

# A Systematic Review of Online Youth Mental Health Promotion and Prevention Interventions

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**Abstract** The rapid growth in the use of online technologies among youth provides an opportunity to increase access to evidence-based mental health resources. The aim of this systematic review is to provide a narrative synthesis of the evidence on the effectiveness of online mental health promotion and prevention interventions for youth aged 12–25 years. Searching a range of electronic databases, 28 studies conducted since 2000 were identified. Eight studies evaluating six mental health promotion interventions and 20 studies evaluating 15 prevention interventions were reviewed. The results from the mental health promotion interventions indicate that there is some evidence that skills-based interventions presented in a module-based format can have a significant impact on adolescent mental health, however, an insufficient number of studies limits this finding. The results from the online prevention interventions indicate the significant positive effect of computerized cognitive behavioral therapy on adolescents' and emerging adults' anxiety and depression symptoms. The rates of non-completion were moderate to high across a number of studies. Implementation findings provide some evidence that participant face-to-face and/or web-based support was an important feature in terms of program completion and outcomes. Additional research examining factors affecting exposure, adherence and outcomes is required. The quality of evidence across the studies varied

significantly, thus highlighting the need for more rigorous, higher quality evaluations conducted with more diverse samples of youth. Although future research is warranted, this study highlights the potential of online mental health promotion and prevention interventions in promoting youth wellbeing and reducing mental health problems.

**Keywords** Systematic review · Online technology · Intervention · Mental health promotion · Youth

## Introduction

Good mental health is a key asset and resource for population health and wellbeing and is critical to positive youth development (WHO 2013). Positive mental health is a requirement for optimal psychological development, the development and maintenance of productive social relationships, effective learning and good physical health. It is estimated that 10–20 % of youth worldwide experience mental health problems (Kieling et al. 2011). The promotion of positive mental health equips youth with the necessary life skills, supports and resources to fulfill their potential and overcome adversity (Barry and Jenkins 2007; Patel et al. 2007). Many opportunities exist to promote positive mental health and wellbeing, not only for those who have mental health problems, but for all youth.

Mental health promotion is based on the underlying principle that mental health is a positive concept, which is important in its own right, is of universal relevance, and is an intrinsic component of the broader health promotion and public health agenda (Herrman and Llopis 2012; WHO 2004). Building on the basic tenets of health promotion (WHO 1986), mental health promotion focuses on enhancing the strengths, capacity and resources of

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individuals and communities to enable them to increase control over their mental health and its determinants (Barry and Jenkins 2007). Prevention, on the other hand, aims to reduce the incidences, prevalence or seriousness of targeted mental health problems. Reviews of the international evidence show that comprehensive mental health promotion and prevention face-to-face interventions carried out with youth in collaboration with families, schools and communities, lead to improvements not only in mental health but also improved social functioning, academic and work performance, and general health behaviors (e.g., Barry et al. 2013; Weare and Nind 2011; Tennant et al. 2007).

In recent years, there has been increasing interest in the use of the internet for the delivery of health promotion and mental health interventions. The potential that online mental health interventions hold includes direct, convenient access to resources one might otherwise not have. Online interventions also offer individuals increased privacy and anonymity. In addition, they provide a cost-effective and accessible means of accessing services for disenfranchised and minority populations and those living in isolated geographical areas. (Barak and Grohol 2011). There is accumulating evidence that online interventions can be effective in addressing mental health problems for adults. Several reviews have examined the impact of computerized cognitive behavior therapy (cCBT) interventions targeting depression and anxiety symptoms in adults and reported small to medium effect sizes (e.g. Griffiths et al. 2010; Cuijpers et al. 2009; Spek et al. 2007). The effectiveness of online technologies in improving adolescent and emerging adult mental health, however, has been less well documented. The findings from recent studies provide evidence that, for youth, the internet can be seen as both a tool and a setting for action in improving their mental health and wellbeing (Blanchard et al. 2011; Rickwood 2010). Research indicates that adolescents and emerging adults use the internet to seek mental health information (Dooley and Fitzgerald 2012; Gould et al. 2002). Importantly, they report feeling comfortable accessing online information about mental health issues (Oh et al. 2008). To date, however, there has been no systematic attempt to synthesize the evidence on the effectiveness of internet-based interventions for population. This was the goal of this study. The review was carried out as part of a larger study that seeks to develop online resources to support the mental health and wellbeing of youth aged 12–25 years (Clarke et al. 2013; <http://www.youngandwellcrc.org.au/research/user-driven-and/bridging-digital-disconnect/>).

### Current Study

The objective of this systematic review was to examine the effectiveness of online mental health promotion and

prevention interventions that are available for youth. The interventions were appraised in terms of their content and delivery, the quality of the evaluation, program outcomes and implementation findings such as drop out and program acceptance. A further objective of this review was to identify gaps in the existing literature. The results from this systematic review may serve as a basis for informing further research in developing and evaluating online mental health promotion and prevention interventions for youth.

### Methods

#### Study Selection

The systematic review conforms with the guidelines outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 Checklist. Studies were eligible for inclusion if the intervention was online and designed to promote positive mental health and/or prevent mental health problems of youth aged 12–25. This age range was selected to comply with the focus of the larger research project, of which this study is a part and current literature on the provision of mental health services to adolescents and young adults (McGorry et al. 2007). For the purpose of this review, mental health promotion interventions were defined as any planned intervention or program that was undertaken with the aim of improving mental health or modifying its determinants. Prevention was defined as universal, selective or indicated interventions (Mrazek and Haggerty 1994), with universal interventions targeting the general/whole population, selective interventions targeting individuals or groups whose risk of developing a mental disorder is significantly higher than the rest of the population, and indicated interventions targeting high risk individuals with minimal but detectable signs or symptoms of a mental disorder. Online treatment interventions were not included in this review.

Experimental study designs including randomized controlled trials, quasi-experimental study designs and experimental studies without a comparison group were included in the review. Academic and grey literature published from 2000 onwards in printed or electronic format was deemed eligible for inclusion. The primary outcomes of interest were mental health and wellbeing outcomes. These outcomes included indicators of positive mental health such as self-esteem, self-efficacy, coping skills, resilience, emotional wellbeing. Negative mental health indicators included, for example, depression, anxiety, psychological distress, suicidal behavior. Wellbeing indicators such as social participation, empowerment, communication and social support were also included. Any adverse events or harms associated with the intervention were also

documented. Studies with the following characteristics were excluded from the review (1) interventions implemented with youth with a diagnosed mental health disorder (2) interventions that were primarily face-to-face with the inclusion of some online technology as an element of the program (3) interventions designed and implemented with a general adult population (age 18+) and (4) process evaluation studies.

### Search Strategy

Academic databases including Scopus, PubMed, PsychINFO, ISI Web of Science, EBSCO and Cochrane database of systematic reviews were searched. Health Promotion and Public Health Review databases were also searched including Evidence for Policy and Practice Information and Coordinating (EPPI) Centre; University of York National Health Centre for Reviews and Dissemination; National Institute of Clinical Excellence (NICE); Effective Public Health Practice; Health Evidence Canada; WHO programs and projects—<http://www.who.int/entity/en/>. Additional sources included Google Scholar and reference lists of relevant articles, book chapters and reviews. Key individuals and organizations identified through the search process were contacted to identify further details on publications. The electronic search strategy used across all databases is provided in Table 1. The search for studies was conducted between 1 November 2011 and 1 March 2012 and included articles published between January 2000 and September 2011. A repeated search was conducted between 4th and 11th June 2013 to update results and included articles published up to June 2013.

### Data Abstraction and Assessment of Quality

Using the search strategy described above, all titles and abstracts retrieved were scanned for relevance. Duplicates, articles not relevant and articles that did not meet the inclusion criteria were removed. Full text papers were obtained for studies that were selected for inclusion. Studies that were subsequently selected related to (1) online mental health promotion interventions and (2) online mental health prevention interventions. Two reviewers assessed the studies in order to ensure they met the inclusion criteria set out for this review.

### Data Analysis

For this review, a narrative synthesis was undertaken. The interventions and outcomes evaluated in the included studies were too diverse to allow a quantitative synthesis of the study findings. Furthermore, given that the review focused on the effects of the interventions and questions

concerned with program implementation, a narrative synthesis was determined to be the most appropriate as it offers more of an insight into potential confounders and moderators that might not necessarily be taken into account during a typical meta-analysis (Rogers et al. 2009). Following the guidelines of the Cochrane Public Health Group, the methodological quality of the intervention evaluations was assessed using the Quality Assessment Tool for Quantitative Studies developed by the Effective Public Health Practice Project (Jackson et al. 2004). Studies were assessed for selection bias, study design, confounders, blinding, data collection and withdrawals and dropouts. Each study was rated independently by two reviewers. The quality assessments were compared and disagreements were resolved through discussion. Based on the ratings of each of the six components, each study received an overall global rating of strong, moderate or weak. Following the quality assessment stage, the inclusion of studies and extraction of key findings was finalized. Extracted data were entered into a table of study characteristics including the quality assessment overall rating for each study and the reasons why the study received a moderate or weak quality assessment rating.

### Results

The results of the search and study selection are shown in Fig. 1. The original search process carried out in 2012 produced 8,834 articles, 37 of which were selected for full review. Of these, 14 studies did not meet the inclusion criteria, thus 23 studies were selected for review. During the repeated search performed in June 2013, a further five studies were identified. The combined searched resulted in a total of 28 studies undergoing quality assessment. No studies in non-English language were identified in the review process.

The results from the online mental health promotion and prevention interventions are presented in Table 2. The promotion and prevention interventions are ordered according to the strength of the evidence (strong–weak). An overview of the key findings in terms of program origin, type, content and delivery, quality of evidence, outcomes and implementation findings will now be presented.

#### Online Mental Health Promotion Interventions

##### *Program Origin and Type*

Eight studies evaluating six online mental health promotion interventions were identified (Table 2). Three studies evaluating one intervention were carried out in the US, two studies were carried out in Australia and one study was

**Table 1** Original search strategy for electronic databases

Mental health terms	Type	Web terms	Sample	Intervention terms	Study terms
Mental health OR	Literacy OR	Internet OR	Young people OR	Education OR	Implementation
Psychoeducation Mental capital Wellbeing	Positive Promoti* Prevent*	Web* ehealth e-health	Youth Adolescent* Student	Therapeutic Program* Intervention	Evaluation Study Random* control trial
“Positive psychology” Mindfulness Resilience Psychosocial “Social emotional”	Universal Targeted Indicated	“Electronic health” “Virtual community” “Computer game” Email Mobile “Cell phone” Smartphone Iphone “Information communication technology” ICT Online Computer-based “Social media”		Support Service Training “Help seeking” “Information awareness” “Awareness raising”	

Searches included: \*denotes multiple word endings including singular and plural

1. Mental health terms AND Type AND Web terms AND Sample

e.g. mental health OR psychosocial OR mental capital OR wellbeing OR positive psychology OR resilience OR psychosocial OR social emotional

AND

literacy OR positive OR promot\* OR prevent\* OR universal OR targeted OR indicated

AND

internet OR web OR ehealth OR e-health OR “electronic health” OR “Virtual community” OR “computer game” OR email OR “cell phone” OR smartphone OR iphone OR “information communication technology” OR ICT OR online OR computer-based OR “social media”

AND

young people OR youth OR adolescent OR student

2. Mental health terms AND Web Terms AND Sample AND Intervention Terms

3. Mental health terms AND Web Terms AND Sample AND Study Terms

4. Mental health terms AND Web Terms AND Sample AND Intervention Terms

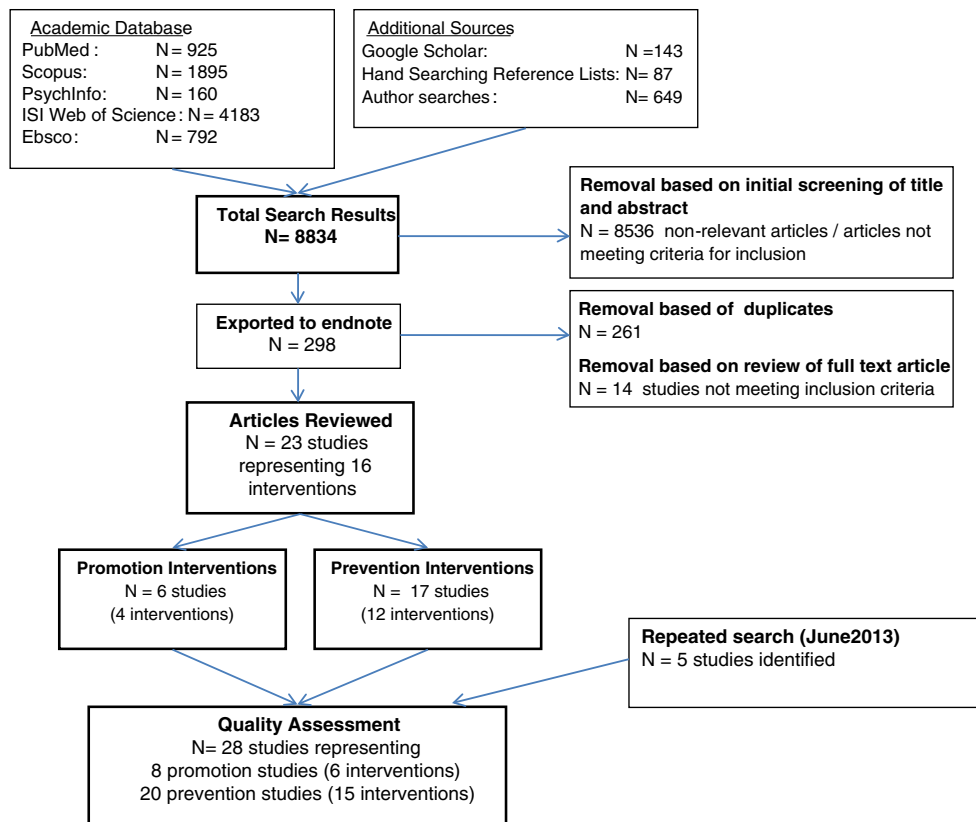
5. Web Terms AND Sample AND Intervention Terms

6. Web Terms AND Sample AND Study Terms

conducted in Germany, China and Canada. Two interventions were stress management interventions aimed at improving mental wellbeing (Van Vliet and Andrews 2009; Fridrici and Lohaus 2009). One intervention, *ePREP* was a relationship education program (Braithwaite and Fincham 2007, 2009, 2011). Another intervention, *In One Voice* was centered around a social media campaign (Livingston et al. 2013). Two interventions were interactive mental health promotion games, *Reach Out Central* (Shandley et al. 2010) and *Ching Ching Story* (Li et al. 2013).

### *Program Content and Delivery*

As may be seen in Table 2, program content and delivery varied considerably across these online interventions. The stress management interventions provided online modules which were facilitated by a teacher or psychologist in middle/high school (Van Vliet and Andrews 2009; Fridrici and Lohaus 2009). *ePREP* utilized email to distribute homework exercises to university students over the course of 7 week which were designed to promoted relationship



**Fig. 1** Flow diagram for study selection process

skills. *In One Voice* utilized social media and an educational focused website to improve youth (age 13–25) mental health literacy skills. The online gaming interventions utilized game mechanics and role play to develop skills. Two interventions were implemented with adolescents in secondary schools (Van Vliet and Andrews 2009; Fridrici and Lohaus 2009). Two interventions were adapted from evidence-based face-to-face interventions (Braithwaite and Fincham 2007; Li et al. 2013).

#### Quality of Evidence

The quality of the evidence from these studies was moderate to weak. One study received a strong quality assessment rating (Van Vliet and Andrews 2009). Three studies received a moderate quality assessment rating as a result of selection bias, weakness in study design or not reporting or not controlling for confounders. Four studies received a weak quality assessment rating as a result of having a combination of the following methodological issues: weakness in study design, high percentage of withdrawals, selection bias, not reporting or not controlling for confounders and not reporting validity and reliability of measures used (Table 2).

#### Program Outcomes

The school-based stress management course, which received a strong quality assessment rating, reported significant improvements in adolescents' mental health literacy skills, psychological wellbeing, use of support seeking coping strategies and reduced avoidant coping and psychological distress (Van Vliet and Andrews 2009). Additional outcomes from studies which received a moderate quality assessment rating included improved mental health literacy skills (Fridrici and Lohaus 2009; Livingston et al. 2013), improved communication skills (Braithwaite and Fincham 2007), reduced psychological distress (Fridrici and Lohaus 2009) and a reduction in symptoms of anxiety, depression and physical aggression (Braithwaite and Fincham, 2007).

#### Implementation findings

Important implementation findings including dropout, efficacy and program acceptance were highlighted in these studies. The dropout rates varied across interventions with school-based interventions having the highest retention rates. Fridrici and Lohaus (2009) reported a

**Table 2** Summary characteristics of included studies

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/weak rating	Implementation findings program completion/dropout rates training program acceptance
Internet-based programme for the management of stress Australia Van Vliet and Andrews (2009)	Adolescents in year 8 or middle school (age 13 years)	School internet-based stress management course for adolescents Aims to develop knowledge about stress and effective coping strategies, to increase use of effective coping strategies and improve mental wellbeing of youth 6 × 30 min lessons Course supplemented with activity books to expand student knowledge	Quasi-experimental Eight high schools (n = 653 students in year 8). 75 % of participants female N = 464 intervention group N = 189 control group Measurements: pre, post and 3-month follow-up	Significant increases in: knowledge about stress and coping use of support seeking coping life satisfaction psychological wellbeing Significant decreases in: psychological distress avoidant coping total emotional and behavioural difficulties No significant effects for perceived competence, active coping or pro-social coping	Strong	69 % completed all six lessons 79 % of students completed 5 or more lessons Teachers given instructions on accessing the program, lesson outlines and assessment and reporting information
Online stress prevention and coping skills training Germany Fridrici and Lohaus (2009)	Adolescents aged 12–18 years	Internet based stress prevention program for secondary schools. Program based on face-face intervention Beyer and Lohaus (2006) which focuses on problem-solving, cognitive reconstruction, seeking for social support, relaxation and time management 8 online lessons, released weekly	Quasi-experimental N = 904 (33 classes of grades 8 and 9 from eight German schools). 48.2 % participants female Participants divided into 4 groups: (1) Online-training in schools (n = 195, 7 classes) (2) Online-training via internet at home (n = 214, 8 classes) (3) School-based face-to-face training (n = 209, 8 classes) (4) No intervention control group (n = 286, 10 classes) Pre- and post-intervention measures	Significant increases in knowledge about stress and coping in all intervention groups (highest effects in online school group, lowest in online home group) Significant increase in positive thinking in face-to-face group & online school group Significant reduction of psychological stress symptoms in face-to-face group and online school group No significant reduction in: negative thoughts stress vulnerability No effect on coping strategies	Moderate: Confounders	98 % participants completed the program in school, 30.8 % completion at home Teachers and psychologists received training in conducting face-to-face and online intervention. Two trainers involved in the supervision of each class Adolescents rated the face-to-face intervention as most accepted form of stress prevention Girls in groups 1 and 3 reported higher training acceptance than boys. Boys in group 2 reported higher training acceptance than girls

Table 2 continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/ weak rating	Implementation findings program completion/ dropout rates training program acceptance
ePREP vs Cognitive Behavioral Analysis System of Psychotherapy (CBASP) USA Braithwaite and Fincham (2007)	University students in dating relationships of over 4-month duration or more	ePREP—internet-based relationship education program, provides skills training for effective communication and problem- solving techniques Initial presentation in the lab (one module), participants then provided with weekly homework by email. Weekly emails for 7 weeks ePREP compared with depression and anxiety focused internet-based preventive intervention CBASP ePREP is an electronic version of evidence based prevention and relationship enhancement program Markham et al. (2001)	Quasi-experimental N = 91 psychology students from one university in US, 59 % of participants females (1) ePREP intervention group (2) CBASP intervention group (iii) Control group presented with information about anxiety, depression and relationships. Sample size of groups not reported Pre and post, 8 weeks follow up measurements	Significant reductions in symptoms of anxiety and depression in ePREP and CBASP groups Significant improvements frequency of psychological and physical aggression and trust in ePREP and CBASP groups Significant increases in constructive communication in CBASP group only No change in global relationship	Moderate: Selection bias	
In One Voice Canada Livingston et al. (2013)	Youth aged 13–25 years	Social media campaign to improve awareness and attitudes of youth towards mental health issues Primary aim to increase awareness and use of a mental health website (mindcheck.ca) aimed at youth, secondary aim to improve attitudes towards mental health issues. Campaign featured a prominent male sports figure	Successive independent samples design (N = 806 youth) Conducted in British Columbia, Canada T1 (n = 403) completed questionnaires before the campaign and T2 (n = 403) 2 months after the campaign	Significant increases in awareness of mental health website (6 % - 15.6 %). Awareness of website did not increase significantly among non-white respondents, 13–17 year- olds and those who reported as having a mental health issue No significant effects on personal stigma or social distance Participants exposed to the campaign were significantly more likely to talk about mental health issues with others and seek information relating to mental health issues	Moderate: Study design	Campaign reached 30.2 % of males and 19.2 % of females

**Table 2** continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/ weak rating	Implementation findings program completion/dropout rates training program acceptance
ePREP— Prevention and Relationship Enhancement Programme USA Braithwaite and Fincham (2009)	University students aged 18–25 years in a romantic relationship of at least 4 months duration	Internet-based relationship education program, provides skills training for effective communication and problem- solving techniques Initial presentation in the lab (one module), participants then provided with weekly homework by email Weekly emails for 7 weeks	RCT N = 77 students from psychology course in US. 71 % of participants female Intervention group (n = 38) Control group (n = 39). Control group provided with information about anxiety, depression and relationships Pre-intervention, 8 weeks post-test measurements and 10 month follow-up	Significant improvement in anxiety scores at 10 month follow up Significantly less psychological and physical aggression in intervention groups' relationships at follow up No significant effect on depression No significant effect on constructive communication and relationship satisfaction	Weak: Selection bias, Confounders	Drop-out rate 19.6 %
ePREP— Prevention and Relationship Enhancement Programme USA Braithwaite and Fincham (2011)	University students in a romantic relationship of at least 6-months duration	A computer-based relationship education program, focusing on skills training for effective communication techniques and problem-solving Weekly emails for 6 weeks	RCT N = 77 couples (152 individuals) from one university in US Intervention group (n = 40 couples) Placebo control group (n = 37 couples) Pre- and post-test measurements	Significant decreases in female depression Significant decreases in self- and partner-reported physical assault, self- and partner-reported severe physical aggression Significant increases in dedication and constructive communication and male relationship satisfaction Couples with poorest communication skills benefited the most	Weak: Selection bias, Confounders	Drop-out rate 12 %



Table 2 continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment for moderate/weak rating	Implementation findings program completion/dropout rates training program acceptance
ReachOutCentral (ROC) Australia Shandley et al. (2010)	Youth aged 18–25 years	Internet-based interactive educational game designed to support the mental health of youth aged 16–25 Utilizes CBT principles to assist youth identify and develop practical coping skills for dealing with life stressors ROC features real life stories and used role play to encourage youth to think about solutions to common problems	Single group pre- post design N = 266 self registered to take part in study. 78 % of participants female Measurements pre-, post intervention, 2-month follow-up	Significant: increase in females' support seeking scores at follow up. reduction in females' stigma increase in females' resilience score at follow-up increase in problem solving scores for males and females at post-intervention, sustained for females at follow up increase in females' satisfaction with life post intervention and follow-up Non-significant worsening effect in males on seeking support, avoidance behavior and resilience Significant decrease in females' self reported alcohol consumption not maintained at follow up. Significantly higher alcohol use among males at pre- and post-intervention	Weak: Study design, Selection bias, High percentage withdrawal	Program satisfaction rates high (7.20/10) Drop-out rate 42.4 % Females played ROC on average for 1.6 sessions and 91 cumulative minutes and males for 1.5 sessions and 69 cumulative minutes Program accessed infrequently due to problems in downloading the programme and the storylines not being complex enough to keep the participants engaged
Ching Ching Story China Li et al. (2013)	University students aged 17–25 years with adequate internet literacy and a Facebook account	Web-based, social network electronic game on enhancing mental health literacy of university students Content based on cognitive-behavioural therapeutic approach. Role playing game in which player assumes role of character and completes missions Programme adopted from a school-based mental health enhancement program (Wong et al. 2012) Duration of intervention 3 weeks	Single group, pre/posttest design Participants recruited from a closed online user group in one major Asian university (N = 127). 59.1 % female	Significant improvements in students' mental health literacy skills	Weak: Study design, Selection bias, Validity of measures, High percentage withdrawal	Dropout rate 67 %

**Table 2** continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment reason for moderate/weak rating	Implementation findings: program completion/dropout rates training program acceptance
MoodGYM Australia Calcar et al. (2009, 2013)	Adolescents in secondary school aged 12–17 years	Online- self-directed CBT designed to prevent depression in youth Intervention delivered over a 5-week period, with one module of the program presented each week during one class period 20–40 min to complete module	Cluster RCT N = 1,477 from 30 schools recruited across Australia. 56 % of participants female Intervention group: n = 563 Waiting list control group: n = 914 Measurements pre, post and 6-month follow-up	Significantly lower levels of anxiety at post-intervention and 6-month follow-up Significantly reduced depression in the male participants post-intervention and 6-months follow up Participants' with high adherence rates reported significantly stronger intervention effects for anxiety and depression at post intervention and at 6-month follow-up Significantly more male participants in the control group met criteria for caseness of clinical depression post intervention and at 6-month follow-up	Strong	Drop-out rate 12.5 % Mean number modules completed = 3.16 62 % completed 3 + modules Older participants and participants with higher levels of depression more likely to be missing at 6-month follow-up Teachers responsible for implementation of the programme
Internet-delivered cognitive behavioural skills training program USA Clarke et al. (2009)	Emerging adults aged 18–24 years Two groups recruited (1) non depressed group that showed elevated health care utilization (2) group with chart diagnosis of depression	Internet, self-help, cognitive-behavioural skills training program for depressive symptoms Contains information about depression, tools to measure and monitor one's mood, online journal and interactive tutorials on cognitive and behavioural therapy methods Participants free to use service at any time during the study period of 32 weeks. Reminders sent by mail at 2, 8 and 13 weeks after enrollment	RCT Participants identified through a health centre's medical records N = 160 (80 % of participants female) Intervention group: n = 83 Control group: n = 77. Control group linked to a website providing information about depression but no skills training Measurements at baseline and 5, 10, 16 and 32 weeks	Significant improvements in intervention group's depression scores at week 32 (effect size small, $d = .20$ ) Moderate effects size among women ( $d = .42$ ) Greater symptom reduction associated with fewer minutes of website use Participants most depressed at baseline more likely to continue using the website throughout study period	Strong	Drop out 36.9 %

Table 2 continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/ weak rating	Implementation findings: program completion/ dropout rates training program acceptance
Grip op Je Dip— Master Your Mood Online The Netherlands Van der Zanden et al. (2013)	Youth aged 16–25 years with depressive symptoms (score 10–45 on CES-D)	An online, professionally facilitated CBT based group course for youth with symptoms of depression 6 × 90 min sessions. Supervised by mental health professionals. Material shared by facilitator in chat room. Participants respond, share experiences and ask questions Intervention derived from Dutch version of the face-to-face 'Coping with Depression' course (Lewinsohn et al. 1984)	RCT N = 244 participants recruited from general population Intervention: n = 121 Control: n = 123. Did not receive an intervention Assessments at baseline, post- intervention and 3 month follow up	Significant improvement in: depressive symptoms (ES = 0.94) anxiety symptoms (ES = 0.49) sense of control or mastery (ES = 0.44) Improvements maintained at 3 month follow up	Strong	Dropout at post- intervention = 21 % Dropouts more likely to be male, have lower education levels, have shown higher anxiety and sense of mastery at baseline
Competent adulthood transition with cognitive behavioural and interpersonal training (CATCH-IT) Netherlands/USA Van Voorhees et al. (2008, 2009), Hoek et al. (2011), Saulsberry et al. (2013)	Youth aged 14–21 years at risk of depressive disorders as measured by PHQ-A scale	Adolescent internet-based depression prevention program combined with primary care physician interview 14 modules based on behavioural activation, CBT, interpersonal psychotherapy and a community resiliency concept model Both groups received 3 safety assessment calls during the intervention; in addition group 1 received 3 motivational calls and a motivational questionnaire	RCT Adolescents recruited from 13 primary care sites in four states in US and posted advertisements. N = 83 (55 % of participants female) Group 1 (N = 43): motivational interview with primary care physician + CATCH-IT Group 2 (N = 40): brief advice with primary care physician + CATCH-IT Measurements at pre- intervention, 6 weeks, 12 weeks, 6 months and 1 year post-randomization	Significant reduction in depression mood in both groups at post- intervention. Changes maintained at 12 weeks, 6 months and 1 year follow up Significant increase in social support by peers in both groups at post- intervention No change in automatic negative thoughts or general self efficacy Motivational interview group demonstrated declines in self harm thoughts and hopelessness and significantly less likely to experience a depressive episode at 6 and 12 month follow up	Strong	Drop-out rate 7.3 % post-intervention, 23 % 6 month follow up, 30 % 1-year follow-up Physicians trained for interviews using a lecture/video format (1 h 15 min) Higher ratings of Internet site ease of use associated significantly with lower levels of depressed mood over 6 months Greater level of ease of site use predicted lower depression scores at post- intervention

**Table 2** continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/ weak rating	Implementation findings: program completion/ dropout rates training program acceptance
MyStudentBody-Stress: An online stress management intervention USA Chiauzzi et al. (2008)	University students aged 18–24 with high levels of stress (>14 on Perceived Stress Scale)	Online program aims to enhance college students' stress management and health promoting behaviors Participants receive individual, tailored feedback about stress management. Site also includes peer stories, interactive tools frequently asked questions and answers, and college health news Students instructed to visit the website at least four times over a 2-week period for a minimum of 20 min/visit	RCT Six colleges in US. N = 240 students (aged 18–24) experiencing high levels of stress. 51 % of participants female Participants allocated to: MyStudentBody-Stress online intervention (n = 80) Control health information website (n = 80) No intervention control (n = 80) Measurements at baseline, and at 1, 3 and 6 months follow-up	No significant effect on primary outcome—perceived stress Significant improvement in: stress management techniques, anxiety, perceived family problems and engagement in light to moderate physical activity at 1 month follow up No significant differences between online intervention and control website group at 6-month follow-up	Strong	Drop-out rate 2 % Average time spent on website: Online intervention = 126 min Control website = 51 min Online intervention group significantly more satisfied with the stress management website than control website
Mobile Tracking of Young People's Experiences—self monitoring program Australia Kauer et al. (2012)	Youth age 14–24 years with mild or more severe emotional or mental health issue (score >16 on Kessler Psychological Distress Scale)	Mobile phone self-monitoring program where youth monitor their mood, stress and daily activities four times a day for 2 weeks. Data reviewed with GP	RCT GPs in Melbourne recruited youth attending GP (N = 118) Intervention group: n = 69 Control group: n = 49: monitored themselves using abbreviated version of mobilytype which only assessed current activities g Pre-, post-intervention and 6 weeks follow up assessment	Significant increase in intervention group's awareness of emotions Significant decrease in intervention group's depressive symptoms No significant effect on rumination	Strong	Participants completed on average 3.3 mobilytype entries a day for 17.7 days

Table 2 continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/ weak rating	Implementation findings: program completion/ dropout rates training program acceptance
Health e-Cards Australia Costin et al. (2009)	Emerging adults aged 19–24 Participants divided into high and low distress groups according to depression scores (K10 scale)	A brief depression information intervention employing health e-cards (personalized emails containing depression information) 3 emails with links to depression information-based website Enhanced intervention provided additional facts about depression and help-seeking, and information on what to expect from an initial consultation with a health professional	RCT N = 348/12,000 youth responded to screening questionnaire and fulfilled criteria. 78 % of participants female High and low distress groups assigned to one of three groups: Group 1: Health e-cards Group 2: Enhanced health information unrelated to depression Pre-, post-intervention measures	Intervention groups significantly improved beliefs about efficacy of formal help sources Intervention group higher intentions of seeking help from formal sources Health e-cards not associated with increase in formal help seeking behaviour. improved beliefs about depression treatments ability to recognize depression knowledge of help-seeking process; or depressive symptoms	Strong	Drop-out rate 14 % 92 % visited at least one Health e-Card site, 48 % visited at least three
Blogging intervention Israel Boniel-Nissim and Barak (2013)	Adolescents (ages 14–17) with social difficulties as measured by IPR scale	Investigating the therapeutic value of blogging Participants instructed to post messages about social difficulties at least twice a week for the period of 10 weeks	RCT N = 161 participants from 14 randomly chosen high schools assigned to: writing about social difficulties in open blog (n = 26) writing about social difficulties in closed blog (n = 27) writing about general subjects in open blog (n = 28) writing about general subjects in closed blog (n = 27) writing a private diary about social difficulties on a personal computer (n = 26) control group (n = 27) 77 % of participants female	Groups 1 and 2 showed significant improvement in self-esteem, social-emotional difficulties and social behaviors Group 1 showed the greatest improvement Level of distress decreased significantly across all four blogging groups Outcomes were sustained at 2 month follow-up	Strong	Attrition rates 23–33 % across groups Participants in all groups posted roughly the same amount of posts
			Pre-, post-intervention, 2-months follow-up measurements			

**Table 2** continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/ weak rating	Implementation findings: program completion/ dropout rates training program acceptance
MoodGYM Norway Lintvedt et al. (2011)	University students with elevated psychological distress (score 20 or above on K10 scale)	Online self-directed CBT designed to prevent depression in youth	RCT N = 163 college students from one university in Norway. 77 % of participants female Intervention group: n = 81 completed MoodGym access to <i>BluePages</i> depression information website. Waiting list control: n = 82 Pre- and post intervention measurements	Significant: reduction in depressive symptoms and negative automatic thoughts reduction in depressive symptoms for subclinical group improvement in depression literacy post-intervention Intervention participants who dropped out had significantly higher pre intervention CBT literacy scales than those who did not	Moderate High percentage withdrawals	Drop-out rate 37.5 % 83.3 % found website useful
Cognitive-behavioural analysis system of psychotherapy (CBASP) USA Cukrowicz and Joiner (2007)	University students aged 18–24 years experiencing normal to mild symptoms of depression or anxiety Beck Depression Inventory score (BDI) less than or equal to 19. Beck Anxiety Inventory score (BAI) less than or equal to 18	Computer-based cognitive behavioural psychoeducation program for depression and anxiety symptoms 6*20 min sessions on information on depression and anxiety. Based on CBT and Situational Analysis principles CBASP originally developed for chronic depression, face-to-face treatment (McCullough 1984)	Quasi-experimental N = 152 undergraduate psychology students from university in US. 74 % of participants female Intervention group: n = 81 Control group n = 71, received educational information on anxiety and depression Measurements at pre and 8 weeks post-intervention	Significant decrease in intervention group's depressive and anxiety symptoms No significant difference in effects between students with high and low mastery of the material	Moderate Selection bias	10 % drop-out rate

Table 2 continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/weak rating	Implementation findings: program completion/dropout rates training program acceptance
The Online Anxiety Prevention Program Australia Kenardy et al. (2003, 2006)	University students with elevated anxiety levels as measured by anxiety sensitivity index (cut off score 24)	Online CBT intervention for individuals at risk of developing anxiety disorders Seven sessions to be completed in participants' own time. Overall intervention period: 6 weeks Programme based on software used in computer assisted treatment of panic disorder (Newman et al. 1997)	RCT N = 83 first year psychology students from one university in Australia. 69 % of participants female Intervention group: n = 43 Waitlist control group: n = 40 Pre- and post, 6 month follow up intervention measurements	Significant reductions in intervention group's depression symptoms and improvements in anxiety related cognitions. Results maintained at follow up Non-significant improvements in anxiety sensitivity and fear of bodily sensations related to panic No change in panic frequency or severity	Moderate Selection bias	Drop-out rate 10 % Participants completed on average 3 sessions Drop-outs had significantly higher baseline levels of depression and anxiety than those who completed the intervention
Kindertelefoon Online Chat Netherlands Fukkink and Hermans (2009)	Children and adolescents aged 8–18 years	One-to-one online chat support service, compared with telephone service Pre and post-chat assessment and 1 month follow up	Quasi-experimental N = 902 users of the telephone based service invited to take part in online support service. 75 % of participants female Intervention group (N = 339) Online support service Control group (N = 563) Telephone based support service	Significant increase in sense of well-being in both groups at post-intervention and one month follow-up Significant decrease in perceived burden of problem in both groups at post intervention and at follow-up Effects greater for online than telephone support group at post-test but no significant differences at follow-up	Moderate High percentage withdrawals	Loss to follow-up 77 % Training for chat volunteers: 40 h + 15 h personal supervision, participation in peer-coaching groups, and a supplementary training session on specific topics
MoodGYM Australia Christensen et al. (2002)	MoodGYM site users	Online- self-directed CBT designed to prevent depression in youth	Single group, pre-, post-design Visitor to MoodGYM website recruited. Data recorded from registrants for 6 months N = 2,909 self-selected participant N = 71 psychology students who visited the site as part of their studies. 60 % of participants female Pre and post measurements	Significant reductions in depression and anxiety scores among self selected participants No significant changes in anxiety and depression among psychology students Visitors who registered on MoodGYM site had high levels of anxiety and depression relative to population sample	Weak Study design, Selection bias, High percentage withdrawals	1,503 registrants completed at least 1 online assessment

**Table 2** continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment rating reason for moderate/weak rating	Implementation findings: program completion/dropout rates training program acceptance
MoodGYM Australia O’Kearney et al. (2006)	Adolescent school boys aged 15–16	Online- self-directed CBT designed to prevent depression in youth Delivered as part of personal development curriculum in secondary school	Quasi-experimental N = 78 boys in Year 9 in one Australian school Intervention group: n = 40 Control group: n = 38. Control group undertook schools standard personal development activities Pre, post and 16 week follow-up	No significant between group differences in change scores pre- to post or pre- to follow up Boys who completed 3 or more modules, there were small benefits of MoodGYM for: depressive symptoms (ES = .4), attribution style (ES = .18), self esteem (ES = .16) at post-intervention. Effects sustained for self-esteem at follow-up Reduction in risk of being depressed in MoodGYM group of 9 % at post-treatment, compared with a slightly increased risk in control group	Weak Selection bias, Confounders	Drop-out rate 15 % 40 % completed three or more of the modules
MoodGYM Australia O’Kearney et al. (2009)	Adolescent school girls aged 15–16	Online- self-directed CBT designed to prevent depression in youth Delivered as part of personal development curriculum in secondary school 5 modules (30–60 min)	Quasi-experimental N = 157 girls in Year 10 in one Australian school Intervention group: n = 67 Control group: n = 90. Control group undertook schools normal personal development activities Pre, post and 20 weeks follow-up	Effect size on depression symptoms not significant at post-intervention but significant (moderate) at 20 weeks follow up (d = .46) No significant effect on attribution style, depression literacy and attitudes towards depression Significant faster rate of decline in intervention group’s depressive symptoms over trial period Benefit most evident for girls with initial level of depression above cut-off for clinically relevant symptoms	Weak Selection bias, Confounders	Drop-out rate 14.6 % at post intervention 29.8 % completed three or more modules. Association between lower completion rates and higher levels of depressive symptoms before interventions
MoodGYM Australia Sethi et al. (2010)	University students (aged 18–25) with low to moderate levels of depression and/or anxiety based on DASS scale	Online- self-directed CBT designed to prevent depression in youth Intervention compared with stand alone face-to-face therapy (5 sessions over 3 weeks) and face-to-face therapy in conjunction with MoodGYM	RCT First-year students studying Health Sciences in one university in Australia N = 38 (66 % of participants female) Group 1: MoodGYM: n = 9 Group 2: Face-to-face CBT: n = 10 Group 3: Face-to-face CBT and MoodGYM combined: n = 9 Group 4: Control: n = 10 Pre and post measurements	Significant improvements in depression, anxiety, distress and frequency of automatic negative thoughts in Group 1, 2, 3 Face-to-face was significantly more effective than MoodGYM in reducing symptoms of depression and frequency of automatic negative thoughts Face-to-face in conjunction with MoodGYM was more effective in reducing depression, anxiety, distress, frequency of automatic negative thoughts than therapy received through stand alone MoodGYM	Weak Selection bias, Confounders	



Table 2 continued

Intervention Name Country Author and Year	Target group	Type of intervention and duration	Study design sample	Program outcomes	Quality assessment reason for moderate/weak rating	Implementation findings: program completion/ dropout rates training program acceptance
Think, Feel, Do UK Attwood et al. (2012)	Adolescents aged 10–16 years with mild or moderate emotional problems identified by school nurse	cCBT online intervention designed for emotional problems of anxiety and mood 6 × 45 min sessions CD-ROM Think, Feel, Do intervention based on Think Good, Feel Good workbook (Stallard 2002)	Single group pre- post-design N = 12 participants aged 8 schools in UK No control Pre and post measurements	Significant improvement in depression, generalized anxiety and self-esteem	Weak Study design, Selection bias	
Online support group UK Freeman et al. (2008)	University students feeling “stressed out or low”	Online mutual support group for college students which used electronic bulletin board over a 10 week period	RCT N = 238 students from one university in UK. 70 % of participants female Support condition: n = 142, access to information website + support group Information only condition: n = 96 website containing information about student problems Measurement pre, post intervention	Significant improvement in both groups: subjective well-being, life functioning risk to self or others and satisfaction with life Support group had no additional benefit No improvements in sense of community in either group	Weak High percentage withdrawals, Confounders	41 % of students in support group accessed the support group and N = 19 students posted messages Support group used by students with more significant problems
Loosetheblues, Ireland Horgan et al. (2013)	University students 18–24 years of age experiencing depressive symptoms (score >16 on CES-D)	Website provided forum to allow participants offer peer support to each other. Also provided information on depression and links to other supports Participants could use the site as often as they liked	Single group pre-, post-design N = 118 participants recruited from one university in Ireland. 36 % participants female Posttest measurements taken after 6 weeks	No significant effects on depression symptoms Statistical analysis impaired by the fact that only a small number of participants (n = 16) completed the posttest questionnaire	Weak Study design, High percentage withdrawals	Drop out = 86.5 %
Internet chat-room therapy Israel Barak and Wander-Schwartz (2000)	University students	Brief group therapy conducted in an internet chat room 7 × 90 min weekly online sessions	Quasi-experimental N = 22 students from universities and community colleges in Israel recruited through newspaper and bulletin board ads. 59 % of participants female Group 1: n = 6, internet chat room therapy Group 2: n = 9, face-to-face therapy Group 3: n = 7, control Pre and post measurements	Small, non-significant improvements in self-image, social relations and well-being in chat room therapy and face-to-face groups with slightly greater improvement in chat room therapy group	Weak Selection bias, Confounders	

significant difference in dropouts rates when comparing school and home implementation (98 % school completion vs. 30 % home completion). The online gaming interventions (*ROC* and *Ching Ching Story*) had the highest dropout rate at 42 %. For the ePREP relationships education program, there was a significant correlation between university students most in need and program effectiveness, in that those with the poorest communication skills benefited the most from the intervention in terms of reduced psychological aggression (Braithwaite and Fincham 2011).

Two studies reported program acceptance findings (Fridrici and Lohaus 2009; Shandley et al. 2010). Fridrici and Lohaus (2009) found that the school face-to-face stress prevention intervention was the most accepted form of stress prevention when compared with the online intervention implemented at school and at home. In terms of gender, female participants reported higher rates of training acceptance than male participants for self-determined online school and face-to-face interventions, however, male participants showed higher acceptance of self-determined online participation via the internet from home.

#### Online Mental Health Prevention Interventions

##### *Program Origin and Type*

A total of 20 studies evaluating 15 prevention interventions were identified (see Table 2). Eight studies were conducted in Australia, three studies in USA and the Netherlands, two studies in the UK and Israel and one study was conducted in Norway and Ireland. Eight of these interventions (12 studies) were computerized cognitive behavioral therapy (cCBT) interventions designed to prevent depression and/or anxiety in adolescents and emerging adults displaying symptoms. One of the cCBT interventions (*MoodGYM*) has been repeatedly evaluated with different users and in different settings, including, high school universal intervention with male participants, female participants, both genders, website users and college students with elevated distress. Other prevention interventions included an online stress management program for university students (Chiauzzi et al. 2008), a depression information intervention (Costin et al. 2009), a mobile phone self-monitoring mood application (Kauer et al. 2012) and a blogging intervention for adolescents experiencing social-emotional difficulties (Boniel-Nissim and Barak 2013). Three studies examined the effectiveness of online support or therapy with emerging adults at risk of developing mental health problems (Freeman et al. 2008; Horgan et al. 2013; Barak and Wander-Schwartz 2000; Fukkink and Hermanns 2009).

##### *Program content and delivery*

The cCBT interventions provided online modules using cognitive behavioral therapy techniques. The majority of these interventions consisted of 5–6 modules implemented weekly. Two of these interventions provided professional assistance along with the self-directed cCBT material (van der Zanden et al. 2013; Van Voorhees et al. 2008). The depression information intervention employed health e-cards which provided personalized emails containing depression and help seeking information (Costin et al. 2009). The mobile phone self monitoring program provided a tracking device to monitor mood, stress and daily activities and was carried out in consultation with the adolescents'/emerging adults' general practitioner (Kauer et al. 2012). The online support therapies provided peer-to-peer support (Freeman et al. 2008; Horgan et al. 2013) or therapist support (Barak and Wander-Schwartz 2000) for at-risk college students.

The majority of interventions were implemented with late adolescents and emerging adults aged 18–25. Four interventions were implemented with adolescents as part of a secondary school curriculum, three interventions were delivered through the health system to youth at risk of developing a mental health disorder and eight interventions were delivered to university students aged 19–25 (Table 2). Three interventions were based on face-to-face prevention interventions that had been modified for use as an online intervention (Cukrowicz and Joiner 2007; Attwood et al. 2012; van der Zanden et al. 2013).

##### *Quality of Evidence*

The quality of the studies varied significantly, eight studies received a strong quality assessment rating. Four studies received a moderate quality assessment rating as a result of either selection bias or a high dropout rate. Eight studies received a weak quality assessment rating as a result of a combination of selection bias, high dropout rate, not reporting or not controlling for confounders, small sample size and no control group (Table 2).

##### *Program Outcomes*

Overall, the cCBT intervention outcomes were positive. Findings from the four studies which received a strong quality assessment rating indicate the significant positive effect of cCBT on adolescents' and emerging adults' depression and anxiety (Van Voorhees et al. 2008; Calear et al. 2009; Clarke et al. 2009; van der Zanden et al. 2013). Long term effects were reported at 6 months (Calear et al. 2013; Van Voorhees et al. 2009; Hoek et al. 2011) and 12 months follow up (Saulsberry et al. 2013). Additional

outcomes included increased social support, reduced self harm thoughts, reduced hopelessness and improved sense of control or mastery (Van Voorhees et al. 2009; van der Zanden et al. 2013).

Additional prevention interventions, which received a strong quality assessment rating, included the mobile phone mood tracking device. Result from this randomized controlled trial showed that the monitoring of mood increased emotional self-awareness which in turn decreased depressive symptoms for youth aged 14–24 years with mild or moderate depressive symptoms (Kauer et al. 2012). The study examining the therapeutic effect of blogging about social emotional difficulties reported significant improvements in adolescents' self-esteem, social emotional difficulties and social behaviors (Boniel-Nissim and Barak 2013). Less structured prevention interventions, including the stress management intervention (Chiauzzi et al. 2008) and Health e-Cards (Costin et al. 2009) produced less positive outcomes. University students that engaged in the stress management intervention evidenced no improvement in primary outcomes including perceived stress and health promoting lifestyle profile. Results from the health e-cards study indicated that the depression information intervention was not associated with changes in emerging adults' help seeking behavior or mental health literacy.

The three cCBT interventions, which received a moderate quality assessment rating, produced similar positive findings in terms of reduced depression and anxiety symptoms among university students aged 18–24 years (Cukrowicz and Joiner 2007; Lintvedt et al. 2011; Kenardy et al. 2003) with improvements maintained at 6 months follow up (Kenardy et al. 2006). Lintvedt et al. (2011) also reported reduced negative automatic thoughts and improved depression literacy. Regarding interventions that received a weak quality assessment rating, four of the six *MoodGYM* studies fell within this category. Selection bias, not reporting if confounders were controlled for and high dropouts limit the conclusions that can be drawn from these studies. The remaining studies that received a weak quality assessment rating included three online support interventions (Horgan et al. 2013; Barak and Wander-Schwartz 2000; Freeman et al. 2008). All three interventions reported non-significant findings.

The results from the *MoodGYM* cCBT studies that received a strong (Calear et al. 2009) and moderate quality assessment rating (Lintvedt et al. 2009) would suggest that this program is effective when implemented as a universal intervention with adolescents (age 12–17) in high schools and when implemented with university students with elevated psychological distress. Calear et al. (2009) reported that the intervention had a significant lasting effect on anxiety and depression in male adolescents at 6 months

follow up (Calear et al. 2013). Another study which compared and contrasted the effect of *MoodGYM* online with (1) face-to-face therapy and (2) face-to-face therapy and *MoodGYM* combined found that face-to-face in conjunction with *MoodGYM* was more effective in reducing university students' depression, anxiety, distress, frequency of automatic negative thoughts than therapy received through stand alone *MoodGYM* (Sethi et al. 2010). This study, however, received a weak quality assessment rating and thus further testing of the impact of face-to-face support in combination with the online intervention is required.

### Implementation Findings

Program dropout was a significant issue across these prevention interventions. On average participants completed half of the cCBT modules. One study reported that only 29.8 % of adolescents completed three or more of the five *MoodGYM* modules (O'Kearney et al. 2009). Baseline symptoms were found to be significantly related to program dropout across several studies, in that higher levels of depression and anxiety predicted program dropout (O'Kearney et al. 2009; Calear et al. 2013; Kenardy et al. 2003; van der Zanden et al. 2013). Related to this, there was an indication from two studies that program fidelity was important in achieving program outcomes and that benefit was most evident for adolescents most at risk (O'Kearney et al. 2006, 2009). Due to the weak quality assessment ratings of these studies, however, it is difficult to draw strong conclusions from these findings. One study reported a counterintuitive association with greater depression symptom reduction and fewer minutes of website usage and with fewer page hits (Clarke et al. 2009). Post hoc analysis revealed that participants who improved more rapidly found the website less necessary and thus discontinued.

In general, program acceptance was high across studies in which it was assessed. Fukkink and Hermanns (2009) reported that despite no significant difference in program outcomes between the online chat and telephone support service, there was greater acceptance for the online chat over the telephone service in terms of children and adolescents feeling supported, being taken seriously, made to feel at ease, therapist being comprehensible and not disorganized. Regarding the intervention *CATCH-IT*, Hoek et al. (2011) found that greater levels of ease of site usage predicted significantly lower depression scores at post-intervention. Conversely, another study reported no relationship between intervention satisfaction and program outcomes (Kenardy et al. 2003). This study also failed to detect a relationship between frequency of component usage and program outcomes.

## Discussion

The ever increasing role of new technologies in adolescents' and emerging adults' lives provides an unprecedented opportunity to increase access to evidence-based mental health resources. The aim of this systematic review was to provide a narrative synthesis of the evidence on the effectiveness of online mental health promotion and prevention interventions for youth aged 12–25. Searching a range of electronic databases, 28 studies conducted since 2000 were identified. Eight studies evaluating six mental health promotion interventions and 20 studies evaluating 15 prevention interventions were reviewed. Although this review included studies carried out post 2000, over two-thirds of the studies (67.8 %) were published since 2009, thus highlighting the growth in studies evaluating online mental health interventions for youth over the past 5 years.

It is difficult to be conclusive regarding the evidence of online mental health promotion interventions due to the small number of studies, the moderate to weak quality of these studies, and the considerable heterogeneity across the interventions in terms of content and delivery. There is, however, evidence that the mental health promotion module-based online interventions, which were implemented with adolescents can have a significant positive impact on their mental health and wellbeing. These interventions were implemented in the school setting and led to significant improvements in adolescent mental health literacy, support seeking behavior and psychological wellbeing (Van Vliet and Andrews 2009; Fridrici and Lohaus 2009). The results from the *In One Voice* social media campaign points to the potential of social media in combination with an education-based mental health promotion website in enhancing youth awareness of mental health and health seeking behaviors (Livingston et al. 2013). The evidence regarding mental health promotion gaming interventions is weak as a result of the absence of a control group and high dropout rates in the two studies reviewed. Additional research is required to investigate whether gaming is an effective approach for mental health promotion with youth.

Regarding online mental health prevention interventions, 20 studies were identified. In comparison to the mental health promotion interventions, there was more homogeneity across these interventions, with 12 studies evaluating the effectiveness of computerized cognitive behavioral therapy (cCBT) interventions aimed at preventing depression and/or anxiety. Of the seven cCBT studies that received a strong or moderate quality assessment rating, there is evidence that these interventions had significant positive effects in reducing anxiety and depression among adolescents and emerging adults identified at risk of developing a disorder. Similar results have been reported in previous systematic reviews examining

the impact of cCBT for symptoms of depression and anxiety among adults. For example, (Spek et al. 2007) found a small effect size for prevention interventions in reducing depression and anxiety in adults. More recently, Griffiths et al. (2010) reported an effect size range from 0.42 to 0.65 for depression interventions involving participants with symptoms of depression. Follow up assessments of cCBT interventions were limited in this review, although, where reported, improvements were maintained. This is important as a previous meta-analysis has highlighted the potential for the effects of cCBT treatment interventions with this age group to be reduced over time (Weisz et al. 2006). One cCBT intervention that reported positive findings across second and third level settings is the Australian *MoodGYM* intervention. It is, however, important to note that, with the exception of one study (Calear et al. 2009), the sample size of these evaluations was relatively small ranging from 39 to 163 participants. Further testing of this intervention with larger, more representative samples would assist in strengthening the evidence base for this intervention. Additional prevention interventions that showed promising findings and require further testing include the GP supported mobile phone self-monitoring intervention (Kauer et al. 2012) and the blogging intervention (Boniel-Nissim and Barak 2013).

Information provided by some studies in this review about the provision of support is important for the future development of this field. While it is difficult to draw strong conclusions about the type or intensity of guidance and support necessary due to variation in methodologies and quality of the studies reviewed, there is evidenced from the studies reviewed that participant support (either face-to-face and/or web-based support) is an important feature of online interventions in terms of participant completion and program outcomes (Fridrici and Lohaus 2009; Sethi et al. 2010). This is in line with findings from a previous meta-analysis of cCBT interventions for symptoms of depression and anxiety which reported that interventions with therapist support have a large mean effect size, while interventions without therapist support have a small mean effect size (Spek et al. 2007). Future research comparing and contrasting different versions of support to accompany online interventions could help in understanding the minimum level of support required to maximize positive gains. As part of this, further research is required to determine the effective components of online interventions and the optimal program and session length to achieve positive outcomes. Due to the variability across interventions, it was not possible to determine specific strategies and methods that resulted in positive outcomes in this review.

Program completion varied across the interventions with frequently reported high levels of dropout and non-completion across promotion and prevention interventions.

This appears to be a significant issue for online interventions and has been reported in previous reviews (Richardson et al. 2010; Mohr et al. 2013; Griffiths and Christensen 2006). Further research is warranted in terms of those who engage and those who choose to disengage from online interventions in terms of their expectation, motivation, personality, experiences and preferences. Several studies in this review found that completion of fewer modules was associated with higher depression scores at the baseline. In addition, one study reported that the benefit from the online intervention was most evident among those most at risk (O’Kearney et al. 2009). Continued research aimed at testing and uncovering new methods of improving adherence will be important to optimize the effectiveness of these interventions as there is evidence from this review that greater adherence and engagement was associated with better outcomes (O’Kearney et al. 2006, 2009). At the same time, however, as recommended by Mohr et al. (2013), overgeneralized assumptions that increased engagement is necessarily better under all circumstances should be avoided. Research is thus needed to better understand patterns of use and engagement, as well as the determinants and consequences of engagement.

While studies that received a moderate to strong quality assessment rating provide an indication as to the impact of these interventions on the knowledge, behavior and well-being of youth aged 12–25, a salient finding of this review is the number of studies that received a weak quality assessment rating ( $N = 12$ ). Six studies did not employ a control group. Sample sizes varied, ranging from 12 to 2,909 participants. In addition, several studies failed to undertake or report sufficient information about randomization. Regarding sampling, with the exception of studies which recruited adolescents through schools, the majority of participants were recruited by self-selection through advertisements in colleges, on websites and in primary care settings. Furthermore, the majority of participants across the reviewed studies were female and were well educated. The significant gender imbalance is notable and, while this provides an indication of the gender profile of users who seek help and access mental health information, it limits the generalizability of the findings to young men. Future research in this field should engage in high quality evaluations with robust research designs in order to better understand the potential of these online interventions. In addition, future studies need to ensure more diverse sample recruitment in terms of gender, race, socioeconomic status, geographic location, access to the internet and computer literacy. Research into program preferences according to gender would also help to (1) clarify and address gender differences such as those identified in this review and (2) identify ways of tailoring interventions to support gender preferences and individual needs.

Five of the online interventions in this review were adapted from evidence-based face-to-face interventions. With the exception of two studies, which had a weak quality assessment rating, results from these studies showed the significant positive effect of these interventions on youth anxiety and depression symptoms. Future research should investigate the feasibility of adapting additional face-to-face interventions that have a strong evidence base and the effectiveness of these interventions when implemented as a standalone online program and/or an additional online intervention to support the face-to-face program.

Finally, it is important to note that all of the studies included in this review were carried out in high income countries and therefore, the findings may not generalize to low and middle income countries. Given the extraordinary increase in the use of cell phone and internet technologies in the latter countries, coupled with the considerable challenges in providing affordable and accessible face-to-face mental health services (Lewis et al. 2012; WHO 2011), there is a pressing need to examine the implementation and effectiveness of online mental health interventions in these countries. The use of technologies is particularly promising given the critical shortage of health workers and poor distribution of service providers in low and middle income countries (WHO 2006, 2008).

This systematic review has a number of important limitations, which impact its validity. There are limitations relating to the scope of the systematic search. A systematic search of studies published in grey literature was not included. Furthermore, a search in languages other than English was not undertaken. The possibility of publication bias needs to be considered as there may have been research studies in the area that did not find positive results and consequently were not published. In addition, given that the methodological quality of the studies reviewed varied, conclusions must, therefore, be tentative. Finally, as a narrative synthesis, the review data from the included studies were summarized and not statistically pooled, which limits the strength of the conclusions that can be drawn.

## Conclusions

The current study systematically reviewed the effectiveness of online youth mental health promotion and prevention interventions. There is tentative evidence that skills-based interventions mental health promotion interventions, presented in a module-based format, can have a positive impact on adolescent mental health, however, an insufficient number of studies limits this finding. The results from the online prevention interventions indicate

the promising evidence regarding computerized cognitive behavioral therapy interventions and their impact on adolescents' and emerging adults' anxiety and depression symptoms. Implementation findings from studies in this review provide some evidence that participant face-to-face or web-based support is an important feature of online interventions in terms of participant adherence and program outcomes. The quality of evidence across the studies varied, thus highlighting the need for more rigorous, higher quality evaluations conducted with more diverse samples of youth. Furthermore, given the high rate of non-completion there is a need for research to investigate factors affecting exposure and adherence. Although future research is warranted, this current study highlights the potential of online mental health promotion and prevention interventions in promoting youth wellbeing and reducing mental health problems.

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**Author contributions** AC and MB conceived the systematic review and devised the protocol. AC and TK conducted the systematic review searches, data abstraction and independent quality assessment. MB conducted a further quality assessment to ensure consistency. AC and TK populated the table of evidence. AC and MB wrote the results and discussion. All authors read and approved the final manuscript.

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