

Full Length Research Paper

Internet-based interventions for pain management: A systematic review of randomised controlled trial (RCTs) conducted from 2010 to 2014

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Limited access to pain management programs was identified as one of the hindering factors in pain treatment. Several internet-based interventions have been developed to improve accessibility. A systematic review of trials of such programs in 2010 documented a preliminary promising effect. A PubMed electronic search was used to identify a systematic randomized controlled trail (RCTs) published 1 January, 2010 to 4 November, 2014 that examined the effectiveness of internet-based pain management programs. The methodological vigorousness of trials was assessed by Jadad scoring system. Out of the 20 RCTs, 5 were on chronic pain, 2 were on acute non-specific pain, while 13 were on disease related pain (rheumatological and neurological diseases, burns, post-operative and cancer-related). Most studies had moderate methodological quality and showed consistent results with respect to effectiveness of internet based programs in reduction of pain, improvement in functionality and psychological well-being. Whilst the current systematic review found a significant pain reduction attributed to internet-based pain interventions further, high-quality RCT are needed to confirm such promising findings.

Key words: Pain, ache, migraine, sciatica, headache, management, treatment, technology, computer, computer-based, internet, internet-based, web, web-based, virtual.

INTRODUCTION

The International Association for Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage” (IASP, 1994). It is important to note that pain is an individual’s experience with an emotional variable attached to it. Thus, management of pain must take this fact into account. (Meredith et al., 2006) Depending on the type of

pain; chronic pain, defined as pain which persists a month beyond the usual course of an acute disease or a reasonable time for an injury to heal, or is associated with a chronic pathological process which causes continuous pain, or pain which recurs at intervals for months or years (Liddle et al., 2004), which seriously affects the quality of social life and working lives of people living in developing world (Breivik et al., 2006). The management

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of unrelieved pain continues to be a major public health issue. Even with the advancement in neurophysiology and pharmacology, this does not help to relieve the pain (European Federation of the International Association, 2004; Boulanger et al., 2007; Statistics Canada, 2008). Literature shows that the economic burden of unrelieved pain is higher than heart disease, cancer and diabetes (Phillips and Schopflocher, 2008). Studies shows that there are many reasons that hinder the cost effective management of unrelieved pain which are lack of knowledge of health professionals, under reporting and limited access to pain management program (Upshur et al., 2006; Peng et al., 2007; Lohman et al., 2010).

Recent studies focused on the management of pain through self employed means, which encourages participating patients to efficiently manage their pain, gain knowledge about the disease and give them confidence to effectively indulge themselves in self employed means (Wagner et al., 1996; Adams et al., 2006). Self employed means the use of internet based intervention, that is both cost-effective and user friendly (Bodenheimer et al., 2002). Literature showed that self management through internet based intervention has become a popular choice in the management of chronic diseases. There are different program designs that have been used by different researchers (Coleman et al., 2010). Internet based programs range from information through website, health risk assessment tools, internet-delivered psychosocial therapies, and multidimensional self-management support programs for children, adults and elderly (Eng et al., 1999).

Previous review conducted in 2010 reported that internet-based interventions seem promising for people in pain (Bender et al., 2011). As with the growing population, the need for cost-effective methods that can reduce the traveling cost, increase the knowledge and confidence of managing the unrelieved pain and also positive change of individual in terms of both behavioral and clinical outcomes are in high demands (Fox, 2008). Literature shows that internet based program can meet the population unmet demands (Gerber, 2006; Fox, 2008).

This review aims to analyze the impact of new management practices and ever evolving means like mobile and internet from 1 January, 2010 to 4 November, 2014 in order to understand the role of this recent development in managing pain of children, adults and elderly. This review will synthesize the newly emerging evidence that involve broad range of internet based intervention in broader age group with broader range of diseases including migraine, sciatica, osteoarthritis, rheumatic arthritis, burn pain and others as all these types of pain badly impact the social and economic aspects of one's life. Additionally, this review will expand upon previous review (Bender et al., 2011) by profoundly probing the recent literature for diverse internet-based interventions. We have tried to expand the findings of these two earlier syntheses by including the evidences

from more studies, and by including multidimensional effects of internet based intervention on these diverse groups of pain.

METHODOLOGY

An electronic search for this systemic review was conducted to identify articles in PubMed that met our inclusion criteria. The following key words were searched with Boolean words OR and And: Pain, ache, migraine, sciatica, headache, management, treatment, technology, computer, computer-based, internet, internet-based, web, web-based and virtual. Each type of pain was added with Boolean phrase with different terminologies like management, treatment, computer based, internet based and others. The same process was included for all the types of pain mentioned above. Inclusion criteria were publications in English language; publication in a peer reviewed journal; clinical trials published from 1 January, 2010 to 4 November, 2014. Initially, 899 articles were retrieved but after reviewing the titles only 51 articles met the inclusion criteria. Full text articles were retrieved for only those studies that were considered relevant by reviewer after reading abstracts. In depth, probing of full text articles were conducted by the reviewer to check that the articles have described different kinds of internet based intervention, including broad range of disease such as migraine, multiple sclerosis and other, has wide range of age group that involved children, adults and elderly, random allocation of study participant in intervention and control arm. Reviewer then selected relevant articles from the 51 articles and extracted information on many important variables in order to get in-depth knowledge of articles, and to reduce the chances of omitting relevant articles. After an in-depth review, 20 articles were selected. Jadad Scale was used to assess the methodological quality of trials, and high quality on the basis of Jadad Scale was assessed (Figure 1).

RESULTS

Our systemic review highlighted that out of 20 studies included in this review, 9 studies were on chronic pain, 2 were of sub acute pain, 4 were related to rheumatoid arthritis, osteoarthritis and joints pain. Other studies were related to multiple sclerosis, burn pain, cancer and cardiac surgery related pain (Kroenke et al., 2010; Miller et al., 2010; Miller et al., 2011, Martorella et al., 2012)

Description of studies

The sample size of the included studies varies from 26 to 2,480. All the studies included in the review were published between 2010 and 2014. Wide geographical variability can be seen among the selected studies. The studies are from UK, USA, Canada, Germany, Indiana and Jordan etc. The duration of internet based intervention varied from minimum of 7 days and a maximum of 9 months (Table 1).

Description of participants

Most studies targeted patients with chronic pain

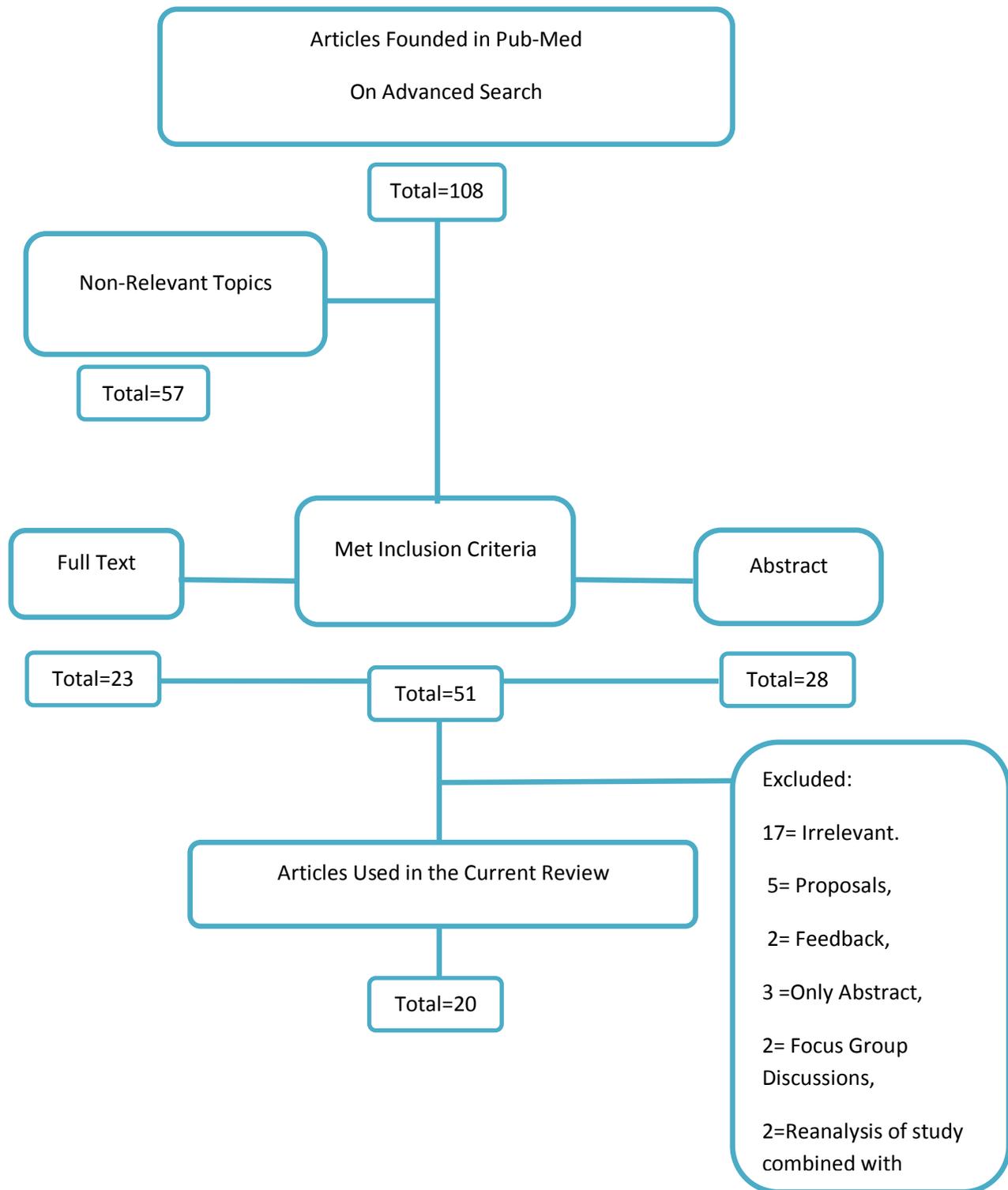


Figure 1. Flow chart of the systematic review.

syndrome including low back pain, migraine, fibromyalgia and musculoskeletal pain (Table 1). Wide age range used in these studies captures adults, elderly and children between 3 years and above. However, one study

only focused on children that were having acute burn pain (Miller et al., 2011). Socio-demographic characteristics of participants were reported by all the studies (Table 1).

Table 1. Selected characteristics of studies evaluating internet-based interventions for pain.

Study	Recruitment (Institution/Countries)	Condition	N	Age in years	Intervention	Control	Program length	Withdrawal
kerin (2012)	Department of veterans Affairs	nonspecific chronic back pain	229	51.2 (mean)	Pedometer access to a website that provided automated walking goals, feedback, motivational messages, and social support through an e-community	usual care	6, 12 months	10%
Ruehlman (2012)	USA	Chronic pain	305	19-78	Online chronic pain management program	wait-listed	7 and 14 weeks	21% 7 weeks 26.1% 14 weeks
Chiauzzi (2010)	Urban Medical School, USA	Chronic back pain	209	46.14	Interactive self-management Website	Standard text-based material	6 month	27% intervention, 16% controls
SE Lamb (2010)	Fifty-six General Practices, UK	Subacute and chronic LBP	701	54 (mean)	AM plus group-based, professionally led CBA	AM in general practice	12 months	15 %
Mahmoud (2013)	Department of Rehab Medc, King Abdullah University Hospital, Jordan	Chronic LBP	100	18-65	Multidisciplinary rehabilitation	Therapist-assisted exercise	36 hours and 40 minutes (6weeks)	
Emily (2012)	Academic Medical Center, USA	Chronic pain	26 adolescent-parents	11-17	Online behavioral pain management intervention	Standard medical care		7.7%
Carpenter et al. (2012)	Internet bulletin boards and advertisement, Seattle	LBP	164	>21	Web-based CBT self-help intervention	Wa\$it-list control	6 weeks	14% baseline 7.03% at 3 rd week 11.5% at6 week
Davis (2013)	USA	FM	79	>18	12-module online intervention MSER	FM patient assign to HT	6-week	37% MSER 51% HT
Bromberg (2012)	website postings electronic newsletter in Neuro centers, USA	Migraine	189	18-65	Web intervention	No treatment	6 months	Less than 100% for intervention 80% control
Buhrman (2013)	Registry, Sweden	residual pain problem	72	40.1(mean)	Guided Internet-delivered CBT	Participate in a moderated online discussion forum	8 weeks	22%

Table 1. Contd.

del Pozo-Cruz et al., (2013)	University Preventive Medicine Service, Spain	acute non-specific LBP	100	18-64	Video demonstration on proper sitting posture and related educational exercises	usual care	9 months	8% intervention 12% control
Simon (2012)	Insurees of a German sickness fund, Germany	depression or acute LBP	2480	20-40	PD	SPI	3 months	73%
Miller (2011)	SPPBC, Australia	acute burn care	40	3–10 years	MMD Group (combined protocol of procedural preparation and distraction)	SD Group		0%
Géraldine et al. (2012)	Cardiac surgery unit of the CHUM, Canada	first cardiac surgery	60	64 (mean)	SOULAGE-TAVIE	usual care, including an educational pamphlet and postoperative follow-up	7 day	13.3%
Miller et al. (2011)	Cleveland Clinic's Mellen Center, Ohio	MS	206	48.1(mean)	Secure electronic messaging plus the new MCCO components	Usual care	12 months	18.9%
Kurt et al. (2010)	INCPAD trial, Indiana	Depression and cancer-related pain	405	58.7(mean)	Centralized telecare management by nurse-physician specialist team with automated home-based symptom monitoring by interactive voice recording	Usual care	12 months	Withdrawal at 1 st month=11.9% 3 months= 16.3 % 12 month= 15.9% in both groups
Elander et al. (2011)	Haemophilia Society, UK	joint pain secondary to hemophilia	196	51.1(mean)	DVD intervention	Control were given booklet only	6 months	44.89%
Stinson et al. (2010)	Tertiary-level centers in Canada, Canada	Idiopathic arthritis	46	12 to 18	Internet intervention self-management program of disease-specific information, self-management strategies, and social support with telecare support	Usual care	12-week	18.1% from intervention and 20.8% from control
Cheryl et al. (2013)	Nationwide Convenience Sample of Adults, Missouri	RA	106	50 (mean years)	Online, cognitive– behavioral, self-management group program (RAHelp), with weekly telecare support	Wait-list control	10 week	11.3%
Bossen et al. (2013)	Articles in newspapers and health-related websites, Dutch	knee and/or hip OA	199	50.-75	Fully automated web-based	Waiting list control group	12 months	15.6% at 3 month 24.6% at 12 months 46% reached adherence threshold

1 CBA: Cognitive Behavioral Approach, 2 AM: Active Management, 3 LBP: Low Back Pain, 4:FM Fibromyalgia, 5:MSER :Mindful Socio-Emotional Regulation, 6 HT: Health Tips Attention, 7PD: Patient dialogue, 8 SPI :Static Patient Information, 9 SPPB: Stuart Pegg Pediatric Burns Outpatient Centre, 10 MMD: Multi Modal Distraction ,11SD: Standard Distraction, 12 MCCO: Mellen Center Care Online, 13 MS: Multiple Sclerosis, 14 INCPAD: Indiana Cancer Pain and Depression, 15 DVD: Digital Video Disk, 16 RA: Rheumatic Arthritis, 17 OA: Osteoarthritis.

Table 2. Jadad scores of internet-based interventions for pain.

Jadad items	Randomization	Sequence of randomization described	Double blind	Double blinding described	Withdrawals and drop out	Inappropriate randomization	Inappropriate blinding	Total
Score	0/1	0/1	0/1	0/1	0/1	0/-1	0/-1	5
kerin et al. (2013)	1	1	0	0	1	0	0	3
Ruehlman et al. (2012)	1	1	0	0	1	0	0	3
Chiauzzi et al. (2010)	1	1	0	0	1	0	0	3
Lamb et al. (2010)	1	1	0	0	1	0	0	3
Mahmoud et al. (2013)	1	1	0	0	1	0	0	3
Law et al. (2012)	1	1	0	0	1	0	0	3
Carpenter et al. (2012)	1	1	0	0	1	0	0	3
Davis and Zautra (2013)	1	1	0	0	1	0	0	3
Bromberg et al. (2012)	1	1	0	0	1	0	0	3
Buhrman et al. (2013)	1	1	0	0	1	0	0	3
del Pozo-Cruz et al. (2013)	1	1	0	0	1	0	0	3
.Simon et al. (2012)	1	1	0	0	1	0	0	3
Miller et al. (2011)	1	1	0	0	1	0	0	3
Martorella et al. (2012)	1	1	0	0	1	0	0	3
Miller et al. (2011)	1	0	0	0	1	0	0	2
Kroenke et al. (2010)	1	1	0	0	1	0	0	3
Elander et al. (2011)	1	1	0	0	1	0	0	3
Stinson et al. (2010)	1	1	0	0	1	0	0	3
Shigaki et al. (2010)	1	0	0	0	1	0	0	2
Bossen et al. (2013)	1	1	0	0	1	0	0	3

Interventions and control conditions

Different internet based interventions were used in this studies that consist of video demonstration, different module of mind socio-emotional regulation, patients dialogue, multi modal distraction, interactive self-management website, centralized telecare management, SOULAGE-TAVIE and others (Table 1) with wait list control, usual care control, and few studies had given some intervention along with the usual care. (Chiauzzi et al., 2010; Lamb et al., 2010; Elander et al., 2011; Martorella et al., 2012; Buhrman et al., 2013; Davis and Zautra, 2013; Nazzal et al., 2013).

Withdrawal from study

The number of participants that withdrew from the studies ranged from 0 to 73%. Most of the studies were compared with the characteristics of withdrawal. The baseline characteristics were compared with those who withdrew from the study and with those who had completed the study (Table 1).

Methodological quality

Because of validity and reliability, Jadad scale was used to evaluate the methodological quality.

The score has the following components randomization, sequence of randomization, blinding, description of blinding, withdrawal, improper randomization and improper blinding. The highest score is 5. Table 1 shows the result of scoring. Most of the studies included in our review had scored 3 (Gerber, 2006; Lamb et al., 2010, Stinson et al., 2010; Elander et al., 2011; Bromberg et al., 2012; Carpenter et al., 2012; Krein et al., 2013; Kroenke et al., 2012; Law et al., 2012; Martorella et al., 2012; Ruehlman et al., 2012) as blinding was not possible in most of the studies. Only two studies scored less on Jadad score (Miller et al., 2011; Shigaki et al., 2013) (Table 2).

Different scales used in the study

Different variety of scales has been used in different studies to report pain severity, stress and depression, and functional distress due to pain. The scales were VA: visual analogue; SOPA: Survey of Pain Attitudes; FABQ: Fear Avoidance Beliefs Questionnaire; PCS: Pain Catastrophizing Scale; RMQ: Roland Morris Disability Questionnaire; SF:

Short Form-12 mental subscale; 7 DASS: Depression Anxiety Stress Scale; BPI: Brief Pain Inventory; SBST: STarT Back Screening Tool; HRQL: Health-related Quality of Life; MO: Medical Outcomes Study and other (Table 3).

Different intervention and its effects

Chronic pain

The type of intervention varies depending on the different types of chronic pains. One study used website that provided automated walking goals, feedback, motivational messages, and social support through an e-community along with pedometer (Table 1). Other studies used 12-module online intervention Mindful Socio-emotional Regulation (MSER) (Davis and Zautra, 2013). One study used interactive self-management website, (Chiauzzi et al., 2010) and others used active management plus a group-based professionally led cognitive behavioral approach (CBA) (Lamb et al., 2010). All these studies reported reduction in pain and improvement in both functional activity and psychological well being. A study by Sarah et al. only reported on the reduction in pain in treatment arm when compared to the usual care control arm (Krein et al., 2013). Study by Nazzal et al reported 25 and 45% reduction in pain on different scales in treatment group and 49 and 25% reduction in disability. This study did not comment on the psychological well-being (Nazzal et al., 2013).

Acute non-specific pain

Two studies focused on the sub-acute non specific pain (Simon et al., 2012; del Pozo-Cruz et al., 2013). One study used video demonstration and other patients dialogue (Simon et al., 2012; del Pozo-Cruz et al., 2013). Del Pazo et al used age range of 18 to 64, while Simons included patients with age range of 20 to 40. del Pazo, reported that significant reduction was reported by participants in pain and disability while positive behavioral changes were found in 9 month of follow up (del Pozo-Cruz et al., 2013). On the other hand, Simons et al., reported the decision making was significantly improved in the participants who were in treatment arm (Simon et

al., 2012).

Osteoarthritis (OA), rheumatoid arthritis (RA) and other related diseases

Elander used DVD (Elander et al., 2011), Stinson used internet intervention self-management program of disease-specific information, self-management strategies, and social support with telephone support (Stinson et al., 2010)]. Shigaki used online, cognitive-behavioral, self-management group program (RAHelp), with weekly telephone support (Shigaki et al., 2013). Bossen used fully automated Web-based intervention (Bossen et al., 2013). Elander, Stinson and Danial reported reduction in pain in intervention group (Stinson et al., 2010, Elander et al., 2011, Bossen et al., 2013). While Shigaki and Bossen also reported positive psychological effects (Bossen et al., 2013, Shigaki et al., 2013). Bossen also reported improved physical activity in intervention group (Bossen et al., 2013).

Multiple sclerosis (MS), Burn, Cancer and Cardiac Surgery related pain

Miller et al designed multi modal distraction (MMD) for acute burn patients of age 3 to 10 years (Miller et al., 2011). Kroenke et al designed centralized telecare management by nurse-physician specialist team coupled with automated home-based symptom monitoring by interactive voice recording or internet for depression and cancer related pain (Kroenke et al., 2010). Miller Debora used secure electronic messaging plus the new MCCO components for patients having MS (Miller et al., 2011) and Geraldine used SOULAGE-TAVIE intervention for patients who had gone for first cardiac surgery (Martorella et al., 2012). Kroenke and Miller also reported reduction in pain intensity in treatment arm and reduction in distress score (Kroenke et al., 2010; Miller K et al., 2011). Miller Deborah reported higher general health-related quality of life (Miller et al., 2011). Martorella reported reduction in pain along with better functioning (Martorella et al., 2012).

DISCUSSION

With this review we took a step forward and included all the recent studies from 2010 to 2014. We included 20 studies that focused on the pain management on different age group of children between 3 to 10 years, 18 to 60 years adults, and more than 60 years elderly (Table 1). Out of 20 studies, 6 studies reported the outcome in terms of pain reduction, improvement in functionality and psychological health (Table 3). The results were consistent across all the studies except that of Chiauzzi

Table 3. Outcomes of internet-based interventions for pain.

Study	Pain	Functioning	Psychological	Cost
Kerin et al. (2013)	At 6 months, average RDQ scores were 7.2 for intervention participants compared to 9.2 for usual care, an adjusted difference of 1.6 (95% CI 0.3-2.8, $P=.02$) for the complete case analysis and 1.2 (95% CI -0.09 to 2.5, $P=.07$) for the all case analysis	Chronic Pain The MOS function measure also suggested greater improvements in function for intervention compared to usual care participants at 6 months	NR	NR
Ruehlman et al. (2012)	The growth rate difference was significant and indicated that the treatment group decreased by roughly 1.63 points more than the control group on PCP-S scale	PCP-EA Battery scales measured, perceived disability and pain-induced fear, produced significant group-by-time interaction effects,	Treatment group experienced a greater decrease in psychological problems relative to the control group	-
Chiauszi et al. (2010)	BPI participants inreported a significantly greater mean decrease in self-reported "worst pain" from baseline to posttest ($t = 2.71, P < 0.05$)	No statistically significant effect of condition over time on physical functioning was noted.	A significant effect of treatment over time for the stress subscale of the DASS ($F3, 197 = 3.92, P < 0.01$) participants who used the website reported significantly lower stress from baseline to 3-month follow-up ($t = 3.23, P < 0.01$) and 6-month follow-up ($t = 2.65, P < 0.05$). Website participants had a significantly greater increased use of coping self-statements from baseline to posttest ($t = -2.67, P < 0.05$), 3-month follow-up ($t = -3.19, P < 0.01$), and 6-month follow-up ($t = -2.44, P < 0.05$)	-
Lamb et al. (2010)	The difference between CBA and AM was estimated to be on average 3.2 at 3 months, 4.1 at 6 months and 3.8 at 12 months on Pain self-efficacy	Difference between the treatment arms was estimated to be, on average, 1.1 RMQ points at 3 months, rising to 1.4 and 1.3 RMQ points at 6 and 12 months respectively	(SF-12) The difference between CBA and AM was estimated to be on average 1.3 at 3 months, 2.5 at 6 months, and 0.1 at 12 months on SF 12. The difference between CBA and AM was estimated to be on average 2.6 at 3 months, 3.1 at 6 months and 3.0 at 12 months on FABQ	-
Nazzal et al. (2013)	25% reduction in VAS-pain average in treatment arm and 43 % reduction in McGill average pain	49 % decrease in disability score in the McGill scores and 25% reduction in VAS scores. Extension scores increased by 30% and Flexion by 13%. Work ability was increased to 50% in treatment group	NR	NR
Carpenter et al. (2012)	Significant difference between SOPA –Control, SOPA - Harm-Exercise PCS –Rumination PCS –Magnification in intervention group	Significant improvement in SOPA –Disability SOPA –Medication FABQ -Physical Activity n intervention group	Significant improvement in SOPA –Emotion Self-Efficacy PCS –Helplessness Negative Mood Regulation in intervention group	NR

Table 3. Contd.

Davis and Zautra (2013)	MSEER group reported increasing levels of pain coping efficacy (t=4.52, p<.0001)	MSEER group reported improvement in their ability to stay engaged in social activities despite pain (t=3.45, p<.0008), and marginal improvement in their enjoyment of family relationships (t=1.87, p<.07)	MSEER group showed marginally significant increases in positive affect (t=1.81, p<.07), MSEER participants also recorded decreases in feelings of loneliness (t=-2.70, p<.008) and family-related stress (t= -3.75, p<.0003), and greater stress coping efficacy (t=3.48, p<.0007)	Cost-effective
Bromberg et al., (2012)	Greater reduction in their pain catastrophizing from baseline to post-intervention (t = 3.34, P = .0030), baseline to 3-month follow-up (t = 2.98, P = .0099), and baseline to 6-month follow-up (t = 3.80, P = .0006), compared with control participants	No significant effect of treatment over time was noted	Post-hoc tests revealed significantly greater decrease in depression, as compared with the control condition, from baseline to 3-month follow-up (t = 3.66, P = .0009) and baseline to 6-month follow-up (t = 2.50, P = .0399); significantly greater decrease in stress, as compared with the control condition, from baseline to post-intervention (t = 2.57, P = .0324) and from baseline to 3-month follow-up (t = 3.23, P = .0045)	-
		Sub acute pain, RA, OA		
del Pozo et al. (2013)	Significant positive effects were found on mean LBP severity scores recorded in the online occupational exercise intervention group (SBST 23% change; 2.12 NNT; 0.80 effect size; -1.01 [-1.790 to 0.118] treatment effect; p = 0.019)	Significant reductions in the risk of chronicity of LBP, measured with SBST, were seen in the intervention group compared with the control group: 60.9% patients in the online occupational exercise intervention group were SBST low-risk at 9 months, compared with 27.9% patients in the control group (p < 0.01)	Significant positive effects were found for stage of change in behavior at nine-month follow up (p < .001)	-
Simon et al. (2012)	-	-	The PD group reported a significantly lower overall decisional conflict than the SPI group (38.7 vs. 45.1; p = 0.028) The largest standardized effect (Cohen's d 0.56) resulted from the preparation for decision-making (PD 59.4 vs. SPI 46.8; p < 0.001)	-
Elander et al. (2011)	Intervention, showed a significant, medium-sized, group _ time effect on pre contemplation, with reductions among the DVD group	-	-	-
Stinson et al. (2010)	In post treatment the experimental group had significantly higher knowledge (p < 0.001, effect size 1.32) and lower average weekly pain intensity (p = 0.03, effect size 0.78)	-	No significant group differences in HRQOL, self-efficacy, adherence, and stress post treatment	-
Buhrman et al. (2013)	-	-	Group differences with large and moderate effect sizes (ES) were found immediately post intervention for self-efficacy (ASES; ES 0.92, P _ 0.00001) and quality of life (QLS; ES 0.66, P _ 0.003)	-

Table 3. Contd.

Bossen et al. (2013)	At 3 months significant differences between the intervention and control group with respect to pain (P=.002; d=-0.2), tiredness (P=.04, d=-0.16), and improvements in self-efficacy for pain (P=.008, d=0.17) in favor of the intervention group	3months, participants in the intervention group reported a significantly improved physical function status (difference=6.5 points, 95% CI 1.8-11.2)	Positive self-perceived effect (OR 10.7, 95% CI 4.3-26.4)	-
MS, burn, cancer and cardiac surgery related pain				
Martorella et al. (2012)	Significantly less pain interference when breathing/coughing (P= .04)	Experimental group also exhibited fewer pain-related barriers as measured by the Barriers Questionnaire-II (mean 10.6, SD 8.3)	-	-
Miller et al. (2011)	-	MCCO-original group had higher general health-related quality of life as measured by the Euro-Quality of Life 5 Visual Analog Scale (p %0.04)	-	-
Miller et al. (2011)	Significantly reduced pain intensity (p < 0.001)number of pain adverse events were also reduced (p < 0.05) with the use of the MMD protocol	-	Significant decrease in distress scores (p < 0.001)	Cost effective
Kurt et al. (2010)	Of the 274 patients with pain, 137 patients in the intervention group had greater improvements in BPI pain severity over the 12 months 30%decrease in BPI	-	154 patients in the intervention group had greater improvements in HSCL-20 depression severity over the 12 months50%decrease in HSCL	-

1 VA: Visual Analogue, 2 SOPA: Survey of Pain Attitudes, 3 FABQ: Fear Avoidance Beliefs Questionnaire, 4 PCS: Pain Catastrophizing Scale, 5 RMQ: Roland Morris Disability Questionnaire, 6 SF: Short Form-12 mental subscale, 7 DASS: Depression Anxiety Stress Scale, 8 BPI : Brief Pain Inventory, 9 SBST: STaRT Back Screening Tool, 10 HRQL: Health-related Quality of Life, 11 MOS: Medical Outcomes Study.

et al. (2010) who reported improvement in pain reduction and psychological well being, but could not find statistically significant improvement in physical functioning. Bromberg et al likewise, reported the same findings (Bromberg et al., 2012). Stinson reported reduction in pain intensity but no group difference in self efficacy, adherence and stress (Stinson et al., 2010). Results of our review showed that the internet based intervention have improved over time and recent studies have catered on a wider age range group.

When outcomes' regarding psychological well-being of an individual was compared, consistent

results across all the studies except one conducted by Stinson et al 2010. Unlike the previous review that reported inconsistent results concerning the affects of internet based cognitive behavioral therapy (CBT) on psychological wellbeing (Bender et al., 2010). This inconsistency was explained as variability in the internet based CBT, while in our review, more studies focused on chronic pain of back pain and non-specific, only one study was related to migraine (Bromberg et al., 2012) and one about fibromyalgia (FM) (Davis and Zautra, 2013). Only 3 studies used internet based CBT (Lamb et al., 2010; Carpenter et al.,

2012; Buhrman et al., 2013), while others have used variable techniques to deal with pain. In previous studies out of 17, 11 studies used internet based CBT and had positive outcome (Bender et al., 2010). This review also highlighted the affirmative response of internet based intervention on children with acute burn pain. This study also highlighted the cost-effective nature of the intervention along with the better improvement in pain among young children between 3 to 10 years (Miller et al., 2011). From all the studies included in this review, it has been highlighted that internet based interventions are the new form of

treatment that cannot only reduce the pain, but also improve the functionality and psychological well-being of an individual (Table 3). The reason for this internet-based intervention improved outcome is mainly because of its availability. Readily available nature of internet-based interventions does not only make its usage easy but it also keeps the participants engaged.

This in turn not only divert the attention of an individual from pain intensity but also make an individual independent in controlling their situation with ease and pace (Bender et al., 2010). Internet based interventions improve both physical and psychological well being by keeping them engaged in different forums that can also give additional peer support.

Previous review commented on the limitation of participants' recruitment via newspapers and websites (Bender et al., 2010). Nonetheless, studies included in this review highlighted that only 3 studies have recruited participants from the news paper and website advertisements thus rules out the limitation of volunteer biased that was reported in previous review (Bromberg et al., 2012; Carpenter et al., 2012; Bossen et al., 2013). Most of the studies in this review recruited patients from clinic to highlight the strength of these studies, which show that these patients were in more need of treatment than the volunteered participants. Two studies received low Jadad scores, as in this nature of intervention the blinding was not feasible and comparable. Internet based control condition was not feasible but study conducted in Canada, Spain, UK and Australia used blinding approach but only single blinded approach was practiced as double blinded was not feasible (Lamb et al., 2010; Miller et al., 2011; Martorella et al., 2012; del Pozo-Cruz et al., 2013).

When we compare our review with the previous ones we can see much improvement have occurred and the withdrawal rates of the studies included in our studies are very low except for few studies which have reported high withdrawal rates. Studies having telecare support showed low withdrawal rates. Likewise (Rosser et al., 2009) found significantly lower withdrawal rates in studies with some therapist involvement compared to those with no therapist involved. The high withdrawal rates from few studies suggested that because of ease and distance that the intervention provided, this could lead to high attrition rates (Cuijpers et al., 2008). Future studies should take into account those participants who withdrew from the studies so that better strategies could be planned. But most of the studies reported low withdrawal rates suggesting improved strategies of upcoming therapies with limited span of intervention.

Most of the studies have reported the baseline characteristics of participants this involved male, females and also the elderly. Thus, the limitations of previous studies were that the finding could not be generalized as those which were done on adults and female. But with recent advancement, recent studies have involved both the gender with wide variety of age and wide

geographical involvement (Table 1). Thus through this review, we can see the widespread use of the internet based intervention in all the age group and across many geographical boundaries.

The inherit limitation of systematic review is publication bias; aim to reduce the chances of publication biased, studies which had provided negative and positive outcome were reported. Although, with incorporated articles there could be a chance of incomplete retrieval of identified research and reporting bias. Further limitations are no effect sizes were reported and no follow-up measures were reported. Other limitation of this review is that, as reported by previous review, (Bender et al., 2010) studies should focus on the role of internet based intervention for pain in relation to pharmacological therapy. This loop hole still persists in recent studies hence raises the question as whether internet based interventions are adjuvant or alternative of pain management when compared with pharmacotherapy.

Further limitation of the review is that only two studies have commented on the cost-effective nature of the internet-based intervention (Davis and Zautra, 2013; Miller et al., 2011). Future studies should compare the total cost and bring out some cost analysis report so that comparison in terms of cost can be evaluated.

Implication for practice

All the studies included in the review are from different geographical location that caters to a wide range of age group. Thus with known few limitations, it can be concluded that internet based intervention can play a vital role in the reduction of different kinds of pain and the improvement in functionality and positive effects in psychological well-being. However, it can be said conclusively on which extent these interventions are effective but it can also be said that all these interventions included in this article are helpful in wider age group.

Implication for research

Future studies should focus its perception on individual internet-based intervention, its long term feasibility and effectiveness. Cost-effectiveness of the internet-based intervention should be compared with the cost of standardized treatment in order to estimates its cost effectiveness for introducing this regimen in Third World countries. Also, standard reporting and evaluation guidelines should be formulated for internet based intervention in-order to make comparison more pronounced and logical so that future recommendation can be standardized for all the patients worldwide.

Conclusion

Internet based interventions are said to have alleviate

pain as shown in the 20 articles selected by the reviewers, where 5 studies were on chronic pain, 2 were of sub acute pain and 4 were related to RA, OA, and joints pain, including other studies that were about pain related to MS, fibromyalgia, migrain, burn pain, cancer and cardiac surgery. Most of these studies showed consistent results in reduction of pain, improvement in functionality and psychological well-being. Moreover, the studies based on the selected articles have confirmed results of previous review that internet based intervention of pain management have greatly improved the functional and psychological health of participants as specified and particularized in Tables 1, 2 and 3. Nonetheless, well designed studies are still required to make the treatment standardized all over the world.

Conflict of Interest

The authors have not declared any conflict of interest.

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