Do online mental health literacy interventions improve the mental health literacy of adult consumers? Results from a systematic review

Abstract

Background

Low levels of mental health literacy (MHL) have been identified as important contributor to the mental health treatment gap. Interventions to improve MHL have used traditional mediums (e.g. community talks, print media) and new platforms (e.g. the internet). Evaluations of interventions using conventional mediums show improvements in MHL improves both community recognition of mental illness, and knowledge, attitude and intended behaviours towards people having mental illness. However, the potential of new mediums, such as the internet, to enhance MHL has yet to be systematically evaluated.

Objectives

Study aims were twofold: (1) To systematically appraise the efficacy of online interventions in improving MHL. (2) To establish if increases in MHL translated to improvement in individual health-seeking and health outcomes as well as reductions in stigma towards people with mental illness.

Methods

We conducted a systematic search and appraisal of all original research published between 2000 and 2015 that evaluated online interventions to improve MHL. The PRISMA guidelines were used to report findings.

Results: Fourteen studies were included; ten RCTs and four quasi-experimental studies. Seven studies were conducted in Australia. A variety of online interventions were identified ranging from linear, static websites to highly interactive interventions such as social media games. Some online

interventions were specifically designed for people living with mental illness whereas others were applicable to the general population. Interventions were more likely to be successful if they included 'active ingredients' such as a structured programme, were tailored to specific populations, delivered evidenced-based content, and promoted interactivity and experiential learning.

Conclusion:

Online interventions targeting MHL are more likely to be successful if they include active ingredients. Improvements in MHL see concomitant improvements in health outcomes, especially for individuals with mild to moderate depression. The most promising interventions suited to this cohort appear to be MoodGym and BluePages, two interventions from Australia. However, the relationship between MHL and formal and informal help-seeking is less clear; self-stigma appears to be an important mediator with results showing that despite improvements in MHL and community attitudes to mental illness, individuals with mental illness still seek help at relatively low rates. Overall, the internet is a viable method to improve MHL. Future studies could explore how new technology interfaces (e.g. mobile phones vs computers) can help improve MHL, mental health outcomes, and reduce stigma.

Keywords:

Mental health literacy, health behaviours, help seeking formal/informal, internet, online interventions, mental health, stigma.

Introduction

Despite the high global prevalence of mental illness [1], a significant treatment gap remains between those requiring care and those receiving care. In high-income English-speaking countries, such as the United States (US), United Kingdom (UK), and Australia, the prevalence of mental illness ranges from 14.9%–24.6% yet the treatment gap is 40%–65% [2-4]. One of the main reasons for this gap is low levels of mental health literacy (MHL) [5, 6]. Defined as "the knowledge and beliefs about mental disorders, which aids their recognition, management or prevention"[7], MHL consists of six components: (a) the ability to recognize mental illness/es; (b) knowledge and beliefs about risk factors and causes; (c) knowledge about self-help interventions; (d) knowledge and beliefs about professional help available; (e) attitudes which facilitate recognition and appropriate help-seeking; and (f) knowledge about how to seek appropriate mental health information [8].

Several studies have now conclusively shown that improvements in MHL improves both community recognition of mental illness, and knowledge, attitude and intended behaviours towards people having mental illness [6, 9-13]. The relationship between MHL and reduction in stigma towards people living with mental illness is still unclear [13]. However, these results have mainly been derived from evaluations of large scale community mental health awareness campaigns delivered through traditional mediums such as television, radio and print media; interpersonal contact with a person with a mental illness; public seminars and community talks [6, 9-13]. The potential of new mediums, such as the internet, to enhance MHL has also been explored but the actual effect on increasing MHL has yet to be systematically evaluated. Given the high rate of internet penetration in the general population – more than 80% in the developed world – the internet is an ideal medium through which to reach significant numbers of people at relatively low cost [14].

Currently many MHL interventions are embedded within other interventions and it is difficult to disentangle the efficacy of each component of the intervention from the other (for review of interventions see [6, 15]). But identifying the efficacy of online MHL interventions is important to enable a more strategic scale-up of what actually works and to increase the cost-effectiveness of any future intervention by discarding unsuccessful elements. A rigorous evidence-based cost effective MHL intervention if successfully delivered online can harness the potential of the internet, thereby increasing MHL at the population level and potentially delivering significant improvements in mental health outcomes among those living with mental illness.

To facilitate the development of such an intervention, the aims of this systematic review are twofold: (1) To collate the existing evidence to establish the efficacy of online interventions that seek to improve MHL and (2) To establish, where possible, whether improvements in MHL translate into improvements in individual health-seeking, reductions in stigmatising attitudes towards people living with mental illness, and better health outcomes for individuals living with mental illness.

Methods

Search strategy

This review was conducted in accordance with the PRISMA guidelines [16]. To identify eligible studies six databases were searched: PsycINFO, EMBASE, PubMed, CINAHL and Web of Science. The search was conducted from April to August 2015 and search results were limited to English language, peer–reviewed articles published between 2000 and 2015. We did not search for articles published prior to 2000 because the global internet penetration was only 6.5% at that time and we did not envisage any online interventions targeting MHL prior to 2000. Key terms to identify studies included: Mental health literacy (Mental health, mental illness*, mental disorder*, mental disease*, depression AND literacy/*health literacy) and Internet (internet* or online* or web or World Wide Web or social media or website or surfing). Articles identified by the database search were screened to assess relevance to the aims. In addition, Google Scholar and selected reference lists were also

searched to identify additional studies of interest. This review is a registered PROSPERO review: CRD42015025572.

Study inclusion and exclusion criteria

To be included studies were required to meet the following criteria: (1) Published in English in a peer-reviewed journal (2) described an online intervention with either the primary or secondary aim to improve MHL and included a measure of MHL or a component thereof such as mental health knowledge, (3) reported original research of either a quantitative, qualitative or mixed methods design (4) included participants who were 17 years or above and (5) included community members, family members and carers, and/or patients. Publications were excluded if participants in the study were health care professionals, the publications comprised commentaries or editorials rather than empirical research, or were published prior to 2000.

Selection of studies

Three authors (BB, JA, JP) independently assessed relevant titles and abstract. Selected studies were obtained in full text and reviewed in detail by three authors (BB, JA, JP). Where any discrepancies arose, a consensus was reached through discussion or if necessary referral to another author (KM). Following full text review a number were excluded as being irrelevant and a final number of included studies was obtained.

Data extraction

Data extraction was carried out independently by three authors (BB, JA, JP). Where any discrepancies arose they were referred to a fourth author (KM). Data was extracted on to a predesigned worksheet relevant to our outcomes of interest.

Quality assessment

To ensure methodological rigor in the review process, all included studies were appraised by a minimum of two authors (JA, BB or JP) for quality in accordance with the United Kingdom's National Institute for Health and Care Excellence (NICE) guidelines and methodology [17]. As it is difficult to

blind participants for behavioural treatment, we redefined the criterion regarding the blinding of participants. If blinding was not feasible, item 4 of the quality assessment was scored positive (+) if the credibility of the treatments was evaluated and treatments were equally credible and acceptable to participants i.e. control as well as intervention could be perceived to be an intervention in its own right [18].

Results

Through the literature search 571 potential records were identified (Figure 1), however after the removal of duplicates, 448 studies were included for review based on title and abstract alone. Of the 448 studies, 26 were retained for full text review. Full-text articles were reviewed by a minimum of two reviewers (BB, JA, JP) and were assessed for suitability for inclusion in accordance to the inclusion and exclusion criteria. During this process a further 12 papers were excluded as they did not meet the inclusion criteria of the current review [19-30] (See PRISMA flow chart for reasons). Therefore 14 articles were retained for inclusion [31-44]. Of these 14 papers, two papers reported on the same large Randomized Controlled Trial (RCT) [31, 36] but reported on different outcomes and were included as separate papers. However this has been taken into consideration in the analysis for the current review. The interrater agreement of the quality assessment was 83.69% and any disagreement between assessments after full text review was resolved through consensus.
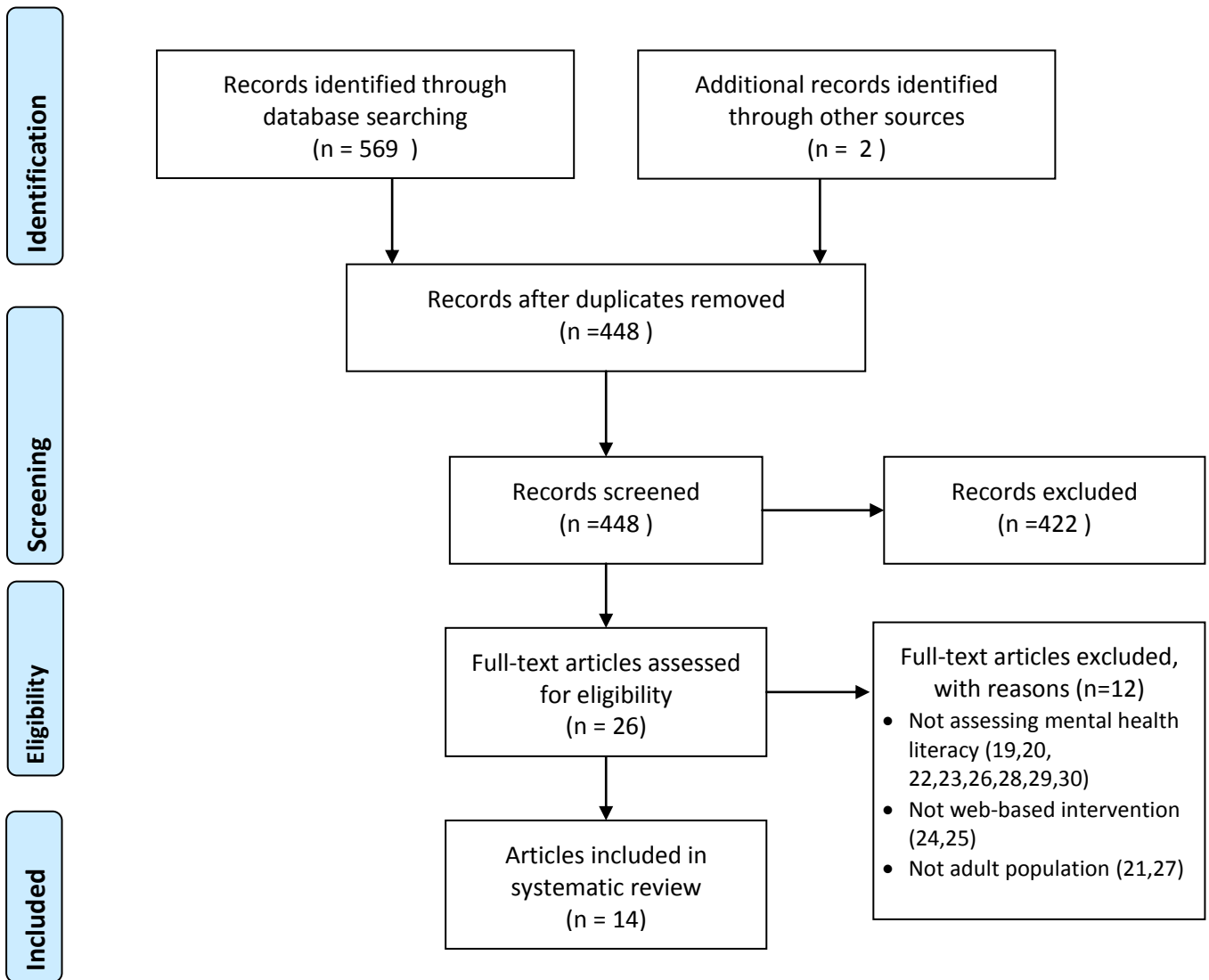
Figure 1 PRISMA flow chart

Types of studies

Of the 14 included studies: 10 were RCTs [31-34, 36-38, 40, 41, 44] and four were repeated measure studies [35, 39, 42, 43]. As two articles reported on the same trial [31, 36], seven studies were conducted in Australia [31, 32, 34, 36-38, 43, 44], four studies were from the US [33, 35, 41, 42], one study was conducted in Hong Kong [39], and finally one study was Norwegian [40], but was reporting a trial of Australian self-help interventions, MoodGym and BluePages translated to Norwegian. None of the reviewed studies included a qualitative exploration of the impact of the intervention on MHL, health seeking, stigma, or health outcomes. Five of the studies were complex interventions comprising two or more components [31, 34, 36-37, 40].

Participant characteristics

Across the 14 studies the total pool of participants was 2605 individuals. Most studies included adult participants with clinical indication of a mental illness [32, 33, 35, 37-39, 42-44], and only four studies (five papers) specifically recruited participants with mental health problems [31, 34, 36, 40, 41]. Two studies [33, 42] specifically focused on family members and carers, seven on the general community [32, 35, 37-39, 43, 44], and one study had a combined focus on patients and carers [41](Multimedia Appendix 1- Study overview & characteristics). Despite the heterogenity of target populations, comparability within and across groups was possible because most used the same constructs and measures; seven studies used the Depression Literacy scale (D-Lit) alone or in combination with others to measure MHL [31,34-38,44]; four of the six studies reporting on stigmaused the Depression Stigma Scale (DSS) [34, 37,38, 44] alone or in combination with other scales; three of the five studies reporting on help seeking used the General Help Seeking Questionnaire (GHSQ) [32,37,44]; and 10 studies which included a measure of mental illness symptomology used the Center for Epidemiological Studies-Depression (CES-D) [31-32, 34-36, 38, 40-41,43-44]. Further information is detailed in Multimedia Appendix 1- Study overview &

characteristics. Eleven studies reported unequal gender representation with an average of 67.9% females [31, 32, 35-37, 39-44].

Study quality indicators

A summary of risk of bias and quality indicators for RCTs can be found in Tables 1 and 2 respectively and Table 3 for quality indicators and risk of bias in non-RCTs. Using the NICE guidelines to assess study quality, we found a substantial number of studies reported high attrition rates (>20%) [31, 33, 34, 37, 39, 40, 43], however most studies included robust means of handling missing data such as Intention To Treat (ITT) analysis, which renders a conservative estimate of intervention effects [45]. Further, while often practically unavoidable, some studies had small sample sizes, frequently related to recruitment and/or retention difficulties and others recruited from limited pools of participants such as social clubs, student populations or organizations, which may limit the generalizability of the findings (Tables 2 and 3).While blinding of participants is problematic for this type of intervention, which we have taken into consideration, most studies did not blind investigators who were involved with assessing the data, which could introduce detection bias. Moreover, in included RCTs randomization procedures were not consistently reported (Table 1) and while the results of many of the included studies were encouraging, in some cases data was only collected immediately before and after the intervention with no subsequent follow-up, hence the sustainability of the interventions remains unclear (Table 2).

Table 1 Risk of bias for RCTs

Authors \ Type of bias	1.Adequate sequence generation	2.Adequate Allocation concealment	3. Blinding Patients*	4. Blinding assessors	5. Incomplete data addressed (Attrition)	6. incomplete data addressed (ITT analysis)	7. Similarity at baseline	8. Overall risk of bias
Christensen, Griffiths, Jorm (2004)	++	++	+	-	++	++	++	++
Griffiths, Christensen, Jorm, Evans, Groves (2004)	++	++	+	-	++	++	++	++
Costin, Mackinnon, Griffiths, Batterham, Bennett, Bennett, Christensen (2009)	++	-	+	-	++	?	++	+
Kiropoulos, Griffiths, Blashki (2011)	+	-	+	-	NA	NA	++	++
Rotondi, Anderson, Haas, Eack, Spring, Ganguli, Newhill, Rosenstock (2010)	+	?	-	-	++	NA	++	+
Taylor-Rodgers, Batterham (2014)	++	+	+	-	++	++	++	++
Lintvedt, Griffiths, Sorensen, Ostvik, Wang, Eisemann, Waterloo (2013)	++	++	+	-	-	++	++	++
Deitz, Cook, Billings, Hendrickson (2009)	-	?	-	-	+	-	++	+
Farrer, Christensen, Griffiths, Mackinnon (2012)	+	++	+	-	+	++	+	+
Gulliver, Griffiths, Christensen, Mackinnon, Calear, Parsons, Bennett, Batterham, Stanimirovic (2012)	++	++	-	-	-	++	++	+

Low risk of bias ++ High risk of bias - Unclear risk of bias + Not applicable NA

Table 2 Quality indicators and limitations for RCTs

Authors	Recruitment	Data collection	Attrition	Adherence	Limitations
Christensen, Griffiths Jorm (2004)	Election roll	Pre/post	Lost to follow-up:18% for Blue Pgs; 33% for Mood Gym and 12% for Control	Yes	Attrition rate Longer follow-up desirable
Griffiths, Christensen, Jorm, Evans, Groves (2004)	Election roll	Pre/post	Lost to follow-up:18% for Blue Pgs; 33% for Mood Gym and 12% for Control	Not reported, but reported in Christiansen (2004)	Small effect sizes Attrition rates Longer follow-up desirable
Costin, Mackinnon, Griffiths, Batterham, Bennett, Bennett, Christensen (2009)	Election roll	Pre/post (3 weeks after intervention)	**Control** (high/low distress): 14.5% **Intervention** (Basic):15.25% **Intervention** (enhanced): 17%	Yes	Power calculations suggest larger sample required. No follow-up
Kiropoulos, Griffiths, Blashki (2011)	Welfare and social groups	Pre/post/1 week	0% (once off access to website)	NA	Sample may not be representative researcher present during intervention longer follow up desirable
Rotondi, Anderson, Haas, Eack, Spring, Ganguli, Newhill, Rosenstock (2010)	Community mental health centres inpatient units	Pre/post/3-6-12 month	Patients: 3% Carers: 17%	Yes, high adherence	small sample size face to face workshop prior to intervention
Taylor-Rodgers, Batterham (2014)	University	Pre/post	control: 18% Intervention:15%	Yes. 65.4% of Intervention and 70.4 % of control viewed all 3 web pages	Small sample size University based sample Longer follow-up desirable
Lintvedt, Griffiths, Sorensen, Ostvik, Wang, Eisemann, Waterloo (2013)	University	Pre/post/ 2month	Control: 28% Interventon: 46.9%	Not reported	Attrition rate University sample Longer follow-up desirable
Deitz, Cook, Billings, Hendrickson (2009)	Employees in 1 worksite	Pre/post	Not adequately reported: given response rate for intervention:	Not reported	Could not monitor "dosage" of intervention

			96%/Control: 98%, but 22% of total sample did not view online material		Limited sample Longer follow-up desirable
Farrer, Christensen, Griffiths, Mackinnon (2012)	Mental health support hotline (Lifeline)	Pre/post/6-12 months	31 % at post intervention 41% at 6 month follow up	Not reported	Small sample size Attrition Adherence not reported
Gulliver, Griffiths, Christensen, Mackinnon, Calear, Parsons, Bennett, Batterham, Stanimirovic (2012)	Sports organizations	Pre/intervention week 1-2/post/3-6 months	49.2 % at follow up	Not reported	Small sample Study underpowered Attrition

Table 3 Quality indicators for non-RCTs

					Non-RCTs				
Authors	Recruitment	Randomization	Blinding of participants and or personnel	Data collection	Attrition	Missing data handling	Adherence	Limitations
Shandley, Austin, Klein, Kyrios (2010)	Not reported	NA	NA	Pre/post/2 months	Post:42.1% Follow-up: 62.4%	ITT	Yes	Attrition Limited adherence
Finkelstein, Lapshin (2007)	University Medical School	NA	NA	Pre-post (immediate)	Not applicable/data collected immediate pre/post	NA	NA	Follow-up University sample
Li, Chau, Wong, Lai Yip (2013)	University	NA	NA	Pre/Post	Post: 42.1%	ITT	Not reported in details	Attrition Small, university sample
Roy, Taylor, Runge, Grigsby, Woolley, Torgeson (2012)	Military services	NA	NA	pre/post/optional @ 10 days	post: 0% (only one event of using website) Optional follow up: (74.44%)	NA	Not reported	lack of reporting on methods short, optional follow up

Impact on mental health literacy

Across the reviewed studies there were an assortment of online interventions (Multimedia Appendix 1) that targeted MHL as a primary outcome. Five of these studies employed samples with no prerequisite of symptomology of mental illness [33, 38, 39, 42, 44].

In an innovative study, Li *et al.* [39] trialled a social network game, 'The Ching-Ching Story', specifically designed to improve knowledge about mental health problems and the results were encouraging with significant improvements in MHL (Multimedia Appendix 2-Study outcomes). Also targeting young adults, Taylor-Rodgers and Batterham [44] assessed the efficacy of a three week psychoeducational intervention based on vignettes about mental health problems on MHL as well as stigma, and help seeking attitudes and intentions (Multimedia Appendix 1- Study overview & characteristics). Results suggested that the intervention was moderately (d=0.65) effective in improving anxiety literacy, but not depression or suicide literacy and that there was a moderate change (effect size=.58) in help seeking attitudes, in particular towards seeking help from primary care providers (effect size=.53) (Multimedia Appendix 2-Study outcomes).

Targeting carers of children between the age of 5-21 years Deitz *et al.* [33] reported significant increases in overall knowledge of mental health problems using a 32-item questionnaire on the knowledge of childhood depression and anxiety (P=.008) and improved self-efficacy using a 9-item questionnaire on treatment seeking self-efficacy in handling mental health problems in children (p=.001) (Multimedia Appendix 2 -Study outcomes). These changes resulted from a narrated and interactive web-based mental health program. However the program created no change in attitudes to help seeking or towards mental health problems (Multimedia Appendix 2-Study outcomes). Roy *et al.* [42] reported improved PTSD knowledge, as measured using a 25-item PTSD knowledge questionnaire, at post intervention following the use of an educational website for PTSD for the families of military service members specifically designed to increase PTSD knowledge and thereby support for returned military personnel. However, the duration of the intervention was unclear and

significant attrition at follow-up was reported (74.44%) (Multimedia Appendix 1 & Table 3, respectively). Similarly, an RCT of three web-based interventions (Multimedia Appendix 1- Study overview & characteristics) aimed at improving help seeking in young athletes results indicated significant improvements in depression and anxiety literacy levels (Hedges' g = 0.90 & 0.90 respectively) compared to all other conditions [37](Multimedia Appendix 2-Study outcomes).

Addressing an extensive gap in the literature, Kiropoulos *et al.* [38] evaluated an internet-based, multilingual depression information resource targeted at Greek and Italian migrants. The results were encouraging with significant improvements in depression literacy and personal stigma (Multimedia Appendix 2-Study outcomes), however, as in other studies, the sustainability of the intervention needs further exploration because participants were only followed up one week post-intervention (Table 2).

Though mental health literacy was not the primary aim of the intervention, Shandley *et al.* [43] evaluated an online, CBT-based gaming intervention "Reach Out Central" aimed at supporting mental health in young adults, in particular targeting males (Multimedia Appendix 1- Study overview & characteristics). Outcomes suggested significant increases in help seeking willingness ($\eta2=0.06$), particular for women, and slight improvements in mental health literacy, but only for female participants (Multimedia Appendix 2-study outcomes).

In an RCT trialling personalized e-health cards (Multimedia Appendix 1-Study overview & characteristics) to improve help seeking and MHL, no significant results were reported on help seeking or MHL measures. A higher, but non-significant, number of positive beliefs about formal help sources and therapy for depression were recorded in the intervention arm (Multimedia Appendix 2). On the other hand, Finkelstein and Lapshin [35] found their interactive, web-based educational intervention for depression stigma not only effective in improving depression stigma,

but also significantly increased depression literacy (through the assessment of knowledge and resistance to treatment) (Multimedia Appendices 1 & 2).

Three studies investigated the impact of web-based depression interventions on MHL in populations with elevated depressive symptoms [31, 34, 40] (Multimedia Appendix 1- Study overview & characteristics); Christensen *et al.* [31] conducted a large scale RCT investigating the impact of BluePages, a depression literacy website, and MoodGym, a web-based CBT intervention. Participants in both interventions were followed up on a weekly basis by the research team, providing measurements on depression symptomology, dysfunctional thoughts, and CBT literacy. As hypothesized both interventions were effective in improving depression literacy relative to the control group. The depression literacy intervention was most effective compared to the CBT intervention and control arm in improving depression literacy; similarly, the CBT intervention was most efficacious in improving CBT literacy (Multimedia Appendix 2-study outcomes).

Lintvedt *et al.* [40], also assessed the effectiveness of BluePages and MoodGym in Norwegian in improving MHL around depression and CBT in a sample of Norwegian University students. However in this instance there was no follow up of participants. Participants were assigned to either the intervention condition which included access to both self-help websites, or to a control condition (Wait list). Results further support the efficacy of MoodGym and BluePages; the intervention significantly improved depression and CBT literacy and decreased depressive symptoms across all outcome measures, even without the weekly tracking previously reported by Christensen *et al.* [31] (Multimedia Appendix 2-Study outcomes). In an Australian study of individuals with psychological distress a comparable paradigm was employed [34]; participants were allocated either to a combination of MoodGym (6 weeks) and BluePages (1 week) without tracking (weekly 10 minute counsellor phone call), tracking only, or control condition (Multimedia Appendix 1- Study overview & characteristics). While CBT literacy significantly improved in web-intervention conditions ($d=.71$ and

.80 without and with tracking respectively), overall the intervention did not render a significant improvement in depression literacy and stigma. There did appear to be a short term improvement in depression literacy and stigma in web-based conditions, but this improvement was not sustained at 12 month follow-up (Multimedia Appendix 2-Study outcomes). As suggested by the authors, these results suggest a dose-dependent effect of the psychoeducational intervention (BluePages) given the success in other trials in which the exposure to intervention content was of a more substantial duration [31, 40].

Impact on seeking help for mental illness

One study reported positive outcomes for help seeking behaviours [42] following web-based interventions [42]. While not reporting details relating to the method of data collection, 57% of carers who returned to a PTSD psychoeducational website 10 days post intervention reported having taken action in facilitating help for family member with suspected PTSD, including discussing symptoms and encouraging family member to seek help [42] (Multimedia Appendix 2-Study outcomes).

Conversely, two studies found no improvement in formal or informal help seeking; Costin *et al.* [32] found no indication that eHealth cards improved help seeking intentions nor actual help seeking among young people; neither did a web-based mental health program for parents improve attitudes towards help seeking [33] (Multimedia Appendix 2-Study outcomes). Similarly, while significant improvements in anxiety and depression literacy was reported, Gulliver *et al.* [37] found no significant impact of their web-based interventions on help seeking attitudes, intentions or behaviours relative to controls (Multimedia Appendix 2-Study outcomes).

Impact on stigma

 A multi-lingual internet-based psychoeducational intervention was found to be effective in reducing personal but not perceived depression stigma [38] (Multimedia Appendix 2-Study outcomes). Furthermore, reduction in depression stigma at post intervention and anxiety stigma at the three month follow-up was observed in the mental health literacy and de-stigmatization condition of a brief, fully automated internet based help seeking intervention [37] (Multimedia Appendix 2-Study outcomes). Conversely, Taylor-Rodgers and Batterham [44] did not report significant changes in depression nor suicide stigma, but a significant decrease in anxiety stigma (effect size=.65) relative to the control group following an online psychoeducational intervention (Multimedia Appendix 2-Study outcomes). Likewise, Farrer *et al.* [34] reported no overall significant improvement in depression stigma in response to MoodGym/BluePages with or without participant follow up, however stigma appeared to be reduced post-intervention in both intervention conditions, but only sustained in intervention without follow up at 6 months. By the 12 month follow up the effect was not sustained in either intervention (Multimedia Appendix 2-Study outcomes). Shandley *et al.* [43] reported minor gender differences in stigmatizing attitudes, with women holding less stigmatising attitudes compared to men, which were sustained from pre- to post intervention. Moreover, the intervention did not significantly change attitudes towards people with mental illness (Multimedia Appendix2-Study outcomes).

Impact on mental health outcomes

 Several studies reported improvements in mental health outcomes following web-based interventions, in particular in studies which focused on patients with mental health problems. For example, Christensen *et al.* [31] found both MoodGym and BluePages to be effective in reducing depression symptomology in patients with clinical level of depression in both in ITT analysis, which is more robust in accounting for missing data (effect size: 0.4, 0.4 and 0.1 for MoodGym, BluePages and Control respectively) as well as in participants who completed all measures (n=414) as also

reported by Griffiths *et al.* [36]. Results were particularly encouraging in participants with CES-D

scores of 16+ (n=369) (completers: 0.6, 0.5 and 0.1 and completers with CES-D of 16+: 0.9, 0.75 and

0.25 for MoodGym, BluePages and Control, respectively) (Multimedia Appendix 2-Study outcomes).

Supporting these findings, Lintvedt *et al.* [40] also found that MoodGym and BluePages were

effective in reducing depressive symptoms (d=.57 on CES-D scores) and negative thoughts (d=.50)(

Multimedia Appendix 2-Study outcomes). Similarly, patients with schizophrenia experienced

decrease in positive symptoms as a result of engaging with a targeted online psychoeducation

(effect size= -.88)[41] (Multimedia Appendix 2-Study outcomes).

Four studies reported no significant impact of their respective online psychoeducational

interventions on mental illness symptomology, [32, 38, 44] nor was depressive symptomology

significantly improved following a psychoeducational gaming intervention [43]. However these

studies were not specifically targeting individuals with mental health problems (Multimedia

Appendix 2-Study outcomes).

Discussion

Key findings

The aims of this systematic review were twofold: first, to synthesise the existing evidence to

establish the efficacy of online interventions that seek to improve MHL. Second, to establish

whether improvements in MHL translated into improvements in individual health-seeking,

reductions in stigmatising attitudes towards people living with mental illness, and better health

outcomes for individuals having mental illness. Outcomes from the review demonstrate that online

interventions targeting MHL are generally efficacious when they include the following 'active'

ingredients: the intervention comprises a structured program where participants are guided through

a series of sequential steps, targets specific population or consumer groups, delivers evidence-based

content (such as CBT and/or psychoeducation, depending on the target population), and is

underpinned by a pedagogical approach that promotes interactivity and experiential learning. Examples of these types of intervention include MoodGym and social network games ([31, 34, 36, 39, 40]). Conversely, from our review we observed that interventions that do not fully utilise the interactive potential of the internet, and deliver generalist information to consumers using an unstructured, didactic approach, and/or where participants can navigate and access the website in any way they chose, are less successful in improving rates of MHL [32, 43, 44].

Several studies found positive associations between increased MHL and reduced symptomology, especially for mild to moderate depression [31, 36, 40, 41]. This suggests that online interventions may be best suited to target people with less severe mental illness (e.g. depression and anxiety) and that are of a mild to moderate nature (e.g. mild to moderate depression rather than clinical depression). However, this finding should be cautiously interpreted as the studies making these findings included therapeutic components (such as CBT) alongside psychoeducational ones, and separating the effects of each is not possible.

Nevertheless, to date the most extensively tested interventions suited to people with mild to moderate depressive symptoms appear to be MoodGym and BluePages. Initially developed and trialled in Australia, the intervention has also been translated into Norwegian and tested in Norway [40]. These interventions have been rigorously evaluated using the 'gold standard' RCT designs and generally reported improvements across a variety of measures of MHL [31, 34, 36, 40] and symptomology [31, 36, 40]. However, these interventions also have a high attrition rate on account of the time commitment required from participants (up to 6 hours) and researchers must carefully consider the merits of this approach in relation to their target population and particular mental illness. Interventions seeking to increase MHL in community members are unlikely to be successful using this intensive approach; likewise for patients whose mental illness precludes them from concentrating for long periods of time. As shown by Rotondi et al. [41], there are other internet-

based interventions that may also hold promise for mental illnesses such as schizophrenia, yet this line of research requires further substantiation.

The relationship between increased MHL and reductions in stigmatising attitudes is more complex. On the one hand, the evidence demonstrates a positive association between the two – as MHL increases, stigma decreases. On the other hand, this evidence is based on participants' self-report measures and it is difficult to establish how such attitudinal shifts inform everyday practices around inclusion and discrimination towards people with mental illness. Moreover, this review found no relationship between improvements in MHL and increased help-seeking, suggesting that better knowledge about mental illness does not necessarily translate into people seeking the therapeutic care they might need. Avoiding the stigma of mental illness is one of the main reasons for not seeking appropriate and timely help [46, 47]. Further research is needed to exemplify the potentially paradoxical relationship between MHL and help-seeking.

Limitations of the included studies

Our findings are tempered by four limitations in the current evidence-base. First, there was high variability between the studies on the duration of the exposure-response relationship. Some studies incorporated a sustained engagement between the participants and the intervention into their design, and followed up over a prolonged period of time (e.g. 12 months) to test the durability of the intervention (Tables 2 and 3). Other studies only had a one-off interaction between participants and the intervention and followed up participants for a very limited period (e.g. one week)(Tables 2 and 3). Second, monitoring participant adherence for complex interventions of this nature is challenging. Whether delivered online or through traditional platforms, there are many confounding factors – e.g. social, cognitive, structural – that could compromise the study results. Third, as several of the studies were complex interventions comprising multiple components it was unclear which components created the effects and whether these effects were intended or not. Finally, as

acknowledged by many of the studies' authors, certain standard measures and techniques, such as ITT analysis, were not applied to the studies due to their small sample size. Thus the extent of the generalisability of many of the studies is not entirely clear.

Limitations of the current review

This review is also not without limitations. Only articles in English were included, thereby excluding research published in other languages. Also, while the utmost care was taken to perform a thorough search, failure to include searches on specific mental illnesses (e.g. schizophrenia) and literacy meant that we might have missed some studies, including evidence from the grey literature. Further, due to the heterogeneity of the measures and outcomes of the included studies a meta-analysis could not be performed, limiting the overall rigour of the review. Lastly, as several of the studies were complex interventions comprising several components it proved difficult to disentangle which components influenced our target outcomes specifically.

Conclusions

To the best of our knowledge this is the first review to examine the efficacy of online MHL interventions and to establish the relationship between these interventions and their effect on help-seeking, stigma, and health outcomes. As our review demonstrates, there are several 'active' ingredients to a successful online intervention and if properly implemented, these interventions can improve MHL and symptomology among those with mild to moderate mental illness. Of greatest promise are the MoodGym and BluePages interventions [31, 34, 36, 40, 41] which have not only proven to be efficacious but also cost-effective and culturally portable from Australia to Norway [40]. Future research could extend the utility of these interventions by testing its applicability in other country settings different to Australia.

Interestingly, much of the intervention research on MHL comes from Australia. For more than a decade now there have been several Australian public health campaigns addressing mental illness, nearly all of which have integrated components of MHL [10, 48-52]. Australia is often cited as an exemplar in this field [13]. Much could also be learned from applying the lessons from Australian interventions in low and middle income countries, where internet penetration is rapidly increasing [14]. Documenting how interventions are adopted and adapted to culturally diverse settings could open new horizons for scholarship vis-à-vis the relationship between MHL, help-seeking, stigma, and health outcomes in culturally diverse settings. Finally, future studies could also explore how these relationships are influenced by the technology interface being used (e.g. mobile phones vs computers). By realising these future avenues for research, we can better harness the full potential of the internet and new technologies in delivering new innovations to help improve the lives of people with mental illness.

Acknowledgements

Conflict of interest

None

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