; little replication of interventions
	Older adults	2 (22 360)	RCT	One trial limited to patients with depression, with insufficient power for suicide deaths and attempts (42); large study reported only composite outcome of suicide attempts plus ideation (71)
	Adolescents	1 (165)	RCT	Single trial with highly selective population; groups not entirely comparable at baseline; insufficient power for suicide attempts
Key question 6 (harms of treatment)	Adults	Psychotherapy: 3 (351) Medication: 1 (167) Enhanced UC: 2 (727) Plus remaining key question 4 and 5 trials for paradoxical effects	RCT	Sparse reporting of harms; methods of data collection not described
	Older adults	No data specific to older adults	NA	NA
	Adolescents	Psychotherapy: trials related to key questions 4 and 5 for paradoxical effects	RCT	No direct reporting of harms

CBT = cognitive behavioral therapy; CCT = controlled clinical trial; DBT = dialectic behavioral therapy; DSH = deliberate self-harm; ED = emergency department; GDS = Geriatric Depression Scale; NA = not applicable; RCT = randomized, controlled trial; SRS = Suicide Risk Scale; UC = usual care.

Table— **Continued**

Consistency	Applicability	Overall Quality	Summary of Findings
NA	Moderate: primary care patients with positive screening result for depression in the United Kingdom	Fair	Among primary care patients with positive screening result for depression, screening for suicide risk (compared with other health screening) did not reduce suicidal ideation after 2 wk; only 1 suicide was attempted in the trial. Data were not reported separately for older adults.
NA	NA	NA	No data.
NA	High: primary care in the United States (32)	Fair	Three suicide items were examined separately; sensitivity was ≥83% and specificity was ≥81% relative to a nurse-administered structured interview on the same day.
NA	High: primary care in the United States (33)	Fair	Sensitivity and specificity of suicide-related items on the GDS were ≤80% for suicidal ideation in the past 2 wk.
Low	Low to moderate: at risk for dropout from U.S. high school (31); Finnish mental health patients (30)	Fair	The study with the best applicability to U.S. primary care reported sensitivity of 87% and specificity of 60% for the SRS.
NA	Moderate: primary care patients in the United Kingdom	Fair	There was no increase in suicide attempts or ideation after screening, and a slightly higher proportion of those who were screened withdrew consent for follow-up (6.6% of screened vs. 2.2% of unscreened). Data were not reported separately for older adults.
Moderate	Low to moderate: Australian and U.S. high school students screened in classroom setting	Fair	There were no adverse effects on mood. Australian youths with a positive screening result found screening more distressing and less worthwhile than those with a negative screening result.
Moderate	Low to moderate: many conducted outside of the United States; only trial that involved population-based screening was done in Sri Lanka (63)	Fair	Sample sizes were insufficient to determine group differences in suicide deaths. Psychotherapy reduced the risk for suicide attempts by 32% (relative risk, 0.68 [95% CI, 0.56 to 0.83]). Pooled effects showed a small benefit for depression but not suicidal ideation. Most data were from trials of CBT or related interventions.
NA	NA	NA	No trials were limited to older adults, and no subgroup analyses examined effects in older adults.
Moderate	Low to moderate: many done outside of United States; the few involving screening were conducted in school settings	Good (developmental group therapy) Fair (other therapies)	Data on suicide deaths were insufficient. Few approaches reduced suicide attempts or ideation compared with UC. Pooled effects showed a small benefit for depression but not suicidal ideation. Some trials showed a nonsignificant increase in suicide attempts (22% to 113%), raising the possibility of harm.
NA	Moderate: German adults identified through ED and inpatient screening	Fair	There were 3 suicide deaths, all in the placebo group. A short-term nonsignificant reduction in suicide attempts was seen (hazard ratio for time to suicide attempt, 0.52; $P = 0.20$). There was no benefit for suicidal ideation compared with placebo.
NA	NA	NA	No trials were limited to older adults, and no subgroup analyses examined effects in older adults.
NA	NA	NA	No trials were limited to adolescents, and no subgroup analyses examined effects in adolescents.
Moderate	Low to moderate: many trials conducted outside of the United States	Fair	One of 7 trials found reduced risk for death at 2-y follow-up (1.8% in intervention group vs. 3.5% in control group) in participants who were sent periodic letters expressing interest in their well-being and among persons who refused treatment after a suicide attempt, but effects were reduced and no longer significant beyond 2 y (61). Reductions in suicide attempts or other health outcomes were generally not seen. Suicidal ideation and depression were rarely reported.
NA	High: one done in general primary care patients (71); the other identified participants through primary screening for depression (42)	Fair	Primary care–based intervention in depressed older adults that included a care manager showed benefits for depression and mixed results for suicidal ideation but no benefit for suicide deaths, attempts, or nonsuicidal deaths (42). Education and training for providers reduced the risk for suicide attempts and ideation combined by 20% in a general primary care population of older adults but had no effect on depression (71).
NA	Low: highly selective population in Australia	Fair	There were no group differences in suicide attempts, suicidal ideation, depression, or hopelessness.
Moderate	Low to moderate: most trials reporting on harms were done in the United States, but 2 of the U.S-based trials were in university students participating in the study for class credit	Fair	No psychotherapy or enhanced UC trials identified any harmful effects. Participants receiving lithium were more likely to withdraw from the study because of adverse effects (13% receiving lithium vs. 2% receiving placebo). Several trials for key questions 4 and 5 reported statistically nonsignificant increases in suicide attempts or DSH, although most of these trials had few events and wide CIs. One trial in the United Kingdom of a practice-based intervention found a 32% (CI, 1.02 to 1.70) increase in the odds of DSH in patients with no history of self-harm.
NA	NA	NA	No trials were limited to older adults, and no subgroup analyses examined effects in older adults.
Low	Low to moderate: many conducted outside of the United States; the few involving screening were conducted in school settings	Good (developmental group therapy) Fair (other therapies)	No trials directly reported harms; 4 of 11 trials related to key questions 4 and 5 reported statistically nonsignificant increases of 22% or more in suicide attempts or self-harm. The trial with the largest increase was small ($n = 31$ with follow-up) and had few events but reported 22% to 33% increases in suicide attempts in the remaining 2 trials (73).

attempts. Combined assessment of all psychotherapy studies found that psychotherapy targeting suicide prevention reduced the risk for attempts by an estimated average of 32%. Psychotherapy also showed small beneficial effects on depression, although other beneficial outcomes were sparsely reported or showed no consistent group differences. Interventions that primarily focused on enhancing usual care had little effect on suicide deaths, suicide attempts, or related outcomes.

The participants in the included adult treatment trials who reported suicide attempts were at high risk for suicide, usually based on a history of multiple attempts, which resulted in a very high incidence of suicide attempts (for example, 11% to 68% in the control groups of the psychotherapy trial). This finding contrasts with the screening accuracy studies that were done in general primary care patients, where attempt rates are substantially lower (probably <1% over 1 year) (115). Thus, the indirect evidence linking screening accuracy with benefits of treatment is not good.

There are several possible explanations for why psychotherapy seemed to be effective in adults, whereas practice-based approaches or other enhanced usual care interventions were not. First, the care provided in enhanced usual care trials was generally less time-intensive than that provided in the psychotherapy trials, which may be associated with smaller effects. In addition, the enhanced usual care trials may have included slightly lower-risk samples than the psychotherapy trials, as evidenced by a smaller proportion of control group participants who attempted suicide at follow-up (0.5% to 28% of control participants).

Alternatively, usual care may have been more effective in these studies, which would also attenuate the effect (but which we could not examine with available evidence). Assuming that these interventions are less likely, on average, to be effective, some of the enhanced usual care interventions may nevertheless be useful components of a larger system-wide approach that includes psychotherapy.

We found minimal data on medication's effectiveness in preventing suicidal behavior. These data were limited to a single, short-term, fair- to poor-quality lithium trial that had high attrition. Lithium is commonly used for treating bipolar disorder and has been shown to reduce the risk for suicide in observational studies (116, 117) and in controlled trials of patients with unipolar and bipolar depression who were not necessarily suicidal, compared with placebo or other agents (pooled Peto odds ratio of randomized trials, 0.26 [CI, 0.09 to 0.77]) (118). We found no studies on lithium use in patients identified through screening for suicidality. Lithium is associated with important adverse effects that were not described in the 1 trial included in this review (119–121).

Our findings were generally consistent with other recent reviews of treatment to prevent suicide or self-harm (122–125). Each of these recent reviews generally included similar bodies of research but grouped the trials differently. Nonetheless, they all found insufficient evidence for an effect on suicide deaths because of the small number of events. They also generally found small to moderate (usually nonsignificant) reductions in suicide attempts or self-harm, and all were limited by the included trials' sparse reporting of other outcomes. The most comprehensive of these reviews, published by the National Institute for Health and Clinical Excellence, concluded that psychological and psychosocial interventions may be effective compared with usual care. However, variations in populations, treatment methods, and comparison groups created uncertainty.

Treatment in Adolescents

Psychotherapy did not reduce the risk for suicide attempts in adolescents in contrast to adults. Data did not allow us to rule out the possibility that the risk for suicide attempts was paradoxically increased. Psychotherapy showed small beneficial effects on depression for adolescents, as it did for adults. Other outcomes either showed no consistent beneficial effects or were sparsely reported.

The research on iatrogenic suicidality related to antidepressants suggests that adolescents react differently from adults to pharmacologic treatment (126). Research also suggests that risk factors and methods of committing suicide differ between younger versus older teenagers (127). Thus, different age groups seem to have different treatment needs and risks. The evidence base in adolescents is still small, and few approaches have been replicated. Replication is important, as shown by the trials of developmental behavior therapy in this review; beneficial results in a first trial (80) were not replicated in 2 subsequent good-quality trials (75, 77). Overall, our findings were consistent with the National Institute for Health and Clinical Excellence review, in which only 1 trial showed a beneficial effect in adolescents (125).

Psychotherapy trials primarily involved high-risk youth, most with a recent suicide attempt or acute suicidal ideation. These samples are consistent with those in the screening studies but may have low applicability to youth identified through primary care screening. Suicidal youth need treatment, but caution, close monitoring, and care coordination are also warranted (128). These trials suggest that active parental involvement in treatment may be important. Further research is urgently needed.

Limitations

One important limitation is that most of the treatment literature was in high-risk populations, so the generalizability of these results to screening-detected populations is unknown. In addition, there was very little evidence on the effectiveness of treatment in older adults and racial or ethnic minorities. Differences in suicide rates among ethnic groups suggest that cultures vary, both in motivation for and meaning of suicide; thus, culturally tailored risk-based screening and interventions may be important (129).

The lack of power and reports of suicide death is another important limitation. Suicide attempts and self-harm

are not good surrogates for suicide death. As a result, we cannot assume that the reduced attempts seen with psychotherapy interventions will decrease the number of deaths (130). Because suicide death is relatively rare and predicting such deaths is difficult, very large collaborative trials are probably required for sufficient power to see an effect on suicide deaths (131). For example, if all participants in all psychotherapy trials that reported suicide deaths were treated as a single study that found a 57% reduction (0.62% in the intervention group vs. 1.44% in the control group), 4 times the number of actual participants would be needed to achieve statistical significance.

Power would probably be even more dramatically limited in studies of screening-detected patients. Assuming an annual suicide rate of 100 per 100 000 persons (twice as high as that of older white men, who have the highest rates of any age, sex, or racial subgroup) and the ability of a treatment to reduce suicide by 40%, more than 83 000 persons per group would be required to generate a statistically significant result. Thus, building a coherent chain of evidence from broad population-based screening through treatment to reduce suicide deaths will be difficult, because treatment studies will necessarily be limited to very high-risk groups in order to have sufficient power to detect a treatment effect.

Conclusion

Suicide prevention is a topic of high national importance in which primary care providers may have a role. Although evidence was limited, primary care–feasible screening tools could probably identify adult patients at increased risk for suicide who may need treatment. A larger body of evidence showed that psychotherapy can reduce the risk for suicide attempts in high-risk populations.

Unfortunately, whether similar benefits would be found in screening-detected patients is unknown. There was little evidence on the accuracy of screening in adolescents, and what little data are available showed that treatment did not demonstrate a positive effect. Results in adolescents also did not rule out the possibility of harm (that is, increased suicide attempts) with some forms of psychotherapy. More research on how to effectively identify and treat adolescents at increased risk for suicide is urgently needed. There is also a need for research on the effect of psychotherapy to prevent suicide attempts in primary care patients who screen positive for suicide risk, as well as whether treatments actually lead to lower suicide death rates, even in high-risk populations.

From Kaiser Permanente Northwest, Portland, Oregon; University of North Carolina School of Medicine, Chapel Hill, North Carolina; and Pharmaceutical Research and Manufacturers of America, Washington, DC.

Note: Ms. Soh accepted a position at the Pharmaceutical Research and Manufacturers of America during the finalization of the full report and drafting and final submission of this manuscript; she contributed most of her intellectual content to this review while she was employed with the Oregon Evidence-based Practice Center at Kaiser Permanente Center for Health Research.

Disclaimer: The views and opinions expressed in this article are those of the authors and do not necessarily reflect the views of the Pharmaceutical Research and Manufacturers of America. The findings and conclusions in this document are those of the authors, who are responsible for its content, and do not necessarily represent the views of AHRQ. No statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

Acknowledgment: The authors thank the AHRQ staff; the USPSTF; J. Michael Bostwick, MD; David A. Brent, MD; Gregory Simon, MD, MPH, who provided expert review of the report; Kevin Lutz, MFA; Daphne Plaut, MLS; and Heather Baird at the Kaiser Permanente Center for Health Research.

Grant Support: By the Oregon Evidence-based Practice Center under contract to AHRQ, Rockville, Maryland (contract HHS-290-2007-10057-I).

Potential Conflicts of Interest: Dr. O'Connor: *Grant (money to institution):* AHRQ; *Support for travel to meetings for the study or other purposes (money to institution):* AHRQ; *Payment for writing or reviewing the manuscript (money to institution):* AHRQ; *Provision of writing assistance, medicines, equipment, or administrative support (money to institution):* AHRQ. Dr. Gaynes: *Grant (money to institution):* AHRQ. Ms. Burda: *Grant (money to institution):* AHRQ; *Consultancy:* Oregon Health & Science University; *Employment:* Howard Hughes Medical Institute, Vollum Institute (Oregon Health & Science University); *Other:* Pennsylvania State University, Howard Hughes Medical Institute. Ms. Soh: *Grant (money to institution):* AHRQ; *Support for travel to meetings for the study or other purposes (money to institution):* AHRQ; *Provision of writing assistance, medicines, equipment, or administrative support (money to institution):* AHRQ. Dr. Whitlock: *Grant (money to institution):* AHRQ; *Support for travel to meetings for the study or other purposes (money to institution):* AHRQ; *Payment for writing or reviewing the manuscript (money to institution):* AHRQ; *Provision of writing assistance, medicines, equipment, or administrative support (money to institution):* AHRQ. Disclosures can also be viewed at www.acponline.org/authors/icmje/ConflictOfInterestForms.do?msNum=M12-2880.

Corresponding Author: Elizabeth O'Connor, PhD, Center for Health Research, Kaiser Permanente NW, 3800 North Interstate Avenue, Portland, OR 97227; e-mail, elizabeth.oconnor@kpchr.org.

Current author addresses and author contributions are available at www.annals.org.

References

1. **Centers for Disease Control and Prevention.** Web-based Injury Statistics Query and Reporting System (WISQARS) Injury Mortality Reports, 1999-2009. Atlanta, GA: Centers for Disease Control and Prevention; 2012.

2. **Centers for Disease Control and Prevention.** Web-based Injury Statistics Query and Reporting System (WISQARS) Leading Causes of Death Reports, 1999-2009. National Center for Injury Prevention and Control. 2012. Accessed at www.cdc.gov/injury/wisqars/leading_causes_death.html on 6 May 2012.

3. **Centers for Disease Control and Prevention.** Years of potential life lost (YPLL) before age 85, 2009. National Center for Injury Prevention and Control. 2012. Accessed at http://webappa.cdc.gov/sasweb/ncipc/ypll10.html on 22 June 2012.

4. **Li Z, Page A, Martin G, Taylor R.** Attributable risk of psychiatric and socioeconomic factors for suicide from individual-level, population-based studies: a systematic review. Soc Sci Med. 2011;72:608-16. [PMID: 21211874]

5. **Nock MK, Hwang I, Sampson N, Kessler RC, Angermeyer M, Beautrais A, et al.** Cross-national analysis of the associations among mental disorders and suicidal behavior: findings from the WHO World Mental Health Surveys. PLoS Med. 2009;6:e1000123. [PMID: 19668361]
6. **Bolton JM, Robinson J.** Population-attributable fractions of Axis I and Axis II mental disorders for suicide attempts: findings from a representative sample of the adult, noninstitutionalized US population. Am J Public Health. 2010;100:2473-80. [PMID: 21068419]
7. **Hamza CA, Stewart SL, Willoughby T.** Examining the link between nonsuicidal self-injury and suicidal behavior: a review of the literature and an integrated model. Clin Psychol Rev. 2012;32:482-95. [PMID: 22717336]
8. **Ekeberg O, Ellingsen O, Jacobsen D.** Suicide and other causes of death in a five-year follow-up of patients treated for self-poisoning in Oslo. Acta Psychiatr Scand. 1991;83:432-7. [PMID: 1882694]
9. **Isometsä ET, Lönnqvist JK.** Suicide attempts preceding completed suicide. Br J Psychiatry. 1998;173:531-5. [PMID: 9926085]
10. **Nielsen B, Wang AG, Brille-Brahe U.** Attempted suicide in Denmark. IV. A five-year follow-up. Acta Psychiatr Scand. 1990;81:250-4. [PMID: 2343748]
11. **Nordström P, Asberg M, Aberg-Wistedt A, Nordin C.** Attempted suicide predicts suicide risk in mood disorders. Acta Psychiatr Scand. 1995;92:345-50. [PMID: 8619338]
12. **Dube SR, Anda RF, Felitti VJ, Chapman DP, Williamson DF, Giles WH.** Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: findings from the Adverse Childhood Experiences Study. JAMA. 2001;286:3089-96. [PMID: 11754674]
13. **Séguin M, Renaud J, Lesage A, Robert M, Turecki G.** Youth and young adult suicide: a study of life trajectory. J Psychiatr Res. 2011;45:863-70. [PMID: 21636096]
14. **Tidemalm D, Runeson B, Waern M, Frisell T, Carlström E, Lichtenstein P, et al.** Familial clustering of suicide risk: a total population study of 11.4 million individuals. Psychol Med. 2011:1-8. [PMID: 21733212]
15. **Garssen J, Deerenberg I, Mackenbach JP, Kerkhof A, Kunst AE.** Familial risk of early suicide: variations by age and sex of children and parents. Suicide Life Threat Behav. 2011;41:585-93. [PMID: 21815914]
16. **Steele MM, Doey T.** Suicidal behaviour in children and adolescents. part 1: etiology and risk factors. Can J Psychiatry. 2007;52:21S-33S. [PMID: 17824350]
17. Practice guideline for the assessment and treatment of patients with suicidal behaviors. Am J Psychiatry. 2003;160:1-60. [PMID: 14649920]
18. **Luoma JB, Martin CE, Pearson JL.** Contact with mental health and primary care providers before suicide: a review of the evidence. Am J Psychiatry. 2002; 159:909-16. [PMID: 12042175]
19. **McCarty CA, Russo J, Grossman DC, Katon W, Rockhill C, McCauley E, et al.** Adolescents with suicidal ideation: health care use and functioning. Acad Pediatr. 2011;11:422-6. [PMID: 21396897]
20. **McNeill YL, Gillies ML, Wood SF.** Fifteen year olds at risk of parasuicide or suicide: how can we identify them in general practice? Fam Pract. 2002;19:461-5. [PMID: 12356694]
21. **Gaynes BN, West SL, Ford CA, Frame P, Klein J, Lohr KN; U.S. Preventive Services Task Force.** Screening for suicide risk in adults: a summary of the evidence for the U.S. Preventive Services Task Force. Ann Intern Med. 2004; 140:822-35. [PMID: 15148072]
22. **O'Connor EA, Gaynes BN, Burda BU, Williams C, Whitlock EP.** Screening for Suicide Risk in Primary Care: A Systematic Evidence Review for the U.S. Preventive Services Task Force. Rockville, MD: Agency for Healthcare Research and Quality; 2012.
23. **Harris RP, Helfand M, Woolf SH, Lohr KN, Mulrow CD, Teutsch SM, et al; Methods Work Group, Third US Preventive Services Task Force.** Current methods of the US Preventive Services Task Force: a review of the process. Am J Prev Med. 2001;20:21-35. [PMID: 11306229]
24. **Whiting P, Rutjes AW, Reitsma JB, Bossuyt PM, Kleijnen J.** The development of QUADAS: a tool for the quality assessment of studies of diagnostic accuracy included in systematic reviews. BMC Med Res Methodol. 2003;3:25. [PMID: 14606960]
25. **Borenstein M, Hedges LV, Higgins JPT, Rothstein HR.** Introduction to Meta-analysis. 1st ed. West Sussex, United Kingdom: J Wiley; 2009.
26. **Higgins JP, Thompson SG.** Quantifying heterogeneity in a meta-analysis. Stat Med. 2002;21:1539-58. [PMID: 12111919]
27. Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0. West Sussex, United Kingdom: Cochrane Collaboration; 2012.
28. **Cohen J.** Statistical Power Analysis for the Behavioral Sciences. 2nd ed. Hillsdale, NJ: Lawrence Earlbaum Associates; 1988.
29. **Crawford MJ, Thana L, Methuen C, Ghosh P, Stanley SV, Ross J, et al.** Impact of screening for risk of suicide: randomised controlled trial. Br J Psychiatry. 2011;198:379-84. [PMID: 21525521]
30. **Holi MM, Pelkonen M, Karlsson L, Tuisku V, Kiviruusu O, Ruuttu T, et al.** Detecting suicidality among adolescent outpatients: evaluation of trained clinicians' suicidality assessment against a structured diagnostic assessment made by trained raters. BMC Psychiatry. 2008;8:97. [PMID: 19116040]
31. **Thompson EA, Eggert LL.** Using the suicide risk screen to identify suicidal adolescents among potential high school dropouts. J Am Acad Child Adolesc Psychiatry. 1999;38:1506-14. [PMID: 10596250]
32. **Olfson M, Weissman MM, Leon AC, Sheehan DV, Farber L.** Suicidal ideation in primary care. J Gen Intern Med. 1996;11:447-53. [PMID: 8872781]
33. **Heisel MJ, Duberstein PR, Lyness JM, Feldman MD.** Screening for suicide ideation among older primary care patients. J Am Board Fam Med. 2010;23: 260-9. [PMID: 20207936]
34. **Robinson J, Pan Yuen H, Martin C, Hughes A, Baksheev GN, Dodd S, et al.** Does screening high school students for psychological distress, deliberate self-harm, or suicidal ideation cause distress—and is it acceptable? An Australian-based study. Crisis. 2011;32:254-63. [PMID: 21940259]
35. **Gould MS, Marrocco FA, Kleinman M, Thomas JG, Mostkoff K, Cote J, et al.** Evaluating iatrogenic risk of youth suicide screening programs: a randomized controlled trial. JAMA. 2005;293:1635-43. [PMID: 15811983]
36. **Allard R, Marshall M, Plante MC.** Intensive follow-up does not decrease the risk of repeat suicide attempts. Suicide Life Threat Behav. 1992;22:303-14. [PMID: 1440744]
37. **Bannan N.** Group-based problem-solving therapy in self-poisoning females: a pilot study. Counseling and Psychotherapy Research. 2010;10:201-13.
38. **Bateman A, Fonagy P.** Effectiveness of partial hospitalization in the treatment of borderline personality disorder: a randomized controlled trial. Am J Psychiatry. 1999;156:1563-9. [PMID: 10518167]
39. **Beautrais AL, Gibb SJ, Faulkner A, Fergusson DM, Mulder RT.** Postcard intervention for repeat self-harm: randomised controlled trial. Br J Psychiatry. 2010;197:55-60. [PMID: 20592434]
40. **Bennewith O, Stocks N, Gunnell D, Peters TJ, Evans MO, Sharp DJ.** General practice based intervention to prevent repeat episodes of deliberate self harm: cluster randomised controlled trial. BMJ. 2002;324:1254-7. [PMID: 12028981]
41. **Brown GK, Ten Have T, Henriques GR, Xie SX, Hollander JE, Beck AT.** Cognitive therapy for the prevention of suicide attempts: a randomized controlled trial. JAMA. 2005;294:563-70. [PMID: 16077050]
42. **Bruce ML, Ten Have TR, Reynolds CF 3rd, Katz II, Schulberg HC, Mulsant BH, et al.** Reducing suicidal ideation and depressive symptoms in depressed older primary care patients: a randomized controlled trial. JAMA. 2004; 291:1081-91. [PMID: 14996777]
43. **Carter GL, Clover K, Whyte IM, Dawson AH, D'Este C.** Postcards from the EDge: 24-month outcomes of a randomised controlled trial for hospital-treated self-poisoning. Br J Psychiatry. 2007;191:548-53. [PMID: 18055960]
44. **Carter GL, Willcox CH, Lewin TJ, Conrad AM, Bendit N.** Hunter DBT project: randomized controlled trial of dialectical behaviour therapy in women with borderline personality disorder. Aust N Z J Psychiatry. 2010;44:162-73. [PMID: 20113305]
45. **Cedereke M, Monti K, Ojehagen A.** Telephone contact with patients in the year after a suicide attempt: does it affect treatment attendance and outcome? A randomised controlled study. Eur Psychiatry. 2002;17:82-91. [PMID: 11973116]
46. **Clarke T, Baker P, Watts CJ, Williams K, Feldman RA, Sherr L.** Self-harm in adults: a randomised controlled trial of nurse-led case management versus routine care only. Journal of Mental Health. 2002;11:167-76.
47. **Comtois KA, Jobes DA, O'Connor SS, Atkins DC, Janis K, Chessen CE, et al.** Collaborative assessment and management of suicidality (CAMS): feasibility trial for next-day appointment services. Depress Anxiety. 2011;28:963-72. [PMID: 21948348]
48. **Crawford MJ, Csipke E, Brown A, Reid S, Nilsen K, Redhead J, et al.** The effect of referral for brief intervention for alcohol misuse on repetition of deliberate self-harm: an exploratory randomized controlled trial. Psychol Med. 2010; 40:1821-8. [PMID: 20047702]
49. **Currier GW, Fisher SG, Caine ED.** Mobile crisis team intervention to enhance linkage of discharged suicidal emergency department patients to outpa-

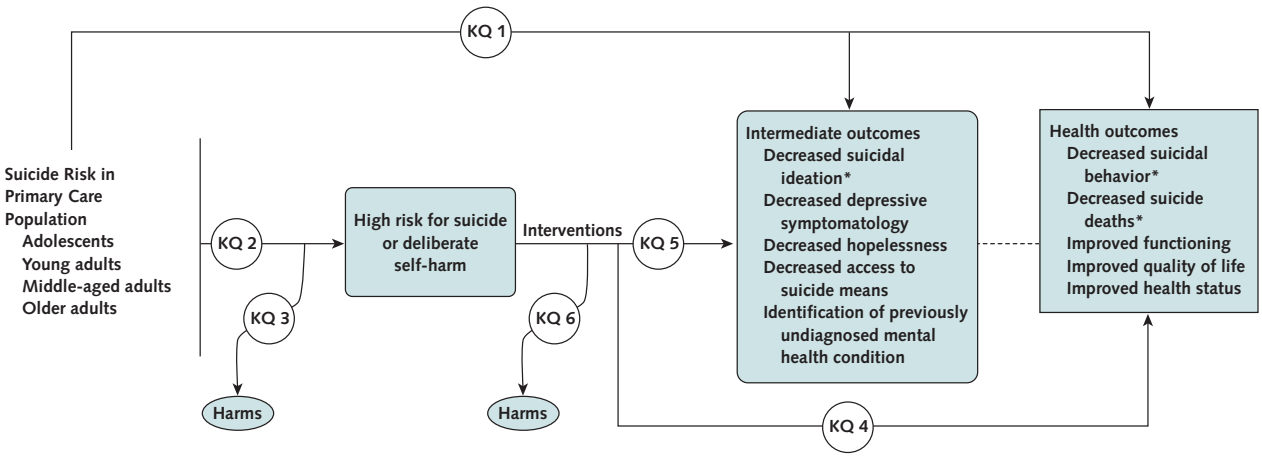
tient psychiatric services: a randomized controlled trial. Acad Emerg Med. 2010; 17:36-43. [PMID: 20015106]
50. **Evans K, Tyrer P, Catalan J, Schmidt U, Davidson K, Dent J, et al.** Manual-assisted cognitive-behaviour therapy (MACT): a randomized controlled trial of a brief intervention with bibliotherapy in the treatment of recurrent deliberate self-harm. Psychol Med. 1999;29:19-25. [PMID: 10077290]
51. **Fitzpatrick KK, Witte TK, Schmidt NB.** Randomized controlled trial of a brief problem-orientation intervention for suicidal ideation. Behav Ther. 2005; 36:323-33.
52. **Guthrie E, Kapur N, Mackway-Jones K, Chew-Graham C, Moorey J, Mendel E, et al.** Randomised controlled trial of brief psychological intervention after deliberate self poisoning. BMJ. 2001;323:135-8. [PMID: 11463679]
53. **Hassanian-Moghaddam H, Sarjami S, Kolahi AA, Carter GL.** Postcards in Persia: randomised controlled trial to reduce suicidal behaviours 12 months after hospital-treated self-poisoning. Br J Psychiatry. 2011;198:309-16. [PMID: 21343332]
54. **Hatcher S, Sharon C, Parag V, Collins N.** Problem-solving therapy for people who present to hospital with self-harm: Zelen randomised controlled trial. Br J Psychiatry. 2011;199:310-6. [PMID: 21816868]
55. **Hawton K, McKeown S, Day A, Martin P, O'Connor M, Yule J.** Evaluation of out-patient counselling compared with general practitioner care following overdoses. Psychol Med. 1987;17:751-61. [PMID: 2819914]
56. **Kovac SH, Range LM.** Does writing about suicidal thoughts and feelings reduce them? Suicide Life Threat Behav. 2002;32:428-40. [PMID: 12501967]
57. **Lauterbach E, Felber W, Müller-Oerlinghausen B, Ahrens B, Bronisch T, Meyer T, et al.** Adjunctive lithium treatment in the prevention of suicidal behaviour in depressive disorders: a randomised, placebo-controlled, 1-year trial. Acta Psychiatr Scand. 2008;118:469-79. [PMID: 18808400]
58. **Linehan MM, Armstrong HE, Suarez A, Allmon D, Heard HL.** Cognitive-behavioral treatment of chronically parasuicidal borderline patients. Arch Gen Psychiatry. 1991;48:1060-4. [PMID: 1845222]
59. **Linehan MM, Comtois KA, Murray AM, Brown MZ, Gallop RJ, Heard HL, et al.** Two-year randomized controlled trial and follow-up of dialectical behavior therapy vs therapy by experts for suicidal behaviors and borderline personality disorder. Arch Gen Psychiatry. 2006;63:757-66. [PMID: 16818865]
60. **Marasinghe RB, Edirippulige S, Kavanagh D, Smith A, Jiffry MT.** Effect of mobile phone-based psychotherapy in suicide prevention: a randomized controlled trial in Sri Lanka. J Telemed Telecare. 2012;18:151-5. [PMID: 22362830]
61. **Motto JA, Bostrom AG.** A randomized controlled trial of postcrisis suicide prevention. Psychiatr Serv. 2001;52:828-33. [PMID: 11376235]
62. **Rudd MD, Rajab MH, Orman DT, Joiner T, Stulman DA, Dixon W.** Effectiveness of an outpatient intervention targeting suicidal young adults: preliminary results. J Consult Clin Psychol. 1996;64:179-90. [PMID: 8907098]
63. **Samaraweera S, Sivayogan S, Sumathipala A, Bhugra D, Siribaddana S.** RCT of cognitive behaviour therapy in active suicidal ideation—as feasibility study in Sri Lanka. European Journal of Psychiatry. 2007;21:175-8.
64. **Slee N, Garnefski N, van der Leeden R, Arensman E, Spinhoven P.** Cognitive-behavioural intervention for self-harm: randomised controlled trial. Br J Psychiatry. 2008;192:202-11. [PMID: 18310581]
65. **Tyrer P, Thompson S, Schmidt U, Jones V, Knapp M, Davidson K, et al.** Randomized controlled trial of brief cognitive behaviour therapy versus treatment as usual in recurrent deliberate self-harm: the POPMACT study. Psychol Med. 2003;33:969-76. [PMID: 12946081]
66. **Vaiva G, Vaiva G, Ducrocq F, Meyer P, Mathieu D, Philippe A, et al.** Effect of telephone contact on further suicide attempts in patients discharged from an emergency department: randomised controlled study. BMJ. 2006;332: 1241-5. [PMID: 16735333]
67. **van den Bosch LM, Koeter MW, Stijnen T, Verheul R, van den Brink W.** Sustained efficacy of dialectical behaviour therapy for borderline personality disorder. Behav Res Ther. 2005;43:1231-41. [PMID: 16005708]
68. **Van Heeringen C, Jannes S, Buylaert W, Henderick H, De Bacquer D, Van Remoortel J.** The management of non-compliance with referral to outpatient after-care among attempted suicide patients: a controlled intervention study. Psychol Med. 1995;25:963-70. [PMID: 8588015]
69. **Welu TC.** A follow-up program for suicide attempters: evaluation of effectiveness. Suicide Life Threat Behav. 1977;7:17-20. [PMID: 206990]
70. **Szanto K, Kalmar S, Hendin H, Rihmer Z, Mann JJ.** A suicide prevention program in a region with a very high suicide rate. Arch Gen Psychiatry. 2007;64: 914-20. [PMID: 17679636]
71. **Almeida OP, Pirkis J, Kerse N, Sim M, Flicker L, Snowdon J, et al.** A randomized trial to reduce the prevalence of depression and self-harm behavior in older primary care patients. Ann Fam Med. 2012;10:347-56. [PMID: 22778123]
72. **Diamond GS, Wintersteen MB, Brown GK, Diamond GM, Gallop R, Shelef K, et al.** Attachment-based family therapy for adolescents with suicidal ideation: a randomized controlled trial. J Am Acad Child Adolesc Psychiatry. 2010;49:122-31. [PMID: 20215934]
73. **Donaldson D, Spirito A, Esposito-Smythers C.** Treatment for adolescents following a suicide attempt: results of a pilot trial. J Am Acad Child Adolesc Psychiatry. 2005;44:113-20. [PMID: 15689724]
74. **Eggert LL, Thompson EA, Randell BP, Pike KC.** Preliminary effects of brief school-based prevention approaches for reducing youth suicide—risk behaviors, depression, and drug involvement. J Child Adolesc Psychiatr Nurs. 2002;15:48-64. [PMID: 12083753]
75. **Green JM, Wood AJ, Kerfoot MJ, Trainor G, Roberts C, Rothwell J, et al.** Group therapy for adolescents with repeated self harm: randomised controlled trial with economic evaluation. BMJ. 2011;342:d682. [PMID: 21459975]
76. **Greenfield B, Larson C, Hechtman L, Rousseau C, Platt R.** A rapid-response outpatient model for reducing hospitalization rates among suicidal adolescents. Psychiatr Serv. 2002;53:1574-9. [PMID: 12461218]
77. **Hazell PL, Martin G, McGill K, Kay T, Wood A, Trainor G, et al.** Group therapy for repeated deliberate self-harm in adolescents: failure of replication of a randomized trial. J Am Acad Child Adolesc Psychiatry. 2009;48:662-70. [PMID: 19454922]
78. **King CA, Klaus N, Kramer A, Venkataraman S, Quinlan P, Gillespie B.** The Youth-Nominated Support Team-Version II for suicidal adolescents: A randomized controlled intervention trial. J Consult Clin Psychol. 2009;77:880-93. [PMID: 19803568]
79. **Tang TC, Jou SH, Ko CH, Huang SY, Yen CF.** Randomized study of school-based intensive interpersonal psychotherapy for depressed adolescents with suicidal risk and parasuicide behaviors. Psychiatry Clin Neurosci. 2009;63:463-70. [PMID: 19531111]
80. **Wood A, Trainor G, Rothwell J, Moore A, Harrington R.** Randomized trial of group therapy for repeated deliberate self-harm in adolescents. J Am Acad Child Adolesc Psychiatry. 2001;40:1246-53. [PMID: 11699797]
81. **Hooven C, Walsh E, Pike KC, Herting JR.** Promoting CARE: including parents in youth suicide prevention. Fam Community Health. 2012;35:225-35. [PMID: 22617413]
82. **Robinson J, Yuen HP, Gook S, Hughes A, Cosgrave E, Killackey E, et al.** Can receipt of a regular postcard reduce suicide-related behaviour in young help seekers? A randomized controlled trial. Early Interv Psychiatry. 2012;6:145-52. [PMID: 22260366]
83. **Esposito-Smythers C, Spirito A, Kahler CW, Hunt J, Monti P.** Treatment of co-occurring substance abuse and suicidality among adolescents: a randomized trial. J Consult Clin Psychol. 2011;79:728-39. [PMID: 22004303]
84. **Chanen AM, Jackson HJ, McCutcheon LK, Jovev M, Dudgeon P, Yuen HP, et al.** Early intervention for adolescents with borderline personality disorder using cognitive analytic therapy: randomised controlled trial. Br J Psychiatry. 2008;193:477-84. [PMID: 19043151]
85. **Tepper M, Whitehead J.** Cognitive therapy and preventing suicide attempts [Letter]. JAMA. 2005;294:2847. [PMID: 16352791]
86. **Ghahramanlou-Holloway M, Bhar SS, Brown GK, Olsen C, Beck AT.** Changes in problem-solving appraisal after cognitive therapy for the prevention of suicide. Psychol Med. 2012;42:1185-93. [PMID: 22008384]
87. **Slee N, Spinhoven P, Garnefski N, Arensman E.** Emotion regulation as mediator of treatment outcome in therapy for deliberate self-harm. Clin Psychol Psychother. 2008;15:205-16. [PMID: 19115441]
88. **Tyrer P, Jones V, Thompson S, Catalan J, Schmidt U, Davidson K, et al; POPMACT group.** Service variation in baseline variables and prediction of risk in a randomised controlled trial of psychological treatment in repeated parasuicide: the POPMACT Study. Int J Soc Psychiatry. 2003;49:58-69. [PMID: 12793516]
89. **Tyrer P, Tom B, Byford S, Schmidt U, Jones V, Davidson K, et al; POPMACT Group.** Differential effects of manual assisted cognitive behavior therapy in the treatment of recurrent deliberate self-harm and personality disturbance: the POPMACT study. J Pers Disord. 2004;18:102-16. [PMID: 15061347]
90. **Davidson K, Scott J, Schmidt U, Tata P, Thornton S, Tyrer P.** Therapist competence and clinical outcome in the Prevention of Parasuicide by Manual

Assisted Cognitive Behaviour Therapy trial: the POPMACT study. Psychol Med. 2004;34:855-63. [PMID: 15500306]
91. **Arensman E, McAuliffe C, Corcoran P, Perry IJ.** Findings of the POPMACT study [Letter]. Psychol Med. 2004;34:1143-4. [PMID: 15554583]
92. **Harned MS, Jackson SC, Comtois KA, Linehan MM.** Dialectical behavior therapy as a precursor to PTSD treatment for suicidal and/or self-injuring women with borderline personality disorder. J Trauma Stress. 2010;23:421-9. [PMID: 20648564]
93. **Reynolds SK, Lindenboim N, Comtois KA, Murray A, Linehan MM.** Risky assessments: participant suicidality and distress associated with research assessments in a treatment study of suicidal behavior. Suicide Life Threat Behav. 2006; 36:19-34. [PMID: 16676622]
94. **Verheul R, Van Den Bosch LM, Koeter MW, De Ridder MA, Stijnen T, Van Den Brink W.** Dialectical behaviour therapy for women with borderline personality disorder: 12-month, randomised clinical trial in The Netherlands. Br J Psychiatry. 2003;182:135-40. [PMID: 12562741]
95. **Bateman A, Fonagy P.** Treatment of borderline personality disorder with psychoanalytically oriented partial hospitalization: an 18-month follow-up. Am J Psychiatry. 2001;158:36-42. [PMID: 11136631]
96. **Guthrie E, Kapur N, Mackway-Jones K, Chew-Graham C, Moorey J, Mendel E, et al.** Predictors of outcome following brief psychodynamic-interpersonal therapy for deliberate self-poisoning. Aust N Z J Psychiatry. 2003; 37:532-6. [PMID: 14511080]
97. **Williamson MK, Pirkis J, Pfaff JJ, Tyson O, Sim M, Kerse N, et al.** Recruiting and retaining GPs and patients in intervention studies: the DEPS-GP project as a case study. BMC Med Res Methodol. 2007;7:42. [PMID: 17875219]
98. **Alexopoulos GS, Reynolds CF 3rd, Bruce ML, Katz IR, Raue PJ, Mulsant BH, et al; PROSPECT Group.** Reducing suicidal ideation and depression in older primary care patients: 24-month outcomes of the PROSPECT study. Am J Psychiatry. 2009;166:882-90. [PMID: 19528195]
99. **Bogner HR, Morales KH, Post EP, Bruce ML.** Diabetes, depression, and death: a randomized controlled trial of a depression treatment program for older adults based in primary care (PROSPECT). Diabetes Care. 2007;30:3005-10. [PMID: 17717284]
100. **Thombs BD, Ziegelstein RC.** Diabetes, depression, and death: a randomized controlled trial of a depression treatment program for older adults based in primary care (PROSPECT): response to Bogner et al [Letter]. Diabetes Care. 2008;31:e54. [PMID: 18509141]
101. **Coyne JC.** Interventions for treatment of depression in primary care [Letter]. JAMA. 2004;291:2814. [PMID: 15199023]
102. **Gallo JJ, Bogner HR, Morales KH, Post EP, Lin JY, Bruce ML.** The effect of a primary care practice-based depression intervention on mortality in older adults: a randomized trial. Ann Intern Med. 2007;146:689-98. [PMID: 17502629]
103. **Bao Y, Alexopoulos GS, Casalino LP, Ten Have TR, Donohue JM, Post EP, et al.** Collaborative depression care management and disparities in depression treatment and outcomes. Arch Gen Psychiatry. 2011;68:627-36. [PMID: 21646579]
104. **Byers AL, Bruce ML, Raue P.** Suicidal ideation in non-depressed elderly primary care patients: The PROSPECT Study. Am J Geriatr Psychiatry. 2009; 17:A86.
105. **Carter GL, Clover K, Whyte IM, Dawson AH, D'Este C.** Postcards from the EDge project: randomised controlled trial of an intervention using postcards to reduce repetition of hospital treated deliberate self poisoning. BMJ. 2005;331: 805. [PMID: 16183654]
106. **Esposito-Smythers C, Walsh A, Spirito A, Rizzo C, Goldston DB, Kaminer Y.** Working With the Suicidal Client Who Also Abuses Substances. Cogn Behav Pract. 2012;19:245-255. [PMID: 23209362]
107. **Ougrin D.** Adding group psychotherapy to routine care does not improve outcomes in adolescents who repeatedly self-harm. Evid Based Ment Health. 2011;14:84. [PMID: 21764883]
108. **Barnes AJ.** Attachment-based family therapy reduces suicidal ideation in adolescents. Evid Based Ment Health. 2011;14:8. [PMID: 21266605]
109. **Goldney RD.** Immediate post intervention effects of two brief youth suicide prevention interventions [Letter]. Suicide Life Threat Behav. 2002;32:454. [PMID: 12501969]
110. **Thompson EA, Eggert LL, Randell BP, Pike KC.** Evaluation of indicated suicide risk prevention approaches for potential high school dropouts. Am J Public Health. 2001;91:742-52. [PMID: 11344882]
111. **Randell BP, Eggert LL, Pike KC.** Immediate post intervention effects of two brief youth suicide prevention interventions. Suicide Life Threat Behav. 2001;31:41-61. [PMID: 11326768]
112. **Robinson J, Hetrick S, Gook S, Cosgrave E, Yuen HP, McGorry P, et al.** Study protocol: the development of a randomised controlled trial testing a postcard intervention designed to reduce suicide risk among young help-seekers. BMC Psychiatry. 2009;9:59. [PMID: 19775469]
113. **Freedenthal S.** Assessing the wish to die: a 30-year review of the suicide intent scale. Arch Suicide Res. 2008;12:277-98. [PMID: 18828032]
114. **Peña JB, Caine ED.** Screening as an approach for adolescent suicide prevention. Suicide Life Threat Behav. 2006;36:614-37. [PMID: 17250467]
115. **Borges G, Angst J, Nock MK, Ruscio AM, Walters EE, Kessler RC.** A risk index for 12-month suicide attempts in the National Comorbidity Survey Replication (NCS-R). Psychol Med. 2006;36:1747-57. [PMID: 16938149]
116. **Baldessarini RJ, Tondo L, Davis P, Pompili M, Goodwin FK, Hennen J.** Decreased risk of suicides and attempts during long-term lithium treatment: a meta-analytic review. Bipolar Disord. 2006;8:625-39. [PMID: 17042835]
117. **Angst F, Stassen HH, Clayton PJ, Angst J.** Mortality of patients with mood disorders: follow-up over 34-38 years. J Affect Disord. 2002;68:167-81. [PMID: 12063145]
118. **Cipriani A, Pretty H, Hawton K, Geddes JR.** Lithium in the prevention of suicidal behavior and all-cause mortality in patients with mood disorders: a systematic review of randomized trials. Am J Psychiatry. 2005;162:1805-19. [PMID: 16199826]
119. **McKnight RF, Adida M, Budge K, Stockton S, Goodwin GM, Geddes JR.** Lithium toxicity profile: a systematic review and meta-analysis. Lancet. 2012; 379:721-8. [PMID: 22265699]
120. **Grandjean EM, Aubry JM.** Lithium: updated human knowledge using an evidence-based approach: part III: clinical safety. CNS Drugs. 2009;23:397-418. [PMID: 19453201]
121. **Werneke U, Ott M, Renberg ES, Taylor D, Stegmayr B.** A decision analysis of long-term lithium treatment and the risk of renal failure. Acta Psychiatr Scand. 2012;126:186-97. [PMID: 22404233]
122. **Mann JJ, Apter A, Bertolote J, Beautrais A, Currier D, Haas A, et al.** Suicide prevention strategies: a systematic review. JAMA. 2005;294:2064-74. [PMID: 16249421]
123. **O'Neil ME, Peterson K, Low A, Carson S, Denneson S, Haney E et al.** Suicide Prevention Interventions and Referral/Follow-up Services: A Systematic Review. Portland, OR: Department of Veterans Affairs; 2012. Accessed at www.hsrd.research.va.gov/publications/esp/suicide-interventions.cfm on 7 December 2012.
124. **Hawton K, Townsend E, Arensman E, Gunnell D, Hazell P, House A, et al.** Psychosocial versus pharmacological treatments for deliberate self harm. Cochrane Database Syst Rev. 2000:CD001764. [PMID: 10796818]
125. **National Institute for Health and Clinical Excellence.** Self-Harm: The NICE Guideline on Longer-Term Management. National Clinical Guideline No. 133. Manchester, United Kingdom: National Institute for Health and Clinical Excellence; 2011. Accessed at http://guidance.nice.org.uk/CG133 on 27 December 2012.
126. **O'Connor EA, Whitlock EP, Beil TL, Gaynes BN.** Screening for depression in adult patients in primary care settings: a systematic evidence review. Ann Intern Med. 2009;151:793-803. [PMID: 19949145]
127. **Hysinger EB, Callahan ST, Caples TL, Fuchs DC, Shelton R, Cooper WO.** Suicidal behavior differs among early and late adolescents treated with antidepressant agents. Pediatrics. 2011;128:447-54. [PMID: 21824883]
128. **Steele MM, Doey T.** Suicidal behaviour in children and adolescents. Part 2: treatment and prevention. Can J Psychiatry. 2007;52:35S-45S. [PMID: 17824351]
129. **Wexler LM, Gone JP.** Culturally responsive suicide prevention in indigenous communities: unexamined assumptions and new possibilities. Am J Public Health. 2012;102:800-6. [PMID: 22420786]
130. **Wortzel HS, Gutierrez PM, Homaifar BY, Breshears RE, Harwood JE.** Surrogate endpoints in suicide research. Suicide Life Threat Behav. 2010;40: 500-5. [PMID: 21034212]
131. **Perlis RH.** Hard outcomes: clinical trials to reduce suicide [Editorial]. Am J Psychiatry. 2011;168:1009-11. [PMID: 21969041]

Current Author Addresses: Dr. O'Connor, Ms. Burda, and Dr. Whitlock: Center for Health Research, Kaiser Permanente NW, 3800 North Interstate Avenue, Portland, OR 97227.
Dr. Gaynes: Department of Psychiatry, CB #7160, University of North Carolina School of Medicine, Chapel Hill, NC 27599.
Ms. Soh: Pharmaceutical Research and Manufacturers of America, 950 F Street NW, Suite 300, Washington, DC 20004.

Author Contributions: Conception and design: E. O'Connor, B.N. Gaynes, C. Soh, E.P. Whitlock.
Analysis and interpretation of the data: E. O'Connor, B.N. Gaynes, C. Soh.
Drafting of the article: E. O'Connor, B.U. Burda, C. Soh.
Critical revision of the article for important intellectual content: B.N. Gaynes, B.U. Burda, C. Soh, E.P. Whitlock.
Final approval of the article: B.N. Gaynes, B.U. Burda, C. Soh, E.P. Whitlock.
Provision of study materials or patients: B.N. Gaynes.
Statistical expertise: E. O'Connor.
Obtaining of funding: E.P. Whitlock.
Administrative, technical, or logistic support: B.U. Burda.
Collection and assembly of data: E. O'Connor, B.N. Gaynes, B.U. Burda, C. Soh.

Appendix Figure 1. **Analytic framework for suicide risk relevant to primary care.**



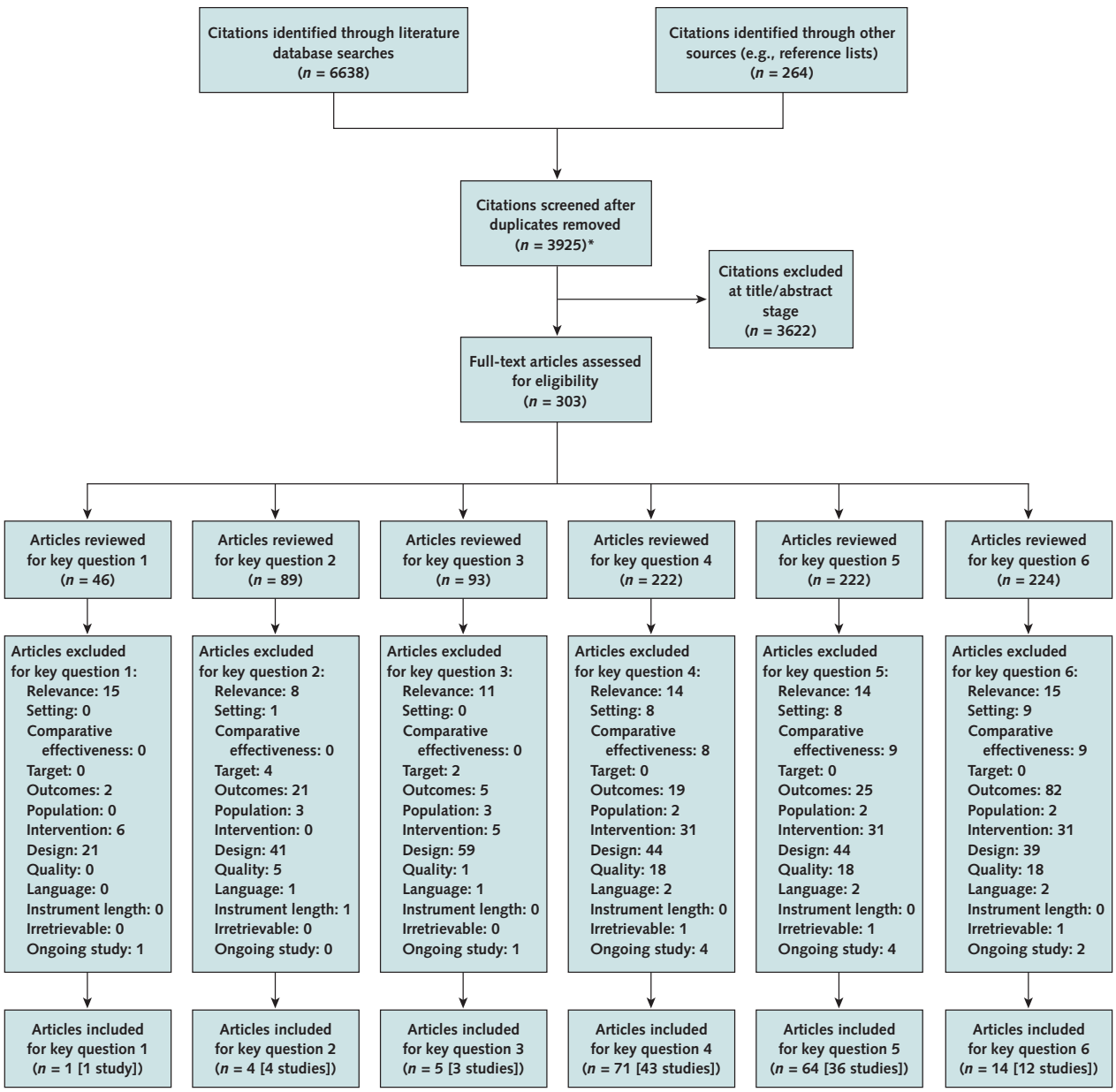
KQ = key question (see **Appendix Table 1**).
* All studies must report at least 1 suicide-specific outcome measure.

Appendix Table 1. **Key Questions**

Number	Question
1	Do screening programs to detect suicide risk among adolescents, adults, and older adults in primary care settings result in improved health outcomes (decreased suicide attempts, decreased suicide deaths, improved functioning, improved quality of life, or improved health status) or intermediate outcomes (decreased suicidal ideation, depressive symptomatology, or hopelessness)? Does the effect of screening programs vary by population characteristics (i.e., sex, age, race/ethnicity, other)*?
2	Do instruments to screen for increased risk for suicide accurately identify adolescents, adults, and older adults who are at increased risk in primary care populations? Does the accuracy of the screening instruments vary by population characteristics*?
3	Are there harms associated with screening for suicide risk in primary care settings? Do the harms vary by population characteristics*?
4	For those identified as being at increased risk for suicide, do interventions to reduce suicide risk (behaviorally based, including home visits or counseling for environmental change, or pharmacologic) result in improved health outcomes (decreased suicide attempts, decreased suicide deaths, improved functioning, improved quality of life, or improved health status)? Does the effect of the interventions vary by population characteristics*?
5	For those identified as being at increased risk for suicide, do interventions to reduce suicide risk (behaviorally based, including home visits or counseling for environmental change, or pharmacologic) result in improved intermediate outcomes (suicidal ideation, decreased access to means of suicide, increased treatment of previously undiagnosed mental health conditions, or decreases in depressive symptomatology or hopelessness)? Does the effect of screening programs vary by population characteristics*?
6	For those identified as being at increased risk for suicide, what are the harms of behaviorally based or pharmacologic treatment to reduce suicide risk? Do the harms vary by population characteristics*?

* Population characteristics include sex; age; race/ethnicity; comorbid medical illness; history of suicide attempts; and social, mental health, or other psychological factors.

Appendix Figure 2. **Summary of evidence search and selection.**



* Surveillance search of MEDLINE only from July 2012 through December 2012 for trials related to screening are not included. No additional trials were identified.

Appendix Table 2. Test Performance Characteristics of Suicide Screening Instruments (Key Question 2)

Population	Study, Year (Reference)	Study Quality	Sample	Prevalence of Higher Suicide Risk*	Reference Test	Time to Test	Instrument
Adolescents	Holi et al, 2008 (30)	Fair	Depressed adolescent outpatients aged 13 to 19 y at a psychiatry clinic (n = 218)	Suicidal or self-harming act, 27.1%	K-SADS-PL	Median, 6 d	Mental health clinicians' suicidality assessment
Adolescents	Thompson and Eggert, 1999 (31)	Fair	High school students aged 14 to 20 y who are at risk for dropping out of high school (n = 581)	High risk for suicide, 21.7%	CRA after computer-assisted interview with clinician	7–10 d	SRS
Adults	Olfson et al, 1996 (32)	Fair	Primary care patients aged 18 to 70 y (n = 1001)	Suicidal ideation, 3.3%	Nurse-administered structured interview	24 h	SDDS-PC
Older adults	Heisel et al, 2010 (33)	Fair	Primary care patients aged 65 to 95 y (n = 626)	Suicidal ideation, 11%†	Suicide items from SCID or HAM-D	NR	Suicide subscale of GDS

CRA = clinician risk assessment; GDS = Geriatric Depression Scale; HAM-D = Hamilton Rating Scale for Depression; K-SADS-PL = Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime Version; NPV = negative predictive value; NR = not reported; PPV = positive predictive value; SCID = Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders*; SDDS-PC = Symptom-Driven Diagnostic System for Primary Care; SRS = Suicide Risk Screen.

* Percentage of participants with a positive result for suicidal behavior on the reference test.

† Combined suicidal ideation variable (6.5% endorsed the HAM-D suicidal ideation item and 9.9% endorsed the SCID suicidal ideation item; 94.4% concordance).

Appendix Table 2—Continued

Threshold	Items, *n*	Time Frame	Positive Test Result, %	Sensitivity (95% CI), %	Specificity (95% CI), %	PPV (95% CI), %	NPV (95% CI), %
Categorized as suicidal or not suicidal	2	In the past 2 wk	25.2	51.6 (38.6–64.5)	85.3 (78.7–90.4)	58.2 (44.1–71.3)	81.6 (74.8–87.2)
4 risk categories; categories I, II, and III considered positive screen	20	NR	50.5	87 (80.2–92.6)	60 (55.1–64.3)	37.8 (32.2–43.6)	94.4 (91.0–96.8)
Affirmative response: 1. thoughts of death 2. wishing one were dead 3. feeling suicidal	3	In the past month	Response 1: 20.2 Response 2: 7.9 Response 3: 3.3	Response 1: 100 (NR) Response 2: 91.7 (76.1–100.0) Response 3: 83.3 (62.2–100.0)	Response 1: 81.0 (78.5–83.5) Response 2: 93.1 (91.5–94.7) Response 3: 97.7 (69.8–98.6)	Response 1: 5.9 (2.6–9.2) Response 2: 13.9 (6.3–21.5) Response 3: 30.3 (14.6–46.0)	Response 1: 100 (NR) Response 2: 99.8 (99.5–100.0) Response 3: 99.8 (99.5–100.0)
1. Cut score ≥1 2. Cut score ≥2 3. Cut score ≥3	5	NR	Cut score 1: 26.2 Cut score 2: 12.5 Cut score 3: 5.8	Cut score 1: 79.7 (68.3–88.4) Cut score 2: 55.1 (42.6–67.1) Cut score 3: 34.8 (23.7–47.2)	Cut score 1: 80.4 (76.9–83.6) Cut score 2: 92.8 (90.3–94.8) Cut score 3: 97.8 (96.2–98.9)	Cut score 1: 33.5 (26.4–41.3) Cut score 2: 48.7 (37.2–60.3) Cut score 3: 66.7 (49.0–81.4)	Cut score 1: 97.0 (95.0–98.3) Cut score 2: 94.3 (92.1–96.1) Cut score 3: 92.4 (89.9–94.4)

Appendix Table 3. **Study Population and Intervention Characteristics of Included Studies (Key Questions 4 and 5)**

Intervention Category	Primary Study, Year (Reference)	Related Study, Year (Reference)	Age Range (Mean Age), *y*	Women, %
Adults and older adults				
CBT	Brown et al, 2005 (41)	Tepper and Whitehead, 2005 (85) Ghahramanlou-Holloway et al, 2012 (86)	18–66 (35)	61
	Evans et al, 1999 (50)		16–50 (NR)	NR
	Hawton et al, 1987 (55)		≥16 (29)	66
	Marasinghe et al, 2012 (60)		15–74 (31)	50
	Rudd et al, 1996 (62)		"Young adult" (22)	18
	Samaraweera et al, 2007 (63)		15–64 (36)	60
	Slee et al, 2008 (64)	Slee et al, 2008 (87)	15–35 (24)	90
	Tyrer et al, 2003 (65)	Tyrer et al, 2003 (88) Tyrer et al, 2004 (89) Davidson et al, 2004 (90) Arensman et al, 2004 (91)	16–65 (32)	68
Dialectical behavioral therapy	Carter et al, 2010 (44)		18–65 (24)	100
	Linehan et al, 1991 (58)		18–45 (NR)	100
	Linehan et al, 2006 (59)	Harned et al, 2010 (92) Reynolds, 2006 (93)	18–45 (29)	100
	van den Bosch et al, 2005 (67)	Verheul et al, 2003 (94)	18–65 (35)	100
Problem-solving therapy	Bannan, 2010 (37)		18–53 (29)	NR
	Fitzpatrick et al, 2005 (51)		18–24 (19)	54
	Hatcher et al, 2011 (54)		≥16 (34)	69
Psychodynamic or interpersonal therapy	Bateman and Fonagy, 1999 (38)	Bateman and Fonagy, 2001 (95)	16–65 (32)	50
	Guthrie et al, 2001 (52)	Guthrie et al, 2003 (96)	18–65 (31)	56
Other therapy, with direct therapeutic contact	Comtois et al, 2011 (47)		19–62 (37)	62
Other therapy, without direct therapeutic contact	Kovac and Range, 2002 (56)		18–42 (23)	73
Medication (lithium)	Lauterbach et al, 2008 (57)		≥18 (39)	57
Practice-based interventions	Almeida et al, 2012 (71)	Williamson et al, 2007 (97)	60–101 (72)	59
	Bennewith et al, 2002 (40)		16–95 (32)	59
	Clarke et al, 2002 (46)		≥20 (33)	56
	Bruce et al, 2004 (42)	Alexopoulos et al, 2009 (98) Bogner et al, 2007 (99) Thombs and Ziegelstein, 2008 (100) Coyne, 2004 (101) Gallo et al, 2007 (102) Bao et al, 2011 (103) Byers et al, 2009 (104)	60–94 (70)	72
	Szanto et al, 2007 (70)		NR (NR)	NR**
Improving treatment adherence with direct person-to-person contact	Allard et al, 1992 (36)		NR (NR)	57
	Cedereke et al, 2002 (45)		NR (41)	66
	Crawford et al, 2010 (48)		18–65 (37)	49
	Currier et al, 2010 (49)		18–69 (33)	57
	Vaiva et al, 2006 (66)		18–65 (36)	73
	Van Heeringen et al, 1995 (68)		≥15 (34)	57
	Welu, 1977 (69)		≥16 (29)	NR

Appendix Table 3—**Continued**

Depressive or Mood Disorder Diagnosis, %	Previous SA or DSH, % (Average Number of Previous SAs or DSH Episodes)	Brief Description of Intervention	Sessions, *n*
77	SA: 72 (NR)	Individual cognitive therapy	10
NR	DSH: 100 (NR)	Brief, manual-based, problem-focused individual cognitive therapy	2–6
NR	SA: 31 (NR)	Brief, problem-focused individual therapy	1–8
NR	NR	Brief, mobile telephone–based counseling and prerecorded messages; 1 initial in-person session	11
18	SA: 41 (NR)	2-wk partial hospitalization (9 h/d), psychoeducational and psychotherapeutic groups, and (as needed) individual crisis counseling	18
NR	NR	Culturally relevant (for Sri Lanka) individual CBT	3–6
89	SA: 58 (NR)* DSH: NR (13)*	Individual CBT with option for partner or parent participation	12
NR	DSH: 100 (NR)	Brief, manual-based, problem-focused individual cognitive therapy	5–7
NR	DSH: 100 (20)*	Team-based, manualized, directive group and individual treatment	≥100 (estimate)
NR	DSH: 100 (NR)†	Team-based, manualized, directive group and individual treatment	104
72	DSH: 100 (NR)	Team-based, manualized, directive group and individual treatment	104
NR	SA: 71 (NR) DSH: 93 (14)‡	Team-based, manualized, directive group and individual treatment	104
50	DSH: 100 (2)§	Problem-solving therapy group	8
NR	NR	Problem-solving video/slide presentation	1
NR	DSH: 55 (NR)	Manual-based, individual problem-solving therapy	4–9
57	DSH: NR (8.5)‡	Long-term partial hospitalization, guided by psychoanalytic model and twice-weekly long-term psychoanalytic group	400 (estimate)
NR	SA: 60 (NR)	Psychodynamic individual interpersonal therapy	4
NR	SA: NR (5.4)	Collaborative assessment and management of suicidality	4–12
54 (previous treatment for depression)	SA: 14 (NR)‖	Writing about difficult times with or without encouragement to "reinterpret" the stressful events through writing	4
76	SA: 44 (NR)	200-mg/wk increase until sufficient blood level attained (0.6 to 0.8 mmol/L) (with usual care)	NA
8 (per PHQ-9 screen)	SA: 4.2 (NR)¶	An educational intervention targeting GPs that included a practice audit with personalized automated feedback, printed educational materials, and 6 monthly newsletters	NA
NR	NR (NR)	Notified GP of DSH episode, provided a letter that GP could send to patient and practice guidelines for assessment and treatment	NA
56 (per HADS screen)	DSH: 47 (NR)	PCP given treatment guidelines for depression in older adults, assigned care manager to advise PCP and provide psychotherapy if needed; informed if patient reported suicidal ideation	NA
66	NR	Case management: comprehensive assessment and determination of treatment needs, monitoring treatment and patient status	NA
NR	NR	5-y depression management educational program for GPs and nurses with consultation service, special depression treatment clinics	4 main provider education sessions with additional optional lectures
87	SA: 50 (2)	Specific schedule of treatment prescribed (starting with weekly visits, then tapering off), outreach in case of missed appointments, content of treatment left to discretion of provider	≤19
42 (mood disorder)	SA: NR (1.1)	Telephone contacts to assess and provide encouragement to stay in or return to treatment if needed	2
NR	NR	Appointment card with alcohol counselor; counselor visit included assessment and advice on alcohol reduction and referral to treatment	1
19	SA: "majority" (NR)	Extensive clinical assessment within 48 h of discharge at location of participant's choice, referral to community resources	1
NR	SA: 9 (NR)††	Single telephone contact 1 or 3 mo after discharge to revisit recommended treatment, encourage reengagement in treatment if needed, provide crisis counseling as needed	1
15 (mood disorder)	SA: 30 (NR) DSH: 89 (NR)§	Home visits for patients not adherent to initial treatment referral, follow-up to check on adherence	1–2
NR	SA: 60 (NR)	Contact immediately after ED discharge by telephone; home visit for assessment and treatment plan/referral, continued monitoring	NR

Appendix Table 3—**Continued**

Intervention Category	Primary Study, Year (Reference)	Related Study, Year (Reference)	Age Range (Mean Age), *y*	Women, %
Improving treatment adherence without direct person-to-person contact	Beautrais et al, 2010 (39)		≥16 (34)	66
	Carter et al, 2007 (43)	Carter et al, 2005 (105)	≥16 (33)	68
	Hassanian-Moghaddam et al, 2011 (53)		≥12 (24)	66
	Motto and Bostrom, 2001 (61)		NR (33)	56
Adolescents				
CBT	Donaldson et al, 2005 (73)		12–17 (15)	82
	Esposito-Smythers et al, 2011 (83)	Esposito-Smythers et al, 2012 (106)	13–17 (16)	67
	Greenfield et al, 2002 (76)		12–17 (14)	69
Developmental group therapy	Green et al, 2011 (75)	Ougrin, 2011 (107)	12–17 (NR)	88
	Hazell et al, 2009 (77)		12–16 (15)	90
	Wood et al, 2001 (80)		12–16 (14)	78
Psychodynamic or interpersonal therapy	Chanen et al, 2008 (84)		15–18 (16)	76
	Diamond et al, 2010 (72)	Barnes, 2011 (108)	12–17 (15)	83
	Tang et al, 2009 (79)		12–18 (15)	66
Other therapy with direct therapeutic contact	Eggert et al, 2002 (74)	Goldney, 2002 (109) Thompson et al, 2001 (110) Randell et al, 2001 (111)	14–19 (16)	49
	Hooven et al, 2012 (81)		14–19 (16)	60
Other therapy without direct therapeutic contact	King et al, 2009 (78)		13–17 (16)	71
Improving treatment adherence without direct person-to-person contact	Robinson et al, 2012 (82)	Robinson et al, 2009 (112)	15–24 (19)	64

Appendix Table 3—**Continued**

Depressive or Mood Disorder Diagnosis, %	Previous SA or DSH, % (Average Number of Previous SAs or DSH Episodes)	Brief Description of Intervention	Sessions, *n*
NR	DSH: 18 (0.4)‡‡	Sent postcards at 2 wk, 6 wk, 3 mo, 6 mo, 9 mo, and 12 mo after DSH episode wishing patients well and inviting them to contact provider	0
NR	DSH: 17 (NR)§	Sent postcards at 1, 2, 3, 6, 8, 10, and 12 mo after DSH episode wishing patients well and inviting them to contact provider	0
NR	SA: 34 (NR)	Sent postcards at 1, 2, 3, 6, 8, 10, and 12 mo after DSH episode in addition to receiving one on birthday wishing patients well and inviting them to contact provider	0
NR	NR	24 letters over 5 y expressing concern and inviting participant to contact staff member	0
29	SA: 48 (NR)	Individual skills-based treatment and brief contact with parents at each session and 1 to 3 family sessions	12–16
94	SA: 75 (NR) DSH: 72 (NR)	Individual skills development with youth; parenting and other skills development for parents with separate therapist; and family sessions, targeting suicidality and substance misuse	≥34
48	SA: 37 (NR)§§	Phone contact immediately after ED visit, involving in-depth assessment and treatment	NR
62	DSH: 100 (21)‡‡	Developmental group psychotherapy	≥6
57	DSH: 100 (NR)	Developmental group psychotherapy	≥6
83	DSH: 79 (4.1)§	Developmental group psychotherapy	≥6
15	DSH: 94 (9.5)‖‖	Cognitive analytic therapy	24
47	SA: 62 (NR)	Process-oriented and emotion-focused attachment-based family therapy	NR
100	NR	Intensive individual interpersonal psychotherapy	18
NR	SA: NR (0.2)¶¶	Computer-assisted suicide assessment; motivational counseling session; and identification of school-based case manager to support connection among school, parents, and youth	1
NR	NR	C-CARE: Computer-assisted suicide assessment; motivational counseling session; and identification of school-based case manager to support connection among school, parents, and youth P-CARE: 2 parent sessions reviewing suicide risk, support and communication skills, conflict reduction, and youth mood management Both of the above	C-CARE:1 P-CARE:2
88	SA: 75 (NR)	Youth-nominated support person trained to provide support to the youth	NA
67	SA: 16 (NR) DSH: 68 (10.7)	Monthly postcards for 12 mo, expressing interest in the person's well-being, reminding him or her about previously identified sources of help, and describing 1 of 6 rotating self-help strategies (e.g., physical activity, books, and Web sites)	0

CBT = cognitive behavioral therapy; C-CARE = Counselors Care, Assess, Respond, Empower; DSH = deliberate self-harm; ED = emergency department; GP = general practitioner; HADS = Hospital Anxiety and Depression Scale; NA = not applicable; NR = not reported; P-CARE = Parents Care, Assess, Respond, Empower; PCP = primary care provider; PHQ-9 = Patient Health Questionnaire-9; SA = suicide attempt.

* In the past 3 mo.
† Participants were parasuicidal.
‡ Median number of self-mutilation acts.
§ Self-poisoning.
‖ Previous treatment for suicide attempt.
¶ Combined outcome of suicide attempts and suicidal ideation.
** 2 regions were similar in proportion of women (52%) and older residents (22%).
†† 4 or more attempts in the past 3 y.
‡‡ In the past 12 mo.
§§ In the past 6 mo.
‖‖ Median number of lifetime "parasuicide" episodes.
¶¶ In the past month.

Appendix Table 4. **Outcomes Reported in Included Trials for Benefits and Harms of Treatment (Key Questions 4 and 5)**

Intervention Category	Primary Study, Year (Reference)	Related Study, Year (Reference)	Population
Adults and older adults			
CBT	Brown et al, 2005 (41)	Tepper and Whitehead, 2005 (85) Ghahramanlou-Holloway et al, 2012 (86)	Adults (aged 18–66 y) with a suicide attempt within 48 h of visit to ED, identified in ED
	Evans et al, 1999 (50)		Adults (aged 16–50 y) presenting to participating mental health center or hospital after DSH
	Hawton et al, 1987 (55)		Adults (aged ≥16 y) admitted to general hospital after overdose and "continuing problems which they were willing to tackle with the help of the counselors"
	Marasinghe et al, 2012 (60)		Adults (aged 15–74 y) admitted to hospital after attempting self-harm; displayed clinically significant suicidal intent at the interview or on the BSSI
	Rudd et al, 1996 (62)		Young adults with suicide attempt or suicidal ideation with mood disorder or suicidal ideation plus alcohol use (age range NR)
	Samaraweera et al, 2007 (63)		Adult (aged 15–64 y) sample from a population study, screening positive for suicidality
	Slee et al, 2008 (64)	Slee et al, 2008 (87)	Adults (aged 15–35 y) visiting a mental health center because of self-harm
	Tyrer et al, 2003 (65)	Tyrer et al, 2003 (88) Tyrer et al, 2004 (89) Davidson et al, 2004 (90) Arensman et al, 2004 (91)	Adults (aged 16–65 y) presenting to accident and emergency department after episode of DSH, with ≥1 previous attempts
Dialectical behavior therapy	Carter et al, 2010 (44)		Adult (aged 18–65 y) female patients with BPD with at least 3 DSH episodes in the past year
	Linehan et al, 1991 (58)		Adult (aged 18–45 y) female patients with BPD with at least 2 episodes of DSH in the past 5 y, including 1 in the past 8 wk
	Linehan et al, 2006 (59)	Harned et al, 2010 (92) Reynolds, 2006 (93)	Adult (aged 18–45 y) female patients with BPD with at least 2 episodes of DSH in the past 5 y, including 1 in the past 8 wk
	van den Bosch et al, 2005 (67)	Verheul et al, 2003 (94)	Adult (aged 18–65 y) female patients with BPD recruited from mental health institutions and addiction treatment services
Problem-solving therapy	Bannan, 2010 (37)		Adults (aged 18–53 y) with a self-poisoning episode, previous DSH within the past 12 mo
	Fitzpatrick et al, 2005 (51)		University students (aged 18–24 y) screening positive for suicide (with BSSI), participated in the study for extra class credit
	Hatcher et al, 2011 (54)		Adults (aged ≥16 y) presenting to the hospital for self-harm but not hospitalized for more than 48 h
Psychodynamic or interpersonal therapy	Bateman and Fonagy, 1999 (38)	Bateman and Fonagy, 2001 (95)	Adult (aged 16–65 y) patients with BPD referred to psychiatric unit
	Guthrie et al, 2001 (52)	Guthrie et al, 2003 (96)	Adults (aged 18–65 y) presenting to ED after episode of DSH
Other therapy, with direct therapeutic contact	Comtois et al, 2011 (47)		Adults (aged 19–62 y) evaluated for suicide attempt or imminent risk but judged safe for discharge; no mental health care available for 2 wk
Other therapy, without direct therapeutic contact	Kovac and Range, 2002 (56)		University students (aged 18–42 y) who screened positive for increased risk for suicide
Medication (lithium)	Lauterbach et al, 2008 (57)		Adults (aged ≥18 y) with a suicide attempt in past 3 mo and depressive spectrum disorder, identified through screening at psychiatric ED and inpatient unit
Practice-based interventions	Almeida et al, 2012 (71)	Williamson et al, 2007 (97)	General practitioners recruited older adult patients (aged 60–101 y)
	Bennewith et al, 2002 (40)		Adult (aged 16–95 y) patients with DSH identified through case registry updated weekly of all DSH patients in hospital accident and ED
	Clarke et al, 2002 (46)		Adults (aged ≥20 y) presenting to ED after DSH
	Szanto et al, 2007 (70)		General practitioners (age range NR) providing services to inhabitants of region with high suicide rates
	Bruce et al, 2004 (42)	Alexopoulos et al, 2009 (98) Bogner et al, 2007 (99) Thombs and Ziegelstein, 2008 (100) Coyne, 2004 (101) Gallo et al, 2007 (102) Bao et al, 2011 (103) Byers et al, 2009 (104)	Depressed older adults (aged 65–94 y), recruited from primary care screening for depression

Appendix Table 4—**Continued**

Participants Randomly Assigned, *n*	Country	Suicide Deaths	Suicide Attempts/ DSH Episodes	Hospitalization or ED Use	Other Health Outcome	Suicidal Ideation	Depression	Hopelessness
120	United States		■*†			□	■†	⊡
34	United Kingdom		□†		□		■	
77	United Kingdom	□	□†		□		□†	
68	Sri Lanka					■	■	
302	United States					□†	□†	□
10	Sri Lanka					■*†		
90	The Netherlands	□	■	⊡			■†	
480	United Kingdom	□	□†		□		□†	
73	Australia		□	■	⊡			
63	United States		□†	■		□	□	□
111	United States	□	■*†	■		□†	□†	
64	The Netherlands		□†					
20	Ireland					□†	■*†	■
110	United States	□				■*†	■*†	□
522	New Zealand		□†			■*†	■†	■
44	United Kingdom		■*†	■	■		■†	
119	United Kingdom	□	■†			■†	⊡†	
32	United States		□†	□	■	■		
121	United States					□†	□†	
167	Germany	■	□					
373 general practitioners, 21 762 patients	Australia		■‡				□	
1932	United Kingdom		□†					
526	United Kingdom		□†	□				
2 geographic locations (*n* = approximately 127 000)	Hungary	□						
598	United States	□	□†		■	⊡	■	

Appendix Table 4—**Continued**

Intervention Category	Primary Study, Year (Reference)	Related Study, Year (Reference)	Population
Improving treatment adherence with direct person-to-person contact	Allard et al, 1992 (36)		Persons with an ED visit for suicide attempt at study hospitals (age range NR)
	Cedereke et al, 2002 (45)		Persons treated at ED for suicide attempt, recruited 1 mo after attempt (age range NR)
	Crawford et al, 2010 (48)		Adults (aged 18–65 y) presenting to ED after DSH and misusing alcohol
	Currier et al, 2010 (49)		Suicidal adults (aged 18–69 y), identified in ED
	Vaiva et al, 2006 (66)		Adults (aged 18–65 y) with a suicide attempt by drug overdose, cleared for discharge from ED
	Van Heeringen et al, 1995 (68)		Adults (aged ≥15 y) who attempted suicide referred to ED
	Welu, 1977 (69)		Adults (aged ≥16 y) who attempted suicide brought to ED
Improving treatment adherence without direct person-to-person contact	Beautrais et al, 2010 (39)		Adults (aged ≥16 y) presenting to psychiatric ED with suicide attempt or DSH
	Carter et al, 2007 (43)	Carter et al, 2005 (105)	Adults (aged ≥16 y) presenting to toxicology service for self-poisoning
	Hassanian-Moghaddam et al, 2011 (53)		Adolescents and adults (aged 12+ y) with a hospital admission for self-poisoning
	Motto and Bostrom, 2001 (61)		Persons refusing further treatment 1 mo after discharge from inpatient stay after suicide attempt (age range NR)
Adolescents			
CBT	Donaldson et al, 2005 (73)		Adolescents (aged 12–17 y) presenting to ED or inpatient unit after suicide attempt
	Esposito-Smythers et al, 2011 (83)	Esposito-Smythers et al, 2012 (106)	Adolescent (aged 13–17 y) psychiatric inpatients with a suicide attempt in past 3 mo or clinically significant suicidal ideation in the past month and an alcohol or cannabis use disorder
	Greenfield et al, 2002 (76)		Adolescents (aged 12–17 y) presenting to ED after suicide attempt
Developmental group therapy	Green et al, 2011 (75)	Ougrin, 2011 (107)	Adolescents (aged 12–17 y) with 2 DSH episodes in past 12 mo, recruited from mental health services centers
	Hazell et al, 2009 (77)		Adolescents (aged 12–16 y) with 2 DSH episodes in past 12 mo (including 1 in past 3 mo), referred to mental health services
	Wood et al, 2001 (80)		Adolescents (aged 12–16 y) referred to mental health services after DSH
Psychodynamic or interpersonal therapy	Chanen et al, 2008 (84)		Adolescents (aged 15–18 y) with 2 or more symptoms of BPD referred to mental health services for acute, severe mental health problems
	Diamond et al, 2010 (72)	Barnes, 2011 (108)	Adolescents (aged 12–17 y) identified as suicidal by screening during primary care or ED visits
	Tang et al, 2009 (79)		Adolescents (aged 12–18 y) with moderate to severe depression, suicidal ideation, previous suicide attempt, moderate to severe anxiety, or substantial hopelessness, based on school-based screening; random sample from participating schools selected for study
Other therapy with direct therapeutic contact	Eggert et al, 2002 (74)	Goldney, 2002 (109) Thompson et al, 2001 (110) Randell et al, 2001 (111)	Adolescents (aged 14–19 y) at increased risk for dropping out of high school who screened positive for increased risk for suicide
	Hooven et al, 2012 (81)		Adolescents (aged 14–19 y) who screened positive for suicide risk or at least 2 of the following: moderate depression, moderate suicidal ideation/threats, and/or alcohol and drug use
Other therapy without direct therapeutic contact	King et al, 2009 (78)		Hospitalized adolescents (aged 13–17 y) with suicidal ideation or attempt within the past 4 wk
Improving treatment adherence without direct person-to-person contact	Robinson et al, 2012 (82)	Robinson et al, 2009 (112)	Young persons (aged 15–24 y) with a history of suicide threats, ideation, attempts, and/or DSH who did not meet entry criteria for service, because they either were not unwell enough or were receiving treatment elsewhere

Appendix Table 4—**Continued**

Participants Randomly Assigned, *n*	Country	Suicide Deaths	Suicide Attempts/ DSH Episodes	Hospitalization or ED Use	Other Health Outcome	Suicidal Ideation	Depression	Hopelessness
150	Canada	□	□†					
216	Sweden	□	□†		□	■		
103	United Kingdom		□†					
122	United States				□	□	□	
605	France	□	□†					
516	Belgium	□	□†					
143	United States		□†					
327	New Zealand		□†					
772	Australia		□†	□				
2300	Iran		■†			■		
843	United States	⊡			□			
39	United States		□†			□†	□†	
40	United States		■†	■		□	□	
286	Canada	□	□†	■	□	□		
366	United Kingdom	□	□†	□	□†	□†	□	
72	Australia		□†	□	□†	□†	□	
63	United Kingdom		■†		□†	□†	□	
86	Australia		□†		□			
66	United States		□†		□†	■*†	□	
73	Taiwan					■†	■†	■
238	United States		□			■	■	■
615	United States		□			■	⊡	⊡
448	United States	□	□†	□		⊡	□	□
165	Australia		□			□	□	□

BPD = borderline personality disorder; BSSI = Beck Scale for Suicidal Ideation; CBT = cognitive behavioral therapy; DSH = deliberate self-harm; ED = emergency department; NR = not reported.
■ Significant group differences for one half or more of reported outcomes/follow-ups.
⊡ Significant group differences for at least 1 but fewer than one half of reported follow-ups or analyses.
□ No significant group differences reported.
* Difference in statistical significance of results between meta-analysis and original study, usually because of differences in outcomes analyzed (e.g., change from baseline in meta-analysis vs. repeated measures group × time effect in study; analyzing risk ratios in meta-analysis vs. odds ratios in study; use of unadjusted results in meta-analysis but adjusted *P* value are presented in study).
† Included in meta-analysis, shown on **Figures 1** to **4**.
‡ Combined outcomes of suicide attempts and suicidal ideation.