



## Review article

# Internet-based interventions for the prevention and treatment of depression in people living in developing countries: A systematic review

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## ABSTRACT

**Background:** Internet-based interventions for depression may be a valuable resource to reduce the treatment gap for those living in developing countries. However, evidence comes mainly from developed countries. This systematic review summarized the evidence on preventive or therapeutic Internet-based interventions for depression for people who reside in developing countries.

**Methods:** CINAHL, EMBASE, PubMed, SciELO Citation Indexes, the Journal of Medical Internet Research, and the Telemedicine and e-Health journal, were searched up to June 2017, to identify feasibility or effectiveness studies of preventive or therapeutic Internet-based interventions for depression, with or without human support. Studies included subjects residing in developing countries, and were published in English or Spanish. Study protocols were included. Risk of bias and/or quality of the reporting of the studies included was assessed.

**Results:** Five feasibility studies, aimed at the prevention of depression, and a study protocol were included in this systematic review. Reports came mostly from the Americas ( $n = 4$ ). Internet-based interventions aimed at the prevention of depression presented low levels of human support, were useful and acceptable to their users, and require further design refinements to improve their use and retention.

**Limitations:** No gray literature was searched or included in this systematic review. Searches were limited to English and Spanish languages.

**Discussions:** Internet-based interventions aimed at the prevention of depression in people who reside in developing countries are in an early phase of development, limiting the generalizability of the results. Future studies must employ persuasive designs to improve user retention, incorporating larger samples and a control group to conclusively determine feasibility.

## 1. Introduction

Depressive disorders are characterized by marked symptoms of low mood and anhedonia, and can have a recurrent course, impairing functional abilities of the individuals affected (American Psychiatric Association (APA), 2013). According to the recent Global Health Estimates published by the World Health Organization, depressive disorders have been ranked as the single largest cause of global disability, with a worldwide pooled prevalence of 4.4% and an upward trend in low- and middle-income countries (World Health Organization (WHO), 2017).

Although effective and low-cost strategies for the prevention and treatment of depression exist (Patel, 2017), the current treatment gap for this disorder has been estimated to be between 72% and 93% of all depressed people, with those from the poorest countries receiving less coverage (Chisholm et al., 2016). When it is not timely and properly treated, depression may increase the risk of worse health outcomes (Ghio et al., 2014; Rotella and Mannucci, 2013).

Internet-based interventions are defined as “treatments that have been operationalized and transformed for delivery via the Internet... highly structured, self or semi-self-guided; based on effective face-to-face interventions; personalized to the user; interactive; enhanced by

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graphics, animations, audio, and possibly video; and tailored to provide follow-up and feedback” (Ritterband and Thorndike, 2006). There is evidence that has proven their feasibility and effectiveness in the prevention and treatment of depression (Andersson and Cuijpers, 2010; Richardson and Richardson, 2012).

These programs are usually based on cognitive-behavioral principles, with guided programs providing more positive results than unguided ones thus becoming a promising alternative or complement to face-to-face interventions by helping to reduce the treatment gap (Anderson and Cuijpers, 2010; Anderson et al., 2013; Richardson and Richardson, 2012; Schröder et al., 2016). More recently, meta-analyses have showed that unguided Internet-based interventions are more effective (Karyotaki et al., 2017) and are associated with a reduced risk of symptom deterioration (Ebert et al., 2016), compared with controls. However, methodological problems, such as a lack of blinding, selection bias, and low adherence, may hinder their internal and external validity (Ye et al., 2014).

Moreover, evidence comes mainly from people living in developed countries (Schröder et al., 2016), whereas it may be a valuable resource to reduce the treatment gap for those living in less developed countries, thus ameliorating social health inequalities between regions (Latulippe et al., 2017), there is little knowledge about purposely developed internet based interventions for depression in such countries. The objective of this systematic review was to summarize the evidence regarding internet-based interventions for the prevention or treatment of depression in people living in developing countries.

## 2. Methods

The Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) statement was used for the reporting of this systematic review (Moher et al., 2009).

### 2.1. Study eligibility criteria

To facilitate the development of the eligibility criteria, the PICOS (Participants, Interventions, Comparators, Outcomes, Study design) approach (Liberati et al., 2009) was applied as follows:

1. Participants: subjects from developing countries, according to the classification published in the 2017 World Economic Situation and Prospects of the United Nations (UN, 2017; see Appendix), without restriction of age, sex, race/ethnicity, or recruitment source. These subjects may or may have not been depressed at recruitment.
2. Interventions: Internet-based prevention or treatment interventions, based on the definition provided by Ritterband and Thorndike (2006), with or without human support.
3. Comparators: any control (placebo, treatment as usual, or waiting list), another active condition, or no comparators.
4. Outcomes: feasibility outcomes related to the question “*Can this study be conducted?*” (e.g. cultural adaptation, acceptability, usability, or adherence/compliance rates), as defined by Arain et al. (2010); effectiveness outcomes (*Does this work?*) dealing with clinical domains (i.e. presence or absence of a depressive disorder according to a diagnostic interview), cost or health resources, or patient-reported outcomes (e.g. depressive symptoms or health-related quality of life) (Velentgas et al., 2013).
5. Study design: Randomized or non-randomized study designs as defined by the Cochrane Collaboration (Higgins and Green, 2011). Systematic reviews and meta-analyses were sought for relevant studies and prospective study protocols were included in the case of randomized controlled trials.

### 2.2. Report eligibility criteria

Reports in English or Spanish, published in the databases and/or

journals listed below, from inception until June 2017 were considered for inclusion.

### 2.3. Information sources and search strategies

The reports were identified by searching the Cumulative Index to Nursing and Allied Health Literature (CINAHL), the ExcerptaMedicadataBASE (EMBASE), the PubMed, and the Scientific Electronic Library Online (SciELO) Citation Index databases, the Journal of Medical Internet Research, and the Telemedicine and e-Health journal. The searches were complemented by scanning the reference lists of the articles included and by consultation with Latin American experts in the field. The search strategies used are detailed in the Appendix.

### 2.4. Study selection and data collection process

All the records retrieved through the searches were imported into EndNote Web and duplicates were removed. Processes of screening, eligibility determination, and inclusion in this systematic review followed the same procedure: each of the articles was assessed by two reviewers independently and in duplicate, and discrepancies solved by consensus and/or with the assistance of a third party. A data extraction sheet was developed based on the template recommended in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins and Green, 2011). The same procedure described above was applied to data collection.

### 2.5. Data items

The following information was extracted from the studies included: (1) First author, year of publication, and country of origin; (2) Participants’ recruitment sources, inclusion/exclusion criteria for participants (i.e. age, sex, Internet proficiency, depressive status, any clinically relevant information), developing countries of provenance; (3) name of the interventions, objective (prevention or treatment), guiding principles or theories, duration, frequency, and number of modules, number of subjects assigned, criteria for assignment in the case of non-randomized studies, presence and type of additional support; (4) type of comparators (placebo, treatment as usual, waiting list, another active condition, or none), delivery medium (face-to-face, Web or Internet-based), and the same specifications as for interventions; (5) type of outcome (feasibility or effectiveness), instruments, and follow-up periods; (6) type of study design; (7) main results regarding the feasibility and/or effectiveness of the intervention.

### 2.6. Risk of bias/quality of individual studies

In the case of studies evaluating current or potential effectiveness, bias risk was assessed based on the Cochrane risk of bias tool (Higgins and Green, 2011). Complementarily, the quality of the reporting of feasibility studies that were non-randomized design was judged based upon selected, applicable, and adaptable items of the “CONSORT 2010 statement: extension to randomized pilot and feasibility trials” (Eldridge et al., 2016), with inputs from the CONSORT-EHEALTH statement (Eisenbach & CONSORT-EHEALTH Group, 2011). No risk of bias assessment was conducted for protocol studies. First author (PM) assessed the risk of bias/quality of the reporting of individual studies, with due supervision by third parties (Corresponding author (CP), third coauthor (ML)).

### 2.7. Analysis

Study-level data were reported via structured narrative synthesis, which included main characteristics and risk of bias/quality assessment of the studies included. Simple summary data were presented for each

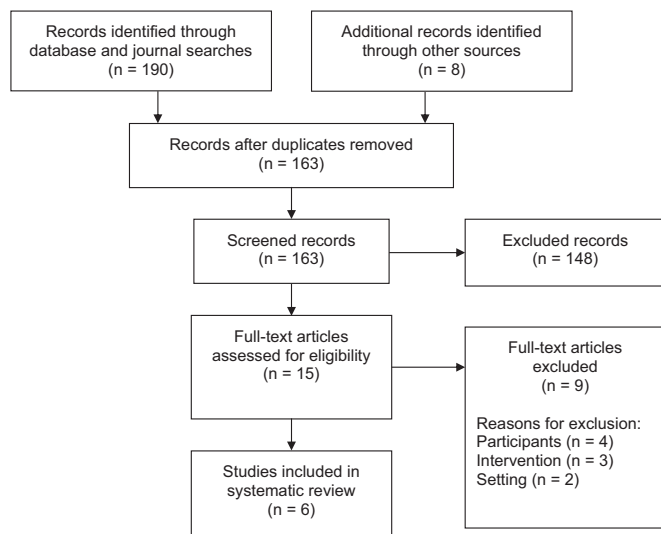


Fig. 1. PRISMA Flow Diagram.

intervention group and for all results (e.g. effect estimates with their confidence intervals). To simplify the interpretation of the results, comparative tables were used. As great variability between studies was expected, and was indeed detected in this review, a meta-analysis was not performed.

### 3. Results

#### 3.1. Selection process

As shown in Fig. 1, the study selection process led to the inclusion of 6 articles in this systematic review (Arjadi et al., 2016; Barrera et al., 2015; Espinosa et al., 2016; Lara et al., 2014; Patel et al., 2016; Tiburcio et al., 2016).

#### 3.2. Characteristics of the studies included

There were no studies assessing effectiveness. There were five feasibility studies (Barrera et al., 2015; Espinosa et al., 2016; Lara et al., 2014; Patel et al., 2016; Tiburcio et al., 2016), one of which reported on the preliminary effectiveness of an Internet-based intervention (Barrera et al., 2015). Additionally, there was a single study protocol (Arjadi et al., 2016). The characteristics of the studies included are displayed in Table 1.

Reports came from the Americas ( $n = 4$ ) and East and South East Asia ( $n = 2$ ), with a large percentage of participants living in Latin American countries, specifically Chile and Mexico (Barrera et al., 2015; Espinosa et al., 2016; Lara et al., 2014; Tiburcio et al., 2016).

The majority of the studies ( $n = 5$ ) were aimed at the prevention of depression: a single study targeted the general population (Lara et al., 2014), two studies were directed to population subgroups with higher-than-average risk of depression (pregnant women in Barrera et al., 2015; adolescents in Patel et al., 2016), and other two studies tested indicated preventive interventions (Espinosa et al., 2016; Tiburcio et al., 2016). Arjadi et al.'s study (2016) was the only study designed for treatment purposes.

No study recruited children, adolescents, or older adults specifically, though the CATH-IT intervention targeted adolescent population (Patel et al., 2016). The study by Barrera et al. (2015) included pregnant women only. Internet access (Espinosa et al., 2016) and/or proficiency (Arjadi et al., 2016; Tiburcio et al., 2016) was specified among the inclusion criteria in three out of four clinical sample-based studies. Common exclusion criteria were severe psychiatric disorders and/or presence of suicidality (Arjadi et al., 2016; Espinosa et al., 2016; Patel

et al., 2016). Further information on the recruitment focus of each study is provided in the Appendix, as a supplementary table.

Studies adapted existing face-to-face or Internet-based interventions from developed countries, with the exception of Lara et al.'s study (2014), which automatized a Mexican face-to-face intervention. Psychoeducation and cognitive behavioral principles were common to all the interventions, shaping the contents of sequentially delivered Web-based modules (Arjadi et al., 2016; Barrera et al., 2015; Lara et al., 2014; Patel et al., 2016; Tiburcio et al., 2016), with the addition of automated symptom assessment systems (Arjadi et al., 2016; Espinosa et al., 2016; Lara et al., 2014; Tiburcio et al., 2016). Details of the interventions are included in Table 2.

In the study by Barrera et al. (2015), a fully automated Internet-based intervention without human support was provided. In the rest of the studies, the type of additional support varied: face-to-face contacts at follow-up to encourage treatment adherence were part of Patel et al.'s intervention (2016); sporadic contacts through forums or chat, mainly dealing with technical issues in using the Web-based interface, were maintained in the case of Lara et al. (2014); in Arjadi et al. (2016) and Tiburcio et al. (2016) studies, a more active approach was employed, with counselors monitoring patients' activities and providing supportive feedback throughout the intervention; lastly, patients in the study by Espinosa et al. (2016) had the possibility to book an online appointment with a psychologist via Internet chat.

Only the Internet-based interventions described in Arjadi et al. (2016) and Espinosa et al. (2016) provided (or were intended to provide) additional referral services or an action plan –involving the research team– in case of an emergency or a crisis experienced by a patient, i. e. suicidal ideation.

#### 3.3. Main results of the studies included

Regarding study results, four of them referred to the adaptation of Internet-based interventions (Espinosa et al., 2016; Lara et al., 2014; Patel et al., 2016; Tiburcio et al., 2016), which are summarized in Table 3. Additionally, Barrera et al. (2015), Espinosa et al. (2016), and Lara et al. (2014), provided data on the acceptability or usefulness of Internet-based interventions, noting that an important proportion ( $> 80\%$ ) of those deemed as active users or completers were satisfied or found these interventions useful/beneficial. Complementarily, a study identified that being female (adjusted Odds Ratio [aOR] = 1.65, 95% Confidence Interval [CI] = 1.02, 2.66), homemaker (aOR = 2.22, 95% CI = 1.20, 4.55) and employed (aOR = 1.67, 95% CI = 1.13, 2.15) predicted a higher likelihood of accessing at least 3 of 7 modules (Lara et al., 2014). Finally, the study by Barrera et al. (2015), which carried out a complete case analysis – 13.0% of enrolled participants found that intervention participants exhibited a lower risk of postpartum depression ( $b = -.514$ ,  $\chi^2(1) = 3.453$ ,  $p = .061$ ; Hazard Ratio [HR] = .598, 95% CI = .339, 1.022) and that women with higher (vs. low) prenatal depression benefited more from the intervention ( $b = -.605$ ,  $\chi^2(1) = 5.201$ ,  $p = .023$ ; HR = .546, 95% CI = .324, .936).

#### 3.4. Risk of bias/quality of individual studies

Full assessment of risk of bias in studies evaluating the potential effectiveness of this kind of interventions was possible for only one study, whose aim was to measure this aspect, in which incomplete outcome data and selective reporting were a major concern (Barrera et al., 2015) resulting from non-usage and dropout attrition, leading to the exclusion of a pre-specified outcome.

The quality of reporting assessment in feasibility studies is summarized in Table 4. Even though most studies met the criteria established, it must be pointed out that only one of them included some degree of user digital literacy among its inclusion criteria (Tiburcio et al., 2016). However, this study does not clearly show whether the number of participants assessed for eligibility is the same as the number

**Table 1**  
Characteristics of studies on Internet-based interventions for the prevention or treatment of depression in people living in developing countries.

Effectiveness studies								
Author, year (country) <sup>a</sup>	N <sup>b</sup>	Setting	Intervention	Intervention Aim	Depressive status <sup>c</sup>	Comparator	Outcomes	Study design
Arjadi, 2016 (ID)	312	Community and/or clinical	GAF-ID (N = 156)	Treatment	PHQ-9 ≥ 10	e-brochure on depression (N = 156)	PHQ-9 <sup>d</sup>	RCT <sup>e</sup>
Barrera, 2015 (US)	852	Internet (Worldwide)	e-MB (N = 435)	Selective prevention	Not MDE (DSM-IV)	e-brochure on PPD (N = 417)	EPDS <sup>f</sup>	Pilot RCT
Feasibility studies								
Author, year (country) <sup>a</sup>	N <sup>b</sup>	Setting	Intervention	Intervention Aim	Depressive status <sup>c</sup>	Study Aims	Outcomes	Study design
Espinosa, 2016 (CL)	35	Private outpatient clinic	ASCENSO	Indicated prevention	PHQ-9 < 15	Intervention Acceptability & Demand	Satisfaction Actual use	Case series
Lara, 2014 (MX)	17,318	Internet (Worldwide)	ADEP	Universal prevention	Not required	Intervention Acceptability & Implementation	Actual Use Satisfaction Degree of execution	Descriptive
Patel, 2016 (CN)	23 <sup>g</sup>	University	CATCH-IT	Selective prevention	PHQ-9 score: 5–9	Adaptation of Intervention	Cultural Adaptation	Cross-sectional
Tiburcio, 2016 (MX)	29 <sup>h</sup>	Addiction treatment centers	PAADD	Indicated prevention	Not required	Intervention Acceptability	Perceived appropriateness	Cross-sectional

Country abbreviations: CL: Chile; CN: China; ID: Indonesia; MX: Mexico; US, United States; GAF-ID: Guided Act and Feel – Indonesia.

Abbreviations: e-MB: Mothers and Babies Internet Course; ASCENSO: Apoyo, Seguimiento y Cuidado de Enfermedades a partir de Sistemas Operativos, in Spanish; ADEP: Ayuda para la Depresión, in Spanish; CATCH-IT: Competent Adulthood Transition with Cognitive-Behavioral, Humanistic and Interpersonal Training; PAAD: Programa de Ayuda para Abuso de Drogas y Depresión, in Spanish; e-brochure: Online informative brochure; PHQ-9: Patient Health Questionnaire-9; MDE: Major Depressive Episode; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; EPDS: Edinburgh Postpartum Depression Scale; RCT: Randomized Controlled Trial.

<sup>a</sup> First author, year of publication, and country of origin.

<sup>b</sup> Enrolled participants.

<sup>c</sup> Depressive status as inclusion criteria of participants (patients).

<sup>d</sup> Primary outcome.

<sup>e</sup> Study protocol for a randomized controlled trial.

<sup>f</sup> Primary outcome.

<sup>g</sup> Recruited 20 medicine students and a panel of 3 expert physicians.

<sup>h</sup> Recruited 20 patients and 9 mental health professionals treating included patients.

of individuals recruited. For their part, Patel et al. (2016) do not state whether participants gave their informed consent, nor do they provide enough details about the intervention to be culturally adapted. Finally, the study carried out by Lara et al. (2014) does not report the results for a previously established outcome (specifically, the results of the Center for Epidemiologic Studies Depression Scale), although the authors' reasons behind this decision are reported.

#### 4. Discussion

This systematic review identified recent studies that support the feasibility of Internet-based interventions for preventing depression in developing countries. No studies have published results regarding the use of these interventions in depression treatment. Data were mainly collected in the Americas, where most participants were middle-aged adults without severe depressive symptoms and with Internet access or were proficient Internet users. All interventions were based on cognitive-behavioral principles and displayed some degree of automation, with limited human support.

The users of these interventions describe them as useful and acceptable, although the fact that these interventions required design adjustments to facilitate their use and encourage retention was an important limitation for conclusive findings regarding their feasibility. In general, the preliminary state of the feasibility tests limits the generalizability of the results, an aspect that could be remedied in future studies with more refined versions of the interventions, larger samples, and the inclusion of a control group.

The evidence collected through this systematic review is recent, with the study by Lara et al. (2014) being the earliest study to describe these types of interventions in the developing world. This indicates that Internet-based programs aimed at tackling depression in developing

countries are an innovative complement for in-person mental health care services in these regions. This reality differs greatly from the long history of such interventions in the management of mental disorders in developed countries; for instance, over the last 20 years, Internet-based cognitive-behavioral therapy has established itself as an effective and cost-effective alternative in countries such as Australia, Switzerland, and the Netherlands (Hedman et al., 2012).

The studies included in this systematic review were mostly conducted in developing countries of the Americas and to a lesser extent in East and Southeast Asia. It must be noted that this summary of the available evidence revealed that technological innovation can make it possible to overcome geographical barriers by facilitating remote access to mental health care services provided in other regions. For example, Barrera et al. (2015) designed the *Mothers and Babies Internet Course* in the USA, which was implemented in order to serve a global community of pregnant women, the majority living in countries such as Chile, Spain, Argentina, Mexico, Colombia, and United States. Nevertheless, none of the studies examined were conducted in the least developed countries, nor did any studies in other regions recruit a substantial sample of participants from such nations; in addition, individuals of a lower social standing (unemployed or insufficiently schooled) were not recruited or had a lower participation rate (Barrera et al., 2015; Lara et al., 2014; Patel et al., 2016).

This lack of research in socioeconomically impoverished countries or in populations of a lower social standing is noteworthy. Unsurprisingly, the production of interventions of this type is quite developed in Europe, North America, Australia, and high-income Asian countries; in contrast, such interventions display incipient growth in Latin America, China, and Southeast Asia due to the development of a recent and basic infrastructure that allows minimal service coverage and a population with lower (but growing) levels of digital literacy,

**Table 2**  
 Characteristics of Internet-based interventions for the prevention and treatment of depression in people living in developing countries.

Author, year <sup>a</sup>	Intervention	Theoretical Models	Delivery modality	Contents
Arjadi, 2016	GAF-ID	Based on the face-to-face behavioral activation intervention and on the Dutch online behavioral activation intervention	8 fixed-structure modules over 8 weeks. Provides automatized feedback of mood self-ratings measured during the intervention. Participants receive feedback, messages and supportive phone contact by a trained and supervised lay counselor. In case of suicidal thoughts and/or serious deterioration (participants may be contacted). 8 fully-automated sequential sessions (without additional support)	Psycho-education about depression, monitoring mood and behavioral activities, expanding potential mood-independent pleasurable activities, recognizing and overcoming difficulties with expanding activities, realizing the impact of avoidance behaviors, and building a prevention of relapse strategy
Barrera, 2015	e-MB	Adapted from a face-to-face group intervention (called Mothers and Babies Course), and based on a cognitive-behavioral framework	8 fully-automated sequential sessions (without additional support)	Contents aim at teaching women to create a healthy lifestyle for their own and their babies, integrating interactive material and health recommendations
Espinosa, 2016	ASCENSO	Based on SUMMIT, a German Internet-based program aimed at reducing the recurrence of depressive episodes, and guided by cognitive-behavioral principles	Patients interact with the program accessing web site, via monitoring e-mail (every 2 weeks), and online counseling. It provides a tailored feedback of their depressive symptomatology. In case of severe impairment and/or suicidal ideation, an alarm message is sent to mental health professionals to contact the patient 7 fully-automated sequential modules. It includes assessments of depressive symptoms with feedback to users; discussion forums and blogs, recorded relaxation exercise, recorded messages, personal workbook, and quizzes 14 modules	Monitoring. Personalized self-care plan, online counseling delivered through Internet chat, psycho-educational information, news on mental health issues, emergency/crisis management, and contact via e-mail with research team.
Lara, 2014	ADEP	Adapted from a face-to-face cognitive-behavioral intervention	7 fully-automated sequential modules. It includes assessments of depressive symptoms with feedback to users; discussion forums and blogs, recorded relaxation exercise, recorded messages, personal workbook, and quizzes 14 modules	Psycho-educational modules: Depressive symptoms and risk factor for depression, negative thoughts, stressor events, gender and depression, social support and violence/addictions
Patel, 2016,	CATCH-IT	Based on cognitive behavioral therapy, interpersonal therapy, behavioral activation and resiliency theory	4 sequential modules over 8 weeks. Minimal contact with a counselor, who provides an initial face-to-face meeting, monitors the activities and gives feedback to support the completion of the program.	No-data
Tiburcio, 2016	PAAD	Based on “How to Stop Using Drugs?”, “Drink Less” and “ADEP” intervention, behavior modification techniques and cognitive restructuring principles guided by a counselor	4 sequential modules over 8 weeks. Minimal contact with a counselor, who provides an initial face-to-face meeting, monitors the activities and gives feedback to support the completion of the program.	Activities aimed at promoting awareness of drug use and risks, setting treatment goals, achieving/reinforcing behavioral change, and preventing relapses

**Table 3**  
Synthesis of studies' results on the adaptation of Internet-based interventions for the prevention or treatment of depression in people living in developing countries.

Author, year <sup>a</sup>	Results
Espinosa, 2016	65.7% (N = 23) of participant were active users (AU) of ASCENSO. 70% of monitoring messages were answered; and 47.8 (N = 11) of patients answered most of them (81%–100% of monitoring by person). 91.3% (21) of AU considered ASCENSO beneficial, 61% found the Website easy to use, and 87% identified the monitoring as the most useful service offered. However, technical problems, predictability of the automated symptoms assessment system, and lack of spaces for communication with other participants were obstacles were noted as negative aspects of the intervention.
Lara, 2014	Use of ADEP dropped from module 1 to module 7 considering accessed (12,366–626) and evaluated (6,872–57) modules. Completed module activities percentage dropped from 65.1 (module 1) to 33.3 (module 7). Qualitative analysis showed that an open exchange of experiences (using empathetic and positive statements) occurred in the discussion forums. No potentially harmful exchanges were detected.
Patel, 2016	CATCH-IT was deemed as appropriate for use in Mainland China, but changes are needed. Involvement of adolescents and teachers in the adaptation process was requested, sociocultural reasons would lead to the exclusion of the interpersonal therapy module, and dissemination of the intervention through schools was recommended.
Tiburcio, 2016	From the patients' perspective, the PAADD Website needed a more dynamic format, clearer instructions, empathetic and reflexive feedback, and the possibility to modify weekly goals. Mental health professionals recommended modifications to the content and format of Website, making it more attractive and intuitive, and compromising the participation of the users through the inclusion of more feedback and activities. No change to the structure of the program was recommended.

<sup>a</sup> First author, and year of publication.

thus being increasingly exposed to information technologies (Huawei Technologies Co., Ltd., 2017). These preconditions do not appear to be met in much of Africa and the rest of Asia (Huawei Technologies Co., Ltd., 2017).

This situation may introduce relevant social inequalities in people's access to technology-based mental health services. A recent summary of the literature described how the eHealth digital gap can contribute to greater inequalities in health care, particularly affecting socially disadvantaged individuals, an issue that may be exacerbated by people's lower levels of health literacy, motivation to use interventions requiring technology, and ability to use technology (Latulippe et al., 2017). Considering that digital literacy is related to the use of these innovations in the health care field, it is surprising to note that it was measured in only one of the studies reviewed (Tiburcio et al., 2016).

The studies included in the present review, whose results have been published, were all aimed at preventing depression at different stages of the health/disease process (universal, selective, indicated, and relapse), with highly structured interventions and limited human support. The literature shows that this type of interventions are a promising alternative for developing low-cost prevention programs in contexts where mental health care resources are scarce (Baumeister et al., 2014). Nevertheless, it has been pointed out that guided interventions are more acceptable, have higher retention rates, and are more effective

(Ebert et al., 2017), even though it is still necessary to determine the impact of the type, amount, and quality of human support provided (Baumeister et al., 2014; Ebert et al., 2017).

Developing Internet-based interventions to prevent or treat depression in child and adolescent populations can be a reasonable way of dealing with the severe scarcity of mental health care resources in mid- and low-income countries (WHO, 2009), considering that this age group is familiar with information and communication technologies. However, the present systematic review yielded no studies which included infants or adolescents, and the cultural adaptation of the single intervention targeting adolescents was performed with adult participants only (Patel et al., 2016). This suggests that it is necessary to include this age group in further research conducted in developing countries. Future studies of this type should take into account the ethical (Harriman and Patel, 2014) and methodological challenges (Wozney et al., 2017) that the inclusion of this age group entails. Particularly, the requirement to obtain parental consent of participants is one of the most critical ethical issues, especially in the case of online interventions (Harriman and Patel, 2014).

Since prevention studies must guarantee the inclusion of participants without baseline pathologies, ensuring the exclusion of those who already meet criteria for the clinical condition being prevented, the use of standardized clinical criteria in research on the prevention of mental

**Table 4**  
Quality of the reporting of non-randomized feasibility studies on Internet-based interventions for the prevention or treatment of depression in people living in developing countries.

Author, year <sup>a</sup>		Espinosa, 2016	Lara, 2014	Patel, 2016	Tiburcio, 2016	
CRITERIA <sup>b</sup>	Objectives	1. Objectives are mainly/directly related to feasibility of the intervention	Y	Y	Y	Y
	Methods	2. Eligibility criteria for each set of participants included in the study are reported.	Y	Y	Y	Y
		3. Details of identification and consent of the study participants are reported.	Y	Y	U	Y
		4. The study details the intervention to allow replication.	Y	Y	N	Y
		5. The assessments or measurements to address each study objective are completely defined and prespecified	Y	Y	Y	Y
		6. Any changes to prespecified assessments or measurements are reported in the study	O	Y	O	Y
	Results	7. Numbers of participants who were assessed for eligibility, received the intervention, and were assessed for each objective are provided in the study.	Y	Y	Y	U
		8. Numbers of losses and exclusions after inclusion in the study are provided, together with reasons.	Y	U	Y	O
		9. For each study objective, results are reported.	Y	N	Y	Y
	Discussion	10. All the important harms or unintended consequences are reported in the study.	Y	Y	Y	Y
		11. The interpretation of the results is consistent with the study objectives and findings, balancing benefits and harms.	Y	Y	Y	Y
		12. The implications for progression from feasibility to a future trial or feasibility study, including any proposed amendments, are discussed in the study.	Y	Y	Y	Y

Y = reported; N = not reported; U = not clearly reported; O = not applic.

<sup>a</sup> First author, and year of publication.

<sup>b</sup> Adapted items from the "CONSORT 2010 statement: extension to randomized pilot and feasibility trials" (Eldridge et al., 2016). Items are related to four article sections: objectives, methods, results, and discussion.

disorders through Internet-based interventions is required (Ebert et al., 2017). The present systematic review showed that only Barrera et al. (2015) performed such a baseline evaluation, while the rest of the studies reported the use of the PHQ-9 self-report instrument (Espinosa et al., 2016; Patel et al., 2016) or did not consider the baseline severity as an inclusion criterion (Lara et al., 2014; Tiburcio et al., 2016). Due to the preliminary state of the feasibility studies, future research should weigh the costs and benefits of incorporating a baseline evaluation and its impact on the design and content of these interventions (Ebert et al., 2017).

For instance, catering to the mental health care needs of depressed individuals in developing countries, where mental health care services are scarce, can be problematic if specialized in-person resources are not available, thus making it impossible to refer the most severe cases requiring urgent treatment (such as those displaying suicidal ideation). One solution is to study alternative intervention models which operate according to the *Blended-Concept* (Erbe et al., 2017), which combines intensive face-to-face care with automated, technology-based, and minimally guided activities that can be used to reinforce in-person sessions. Even more so, these components can be supplemented by staggered (or stepped) care approaches, in which the degree and intensity of human support received is tailored to individual needs (Ebert et al., 2017).

The evidence collected through this systematic review shows that Internet-based interventions aimed at preventing depression in people who reside in developing countries are in an early phase of development. Future research must employ persuasive designs to improve user retention (Wozney et al., 2017), incorporating larger samples and a control group to conclusively determine feasibility and later explore potential effectiveness and implementation-related costs. In the meantime, the risk of proliferation of eHealth interventions not backed by evidence is high (Shen et al., 2015; Bakker et al., 2016).

The protocol of this systematic review was published before the study was performed (Martínez et al., 2017); evidence selection and evaluation processes were performed independently and in duplicate, and multiple information sources were sought, including specialized journals and reference listings. These procedures ensured the transparency, scope, and quality of the systematic review performed; however, major limitations were also observed. This systematic review was limited to: 1) studying all the evidence published, including research protocols, but without conducting a gray literature search; 2) examining studies published in English or Spanish, thereby reflecting only a small part of the linguistic diversity of developing countries and possibly introducing bias towards the Americas in the study selection process.

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## Abbreviations

All abbreviations provided throughout the text are standard in the field of ‘depression’ and ‘systematic reviews’.

## Role of the funding source

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## Institutional Board Review

This is a systematic review, Institutional Board Review was not required.

## Limitations of this study

As noted in the final paragraph of the manuscript:

The protocol of this systematic review was published before the study was performed; evidence selection and evaluation processes were performed independently and in duplicate, and multiple information sources were sought, including specialized journals and reference listings. These procedures ensured the transparency, scope, and quality of the systematic review performed; however, major limitations were also observed. This systematic review was limited to: 1) studying all the evidence published, including research protocols, but without conducting a gray literature search; 2) examining studies published in English or Spanish, thereby reflecting only a small part of the linguistic diversity of developing countries and possibly introducing bias towards the Americas in the study selection process.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.jad.2018.02.079>.

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