

Review

Safety planning-type interventions for suicide prevention: meta-analysis

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Background

Safety planning-type interventions (SPTIs) for patients at risk of suicide are often used in clinical practice, but it is unclear whether these interventions are effective.

Aims

This article reports on a meta-analysis of studies that have evaluated the effectiveness of SPTIs in reducing suicidal behaviour and ideation.

Method

We searched Medline, EMBASE, PsycINFO, Web of Science and Scopus from their inception to 9 December 2019, for studies that compared an SPTI with a control condition and had suicidal behaviour or ideation as outcomes. Two researchers independently extracted the data. To assess suicidal behaviour, we used a random-effects model of relative risk based on a pooled measure of suicidal behaviour. For suicidal ideation, we calculated effect sizes with Hedges' *g*. The study was registered at PROSPERO (registration number CRD42020129185).

Results

Of 1816 unique abstracts screened, 6 studies with 3536 participants were eligible for analysis. The relative risk of suicidal

behaviour among patients who received an SPTI compared with control was 0.570 (95% CI 0.408–0.795, $P = 0.001$; number needed to treat, 16). No significant effect was found for suicidal ideation.

Conclusions

To our knowledge, this is the first study to report a meta-analysis on SPTIs for suicide prevention. Results support the use of SPTIs to help preventing suicidal behaviour and the inclusion of SPTIs in clinical guidelines for suicide prevention. We found no evidence for an effect of SPTIs on suicidal ideation, and other interventions may be needed for this purpose.

Keywords

Suicide; suicide prevention; safety planning; meta-analysis.

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Background

Suicidal behaviour is a significant public health issue worldwide, resulting in an estimated 16 million suicide attempts and 800 000 suicides per year.¹ For every person who dies by suicide, more than 20 others make a non-fatal attempt,² and many more have serious thoughts about ending their life.³ Suicidal ideation and suicidal behaviour (including both fatal and non-fatal suicide attempts) thus constitute a substantial disease burden. This underlines the importance of suicide prevention.⁴

There is an increasing body of evidence in support of several psychological treatments for suicide prevention, including cognitive-behavioural therapy and dialectical behaviour therapy.^{5,6} In recent years, brief interventions, defined as up to three encounters between a patient and (para-)professional, have also been linked to reduced risks of suicidal behaviour.^{7,8}

Safety planning-type interventions

One group of brief interventions consists of safety planning-type interventions (SPTIs). The technique in SPTIs is called safety planning, and is derived from cognitive therapy and cognitive-behavioural therapy for suicide prevention.^{9,10} The goal of safety planning is to reduce the imminent risk of suicidal behaviour by constructing a predetermined set of coping strategies and sources of support in a plan.^{10,11} During a crisis, an individual may use these strategies to avert their thoughts about suicide and manage their suicidal urges.¹¹ Since its introduction, safety planning has become an integral part of standard clinical care for people at risk of suicide, and it is being used as a brief standalone intervention.¹¹

The plan that is constructed in safety planning has been referred to in a number of ways, including 'safety plan',¹¹ 'crisis response

plan'¹² and 'coping card',¹³ but in essence they all cover the same psychological technique. The current review uses the term SPTIs to summarise the entire range of brief interventions in which safety planning is applied. The strategies and sources of support are embedded in what we will call a safety plan.

Interventions of the safety planning type are recommended as best practice by the National Institute for Health and Care Excellence (<https://www.nice.org.uk/guidance/cg133>) in the UK, and the Suicide Prevention Resource Center (www.sprc.org) in the USA. Historically, the use of safety plans in clinical practice seems to be based on clinicians' beliefs about their effectiveness,^{14,15} rather than on empirical evidence.¹⁶ Individual trials on the effectiveness of SPTIs have yielded conflicting results,^{17,18} whereas meta-analyses of studies that included SPTIs have focused on brief interventions more broadly.^{7,8} Although the latter have made an important contribution to the literature, they did not include all published trials on SPTIs, and did not report on the effectiveness of SPTIs specifically.^{7,8}

Aims

The purpose of this study was to conduct a meta-analysis to assess whether SPTIs for suicide prevention are linked to reductions in first, suicidal behaviour (fatal and non-fatal suicide attempts), and second, suicidal ideation.

Method

Before study commencement, the study protocol was registered in the international Prospective Register of Systematic Reviews at the University of York (PROSPERO; registration number

CRD42020129185). We modified the protocol in two respects. First, to more accurately reflect the focus of the study, we chose to use the term ‘safety planning-type’ instead of ‘crisis management’. Safety planning-type is a better description of a personalised plan. Second, to facilitate interpretation, we calculated relative risks instead of odds ratios. As the underpinning calculation is similar to that for an odds ratio, the use of relative risks should not alter the findings. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed for reporting the meta-analysis;¹⁹ the PRISMA checklist is reproduced in Supplementary Appendix 1 available at <https://doi.org/10.1192/bjp.2021.50>.

Search strategy

A systematic literature search was developed and performed in collaboration with a librarian. We searched the following databases from their inception to 9 December 2019: Medline (PubMed.com), EMBASE (embase.com), PsycINFO (EBSCO), Web of Science (Clarivate) and Scopus (Elsevier). The search strategy included MeSH terms and free-text terms relating to suicide, safety management, crisis intervention and prevention. The actual terms used in the search strategy for PubMed are listed in Supplementary Appendix 2; these were subsequently adapted for other databases. We additionally conducted hand searches of reference lists in identified publications and consulted experts in the field to identify additional publications (C.N.).

Selection of studies

The following inclusion criteria were applied: (a) a brief standalone intervention based on safety planning for suicide prevention was delivered; (b) the safety plan contained, as a minimum, personalised coping strategies and sources of support; (c) the safety plan was the primary element of the intervention; (d) a control condition was applied (including treatment as usual (TAU) or another treatment) and (e) the study reported on at least one of the outcomes of suicidal behaviour, suicide attempts, suicides or suicidal ideation. The outcome ‘suicidal behaviour’ (suicide attempts, fatal suicides or both combined) was defined as the number of participants who engaged in suicidal behaviour as defined by the original authors of the included studies. As a result, suicide attempts were either identified from medical records, identified from clinical notes (recorded by a clinician or gatekeeper) or reported by patients (via questionnaires or during interviews). Suicidal ideation was reported by patients and assessed on the basis of questionnaires or clinical interviews. There were no restrictions on study participants in terms of age or disorder, as long as they were at risk of suicide (on the basis of current suicidal ideation or a recent suicide attempt). Studies were excluded if they were not written in English or not peer-reviewed.

All identified studies were exported to EndNote X9 for Windows (Clarivate, Boston, USA; see <https://endnote.com/>), where duplicates were removed. The studies were subsequently imported into Covidence software for Windows (covidence, Melbourne, Australia; see <https://www.covidence.org/>) for managing the meta-analysis. To determine study eligibility, all titles and abstracts were screened independently by two researchers (C.N. and W.v.B.), who also conducted the second full-text screening independently. Disagreements or uncertainties were discussed with the senior researcher supervising the project (H.R.).

Data extraction

We started data extraction on 4 February 2020. A data extraction sheet was used to collect information regarding setting, participants, design, intervention and control group. Intention-to-treat data were

extracted when possible. The data were extracted independently by two authors (C.N. and D.J.). In the event of disagreement, a third author was consulted (W.v.B.). The corresponding authors were contacted if studies did not list the necessary data to conduct the quantitative analyses. If no additional data were available, the study was omitted from further analyses.

Statistical analysis

For our primary outcome of suicidal behaviour measured as the combined rate of suicide attempts and suicide deaths, effect sizes were calculated based on the number of participants in the intervention and control condition who had engaged in suicidal behaviour during the follow-up period. Effects were based on relative risk and its 95% confidence interval, calculated as the ratio of the probability of suicidal behaviour in the intervention condition to its probability in the control condition. A relative risk lower than 1 would indicate that persons receiving an SPTI had lower risks of suicidal behaviour than controls, whereas a relative risk higher than 1 would indicate a higher risk and a relative risk of 1 would indicate a similar risk for the two groups.

For the secondary outcome of suicidal ideation, we extracted mean (s.d.) scores and presented them as standardised effect sizes, using Hedges’ *g*. Hedges’ *g* was calculated by subtracting the average score at follow-up for suicidal ideation by persons receiving the intervention from the average score of those in the control condition, and dividing the result by the pooled standard deviation. An effect size of 0.8 was considered a large effect, 0.5 was considered moderate and 0.2 was considered small.²⁰

To further quantify effects, the number needed to treat (NNT), which summarises the number of patients who would need to be treated in order for one additional patient not to engage in suicidal behaviour, was calculated if a significant outcome effect supported this.²¹

To account for differences between study populations, interventions and control conditions, we performed a random-effects meta-analysis. In studies where multiple intervention conditions were investigated, the control condition was split into two or more subgroups, dividing the number of control participants by the number of intervention conditions.

Outliers were evaluated by examining whether the 95% confidence intervals of individual studies overlapped with the 95% confidence interval of the pooled effect size. In the absence of an overlap, the study would be identified as an outlier. Publication bias was assessed by visually examining the funnel plots of the outcome measures.²² We used Egger’s linear regression test of the intercept to examine whether bias captured by the funnel plot was significant, and performed Duval and Tweedie’s trim-and-fill procedure to assess for potential publication bias.^{23,24}

As a test of homogeneity of effect sizes, we calculated the I^2 statistic, an indicator of variation between studies. No observed heterogeneity is shown as 0%, and larger values suggest an increasing level of heterogeneity, with 25% as low, 50% as moderate and 75% as high.²⁵ We further estimated the 95% confidence interval around I^2 , using the non-central χ^2 -based approach within the *heterogi* module in Stata for Windows version 16.0.^{26,27} Factors that may have introduced heterogeneity in individual studies were investigated with subgroup analyses. Based on study characteristics of the included studies, subgroup analyses were performed with the following potential moderators: methodological quality, setting and population.

Statistical significance was set at $P < 0.05$. All of these analyses were conducted with the software Comprehensive Meta-Analysis for Windows version 3.3.070 (Comprehensive Meta-Analysis, Englewood, USA; see <https://www.meta-analysis.com/>), except for the heterogeneity (I^2) and its confidence interval, for which we used Stata.^{26,27}

Quality assessment

The methodological quality was determined with the Cochrane Collaboration's Risk-of-Bias Tool 2,²⁸ which considers risk of bias across five domains: the randomisation process, deviations from the intended interventions, missing outcome data, measurement of outcome and selection of the reported results. The risk of bias for each domain was scored as low, moderate or high. The overall bias was considered high when one of the domains was scored as high. The risk of bias assessment was performed independently by two authors (C.N. and D.J.), with a third author (W.v.B.) consulted in case of disagreement.

Results

Study selection

The systematic search identified 3463 studies, and one additional study was added after the hand-searching of relevant journals. After removal of duplicates, 1816 studies remained. After evaluation of titles and abstracts against the inclusion criteria, 1782 studies were deemed not eligible. We retrieved 34 full-text articles for further review, from which 6 studies were ultimately included in the meta-analysis (see PRISMA flow chart in Fig. 1). Corresponding authors of four studies were contacted to retrieve

additional information necessary for our meta-analysis, of which two authors replied.

Study characteristics

The six studies were conducted in three different countries (USA, $n = 3$; Taiwan, $n = 2$; Switzerland, $n = 1$) and published between 2013 and 2018 (Table 1).^{12,13,17,18,29,30} All studies reported rates for suicide attempts and suicides. Three studies additionally reported on suicidal ideation.^{12,13,30} Intention-to-treat data could be extracted from five studies,^{12,13,17,18,30} and one study had only study completers' data available.²⁹

The meta-analysis included four randomised controlled trials,^{12,13,29,30} a non-randomised controlled trial¹⁸ and one study with an interrupted time-series design.¹⁷ In four studies, safety planning was assessed as an add-on to TAU.^{13,18,29,30} Two studies compared a safety plan as a standalone intervention to TAU and included two intervention arms.^{12,17} One of those studies used a safety plan in both conditions,¹² and the other in only one condition.¹⁷ Here, the intervention condition without the safety plan was omitted from the meta-analysis. This yielded a total of seven comparisons in the current meta-analysis.

In all, 3536 participants ($n = 2096$ in intervention conditions; $n = 1440$ in control conditions) aged ≥ 18 years (average age range of 26–48 years) were enrolled in the studies. More male (63.2%) than female participants were included, and half of the participants

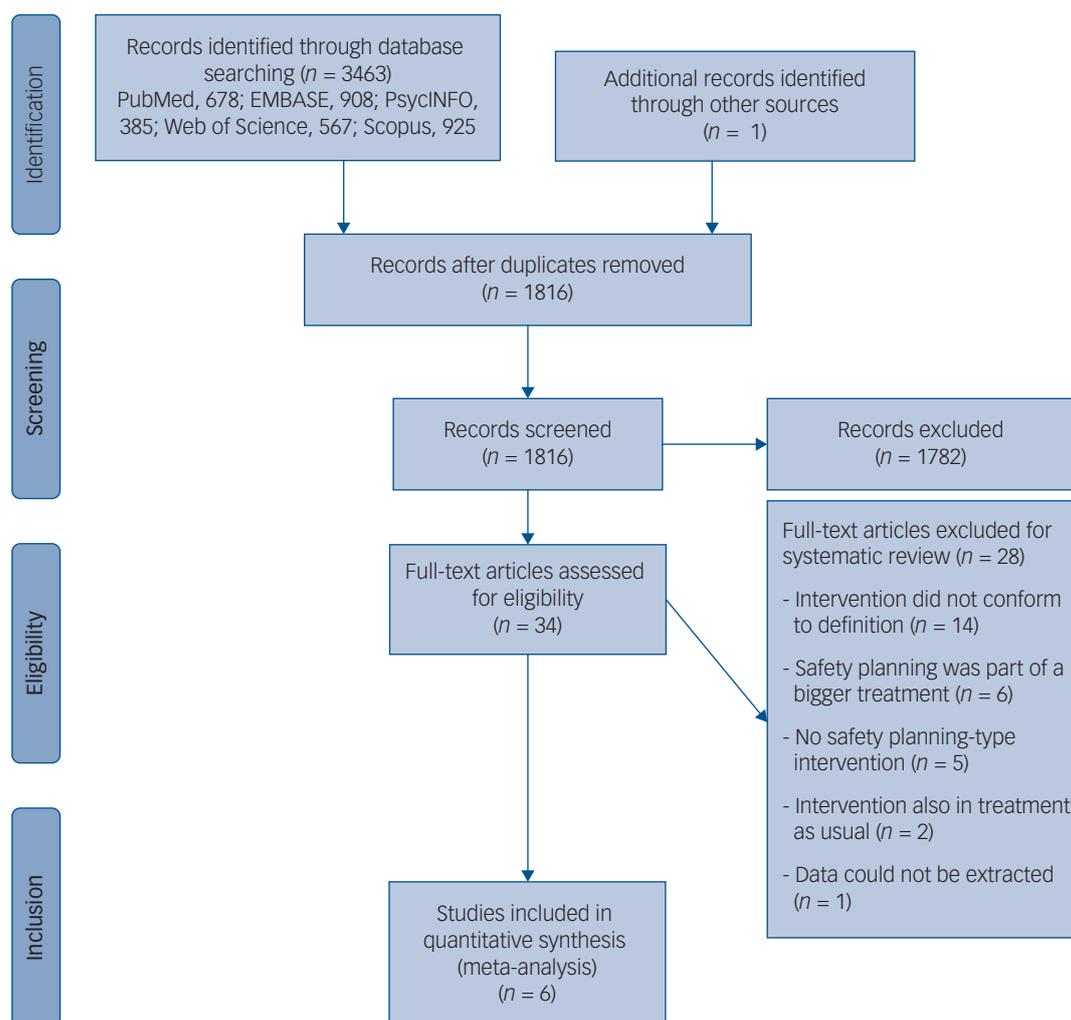


Fig. 1 Preferred Reporting Items for Systematic Reviews and Meta-Analysis flow chart of study selection process.

Table 1 Characteristics of studies

| Study | Country | Target group | Setting | Design | Intervention (n) | Control (n) | Outcome | Follow-up |
|------------------------------------|-------------|---|---|------------------|--|--|--|-----------|
| Bryan et al ¹² | USA | Active-duty United States Army soldiers, adults, attending emergency department with suicidal ideation and/or attempt | Veterans Health Administration emergency department | RCT | CRP (n = 32) and E-CRP (n = 33); single session; CRP (warning signs, coping strategies, social support, crisis resources) and referral to treatment; E-CRP (CRP plus reasons for living) and referral to treatment | TAU (n = 32); contract for safety | Suicidal behaviour: SASII, medical records; suicidal ideation: BSS | 6 months |
| Chen et al ²⁹ | Taiwan | Referred to suicide prevention centre in Kaohsiung following suicide attempt | Case management services | RCT | Control plus coping card (n = 250 ^a); crisis postcard (individualised coping strategies, crisis resources) sent after 3 months | Control (n = 363 ^b); case management for 3 months (psychological support, coping strategies, adherence to treatment, individualised case-work) | Suicidal behaviour: clinical notes | 6 months |
| Gysin-Maillart et al ³⁰ | Switzerland | Adults, admitted to emergency department for suicide attempt | Emergency department | RCT | TAU and ASSIP (n = 60); three sessions; narrative interview, reconstruction of suicidal action, leaflet (long-term goals, warning signs and personal safety strategies, crisis resources), regular letters to participants for 24 months | TAU (n = 60); enhanced TAU (care as considered necessary by the clinicians in charge), single clinical interview | Suicidal behaviour: medical records; suicidal ideation: BSS | 24 months |
| Miller et al ¹⁷ | USA | Adults, attending emergency department with recent suicide attempt or ideation | Emergency department | ITS | ED-SAFE and screening (n = 502); secondary suicide risk screening, self-administered safety plan (safe environment, warning signs, coping strategies, important things, social support, professional help), follow-up calls | Screening only (n = 377) ^c and TAU (n = 497); secondary suicide risk screening and care as usual; usual care at each site | Suicidal behaviour: CSSRS, medical records | 12 months |
| Stanley et al ¹⁸ | USA | USA military veterans, adults, attending emergency department for suicide concerns | Veterans Health Administration emergency department | Controlled trial | CAU and SPI (n = 1186); single session; SPI (warning signs, coping strategies, social support, crisis resources, safe environment), follow-up calls | CAU (n = 454); assessment, secondary evaluation, care as needed, out-patient appointment at discharge | Suicidal behaviour, medical records | 6 months |
| Wang et al ¹³ | Taiwan | Adults, reporting to case management services following suicide attempt | Case management services | RCT | TAU and crisis coping cards (n = 34); 6-week coping card training sessions, coping card (self-awareness of ideation, coping strategies, crisis resources, local medical information) | TAU (n = 33); case management (suicide crisis assessment, emotional support, referral) | Suicidal behaviour: clinical notes; suicidal ideation: BSRS | 3 months |

RCT, randomised controlled trial; CRP, Crisis Response Plan; E-CRP, Enhanced Crisis Response Plan; TAU, treatment as usual; SASII, Suicide Attempt Self-Injury Interview; BSS, Beck Scale for Suicide Ideation; ASSIP, Attempted Suicide Short Intervention Program; ITS, interrupted time series design; ED-SAFE, Emergency Department Safety Assessment and Follow-up Evaluation; CSSRS, Columbia Suicide Severity Rating Scale; CAU, care as usual; SPI, Safety Planning Intervention; BSRS, Brief Symptom Rating Scale.

a. Participants who read their crisis postcard.
b. Participants who received full case management for 3 months.
c. Screening-only condition was not included in the meta-analysis.

(50.2%) had attempted suicide at least once before enrolment. Not all studies reported on participants' mental health,^{13,29} but depression,^{17,18} affective disorders³⁰ and adjustment disorders¹² were mentioned as predominant comorbid disorders in other studies.

Suicidal behaviour was measured via interviews,^{12,17} medical records^{12,17,18,30} and clinical notes (i.e. recorded by a gatekeeper or clinician).^{13,29} In some studies, participants had all previously attempted suicide ($n = 3$)^{13,29,30} or were experiencing suicidal ideation and/or a recent suicide attempt ($n = 2$),^{12,17} whereas the participants in one study were reported to have visited a hospital for suicide-related concerns.¹⁸ In two studies, professional groups (soldiers and military veterans) were involved,^{12,18} and the other studies comprised participants from the general population.^{13,17,29,30} Settings varied between general hospitals ($n = 2$),^{17,30} military hospitals ($n = 2$)^{12,18} and case management services ($n = 2$).^{13,29} Participants of one study were in-patients,³⁰ whereas all others were out-patients.^{12,13,17,18,29}

All interventions were provided face to face by a clinician, and consisted of comparable safety plans. See Table 1 for an overview of safety planning components included in the interventions. In addition to coping strategies and sources of support, four studies included personal warning signs of an impending suicidal crisis.^{12,17,18,30} The safety plan was generally provided in person and on paper,^{12,13,17,18,30} although in one study it was sent to participants by post.²⁹

Primary outcome: suicidal behaviour

Of the 3536 included participants, 348 engaged in suicidal behaviour during the follow-up period ($n = 150$ in the intervention condition; $n = 198$ in the control condition). The incidence of suicidal behaviour ranged from 0 to 18.3% in intervention conditions, and 5.3 to 26.7% in control conditions (see Supplementary Appendix 3).

The relative risk of suicidal behaviour for participants who received an SPTI was 0.57 compared with TAU (95% CI 0.41–0.80, $P = 0.001$; $I^2 = 32.51\%$, 95% CI 0–71%; NNT = 16), indicating that the risk of suicidal behaviour was significantly reduced by 43% in the intervention condition (Fig. 2). A visual inspection of the forest plot indicated no outliers, as the effect sizes overlapped with the 95% confidence interval of the pooled effect size (see Fig. 2).

Secondary outcome: suicidal ideation

The mean effect size of the three studies examining the effects of SPTIs on suicide ideation (combined $N = 283$) was non-significant

($g = 0.69$, 95% CI -0.04 to 1.42 , $P = 0.06$; $I^2 = 87.60\%$) (see Fig. 3 and Supplementary Appendix 3).^{10,20,26}

Methodological quality

In terms of methodological quality, participants in two studies were not randomised, and in two other studies, the randomisation was based on a national identification number. Hence, results of these four studies were considered to be at high risk of bias (Table 2). In five studies, deviations from the intended interventions (such as problems in recruitment or in delivering the intervention) were reported. All studies apparently handled incomplete outcome data correctly. In two studies, no description was given of the assessments and assessors, hence bias in outcome measurement was evaluated to be high. Five studies were considered at moderate risk of bias in their selection of the reported outcome measures. Overall, one study was considered to be at low risk of bias, one at moderate risk of bias and four at high risk of bias.

Publication bias

The inspection of the funnel plot suggested publication bias (Fig. 4), and that was supported by a significant Egger's test of the intercept ($P = 0.001$). Duval and Tweedie's trim-and-fill procedure suggested that three studies in favour of TAU, with a smaller s.e., might be missing from the research literature. With those studies imputed, the relative risk for engagement in suicidal behaviour came to 0.71 (95% CI 0.59–0.86), implying that the relative risk for patients who received an SPTI would be closer to 1, as compared with TAU, but would remain significant.

Subgroup and sensitivity analyses

We assessed possible sources of the heterogeneity, using methodological quality, setting and population as potential moderators in subgroup analyses, but found no significant differences between groups (Table 3).

We tested the robustness of the effect on suicidal behaviour in additional sensitivity analyses, yet the pooled relative risk remained significant after exclusion of the studies with the highest or lowest relative risk (relative risk 0.481, $P = 0.000$ versus relative risk 0.598, $P = 0.001$). A significant pooled relative risk was also found when we distinguished between studies with large samples ($N > 500$) and smaller samples (large samples: relative risk 0.688,

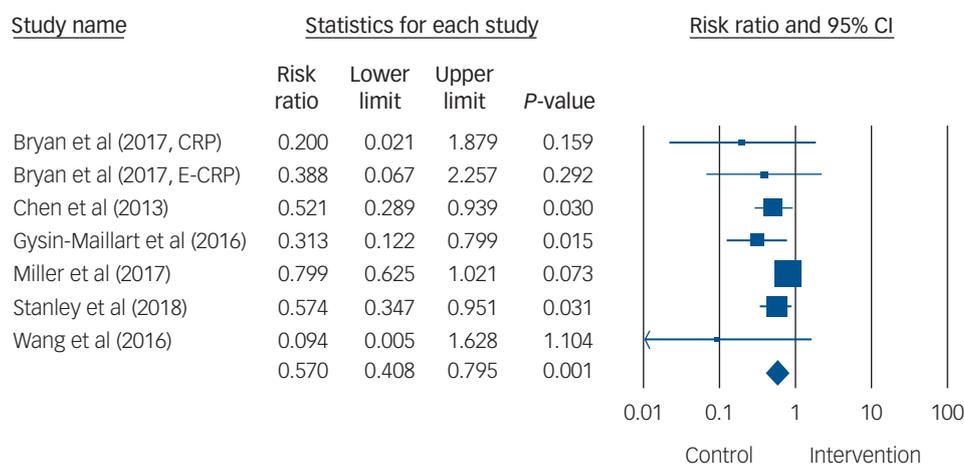


Fig. 2 Forest plot for suicidal behaviour. CRP, standard crisis response plan; E-CRP, enhanced crisis response plan.

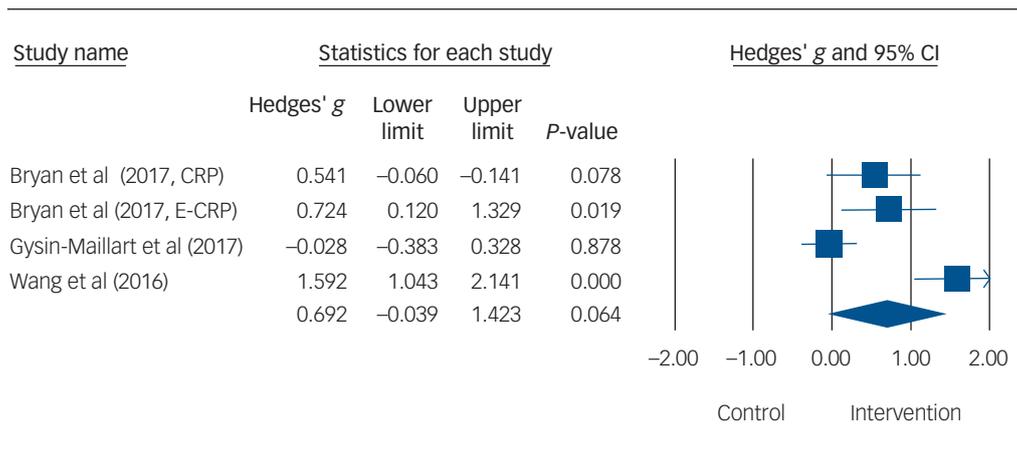


Fig. 3 Forest plot for suicidal ideation. CRP, standard crisis response plan; E-CRP, enhanced crisis response plan.

Table 2 Risk of bias within studies

| Study | Randomisation | Deviation from intended interventions | Missing outcome data | Measurement of outcomes | Selection of reported results | Overall bias |
|------------------------------------|---------------|---------------------------------------|----------------------|-------------------------|-------------------------------|--------------|
| Bryan et al ¹² | Low | Moderate | Low | Low | Moderate | Moderate |
| Chen et al ²⁹ | High | High | Low | High | Moderate | High |
| Gysin-Maillart et al ³⁰ | Low | Low | Low | Low | Low | Low |
| Miller et al ¹⁷ | High | Moderate | Low | Low | Moderate | High |
| Stanley et al ¹⁸ | High | Moderate | Low | Low | Moderate | High |
| Wang et al ¹³ | High | High | Low | High | Moderate | High |

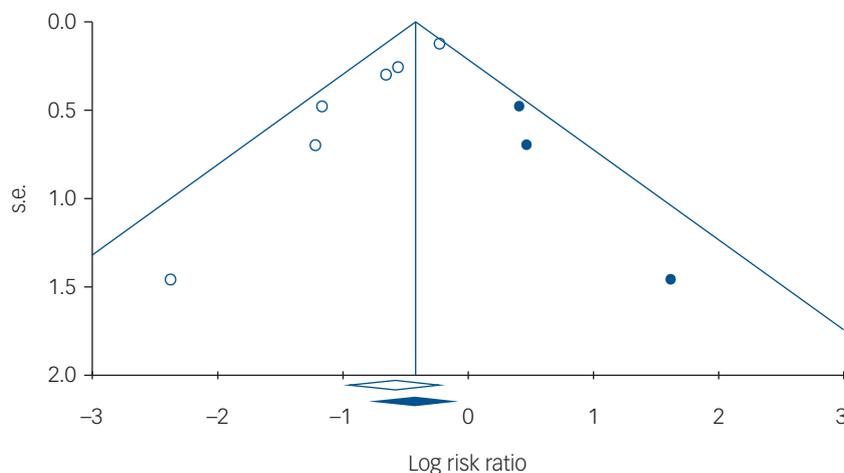


Fig. 4 Funnel plot of s.e., by log risk ratio.

$P = 0.006$; small samples: relative risk 0.285, $P = 0.001$), and between studies with and without randomisation (randomised: relative risk 0.414, $P = 0.000$; not randomised: relative risk 0.713, $P = 0.032$).

Discussion

This meta-analysis found that SPTIs for suicide prevention were associated with reductions in suicidal behaviour, but no effect was identified on suicidal ideation. Overall, six studies were included for analysis. SPTIs were associated with a risk of engagement in

suicidal behaviour that was 0.57 times the risk of patients without such an intervention. This means that the risk of suicidal behaviour was reduced by 43% (NNT = 16) for patients who were utilising an SPTI. The findings from sensitivity analyses supported a robust effect. The observed effect is in line with the hypothesis that safety plans reduce the imminent risk of engagement in suicidal behaviour by presenting alternative coping strategies and sources of support.^{10,11} The outcome also appears consistent with clinicians' beliefs in the effectiveness of safety planning.^{14,15} However, other interventions may be needed to reduce suicidal ideation.

The lack of an effect from SPTIs on suicidal ideation might be explained by the fact that suicidal ideation was not directly targeted

Table 3 Subgroup analyses of associations between effect sizes and study characteristics

| | Number of comparisons | Relative risk | 95% CI | I^2 | 95% CI | <i>P</i> -value ^a |
|-----------------------------------|-----------------------|---------------|-------------------------------|--------|----------------|------------------------------|
| All studies (<i>N</i> = 6) | 7 | 0.570 | 0.408–0.795, <i>P</i> = 0.001 | 32.505 | 0–71% | |
| Subgroup analyses (<i>n</i> = 7) | | | | | | |
| Quality of study | | | | | | |
| Low risk of bias | 3 | 0.309 | 0.142–0.672, <i>P</i> = 0.003 | 0.00 | 0–90% | 0.082 |
| High risk of bias | 4 | 0.651 | 0.471–0.900, <i>P</i> = 0.009 | 34.230 | 0–77% | |
| Setting | | | | | | |
| Emergency department | 5 | 0.595 | 0.404–0.875, <i>P</i> = 0.008 | 35.277 | 0–76% | 0.542 |
| Case management | 2 | 0.339 | 0.118–1.351 | 24.926 | Not applicable | |
| Population | | | | | | |
| General population | 4 | 0.543 | 0.320–0.921, <i>P</i> = 0.024 | 56.008 | 0–85% | 0.955 |
| Other | 3 | 0.532 | 0.331–0.855, <i>P</i> = 0.009 | 0.00 | 0–90% | |

a. The *P*-values in this column indicate whether the difference between the effect sizes in the subgroups is significant.

by this type of intervention. Such a supposition is supported by a recent systematic review by McCabe et al on brief psychological interventions for suicide prevention, which suggested that such interventions may alter behaviours of individuals at risk of suicide, but their level of cognitive distress remains unaffected.⁷ Another explanation for the lack of effect on suicidal ideation may lie in the fact that suicidal thoughts are known to fluctuate over time;³¹ hence, possible initial effects might have abated by the end of follow-up. Psychotherapeutic interventions that are known to be effective in reducing suicidal ideation include cognitive-behavioural therapy and dialectical behaviour therapy.^{5,6}

Strengths and limitations

To the best of our knowledge, this paper is the first to report a meta-analysis on SPTIs for suicide prevention. Our meta-analysis was adequately powered and supported by sensitivity analyses. Nonetheless, our results should be interpreted with caution because of several limitations. First, the field of SPTIs is relatively new, thus only a few controlled studies could be included in the analyses. Second, not all of the included studies were randomised, implying limited comparability. Third, our findings cannot be generalised to adolescents and children, as only adults were included in the analyses. Fourth, we did not include the term ‘self-harm’ in our search string because the known SPTIs were developed specifically as suicide prevention tools. However, in response to a reviewer, we have run a *post hoc* search including self-harm as a search term, and this did not yield any additional studies meeting our inclusion criteria. Another limitation is the low methodological quality of the studies, which may have affected outcomes. On the other hand, our use of a single bias risk assessment tool for all studies could have distorted results from non-randomised controlled studies. Furthermore, the studies varied amongst themselves, including differences in the measurement of ‘suicide attempt’ and in the length of follow-up. That said, variations in terms of quality, settings and included populations did not explain the heterogeneity in this meta-analysis. Other differences between studies might offer explanations; for example, in terms of inclusion criteria or the content of TAU (such as possible variations in the care needed in different countries). Moreover, since the studies implemented safety planning in different ways, future research is required to determine the active ingredients of SPTIs, and to assess whether follow-up telephone calls play a role.

Implications for the future

From a clinical point of view, the present study has important implications. SPTIs are already widely implemented, and they are identified as best practice for suicide prevention by the National Institute for Health and Care Excellence and the Suicide Prevention Resource Center. So far, implementation has been largely based on

clinicians’ beliefs about the value of the interventions,^{14,15} but our study has now demonstrated their effectiveness in reducing suicidal behaviour. This suggests that safety planning should continue to be identified as best practice for the prevention of suicidal behaviour in individuals at risk of suicide, and should be strongly recommended in clinical practice and guidelines for suicide prevention.

Higher-quality, randomised controlled studies on the effectiveness of SPTIs will be needed to replicate the results of the current meta-analysis. For now, SPTIs appear to be an effective strategy to reduce suicidal behaviour.

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Supplementary material

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Data availability

Data availability is not applicable to this article as no new data were created or analysed in this study.

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Author contributions

C.N. had full access to all data in the study and takes responsibility for integrity of the data and accuracy of data analyses. C.N., W.v.B. and H.R. were responsible for the study concept and design. C.N., W.v.B. and D.J. contributed to the collecting and processing of the data. C.N. analysed the data and discussed the results and interpretation, with W.v.B. and H.R.. C.N. drafted the manuscript. C.N., W.v.B., D.d.B., D.J., A.E., G.P., R.C.O., J.H.S., A.K. and H.R. critically revised the manuscript.

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Declaration of interest

None.

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