



A Scoping Review of Evidence-Based Interventions for Adolescents with Depression and Suicide Related Behaviors in Low and Middle Income Countries

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Received: 21 August 2018 / Accepted: 30 May 2019 / Published online: 3 June 2019
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Abstract

Depression is the number one cause of disability for adolescents. Moreover, depression is the strongest predictor for suicide, which is the second cause for death among adolescents worldwide. A total of 22 RCTs conducted in 14 different LMICs have been reviewed. This is a significant effort to provide mental health services for adolescents in LMICs. However, considering that 2/3 of the world's countries meet criteria for LMIC status and 75% of suicides occur in LMICs, more research addressing both understanding and intervention/prevention of depression and suicide must be conducted in these countries.

Keywords Adolescent · Depression · Suicide · Low and middle income countries · Interventions

Background

To date, we are not aware of any scoping reviews that specifically synthesized evidence-based interventions for adolescent depression or suicide related behaviors in low middle income countries (LMICs). Most systematic reviews and meta-analyses that examined psychotherapeutic treatments for adolescent depression have solely focused on treatment techniques without the addition of effects of culture, geography, or country of origin. This scoping review hopes to map and summarize the results of existing RCT's for adolescent depression and/or suicide specifically conducted in LMICs. A scoping review methodology was adopted in order to synthesize the existing literature pertaining to adolescent depression and suicide preventions and interventions in

LMICs for suitability and further evaluations for interventions effectiveness.

Depressive disorders are characterized by symptoms of depressed mood, reduced energy, sleep and appetite disturbances, feelings of guilt and/or low self-worth, poor concentration and agitation (WHO 2016a). While depression is a common mental illness that affects about 4.4% of the global population (WHO 2017) its prevalence is much higher in LMICs. More than 80% of people who suffer from mental illnesses including depression reside in LMICs where the burden of mental illnesses ranges from 8.8 to 16.6% of total burden of disease (Vigo et al. 2016).

Among adolescents, depression is a leading cause of disability that significantly contributes to the burden of disease. According to the WHO (2016a, b), depressive disorders are responsible for about 50% of years lost disability (YLD) for adolescents 10–19 years old. It is also predicted that depressive disorders will independently be the third leading cause of disease burden in LMICs by the year 2030 (Mathers and Loncar 2006).

Adolescents with depression are likely to engage in risky behaviors such as substance abuse (Jackson et al. 2015; Tapert et al. 2001) and unsafe sexual behaviors (Jackson et al. 2015; McFarlane et al. 2014). Numerous studies have also reported gender differences where females were more likely to report depressive symptoms than males (Davaasambuu et al. 2017; Galambos et al. 2004; Hankin and Abramson 2001).

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Studies have also reported that adolescent depressive disorders are comorbid with other mental illnesses such as anxiety, post-traumatic stress disorder, schizophrenia, substance abuse and substance dependency disorders (Cummings et al. 2014; Marmorstein et al. 2010; Okello et al. 2013). These co-morbidities also act to increase risk for disability (Peninx et al. 1999) and hinder the ability to perform activities of daily living (Kivelá and Pakkala 2001; Nagarkar and Kashikar 2017).

Importantly, depression is also one of the strongest predictors of suicide (Auerbach et al. 2015; Miller et al. 2017; Rihmer 2007). In 2015, more than 788,000 people died by suicide worldwide (WHO 2017), with someone dying by suicide roughly every 40s. Among adolescents and young adults aged 15–29, suicide is the second leading cause of mortality worldwide (WHO 2014). It is also estimated that 75% of adolescents with depression will make a suicide attempt in adulthood (Nock et al. 2013).

Rates of suicide vary strongly across countries and regions. For instance, approximately 5 suicides per every 100,000 were reported among females in LMICs of Eastern Mediterranean and American Regions while more than 20 suicides per every 100,000 were reported among males in LMICs of African and South East Asian regions (WHO 2017). One study conducted in 49 LMICs reported that 15.3% of adolescents between 13 and 15 years of age endorsed thoughts of suicidal ideation in the past 12 months (Page et al. 2013). The study also found that 16.2% of females and 12.2% of males had suicidal ideation in the past 12 months (Page et al. 2013). Another study that examined suicidal ideation and attempts in 32 LMICs reported that endorsement of suicidal ideation among adolescents ranged from 5.1 (Indonesia) to 28.1% (Zambia) (McKinnon et al. 2016).

Although depression and suicidal behaviors are both common and are identified as significant risk factors for the well-being of adolescents in LMICs, there are currently only a few services for depressive disorders and/or suicidal behavior. Moreover, mental health services in LMICs face many challenges such as culture based resistance to mental health, financial and human resource limitations, and lack of robust health care delivery systems (Becker and Kleinman 2013). Most LMICs spend less than \$2 a year per individual on mental health services compared to \$50 a year per individual in high income countries (WHO 2014). Additionally, there is typically only 1 mental health worker per 100,000 people in LMICs compared to 50 per 100,000 in high-income countries (HICs) (WHO 2014).

There are many evidence-based interventions for adolescents suffering from depression and suicide related behaviors that have been evaluated in HICs of Europe and North America. The majority of these interventions have been based on cognitive-behavioral therapy (CBT), interpersonal

therapy (IPT) and psychopharmacology (Callahan et al. 2012; Merry et al. 2011). These studies are typically conducted in highly specialized psychiatric clinics, in group settings, or at schools by trained mental health professionals (Hetrick et al. 2016). By and large, it is unclear whether these interventions would be as effective in LMICs. Numerous variables may account for differences in effectiveness across countries. For instance, cultural differences may make the interpretation of depressogenic cognitions highly variable across countries (Chenstsova-Dutton and Tsai 2008).

Methods

A scoping review methodology was utilized for review because it aims to map concepts, sources, and evidence, that are central to a research area that is relatively new or not yet well defined (Mays et al. 2001, p. 194). Scoping reviews allow for the inclusion of broader topics and research questions by assessing the content of existing literature (Arksey and O'Malley 2005). In addition, the scoping review is distinct from a systematic review in that: (1) a scoping review addresses broader topics and research questions while a systematic review focuses on a well-defined research question; and (2) a scoping review does not assess the quality and rigor of included studies while a systematic review aims to do so (Arksey and O'Malley 2005). Although this methodology of review is relatively new, it has been adopted throughout numerous veins of in health research including adolescent depression and suicide related treatments (Boydell et al. 2014; Hamm et al. 2015; Han et al. 2013; Renton et al. 2014; Seko et al. 2014).

This scoping review followed a five-stage protocol and review process as outlined by Arksey and O'Malley (2005). The five stages included: (1) identifying the research question; (2) identifying appropriate literature; (3) study selection; (4) presenting of data; and (5) collating, summarizing and reporting results (Arksey and O'Malley 2005; Levac et al. 2010).

Stage 1: Identifying Research Question

As suggested in Levac et al. (2010), a research question was developed to guide the scoping review: *What types of interventions have been studied to treat adolescent depression and suicide related behaviors in LMICs in the last 12 years?* Suicide related behaviors included all suicidal ideation, suicidal plans, and suicide attempts among adolescents. Adolescents were operationalized as individuals with age ranges from 10 to 19, as defined by the WHO (WHO 2016a, b).

Furthermore, specific objectives were developed to guide the review:

- To map a body of depression and suicide prevention evidence based interventions for adolescents in LMICs.
- To summarize existing knowledge for adolescent depression and suicide prevention in LMICs.
- To disseminate findings of evidence based interventions.
- To identify existing knowledge gaps.
- To determine the feasibility and value of a full systematic review to identify the extent and sources of bias and other threats to validity.

Stage 2: Identifying Literature

A full systematic search of peer reviewed journal articles published in English was conducted using five different academic databases:

- PubMed/MEDLINE (National Library of Medicine)
- EMBASE (Excerpta Medica dataBASE)
- CENTRAL (Cochrane Central Register of Controlled Trials)
- CINAHL (Cumulative Index to Nursing and Allied Health Literature)
- PsychINFO

A systematic search of grey literature was conducted using two other databases:

- ICTRP (<http://apps.who.int/trialsearch>)
- Clinical Trials (<https://clinicaltrials.gov>)

Additional resources included Google Scholar and reference lists of relevant systematic reviews and meta-analysis.

First, Medical Subject Headings (MeSH), text word terms, and other criteria were used depending on the specific database. For example, MeSH terms such as (depress* OR mood OR suicide*) AND (adolescent OR teen OR youth OR juvenile) were employed. Second, additional filters were applied for each database e.g., *article type, publication dates*

and ages for PubMed/Medline; *publication date, subjects areas, and publication type* for EMBASE; *database, article type, publication dates* for CENTRAL; *publication date, study subjects, and language limitations* for CINAHL; and *index term, article type, publication dates, age groups, population groups and methodology* for PsychINFO.

Stage 3: Study Selection Criteria

The literature search was based on following inclusion and exclusion criteria (Table 1) set by SD and PS. Inclusion and exclusion criteria were focused on identifying RCTs for adolescent depression and/or suicide prevention in LMICs for past 12 years. World Bank classification of Gross National Income (GNI) was used to delineate LMICs from other countries. The World Bank classifies countries as high income, upper middle income, lower middle income and low income countries using this index. Countries with a GNI of \$1005 or less are considered low income; a GNI between \$1006 and \$3955 are lower-middle income; and a GNI between \$3956 and \$12,235 are classified as upper-middle income countries (Bank 2018). The LMICs in this study included all countries that had a GNI less than \$12,235. The search was also limited to psychological, therapeutic, and educational interventions. Pharmacological and psychotherapy with pharmacological treatment trials were excluded.

Study Selection Process

A full systematic search of articles published between January 2006 and June 2018 was conducted using the above inclusion/exclusion criteria. Two reviewers (SD and PH) independently completed a search for eligible articles from the above mentioned databases. More than 20 systematic review and meta-analyses were also identified and reviewed as additional sources for identifying relevant literature. Any disagreements about article inclusion and exclusion criteria

Table 1 Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion criteria
Design	Randomized controlled trial, cluster randomized controlled trial	Not randomized, quasi-experimental, experimental
Outcome	Depression, depressive symptoms, suicidal ideation, suicidal behaviors and suicide attempts	Not depression or suicidal ideation, suicidal behaviors, or suicide attempts
Type of Intervention	Psychological, therapeutic, educational	Pharmacological
Population	Adolescent: 10–19 years old	Younger than 10 or older than 19
Publication type	Peer-reviewed	Not peer reviewed
Place	Low and middle income countries	High income countries
Time limit	January 1995–December 2016	Earlier than 1995
Language	English	Not English
Settings	All settings	None

were resolved through discussions and meetings between the reviewers.

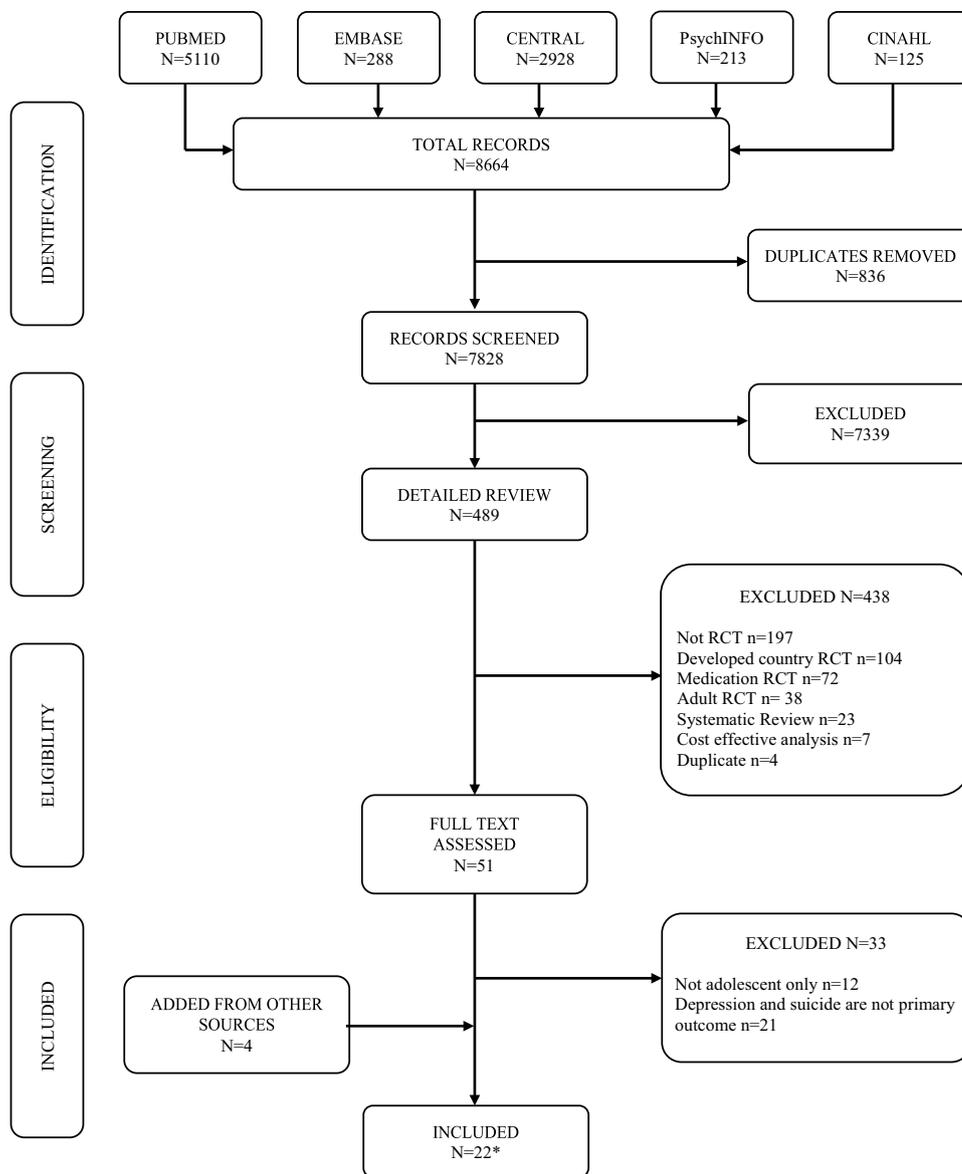
Stage 4: Presenting Data

All references found in each database was transferred to Endnote X8 (Thomson Reuters), a database library for managing records, keeping track of articles, and reviewing titles and abstracts. Figure 1 shows the results of the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) flowchart for systematic literature search processes (Moher et al. 2015).

Interventions were reviewed with respect to the following characteristics: geographic location of implementation;

participants and setting; intervention models; frequencies and durations of sessions, length of interventions, facilitators; and outcome results. The World Bank classification for regions and countries were employed to denote geographic locations and economic classifications (Bank 2018). Intervention models were classified by treatment techniques e.g., CBT, IPT, memory based treatment, play therapy, sports therapy, or integrated therapy. Any RCT that employed two or more treatment techniques were classified as integrated therapy techniques. A critical appraisal of the internal and external validity of the studies was not carried out in this paper as such efforts were outside the parameters of a scoping review.

Fig. 1 PRISMA flow chart



*one article examined both depression and suicide related behaviors

Results

Stage 5: Collating, Summarizing and Reporting Results

Twenty-two RCTs conducted across 12 different LMICs were identified for the review. All studies were classified by treatment technique e.g., CBT, IPT, Memory based or integrated techniques treatments. In addition, classifications were made utilizing demographic information, descriptions of intervention, utilization of control groups, assessment tools, follow-up assessment timelines, intervention results, and conclusions (Table 2). Table 3 describes intervention characteristics based on intervention types, frequency, duration, length and facilitators.

Geographic Locations

Three out of the 12 countries were classified as low income (Nepal, Burundi, and Uganda); four countries were classified as lower-middle income (West Bank and Gaza, Sri-Lanka, Philippines and Indonesia); and five countries were upper-middle income (Iran, China, Mauritius, South Africa and Bosnia). In addition, 9 out of 22 RCTs were conducted in Sub-Saharan Africa (6—Uganda, 1—South Africa, 1—Mauritius, and 1—Burundi); followed by six in the Middle East and North Africa (2—Iran, 4—West Bank and Gaza); three in the East Asia and the Pacific (1—China, 1—Philippines, and 1—Indonesia); three in South Asia (2—Sri Lanka, 1—Nepal); and one in Europe and Central Asia (1—Bosnia).

Participants and Settings

All RCTs had an average sample size of $n = 242$ participants. Age of participants ranged from 8 to 19 years old (Table 2). Most studies recruited participants at similar rates with respect to gender and about half of the total participants of all of the studies combined were female. However, two studies (Alavi et al. 2013; Rossouw et al. 2016) reported that the majority of their participants (90%) were female. Thirteen studies recruited high-risk students who were suffering from depressive symptoms and/or suicidal ideation and behaviors (Alavi et al. 2013; Barron et al. 2013; Bolton et al. 2007; Church et al. 2012; Lange-Nielsen et al. 2012; Layne et al. 2008; Neshat-Doost et al. 2012; Peltonen et al. 2012; Qouta et al. 2012; Rossouw et al. 2016; Tol et al. 2008, 2014; Yang et al. 2016). Eight studies recruited students in specific grades and schools, who were orphaned because of AIDS or exposed to traumatic events such as wars or earthquakes (Berger and Gelkopf 2009; Han et al. 2013; Jordans et al. 2010; Kumakech et al. 2009; Richards et al. 2014;

Rivet-Duval et al. 2011; Ssewamala et al. 2012; Tol et al. 2012). Thirteen interventions were implemented in middle or high schools and one was delivered at a college campus (Church et al. 2012). One study recruited participants at a hospital emergency department but did not describe whether the intervention was delivered at a community mental health center, or at the hospital (Alavi et al. 2013). Another study recruited adolescents with mild to moderate depressive symptoms for a computerized intervention but the authors failed to report whether the intervention was solely based online or was also delivered offline (Yang et al. 2016).

Intervention Modalities

Treatment types were diverse ranging from cognitive behavioral and memory-based treatments to physical activity and micro-finance interventions (Table 3). Most frequently reported interventions types were *integrated therapy techniques*. Many of these integrated interventions incorporated CBT components, for example, Berger and Gelkopf (2009) combined CBT, psychoeducation, and meditative exercises with bio-energetic activities. Church et al. (2012) combined CBT with exposure therapy and an element of somatic simulation. Five studies combined CBT and experiential therapy with cooperative play (Jordans et al. 2010; Qouta et al. 2012; Tol et al. 2008, 2012, 2014). One study intergrated both CBT and IPT (Bolton et al. 2007) and another study combined psycho-education and grief-focused treatment with coping skills (Layne et al. 2008).

As displayed in Tables 2 and 3, a number of non-integrated interventions were also included identified. For example, *Cognitive Behavioral Therapy (CBT)* was utilized in two of the RCTs (Alavi et al. 2013; Barron et al. 2013). Three *Memory based treatments* were identified. These interventions focused on recollection of traumatic events to improve cognitive and social functions as well as overall mental health (Lange-Nielsen et al. 2012; Neshat-Doost et al. 2012; Rossouw et al. 2016). Two *micro-finance interventions* were also identified. These studies were both implemented in Uganda, and sought to promote mental health through matched savings accounts as well as educational, mentorship, and small business opportunities (Han et al. 2013; Ssewamala et al. 2012). One *Interpersonal therapy (IPT)* intervention was identified. This RCT placed focus on interpersonal problems, interpersonal sensitivity, role transition, and grief to improve interpersonal functioning and social support (Betancourt et al. 2012). The utilization of *play therapy* was identified in one study (Kumakech et al. 2009). This intervention focused on using recreational activities such as playing music, dancing, drawing, singing, name games, and blindfolded walking to improve the mental well-being of adolescents (Kumakech et al. 2009). *Attention-bias treatment* was identified one study (Yang et al. 2016).

Table 2 Summary of RCTs

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
Cognitive-behavioral therapy								
1 Alavi et al. (2013)	Iran/upper middle income	Suicidal ideation and attempt in the past 3 months Depression symptoms	30	12–18/(90.0)	Safety planning Mood monitoring Problem solving Goal setting Social support Communication	Wait list No treatment	SSI: At 3 month follow up suicidal ideation among adolescents in the interventions significantly decreased with $M=4.6$ $p<0.001$ BDI: At 3 month follow up depression among adolescents in the intervention group decreased at statistically significant levels with $M=14.4$ $p<0.001$ Conclusion	The study concluded that the intervention was effective, appropriate and acceptable treatment to reduce suicidal ideation for adolescents
2 Barron et al. (2013)	West Bank and Gaza/ lower-middle income	Exposure to trauma High scores on CRIES-13	140	11–14/(42.8)	Normalizing trauma and teaching strategies for intrusive memory Providing information, modeling, reflection and feedback	Wait list: No treatment	DSRS: Large effect sizes were found on reduction of depression for the intervention group: $D=1.24$ $P<.005$	The intervention was effective in reducing depression for adolescents with trauma.
Memory based therapy								
3 Rossouw et al. (2016)	South Africa/upper middle income	Lower socioeconomic school Chronic or subthreshold PTSD	11	13–18 (90)	Confront traumatic memory healthy ways Promote recovery through prolonged and repeated exposure of traumatic memory Enable cognitions to be realistic and improves functioning	Supportive counseling:	BDI: Depression scores were significantly lower in the treatment group at 12 month follow up $T_{(11)}=22.7$ $p<0.03$	The intervention can be delivered by nurses at school settings and maintained its depression reductions effects in long term

Table 2 (continued)

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
4 Neshat-Doost et al. (2012)	Iran/upper middle income	Afghan refugees Bereaved adolescents from a war zone Symptoms of depression	23	12–18/(47.8)	5 sessions of autobiographical memory and recall	Control group: No treatment	MFQ: At 3 month follow up the intervention group had significantly less depressive symptoms than the control group $T_{(21)} = 2.35, p = .03$ $d = 0.97$	Memory based interventions can reduce adolescent depression successfully but study recommended more trials with larger samples
5 Lange-Nielsen et al. (2012)	West Bank and Gaza/ lower-middle income	War exposure High scores on CRIES-13	170	12–17/(50.0)	15 min for 3 days Writing for Recovery	Wait list: No treatment	DSRS: Depression scores elevated at the post intervention assessment compared to the baseline scores. However, there was no significant difference between baseline and 5 month assessment scores ($M = 14.05$ T1 and $M = 13.94$ T4)	The study reported that the intervention did NOT have significant effect for adolescents who had war related trauma
Micro finance/economic intervention								
6 Han et al. (2013)	Uganda/low income	AIDS orphaned child Enrolled in primary school	297	12–14 (64.8)	Matched savings account Financial management workshops Mentorship	Usual Care: Counseling Mentorship Food aid School supply	CDI: Depression scores were reduced for both arms of the study at 12 month follow-up. However, scores for the intervention group had greater (almost 5 points) compared to the control group (2.66 points) decrease. $F_{(12)} = 4.37,$ $p < .001$	Family economic empowerment program may reduce depression symptoms for adolescents in poor resource communities

Table 2 (continued)

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
7 Ssewamala et al. (2012)	Uganda/low income	AIDS orphaned child Enrolled in primary school	286	9–17 (57.0)	Matched savings account Financial management workshops Mentorship Counseling School supply	Control group: Counseling School supply	CDI: Depression symptoms reduced in the intervention group over time $M = 2.39$ at 10 months and $M = 2.05$ at 20 months follow ups	A comprehensive microfinance intervention may help to reduce depression among adolescents in poor resource communities
Interpersonal therapy								
8 Betancourt et al. (2012)	Uganda/low income	Speak in Acholi Luo Having depressive symptoms Some functional impairment in the past	304	14–17/(57.0)	Interpersonal skills Group relationship-building	Creative Play: Drawing expression of personal issues Wait list: No treatment	APAI: Results indicated that depression scores were lower in the intervention group than control groups ($M = 32.76$ for abducted females and 28.21 for abducted males).	Adolescents who had a history of abduction benefited from the intervention the most especially girls
Play therapy								
9 Kumakech et al. (2009)	Uganda/low income	AIDS orphaned child	298	10–15 (50.0)	16 psychological exercises for 10 weeks Reflect, challenge and face difficulties Develop coping skills	Control group: No treatment	BYI: At 10 week follow up adolescents in the intervention group has much lower depression scores compared to adolescents in the control group $F(1, 297) = 16.12$, $p < .001$	A peer-group support intervention may result significant impact for reducing depression among adolescents
Attention based therapy								
10 Yang et al. (2016)	China/upper middle income	Major Depressive Disorders No current treatment	45	12–16/(45.4)	8 sessions 2 stimuli 1 neutral 1 emotional dot-probe task	Placebo: Shifted attention toward neutral and sad words	HAM-D: Depression scores were much lower for the adolescents in the intervention group than those in the control group $F(1, 43) = 5.21$, $p < 0.03$, $D = 0.11$	The intervention reduced depressive symptoms in long term

Table 2 (continued)

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
Integrated therapy techniques interventions								
11 Tol et al. (2014)	Burundi/low income	Traumatic event PTSD, depressive symptoms, and anxiety	329	8–17/(48.0)	CBT 15 sessions for 5 weeks Psycho-education, strengthening cop- ing activities and discussion Safety, trauma nar- rative, self-esteem, awareness, coping skills and recon- nection	Wait list No treatment	DSRS: There was no statisti- cally significant differences in mean changes between the intervention and the control groups Boys: $T_{(169)} = 1.45$, $p < .14$ Girls: $T_{(156)} = 0.86$, $p < .39$	Other interventions are more suitable and beneficial to reduce depression among adolescents with war related trauma
12 Tol et al. (2012)	Sri Lanka/lower- middle income	Exposure to trauma Absence of protective factors	399	9–12/(38.6)	15 sessions for 5 weeks CBT Creative expression skills	Wait list: No treatment	DSRS: At 3 month follow up the mean changes between the study arms had no signifi- cant differences. Boys: $T_{(df=243)} = 0.03$, $p < 0.97$ Girls: $T_{(df=132)} = -0.95$, $p < 0.34$	Adolescents with war experiences may require more special- ized approach e.g., an individual or fam- ily based approach
13 Peltonen et al. (2012)	West Bank and Gaza/ lower-middle income	War exposed Symptoms of PTSD and depression	225	10–14 (36.0)	8 monthly sessions Identifying strengths and weaknesses Improving psychoso- cial skills Changing attitudes and rules of behavior Improving relation- ships between peers	No intervention	CDI: Depressive symptoms were decreased for adolescents in the intervention group compared to the control group. However, there was no difference between baseline and post interven- tion scores Baseline: $M = 10.04$ (6.11) Post intervention: $M = 10.78$ (5.55)	The child centered mediation interven- tion was not effective to reduce depression for adolescents in armed conflicts

Table 2 (continued)

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
14 Church et al. (2012)	Philippines/lower-middle income	Moderate to severe depressive symptom scores on BDI	30	16–18/(59.0)	4 sessions for 3 weeks exposure and cognitive reprocessing somatic stimulation	Control group: No treatment	BDI: The intervention group had significantly lower depression scores at the posttest. $F_{(1,15)} = 18.79$, $p < .001$ $d = 2.28$	The intervention may be an effective treatment for depression when it is delivered as peer counseling
15 Qouta et al. (2012)	West Bank and Gaza/lower-middle income	War affected PTSD and depressive symptoms	482	10–13/(49.4)	16 sessions for 4 weeks creative expressive cooperative play CBT	Control group: No treatment	DSRS: There were no significant differences in terms of depression between the study arms at 6 month follow-up Intervention: $M = 13.6$ (5.0) Control: $M = 13.2$ (4.9)	The effectiveness of the intervention in reducing depression was not significant
16 River-Duval et al. (2011)	Mauritius/upper middle income	No severe mental and/or intellectual disabilities	160	12–16/(50.0)	Cognitive behavioral and interpersonal therapy	Wait list: No treatment	RADS-2: There were no significant differences in terms of depression between the study arms at 6 month follow-up Intervention: $M = 49.7$ (9.2) Control: $M = 50.0$ (11.1)	The intervention had no long term effects
17 Jordans et al. (2010)	Nepal/low income	Conflict affected No severe psychiatric issues	325	11–14/(48.6)	15 sessions for 5 weeks creative expressive cooperative play CBT	Control group: No treatment	DSRS: Moderate effects were found in reducing depression symptoms $T_{(df=323)} = -4.15$ $p < 0.0001$ $d = 0.46$	The intervention should be introduced as a secondary prevention intervention

Table 2 (continued)

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
18 Berger et al. (2009)	Sri Lanka/lower-middle income	Exposed to tsunami Previous traumatic experience	166	9–15/(49.0)	12 sessions psycho-educational therapy cognitive-behavioral skills meditative practice bio-energetic exercise	Wait list Participation in regular religious services	BDI: Depression scores were significantly improved at the 2 month follow up $F_{(1,164)} = 48.9, p < .0001$	The intervention may help to reduce depression for disaster traumatized adolescents
19 Layne et al. (2008)	Bosnia/upper middle income	War exposed Symptoms of PTSD, depression, and grief Impairment in school	127	13–19/(64.5)	17–20 weekly group session Module I: Psycho-education for trauma Module II: Processing traumatic experience Module III: Processing grief experience	Classroom based intervention: Psycho-education for trauma, relaxation techniques, problem solving and social support skills	DSRS: Average depression score decreased significantly for the treatment group at 4 month follow up $F_{1,123} = 6.45, p < .05$	The school based intervention may be useful to reduce depression symptoms for war-exposed adolescents
20 Tol et al. (2008)	Indonesia/lower-middle income	Violence affected communities PTSD, anxiety and depression symptoms	495	8–12/(48.7)	5 week group intervention Trauma processing activities Cooperative play Creative expressing	Wait list: No treatment	DSRS: The mean change result showed that the depression symptoms were not reduced significantly at 6 month follow up M change difference = $-070 (0.40)$	The school based intervention was not effective in reducing depression symptoms in war-exposed adolescents
21 Bolton et al. (2007)	Uganda/low income	Scored greater than 32 on depression symptom scale More than 0 on function scale Had symptoms in the past month Resided in the camps	314	14–17/(78.5)	Interpersonal skills Group relationship-building Drawing on verbal and non-verbal expression of personal issues	Wait list: No treatment	LDSS: Depression symptoms were decline significantly for the treatment group. However, girls received IPT had significant improvement by 12.61 points for depression.	Girls benefited from the IPT more than boys

Table 2 (continued)

Author (year)	Country/World Bank classification	Inclusion criteria	N	Age/female (%)	Intervention	Control	Tools: results	Conclusion
Sports focused								
22 Richards et al. (2014)	Uganda/low income	Able bodied Enrolled in 6th grade	662	11–14/(33.7)	11 week voluntary development for football league 40 min football game every weekend	Wait list: No treatment	APAI: Depression symptoms were deteriorated for the boys in the intervention group while girl depression symptoms reduced slightly ES = 0.67 no improvement for depression.	The study results do not support the hypothesis of sport programs can improve depression symptoms for adolescents

SSI scale for suicidal ideation, *BDI* beck depression inventory, *DSRS* depression self-rating scale, *MFQ* mood and feeling questionnaire, *CDI* children's depression inventory, *APAI* acholi psychological assessment, *BYI* beck youth inventories; *HAM-D* hamilton depression scale, *RADS-2* the reynolds adolescent depression scale, *LDSS* local depression symptom scale

The aim of this intervention was to shift attention to neutral or positive stimuli in order to reduce depressive symptoms (Yang et al. 2016). Lastly, utilization of *physical activities* such as playing football an intervention to improve mental health among adolescents was identified in one study (Richards et al. 2014).

Frequency, Durations of Sessions, Length of Interventions and Facilitators

All but one study (Neshat-Doost et al. 2012) used trained facilitators to the interventions. These facilitators were also supervised through the course of the interventions. Intervention delivery for Neshat-Doost et al. (2012) was carried out by senior clinical psychologists. (Table 3). Duration of individual treatment sessions ranged from 15 min (Lange-Nielsen et al. 2012) to 2 h (Betancourt et al. 2012). Overall treatment lengths ranged from 3 days (Lange-Nielsen et al. 2012) to 1 year (Han et al. 2013; Ssewamala et al. 2012). Frequencies of intervention sessions were once or twice a week for most interventions.

Outcomes Assessed in Interventions

All but one of the articles examined depressive symptoms as one of the main outcomes. Ali Alavi et al. (2013) examined both suicidal ideation and depression among adolescents

Twelve of the articles that exclusively examined depressive symptoms as an outcome variable reported statistically significant reductions in both within or between group comparisons (Table 2). All but one of these articles concluded that the treatments produced both short term and long term effects in reducing depression for high-risk adolescents. One study (Lange-Nielsen et al. 2012) reported short-term reductions in depression in the intervention group, but not at 12-month follow-up. The two studies that delivered CBT interventions reported that the interventions were effective and appropriate to reduce adolescent suicidal ideation and depression (Alavi et al. 2013; Barron et al. 2013). Two of the three memory based interventions concluded that the interventions reduced the depression symptoms after a 12 month follow up (Neshat-Doost et al. 2012; Rossouw et al. 2016). Both studies that utilized micro-finance interventions with AIDS orphaned adolescents in Uganda reported that the interventions might reduce adolescent depression in low income countries (Han et al. 2013; Ssewamala et al. 2012). Another study that utilized play therapy in Uganda with AIDS orphaned children reported short term depression symptom reduction and concluded that peer group supported play therapy could be used to decrease adolescent depression (Kumakech et al. 2009). The computerized attention-biased therapy delivered in China indicated long term reductions in

Table 3 Summary of intervention characteristics

	Author (year)	Frequency	Duration of session	Length of intervention	Facilitator	Settings
Cognitive-behavioral therapy						
1	Alavi et al. (2013)	12 sessions	–	12 weeks	–	Community health center
2	Barron et al. (2013)	5 sessions	1.5 h	5 weeks	Counselors	School
Memory based therapy						
3	Rossouw et al. (2016)	14 sessions	60–90 min	14 weeks	Nurses	School
4	Neshat-Doost et al. (2012)	5 sessions	80 min	5 weeks	Senior clinical psychologists	School
5	Lange-Nielsen et al. (2012)	6 sessions	15 min	3 days	Teachers	School
Micro finance/economic intervention						
6	Han et al. (2013)	10 sessions	1–2 h	12 months	Counselors and adult mentors	Community health center
7	Ssewamala et al. (2012)	12 sessions	1–2 h	10 months	Counselors and mentors	Community health center
Interpersonal therapy						
8	Betancourt et al. (2012)	16 sessions	1.5–2 h	16 weeks	Local facilitators	Camps for displaced persons
Play therapy						
9	Kumakech et al. (2009)	16 exercises	1 h	10 weeks	Teachers	School
Attention based therapy						
10	Yang et al. (2016)	16 sessions	50 min	2 weeks	N/A	Computerized
Integrated therapy techniques interventions						
11	Tol et al. (2014)	15 sessions	–	5 weeks	Non specialized trained facilitators	School
12	Tol et al. (2012)	15 sessions	–	5 weeks	Non specialized trained facilitators	School
13	Peltonen et al. (2012)	–	–	8 months	Mental health specialists	Community health center
14	Church et al. (2012)	4 sessions	90 min	3 weeks	Students	University campus
15	Qouta et al. (2012)	8 sessions	2 h	4 weeks	Psychologists	School
16	River-Duval et al. (2011)	11 sessions	1 h	11 weeks	Teachers	School
17	Jordans et al. (2010)	15 sessions	60 min	5 weeks	Locals with experience working with children	School
18	Berger et al. (2009)	12 sessions	90 min	12 weeks	Teachers	School
19	Layne et al. (2008)	17–20 sessions	60–90 min	5 months	School counselors (teachers/psychologists)	School
20	Tol et al. (2008)	15 sessions	–	5 weeks	Non specialized trained facilitators	School
21	Bolton et al. (2007)	16 sessions	1.5–2 h	16 weeks	Local facilitators	Camps for displaced persons
Sports focused						
22	Richards et al. (2014)	Every weekend	40-min game 1.5 h training	11 week	Paid staff and volunteer adults	Community center

conclusion that the intervention might be a successful mode of treatment for adolescent depression (Yang et al. 2016).

Conclusions of the integrated therapy technique studies were mixed. Five studies that integrated CBT with other

therapy techniques reported that the interventions were successful at reducing depressive symptoms for adolescent groups. These studies suggested that integrated therapies might help to reduce depressive symptoms and increase

mental well-being of adolescents in LMICs (Berger and Gelkopf 2009; Bolton et al. 2007; Church et al. 2012; Jordans et al. 2010; Layne et al. 2008). Church et al. (2012) specifically reported that their brief group intervention was effective for adolescent depression when it was delivered as peer counseling. However, Jordans et al. (2010) recommended the use of the I-Deal Life skills intervention as only as a secondary intervention for adolescent depression.

Grey Literature Search Results

The International Clinical Trials Registry Platform (ICTRP), WHO, and Clinical trial registry at the National Institute of Health (NIH), USA have been utilized to search for registered ongoing trials. Total of 156 trials were found in the ICTRP and 45 RCTs on the NIH registry website. Of the cumulative 201 trials identified, only 4 were registered in LMICs: Integrate Mental Health into a HIV Clinic to improve Outcomes among Tanzanian Youth (*ID: NCT02888288*); The Relationships of Cyber-Bullying and Bullying with Self-esteem, Depression, and Suicidal Ideation among Taiwanese Adolescents (*ID: NCT02860832*); Attention Bias Modification Treatment for Major Depression Disorders in Adolescents: A Randomized Controlled Trial in China (*ID: NCT02078258*); School-based Comprehensive Suicide Intervention in Shanghai, China (*ID: CT01598519*).

Discussion

The objectives of this review were to map the existing literature about evidence based depression and suicide prevention/interventions for adolescents in LMICs; to summarize the existing body of knowledge; to disseminate the findings of evidence-based interventions; to identify existing knowledge gaps and, to determine the feasibility and value of a full systematic review and meta-analysis.

Summarizing and Disseminating Findings

The current review included 22 RCTs across 12 LMICs. Eight different modalities of intervention were implemented the outcomes of the studies were mixed. For example, CBT, IPT, play therapy, and integrated types of interventions reported both significant and non-significant results. This is consistent with prior systematic reviews and meta-analyses that also reported mixed results. For example, some systematic reviews and meta-analyses reported that IPT or CBT were more effective than other types of interventions such as play therapy (Arnberg and Öst 2014; Hetrick et al. 2015; van Zoonen et al. 2014; Weisz et al. 2017; Zhou et al. 2015) while many others reported that exercise programs had moderate to large

effects for adolescents (Carter et al. 2016; Schuch et al. 2016). The study included in this scoping review reported adverse effects (Richards et al. 2014). Additionally, some studies stated that interventions at school settings were more effective (Franklin et al. 2017; Werner-Seidler et al. 2017) while other studies reported web-based interventions were the best mode of delivery. (Rice et al. 2014; Ye et al. 2014).

Twenty-two RCTs for depression in LMICs were conducted in the past 12 years. Considering that 2/3 of the countries in the world are classified as LMICs and 75% of suicide occurs within these countries, this is a relatively small body of research (WHO 2014). Importantly, Only one study identified in this review addressed suicidal ideation among adolescents in LMICs. Taken together, these findings suggest that evidence for the effectiveness of depression and suicide prevention treatments for adolescents in LMICs is limited at best. The mixed findings and small number of RCTs in LMICs make it challenging to discuss the effectiveness of various modalities of interventions. These mixed findings make it difficult to confidently assume that interventions demonstrated to be effective in HICs will automatically be effective in LMICs.

Interventions need to be contextualized or modified to account for local culture and conditions as well as culture specific views of depression and suicide related behaviors. No studies were identified that examined how the economic status of countries affect mental health interventions and treatments for adolescents. Many LMICs spend less than \$1 of their budget to mental health services. For instance, India only spends \$0.22 and Pakistan only dedicates about 0.4% of their overall health budget on mental health services (Rathod et al. 2017). In addition, one meta-analysis examining the links between income inequality and depression emphasized that there was a strong causal relationship between income inequality and depression (Patel et al. 2018). The study also predicts that the overall status of global mental health may be predicted to decline due to increasing global income inequality gaps (Patel et al. 2018). The possible effects of the economic status of countries and mental health prevention/intervention outcomes, especially among adolescents presenting with depressive symptoms and/or suicidal behaviors should be a focus in future studies.

Many studies were conducted in countries that were struggling with armed conflict. WHO reported that most countries that have high suicide rates are not countries with armed conflict (WHO 2014). While it is a priority to address mental well-being of children who are suffering from wars and other types of violence, it is still important to address mental health issues within other contexts such as emotional and physical abuse, domestic violence, bullying and other adverse life events. Only one RCT examined suicidal ideation among adolescents in LMICs. The dearth of literature

on this topic indicates a general neglect and insufficiency of mental health services in LMICs.

It is important to that all adolescents in LMICs, not only those exposed to trauma, violence and war have access to quality mental health services

Integrated Mental Health Services

Thirteen depression and suicide prevention interventions recruited participants in school settings. The other six interventions were delivered at community health care settings. Studies conducted in HICs found that integrating depression and suicide prevention/interventions into primary and specialized health care systems can be an effective approach (Asarnow et al. 2005; Kolko and Perrin 2014; Richardson et al. 2014; Walker et al. 2002). Patel et al. (2013) discussed at least two additional benefits of integrating mental health into primary care and other health care services: integration would provide opportunities (1) to improve patient centered health services and to treat “the whole patient” and (2) increase acceptance and utilization of mental health services for mental health patients and their families where high levels of stigma may be with associated mental illnesses. Even integrating psychotherapies with positive youth development skills such as communication skills, social competencies, cognitive development, problem solving skills etc. may be more effective than psychotherapeutic models by themselves.

Human Resources

Most of the interventions included in this scoping review were delivered by teachers, locals who have experience with children, volunteers, lay individuals with high school diplomas etc. Human resources are an integral asset of mental health services and interventions. Most interventions in high income countries are delivered by trained and certified mental health professionals such as psychiatrists, neurologists, psychologists, psychiatric nurses and mental health social workers, who undertake additional training and education for specific interventions. While specialized mental health experts may be unrealistic for LMICs, task shifting of other health care workers such as nurses, social workers, and other health care workers can provide some mental health treatment services for adults and by extension to adolescents (Araya et al. 2003; Chatterjee et al. 2003; Patel et al. 2008; Saxena et al. 2007). Primary care physicians can also be involved in mental health diagnosis, treatment, and referral activities (Saxena et al. 2007). Therefore, it is important to evaluate interventions where trained non-mental health care professionals can deliver basic depression and suicide prevention interventions for adolescents as well.

Identifying Existing Gaps

Most of the studies in this review did not specifically discuss implementation strategies, barriers to successful adaptation and implementation, innovative solutions to implementation issues, or dissemination and sustainability issues. An examination of large pragmatic trials of mental health interventions in LMICs would help to provide in-depth understanding of the barriers unique to implementing evidence-based interventions in LMICs, implementation strategies, as well as sustainability and dissemination of feasible interventions. Thus, it is important to support the implementation and evaluation of evidence based interventions in LMICs in a way that combines both efficacy and effectiveness of intervention development (ex. hybrid designs). Doing will increase usefulness and policy relevance of RCTs (Wells et al. 2004).

Determining Feasibility of a Systematic Review and Meta-analysis that Addresses the Validity of Study Findings

One of the objectives of the study was to determine whether there was enough evidence to conduct a systematic review and meta-analysis that addresses effectiveness of the interventions, identifies effective approaches, and provides public health professionals and policy makers in LMICs with systematic scientific recommendations. The results of the scoping review show that there are a sufficient number of interventions that have been implemented in LMICs to improve adolescent depression and suicide prevention. The results of the scoping review also show that there is a need for a systematic reviews and meta-analysis. These reviews would more precise estimate of the effectiveness of the interventions, examine heterogeneity of the studies, and identify more effective treatment models for adolescent depression in LMICs.

Strengths and Limitations

This scoping review has a number of strengths and limitations. As far as we are aware, this is the first scoping review that has examined adolescent depression and suicide prevention/interventions for adolescents in LMICs. Most systematic reviews and meta-analysis studies focused on specific types of interventions e.g., CBT, IPT, school based, primary care based, or even depression, or suicide prevention only interventions; however, this scoping review included any type of intervention that was implemented for adolescent depression and suicide prevention. One limitation of the current scoping review was that it was not able to include reviews of grey literature due to time and resource constraints. In addition, only studies that were published

in English were included in the review. Lastly, this review was limited to descriptive screening of the RCTs that were conducted from 1996 on in LMICs and does not include an assessment of methodologic rigor.

Conclusions

The most important implication of the current scoping review is that there is insufficient evidence to conclude that there is any single effective intervention for adolescent depression and suicide related behaviors in LMICs. Innovative interventions that are culturally sensitive and geographically specific need to be critically designed and evaluated. A need to incorporate more health care professionals in mental health treatment delivery is also important. Lastly, an increase in attention and effort is required from policy makers and public health professionals at both micro and macro levels to help determine optimal pathways to address depression and suicide among adolescents in LMICs, to decrease their morbidity and mortality, increase access to effective care, decrease the burden of these disorders, and improve the opportunities for adolescents in LMICs.

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