Published in final edited form as:

Soc Psychiatry Psychiatr Epidemiol. 2021 October 01; 56(10): 1729–1750. doi:10.1007/s00127-020-02005-5.

Psychosocial interventions for self-harm in low-income and middle-income countries: systematic review and theory of change

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Abstract

Purpose—To synthesise the evidence on effectiveness, acceptability and the delivery mechanisms of psychosocial interventions for self-harm in low and middle income countries and to develop a pathway of change specific for self-harm interventions.

Method—Studies reporting one or more patient or implementation outcomes of a psychosocial intervention targeting self-harm and conducted in low- and middle-income countries were included. Taxonomy of treatment components and a theory of change map was created using information from the studies.

Results—We identified thirteen studies including nine randomised controlled trials (RCT), three non-RCTs, and a single experimental case design study. A single study using postcard contact and another using cognitive behaviour therapy (CBT) reported a reduction in self-harm attempts. Suicidal ideations were significantly reduced with CBT, volitional help sheets and postcard contact in different studies. Suicide risk assessment, problem solving and self-validation were the most frequently used elements in interventions. Goal-setting was the technique used most commonly. Cultural adaptations of psychotherapies were used in two studies. High attrition rates in psychotherapy trials, limited benefit of the delivery of treatment by non-specialist providers, and variable benefit observed using phone contact as a means to deliver intervention were other important findings.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Conclusion—There were no strong positive findings to draw definitive conclusions. Limited availability and evidence for culturally adapted interventions in self-harm, lack of evaluation of task sharing using evidence based interventions as well as a dearth in evaluation and reporting of various intervention delivery models in low- and middle-income countries were major literature gaps.

Keywords

Self-harm; Psychosocial interventions; Low- and middle-income countries; Theory of change

Introduction

Three quarters of global suicides occur in low- and middle-income countries with self-harm the strongest predictor of completed suicide [1, 2]. Contextual and motivational risks for self-harm appear to be different in low- and middle-income countries (LMICs) compared to high-income countries (HICs). The stronger association of social and family related factors with self-harm as compared to mental illness, greater reliance of youth on their families, and the blurring of non-suicidal and suicidal self-harm are some of the key differences [3, 4]. This is important in the context of the psychosocial interventions for self-harm that are central to WHO recommendations to reduce the burden of suicide [2]. Overwhelmingly, the psychological interventions that have shown promise in reducing self-harm have been developed and tested in HICs [5, 6]. Such interventions may be adapted for use in LMICs with delivery by non-specialist providers without formal training or certification in mental health, and in different settings, such as in a hospital or a patient's home [7]. Very few studies have to date examined the effectiveness of psychological interventions for self-harm in LMICs. Important questions remain about what has already been tested, how, where and for whom as well as what the most efficacious delivery mechanisms may be in view of resource constraints.

This systematic review synthesises the literature on the acceptability and effectiveness of psychological therapies for self-harm and the optimal mechanisms for delivery of interventions in LMICs. It complements theory of change (ToC) work focussed on how an intervention works, why and for whom [8]. A pathway of change for self-harm interventions that takes into account the contextual specificities of LMICs could be of great help in guiding the future research on pragmatic and scalable interventions and their delivery using non-specialist human resources.

Aim of the study

The review aims to synthesise the research literature on the implementation and effectiveness of interventions for reducing self-harm in low- and middle-income countries.

The specific objectives of the current review are:

To conduct a systematic review of studies on the implementation, adaptation or effectiveness of psychosocial interventions for self-harm in LMICs.

To identify effective components and the delivery mechanisms of these interventions, using a narrative synthesis.

To create a ToC map from an evaluation of interventions, indicators, assumptions, rationales, outcomes as well as contextual and motivational factors to guide delivery of future interventions in LMIC contexts.

Methods

We conducted the systematic review in accordance with PRISMA guidelines [9]. To qualify for inclusion, psychosocial therapies had to explicitly target non-suicidal self-harm, or a suicide-related behaviour, including suicide, suicide attempts (SA), suicidal ideation (SI) or suicide risk (the term self-harm is used for all these behaviours in this review) in children, adolescents and adults. Studies of any design (qualitative, quantitative and mixed-methods) assessing the implementation, adaptation or effectiveness of psychological therapies to reduce self-harm (intentional selfpoisoning or self-injury, irrespective of motive or the extent of suicidal intent), or a suicide-related outcome (see above) were considered.

Eligibility criteria

Setting

Studies conducted in LMICs were included in the review. The World Bank classification 2019 was used to identify LMICs.

Interventions

In this review, the psychological or psychosocial interventions involving any form of contact with health care providers were included. All studies in English language published between 2000 and 2019 were eligible for inclusion. We excluded self-help, psychological first aid, computerized and other general psychoeducation interventions that are not specific to self-harm, studies from high-income countries and unpublished studies.

Outcomes

Studies had to report one or more patient outcomes or implementation outcomes of a relevant intervention targeting self-harm to be considered for inclusion. Outcomes had to be measured quantitatively or described qualitatively. The outcome could be patient related or delivery related.

Study selection

We began our review by identifying eligible studies from two Cochrane reviews published on interventions for self-harm [5, 6]. In addition, five electronic databases were searched: MEDLINE, Embase, PsycINFO, PsycEXTRA, and Global Health. The following terms formed the basis of the search strategy: 'self-harm' OR 'deliberate self-harm' OR 'DSH' OR 'self-injurious behaviour' OR self-injury OR 'self-inflicted wounds' OR 'suicide attempt' OR 'suicidal behaviour' OR 'suicidal thoughts' OR 'suicidal ideations' AND 'interventions' OR 'treatment' OR 'psychotherapy' OR 'therapy' AND 'low middle income country/ies' OR 'an individual country from LMIC list (WHO Classification, 135 countries)'. Further papers were identified through hand searching the references of relevant studies and reviews.

Two reviewers (SA and SS) independently screened studies for inclusion, and assessed study quality.

Analysis

The common elements and techniques from interventions were identified by a distillation approach of analysing different elements within any psychological treatment package [10]. We developed a taxonomy of treatment components consisting of elements and techniques. An element was defined as a therapeutic activity or strategy [11], and technique as a skill that the therapist implements during a session to deliver an element [7]. We further categorized elements into two categories—self-harm specific and generic. Self-harm specific elements include strategies to assess risk and enhance safety, and are specific to the condition. Generic elements are grounded in specific psychological mechanisms; we grouped them into domains that have been previously used for an easy understanding: emotional, behavioural, cognitive, interpersonal and engagement.

Engagement elements are universal therapy experiences and reflect the approach used by the therapist to engage a patient or implement the therapy, or both [12]. In addition, we identified delivery processes including who delivered the intervention (treatment providers), where the intervention was delivered (delivery site); the training given to the treatment providers; and the expected impact to allow us to map the approaches that have been used by these interventions in different contexts and different subpopulation to design a ToC map that could guide the delivery of future interventions (Fig. 1).

The ToC was first conceptualised and drafted by the lead reviewer (SA), drawing on the findings of the studies. A senior reviewer with expertise in designing complex interventions using ToC model evaluated the ToC map, and a working draft was agreed between the two reviewers. The map was finalised in consensus with a third reviewer.

Results

Study details

Design and country—We identified thirteen studies out of which nine were randomised controlled trials (RCTs), three non-RCTs and a single case experimental design study (Table 1). Four RCTs were conducted in Iran, one in China, Malaysia, Pakistan and Sri Lanka each, and one was conducted across five nations by WHO (Brazil, China, India, Iran, Sri Lanka). The non-RCTs were conducted in China, India and Sri-Lanka and the single case experimental design study was conducted in Nepal (Table 1).

Sample—The sample size for studies using psychotherapy was smaller and ranged from 10 in a DBT adaptation study to 221 in a cognitive behaviour therapy (CBT) trial [13, 14]. The sample size was larger for brief contact intervention studies and ranged from 55 in the phone contact trial to 2133 in the postcard trial (Table 1) [15, 16]. The participants' minimum age ranged from 12 to 18 years. The mean age of the sample was under 35 years in ten studies and not reported in three studies (Table 1). The gender distribution varied in different studies with no male participation in a small sample psychotherapy adaptation study to 50% male

participants in a RCT [13, 17]. Female participants outnumbered males in twelve studies. The gender distribution was not reported in a single study [18].

Outcomes—Seven RCTs reported self-harm and suicide attempts as an outcome. Six out of seven studies did not find any difference in self-harm and suicide attempts between the intervention and control groups (Table 1). A single RCT reported a significant reduction in total suicide attempts and the number of attempts at the end of the intervention at 12 months [16]. The positive effect in this study was sustained at 24-month follow-up [19].

Seven RCTs reported suicidal ideation as an outcome. Out of these, five RCTs found a significant reduction in suicidal ideation scores post-intervention (two studies using CBT, single studies using phone contact, postcard contact and volitional help sheets each) (Table 1). Interestingly, a single RCT reported significantly lower suicidal ideations in the control group (consisting of face to face reviews) [20]. There was no difference in suicidal ideations at post-intervention in between the groups in the seventh RCT [21]. Suicidal ideation and behaviour were reported together as an outcome and were significantly less in the intervention group as compared to control in a single RCT [22].

Two RCTs reported a significant improvement in depressive symptoms, whereas no improvement in depressive symptoms occurred in a single RCT [15, 17, 21]. Problem solving skills as an outcome did not improve with intervention in a single RCT [20]. On the contrary, a significantly greater improvement in hope and interest was observed in the control group as compared to the intervention group in this study [20].

Two non-RCTs reported self-harm and suicide attempts as an outcome. There was no difference in the attempts in one of the studies, whereas the significance and effect size of the reduction was not reported in the other [18, 23]. Suicidal ideations as an outcome were reported in two non-RCTs (Table 1). A single non-RCT reported a significant reduction in ideations with the intervention. On the other hand, there was no significant change in suicidal ideations post-intervention in the other non-RCT [23, 24].

Significant improvement in depressive symptoms was reported in a single non-RCT and the problem solving skills improved with the intervention in two non-RCTs [18, 24].

The intervention

Type of interventions—Six out of the thirteen studies used CBT or problem solving therapy with varying results (Table 1). Brief periodic contact checking the status of participants by the health professionals was used as the treatment in the WHO led five nation study [23, 25]. Phone contact to assess participants' mental status and providing information about stress reduction was the intervention used and compared with treatment as usual in a single study [26]. In another study led by the same group, phone contact assessment was compared with face to face reviews [20]. Postcard contact was compared with treatment as usual in a single study [16]. The exploratory study from Malaysia used volitional help sheets (VHS) intervention to identify more adaptive alternative solutions to self-harm by exploring implementation intentions [22]. Dialectical behaviour therapy (DBT) was adapted for use in Nepal in a single case experimental design study [13].

Elements and techniques—The common elements and techniques of the interventions identified using distillation approach are shown in Fig. 2 and the components are listed in Table 2. The elements were divided into self-harm specific and generic elements which were further categorised in five domains. Self-harm specific elements identified from the studies include chain analysis; safety and crisis plan; developing reasons for living and hope; suicidal contracts; relapse prevention; and suicide risk screening [27, 28] (“Appendix”).

Suicide risk assessment was used in five studies making it the most commonly used specific element. Problem solving used in seven studies was the most commonly used behavioural element and self-validation the most commonly used cognitive element (Table 2). The interpersonal elements were part of fewer studies with interpersonal effectiveness appearing in a single treatment package and assertiveness and social support mobilization in two treatments (Table 2). Goal setting was the most commonly used in-session technique. Implementation intentions technique constituted the complete treatment as part of a volitional health sheet in a single trial [22].

The delivery

Table 3 lists the delivery related processes of various interventions.

Treatment duration and sessions—The length of interventions varied from four sessions for problem solving therapy, six to twelve sessions for CBT, ten sessions for DBT adaptation, up to 8 months for phone contact intervention and postal follow-up, 12 months for postcards and 9–18 months for brief contact interventions (Table 3). Attrition rates were higher in psychotherapy trials as compared to brief contact interventions. The highest refusal and attrition rates were noted in the three armed RCT from China in which there was a total loss of 93% from the randomised sample from the intervention arm (CBT) as compared to 25% from the telephone contact arm of the study [21]. More than an 80% attrition in the RCT from Malaysia using VHS prevented the researchers from reporting the follow-up findings at 6 months instead opting for reporting the final outcome at 3 months with 53% attrition [22]. On the other hand, brief contact interventions had lower drop-out rates. The postcard study from Iran noted a drop-out rate of 8.1%, and the five nation SUPRE-MISS (SUicide PREvention Multisite Intervention Study on Suicidal Behaviours) study had a 5% drop-out rate in the intervention arm compared to 12% in the control arm [25].

Who delivered the treatment—Interventions involving brief contact were delivered by nonspecialist health providers in two studies, Law et al. in Hong Kong and the five nation SUPRE-MISS study led by WHO [23, 25]. Psychotherapy trials involved treatment delivery by therapists. CBT was delivered by Masters-level psychologists with a few years of experience in two studies [14, 21]. Therapist details were not specified in four other psychotherapy trials (Table 3). An experienced local counsellor delivered DBT with the help of a specialist DBT trainer in the DBT adaptation study [13]. Phone contact interventions were delivered by a psychiatry resident doctor or an assistant in psychiatry in two studies [20, 26].

Where treatment was delivered—Ten studies did not mention the delivery site (Table 3). Treatment was delivered in an out-patient clinic or patient's home in a single trial [14]. In the five nation SUPRE-MISS study, the intervention was delivered at home where possible [25]. In an exploratory trial, the initial questionnaire was filled-in during the hospital stay and the follow-up questionnaire at home [22].

How treatment was delivered—Telephone contact was used for intervention delivery in four studies (Table 3). The components delivered by phone contact were supportive in nature in three studies, whereas it was used for delivery of components of problem solving therapy in a single trial [17]. Brief contact was initiated using postcards in a single study [16]. Self-report questionnaires were sent through the post for assessment in an exploratory trial [22].

Various approaches were used in the delivery of psychotherapeutic interventions. Three phase delivery of CBT based on the Stanley et al. model was used in single study, whereas another trial used a six step approach from Andrews and Hunt for problem solving therapy [15, 18]. Culturally adapted versions of interventions were used in two psychotherapy trials. The DBT adaptation was delivered to ten women in rural Nepal after specific modifications (Table 1) [13]. A cultural adaptation of CBT with various changes and additions was used in a study from Pakistan (Table 3) [14, 29]. Measures such as assertive follow-up, sharing therapist contact details, empathic approach, psychoeducation of the parents were used to reduce attrition while delivering psychotherapy in some studies [15, 24].

Discussion

The findings of the current review provide us with an understanding of what might work in preventing the recurrence of self-harm in LMICs and identifying the gaps in the literature. CBT and problem solving therapy emerged as the most investigated interventions for self-harm in LMICs. Systematic contact using postcards, CBT and volitional help sheets were effective in reducing suicidal ideations significantly (Table 1). The most frequently used treatment elements in interventions were: suicide risk assessment (self-harm specific); problem solving and self-validation (generic). Goal setting was the technique used most commonly. Successful use of culturally adapted psychotherapies was reported in two studies [13, 14]. High attrition rates in psychotherapy trials, variable benefits of using phone contact as a means to deliver intervention and limited benefit with delivery of treatment by non-specialist providers were other important findings.

The significant reduction seen in suicidal ideations and self-harm attempts with CBT and problem solving in five studies is consistent with the findings of a recent Cochrane review that found CBT to be the most promising psychosocial intervention for self-harm [6]. In addition, a systematic review of randomised trials comparing CBT with treatment as usual in patients with a previous recent suicide attempt showed the risk of a new suicide attempt reducing to half with CBT [30]. WHO mental health gap action programme recommends structured problem solving as a treatment for those with self-harm in the last year, if there are sufficient human resources (e.g., supervised community health workers) [31]. These findings together suggest the possibility of CBT or problem solving therapy as an option

to address high suicide rates and its clearest antecedent, non-fatal self-harm in LMICs. Although the theory of change proposed later in the review does not specify any particular psychological treatment, it can be used for the delivery of CBT or problem solving type of intervention (Fig. 3).

Administering therapy in an acceptable manner with low attrition remains a challenge in LMICs. The authors of two out of four RCTs using CBT found a lack of motivation and willingness to participate in the CBT programme. In Alavi et al.'s study, various measures listed could address this but it couldn't be overcome in Wei et al.'s study [15, 21]. The authors attributed the 93% attrition rate in this study to the negative life events leading to suicide attempts, poor understanding of CBT and suicide as an acceptable way to end misery or reduce the financial and emotional burden of families [21]. High attrition rates (53%) observed by researchers in Malaysia using VHS at 3-month follow-up were attributed to healthcare system related administrative processes mainly postal follow-up [22]. Our proposition in the theory of change model described later is to incorporate indicators to assess motivation to change and therapy preparedness at the beginning of the therapy as well as awareness building strategies amongst vulnerable youth, reasons for self-harm and help available, to prepare a sound background for success of any psychotherapeutic intervention (Table 4, Fig. 3).

Self-harm and suicide appear more closely associated with social causes and less with mental illness in LMICs as compared to western countries [4]. It becomes important for interventions for self-harm to address social, personal, and historical contexts to be acceptable in this setting. The use of a culturally adapted version of CBT could possibly explain the better engagement and low attrition rate in a single trial from Pakistan [14]. Similarly, DBT adaptation with specific modifications to the treatment content resulted in greater comprehensibility of the treatment and was acceptable in a rural Nepal setting [13]. These findings are consistent with an increased recognition of cultural influences in psychotherapy [32]. The development of a culturally congruent intervention or cultural adaptation of an evidence based treatment form the short-term and intermediate outcome in the theory of change causal pathway proposed later (Table 4, Fig. 3).

With limited resources and in absence of face to face reviews, phone contact could be a potential option in LMICs. The mixed results observed with telephone contact in the review can possibly be explained by the nature of the treatment delivered. Three studies used telephone contact to offer support rather than deliver specific components of an evidence based psychological intervention which was the case in a single study [17]. Even though Mousavi et al. found some benefit of supportive phone contact when compared with treatment as usual this benefit was lost when they compared the phone contact with face to face reviews [20, 26]. On the other hand, problem solving interventions when used with mixed with face-to-face reviews brought a significant reduction in suicidal ideations and improvement in social support [17]. The experience and background of the person making the phone calls could also influence the outcome. In Mousavi et al.'s study, a psychiatry registrar in last year of training made the phone calls, whereas in a large multicentre RCT in France, phone contact by a psychiatrist with at least 5 years of experience in managing suicidal crisis at 1 month after an emergency department presentation for self-harm,

significantly reduced the subsequent suicide attempts at 13-month follow-up as compared to treatment as usual [33]. A systematic review of digital technology found potential effectiveness of online, text-messaging, and telephone calls in treating and preventing mental disorders in LMICs [34]. This suggests a possibility of phones for either for delivery of interventions or for systematic contact in both clinical and community settings in self-harm in LMICs. An earlier study found a significant preventive influence of systematic contact for at least 2 years in people who are at risk of suicide and who refuse to remain in the health care system [35]. This was supported in an RCT using postcard contact in Iran that found a reduction in suicide related outcome measures at 1-year and 2-year follow-up [16, 19]. Our theory of change model proposes systematic contact for those who are unwilling for therapy or to remain in healthcare and have low motivation to change as assessed on motivational indicators (Table 4, Fig. 3).

It remains to be seen if any alternative forms of evidence based interventions such as CBT can be delivered effectively for self-harm by non-specialist providers as has been done in mental health conditions such as perinatal depression in LMICs [36]. Two studies in the review using non-specialist providers showed little improvement in the primary outcome measures suicide attempt and ideations [23, 25]. Although the participant satisfaction rates in the study involving volunteers were high, the type of interventions used were mainly supportive. The theory of change model (below) uses non-specialist providers (peer support workers) and elaborates on the training and support requirements for adequate delivery of a psychological intervention (Table 4, Fig. 3). In addition, the challenges related to motivation and willingness to participate in therapy need to be considered carefully in LMICs to establish a successful intervention delivery model making the best use of available resources. We propose to use the most common self-harm specific elements from interventions trialled in LMICs such as suicide risk assessment, safety and crisis planning and chain analysis to decide the referral pathway for self-harm hospital presentations (Fig. 3).

Fig. 3. Motivational theory of change for self-harm in low- and middle-income countries

Theory of change (ToC)

Drawing upon the findings of the studies included in the review, we propose a model of delivery of intervention in self-harm in LMICs based on theory of change (ToC) incorporating motivational indicators. Most of the self-harm presenting to the hospital emergency department in a hospital setting is impulsive in nature precipitated by an interpersonal conflict or some other negative life event [3]. Once the acute crisis is over, the motivation to address underlying problems responsible for the self-harm is diminished. The additional motivational indicators are based on a couple of premises, i.e., the change will be sustained only if there is a perceived need and desire for the change and there are extrinsic motivators for the change [37]; and an assessment of psychosocial vulnerabilities that play an important part in repetition of self-harm and delivering intervention to match the stage of change they are at, would result in greater success and best use of limited resources. The ToC map includes the core components identified by De Silva et al. and does not specify any particular psychological therapies or lay-counsellors delivered interventions [8].

The definitions, examples for each and details of the constructs used in the ToC map (Fig. 3) are listed in Table 4. We used conceptual mapping to identify themes from the studies that could be used for the ToC model [38]. The ToC map shows the multiple causal pathways through which the outcomes and activities work to achieve the desired impact which is to

reduce recurrence of self-harm in the community. The findings from the review studies as well as past evidence have informed the rationale for the interventions needed to move from one precondition on the causal pathway to the next. We identified the gaps in the research, the potential barriers and the interventions needed to overcome these barriers along the way. The key assumptions for each causal pathway to are mentioned in Table 4. Furthermore, indicators for the achievement of each precondition in the pathway is listed to evaluate whether every stage of the pathway leads to the final impact.

Table 4

Components of motivational theory of change for self-harm in low- and middle-income countries (based on theory of change by De Silva et al. [8])

Components	Examples from theory of change map for self-harm interventions
Ultimate (impact) real-world change the program may contribute towards	Reduced recurrence of self-harm in the community
Long-term outcome Final outcome program is able to change on its own	Reduced recurrence of self-harm in those receiving intervention
Short-term and intermediate outcome things that need to exist in order for logical causal pathway not to be broken and the impact achieved	Development/ adaptation of intervention/ treatment by staff in post Successful intervention delivery by health workers in the community/ hospital through changes in knowledge, attitudes and skills of health workers
Indicator things you can measure and document to determine whether you are making progress towards, or have achieved, each outcome (Fig. 3)	<p>(i) Number of staff trained (e.g., 1 IF per hospital clinic)</p> <p>(ii) PSW supervised by 1 CHW participate in the assessment process per hospital clinic</p> <p>(iii) PSWs in post and role incorporated into structure of hospital</p> <p>(iv) 80% of cases referred for therapy attend 60% of sessions</p> <p>(v) 80% of self-harm presentation to emergency department undergo therapy appropriateness assessment</p> <p>(vi) PSWs assess therapy appropriateness at 3-month follow-up of patients who were not referred for therapy earlier</p> <p>(vii) PSWs deliver counselling intervention under supervision</p> <p>(viii) 60% of cases referred by PSWs for specialist care receive care and 60% recovering cases come back for counselling</p> <p>(ix) Self-harm attempts at 12 months are reduced to half in those in program</p> <p>(x) 64% more reduction in self-harm ideations frequency and intensity</p> <p>(xi) 50% improvement in social functioning score at 3 months</p>
Motivational indicators Indicators related to perceived needs and desire determining individuals' motivation (can be measured to assess progress) (Fig. 3)	<p>I. 20% increase in awareness about individuals' reasons for self-harm behaviour and 20% reduction in stigma towards self-harm among family members/ carers</p> <p>II. 20% increase in motivation to change self-harm behaviour by self-awareness, desire to change, and skill acquisition</p> <p>III. 20% increase in knowledge of underlying factors (beyond immediate triggers) in self-harm among family members/ carers</p>
Interventions Strategies in the treatment/ intervention delivery model, the different components of the complex intervention	<p>1 Adequate training of staff to learn specific strategies related to self-harm such as risk assessment, safety and crisis planning</p> <p>2 IC conducts regular supervision with nurses, IFs, MOs</p>

Components	Examples from theory of change map for self-harm interventions
	<p>3 Adequate training of staff in post to assess motivation to change self-harm behaviour, perceived needs and therapy readiness</p> <p>4 Awareness building workshops for vulnerable population such as youth about self-harm behaviour, and help available</p> <p>5 IFs screens potential candidates for therapy according to severity of presentation as well as motivation to change</p> <p>6 Specialist care provided to clients with severe psychopathology</p> <p>7 Support options and systematic contact provided to self-harm candidates who need it but refuse to remain in healthcare</p> <p>8 IFs re-evaluate clients with severe psychopathology for therapy after symptoms improve and refer them for appropriate treatment</p>
Rationale key beliefs that underlie why one outcome leads to next, and why you must do certain activities to produce the desired outcome. Can be based on evidence or experience	<p>(a) Stronger association of self-harm in LMICs with social causes and less with mental illness [4]</p> <p>(b) Tailoring the management plan to self-harm candidates' needs to reduce refusal, drop-out rates and attrition [21–23]</p> <p>(c) Task shifting measures involving evidence based therapy might be more useful as compared to brief contact type interventions [23, 25] (further investigation needed)</p> <p>(d) Periodic contact with those who have engaged in self-harm can exert a preventive effect [19]</p> <p>(e) Culturally adapted version of evidence based treatments might be more acceptable [13, 14]</p> <p>(f) Assessment of motivational factors and therapy preparedness for improved participation in therapy (further investigation needed)</p>
Assumptions an external condition beyond the control of the project that must exist for the outcome to be achieved	<p>(A) Availability and willingness of PSWs and CHWs to deliver intervention and acquire required skills</p> <p>(B) PSWs have the necessary qualities as well as time and motivation to be counsellors for self-harm presentations</p> <p>(C) PSWs are regularly supervised, supervisors are available to discuss the difficult cases, and to provide support during crisis situation</p> <p>(D) IF and IC works in close coordination with specialised care available at the hospital to ensure smooth referral of cases requiring their help</p> <p>(E) Referral pathways for transition of care from counsellors to specialist services and back</p> <p>(F) Patients with self-harm are willing to receive counselling by peer support workers with involvement of specialist care where necessary</p> <p>(G) Specialist services are willing to receive referrals from IFs and refer back candidates who are recovering for counselling from PSWs</p>

CHW community health workers, *IC* intervention coordinator, *IF* intervention facilitator, *MO* medical officer, *PSW* peer support work

Our ToC map uses intervention delivery by non-specialist providers without formal training or certification in mental health (peer support workers). In addition, the current model uses hospital as the intervention delivery site as a majority of the studies had recruited the sample from hospitals. The ToC map for peer counselling for maternal depression in Goa (SHARE) served as the initial point of departure for ToC development as it proposes a model of counselling services using human resources in a LMIC [8]. The proposed ToC model could be adapted locally to guide the delivery of intervention in self-harm in other LMICs. The model takes into account motivational, and contextual variables in addition to the clinical presentation in assessing an individual's understanding of their behaviour

and their likelihood of change. The staff can be trained in specific tasks related to the intervention delivery resulting in better retention rates, better usage of resources as well as better outcomes for self-harm patients. They could work in different capacities depending on the regional needs and the resources available, e.g., intervention coordinator, intervention facilitator, community health workers, and peer support workers.

The information we could gather and use from the review studies for our synthesis was limited. In addition, the variable quality of data with vast differences in outcome measurement and reporting standards restricted our ability to conduct a meta-analysis. It is acknowledged that designing a controlled trial or an exploratory study for any psychotherapy or intervention is especially challenging in LMICs due to the associated psychosocial and logistic factors. Furthermore, we excluded studies that did not report explicit self-harm related outcome measures. As a result, we might have missed the studies that may have had positive effects on other related factors and the studies that were not captured by our search strategy.

There were no strong positive findings in the review for us to draw definitive conclusions about what works in reducing self-harm in LMICs. CBT and problem solving type of therapy emerged as the most investigated evidence based intervention in self-harm in LMICs. Other interventions such as VHS hold promise due to the low costs involved and the beneficial effects seen in an exploratory trial. An assessment of motivation and therapy preparedness to match the needs with the therapy offered may help in reducing attrition and possibly improve clinical outcomes in self-harm in low- and middle-income countries. Future studies should include a range of outcome measures to not only evaluate suicidal or self-harm behaviour but take into account positive effects on other important factors, such as problem solving and coping skills, help-seeking behaviour, personality vulnerabilities, attitudes and literacy.

Limited availability and evidence for culturally adapted interventions for self-harm in LMICs, lack of evaluation of task sharing using evidence based interventions as well as a dearth in evaluation and reporting of different intervention delivery models in LMICs are the gaps that need to be addressed urgently. In addition, our proposed theory of change model needs a comprehensive evaluation for its usefulness and effectiveness in delivering a culturally congruent evidence based intervention.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

The authors acknowledge the support of Sufiya Shaikh in helping with the study search for the systematic review

Funding

The current work is supported by the Wellcome Trust- India Alliance Research Fellowship (IA/CPHE/16/1/502664) awarded to SA.

Availability of data and material

The data reported in this manuscript were obtained from publicly available data from published studies searched using databases mentioned in the manuscript. The variables and relationships examined in the present article have not been examined in any previous or current articles, or to the best of our knowledge in any papers that will be under review soon.

References

1. Whitlock J, Muehlenkamp J, Eckenrode J, Purington A, Abrams GB, Barreira P, Kress V. Nonsuicidal self-injury as a gateway to suicide in young adults. *J Adolesc Health*. 2013; 52 (4) :486–492. [PubMed: 23298982]
2. World Health Organization. Preventing suicide: a global imperative. World Health Organization. 2014
3. Aggarwal S, Patton G, Reavley N, Sreenivasan SA, Berk M. Youth self-harm in low- and middle-income countries: systematic review of the risk and protective factors. *Int J Soc Psychiatry*. 2017; 63 (4) :359–375. DOI: 10.1177/0020764017700175 [PubMed: 28351292]
4. Knipe D, Williams AJ, Hannam-Swain S, Upton S, Brown K, Bandara P, Chang S-S, Kapur N. Psychiatric morbidity and suicidal behaviour in low- and middle-income countries: a systematic review and meta-analysis. *PLOS Med*. 2019; 16 (10) :e1002905. doi: 10.1371/journal.pmed.1002905 [PubMed: 31597983]
5. Hawton K, Witt KG, Salisbury TLT, Arensman E, Gunnell D, Hazell P, Townsend E, van Heeringen K. Psychosocial interventions for self-harm in adults. *Cochrane Database Syst Rev*. 2016; 12 (5) doi: 10.1002/14651858.CD012189
6. Hawton K, Witt KG, Salisbury TLT, Arensman E, Gunnell D, Townsend E, van Heeringen K, Hazell P. Interventions for self-harm in children and adolescents. *Cochrane Database Syst Rev*. 2015; 21 (12) doi: 10.1002/14651858.CD012013
7. Singla DR, Kohrt BA, Murray LK, Anand A, Chorpita BF, Patel V. Psychological treatments for the world: lessons from low- and middle-income countries. *Annu Rev Clin Psychol*. 2017; 13 :149–181. [PubMed: 28482687]
8. De Silva MJ, Breuer E, Lee L, Asher L, Chowdhary N, Lund C, Patel V. Theory of change: a theory-driven approach to enhance the Medical Research Council's framework for complex interventions. *Trials*. 2014; 15 (1) :267. [PubMed: 24996765]
9. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009; 151 (4) :264–269. [PubMed: 19622511]
10. England, MJ, Butler, AS, Gonzalez, ML. Psychosocial interventions for mental and substance use disorders: a framework for establishing evidence-based standards. National Academies Press (US); 2015.
11. Chorpita BF, Becker KD, Daleiden EL. Understanding the common elements of evidence-based practice: Misconceptions and clinical examples. *J Am Acad Child Adolesc Psychiatry*. 2007; 46 (5) :647–652. [PubMed: 17450056]
12. Becker KD, Lee BR, Daleiden EL, Lindsey M, Brandt NE, Chorpita BF. The common elements of engagement in children's mental health services: which elements for which outcomes? *J Clin Child Adolesc Psychol*. 2015; 44 (1) :30–43. [PubMed: 23879436]
13. Ramaiya MK, McLean C, Regmi U, Fiorillo D, Robins CJ, Kohrt BA. A dialectical behavior therapy skills intervention for women with suicidal behaviors in rural Nepal: a single-case experimental design series. *J Clin Psychol*. 2018; 74 (7) :1071–1091. [PubMed: 29457638]
14. Husain N, Afsar S, Ara J, Fayyaz H, ur Rahman R, Tomenson B, Hamirani M, Chaudhry N, Fatima B, Husain M. Brief psychological intervention after self-harm: randomised controlled trial from Pakistan. *Br J Psychiatry*. 2014; 204 (6) :462–470. [PubMed: 24676964]

15. Alavi A, Sharifi B, Ghanizadeh A, Dehbozorgi G. Effectiveness of cognitive-behavioral therapy in decreasing suicidal ideation and hopelessness of the adolescents with previous suicidal attempts. *Iran J Pediatr*. 2013; 23 (4) :467. [PubMed: 24427502]
16. Hassanian-Moghaddam H, Sarjami S, Kolahi A-A, Carter GL. Postcards in Persia: randomised controlled trial to reduce suicidal behaviours 12 months after hospital-treated self-poisoning. *Br J Psychiatry*. 2011; 198 (4) :309–316. [PubMed: 21343332]
17. 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 (3) :151–155. [PubMed: 22362830]
18. Perera ER, Kathirarachchi ST. Problem—solving counseling as a therapeutic tool on youth suicidal behavior in the suburban population in Sri Lanka. *Indian J Psychiatry*. 2011; 53 (1) :30. [PubMed: 21431005]
19. Hassanian-Moghaddam H, Sarjami S, Kolahi AA, Lewin T, Carter G. Postcards in Persia: a twelve to twenty-four month follow-up of a randomized controlled trial for hospital-treated deliberate self-poisoning. *Arch Suicide Res*. 2017; 21 (1) :138–154. DOI: 10.1080/13811118.2015.1004473 [PubMed: 25774646]
20. Mousavi SG, Amini M, Mahaki B, Bagherian-Sararoudi R. Effect of phone call versus face-to-face follow-up on recurrent suicide attempts prevention in individuals with a history of multiple suicide attempts. *Adv Biomed Res*. 2016; 5 :184. doi: 10.4103/2277-9175.190990 [PubMed: 28028524]
21. Wei S, Liu L, Bi B, Li H, Hou J, Tan S, Chen X, Chen W, Qin X. An intervention and follow-up study following a suicide attempt in the emergency departments of four general hospitals in Shenyang. *China Crisis*. 2013; 34 (2) :107–115. DOI: 10.1027/0227-5910/a000181 [PubMed: 23261916]
22. Armitage CJ, Rahim WA, Rowe R, O'Connor RC. An exploratory randomised trial of a simple, brief psychological intervention to reduce subsequent suicidal ideation and behaviour in patients admitted to hospital for self-harm. *Br J Psychiatry*. 2016; 208 (5) :470–476. [PubMed: 26743808]
23. Law YW, Yip PS, Lai CC, Kwok CL, Wong PW, Liu KS, Ng PW, Liao CW, Wong TW. A pilot study on the efficacy of volunteer mentorship for young adults with self-harm behaviors using a quasi-experimental design. *Crisis*. 2016; 37 (6) :415–426. DOI: 10.1027/0227-5910/a000393 [PubMed: 27278570]
24. Raj MAJ, Kumaraiah V, Bhide AV. Cognitive-behavioural intervention in deliberate self-harm. *Acta Psychiatr Scand*. 2001; 104 (5) :340–345. [PubMed: 11722314]
25. Fleischmann A, Bertolote JM, Wasserman D, De Leo D, Bolhari J, Botega NJ, De Silva D, Phillips M, Vijayakumar L, Värnik A. Effectiveness of brief intervention and contact for suicide attempters: a randomized controlled trial in five countries. *Bull World Health Organ*. 2008; 86 :703–709. [PubMed: 18797646]
26. Mousavi S, Rabiei Z, Maracy MR, Ebrahimi A, Sharbafchi MR. The efficacy of telephonic follow up in prevention of suicidal reattempt in patients with suicide attempt history. *Adv Biomed Res*. 2014; 3 :198. doi: 10.4103/2277-9175.142043 [PubMed: 25337528]
27. McMyler C, Prymachuk S. Do “no-suicide” contracts work? *J Psychiatr Ment Health Nurs*. 2008; 15 :512–522. DOI: 10.1111/j.1365-2850.2008.01286.x [PubMed: 18638213]
28. Stanley B, Brown G, Brent DA, Wells K, Poling K, Curry J, Kennard BD, Wagner A, Cwik MF, Klomek AB. Cognitive-behavioral therapy for suicide prevention (CBT-SP): treatment model, feasibility, and acceptability. *J Am Acad Child Adolesc Psychiatry*. 2009; 48 (10) :1005–1013. [PubMed: 19730273]
29. Naeem F, Ayub M, Gobbi M, Kingdon D. Development of Southampton Adaptation Framework for CBT (SAF-CBT): a framework for adaptation of CBT in non-western culture. *J Pak Psychiatr Soc*. 2009; 6 (2) :79–84.
30. Gøtzsche PC, Gøtzsche PK. Cognitive behavioural therapy halves the risk of repeated suicide attempts: systematic review. *J R Soc Med*. 2017; 110 (10) :404–410. [PubMed: 29043894]
31. World Health Organization. World Health Organization; Geneva: 2016. mhGAP intervention guide for mental, neurological and substance use disorders in nonspecialized health settings: mental health gap action programme (mhGAP): Version 2.0. <https://www.ncbi.nlm.nih.gov/books/NBK390815/>

32. Castro FG, Barrera M Jr, Holleran Steiker LK. Issues and challenges in the design of culturally adapted evidence-based interventions. *Annu Rev Clin Psychol.* 2010; 6 :213–239. DOI: 10.1146/annurev-clinpsy-03-3109-132032 [PubMed: 20192800]
33. Vaiva G, Ducrocq F, Meyer P, Mathieu D, Philippe A, Libersa C, Goudemand M. Effect of telephone contact on further suicide attempts in patients discharged from an emergency department: randomised controlled study. *BMJ.* 2006; 332 (7552) :1241–1245. [PubMed: 16735333]
34. Naslund J, Aschbrenner K, Araya R, Marsch L, Unützer J, Patel V, Bartels S. Digital technology for treating and preventing mental disorders in low-income and middle-income countries: a narrative review of the literature. *Lancet Psychiatry.* 2017; doi: 10.1016/S2215-0366(17)30096-2
35. Motto JA, Bostrom AG. A randomized controlled trial of postcrisis suicide prevention. *Psychiatr Serv.* 2001; 52 (6) :828–833. DOI: 10.1176/appi.ps.52.6.828 [PubMed: 11376235]
36. Chowdhary N, Sikander S, Atif N, Singh N, Ahmad I, Fuhr DC, Rahman A, Patel V. The content and delivery of psychological interventions for perinatal depression by non-specialist health workers in low and middle income countries: a systematic review. *Best Pract Res Clin Obstetr Gynaecol.* 2014; 28 (1) :113–133.
37. Prochaska JO, DiClemente CC. Stages and processes of self-change of smoking: toward an integrative model of change. *J Consult Clin Psychol.* 1983; 51 (3) :390. [PubMed: 6863699]
38. Popay J, Roberts H, Sowden A, Petticrew M, Arai L, Rodgers M, Britten N, Roen K, Duffy S. Guidance on the conduct of narrative synthesis in systematic reviews. A product from the ESRC methods programme Version. 2006; 1
39. Berk MS, Henriques GR, Warman DM, Brown GK, Beck AT. A cognitive therapy intervention for suicide attempters: An overview of the treatment and case examples. *Cogn Behav Pract.* 2004; 11 (3) :265–277.
40. Andrews G, Hunt C. 15. Treatments that work in anxiety disorders. *Med J Aust.* 1998; 168 (12) :628–634. [PubMed: 9673627]

Fig. 1. Study selection flowchart

Fig. 2. Components of psychological treatments for self-harm used in low- and middle-income countries

Table 1

Self-harm intervention studies (low- and middle-income countries)

Country Authors	Study design Inclusion	Target population	Intervention (age in years)	Comparison	Risk of bias	Conclusion
China [21] (Wei et al. 2013)	RCT Inclusion-first SA, age more than 15 years	<i>n</i> —239 Mean age NR Male—25%	CBT, <i>n</i> —5 Mean age 31.41 Male—25%	Telephone intervention <i>n</i> —60 Mean age 34.06 Male—21% TAU, <i>n</i> —77 Mean age— 32.12 Male— 25%	Power calculations NR, computerised randomisation, outcome assessor blinding—unclear ITT analysis undertaken Drop-out rate at 12 months 69.5% (CBT), 55% (telephone contact), 64.9% (control)	Subsequent SA at 12-month follow-up 1 (1.2% CBT), 1 (1.3% telephone intervention) 5 (6.5% control) No difference in rates of repeat SA, SI (BSI), depression (HAMD) at 3, 6, and 12 months between groups
China (Hong Kong) [23] (Law et al. 2016)	Non-RCT Self-harm presenting to ED. Exclusion: any DSM IV-TR Axis II disorder; psychosis; bipolar disorder	<i>n</i> —78 Mean age: NR Male NR	Brief contact intervention <i>n</i> —40, Mean age: 24.7 Male 18.4%	TAU <i>n</i> —38 Mean age: 26 Male 11.1%	Power calculations provided, study unlikely to be adequately powered for SRB ITT analysis—NR, drop-out rate— 67.6%	No significant reduction in SI (ASIQ) between groups at 3 months and post-intervention (9 months) (<i>p</i> > 0.05). No reduction in SRB (4/38 vs. 4/36) (significance NR)
5 nation SPREMISS study [25] (Fleischmann et al. 2008)	RCT Presentation to ED following SA Exclusion NR	<i>n</i> —1867 Median age 23 Male NR	Brief Intervention Contact <i>n</i> — 922, Male 29— 48% (site range)	TAU <i>n</i> —945 Male 33— 49% (site dependent)	Underpowered at some sites Random allocation to 2 groups, Participants-blind allocation, outcome assessor blinding— not done, ITT analysis NR, drop- out rate TAU— 12%, BIC—5%	BIC is not effective in reducing SA at 18 months following periodic contact
India [24] (Raj et al. 2001)	Non-RCT SA (1st/2nd) by drugs or pesticide Exclusion MMSE (20 or less), psychosis, dysthymia, OCD, eating disorder, bipolar, substance use, personality disorder, psychological intervention received	<i>n</i> —40 Mean age <i>N</i> Male 42%	CBT <i>n</i> —20 Age, gender— NR	TAU <i>n</i> —20 Age, gender— NR	Power calculations NR, study likely to be underpowered for SRB Sequential allocation to 2 groups ITT analysis and drop-out rate NR	Significant decrease in SI (SSI), factor II and total score of HS, DAS, PSI-total score and its three factors, HADS—total scores, anxiety, depression subscales, and hostility. No significant changes in factors I and III of HS and impulsivity
Iran [15] (Alavi et al. 2013)	RCT Hospital presentation for SA, 12–18 years of age. Exclusion no current SI, can't participate in psychotherapy, bipolar, psychosis, PDD, substance use disorders	<i>n</i> —30 Mean age: 16.1 Male 10%	CBT <i>n</i> —15 Mean age— 16.1 Male 6.7%	TAU <i>n</i> —15 Mean age—16 Male 13.3%	Power calculations NR, study likely to be underpowered for SRB Random allocation: Yes Allocation concealment method: NR Outcome assessor blinding: NA ITT analysis NR Drop-out rate 0%	Significant reduction in SI (measured by scale for suicidal ideation), hopelessness (measured by Beck's Hopelessness Inventory), depression (measured by Beck's Depression Inventory) at 3- month follow-up
Iran [26] (Mousavi et al. 2014)	RCT 15 years or older, 2 or more SA, telephone contact	<i>n</i> —139 Mean age NR Male NR	Brief Intervention Contact <i>n</i> —69	TAU <i>n</i> —70 Mean age NR Gender (M) 32%	Power calculations NR Random sequence generation method:	No significant difference in SA. Significant decrease in SI in intervention

Country Authors	Study design Inclusion	Target population	Intervention (age in years)	Comparison	Risk of bias	Conclusion
	possible, exclusion illness requiring surgery, or ICU		Mean age NR Male 19%		NR Random allocation: Yes. Allocation concealment method: NR Outcome assessor blinding: NR ITT analysis NR Drop-out rate NR	group ($p = 0.007$), significant increase in hope ($p = 0.001$) at 6-month follow-up as measured by a study questionnaire
Iran [20] (Mousavi et al. 2016)	RCT 2 or more SA, 20 years or older Exclusion: dementia, severe cognitive impairment, surgery or ICU, change of address, telephone, problems in communication, death	$n=55$ Mean age NR Male NR	Phone contact $n=29$ Mean age 27.07 Male 7%	Face to face $n=26$ Mean age 29.69 Male 19%	Power calculations not given, likely to be underpowered for SRB Random allocation to two groups Blinding—unclear Outcome assessor blinding: NR ITT analysis NR, drop-out rates face to face review —11.5%, phone contact—13.7%	No difference in SA in the groups Significant improvement in hope and interest in face to face group as compared to phone support Suicidal ideations lower in face to face group as c/t phone support ($p=$ 0.038) (measuring tools NR). Equal resolution of previous problems in both groups
Iran (Persia) [16] (Hassanian- Moghaddam et al. 2011)	RCT Hospital presentation with self-poisoning Exclusion— psychosis	$n=2133$ Mean age— 24.1 Male 33.7%	Brief contact intervention n —1043 Mean age— 24.7, Male 33.3%	TAU $n=1070$ Mean age—24.1 Male—34%	Adequately powered— yes Block randomization using a random numbers table, Allocation was concealed, details NR Outcome assessor blinding No Ascertainment of SH repetition by Interview, ITT analysis NR Drop-out rate 8.1%	Significant reduction in SI (NNT 7.9), SA (NNT 46.1), SA per person (incidence rate ratios—0.64, CI 0.42–0.97) at 12 months No significant reduction in self- cutting
Malaysia [22] (Armitage et al. 2016)	RCT Hospital admission following self- harm Exclusion—NR	$n=226$ Mean age— NR Male 30%	Volitional help sheet (VHS) n —75 Mean age—31.57 years Male NR	Self-generated implementation intentions $n=78$ Mean age— 30.26 Male NR TAU—73 Mean age— 28.25 Male NR	Adequately powered Random sequence generation using web based randomiser, Allocation concealed, Outcome assessor blinding, postal follow-up using self-report questionnaire. ITT analysis undertaken Drop-out rate 53%	SI and behaviour (SBQ) reduced significantly in both conditions c/t control, largest decrease in VHS, p < 0.01. No significant difference between two treatment groups ($p = 0.13$). Significant reduction in threats of suicide in VHS c/t self-generated and control ($p < 0.01$). Significant reduction in likelihood of future attempts in VHS c/t control ($p <$ 0.01)
Nepal [13] (Ramaiya et al. 2018)	Single Case Experimental Design (3 small studies) SA in past 2 years, reproductive age range women (18–	$n=10$ Mean age— NR Male 0%	DBT-N Mean age— NR $n=10$	NA	—	Modifications identified: changes according to socio-demographics; inclusion of metaphors, imagery and symbolism; skills training to

Country Authors	Study design Inclusion	Target population	Intervention (age in years)	Comparison	Risk of bias	Conclusion
	45 years), Exclusion—NR					incorporate measures form daily life; therapy engagement measures; skills to address specific vulnerabilities
Pakistan [14] (Husain et al. 2014)	RCT Hospital admission following self- harm Exclusion: dementia, substance misuse, bipolar disorder, organic mental disorder, schizophrenia, intellectual disability	<i>n</i> —221 Mean age 23.1 years Male 31.2%	CBT (Adapted version used) <i>n</i> —108 Mean age: 23.2 years Male 30%	TAU <i>n</i> —113 Mean age: 23.1 years Male 33%	Power calculations NR Computer generated random numbers table for allocation Independent, offsite researcher for concealment, Outcome assessor blinding: Yes, ITT analysis undertaken, Drop-out rate 3.6% at 6-months	Significant difference between groups in SI (BSI) ($p=0.010$ at 3 months, 0.019 at 6 months), coping (CRI), hopelessness (BHS, quality of life at 3 and 6 months Depressive symptoms (BDI) improved at 6 months, not at 3 months. 2 completed suicide and 1 episode of self-harm in each group
Sri Lanka [17] (Marasinghe et al. 2012)	RCT, 15–74 years, hospital admission following SA Exclusion ongoing psychiatric treatment, psychosis, dementia	<i>n</i> —68 Mean age— NR, Male 50%	Immediate— Brief Mobile Treatment <i>n</i> — 34 Mean age— Male 30, Female 34 Male 50%	TAU <i>n</i> —34 Mean age—male 29, female 31 male 50%	Power calculations NR, study appears to be underpowered for SRB Random allocation to two groups: yes, Allocation concealment method: NR, Outcome assessor blinding: yes, ITT analysis done details NR, Drop- out rate: NR	Significant reduction in SI (measured by BSI), depression (measured by BDI), significant improvement in social support (measured by MOS), no significant reduction in self- harm or substance use. Significance values NR
Sri Lanka [18] (Perera and Kathirarachchi, 2011)	Non-RCT Admitted to hospital for SA Exclusion—Major psychiatric disorder	<i>n</i> —124, Mean age— NR Male NR	Individual problem solving therapy <i>n</i> —62 Age/male NR	TAU <i>n</i> —62 Age/male	Power calculations NR, study appears to be underpowered for SRB Sequential allocation to 2 groups Blinding NR. ITT analysis NR Drop-out rate— 18.5%	Significant reduction in SA in intervention group as c/t control at 6 months (0/55 vs. 2/46, p —NR). Significant improvement in problem solving skills in experimental group (individual visual analog scale) ($p < 0.01$)

ASIQ adult suicidal ideation questionnaire, *BDI* Beck's Depression Inventory, *BHS* Beck's hopelessness scale, *BSI* Beck's Scale for suicidal ideation, *CRI* coping resource inventory, *c/t* compared to, *ED* emergency department, *MOS* Medical Outcome Study Social Support Survey, *NR* not reported, *PDD* pervasive developmental disorder, *SA* suicide attempt, *SBQ* suicidal behaviours questionnaire, *SD* standard deviation, *SIQ* suicidal ideation questionnaire, *SRB* suicide related behaviour, *SSI* Scale for Suicidal Ideation, *TAU* treatment as usual

Table 2

Treatment elements and techniques used in studies included in review

	Components of therapy	Alavi et al. (2013) [15]	Husain et al. (2014) [14]	Perera and Kathriarachchi (2011) [18]	Raj. M et al. (2001) [24]	Wei et al. (2013) [21]	Hassanian-Moghaddam et al. (2011) [16]	Law et al. (2016) [23]	Fleischmann et al. (2008) [25]	Ramaiya et al. (2017) [13]	Armitage et al. (2016) [22]	Mousavi et al. (2016) [20]
Self-harm specific elements	Chain analysis											
	Safety/crisis plan											
	Developing reasons for living and hope											
	Suicidal contracts											
	Relapse Prevention											
	Suicide risk screening											
Engagement elements	Psychoeducation											
	Case conceptualisation											
	Family meeting											
	Family education											
	Referral for professional help											
Behavioural elements	Problem solving											
	Behavioural Activation											
	Relaxation strategies											
	Breathing exercises											
	Self-soothing											
Emotional elements	Emotion regulation skills											
	Distress tolerance											
Cognitive elements	Identify thoughts											
	Cognitive restructuring											
	Mindfulness											
	Distraction skills											
	Self-validation											
Interpersonal elements	Mobilizing social support											
	Assertiveness skills											
	Interpersonal effectiveness											
In-session techniques	Graded task assignment											

Components of therapy	Alavi et al. (2013) [15]	Husain et al. (2014) [14]	Perera and Kathriarachchi (2011) [18]	Raj. M et al. (2001) [24]	Wei et al. (2013) [21]	Hassanian-Moghaddam et al. (2011) [16]	Law et al. (2016) [23]	Fleischmann et al. (2008) [25]	Ramaiya et al. (2017) [13]	Armitage et al. (2016) [22]	Mousavi et al. (2016) [20]
Hope kit											
Downward arrow method											
Diary maintenance											
Guided imagery											
Goal setting											
Skills generalization											
Mood monitoring											
Behavioural experiments											
Homework assignment											
Motivational interviewing for substance use											
Implementation intentions

Table 3

Delivery processes of interventions

Authors, year	Treatment duration and sessions	Who delivered it	Where was it delivered	How was it delivered
Wei et al. (2013) China [21]	CBT 10 sessions in 3 months, each session 45–60 min Telephone intervention 20–40 min weekly phone calls for 12 weeks	Therapists (psychologists) with more than 5 years of experience. Training, supervision NR	Not reported	CBT sessions weekly, biweekly or as needed basis to teach adaptive ways of dealing with stress, thinking and behaviour [39]. Nil adaptation. Telephone intervention using empathy, reassurance, explanation, suggestion and collaborative problem solving
Law et al. (2016) China (HONG KONG) [23]	Brief contact intervention by volunteers, more than 2 contacts per month for 9 months	Volunteers 25 years or more, post-secondary education, stable work experience, no criminal record. 3 h orientation, 20-h training, monthly case conferences, guest group discussion, lectures	Not reported	Two-mentors-to-one participant matching to ensure safety on both sides. Contact by face-to-face visits, and meetings, messaging, mail by post and e-mails. Volunteers screened participants for suicide risk, offered emotional support and information on medical and community resources; shared problem- solving skills; and referred for professional help. Delivery supervised by psychiatrists, psychologists, social workers
Fleischmann et al. (2008) SUPRE- MISS five nation study [25]	Brief Intervention Contact (BIC) 10 contacts over 18 months after discharge	Doctor/ nurse/ psychologist/ psychology or social work student. 1-day special training to “check-in” patients’ status	Delivery at home or by phone contact	1-h individual information session close to discharge, 9 periodic follow-up contacts after discharge (1, 2, 4, 7, and 11 weeks, 4, 6, 12, and 18 months). Referral to appropriate service, if needed
Raj. et al. (2001) India [24]	CBT 10 sessions over 2–3 months	Therapists details not reported	Not reported	Engagement facilitated by providing therapist details, follow-up phone calls if they missed the session. Monthly follow-up letters after completion of sessions till study end, booster sessions (1–5) if further therapy required. Name, contact details of therapist given to nonconsenting participants, option open for 2 months during which reminder contact letter sent. Nil adaptation reported
Alavi et al. (2013) Iran [15]	CBT 12 sessions in 3 months	Not reported	Not reported	First 3 sessions on case conceptualisation, psychoeducation and safety planning. 4th to 9th session, optional individual and family skills training. 10th to 12th session on relapse prevention. CBT based on Stanley et al. model used [28]. Nil adaptation reported
Hassanian- Moghaddam et al. (2011) Iran [16]	Brief contact intervention 8 + 1 postcards mailed over 12 months	By postcards	Not reported	Eight four-page postcards with a message and floral images mailed at 1-, 2-, 3-, 4-, 6-, 8-, 10- and 12-month post discharge, ninth postcard on birthday (monthly postcard for first 4 months, once in 2 months thereafter)
Mousavi et al. (2014) Iran [26]	Brief Intervention Contact (BIC). 7 follow- up contacts over 6 months. Each contact for 30 min	Phone contact by psychiatric resident doctor (psychiatrist in training, final year)	Not reported	Telephone contact at 2nd, 4th weeks, 2nd, 3rd, 4th, 5th and 6th months. Initial assessment in hospital for psychiatric condition appraisal, stresses, brief supporting guides, and referral to a psychologist, social workers, or psychiatrist
Mousavi et al. (2016) Iran [20]	Phone contact compared with face to face review on 8 occasions over 8 months. Each contact for 20 min	‘Assistant of psychiatry’ without further detail	Not reported	Participants contacted during 2nd and 4th weeks, and 2nd, 3rd, 4th, 5th, 6th, 8th months following initial presentation for assessment of mental state, warning signs, appraisal of last and new problems and visit to a therapist if needed
Armitage et al. (2016) Malaysia [22]	Self-report questionnaire with volitional help sheet (VHS)/ self-generated implementation intentions during hospital admission	Site investigator details/qualifications not reported	Initial questionnaire in the hospital, Follow-up questionnaire at home	Self-generated implementation intention condition- formulation of plans to identify critical situations and appropriate responses to not self-harm in future. VHS-11 critical situations acting as self-harm triggers and 11 appropriate responses to measure the processes of change (Prochaska and DiClemente's

Authors, year	Treatment duration and sessions	Who delivered it	Where was it delivered	How was it delivered
	Self-report questionnaire at 3 months			transtheoretical model). Generation of links and implementation intentions using options. Control-given VHS but not asked to form implementation intentions
Ramaiya et al. (2018) Nepal [13]	DBT-N 10 sessions of 3 h weekly group therapy	Group leaders- local counsellor (attended 5-day DBT adaptation workshop) and DBT trainer. Weekly and ad-hoc supervision by US based clinical psychologist with an active DBT clinical practice	Not reported	Group sessions with 10 participants. Initial meeting, group mindfulness exercise, activities related to DBT-N modules (Mindfulness, distress tolerance, self-validation, emotion regulation, and inter- personal effectiveness), and skills generalization strategies at each session end. Adaptation process involved stakeholders interviews and pilot delivery. Areas of adaptation listed under conclusion in Table 1
Husain et al. (2014) Pakistan [14]	CMAP (Brief problem solving therapy) 6 sessions over 3 months First two sessions weekly, later sessions fortnightly lasting about 50 min each	Psychologists (masters degree, minimum 3-year work experience). Fidelity training, individual and weekly group supervision. Protocol adherence and treatment integrity assessed using revised Cognitive Therapy Scale	Home/out-patient clinic according to participant's choice	Engagement session prior to actual therapy. Use of relevant sections of manual to address participant's problems. Family education and involvement if appropriate and acceptable. Cultural adaptation of therapy by incorporating culturally acceptable idioms, local stories and images and examples from Islamic teachings [29]. Use of simple local language for rapport and engagement
Marasinghe et al. (2012) Srilanka [17]	Brief mobile treatment intervention	Not reported	Not reported	3 phases: phase I face-to-face -mental health assessment; meditation; problem solving; social support enhancement; intervention for alcohol and other drug use; mobile phones usage training. Phase II 10 mobile calls- days 2, 4, and 1, 2, 4, 6, 10, 12, 18 and 24 weeks to assess suicidality and mood; brief problem-solving; enhance social support; reduce alcohol/other drug use. Access to 5 min audio phone messages-3 meditation messages; 3 problem-solving messages. Weekly SMS reminders for 26 weeks
Perera and Kathirarachchi, (2011) Srilanka [18]	Individual problem solving therapy. 4 sessions- post-assessment, 2 sessions weekly, last session after a fortnight	Therapists, details not reported	Not reported	Exploring options to solve problem, selecting the best option and making a plan to execute it [40]. Nil adaptation reported

BIC Brief intervention contact, *CBT* cognitive behaviour therapy, *CMAP* culturally adapted manual assisted problem solving therapy, *DBT* dialectical behaviour therapy, *DBT-N* Nepali DBT, *SUPRE-MISS* WHO Suicide PREvention Multisite Intervention Study on Suicidal Behaviours, *VHS* volitional help sheet