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## **Internet-based interventions for traumatic stress-related mental health problems: A review and suggestion for future research**

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### **ABSTRACT**

Exposure to potentially traumatic events is a common occurrence. Most individuals exposed to such an event are resilient or recover rapidly, although some individuals develop psychological problems that warrant treatment. However, a small percentage of individuals seek traditional treatment, thereby calling for novel approaches or methodologies of treatment. The present paper provides a comprehensive and critical review of the extant literature on computerized and internet-based interventions (IBIs) for traumatic stress-related conditions (i.e., panic disorder, posttraumatic stress disorder/complicated grief, depression, comorbid anxiety and depression, alcohol abuse, smoking cessation). Generally, computerized or IBIs for depression and anxiety are yielding effect sizes that are comparable to traditional psychosocial treatment. Interventions aimed at alcohol and smoking cessation generally have lower effect sizes than do IBIs for anxiety and depression. Most interventions reviewed in this paper included common components (e.g., were developed through a cognitive behavioral framework and included psychoeducation, cognitive restructuring, goal setting, exposure). Therefore, it is possible that these shared features may in part account for symptom reduction. Little is known regarding mechanisms of change. Future directions for novel web-based approaches to treatment are provided.

## **1. INTRODUCTION**

Estimates from studies with nationally representative samples have suggested that between 50 and 70% of individuals in the United States have been exposed to at least one potentially traumatic event (PTE) during their lifetime ( [Kessler et al., 1995] , [Kilpatrick et al., 2003] and [Resick, 1993] ). PTEs include a range of major life stressors, such as natural and technological disasters, combat exposure, rape, physical assault, child abuse, severe car crashes, and sudden death of a loved one. There is considerable variability in the way that individuals are affected by PTEs. Most commonly, individuals demonstrate resilience or recover rapidly. However, another potential trajectory is development of chronic mental health problems ( [Kessler et al., 1995] , [Kilpatrick et al., 2003] and [Resick, 1993] ). Mental health problems most prevalent in this population include posttraumatic stress disorder (PTSD), major depressive disorder (MDD), generalized anxiety disorder (GAD), panic attacks, and health-risk behavior such as substance abuse ( [Galea et al., 2002] , [Hoge et al., 2004] and [Kilpatrick et al., 2003]).

Treatment is often necessary to facilitate recovery to healthy levels of functioning for individuals who develop significant mental health problems after exposure to PTEs. However, the number of individuals who seek mental health services is strikingly low. In a community sample of adult crime victims only 12% of individuals initiated psychological services (Norris, Kanisaty, & Scheer, 1990). Research with soldiers returning from deployment to Iraq and Afghanistan found that only 25–40% of veterans with mental health problems actually sought mental health care (Hoge et al., 2004). These percentages are consistent with research on rape victims (Lewis et al., 2005). Several barriers to seeking mental health care have been identified (Hoge et al., 2004), including perceived stigma, scheduling difficulties, and access to care more broadly (e.g., lack of transportation or financial resources). These findings highlight the potential value of self-help, Internet-based, and other widely accessible resources designed for use by at-risk individuals who may be disinclined to access formal mental health services.

### **1.1. Current status of the self-help literature**

Several review articles have focused broadly on a wide range of self-help interventions such as bibliotherapy, workbook-based interventions, video protocols, and computerized interventions ( [Gould et al., 1995] and [Scogin et al., 1990] ). In their meta-analysis of 40 studies, Gould and Clum (1993) reported that self-help interventions had a strong overall effect size (.76) at posttreatment and moderate overall effect size (.53) at follow-up; these gains were comparable to those of clinician-delivered interventions. In a more recent meta-analysis, strong effect sizes were reported for self-help interventions designed to target anxiety and depressive symptoms (.84 at posttreatment and .76 at follow-up) (den Boer, Wiersma, & Van Den Bosch, 2004). There is evidence to suggest that self-help may be more appropriate for some clinical problems (e.g., skills deficits, phobia, depression) than others (e.g., overeating, smoking) (Gould & Clum, 1993).

Whereas previous reviews have generally focused on a wide range of self-help resources, relatively little is known specifically about the efficacy of Internet-based interventions. Internet-based interventions offer a good alternative to other self-help modalities for a variety of reasons. First, Web-based interventions are often personalized and tailored to the needs of a diverse group of users, including presentation of educational material in various formats (written, video, audio). Second, Web interventions can reach a large population at relatively low cost. Third, they can be accessed privately from the household, allowing individuals to avoid the perceived social stigma associated with seeking services relating to mental health and health-risk behavior. Fourth, they can be easily updated, refined, and expanded as the feedback and latest research findings dictate. Fifth, growth in Web usage has rendered it a viable method of intervention delivery. In the past decade, high-speed household Internet access has climbed sharply. In 2000, less than 5% of adult Americans had broadband access to the Internet in their household; this increased to 15% in 2003, 25% in 2004, 35% in 2005, 42% in 2006, and nearly 50% in 2007 (Horrigan & Smith, 2007). Major increases also have been seen in ethnic minority populations; it is reported that 40% of African American adults as of February, 2007, have broadband access at home, 9 percentage points higher than in 2006 (Horrigan & Smith, 2007). Many more have dial-up access. Further, many individuals use the Internet as a source of health information (Atkinson & Gold, 2002), and this also has recently increased considerably. Horrigan and Rainie found that, between 2002 and 2005, there was (a) a 54% increase in the number of adults indicating that the Internet played an important role as they helped another person cope with a major illness; and (b) a 40% increase in the number of adults indicating that the Internet played an important role as they coped with a major illness (Horrigan & Rainie, 2006).

As with bibliotherapy, the vast majority of self-help protocols found on the Web have been subjected to little or no scientific evaluation. However, there is an emerging body of literature providing empirical support for a small subset of these interventions. The current review summarizes the current state of the research literature on Internet-based interventions relevant to traumatic stress populations. We focused specifically on interventions for mental health and health-risk correlates that are known to be associated with exposure to traumatic events: PTSD, MDD, panic, alcohol abuse, and smoking.

## **2. METHOD**

Articles of potential relevance were identified using PsychInfo and PubMed to search a database of English language abstracts for articles published between 1969 and April 2008. The bibliographies of the articles identified via searches revealed additional sources. Only articles reporting the results of randomized controlled trials (RCT) for computer-based or IBIs were included in Table 1. A total of 36 articles met the inclusion criteria. These were loosely grouped by treatment target into six categories and presented in Table 1: a) panic disorder (PD); b) PTSD/complicated grief; c) depression; d) comorbid anxiety and depression; e) alcohol abuse; and f) smoking cessation. For each, information is provided regarding sample characteristics, intervention conditions, sessions/modules, level of clinician involvement, follow-up periods, and

within groups effect size. For studies that did not provide effect sizes, Cohen's *d* was calculated using the pooled standard deviation equation  $(M1 - M2 / (SD1 - SD2 / 2))$ . Effect sizes were averaged across outcome measures. IBIs developed specifically for PTSD that were not yet evaluated via an RCT were reviewed as well, but not included in the table.

**Table 1**  
Effects of IBI for conditions associated with traumatic stress.

Study	Participants	Intervention conditions	Sessions/modules	Clinician involvement	Follow-up (months)	DVs	Pre-post effect sizes ( <i>d</i> )	Pre-follow-up effect sizes ( <i>d</i> )
<b>Panic</b>								
Newman et al. (1997)	18 PD adults	1. CBT + computer 2. Clinician led CBT	1. 4 sessions with therapist; use of palmtop for 12 weeks 2. 12 sessions	1. 4 face-to-face sessions 2. 12 face-to-face sessions	6	FQ; MI; ACQ; BSQ	1.130 2.1.85	1.1.09 2.1.70
Garfring et al. (2001)	41 PD adults	1. IB-CBT 2. Wait list	1. 6 modules (psychoed., breathing retaining, cognitive restructuring, interoceptive exposure, in vivo exposure, relapse reduction) 2. 6 CBT sessions	1. Individual feedback on answers to post-module questions 2. None	N/A	Daily anxiety; panic diary; BSQ, ACQ, MI, BAI, BDI, QOLI	1.87 2. .05	N/A
Klein and Richards (2001)	22 PD adults	1. IB-CT 2. Self-monitoring	1. One week access to the program which included psychoed., coping techniques for panic, cognitive restructuring 2. 6 CBT sessions	1. None 2. None	1 week	PRF; DRF; SEQ; ASI	Not available	
Kenardy et al. (2003)	186 PD adults	1. 6 session CBT + computer 2. Clinician led 6 session CBT 3. Clinician lead 12 session CBT 4. Wait list	1. 6 sessions with therapist, computer reminders to use skills five times per day 2. 6 CBT sessions 3. 12 CBT sessions 4. None	1. and 2. 6 face-to-face sessions 3. 12 face-to-face sessions 4. None	6	FQ, MI; ACQ; STAI-T; SF-36; frequency of panic attacks; distress from panic attacks	1.191 2.1.46 3.2.48	1.1.63 2.1.74 3.2.27
Garfring et al. (2003)	22 PD adults	1. IB-CBT 2. IB-AR	1. 6 modules (psychoed. and socialization, breathing retaining, cognitive restructuring, interoceptive exposure, in vivo exposure, relapse reduction and assertiveness) 2. Dct's (1997) book adapted to Web (9 modules + CDs)	1. and 2. Standardized feedback to post-module questions	N/A	Daily anxiety; panic diary; BSQ, ACQ, MI, BAI, BDI, QOLI	4. .06 1.42	4. N/A N/A
Marks et al. (2004)	93 PD adults	1. IB-exposure (FearFighter) 2. Clinician led exposure 3. IB-Relaxation	6 h long sessions over 10 weeks in all conditions 1. FearFighter has 9 steps that include psychoed., treatment rationale, recruiting a co-therapist, identification of triggers, guided exposure tasks, coping skills, coping exercises, exposure homework, and troubleshooting 2. Similar to FearFighter, but lead by a clinician 3. Guided self-relaxation techniques, bio-feedback, homework	1. 6 face-to-face sessions 2. and 3. 5 min at the beginning and up to 15 min at the end of sessions	1,3	MPG; Global Phobia item of FQ; WSA	1.29 2.3.5	1 month follow-up 2.3.5 3.5
Garfring et al. (2006)	49 PD adults	1. IB-CBT 2. CBT	1. 6 modules (psychoed. and socialization, breathing retaining, cognitive restructuring, interoceptive exposure, in vivo exposure, relapse reduction and assertiveness) 2. Same modules conducted in-person	1. Individual feedback on answers to post-module questions; patients could send unlimited emails (M=15) 2. 10 face-to-face sessions	12	BSQ; ACQ; MI; BAI; BDI; QOLI	1.87 2.1.11	1.80 2.93
Schneider et al. (2005)	68 PD adults	1. IB-exposure (Fear Fighter) 2. IB-CBT (excluding exposure)	6 h long sessions over 10 weeks in both conditions 1. FearFighter has 9 steps that include psychoed., treatment rationale, recruiting a co-therapist, identification of triggers, guided exposure tasks, coping skills, coping exercises, exposure homework, and troubleshooting 2. Managing Anxiety is a CBT that excludes exposure	Both conditions had 6 scheduled therapist phone calls (M=18 min)	1	MPG; Global Phobia item of FQ; Global Impression; Patient Satisfaction; WSA	1.166 2.1.71	1.2.02 2.1.68
Klein et al. (2006)	55 PD adults	1. IB-CBT	1. 6 modules (intro, 4 learning modules, relapse prevention).	1. Unlimited emails answered within 24 h	3	Clinician PD; PDSS; # panic attacks one week before	1.122	1.1.68

		2. CBT workbook 3. Informational control	2. MAP-3 workbook 3. Read online panic resource (Info about nature, causes, effects, and treatment resources for PD)	2. Weekly telephone calls 3. Weekly telephone calls		assessment; clinician agoraphobia rating; ACQ; ASP; BVS; DASS; TCS; health rating; # GP visits one month before assessment	2. .96 3. .05	2. 1.14 3. N/A
PTSD/complicated grief Litz et al. (2007)	45 service members with PTSD	1. IBI-CBT 2. IBI-supportive counseling	1. 8 weeks (with maximum 56 log on days) that included self-monitoring, fear hierarchy, stress management, self-guided exposure, trauma writing sessions, progress review and relapse prevention 2. 8 weeks that included self-monitoring of nontrauma-related concerns and hassles, writing about these concerns, psychoeducation about trauma.	1. Therapist assistance in building hierarchy in person and via email, in person breathing training, phone call regarding narrative 2. Access to daily calls from therapists, email contact with therapists	3, 6	PTSD symptom scale interview version, BDI, BAI, daily online symptom ratings	Differential effect sizes are presented: .40-.51	Differential effect sizes are presented .09-.54 (3 month) .95-1.03
Lange et al. (2001)	25 Dutch students with posttraumatic stress and grief symptoms	1. IB-CBT 2. Wait list	1.5 weeks; 10 45-minute writing sessions; exposure and cognitive reappraisal 2. Psychoeducation	1. Therapists provided written feedback on essays 7 times	1.5	IES, SCL-90, Profile of Mood States	1. 1.15 2. .12	1. 1.31
Lange et al. (2003)	110 Dutch adults with posttraumatic stress and grief symptoms	1. IB-CBT 2. Wait list	1.5 weeks; 10 45-minute writing sessions; exposure and cognitive reappraisal	1. Therapists provided written feedback on essays 7 times	1.5	IES, SCL-90	1. .86 2. -.16	1. .93
Wagner et al. (2006)	55 complicated grief adults	1. IB-CBT 2. Wait list	1. Psychoed and 2 weekly 45-minute writing assignments over 5 weeks; 3 phases (exposure to bereavement cues; cognitive reappraisal; integration and restoration)	1. Therapist emailed assignments and gave personal feedback	3	IES; SCL-90; SF-12; Failure to Adapt Scale	1. .99 2. .13	1. .86 2. N/A
Hirai and Gum (2005)	27 subclinical PTSD adults	1. IB-CBT 2. Wait list	1. 8-week program consisting of psychoeducation, relaxation training, cognitive restructuring, exposure	1. Therapists emailed prompts for assessments and homework	N/A	STAI; BDI; IESR; SRQ; ACTS-General Strategy; Self-Efficacy Scale	1. 1.43 2. .51	N/A
Depression Selmi et al. (1990)	36 depressed adults	1. Computer-administered CBT 2. Therapist-administered CBT 3. Wait list	1. 6-session interactive CBT program: record of dysfunctional thoughts, scheduling pleasurable activities, and graded task assignments and homework. 2. Identical to computer-administered except administered by the therapist 3. Told they could begin treatment after 14 weeks	1. None 2. Therapist-administered treatment	2	BDI SCL-90-R	1. 1.170 2. 1.137	1. 2.30 2. 1.80
Clarke et al. (2002)	223 adults receiving medical services for depression and 76 nondepressed adults	1. IB-CBT 2. Access to Kaiser Permanente home page, TAU	7 chapters based on group CBT, focusing on interactive cognitive restructuring	None	1, 2, 4, 8	HRSD ATQ CES-D	1-month posttreatment 1. .61	8 months 1. .72
Patton (2003)	786 Canadian adults	1. IB-CBT 2. Psychoeducation control	1. 4 modules: cognitive restructuring, activity levels, sleep stimulus control and sleep hygiene, alcohol depression 2. 4 modules of general information about depression	None	1,2,3	CES-D, CIDI, measures of cognitive style, activity, sleep quality, alcohol consumption	N/A No differences between IBI and Control were found	2. .64

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**Table 1** (continued)

Study	Participants	Intervention conditions	Sessions/modules	Clinician involvement	Follow-up (months)	DVs	Pre-post effect sizes (d)	Pre-follow-up effect sizes (d)
Christensen et al. (2004), Mackinnon et al. (2008)—follow-up report	525 adults with depressive symptoms	1. MoodGym	1. 6 Internet CBT sections	1. Weekly contact by phone to direct use of website	N/A	CES-D, ATQ, medical literacy, psychological literacy, lifestyle literacy, CBT literacy	1. .58	6-months
		2. IB- Psychoeducation	2. Website providing psychoeducation on depression	2. Same as above			2. .50	1. .60
		3. Control	3. Weekly contact with a lay interviewer to discuss lifestyle factors (6 weeks)				3. .18	2. .59 3. .26 12-months 1. .73 2. .89 3. .46
Griffiths et al. (2004)	525 adults with depressive symptoms	1. MoodGym	1. 6 Internet CBT sections	1. Weekly contact by phone to direct use of website	N/A	Personal stigma, perceived stigma	1. .01	
		2. IB- Psychoeducation	2. Website providing psychoeducation on depression	2. Same as above			2. .06	
		3. Control	3. Weekly contact with a lay interviewer to discuss lifestyle factors (6 weeks)				3. -.08	
Bergstrom et al. (2003)	85 participants with mild to moderate depression	1. IB-CBT 2. Wait list	1. Internet-delivered CBT: psychoeducation, behavioral activation, cognitive restructuring, sleep/physical health, relapse prevention	"Minimal therapist contact"	6	BDI; MADRS	N/A	Gains maintained at follow-up.
Andersson et al. (2005)	117 mild to moderately depressed Swedish adults	1. IB-CBT and discussion group 2. Wait list and discussion group; delayed treatment	Behavioral activation, cognitive restructuring, sleep and physical health, relapse prevention	Therapist provided email feedback on quiz responses for each module; monitoring of discussion group	6	BDI, Montgomery-Asberg Depression Rating Scale, BAQ, Quality of Life Inventory	1. .77 2. .16	1. .62 2. .76
Clarke et al. (2005)	200 adults receiving services for depression and 55 matched nondepressed adults	1. IB with postcard reminders 2. IB with phone reminders 3. TAU control	7 chapters based on group CBT, focusing on interactive cognitive restructuring	None	5, 10, 16 weeks	CES-D, SF-12	5 weeks posttreatment	4 months
Spek et al. (2007)	301 Dutch adults over 50 with subthreshold depression	1. IB-CBT	1. 8 modules: psychoeducation, behavior change, cognitive restructuring, relapse prevention	None	N/A	BDI	1. 1.0	N/A
		2. Group CBT	2. 10 sessions, same material as IB				2. .65	
		3. Wait list					3. .45	
Anxiety and depression Proudfoot et al. (2003)	167 anxious and/or depressed adult general practice patients in England	1. Computer-administered CBT	1. 1 introductory video and 8 50-minute, weekly CBT sessions.	1. Nurses spent <5 min with participants at start or finish of sessions. Contact with regular GPs	1,3,6	BDI-II	1. 1.0	1 month
		2. TAU	2. Usual treatment prescribed by GP			2. .45	1. .94 2. .64 3 months 1. 1.24 2. .85 6 months 1. 1.26 2. .74	

Proudfoot et al. (2004)	248 anxious and/or depressed adult general practice patients in England	1. Computer-administered CBT 2. TAU	1.1 introductory video and 8 50-minute, weekly CBT sessions. 2. Usual treatment prescribed by GP	1. Nurses spent <5 min with participants at start or finish of sessions. Contact with regular GPs	1,3,6	BDI-II BAI WSA ASQ	1.85 2.35	6 months 1.95 2.48
Spence et al. (2006)	72 clinically anxious children and their parents	1. CBT partially delivered through internet 2. Clinic-based group CBT 3. Wait list control	1.10 child and 6 parent sessions, plus booster sessions at 1 and 3 months posttreatment identifying physiological symptoms of anxiety, progressive muscle relaxation, guided imagery, deep breathing, coping self-talk and cognitive restructuring, graded exposure, problem solving, self-evaluation and reward 2. Same as above, but all clinic-based	5 of 10 child and 3 of 6 parent sessions delivered via Internet	6, 12	Spence Children's Anxiety Scale, Revised Children's Manifest Anxiety Scale (RCMAS), Children's Depression Inventory (CDI), Child Behavior Checklist (CBCL)	1.99 2.142 3.42	12-months 1.124 2.198
Alcohol use Hester and Delaney (1997)	40 nonalcoholic heavy drinkers	1. BSCPWIN (computer-administered behavioral self-control program) – immediate 2. BSCPWIN – 10 week delayed start (functioned as wait list)	1. 8 sessions (over 10 weeks) of an interactive program that teaches goal setting, self-monitoring, rate control and drink refusal, behavioral contracting with rewards and penalties, evaluating overdrinking triggers, functional analysis of drinking, relapse prevention 2. Same as above, delayed start date	1. and 2. Clinician administered breathalyzer, available for questions during sessions (held at office)	20 weeks 12 months	Standard drinks per week; peak BAC per week; drinking days per week	1.73 2.31	1.117 at 20 weeks; 1.25 at 12 months 2. N/A
Kypri et al. (2004)	104 heavy drinkers using student health services in New Zealand	1. BI 2. Control	1. Web-based assessment questions and personalized feedback (e.g., summary of consumption, comparison to recommended upper limits and national norms, correction of norm misperceptions); Alcohol Facts and Effects leaflet 2. Alcohol Facts and Effects leaflet	Research assistants provided leaflets	6 weeks 6 months	Frequency of drinking, typical occasion quantity, total volume, frequency of heavy drinking episodes, Alcohol Problems Scale, Alcohol Role Expectations and Alcohol Scale	6 weeks post-intervention Effect size comparing BI to control = .40 for consumption, .45 for alcohol-related problems	Effect size comparing BI to control = .15 for consumption, .44 for alcohol-related problems
Hester et al. (2005)	61 problem drinkers (over 21 years of age)	1. Drinker's Checkup (computer administered motivational interviewing program) 2. Drinker's Checkup – 4 week delayed start (functioned as wait list)	1. Used motivational interviewing techniques (assessment, feedback, decision making, decisional balance, negotiating goals of change, plan of change). Entire program takes 1–2 h to complete. 2. Same as above, with a 4 week delayed start	1. and 2. A research assistant was sitting in the room while the program was completed; total therapist time per was about 10 min	12	Drinks per drinking day; average peak BAC	1.93 2.21	1.105 2. N/A

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**Table 1** (continued)

Study	Participants	Intervention conditions	Sessions/modules	Clinician involvement	Follow-up (months)	DI/s	Pre-post effect sizes (d)	Pre-follow-up effect sizes (d)
Riper et al. (2007)	261 Dutch adult problem drinkers	1. IB-CBT and self-control 2. Control – psychoeducation	1. 6 week interactive intervention 2. Online psychoeducational brochure on alcohol use	None	6	Alcohol consumption	N/A	Intervention participants decreased mean weekly alcohol consumption significantly more than control
Walters et al. (2007)	106 student heavy drinkers	1. Electronic Check up and Go (ECHUG) 2. Control – assessment only	1. Personalized feedback on quantity/frequency, peak BAC, peer-based norms, estimated risk, amount of money spent, advice and local referrals 2. Assessment only	None	2, 4	Alcohol consumption, peak BAC, RAPI	N/A	Intervention participants at 2 months decreased mean weekly alcohol consumption and peak BAC over control; by 4 months there was no difference
Smoking Schneider et al. (1990)	1,158 adult smokers	1. IBI full version, access to forum 2. IBI full version, no access to forum 3. Control (short version), access to forum 4. Control (short version), no access to forum	1. 4 week interactive, behavioral smoking cessation program; forum-moderated group discussion 3. Broad outline of smoking cessation program with little interactivity	None	13,6	Reasons for Smoking Test, daily cigarette consumption, abstinence rates	N/A	Treatment was associated with greater abstinence in comparison to control
Eiter (2005)	11,969 Swiss current and former smokers	1. IBI 2. Modified IBI	1. Completion of questionnaire and receipt of 6-9 page written feedback based on addiction theory 2. Completion of shorter questionnaire and receipt of 6-9 page written feedback based on nicotine replacement therapy and nicotine dependence	None	11 weeks	Smoking abstinence rates	N/A	IBI was more effective than the control (modified IBI)
Stretcher et al. (2005)	3971 nicotine patch users	1. IBI –tailored 2. IBI –non-tailored	1. CBT-based cessation guide, 3 tailored newsletters, support messages to participant and support person via email 2. Same except not tailored and no newsletters or emails to support person	None	6 weeks 12 weeks	Smoking abstinence rates	N/A	Tailored IBI resulted in higher cessation rates
Swartz et al. (2006)	351 adult smokers	1. IBI 2. Wait list	1. Five modules tailored to sex, age, race/ethnicity, and baseline survey data: benefits of stopping smoking, overcoming barriers, avoiding situations that prompt cravings, dealing with cravings, setting a quit date	None	3	Smoking abstinence rates	N/A	IBI resulted in greater abstinence
Brendryen and Kraft (2008)	396 Norwegian adult smokers	1. IBI – Happy Endings and nicotine replacement 2. Control – booklet and nicotine replacement	1. Daily web-based lessons, text messages, and automated phone calls for 6-weeks, less intensive contact for 54 weeks 2. Informational booklet with quit-calendar and quit log	None	12	Smoking abstinence rates	N/A	Happy Endings resulted in greater abstinence

(all acronyms in table): PD = panic disorder; CBT = cognitive behavioral therapy; PTSD = posttraumatic stress disorder; IB = internet-based; IBI = internet-based interventions; IB-AR = internet-based applied relaxation; IB-CBT = internet-based-cognitive-behavioral therapy; IBI-CBT = internet-based interventions-cognitive behavioral therapy; TAU = treatment-as-usual; IB-psychoeducation = internet-based psychoeducation; BSCPWIN = Behavioral Self-Control Training for Windows; ECHUG = Electric Check-Up and Go; GP = general practitioner; FQ = fear questionnaire; MI = motivational interview; ACQ = Agoraphobic Cognitions Questionnaire; BSQ = Body Shape Questionnaire; BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; QOLI = Quality of Life Inventory; PRF = panic record form; DRF = diary record form; SEQ = Self-Efficacy Questionnaire; ASI = Anxiety Sensitivity Index; SF-36 = 36 item health questionnaire; STAI-T = Trait only scale of the State-Trait Anxiety Inventory; WSA = Work and Social Adjustment Scale; PDSS = Panic Disorder Severity Scale; BVS = Body Vigilance Scale; DASS = Depression, Anxiety, and Stress Scale; ASP = Anxiety Sensitivity Profile; TCS = Treatment Credibility Scale; IES = Impact of Event Scale; SCL-90 = Symptom Checklist 90; SF-12 = 12-item version of SF-36; IESR = Impact of Events Scale-Revised; SRQ = Self-Regulation Questionnaire; ACTS = Active Coping with Trauma Scale; HRSD = Hamilton Rating Scale for Depression; ATQ = Automatic Thoughts Questionnaire; CES-D = Center for Epidemiologic Studies Depression (Scale); CIDI = Central Index of Dose Information; MADRS = Montgomery–Asberg Depression Rating Scale; RCMAS = Revised Children's Manifest Anxiety Scale; CDI = Children's Depression Inventory; CBL = Child Behavior Checklist; BAC = Blood Alcohol Content; RAPI = Rutgers Alcohol Problem Index.



### 3. RESULTS

#### 3.1. Interventions specifically for trauma-related conditions

Four Web-based interventions have been developed specifically for traumatic stress populations. Three of these interventions place primary emphasis on PTSD reactions following traumatic event exposure ( [Hirai and Clum, 2005] , [Lange et al., 2003] , [Litz et al., 2007] and [Litz et al., 2004] ). A fourth intervention (Ruggiero et al., 2006) includes a PTSD component but focuses more broadly on several mental health and substance-related reactions associated with traumatic events. We describe each of these interventions briefly below.

An IBI was developed and evaluated for individuals who had experienced a traumatic event and reported symptoms of PTSD that fulfilled DSM-IV reexperiencing and avoidance criteria (Hirai & Clum, 2005). The eight week program was CBT oriented and included psychoeducation, relaxation training, cognitive restructuring, and written exposure modules. Hirai and Clum conducted a small-scale randomized trial with 27 adults recruited from university and community-based settings. In comparison to a wait list (WL) condition, those receiving the IBI demonstrated greater improvements in anxiety, depression, frequency of intrusions and avoidance, self efficacy, and trauma-related coping. Effect sizes across measures for the treatment group were medium to large.

Litz, Williams, Wang, Bryant and Engel (2004) developed a self-help program to be employed in conjunction with therapist assistance that was developed with military trauma in mind; however, the authors state that the program can easily be adapted to other forms of traumatic exposure by changing the psychoeducational components. This program entails an initial two-hour face-to-face meeting in which the patient is oriented to the treatment website and taught two relaxation techniques, followed by an intended 52 day daily program. Throughout treatment the patient and therapist are in contact via email and telephone to ensure compliance, accuracy of completion of assignments, and if need be, crisis management. The internet program consists of techniques grounded in Stress Inoculation Therapy (Meichenbaum, 1994) and includes educational information on PTSD and common comorbid problems, strategies targeting sleep hygiene, coping skills, cognitive reframing, and trauma narrative exposure. Each day the patient logs on they are prompted to report on their trauma-related symptoms, and enter their homework from the previous day prior to being given new information and homework exercises. Results from a “proof-of-concept trial” have recently been reported (Litz, Engel, et al., 2007). This study was an eight week, randomized trial of a therapist-assisted IBI-CBT vs. an IBI-supportive counseling condition for patients exposed to the 9/11 attack on the Pentagon and soldiers returning from duty in Iraq and Afghanistan. Groups did not differ in drop out rate, and completion analyses suggested the IBI-CBT group had significantly lower PTSD, depression, and anxiety six months after the initiation of the trial.

Ruggiero et al. (2006) developed an IBI that incorporates psychoeducation and information about adaptive coping techniques for various mental health outcomes that are common in the aftermath of disasters and mass violence incidents. It is designed for use in an early intervention context to accelerate recovery among symptomatic adults. Consistent with expert recommendations (Litz, Gray, Bryant, & Adler, 2002), module development centered on

translation of evidence-based cognitive–behavioral approaches into brief Web-deliverable formats, and users were screened into modules only when they endorsed relevant symptoms. The intervention consists of seven interactive modules: (a) posttraumatic stress, (b) depressed mood, (c) generalized anxiety, (d) alcohol use, (e) marijuana use, (f) illicit drug use, and (g) cigarette use. Pilot and feasibility data from a sample of New York City-area residents followed longitudinally post September 11, 2001 are promising both in terms of the feasibility of this particular project and also for web-based interventions in general as potentially viable interventions following exposure to traumatic events.

In contrast to the interventions for PTSD described above in which the intervention is computer guided with little interaction with a clinician, Lange et al. developed and tested an online therapy led by a clinician over the internet ( [Lange et al., 2003] and [Lange et al., 2001] ). Utilizing an expressive-writing paradigm, treatment consists of 10 structured writing assignments that the patient completes in a 5 week period. Individual therapists receive the writing assignments, provide feedback, and give instruction on subsequent assignments. Moderate effect sizes have been found with a college sample (Lange, van de Ven, et al., 2001) and with a community sample (Lange, Rietdijk et al., 2003) of adults suffering from posttraumatic stress symptoms. Similarly, Wagner, Knaevelsrud, and Maercker (2006) implemented an expressive-writing IBI for complicated grief in which writing assignments were given via the internet to a patient from a therapist. In both Wagner and Lange's treatment packages, psychoeducation is provided online and the internet serves as the main communication device. However, these treatment protocols are highly clinician directed, whereas the other interventions reviewed are primarily computer mediated.

### **3.2. Panic disorder (PD)**

Anxiety disorders appear to be particularly amenable to Internet-based interventions due to the proven efficacy of cognitive–behavioral therapy (CBT) techniques (e.g., psychoeducation, self-exposure) that can be easily adapted to Web-based programs. Consequently, a growing number of computerized treatment programs have been created to treat various anxiety-related disorders, such as PD, a disorder for which nine IBI RCTs have been conducted.

Generally, IBIs have been found to be highly effective in treating PD, as well as affording a treatment modality that has higher availability and lower cost than traditional face-to-face services. As outlined in Table 1, studies utilizing a self-monitoring control group (Klein & Richards, 2001) or a WL ( [Carlbring et al., 2006] and [Carlbring et al., 2001] ) have demonstrated superiority of the IBI condition to the control condition in amelioration of PD symptoms. Although IBIs have typically performed strongly against control/self-monitoring groups, differences are more subtle when compared with face-to-face therapy ( [Carlbring et al., 2006] , [Kenardy et al., 2003] , [Marks et al., 2004] and [Newman et al., 1997] ). Three additional IBI RCTs for PD compared different strategies of therapy that did not include extensive face-to-face time with a clinician. Carlbring, Ekselius, and Andersson (2003) compared CBT to

relaxation, both administered via the internet, and found that both treatments were equally and significantly effective in reducing symptoms. In general, most IBIs for PD utilized a rendition of CBT; however, there is some evidence that not all CBT techniques are equally beneficial. Schneider, Mataix-Cols, Marks, and Bachofen (2005) compared two IB-CBT conditions, one with an exposure component and one without. Results indicated that although both conditions improved from baseline, the exposure condition was more effective in about half of the anxiety-related measures at follow-up. The efficacy of self-help manuals was also evaluated in a study (Klein, Richards, & Austin, 2006): compared to a self-help manual with limited clinician assistance, the CBT IBI condition experienced slightly greater improvement at a lower cost. This study also included an information-only control group, which did not yield symptom improvement for PD symptoms. In sum, moderate to large effect sizes for IBI conditions were found across studies, both at posttreatment and at follow-up (which ranged from one week to one year), supporting the utility of this treatment modality for PD populations.

### **3.3. Depression**

Ten RCTs have been conducted targeting depression, eight of which reported positive results, suggesting that IBIs can attenuate symptoms of depression (Table 1). Compared to a WL condition, four IBI RCT studies found lower depression scores at posttreatment and follow-up in the IBI group ( [Andersson et al., 2005] , [Bergstrom et al., 2003] , [Christensen et al., 2004] and [Spek et al., 2007] ). Mackinnon, Griffiths, and Christensen (2008) reported 6- and 12-month follow-up to their previous report (Christensen et al., 2004), and results indicated that treatment effects remained significant compared to the control condition. Griffiths, Christensen, Jorm, Evans, and Groves (2004) also found that the IBI reduced feelings of stigma over the control condition. Selmi, Klein, Greist, Sorrell, and Erdman (1990) compared computer-based CBT, therapist-delivered CBT, and WL conditions (Selmi et al., 1990). Results indicated that both CBT groups improved over the WL condition, and moreover, no significant differences were found between the computer- and therapist-delivered treatment groups. In one of the RCTs for depression that yielded a negative finding, Clarke, Reid, Eubanks, O'Connor, DeBar and Kelleher (2002) assigned participants to an access or no-access condition of a skills based training program. Most participants accessed the site infrequently ( $M = 2.6$ , range = 1–20). Clarke et al. (2005) conducted a second RCT for adults with self-reported depression. In this trial, reminders were sent to participants in the IBI condition. In contrast to the previous negative trial, results from this trial indicated lower depression in the IBI group compared to the control group. The second negative trial was reported in which a preventative IBI was developed and compared to an information-only control condition (Patton, 2003). No differences were found between conditions. It can be tentatively concluded that higher-intensity IBI for depression may be more efficacious, such as those described above.

### **3.4. Depression and anxiety**

Proudfoot, Goldberg, Mann, Everitt, Marks, and Gray (2003), and Proudfoot et al. (2004) evaluated an interactive, computerized, CBT-based intervention for anxiety and depression with a convenience sample of adult patients with untreated depression and/or anxiety. Participants were randomly assigned to the IBI condition or a treatment-as-usual condition, defined as practitioner-led treatment intended to approximate “natural conditions in primary care.” Results published in original and extension studies indicated that the IBI condition was superior to the treatment-as-usual condition in terms of decreasing depression and anxiety, as well as work and social adjustment ( [Proudfoot et al., 2003] and [Proudfoot et al., 2004] ).

### **3.5. Alcohol use**

The first RCT to address at-risk alcohol consumption was conducted in 1997 (Hester & Delaney, 1997). The authors developed a computer-administered behavioral self-control training (BSCT) program, an intervention with established effectiveness when administered by a clinician. Employing a delayed treatment control condition for nonalcoholic problem drinkers, results indicated that the computer treatment group decreased significantly over the delayed start group in terms of total drinks consumed and peak blood alcohol content (BAC), whereas drinking days per week decreased in both groups. Reductions were maintained at follow-up. Squires and Hester (2002) describe the development of their computer-based brief motivational intervention, with efficacy data presented in a later report (Hester, Squires, & Delaney, 2005). Also utilizing a delayed start control group, these authors found that the intervention significantly decreased the quantity and frequency of alcohol consumption, as well as alcohol-related problems. Results from a low-intensity (10–15 min) web-based screening and feedback program were also promising compared to a group who received a leaflet on alcohol facts and effects (Kypri et al., 2004). In comparison to the leaflet control group, those receiving the web intervention had lower alcohol consumption, binge drinking episodes, and personal problems at six week follow-up. Similarly, a cognitive–behavioral IBI for heavy drinkers was found to be more effective in reducing alcohol consumption than a psychoeducational control in an RCT (Riper et al., 2007). Assessment and personalized IBI feedback was reported to be more effective in reducing average weekly drinking and peak blood alcohol content compared to an assessment only condition (Walters, Vader, & Harris, 2007). Several other programs have been developed to reduce harmful drinking (Dimeff & McNeely, 2000); however, to date RCT efficacy data has not been reported.

### **3.6. Smoking cessation**

Although numerous web-based smoking cessation programs are available, only six studies have been conducted to examine efficacy of such programs. Schneider, Walter, and O'Donnell (1990) conducted the first RCT to examine a computer-based cessation program, finding a trend for the active computerized treatments over the control group in terms of abstinence rates.

Etter (2005) conducted an RCT to compare the efficacy of two Internet-based, individually tailored smoking cessation interventions. Participants included visitors to a smoking cessation Website who were randomly assigned to an interactive Web-based smoking cessation intervention or to a shorter modified program that focused more content on nicotine replacement therapy and nicotine dependence (and less education relevant to health risks and coping techniques). Among participants who were current smokers at baseline, abstinence rates were 10.9% for the original intervention vs. 8.9% for the modified, briefer intervention, a significant difference. Stretcher, Shiffman, and West (2005) examined the efficacy of a tailored vs. non-tailored web-based smoking cessation intervention. Results at six- and 12-week assessment revealed that participants in the tailored condition reported significantly higher continuous abstinence rates and satisfaction than participants in the non-tailored condition. In the only RCT for smoking cessation utilizing a WL control, Swartz, Noell, Schroeder, and Ary (2006) examined the efficacy of their personalized web-based program. At the 90-day follow-up the cessation rate for treatment participants was significantly higher than for wait-list participants (24.1% for treatment participants, 8.2% for control group participants). Similarly, an IBI/cell-phone treatment was found to be effective over an educational booklet in abstinence rates (Brendryen & Kraft, 2008). It should be noted that although the majority of published studies found positive results over control conditions, the abstinence rates are still quite low, underscoring the continued need for development and improvement in smoking cessation programs. Nonetheless, these studies mark the first RCTs conducted on smoking cessation, providing promising data for the utility of the internet to target this health-risk behavior.

### **3.7. Other interventions related to traumatic event exposure**

Exposure to traumatic events is associated with broad impairment (Amaya-Jackson et al., 1999), underscoring the need for interventions to address areas of possible impairment that may not be directly linked to a psychological disorder. For example, an IBI stress management program that may be applicable to traumatic stress populations was developed and tested (Zetterqvist, Maanmies, Strom, & Andersson, 2003). The program consisted of six treatment modules that addressed time management, problem solving, and cognitive restructuring. Posttreatment the IBI group had greater reductions in perceived stress, anxiety, and depression compared to the WL group. Additionally, an IBI for insomnia was made and tested to assess whether psychological treatments previously designed to be delivered in face-to-face settings, such as stimulus control and sleep restrictions, could be effectively administered through the internet (Strom, Pettersson, & Andersson, 2004). Using a WL control, this RCT found significant improvements in overall sleep quality for both groups, and greater improvement for the IBI group on morning wake time, wake after sleep onset, total wake time and total sleep time. These results show promise for IBIs targeting insomnia, another condition that is sometimes associated with traumatic event exposure. Additionally, IBIs have been developed for other substance abuse conditions (e.g., benzodiazepines, opioids).

#### 4. DISCUSSION

A growing body of research has suggested that a number of computerized and IBIs produce effect sizes that are comparable to clinician-administered interventions for anxiety and depression ( [Carlbring et al., 2001] , [Proudfoot et al., 2003] , [Proudfoot et al., 2004] and [Selmi et al., 1990] ), mental health constructs for which potentially traumatic stressors are known to increase risk (Kilpatrick, Ruggiero, et al., 2003). As noted above, most individuals with mental health diagnoses do not seek treatment ( [Hoge et al., 2004] and [Norris et al., 1990] ). Many trauma-exposed individuals who experience mental health problems may be drawn to IBIs for several reasons: (1) individuals with mental health diagnoses are not likely to seek treatment; (2) perceived stigma associated with mental health help seeking is high among this population and IBIs would overcome this barrier; (3) IBIs can be delivered at a low cost; and (4) IBIs may address significant geographical barriers for those in rural settings or with schedules that do not permit transportation time for treatment. Given that the essential behavioral features of PTSD are avoidance, alienation, and detachment, IBIs may be a more attractive treatment option. Given the high prevalence of exposure to traumatic events known to increase risk for mental health problems ( [Kessler et al., 1995] and [Kilpatrick et al., 2003] ), the potential value of effective, privately accessible, and cost-efficient mental health interventions that target post-trauma mental health outcomes is considerable.

To our knowledge, only four IBIs for PTSD have been developed (Hirai & Clum, 2005). Compared to other disorders, such as PD, for which 9 IBI RCTs have been conducted, controlled outcome research for PTSD is lacking. Only two RCTs ( [Hirai and Clum, 2005] and [Litz et al., 2007] ) have been conducted for a computer-centered intervention for PTSD. Therefore, future research is needed to determine the efficacy of IBIs for PTSD. One major limitation of existing IBI packages for the application to trauma-exposed populations is that they have a singular focus (e.g., PTSD only, depression only, anxiety only), which limits applicability to traumatic stress populations who are at risk for a broad range of mental health problems. For example, two of the four packages developed for trauma-exposed patients ( [Hirai and Clum, 2005] and [Litz et al., 2007] ) have a limited focus to PTSD symptoms. Yet, comorbid conditions are highly prevalent among individuals with PTSD ( [Kessler et al., 1995] and [Kilpatrick et al., 2003] ), which underscores the importance of incorporating intervention elements that attempt to address comorbidity (Ruggiero et al., 2006). Whereas IBIs exist that address many treatment targets applicable to traumatic stress populations, estimates of efficacy differ across treatment targets. For example, effect sizes for interventions targeting anxiety and depression tend to be higher than interventions targeting substance abuse, suggesting an area for future development and research.

With the exception of some of the controlled drinking IBIs (Hester et al., 2005), and Ruggiero et al.'s (2006) IBI package, the interventions reviewed address chronic conditions; therefore protocols amenable to a secondary prevention/early intervention context are needed. Early interventions are designed to reduce risk for chronic psychopathology following one or more traumatic stressors. They typically take the form of brief, education-focused secondary prevention protocols. Most of the IBIs reviewed were designed to treat chronic psychopathology, often a substantial time commitment from users is required. For example, both BluePages and

MoodGym entail six one-hour “sessions.” This significant time commitment precludes applicability to an early intervention context in which people often do not need, or have the time to devote to, the level of intensity of treatment delivered in existing packages. Early interventions have the potential to be enormously valuable if found to reduce risk for mental and physical health-related problems among traumatic stress populations in the aftermath of stressor exposure, and therefore future work is needed for development and evaluation of early intervention IBI programs.

It is also notable that few existing IBIs are aimed at treating children, adolescents, or parent-child dyads. Prevalence of exposure to traumatic events, and associated mental health problems, is high in adolescence (Kilpatrick, Ruggiero, et al., 2003). IBI programs may be especially useful for this population because internet usage is high among children and adolescents. Recent estimates, based on a 2006 survey by the Pew Internet and American Life Project of 935 parents and youth, indicate that 93% of 12–17 year old youth are online and 94% of their parents are online (Macgill, 2007). Notably, the highest rates of broadband access are found in parents of teenage children and other adults in the 30–49 year age range, 60% of whom have broadband access at home. Yet, few computer- or Web-based interventions have been developed and evaluated for youth and families, though preliminary results are encouraging. First, initial efficacy was documented of a Web-based intervention for pediatric encopresis with 24 children aged 6–12 years who were randomly assigned to Web intervention (completed at home) vs. no intervention (Ritterband et al., 2003). Children in the Web group demonstrated a significant reduction of accidents, whereas no change occurred for the non-intervention group. Second, Segal, Chen, Gordon, Kacir, and Gylys (2003) tested a stand-alone computerized protocol called Parenting Adolescents Wisely (provides information on effective communication, problem solving, respect, and assertive discipline) against a videotape protocol with comparable content. More than 50% of children in both groups showed reliable behavior change (i.e., pre-to-post difference scores exceeding 1.96 times the standard error of measurement); and about 40% of overall sample met well-established criteria for clinically significant change. Third, Demaso, Marcus, Kinnamon, and Gonzalez-Heydrich (2006) examined the feasibility and safety of a stand-alone Web intervention for childhood depression. Results were promising and supported the feasibility of the intervention, but efficacy evaluations have yet to be completed. Taken together, these and complementary studies in the self-help literature suggest that adolescents and families can meaningfully benefit from low-intensity interventions distributed via Internet.

The majority of the interventions reviewed included common components. For example, most IBIs were developed from a CBT framework and therefore included modules that addressed common components (e.g., psychoeducation, cognitive restructuring, goal setting, exposure). Given the similarities across studies, it is possible that common components may account for symptom reduction; however, little is known regarding mechanisms of change. There is a need for more systematic evaluations of Web-based interventions with the purpose of moving toward the study of mechanisms and processes associated with symptom and behavior change, such as dismantling studies that identify active ingredients. Additionally, research needs to be

conducted on dose-response effects to determine the amount of time patients need to devote to treatment to achieve maximal benefits. Studies should also seek to identify the incremental utility of clinician contact.

In sum, existing studies suggest that IBIs are efficacious in addressing a range of trauma-related mental health symptoms. They offer several advantages over clinician-administered treatments, including cost-effectiveness and accessibility. Promising avenues for further research include the examination of IBIs for PTSD and early interventions, as well as determining the differential efficacy in comparison to clinician-administered treatments.

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