Suicide Prevention by Internet and Media Based Mental Health Promotion

Deliverable 6.1

Scientific review of Internet based interventions for mental health promotion and suicide prevention

Mapping and evaluation of scientific publications for internet based interventions

Summary

Background

It is estimated that one out of four people experiences mental-illness during life time. Among mental disorders, depression, anxiety and suicide have great burden on societies. Due to the rapid growing of the Internet, Internet-based interventions to promote mental health and prevent mental illness, including suicide, have received great attention. The aim of this study was to map and review the scientific literature regarding Internet-based mental health interventions related to anxiety/stress, depression and suicide.

Methods

Pubmed, Ovid, and Web of Science were searched for articles related to Internet based interventions on depression, anxiety/stress and suicide. The title and abstract of the obtained articles were reviewed. Articles regarding other mental health disorders, physical problems and co-morbidities beyond the scope of this review and articles in which computer was used as a tool for data-collection were excluded. Important characteristics of the reviewed articles were summarized. Three researchers with different backgrounds reviewed categories and agreed upon them in a group discussion.

Results

In total, 148 articles were found. 126 articles were excluded because irrelevant or duplicate. By reviewing the full text of remaining studies 18 relevant articles were included for final analysis.

The important characteristics of the included studies were summarized in the following five categories: design of the study, demographic pattern of the study, type of intervention, content of intervention, and measures & outcomes.

All the included studies were performed in high-income countries with dominancy of Australia. 4 were related to depression, 10 to anxiety/stress, and 3 to both depression and anxiety and only 1 article focused on suicide. Most interventions were human-assisted and the content was based on cognitive behavioural therapy. Female participants were dominant. Since different outcomes were measured by various tools in the reviewed articles, the results were not comparable.

Conclusions

There are different Internet-based mental health interventions related to depression and anxiety but few targeted suicide. Most of the websites still require direct human assistance to assure quality of care. In order to improve Internet-based mental health interventions, developing clinical decision support systems based on scientific guidelines, creating standardized evaluation and accreditation systems and using a common terminology should be a priority of the future research.

1. Background

According to WHO definition, mental health," is not only absence of mental disorder but also it is a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community." (World Health Organization 2001)

There are many people who suffer from a mental disorder without having clear diagnosis or treatment. Globally, it is estimated that one out of four people will experience mental-illness during their life time (World Health Organization 2004). Mental disorders may start from early adolescence and increase the risk of physical illnesses. From 50 years ago up to now, there has been a significant increase in prevalence of mental health disorders among young students (Mailey, Wojcicki et al. 2010). New estimates show that 12-18% of college students have a certain mental diagnosis (American college health association 2005). Suicide rate is also increased more than three times in this age group (Vastag 2001). However, young people are hesitant to ask for help when they don't feel good especially when they are suicidal or suffer from depression (Mailey, Wojcicki et al. 2010). Negligence of mental health disorders is mainly due to surrounded stigma. For mental-ill people stigma around mental disorders is one of the main reasons of being reluctant to seek for help directly and to avoid face to face therapies (Klein, Mitchell et al. 2009)

1.1 Anxiety Disorders

Anxiety disorders are very common among mental-illnesses (Christensen, Griffiths et al. 2010). In anxiety disorders impaired cognition leads to distortion of perception.

One fourth of population could end up with one of these eleven anxiety disorders and women are more susceptible to develop anxiety compared to men. It can start in early adolescence. The prevalence decreases with higher socioeconomic status. Both CBT and pharmacotherapy such as SSRIs (selective serotonin reuptake inhibitors) are effective for treatment of anxiety disorders (Christensen, Guastella et al. 2010). Despite the effectiveness of these two modalities, there are many patients who do not have access to psychotherapies or drugs in remote areas. They prefer to be anonymous while seeking for help because of the stigma. Internet interventions, consisting CBT or other effective psychotherapies can be a good solution (Christensen, Guastella et al. 2010).

1.2 Depression

Depression affects about 154 million people and is one of the leading causes of disability worldwide. Only less than 25 % of those affected have access to effective treatments. It was the major cause of disability and the 4th leading contributor to the global burden of disease (DALYs) in 2000. By the end of year 2020, it is estimated that depression will be the 2nd highest cause of DALYs among all age groups in both male and female. Today, it is already the 2nd cause of DALYs in the age group of 15-44 years for both sexes combined (World Health Organization 2008).

Depression is proved to be an important risk factor for suicide. Treatment modalities in depression is not limited to medication but also to psychotherapy to develop appropriate and practical coping skills and enhancing adherence to pharmacotherapy (Wasserman and Wasserman 2009).

Cognitive Behavior Therapy (CBT) is an effective psychotherapeutic intervention for depression. Previous studies have shown that CBT is cost-effective in terms of prevention of recurrent depression after 2 years or even five years (Bockting, Kok et al. 2011). The positive effects of CBT can remain for more years compared to

pharmacotherapy and that is why so many people prefer to undergo this kind of treatment (Roy-Byrne, Craske et al. 2010).

Because of high prevalence and burden of depression, effective and accessible therapeutic interventions should be developed in this field. The intervention should also target those people who do not seek help or they are in remission (Bockting, Kok et al. 2011). Internet-based interventions seem to be an appropriate solution for the mentioned problems in this area (Hickie, Davenport et al. 2010).

1.3 Suicide

Suicide is a major public health concern which needs appropriate prevention and control. Viewing suicide as a single pathway without having multi-perspective approaches is not possible. Closer look on populations, societies and communities rather than just emphasizing on individuals are important to understand the suicidal process (Wasserman and Wasserman 2009).

Suicide is the third leading cause of death among 15-34 years old (World Health Organization 2010). Up 70 90% of people who have suicidal thoughts suffer from a diagnosable psychiatric disorder (Kessler RC, Berglund P et al. 2005). Many of these individuals avoid visiting doctors and psychologists because they don't think they need help. Research has shown that 75% of this group did not meet any mental health care in the year before committing suicide (van Spijker, van Straten et al. 2010) .

There are many psychological theories of suicide mainly based on cognitive approaches in last decade; it has been suggested that once suicidal thoughts arise in an individual during depression , the risk for returning suicidal thoughts in the next episodes will be increased. That is why early prevention before development of recurrent suicidal thoughts is recommended (Williams, Crane et al. 2006). Therefore, a quick and accessible assistance before and at the moment of crisis would be a substantial help for suicidal people.

1.4 Internet based mental health interventions

Internet is a new era in our modern life. Its application in daily life is progressively enhancing. The availability of the communication platform provided by the Internet is rapidly increasing. Socioeconomic gaps in Internet-use are decreasing, while Internet access is available in more and more rural and remote areas. According to latest statistics, it is estimated that there are more than two billion internet users world-wide with about half of them living in Asia (Fig.2) (Internet World Stat 2011). Internet use is especially wide-spread among the younger age-groups. A survey in Europe showed that approximately 90% of young people aged 16-24 years used the Internet regularly during 2010 (http://www.internetworldstats.com/stats4.htm, accessed on 2011-09-20).

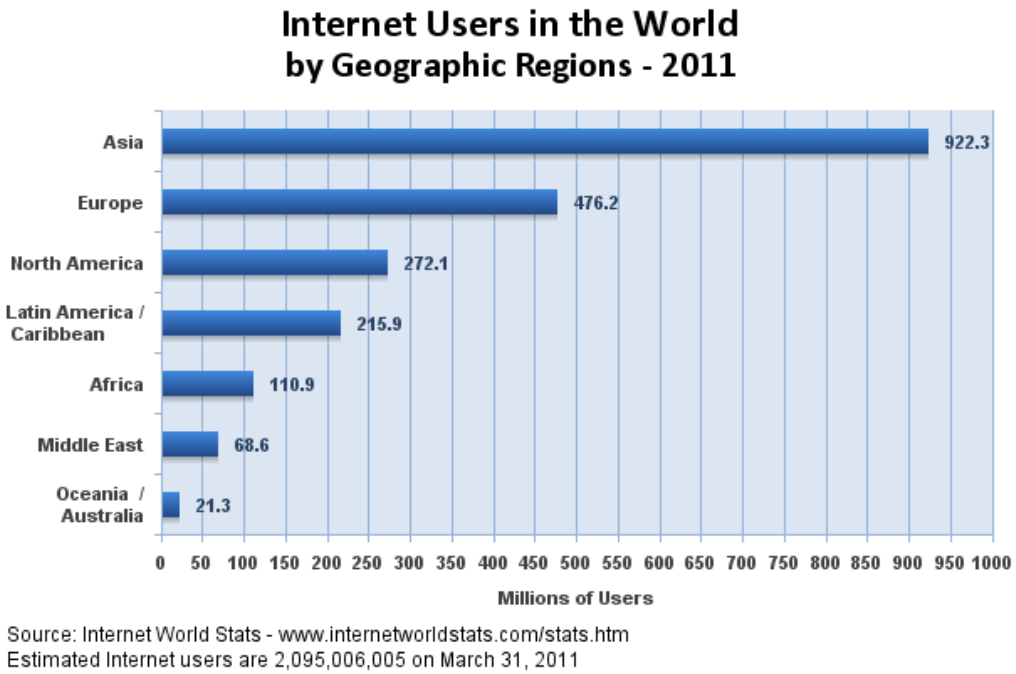

Figure 1. The number of Internet users in different regions around the world

The introduction of Internet to clinical practice has brought many opportunities not only for mental-ill people but also for mental health professionals to have better communication with their patients who are concerned of being involved in face-to-face treatments. Studies have shown that numbers of people who are searching for mental health information are increasing. Close to 40% of Americans believed Internet has helped them to take care of their health (Christensen, Griffiths et al. 2010).

Internet-based mental health interventions are growing fast and can be used several times without having extra cost for the individual and the society. Internet-based mental health interventions are those methods which could be delivered through Internet to change one's knowledge, attitudes and behaviors or to provide treatment. In general there are two main forms of Internet-based mental health interventions. 1- Automated (self-help) internet interventions in which no human-assisted therapy or help exist and the intervention is only based on the computer and internet. 2- Guided (therapist-assisted) Internet interventions in which human can play a direct role as a therapist and having face to face contacts during the intervention or being indirectly involved with sending emails, SMS, chat messages (Muñoz 2010).

In another comprehensive literature review Internet interventions were categorized to four types: (1) Web-based interventions; (2) online counseling and therapy; (3) Internet-operated therapeutic software; and (4) other online activities. A web-based intervention was defined as "a primarily self guided intervention program that is executed by means of a prescriptive online program operated through a website and used by consumers seeking health- and mental-health related assistance". The main aim of these programs was to induce positive changes and raise awareness related to mental-illnesses. The contents of these programs were both educational and therapeutic (Barak, Klein et al. 2009). The contents of these programs were usually interactive and the user could benefit from different animation, graphics, video or audio modalities to get a better understanding of his/her own mental condition.

Overall, the number of studies that is focusing on development of Internet-based mental health interventions is rapidly increasing (Ritterband, Andersson et al. 2006). However, efficacy and cost-effectiveness of such trials should be carefully evaluated.
In one study in Finland Koivunen and Välimäki have shown (Koivunen, Välimäki et al. 2010) that following the implementation of a web-based patient support system in two psychiatric hospitals the use of Internet and IT was substantially increased In another study in the USA mental health education was delivered through a computer-based interactive video program for nursing home staff resulted in increasing the knowledge of nurses (Rosen, Mulsant et al. 2002).

1.5 Study rationale and objectives

In a random sample of over 3000 American adults, it was found that 58% of the Internet users reported searching for health information for themselves (Atkinson, Saperstein et al. 2009). If this figure is representative of the rest of the globe, there are around 1.2 billion Internet users that search health related information (Internet World Stats 2011). One important question for suicide prevention (and perhaps for mental health care in general) is what these information seekers find and perhaps even more importantly, how these users seek information. In order to assess whether a web-based intervention has practical significance for public health, it might not be enough to assess whether that intervention has statistical significance. An intervention with a high statistical effect-size will be of little practical use if those who seek it cannot find it. For suicide prevention it seems to be important to identify what strategies suicidal people use to search, in order to increase the probability that they find the appropriate web-based interventions.
This issue was investigated for the ourposes of the SUPREME project. Google Trends (http://www.google.com/trends, accessed 2011-09-20) was used to analyze the frequency of suicide related terms. The findings were then used for defining the main domains of the literature review in this thesis work. Google Trends is an online service that shows how often different search-terms are entered into the Google search engine, in different time periods, in various regions of the world. In this analysis, a large number of suicide-related terms were identified through brainstorming. These terms were then analyzed in Google Trends to establish their frequency in searches. Terms with extremely low use-frequencies were then excluded. Finally, the overtime usage-frequency of each remaining term was correlated to the overtime usage-frequency for the term “suicide”. The terms with the highest correlations were identified as ($r = 0.6\text{-}0.9$, $p < 0.01$): suicide, depression, anxiety, stress.
This analysis suggests that people who make searches on the term “suicide” in the Google search engine are also likely to search the terms “depression”, “anxiety”, and “stress”. In turn, websites (including those used in web-based mental health interventions) covering these topics are likely to be more salient and thus more often accessed by users. Thus, the primary focus of this study is a review of web-based interventions targeted at suicide, depression, anxiety and stress: these interventions, given a high statistical effect-size, are good candidates for making a significant impact in suicide prevention as well.

2. Method

A review of the literature was conducted with a systematic approach in MEDLINE, PsycARTICLES, PsychINFO, Global Health, and Web of science, for published articles on Internet-based mental health interventions. Searched terms included ("Internet-based" AND "mental health" AND intervention) OR ("Computer based" AND "mental health" AND intervention) OR ("web-based" AND "mental health"

AND intervention) OR ("Computer assisted" AND "mental health" AND intervention) (Table 1).

Both MeSH and free search terms for all search commands were included as a strategy to increase the sensitivity.

Only peer-reviewed original published papers were included for the search (dissertations, conferences, and etc. were not included). In addition, to be able to review the full-texts, the search was limited to articles published in English.

As the scope of this study is limited to depression, anxiety and suicide, studies on web-based interventions regarding other mental health problems (alcohol abuse, eating disorders, schizophrenia etc.), comorbidities regarding these, or somatic problems (HIV, diabetes etc.) were excluded. Articles in which computers were only used as a tool for data-collection and not as a clinical intervention were also excluded.

The literature search was performed in June-August 2011.

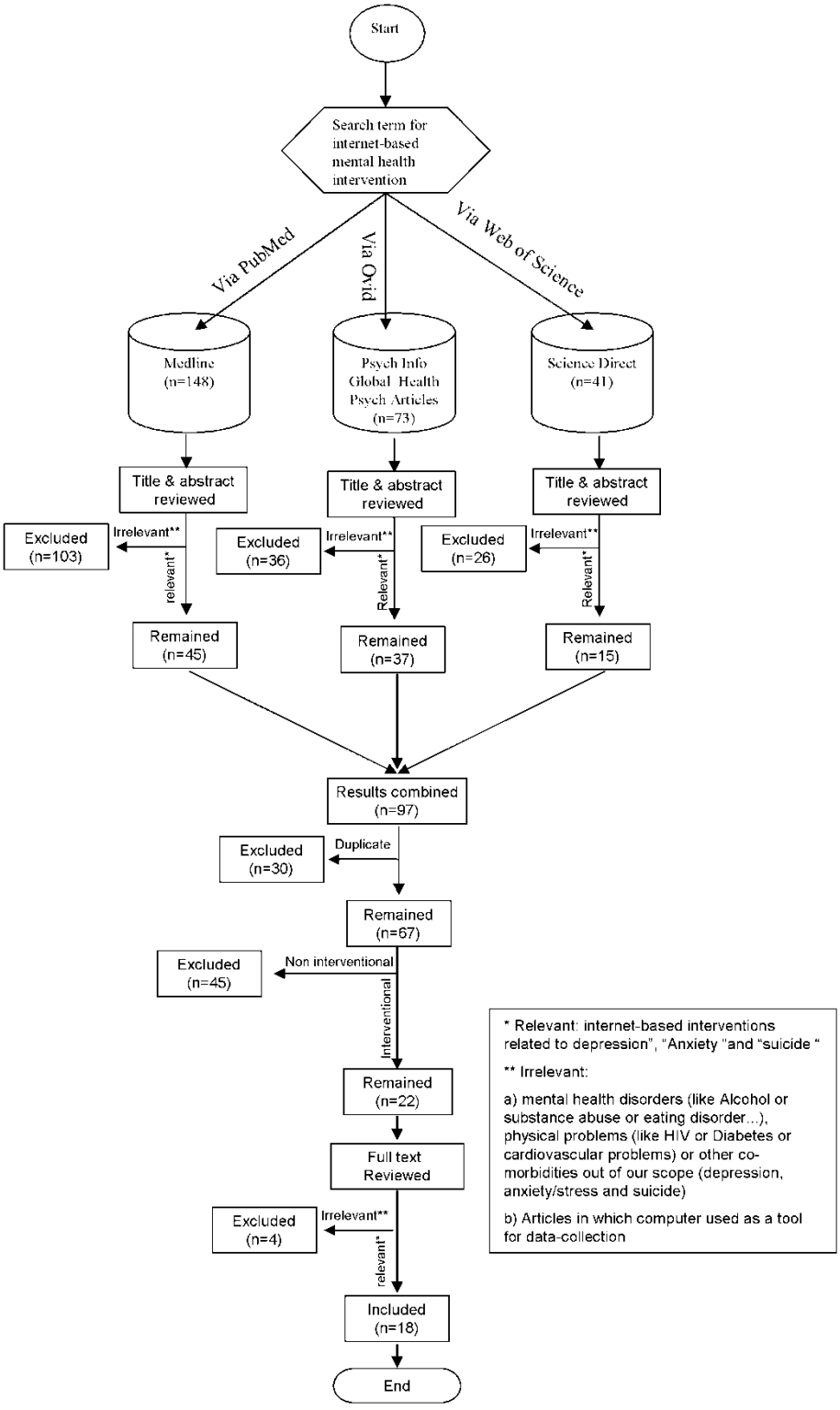

Figure 2. Search strategy used to find mental health Internet-based interventions

3. Results

In first step, by using the mentioned search terms in selected electronic databases, 148 articles were identified via Pubmed, 73 via Ovid (PsycARTICLES, PsychINFO, Global Health) and 41 via Web of Science (Fig. 3). In the second step, by excluding irrelevant articles, 45, 37 and 15 articles remained respectively. In the next step by excluding duplicates, 67 articles remained. By excluding non-interventional studies, 22 articles remained. By reviewing the full text of all 22 studies, 18 relevant articles were included. A summary table for all 18 included articles describing their important characteristic of study design, type of intervention, demographic pattern, and outcome measures is shown in Table 4.

Out of these 18 studies, most of the Internet-based mental health interventions were performed in Australia (8) and USA (4), only 4 in three European countries, and just 2 in Asia (Japan) (Fig. 4). With regards to year of publication, articles were published between 2001-2011. More than half of the studies were published after 2009 and the rest from 2001 to 2009.

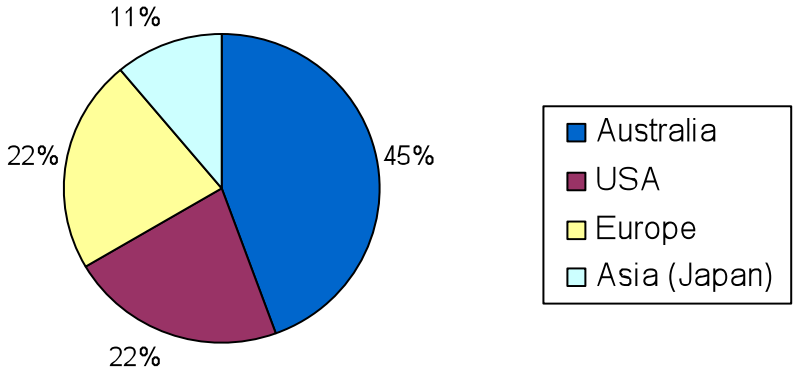

Figure 3. Distribution of publications based on the continent

Mental health interventions in the 18 included studies were reviewed and the characteristics were categorized in five categories as: 1. Study design 2.Type of intervention 3. Content of intervention 4. Demographic pattern 5. Measures and outcomes.

A summary of the characteristics is shown in Table 4.

Of the 18 included studies on Internet-based interventions, 4 were related to depression, 9 to anxiety/stress, and only 1 article focused on suicide. Four of eighteen, targeted both anxiety and depression. Based on type of intervention, there have been 8 published randomized clinical trials, 5 ongoing trials without results and 5 pre-post test studies. Relation between type of disorder and study design is shown in Table 2.

Table2. Distribution of included articles based on study design

Study design / Disorder type	RCT	ongoing RCT	Pre-post test	Sum
Anxiety /stress	3	2	4	9
Depression	2	2	0	4
Depression and anxiety (Mixed)	3	0	1	4
suicide	0	1	0	1

Sum	8	5	5	18

Interventions in the reviewed studies could be divided into two major groups:
1. Human assisted 2. Automated
Human assisted interventions were divided further into direct (face to face contact or visit) or indirect (through chat, SMS, and Email). Interventions where no human support was offered to users were categorized as “automated”.
Type of intervention based on the selected mental health disorders in the reviewed studies is as follow:

3.1Anxiety/ Stress

Of the 9 Internet-based interventions related to anxiety/stress, 7 of them used human assisted intervention, one used automated intervention, and another one compared human assisted with automated.
Among the 7 human assisted studies, 3 used direct human assistance (Vliet and Andrews 2009; Christensen, Guastella et al. 2010; Roy-Byrne, Craske et al. 2010), and 4 used indirect human assisted Internet interventions (Kawakami, Kobayashi et al. 2005; Klein, Austin et al. 2009; Klein, Mitchell et al. 2009; Knaevelsrud and Maercker 2009).
In the indirect human assisted group, one study reported that the frequency of therapist contact was not related to effectiveness of the intervention (Klein, Austin et al. 2009). In one ongoing trial study so called "webGAD trial", indirect human assisted is being compared with automated intervention (Christensen, Griffiths et al. 2010).
There was only one study that applied an automated Internet intervention (Kawai, Yamazaki et al. 2010).

3.2 Depression and suicide

Of the 5 articles related to depression and suicide, 3 used human assisted interventions and 2 used automated interventions.
Among the 3 human assisted, 2 studies used direct human assisted Internet interventions (Van Voorhees, Fogel et al. 2009; Hickie, Davenport et al. 2010) and 1 used indirect human assisted intervention (Bockting, Kok et al. 2011) . Two studies applied automated Internet interventions (Griffiths, Crisp et al. 2010; van Spijker, van Straten et al. 2010).
The Internet intervention used in the suicide intervention study was automated. However, for ethical reasons human support was available in emergencies.

3.3 Articles related to both depression and anxiety

It is important to notice that 4 studies focused on both anxiety and depression. One of them used indirect human assistance (van Straten, Cuijpers et al. 2008), two were automated (Christensen, Griffiths et al. 2004; Deitz, Cook et al. 2009) and in one study both direct and indirect human assistance were used (Mailey, Wojcicki et al. 2010).

3.4 CONTENT OF INTERVENTION

The active therapeutic components in the interventions are described below.

3.4.1 Anxiety

In 8 studies the content of interventions were based on cognitive behavior therapy (Christensen, Griffiths et al. 2004; Klein, Austin et al. 2009; Klein, Mitchell et al. 2009; Knaevelsrud and Maercker 2009; Christensen, Griffiths et al. 2010;

Christensen, Guastella et al. 2010; Kawai, Yamazaki et al. 2010; Roy-Byrne, Craske et al. 2010).
There were two studies based on a problem solving approach (van Straten, Cuijpers et al. 2008; Vliet and Andrews 2009) and one intervention was based on the promotion of occupational mental health information (Kawakami, Kobayashi et al. 2005). Another intervention regarded physical activity among students with mental health problems and was based on social cognitive theory (Mailey, Wojcicki et al. 2010).
The intervention in the study performed by Deitz and Cook was a health promotion programme aimed at providing the target population with information related to depression and anxiety (Deitz, Cook et al. 2009).

3.4.2 Depression and suicide

The content of all interventions related to depression and suicide was based on CBT. Different studies have used this approach with varying timetables and modules (Van Voorhees, Fogel et al. 2009; Griffiths, Crisp et al. 2010; Hickie, Davenport et al. 2010; van Spijker, van Straten et al. 2010; Bockting, Kok et al. 2011).

3.5 Demographic Pattern of Intervention

Out of 18 included studies, 10 reported proportion of sex and 15 stated the age group of participants. Among those reported, female participants were dominant (8 of 10 studies) (Klein, Austin et al. 2009; Klein, Mitchell et al. 2009; Knaevelsrud and Maercker 2009; Vliet and Andrews 2009; Christensen, Griffiths et al. 2010; Hickie, Davenport et al. 2010; Kawai, Yamazaki et al. 2010; Mailey, Wojcicki et al. 2010; Roy-Byrne, Craske et al. 2010).
Among those reported age groups, near all of them were between 18-65 years of old. Participants younger than 18 years old were only recruited in one study (14 to 21 years) (Van Voorhees, Fogel et al. 2009).

3.6 Measures and Outcomes

In the 18 reviewed articles, various outcomes were measured by different tools. Outcome measures in the included articles are explained in Table 4. In the following sections some of the important results are highlighted based on primary and secondary outcomes.

3.6.1 Anxiety

The primary outcome measured in two ongoing trials were severity of anxiety symptoms, level of anxiety symptoms, presence or absence of GAD measured by GAD-7 scale and ADIS-IV respectively (Christensen, Griffiths et al. 2010; Christensen, Guastella et al. 2010). There were many different secondary outcome variables measured using different tools among these two and other studies. However, depressive symptoms, anxiety symptoms, psychological well-being and work-related stress and quality of life were measured more frequently (Christensen, Griffiths et al. 2004; Kawakami, Kobayashi et al. 2005; van Straten, Cuijpers et al. 2008; Klein, Austin et al. 2009; Klein, Mitchell et al. 2009; Vliet and Andrews 2009; Kawai, Yamazaki et al. 2010; Mailey, Wojcicki et al. 2010; Roy-Byrne, Craske et al. 2010).

3.6.2 Depression and suicide

The primary outcomes in three out of five depression and suicide studies were, time until relapse and comorbidity with chronic physical illness, severity of depressive symptoms, reduction in frequency and intensity of suicidal thought measured by SCID, Nemisis somatic illness list, CES-D and BSS respectively (Griffiths, Crisp et al. 2010; Bockting, Kok et al. 2011) . Secondary outcomes varied in all studies and

were measured by different scales. Two studies have considered quality of life and user satisfaction as their secondary outcome measures (Van Voorhees, Fogel et al. 2009; Griffiths, Crisp et al. 2010).

In summary, among the 13 included studies that reported results, 10 demonstrated a significant reduction of symptoms (Christensen, Griffiths et al. 2004; van Straten, Cuijpers et al. 2008; Klein, Austin et al. 2009; Klein, Mitchell et al. 2009; Knaevelsrud and Maercker 2009; Van Voorhees, Fogel et al. 2009; Hickie, Davenport et al. 2010; Kawai, Yamazaki et al. 2010; Mailey, Wojcicki et al. 2010; Roy-Byrne, Craske et al. 2010) and 3 reported significant increase in knowledge of participants (Kawakami, Kobayashi et al. 2005; Deitz, Cook et al. 2009; Vliet and Andrews 2009) (Table 3).

Table 3. Overall outcome of the included studies

Outcome / Disorder type	Significant reduction of symptoms	Significant increase of knowledge	On going	Sum
Anxiety /stress	5	2	2	9
Depression & suicide	2	0	3	5
Depression & anxiety	3	1	0	4
Sum	10	3	5	18

Table 4. Different characteristics of the included Internet-based mental health interventions

Internet -based mental health interventions related to anxiety/stress

Study			Intervention					
Name	**Region**	**Design**	**Type**	**Content**	**Demography** • **Sample size** • **Mean age or age group** • **Gender**	**measures & outcomes**		
						Outcome Variable	**Association**	**Effect size or p value**
Roy-Byrne P, Craske MG, et al., 2010	USA	RCT	human assisted indirect	Coordinated Anxiety Learning and Management (CALM) computer assisted CBT program	1004 patients with anxiety 43 M/F	response	significantly , Higher proportion in intervention group responded	p<.001
						remission	significantly , Higher proportion in intervention group remitted	p<.001
						BSI-12	significantly lower in interventional group at 6months, p<.001 12months p<.001 18 months p=.05	-0.30 (-0.43 to -0.17) -0.31(-0.44to-0.18) -0.18(-0.30to-0.06)
Christensen H, Guastella AJ, et al., 2010	Australia	RCT	human assisted direct	web-based program for treating GAD, E-couch website, Healthwatch website	120 GAD 18-30 M/F	level of anxiety symptoms as indexed by scale scores on the GAD-7, reduction in worry(PSWQ),(AnTI)(LIS),WAQ-som,ASI CES-D,K10,DAS-21,AUDIT,CGI,(A-Lit),GASS SPIN,patient-health panic ongoing project		ongoing project
Christensen H, Griffiths KM, et al., 2010	Australia	RCT	Automated	WebGAD trial web-based program for GAD five trial arm , Ecouch, healthwatch Ecouch(Intervention): consist of 4 sections,Psychoeduation,CBT,relaxation, and exercise atttention control condition : healthwatch,it has information about various topics like environmental health,nutrition,medication,oral health	120 in each arm 18-30 M/F	severity of anxiety symptoms(GAD-7) scale GAD caseness status at 6 months worry anxiety sensitivity depression symptoms(CES-D) & PHQ depression Harmful alcohol use (AUDIT) disability (days out of role) health knowledge psychological distress(K10) help seeking perceived need for treatment personal and perceived stigma towards GAD symptoms of social phobia symptoms of panic(PHQ panic) availability of social support adherence preferences for treatment type and expectations of the trial		ongoing project
Klein B, Mitchell J, et al., 2009	Australia	pre-test & post-test	human assisted direct	PTSD online: 10-week Internet-based Cognitive	16 (intervention) 40 F 56 M M/F	treatment credibility	positive attitudes toward the credibility	67.2%
						PTSD	significant	0.42

Klein B, Mitchell J, et al., 2009	Australia	pre-test & post-test	human assisted direct	PTSD online: 10-week Internet-based	16 (intervention) 40 F 56 M	treatment credibility	positive attitudes toward the credibility	67.2%
						PTSD symptomatology and related secondry measures	significant reduction on symptoms and dissociation	0.42 0.49 0.34 0.31
						clinical significance	significant	85%
						treatment satisfaction	overall satisfaction significantly higher	65.1%
						therapeutic alliance	high level	84.6%
Knaevelsrud Maercker A., 2010	Germany	18 month follow up study	human assisted indirect	Internet- based treatment for posttraumatic stress. 10 sessions CBTin 5 weeks follow up at the end point and 3 months after(Intherapy)	34 34 M/F	Severity of PTSD symptoms, Depression, Anxiety Impact of event scale Brief symptom inventory Short Form-12	post treatment symptom levels were maintained at 18 month follow up.	P<0.001
Klein B, Austin D., et al., 2009(Klein, Austin et al. 2009)	Australia	RCT	human assisted indirect	Internet-based cognitive behavioural treatment intervention for PD	57 39 M/F	clinician PD rating clinician Ag rating PAMTH PDSS ASP DASS(depression) DASS(anxiety) DASS (stress) ACQ BVS WHOQOL (physical, psychological, social ,environmental) TCS TSQ TAQ	Overall the results provide evidence that the efficacy of human supported internet interventions does not appear to be dependent on the frequency of email received by patients	
Vliet HV, Andrews G., 2009	Australia	pre-post test	human assisted direct	Web-based stress management programe. PBS (problem-based solving)	464 students year 8(college) M/F	knowledge, coping competence and coping behaviour	significant increase in knowledge and support seeking coping and significant decrease in avoidant coping significant decrease in psychological distress and a significant increase in well being over the study period	
Kawai K, Yamazaki Y, et al., 2010	Japan	pre-test & post-test	Automated	Web based stress management program	168 39.3 +/ 8.7 M/F	psychological well-being CES-D	participants in depressive condition are easily discouraged or confused	
Kawakami M, Kobayashi Y., et al., 2005	Japan	RCT	human assisted indirect	web-based supervisor training on worksite mental health	190 (100 interv. + 90 control) 32.7 M/F	Changes in perception of worksite support	significant	P = 0.032
						supervisors' knowledge and	significant	P=0.046

						workers' psychological distress	non-significant	P>0.05
						other job stressors	non-significant	P>0.05

Internet -based mental health interventions related to depression

Study			Intervention					
Name	**Region**	**Design**	**Type**	**Content**	**Demography** • **Sample size** • **Mean age or age group** • **Gender**	**measures & outcomes**		
						Outcome Variable	**Association**	**Effect size or p value**
Hickie I Davenport T et al., 2010	Australia	RCT	human assisted direct	enhanced GP care+MoodGYM or enhanced GP care alone	1571patients+ 90 GPs 35 M/F	SPHERE-12 After treatment	significant	d=0.40
						K10 After treatment	significant	d=0.29
Bockting C, Kok G, et al., 2011	Netherlands	RCT	human assisted indirect	M-CT program Depression Free prevention of relapse program as part of a SMS based monitoring	MCT=107 TAU=107 M/F	time until relaps,comorbidities symptom severity,number of relapses economic evaluation		ongoing trial
Van Voorhees Fogel J., et al., 2009	USA	RCT	human assisted direct	Internet based depression prevention program	83 14-21 M/F	demographic diffs. fidelity dose physician relationships training socio-cultural relevance	MI superiority over brief advice MI had superior scores in trust and greater level of satisfaction with internet program but not training participants did not continue to use internet-based intervention after the study ended	
Griffiths KM, Crisp D,et al.2010	Australia	RCT	Automated	-Internet support group (ISG) - Automated internet intervention(ITP)	70000 18-65 M/F	depressive symptoms anxiety symptoms quality of life, disability, self esteem, perceived social support, loneliness, depression knowledge, stigma, help seeking behaviours, empowerment		ongoing trial

Internet -based mental health interventions related to anxiety and depression (mixed)

Study			Intervention					
Name	**Region**	**Design**	**Type**	**Content**	**Demography** • **Sample size** • **Mean age or age group** • **Gender**	**measures & outcomes**		
						Outcome Variable	**Association**	**Effect size or p value**
Mailey EL, Wojcicki TR, et al., 2010	USA	RCT	human assisted direct and indirect	internet-based physical activity website	47 25 years M/F	Physical activity	significant	0.68
						State anxiety	Non-significant	-0.09
						Exercise self efficay	More in control than intervention	-0.22

						Beck depression inventory	Non-significant	-0.12
						Barriers self efficacy	significant	-0.19
						the identification of psychiatric illness	significant	OR: 1.70 (1.30-2.10)
						number of ED-based behavioral health assessments by social workers and/or psychiatrists	significant	OR: 1.47 (1.13-1.90)
Christensen H, Griffiths KM, et al., 2004	Australia	pre-test & post-test	Automated	MoodGym website Based on CBT	182 in bluemood trial with19607 visitors M/F	age gender, initial depression severity score, number of assessments, symptom change measures	community users of the site are similar in gender distribution and severity of depression and that site exposure results in similar significant improvement	
van Straten A, Cuijpers P, Smits N., 2008	Netherlands	RCT	human assisted indirect	Web-based intervention based on PBS	213 45 M/F	CES-D MDI SCL-A HADS MBI-EE MBI-PA MBI-DP EQ-5D	for depression and anxiety: significant for burn out and quality of life: less significant	0.54 (0.25-0.84) 0.41 0.37 0.45 0.65 0.33 0.44 0.34
Deitz DK, Cook RF, et al., 2009	USA	RCT	Automated	web-based program for parents, The web-based YMH program consisted of four modules that were multimedia rich, fully narrated, and interactive.	99 42 M/F	Family function Parent-adolescent communication	non-significant	p=0.6
						increase in knowledge of childhood depression and anxiety	significant	p=0.08
						Attitudes about seeking help	non-significant	p=0.6
						self efficacy	significant	p=0.001
						reaction to program	non-significant	Not reported

Internet -based mental health interventions related to suicide

Study			**Intervention**					
Name	**Region**	**Design**	**Type**	**Content**	**Demography** • **Sample size** • **Mean age or age group** • **Gender**	**measures & outcomes**		
						Outcome Variable	**Association**	**Effect size or p value**
van Spijker BA, et al ., 2010	Netherlands	**RCT**	Automated	web-based self-help intervention for suicidal thoughts	260 18 M/F	reduction in frequency and intensity of: suicidal thoughts depressive symptoms anxiety symptoms		ongoing project

4. Discussion

The major focus of our study was on studies related to Internet-based mental health interventions regarding depression, anxiety and suicide.

Almost all of the published studies were performed in high-income countries with the significant dominance of Australia, USA and Netherlands, only a few in Japan and no studies in any middle or low-income countries. This is in contrast with the statistics shown by Internet World Stats in which Asia has the highest number of Internet users (922.3 million people, almost double that in Europe) in the world and therefore there are enormous possibilities for developing Internet-based interventions in that region.

Australia, with the highest number of related studies, is the pioneer in this field. It seems that Australia has shown great attention to mental health promotion at the national level with spending near $5.32 billion on mental healthcare in 2008 (National mental health report 2010, http://www.health.gov.au/internet/main/-publishing.nsf/Content/mental-pubs).

The increasing trend of publications over the years is predictable because of the enormous penetration of Internet in daily life (Muñoz 2010). From 1996 to 2003, a twelve-fold increase has occurred in the number of citations related to web-based therapies (from 13 citations in 1996 to 152 in 2002) (Wantland, Portillo et al. 2004).

In our review we noticed that most of the studies were not randomized control trials. Performing randomized clinical trial for Internet-based interventions has its own challenges and difficulties like number of drop outs or small sample sizes that researchers have to deal with (Ritterband, Andersson et al. 2006; Klein, Mitchell et al. 2009; Muñoz 2010). In order to resolve this problem, one probable solution is to give some incentives to participants to encourage them to complete the study (Mailey, Wojcicki et al. 2010). However, ethical issues should be considered carefully.

In our study we could find and include only one study related to suicide. The scarcity of automated or assisted internet-based interventions related to suicide can be interpreted from different perspectives. One probable reason is that these patients are at higher risk of committing suicide without seeking for help, while they are participating in the study. Therefore, immediate human support at that moment is crucial and computer software may not be a good substitute (Leach, Christensen et al. 2007). Another reason is that developers are mostly afraid of being sued if someone dies because of the design of their web-based intervention and they are mostly skeptical of designing such programs. A third reason is that the anonymity of participants should be disclosed at the time of crisis. In many studies researchers have to exclude suicidal individuals for preventing them from actual self -harm and other ethical considerations (van Spijker, van Straten et al. 2010).

Most of the reviewed interventions were human assisted. The nature of psychotherapies and mental health treatments are mostly based on counseling and direct communication between patient and mental health care provider. Lack of robust computerized clinical decision support systems (CDSS) in the field of mental health

disorders compared to somatic disorders creates difficulties to just rely on Internet interventions not equipped with a CDSS. Another reason may be ethical considerations. Individuals with sever chronic form of mental disorders have to receive different treatments including medications and planned visits by psychologists. Using automated Internet-based interventions for these patients may result in poor outcomes (Ritterband, Andersson et al. 2006; Muñoz 2010).

The frequency and mode of human contact (direct or indirect) is varied among different studies resulting in different outcomes. Telephone, SMS, and email based communications are the most common means of indirect human assisted Internet interventions. However, one study suggests that frequency of therapist contact does not change effectiveness of the intervention (Klein, Austin et al. 2009).

The content of interventions in the reviewed studies varied with regards to therapeutic components, number of modules, time for each session and user interface design. There were few interventions which combined information with graphic visualization or interactive media (Klein, Mitchell et al. 2009; Vliet and Andrews 2009; Christensen, Griffiths et al. 2010). Using graphic visualization and designing an appropriate and attractive user interface may result in better interaction of the end user with the system (Bates, Kuperman et al. 2003; Bruegge and Dutoit 2004). However, further comprehensive research focusing on the component of internet interventions and level of user satisfaction and usability is necessary.

In our study we have found that CBT is the therapeutic approach used in the majority of Internet-based interventions; this is because of sustainable effectiveness of CBT in face to face treatments for depression and anxiety and suicide. Other studies also highlighted these aspects of cognitive therapy (Leach, Christensen et al. 2007; Bockting, Kok et al. 2011).

Different types of Internet-based mental health interventions appear to be effective in terms of reducing symptoms of depression and anxiety which are comparable to face to face therapies and could help the patients to manage their illness (Christensen, Griffiths et al. 2004; Klein, Austin et al. 2009; Griffiths, Crisp et al. 2010; Hickie, Davenport et al. 2010). However, because of inconsistency in outcome measures used in different studies, it is difficult to pool and interpret these results. In addition, most of the tools which are used to measure outcomes are not specifically designed for Internet-based interventions; therefore developing standardized assessment tools concerning Internet-based interventions appears to be an important next step in this field of research.

In general, ease of access, cost-effectiveness, and anonymity may encourage users to use Internet-based mental health interventions (Christensen, Griffiths et al. 2004; Leach, Christensen et al. 2007; Hickie, Davenport et al. 2010; Muñoz 2010; Bockting, Kok et al. 2011). However, the level of public awareness towards availability and usage of such interventions depends on how much mental health policy makers put their efforts on this area.

4.1 Limitations

Due to the exclusion of “grey literature” and “file-drawer manuscripts” this review may be vulnerable to a publication bias, and thus result in an overly optimistic assessment of the value of internet-based mental health interventions.

Articles which were related to Internet-based interventions for alcohol consumption or substance abuse have not been included in our study.

Due to the lack of established taxonomy regarding terms and definitions in internet-based intervention research it might be possible that relevant studies were missed in our search strategy.

5. Conclusions

Internet seems to be a promising medium for mental health interventions. The reviewed studies showed promising efficacy in improving depression, anxiety and suicidality. However, due to a lack of standardized evaluation and accreditation systems, lack of common scientific nomenclature, and varying intervention contents, it is difficult to interpret but especially to compare the results of studies in this field. In addition, most of the websites still require direct human assistance to assure quality of care. In order to improve Internet-based mental health interventions, developing clinical decision support systems based on scientific guidelines, creating standardized evaluation and accreditation systems and using a common terminology should be a priority of the future research.

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