Behavior Therapy

Internet-Based Intervention for Mental Health and Substance Use Problems in Disaster-Affected Populations: A Pilot Feasibility Study

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Early interventions that reduce the societal burden of mental health problems in the aftermath of disasters and mass violence have the potential to be enormously valuable. Internet-based interventions can be delivered widely, efficiently, and at low cost and as such are of particular interest. We describe the development and feasibility analysis of an Internet-delivered intervention designed to address mental health and substance-related reactions in disaster-affected populations. Participants ($n = 285$) were recruited from a cohort of New York City-area residents that had been followed longitudinally in epidemiological research initiated 6 months after the terrorist attacks of September 11, 2001. The intervention consisted of 7 modules: posttraumatic stress/panic, depression, generalized anxiety, alcohol use, marijuana use, drug use, and cigarette use. Feasibility data were promising and suggest the need for further evaluation.

A SINGLE DISASTER, TERRORIST ATTACK, or other large-scale incident can be far reaching, affecting thousands, or millions, of lives (International Federation of Red Cross and Red Crescent Societies, 2004). The consequences are often severe at the level of basic needs (e.g., injury, loss of resources), and a substantial body of research suggests that these events increase risk for a wide range of mental and physical health-related reactions, including posttraumatic stress disorder (PTSD), depression, drug and alcohol abuse, and increased cigarette use (e.g., Galea et al., 2002; Vlahov et al., 2002; see Norris et al., 2002). Clearly, early postdisaster interventions that effectively reduce the impact of such events can be of considerable value. Few early interventions have undergone rigorous scientific evaluation (Litz & Gray, 2004; National Institute of Mental Health [NIMH], 2002), with mixed results. For example, whereas psychological debriefing approaches have consistently fared poorly in the prevention of PTSD (see Rose, Bisson, & Wessely, 2001), some evidence-based interventions delivered several weeks post-incident appear to be associated with accelerated short-term recovery (e.g., Bryant, Harvey, Dang, Sackville, & Basten, 1998; Foa, Hearst-Ikeda, & Perry, 1995). Based on the current status of the empirical literature, experts have concluded that, in the aftermath of disasters and terrorism: (a) early interventions built on behavioral and cognitive principles may be beneficial in the secondary prevention of mental health problems, (b)

psychological debriefing approaches are contra-indicated, (c) it is inappropriate to prescribe formal psychological services to *all* victims of disasters, and (d) the expectation of resilience and/or normal recovery (i.e., absence or reduction of symptoms without intervention) is a reasonable working hypothesis, but that (e) disaster-response professionals should not wait to provide psychological care until problems have become chronic (Bonanno, 2004; Ehlers & Clark, 2003; Litz & Gray, 2004; Litz, Gray, Bryant, & Adler, 2002; McNally, Bryant, & Ehlers, 2003; NIMH, 2002).

Early interventions, typically defined as any form of psychological intervention delivered within the first 4 weeks of a potentially traumatic event (NIMH, 2002), vary considerably in content, timing, and method of delivery. For example, some early interventions include an exposure-based victimization-processing component whereas others are strictly psychoeducational or supportive in nature. With regard to timing, some early interventions are intended for implementation within hours or days of a traumatic event, whereas others have been initiated 1 to 4 weeks post-incident (e.g., Bryant et al., 1998; Foa et al., 1995). Method of delivery has also varied, with some early interventions being delivered via video (e.g., Resnick, Acierno, Holmes, Kilpatrick, & Jager, 1999) and others being clinician-directed (e.g., Bryant et al., 1998; Foa et al., 1995). Due to limited research and high variability in design and delivery formats, many important questions remain unanswered regarding the potential feasibility, value, and role of various forms of early intervention in disaster response. The utility of Internet-based interventions is of particular interest because they are highly accessible, transportable, and can reach a large population at low cost. Before describing the intervention developed for this study, we refer to relevant data from the literature on self-help and Internet-based interventions.

Research on Self-Help and Internet-Based Interventions

NONCOMPUTERIZED INTERVENTIONS

Research has yielded promising findings relating to the efficacy of self-help protocols delivered via videotapes, audiotapes, brochures, manuals, or bibliotherapy. Gould and Clum (1993) concluded in their meta-analysis of 40 studies that self-help interventions (a) had a large overall effect size (.76) at posttreatment and moderate overall effect size (.53) at follow-up, (b) had rates of attrition that were comparable to rates in psychotherapy, (c) produced gains comparable to those of clinician-

assisted interventions, (d) appeared more effective in some delivery formats than others for certain problems (e.g., videotaped presentation of easily modeled skills may be more effective than written descriptions), and (e) may be better equipped to address some clinical problems (e.g., skills deficits, phobias, depression) than others (e.g., overeating, smoking). In a more recent meta-analysis, den Boer, Wiersma, and van den Bosch (2004) reported large effect sizes for self-help interventions for anxiety and depressive symptoms (.84 at posttreatment and .76 at follow-up). Taken together, these observations suggest that many noncomputerized self-help approaches hold promise.

COMPUTERIZED INTERVENTIONS

Self-help interventions have traditionally been carried out without the use of computer technology. However, computerized interventions have several potential advantages over noncomputerized protocols. First, computer-based interventions (i.e., delivered via Internet, CD-ROM, DVD, floppy disk, computer hard drive, or other electronic device) often are designed to interact directly with users and can be tailored to the needs of a diverse group of participants. This allows for personalization of recommendations with minimal burden of superfluous material. Second, precise user data (e.g., time burden on users, answers to knowledge questions) are more readily collected via interactive computerized interventions relative to other, noncomputerized "self-help" methods, such as bibliotherapy or videotape protocols. Third, Internet-based interventions can reach a large population at relatively low cost and can be accessed wherever computers are available, whereas traditional self-help interventions may be less accessible (e.g., need to be purchased, transported) for portions of the population. Fourth, they can be accessed privately from individuals' homes and completed at users' own pace. Fifth, they can be easily updated, refined, and expanded on a continual basis as the empirical literature dictates. Since the release of the first popular graphical Web browser, growth in Internet usage has rendered it a viable method of intervention delivery. It is estimated that over half of all households have Internet access (Rainie, 2004) and over one-third use the Internet as a source of health information (Atkinson & Gold, 2002). As such, the Internet provides an inexpensive, easily updated, and exceptionally accessible medium to distribute preventive interventions.

Computer- and Internet-based interventions have performed well in several methodologically rigorous efficacy studies. For example, computerized interventions have been successfully used as adjuncts to clinician-directed treatment for individuals with

phobias (e.g., Przeworski & Newman, 2004), panic disorder (Newman, Kenardy, Herman, & Taylor, 1997), eating disorders (e.g., Celio et al., 2000; Winzelberg et al., 2000), and pediatric encopresis (Ritterband et al., 2003). Perhaps most striking, randomized controlled trials have supported the efficacy of computer/Internet-based interventions as front-line, virtually comprehensive interventions (i.e., with minimal or no clinician contact) for panic (e.g., Carlbring, Ekselius, & Andersson, 2003; Klein & Richards, 2001), depression (e.g., Bergström et al., 2003; Christensen, Griffiths, & Jorm, 2004; Clarke et al., 2002; Proudfoot et al., 2004; Selmi, Klein, Greist, Sorrell, & Erdman, 1990), weight loss (Tate, Wing, & Winett, 2001), and diabetes self-management (e.g., McKay, Glasgow, Feil, Boles, & Barrera, 2002). Moreover, several studies have reported effect sizes for computerized interventions that are comparable to those of clinician-administered interventions for anxiety and depression (Proudfoot et al., 2003, 2004; Selmi et al., 1990). In light of these data, the translation and extension of computerized interventions into early intervention and postdisaster contexts would appear to hold considerable promise.

The Present Study

This study represents an initial step toward the development and evaluation of a new Internet-based early intervention for disaster-affected populations. The purpose of this pilot study was to preliminarily evaluate the feasibility of the intervention using a longitudinal epidemiological sample of New York City-area residents who were initially recruited approximately 6 months after the September 11 attacks. Whereas a future goal in this line of research is to evaluate the effectiveness of this protocol as an *early* intervention following a large-scale incident, the present study was limited to assessment of feasibility *outside of an acute, postdisaster context*. Thus, the present study cannot speak directly to feasibility in the early aftermath of disasters. However, the strengths of the study design allowed us to capitalize on the availability of a preexisting, well-characterized cohort sample to assess feasibility more broadly. For example, this design enabled us to compare adults who accessed versus did not access the Web intervention on key variables because complete data were available on the larger sample from which the present sample was drawn. Further, participants were recruited from a sample that was constructed via random digit dial procedures, thereby strengthening confidence in the representativeness of the original sample. Finally, recruitment occurred from a previously disaster-affected population that was well characterized with regard to their experiences and physical and mental health functioning in the aftermath of the September 11 attacks.

Development of our intervention was guided by promising findings in support of other early interventions that were built on behavioral and cognitive principles (e.g., Acierno, Resnick, Flood, & Holmes, 2003; Bryant et al., 1988; Foa et al., 1995; Resnick, Acierno, Kilpatrick, & Holmes, 2005). Specifically, an educational and skills-based approach was used to guide the development of a computerized intervention targeting prevalent reactions in the aftermath of disasters and mass violence. This Internet-based intervention was designed to provide education to adults on common emotional and behavioral reactions to traumatic stressors as well as effective coping strategies. Separate modules, selected on the basis of epidemiological research having found these clinical problems to be prevalent following exposure to disasters and traumatic events (e.g., Galea et al., 2002, 2003; Kilpatrick et al., 2000, 2003; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993; Ruggiero, Van Wynsberghe, Stevens, & Kilpatrick, in press; Vlahov et al., 2002), were developed for: (a) posttraumatic stress and panic, (b) depression, (c) generalized anxiety or excessive worry, (d) alcohol use, (e) marijuana use, (f) drug use, and (g) cigarette use. Content was broadly designed to address these symptom domains as correlates of disasters and potentially traumatic events; thus, language directly relating to the September 11 terrorist attacks was minimized despite its high relevance to the present sample. All modules were guided by empirically based principles and procedures drawn from the best available psychological interventions for each clinical domain.

Several research questions guided this NIDA-funded feasibility study. First, are there differences relating to demographics, disaster exposure, and disaster impact (e.g., mental health, substance use) among those with Internet access versus those without? Second, how many participants will access the study Web site, and what factors will predict those who access versus do not access (e.g., what proportion of those with relevant mental health problems)? Third, how effectively do module screeners differentiate diagnostic versus subdiagnostic participants who access the study Web site? Fourth, of those participants who screen into one or more modules, how many will complete the module and what variables will differentiate completers versus noncompleters? Fifth, what is the time burden of the intervention to participants? Sixth, what are participants' reactions and feedback (e.g.,

satisfaction) concerning the Web intervention? Finally, do participants who complete certain modules experience gains in knowledge relating to the primary educational goals of the intervention?

Method

CONTEXT

Participants were recruited from a probability sample of adults following their participation in the third wave of a large epidemiological study of New York City-area residents who were initially recruited approximately 6 months after the terrorist attacks of September 11, 2001 (Galea et al., 2003; Survey 3). The aims of the original multiwave study were to examine: (a) participants' exposure to the September 11 terrorist attacks; (b) mental and physical health correlates of exposure to the terrorist attacks; and (c) individual, familial, social, postdisaster, and community risk factors for mental and physical health-risk problems. The first wave of the study, conducted 6 to 9 months after the September 11 attacks, surveyed 2,752 participants aged 18 years and older from the New York City metropolitan area. Participants were recruited via random digit dial methods and a random adult household member was selected for interview (Galea et al., 2003). Shortly after the 1-year anniversary of the September 11 attacks, a second wave of the study was completed with 1,939 participants (70.5%) from the original sample. A third wave was conducted 2 years after the attacks with 1,832 participants (66.6%) from the original sample. The sample for the present pilot feasibility study was drawn from the 1,832 participants who completed Wave 3. Note that, because this pilot study was initiated 2 years after the September 11 attacks, our evaluation of feasibility may not generalize well to the early aftermath of disasters.

The distribution of demographic characteristics of the cohort at all three survey waves was similar to that in the New York City metropolitan area according to 2000 U.S. Census data, supporting the representative nature of the sample. However, some variables were associated with attrition in the longitudinal study. Table 1 illustrates demographic and mental health variables that differentiate Wave 1 participants who *completed* versus *did not complete* the Wave 2 or Wave 3 interviews. Briefly, older participants (aged 35 and over) were more likely than younger participants to complete at least one follow-up interview. Further, Caucasian participants were most likely, and Hispanic participants least likely, to complete at least one follow-up wave. No differences existed on the basis of gender or diagnostic status.

Table 1

Correlates of attrition in the longitudinal epidemiological sample from which participants were recruited into the internet-based intervention study

Variable	Completed wave 1	Completed wave 2 and/or wave 3	p-value
	Survey only (n = 534)	Survey (n = 2218)	
Age			
18–24	17.16	12.82	<.001
25–34	36.19	20.89	
35–44	18.06	21.17	
45–54	14.83	20.02	
55–64	7.90	13.32	
65+	5.86	11.79	
Gender			
Male	50.99	44.75	.058
Female	49.01	55.25	
Race			
White	43.16	55.84	.001
Asian	6.16	5.16	
African American	17.18	16.57	
Hispanic	28.90	18.40	
Other	4.60	4.04	
PTSD ever	13.86	15.17	.572
PTSD since 9/11	7.94	8.26	.863
PTSD related to 9/11 attacks	5.94	6.03	.955
Depression ever	16.40	18.29	.448
Depression since 9/11	9.85	9.32	.786

Note. Values in the table are percentages. Original epidemiological sample (i.e., Wave 1) consisted of 2,752 participants, 1,939 (70.5%) of whom completed Wave 2 interview, and 1,832 (66.6%) of whom completed Wave 3. Of Wave 3 completers, 279 were unavailable for Wave 2. Thus, at least one follow-up wave was completed by 2,218 participants (1,939 + 279); 80.6% of original sample.

PARTICIPANTS

The sample was drawn from the 1,832 participants completing Wave 3 interviews. Prior to the study, 796 (43.4%) participants were removed from the recruitment pool based on the following exclusion criteria: (a) no Internet access from home (n = 603; 32.9%), (b) participant did not provide mailing address and therefore could not be sent an invitation letter (n = 173; 9.4%), or (c) not English-speaking (n = 20; 1.1%). Table 2 describes differences between those who were *invited* versus *not invited* to participate in the Internet-based intervention study. Briefly, those excluded from the recruitment pool were more likely to be women, African American or Hispanic, older, unemployed, and less educated. These findings are concordant with U.S. Census Bureau (2001) data documenting sociodemographics associated with household computer and Internet access. Thus, the final recruitment pool (n = 1,036) appears to be fairly

Table 2

Participants from the wave 3 recruitment pool who were *invited* versus *not invited* into the internet-based intervention study (alpha = .01)

Variable	Invited (*n* = 1,035)	Not invited (*n* = 795)	*p*-value
Female gender	52.9%	60.0%	.002
Age categories			<.001
18–24 years	9.6%	5.5%	
25–34 years	22.5%	15.7%	
35–44 years	26.2%	19.0%	
45–54 years	22.1%	19.0%	
55–64 years	11.9%	16.5%	
65+ years	7.6%	24.4%	
Educational attainment			<.001
<High school degree	1.5%	17.7%	
High school/GED	15.9%	27.9%	
Some college	20.4%	18.3%	
College graduate	39.7%	22.5%	
Graduate work	22.5%	13.6%	
Racial/ethnic status			<.001
Caucasian	67.4%	56.4%	
Asian	5.7%	5.4%	
African American	11.6%	16.5%	
Hispanic	11.8%	19.0%	
Other	3.6%	2.7%	
Born in the United States	79.0%	70.7%	<.001
Employed past week	72.9%	53.6%	<.001
Marital status			<.001
Married	51.1%	40.7%	
Divorced	10.8%	11.0%	
Separated	4.0%	4.3%	
Widowed	3.0%	15.3%	
Never been married	24.6%	24.4%	
Unmarried couple	6.2%	4.4%	
Sought health info online	20.6%	8.2%	
Current overall health			<.001
Excellent	24.0%	15.9%	
Very good	38.2%	26.4%	
Good	25.6%	29.3%	
Fair	9.1%	20.8%	
Poor	3.1%	7.7%	
Past-year depression	13.9%	15.7%	.285 (*ns*)
Past-year PTSD	14.5%	17.0%	.153 (*ns*)
Past-year marijuana use	7.3%	4.0%	.004
Past-year cigarette use	25.1%	25.3%	.957 (*ns*)
Past-year alcohol abuse	3.4%	2.6%	.412 (*ns*)
Past-year panic attack	17.8%	27.0%	<.001
Past-year stressor exposure	34.0%	30.2%	.412 (*ns*)
September 11 variables			
Lost job because of 9/11	5.4%	3.8%	.118 (*ns*)
Lost/damaged belongings	4.4%	2.6%	.042 (*ns*)
Lived below 110th St.	31.3%	33.5%	.328 (*ns*)
Acquaint. killed/injured	29.1%	21.4%	<.001
Friend killed/injured	15.7%	13.9%	.288 (*ns*)
Relative killed/injured	4.4%	3.3%	.243 (*ns*)
Saw WTCD in person	31.6%	24.3%	.001

Table 2 (*continued*)

Variable	Invited (*n* = 1,035)	Not invited (*n* = 795)	*p*-value
Saw WTCD on live TV	64.8%	68.5%	.100 (*ns*)
NYC borough			.654 (*ns*)
Bronx	4.5%	5.7%	
Brooklyn	21.1%	21.9%	
Queens	8.6%	10.5%	
Manhattan	61.3%	57.8%	
Staten Island	4.5%	4.1%	

Note. *N* = 1,830. PTSD = posttraumatic stress disorder; WTCD = World Trade Center Disaster; *ns* = nonsignificant. Acquaint. = acquaintance.

representative of the population of New York City-area residents with household Internet access.

A total of 325 individuals from the recruitment pool accessed the Web site during the course of the study (differences between those who accessed versus did not access the Web site will be described in the Results section). Of these, 285 consented to participate on-line (no sociodemographic, mental health, or September 11-related variables differentiated consenters and nonconsenters; alpha = .01). The final study sample (*n* = 285) included 144 men (50.5%) and 141 women (49.5%) with a mean age of 41.9 years (*Mdn* = 41; *SD* = 13.6). Racial/ethnic distribution was 72.9% Caucasian, 8.6% Asian, 6.1% African American, 9.3% Hispanic, and 3.2% other. Marital status was 44.9% married, 11.6% divorced, 1.8% separated, 1.1% widowed, 35.1% never married, and 5.6% member of an unmarried couple. With regard to educational attainment, 1.1% did not have a high school degree, 13.3% had a high school degree only, 15.8% had some college education, 41.8% were college graduates, and 28.1% had some graduate education.

MEASURES

There were three sets of measures relevant to the present study: (a) the Wave 3 survey interview, (b) brief on-line screeners for participants accessing the intervention to determine eligibility for each Web module, and (c) extended screeners within each Web module to guide educational content. We describe each level of assessment briefly below. In addition to these levels of symptom measurement, all of the Web modules included five satisfaction questions, and two (PTSD/Panic and Depression) included three premodule/postmodule knowledge-change questions. Satisfaction and pre/post questions are described in the results section.

Wave 3 telephone interview. Interviews included the following sections: (a) demographics, (b) peri-event experiences (e.g., September 11th exposure variables, panic), (c) past-year exposure to potentially traumatic events, (d) mental health

functioning (e.g., PTSD, depression), (e) resources (e.g., social support, use of services), and (f) physical health-risk variables (e.g., substance use, general health). *Past-year stressor exposure* was assessed using a series of behaviorally specific questions measuring exposure to rape or sexual assault, physical assault, natural disasters, serious accidents, witnessed death or injury, and other situations involving fear of death or serious injury. *Past-year PTSD* was assessed with the PTSD module of the National Women's Study (NWS) survey (Kilpatrick, Resnick, Saunders, & Best, 1989), a structured *DSM*-based interview with questions in closed-ended format. Research on the NWS-PTSD module has provided support for concurrent validity and several forms of reliability (e.g., temporal stability, reliability of administration, diagnostic reliability; Kilpatrick et al.; Resnick et al., 1993; Ruggiero et al., 2003). Further, the NWS-PTSD module was validated in a field trial against a well-established structured diagnostic interview (Structured Clinical Interview for *DSM-III-R* [SCID]; Spitzer, Williams, & Gibbon, 1986). In the field trial, the interrater kappa coefficient was .85 for the diagnosis of PTSD, and comparisons between the NWS-PTSD module and SCID yielded a kappa coefficient of .71 for current and .77 for lifetime PTSD (Kilpatrick et al., 1998). *Past-year major depressive episode* (MDE) was assessed using a module for depression adapted from the well-validated and widely used SCID. Questions were closed-ended with specific response metrics, permitting a highly structured interview corresponding to diagnostic criteria. Studies have provided support for internal consistency and convergent validity (Boscarino et al., 2004; Kilpatrick et al., 2003). Boscarino et al. (2004) compared the depression module against the depression scale of the Brief Symptom Inventory-18 (Derogatis, 2001), yielding a sensitivity of 73% and specificity of 87% in detecting MDE as classified by our instrument. Receiver operating characteristic analysis using a BSI cutoff score of 65 or higher (clinical cutoff) optimally predicted depression (area under the curve = .89). *Past-year substance use/abuse* was assessed for alcohol, marijuana, and tobacco. For each substance, respondents were asked about their frequency and intensity of use as well as associated impairment. Questions were adapted, in part, from the National Survey on Drug Use and Health conducted by the Substance Abuse and Mental Health Service Administration (2003). *Current overall health* was assessed with a general question (i.e., "Overall, would you say that your health is excellent, very good, good, fair, or poor?") followed by more specific questions about the frequency of health problems and related functional impairment.

Module screeners. Participants were given access only to modules (if any) for which they endorsed relevant symptoms on module screeners. Screeners were completed by 284 respondents who consented to participate on-line. These screeners asked about past-year symptoms and were designed to be brief, highly sensitive, and moderately specific (screeners, except for the Alcohol screener, were 1 to 3 items in length). The PTSD/Panic module screener asked, "In the past year, have you (a) had panic or anxiety attacks? (b) avoided people, places, situations, or conversations that remind you about something very bad that happened to you? (c) felt anxious or very upset when in the presence of people, places, or things that remind you about something very bad that happened to you?" The Depression screener consisted of two questions: "In the past year, have you (a) felt really down, sad, irritable, or depressed for at least a week? (b) stopped being able to enjoy things you used to enjoy for at least a week?" The Worry screener asked, "In the past year, have you worried so much that you couldn't control it?" The Alcohol screener used 10 questions about functional impairment tied to alcohol consumption (e.g., calling in sick to work; failing to meet obligations at work, school, or home; difficulties with coworkers). The Marijuana screener asked, "In the past year, have you used marijuana?" The Drug screener asked, "In the past year, have you used drugs (other than marijuana) that are not prescribed to you by a doctor, such as cocaine, angel dust, LSD, heroin, methadone, inhalants, or other type of drug?" Finally, the Smoking screener asked, "In the past year, have you smoked cigarettes?"

Extended screeners within modules. Once participants screened into and entered a particular module, they were administered extended screeners that were used to tailor educational content to the needs and motivational level of participants. For example, participants who screened into a module but exhibited response patterns on extended screeners that were indicative of low symptom levels (and lack of functional impairment) were given an additional opportunity to exit portions of the educational content. Most participants chose to exit under these conditions. In addition, participants were permitted to skip (or repeat) components of various modules based on their preferences, reported motivation to change, and/or extended-screener symptom levels.

Because extended screeners were not designed to assess or predict outcomes or feasibility, we describe them only briefly. Within the PTSD/Panic and Depression modules, measures for PTSD (6

items, emphasis on intrusion and avoidance symptoms), panic (14 items), and depressive symptoms (10 items) were modified from the NWS interview (Galea et al., 2002; Kilpatrick et al., 1989; Resnick et al., 1993). Other measures included a brief (5 item) *DSM-IV*-based assessment of generalized anxiety disorder symptoms within the Worry module; the Alcohol Use Disorders Identification Test (AUDIT; Babor, Biddle-Higgins, Saunders, & Monteiro, 2001) and Readiness to Change Questionnaire (RCQ; Rollnick, Heather, Gold, & Hall, 1992) within the Alcohol module; the Marijuana Dependence Scale and other measures of the history, chronicity, and timing of marijuana use adapted from previous controlled treatment trials (e.g., Stephens, Roffman, & Curtin, 2000) within the Marijuana module; the Drug Abuse Screening Test (DAST-10; Skinner, 1982) and adapted RCQ in the Drug module; and measures of patterns of cigarette use, perceived risks and rewards of use, and the short form (6 items) of the Decisional Balance Scale (DBS; Velicer, DiClemente, Prochaska, & Brandenberg, 1985) within the Smoking module.

INTERVENTION

Several assumptions guided our planning around module content and structure. Our first assumption was that brief, accessible interventions designed to address a wide range of victimization-related issues are of potentially high value. Second, some clinical "best practices" translate well into an education-based, interactive format and can be delivered successfully via the Internet. Third, a one-size-fits-all approach is limited in value. Following this assumption, we used screening questions and interactive components to ensure that module content was relevant and tailored to the specific needs of users. Our fourth assumption was that attention to stage-of-change issues would limit attrition and enhance adherence to treatment recommendations.

The intervention was developed with attention to several research literatures, including epidemiological research on emotional and behavioral correlates of disasters and violence; research on best practices in behavior therapy and early interventions (cf. Chambless & Ollendick, 2001; Litz, 2004); the motivational interviewing/enhancement literature (Burke, Arkowitz, & Menchola, 2003; Miller & Rollnick, 2002); and research on self-help, Internet-based, and distance-learning interventions. Consistent with expert recommendations (Litz et al., 2002; NIMH, 2002), module development centered on the translation of evidence-based, cognitive-behavioral approaches into brief Web-deliverable formats, and participants were screened into modules only when they endorsed relevant symptoms. Co-investigators and consultants were recruited to the research team on the basis of their expertise in the relevant content domains, and each assumed a significant role in module development. To maximize flow and consistency in presentation format, all modules had similar components (e.g., screening questions, psychoeducation, individualized feedback, motivational enhancement verbiage). One advantage of a computerized intervention is that modules could be constructed using branching logic formats. This permitted sending participants to different sections of a module depending on their responses to screening questions. Each module also was interactive and included monitoring sheets, fact forms, and progress checks that participants could print out and use.

Mental health modules. The PTSD/Panic module provided psychoeducation as well as evidence-based recommendations focusing on exposure, avoidance reduction, and controlled breathing. Exposure-centered recommendations emphasized the differentiation of realistically dangerous versus *nondangerous* cues to ensure that exposure exercises were realistically safe. These strategies are consistent with best-practice recommendations for the treatment of PTSD symptoms in adults and youth (Foa, Davidson, & Frances, 1999; Ruggiero, Morris, & Scotti, 2001). The Depression module was based on behavioral-activation strategies, which have shown considerable promise as efficacious, parsimonious, and cost-effective approaches in the treatment of depression (Hopko, Lejuez, Ruggiero, & Eifert, 2003; Jacobson et al., 1996). The overarching goal of these strategies is to increase healthy activities that yield reinforcing consequences and corresponding improvements in mood and quality of life (Lejuez, Hopko, & Hopko, 2003). To accomplish this, pleasant activity lists were used to recommend specific activities based on each participant's self-reported perceived reward value and past-month frequency of engagement. The Worry module emphasized evidence-based cognitive and behavioral approaches commonly used in the treatment of severe worry and generalized anxiety disorder, including psychoeducation, self-monitoring, relaxation training (diaphragmatic breathing), problem solving, and cognitive restructuring (Borkovec & Ruscio, 2001). Basic problem solving and cognitive restructuring were demonstrated through specially designed worksheets, with participants first shown a worked-out example of each worksheet, then invited to complete the worksheet on-line using a self-identified worry,

and then provided with printable worksheets for use in everyday life.

Substance-related modules. The Alcohol, Marijuana, and Drug modules made use of brief motivational interviewing/enhancement strategies that have received promising empirical support in the recent literature (Marijuana Treatment Project Research Group, 2004; Miller & Rollnick, 2002; Rohsenow et al., 2004; Stephens et al., 2000). Participants completed self-report measures assessing the frequency and consequences (e.g., legal, health, employment, interpersonal), both positive and negative, of substance use, readiness and willingness to change substance use behavior, and confidence in one's ability to change drug or alcohol use behavior. Participants were offered feedback on each measure in a manner consistent with motivational interviewing approaches (e.g., use of decisional balances, options to exit or continue at various steps within the module). After feedback was provided, users were given the option to exit or to continue using the program to receive further education and evidence-based recommendations aimed at reducing substance use. The motivational content of the smoking module was based on the "5 R's" as recommended in the USPHS Clinical Practice Guidelines (Fiore, Bailey, & Cohen, 2000), including a discussion of the *relevance* of smoking to the individual, the *risks* of continued smoking, the *rewards* of quitting, and the *roadblocks* to quitting, with recommendations that these be considered on a *repeated* basis. Recent evidence suggests that this approach, when coupled with adjunctive pharmacotherapy, can effectively induce recalcitrant smokers to attempt and achieve abstinence (Carpenter, Hughes, Solomon, & Callas, 2004), and that advice to quit smoking based on the 5-R principles is more likely than no treatment to induce cessation attempts (Fiore et al., 2000).

PROCEDURE

Recruitment. The final recruitment pool consisted of 1,036 New York City-area individuals who completed Wave 3 interviews for a large-scale epidemiological study. Recruitment occurred by letter that accompanied participants' reimbursement for completion of the Wave 3 interview; a postcard reminder was subsequently sent to 913 participants who were unresponsive to the initial recruitment letter. The 1-page recruitment letter briefly described the purpose of the Internet-based intervention study, provided toll-free telephone numbers for study investigators to address any questions, and provided the Web site address of the intervention as well as an identification number for logging on to the Web site. The letter also stated

that participants would be reimbursed $10 for completing the study (reimbursement was later increased to $25 at the time of the postcard reminder to ensure adequate sample sizes across intervention modules).

Early in the recruitment phase, about 15 participants contacted us who had difficulty accessing the Web site. Most of these participants had misentered the Web site address (http://www.on-linesurvey.com/webprogram) or user ID (e.g., r0123456). We also had occasional difficulty with the server failing to recognize a user ID as valid, and with the program telling respondents to "wait 5 minutes" when the system was inoperative or when participants were between modules after completing the initial module in fewer than 5 minutes. Although we resolved most problems within the first several weeks of recruitment, it is not clear how many participants were lost as a result of these technical difficulties during the recruitment phase.

Organization of web site. At the broadest level, the structure of the intervention was as follows: Log On Screen → Introduction → Consent → Web Screeners → Module Access Point → Modules. Participants who endorsed no symptoms across the screeners ($n = 92$, 32.7%) were given a choice between exiting the program ($n = 70$) and receiving education via one or more of the seven modules ($n = 22$). Among asymptomatic participants, the PTSD/Panic ($n = 15$) and Depression ($n = 7$) modules were most frequently accessed; no other modules were accessed by greater than two such participants. Participants who screened into one or more modules were also permitted to access modules that they did not screen into ($n = 11$ for PTSD/Panic, $n = 5$ for Depression, $n = 1$ for Alcohol).

Participants who qualified for one or more modules on the screener were directed to a module selection screen that listed the modules for which they were eligible. The format of the intervention from the point of the module selection screen was as follows: Module Selection → Knowledge Assessment (pre-module) → Extended screener (designed to inform delivery of educational content) → Interactive delivery of content (education plus recommendations) → Knowledge Assessment (postmodule) → Satisfaction Questionnaire → Return to Module Access Point or Exit (depending on eligibility for any remaining modules).

The Institutional Review Board (IRB) of the Medical University of South Carolina approved all study procedures. Participants were not asked to provide identifying information on the Web site, and data were collected and stored via a secure server. Confidentiality was protected by maintaining an

encrypted log file (which had the capacity to link interview and Web-intervention data) separate from data collected via the Web intervention. To address issues relating to possible current suicidal ideation, several hot lines and phone numbers were offered to participants within the Depression module. Because we did not specifically assess *current/active* suicidal ideations in the context of the Web intervention or interviews, it was not possible for the investigators to access this information unless it was volunteered by the participant during the interview or as a comment on the satisfaction questionnaire. An IRB-approved protocol was in place to manage such circumstances, but none developed during the course of the study.

Results

RATES AND CORRELATES OF PARTICIPATION

Of the 1,035 New York City-area residents invited to participate, 325 (31.4%) successfully logged on to the study Web site, and 285 (27.5%) ultimately consented. These percentages are somewhat higher than the only other Web-based intervention study using population-based recruitment (Christensen et al., 2004), likely due in part to payment of participants in the present study. Using interview data from the Wave 3 survey, several variables differentiated those who *accessed* versus *did not access* the Web site. Compared to nonparticipants, those accessing the Web site were: (a) more likely to be male (53.1% vs. 44.4%), X^2 (1, $n = 1035$) = 6.67, $p = .01$; (b) better educated (e.g., college education was reported by 70.1% vs. 58.6%), X^2 (4, $n = 1034$) = 16.33, $p < .01$; (c) in better overall health (e.g., "very good" or "excellent" health reported by 68.8% vs. 59.1%), X^2 (4, $n = 1034$) = 14.64, $p < .01$; (d) less likely to endorse a panic attack within the past year (13.0% vs. 20.0%), X^2 (1, $n = 1035$) = 7.48, $p < .01$; (e) less likely to be African American (5.6% vs. 14.3%), and more likely to be of Asian descent (7.8% vs. 4.7%), X^2 (4, $n = 1020$) = 25.33, $p < .001$.

Participants and nonparticipants were proportionally similar on substance use and mental health variables (excluding past-year panic attacks). The groups had comparable prevalences of past-year stressors, PTSD, depression, alcohol abuse, marijuana use, and cigarette use. Demographically, participants and nonparticipants did not differ significantly in age, place of birth (U.S. vs. foreign-born), employment status, or marital status. With regard to September 11 experiences, participants and nonparticipants did not differ statistically as a function of lost possessions due to the terrorist attacks; lost employment due to the terrorist attacks; proximity to the World Trade Center site; death or injury of an acquaintance, friend, or relative due to the terrorist attacks; whether they observed the attacks in person; or whether they observed the attacks on television. Finally, the groups did not differ in whether they had ever accessed health-related information on-line.

UTILITY OF WEB-BASED SCREENERS

Qualification rates for the seven modules were 34.5% for PTSD/Panic, 40.5% for Depression, 11.6% for Worry, 19.0% for Alcohol, 9.2% for Marijuana, 3.9% for Drug, and 25.0% for Smoking. Chi-square analyses were used to examine concordance between Wave 3 diagnostic status (i.e., interview criterion met vs. not met) and Web-module qualification (i.e., screener criterion met vs. not met). Concordance between diagnostic prevalence and module qualification was satisfactory, providing insight into the utility of the screeners. PTSD/Panic-module qualifiers included 28 of 33 (84.8%) with Wave 3 past-year PTSD, compared to 70 of 252 (27.8%) without PTSD, X^2 (1, $n = 285$) = 42.12, $p < .001$. Depression-module qualifiers included 28 of 31 (90.3%) with versus 85 of 254 (33.5%) without past-year major depressive episode, X^2 (1, $n = 285$) = 36.86, $p < .001$. Alcohol-module qualifiers included 10 of 13 (76.9%) participants with versus 44 of 228 (16.2%) without past-year alcohol abuse, X^2 (1, $n = 285$) = 29.81, $p < .001$. Marijuana-module qualifiers included 17 of 22 (77.3%) with versus 9 of 262 (3.4%) without past-year marijuana use, X^2 (1, $n = 285$) = 133.05, $p < .001$. Finally, Smoking-module qualifiers included 62 of 71 (87.3%) with versus 8 of 214 (3.7%) without past-year smoking, X^2 (1, $n = 285$) = 201.02, $p < .001$. Thus, these five module screeners performed satisfactorily with regard to detection of individuals with clinically significant symptom presentations. Further, in keeping with our intention to create Web screeners that were both reasonably specific *and* inclusive of at-risk individuals with subclinical symptom patterns, a meaningful but nonexcessive percentage of participants were recruited who did not meet full diagnostic criteria at Wave 3. No Wave 3 data were available to evaluate the utility of screeners for the Worry and Drug modules.

PATTERNS AND CORRELATES OF MODULE COMPLETION AMONG MODULE QUALIFIERS

Module completion (yes/no, based on whether participants completed each step of a module into which they screened, with the exception of the satisfaction survey) was examined via chi-square analyses in relation to four sets of variables: (a)

sociodemographics (i.e., gender, age, U.S. vs. foreign born, racial/ethnic status, income, education level, marital status), (b) September 11 characteristics (i.e., lost job; possessions lost/damaged; acquaintance, friend, or relative killed/injured; saw attacks in person; saw attacks live on television), (c) health-related variables (i.e., past-year PTSD, panic attack, depression, alcohol use, marijuana use, smoking, and stressors; ever having looked online for health information), and (d) number of modules for which participants qualified. The latter variable was included because we hypothesized that participants who qualified for several modules might have limited the number of modules they accessed to minimize their burden of time and effort invested. Completion was unrelated to demographics or September 11 variables for any modules, so these will not be discussed further below. Only those participants who qualified for each module by virtue of their screener responses are included in the analyses below.

PTSD/Panic module. Fifty-five of 98 (56.1%) qualifiers completed the PTSD/Panic module. Completion was unrelated to the number of modules for which participants qualified. However, completion was associated with two health-related variables. First, Wave 3 marijuana users were less likely (3 of 13; 23.1%) than nonusers (52 of 85; 61.2%) to complete the PTSD/Panic module, X^2 (1, $n = 98$) = 6.65, $p = .01$. Second, cigarette users were less likely (9 of 29; 31.0%) than nonusers (46 of 69; 66.7%) to complete the module, X^2 (1, $n = 285$) = 10.53, $p = .001$.

Depression module. The Depression module was completed by 73 of 115 (63.5%) qualifiers. Completion was unrelated to health variables, but it was associated with the number of modules for which participants qualified. Participants who qualified for one or two modules were more likely to complete the Depression module (50 of 63; 79.4%) than those who qualified for three or more modules (23 of 52; 44.2%), X^2 (1, $n = 115$) = 15.26, $p < .001$.

Worry module. Twelve of 33 (36.4%) qualifiers completed the Worry module. Completion was associated with Wave 3 depression; 0 of 10 depressed participants completed the Worry module, as compared with 10 of 20 (50%) nondepressed participants, X^2 (1, $n = 32$) = 7.62, $p < .01$. However, this effect may be explained by the number of modules for which participants qualified, as 6 of 6 (100%) participants who were eligible for one or two modules, but only 6 of 27 (22.2%) participants eligible for three or more modules, completed the Worry module, X^2 (1, $n = 32$) = 12.83, $p < .01$.

Alcohol module. Twenty-three of 54 (42.6%) participants who qualified via the Web screener completed the Alcohol module. Likelihood of completion was unrelated to health variables or the number of modules for which participants qualified.

Marijuana module. Fifteen of 26 (57.7%) qualifiers completed the Marijuana module. Likelihood of completion was unrelated to the number of modules for which participants qualified or to health variables, with the exception of past-year tobacco smoking. Participants who were using cigarettes at Wave 3 were less likely to complete the Marijuana module (3 of 12; 25.0%) than cigarette nonusers (12 of 14; 85.7%), X^2 (1, $n = 26$) = 9.76, $p < .01$.

Drug module. Only 4 of 11 (36.4%) qualifiers completed this module. Due to the low cell sizes, analyses were not conducted to examine correlates of completion.

Smoking module. Forty-five of 71 (63.4%) qualifying participants completed the Smoking module. Module completion was unrelated to health variables. However, completion was associated with the number of modules for which participants qualified. Participants who were eligible for one or two modules were more likely to complete the Smoking module (31 of 37; 83.8%) than those who screened into three or more modules (14 of 34; 41.2%), X^2 (1, $n = 71$) = 13.86, $p < .001$.

TIME BURDEN OF MODULES

Table 3 describes mean, median, standard deviation, and range of time required to complete each

Table 3
Time burden of web modules among module completers

Module	n	Time to completion (in minutes)				
		M	Mdn	SD	Min	Max
Alcohol	24	7:51	4:25	9:52	1:10	53:21
Marijuana	17	11:28	11:06	8:09	1:15	32:04
Drug	4	6:05	5:12	4:22	2:01	11:53
Smoking	48	8:54	7:18	6:56	1:21	38:51
Depression	81	21:24	20:19	14:38	2:34	89:32
PTSD/Panic	71	13:04	8:59	13:43	1:13	73:25
Worry	13	15:51	11:25	19:48	0:50	74:05

Note. Time estimates are based on recordings of the precise dates and times of entry into, and exit from, each module. We therefore were unable to account for active engagement vs. inactivity (e.g., distractions such as phone calls and bathroom breaks) between times of entry and exit. Data above excluded 8 outliers (of 258 completed visits in all) for which recorded log-in time was greater than 24 hours; for a handful of these cases, recorded log-in time was several months in length, precluding estimates of their true time burden. A small percentage of participants (<10%) had more than one completed visit to a given module; data from these visits were included above.

module. Median time burden ranged from 4.4 minutes for the *Alcohol* module to 20.3 minutes for the Depression module. The other five modules all had median completion times between 6 and 12 minutes. The time burden was affected by the use of extended screeners and motivational enhancement strategies within modules. For example, 31.1% of participants accessing the Smoking module indicated that they were "not ready to quit [smoking] yet" after receiving a portion of the educational content, and exited the module without having seen content on smoking cessation strategies. Also, participants endorsing few symptoms on extended screeners within modules for which they qualified were invited to exit the program before receiving content, and several chose to exit (e.g., 18 of 27 exited the PTSD/Panic module after endorsing no additional symptoms on the extended screener, 9 of 14 exited the Depression module after endorsing fewer than two additional symptoms on the extended screener).

PARTICIPANT KNOWLEDGE CHANGE

Knowledge change measures were created for the Web protocol shortly before initiating data collection. Given the addition of this component at this late stage, time available was insufficient to develop knowledge-based evaluative mechanisms for all seven modules. Thus, we piloted measures of knowledge change for the PTSD/Panic and Depression modules only. These three-question measures were administered at the beginning of the modules and readministered after module content was received, immediately prior to the satisfaction survey. Knowledge questions targeted focal content delivered within each module. For example, PTSD/Panic module questions focused on panic attacks as cued events, characteristics of normal stress reactions, and avoidance of nondangerous victimization-related cues as a beneficial versus problematic coping response. Depression module questions emphasized that increased pleasant-activity levels can have a positive impact on mood and that behavior change can produce positive changes in thoughts, feelings, and mood.

Paired-samples t-tests were conducted to analyze premodule versus postmodule scores separately for each question. Analyses suggested that participants had significant knowledge change on one of three PTSD/Panic questions. The first PTSD/Panic question (cued panic attacks) was answered correctly by 73% (premodule) vs. 77% (postmodule), $t(51) = .81$, p (*ns*). The second item (normal bodily stress reactions) was answered correctly by 63% (pre) vs. 65% (post), $t(51) = .28$, p (*ns*). However, significant knowledge change occurred on the third

question (avoidance of nondangerous trauma-related cues), with correct responses by 62% (pre) vs. 81% (post), $t(51) = 3.12$, $p < .01$.

Premodule to postmodule knowledge change occurred on all three Depression module questions. For the first question (benefits of social/physical activity), 42% of participants answered correctly premodule, compared to 78% postmodule, $t(71) = 5.69$, $p < .001$. The second question (behavior change in relation to thoughts and feelings) was answered correctly by 82% (pre) vs. 99% (post), $t(71) = 3.44$, $p = .001$. The third question (relating to benefits of functional/social events) was answered correctly by 68% (pre) vs. 83% (post), $t(71) = 2.99$, $p < .01$.

PARTICIPANT SATISFACTION

Satisfaction data were generally promising. These findings are based on all visits to all modules for which satisfaction surveys were completed ($n = 199$). The first satisfaction question ("Was this [module name] program easy to use?") generated responses of "yes, definitely" or "yes, generally" in 98% of cases. The second satisfaction question ("Would the information provided in this program have been helpful to you in the weeks after the terrorist attacks of September 11, 2001?") produced responses of "yes, definitely" or "yes, generally" in 57% of cases, and responses of "no" in 43% of cases (prevalence of "yes" responses varied from 75% in the PTSD/Panic module to 25% in the Marijuana module). Responses to the third question ("Has this program been helpful to you now?") included 80% who responded in the affirmative-"yes, definitely" or "yes, generally." Finally, for the fourth question ("If a friend or family member were in need of help related to [*module name*], would you be likely to recommend this program to him or her?"), 83% of respondents answered in the affirmative.

Discussion

As an increasing proportion of the U.S. population obtains Internet access, the Internet is rapidly becoming a viable means of disseminating interventions on a large scale. Some advantages to using Internet-based interventions are that they: (a) can be used successfully as comprehensive interventions and as adjuncts to traditional care (e.g., Proudfoot et al., 2004; Selmi et al., 1990; Tate et al., 2001), (b) have rates of attrition that appear to be similar to usual care (e.g., Newman et al., 1997), (c) may increase participation likelihood among individuals who might not otherwise seek care, (d) can reach a large population rapidly and at low cost (i.e., over

one half of U.S. households have Internet access; Rainie, 2004), and (e) can be tailored for secondary prevention as well as augmentation of traditional mental health treatment. As such, Internet-based interventions have the potential to serve a valuable function in the aftermath of disasters, terrorist attacks, and other large-scale incidents that raise risk of emotional and behavioral problems at the community level.

Pilot feasibility data for the Web-based intervention yielded several findings that support the need for further development and scientifically rigorous evaluation of efficacy. First, participation was sufficiently high to support the feasibility of obtaining adequate subsample sizes in future large-scale randomized controlled efficacy studies. Nearly one-third (31.4%) of the sample successfully logged onto the study Web site, 27.5% ultimately consented to participate, and qualification/completion was particularly strong for the PTSD/Panic, Depression, Alcohol, and Smoking modules. Further, it will be possible to improve upon recruitment procedures in future efficacy research, as recruitment in this study occurred exclusively via mail and remuneration was small. Future studies that introduce the Web intervention in the context of a baseline interview will allow participants a better opportunity to be acquainted with the purpose of the study and have questions answered by the interviewer. Further, recruitment of participants in an acute postdisaster context may enhance relevance of the study and participation. In the present study, it was unclear how many nonparticipants in the recruitment pool were insufficiently acquainted with the Web-based study, opportunity for remuneration, and security features of the site; and participation also may have been limited due to 2 years having elapsed following the September 11 attacks prior to the study.

Second, correlates of participation (e.g., gender, education level, racial/ethnic status) were identified that provide insight into barriers to participation that may be addressed in future studies. Future research should assess barriers to participation more directly and use such information to identify methods by which recruitment might be enhanced, particularly among demographic groups (e.g., ethnic minorities, older adults) that are least likely to participate.

Third, module screeners, which were designed to be highly succinct and inclusive of individuals with subclinical symptoms, appeared to perform well. None of the modules had qualification rates that exceeded 40%, suggesting that screeners were not excessively sensitive. Further, concordance was high with Wave 3 diagnostic-level data, as screeners successfully differentiated subdiagnostic from diagnostic symptom patterns. Fourth, completion among module qualifiers varied widely, ranging from 36% (Worry and Drug modules) to 63% (Depression and Smoking modules). Lower completion was associated with eligibility for a higher number of modules. These findings suggest that, while it may be beneficial to continue using highly sensitive module screeners for most participants, it may also be advantageous to incorporate procedures that prioritize content most relevant to their needs. Alternatively, participants eligible for three or more modules may have been among the most highly symptomatic participants in the sample, and these individuals may not have had sufficient attentional/coping resources to benefit from the brief education-focused modules. Research is needed into the reasons that such individuals might not complete the intervention, and possible pathways to matching these cases with more intensive treatment should be explored.

Fifth, the intervention was not burdensome in terms of users' time and effort. With the exception of the Depression module (20 minutes), all modules had median completion times of 11 minutes or fewer. This, in part, was due to the motivational-enhancement components of the intervention that invited participants to exit when they did not have significant impairment or numbers of symptoms or when they were unwilling to consider behavior change and treatment recommendations. Although it is unclear at present whether an intervention requiring such limited time and effort of users is likely to produce change in symptoms and behavior, efficacy research is needed to determine whether symptom reduction can be achieved via this interactive Web-based intervention in the acute aftermath of disasters, terrorism, or other large-scale incidents.

Sixth, for modules that included pre/post-module knowledge assessments, significant positive knowledge change was detected by four of the six questions. These findings suggest that participants were sufficiently engaged with module content to benefit at the level of psychoeducation. Although knowledge gain is a potentially important mechanism for behavior/symptom change, the extent to which knowledge change facilitates behavior/symptom change is unclear and was not addressed in this pilot study. Future efficacy research should examine knowledge change in greater depth and across all modules, and should also closely examine the nature and patterns of relations between knowledge change and behavior/symptom change. Indeed, ongoing development of the evaluative mechanisms

for the Web protocol is guided by Kirkpatrick's (1998) conceptual model of program evaluation, which has identified four distinct levels to be targeted for comprehensive evaluation: (a) reaction (e.g., satisfaction, interest, usability), (b) learning (e.g., knowledge change, attitude change), (c) behavior (e.g., symptom/behavior change), and (d) results (e.g., cost-effectiveness). With regard to the present findings, our identification of knowledge change on the PTSD/Panic and Depression modules may be a useful step, when considered in conjunction with future behavior/symptom-change data, toward understanding mechanisms by which the Web intervention might increase likelihood of behavior/symptom change. For example, if future studies were to reveal that the intervention produces knowledge change but not behavior/symptom change, such a finding might inform the development of supplementary exercises or components designed to strengthen the bridge between knowledge gain and overt action.

Finally, participant satisfaction was high for each module. A particularly relevant satisfaction question, given the purpose of the intervention, was whether participants felt that the modules would "have been helpful to you in the weeks after the terrorist attacks of September 11, 2001?" The mental health modules fared better than the substance-related modules on this question (35% vs. 61% felt it would *not* have been helpful in the weeks after the September 11 attacks). In particular, three-fourths of completers felt that the PTSD/Panic module would have been helpful in the acute aftermath of September 11. This finding suggests that respondents viewed the educational content of this module, and to a slightly lesser extent the Depression and Worry modules, as particularly relevant to their experiences following the September 11 attacks. It is also notable that a higher percentage of respondents indicated that the modules were "helpful now" (80%) than reported would have been "helpful in the weeks after the terrorist attacks" (57%). This finding may reflect perceptions that psychoeducational or self-guided interventions may face some unique barriers to behavior/symptom change during a period of overwhelming stress and confusion in the days and weeks after a large-scale incident. Future research is needed to improve our understanding of the timing of psychoeducation delivery as it relates to the efficacy of intervention and secondary prevention protocols.

LIMITATIONS

Several methodological limitations restrict the conclusions that can be drawn from this study.

First, because we provided payment to participants who accessed the study Web site, participation rates cannot speak to the feasibility of delivering Web-based interventions in the context of effectiveness trials or real-world conditions where payment of users is less feasible. We plan to address this limitation in future studies. Second, this study established only that delivery of the Web-based intervention is *feasible,* not that it is efficacious or effective. Given support for feasibility, an efficacy trial is warranted. Third, assessments of knowledge change were very brief and restricted to only two modules. More information is needed about knowledge change as a function of each of the modules to ensure that major educational objectives are achieved. In addition, assessment of relevant outcomes (symptoms, behavior, quality of life) is needed, as is assessment of the degree to which changes in knowledge and symptoms are sustained over time. Fourth, the current intervention is designed for use by adults, and does not include components for children or adolescents. Fifth, feasibility may differ in relation to different types of events (e.g., terrorist bombing, bioterrorism, earthquake, hurricane) and the scope of their consequences. For example, in the case of large-scale devastation, Internet access may be extremely limited for extended periods of time, precluding access to potentially useful Web-based protocols. On the other hand, if Internet access is not severely affected, participation rates may be higher than those seen in the present study among individuals for whom relevance is high (i.e., those who are most directly affected by a disaster). Sixth, this pilot feasibility study was not conducted in the acute aftermath of a disaster or terrorist attack and therefore the protocol was not evaluated in the context for which it was designed. There are several ways in which this previously disaster-affected sample might differ from a more acutely affected sample. For example, prevalences of anxiety, distress, and psychological sequelae in disaster-affected populations are typically highest in the early aftermath of a large-scale incident (e.g., Galea et al., 2003). Relevance of the intervention content therefore is likely to be highest when available within six months of a disaster, and we would hypothesize that participation, qualification for modules, and benefit from the intervention all may be higher as a result. On the other hand, some disasters (e.g., Hurricane Katrina) may produce prolonged periods of displacement, limited fulfillment of basic needs, and disruption of social support networks (Acierno et al., 2005). Web-intervention content would not be expected to benefit such populations

until *after* basic needs have been satisfactorily addressed.

FUTURE DIRECTIONS

Several lessons were learned in the context of the feasibility study that have implications for future efficacy research in this area. First, we learned that recruitment of participants from a documented sample is advantageous for a number of reasons. For example, this allowed us to identify participants who were invited to use the Web protocol but chose not to access, as well as to compare individuals who accessed to those who did not access. Feasibility data would have been severely limited had we used flyers, newspaper advertisements, bulletin boards, Internet announcements, or similar methods to recruit participants (which would have reduced our ability to identify correlates of participation). To our knowledge, ours is the first study to examine the feasibility of delivering a Web-delivered intervention using a population-based recruitment sample. Second, we learned that participants who qualified for three or greater modules were less likely to complete modules into which they screened than were participants who qualified for only one or two modules. We discussed several potential explanations for this finding above, but a separate issue relates to how we might address this in future studies. One way to address this, consistent with a motivational interviewing approach, would be to facilitate participants' rank-ordering (prioritization) of modules into which they screen. This will increase the likelihood that relevance of the educational content is high when the first of multiple modules is initially accessed by participants, which may improve benefit and also may encourage use of additional modules with lower prioritization ranks. Third, we learned that use of a knowledge-based evaluative mechanism can provide important insight into the utility of an intervention that relies heavily on the delivery of educational material. Future efficacy studies with this intervention will utilize more comprehensive knowledge-based evaluations within each of the seven modules, which will allow us to (a) identify the extent to which participants receive key educational content, (b) identify the degree to which participants retain this knowledge over time, (c) examine relations between knowledge change and symptom/behavior change over time, and (d) explore methods by which we might strengthen the bridge between knowledge gain and overt action.

Building on the present study, additional research is needed to further develop the existing intervention and examine its efficacy and effectiveness.

Large-scale general-population-based randomized controlled efficacy studies are needed to examine knowledge change in greater detail and, more important, to examine short- and long-term symptom and behavior change among individuals who are at risk or have clinically elevated symptoms. In addition, it will be important to examine the efficacy and effectiveness of the intervention under the conditions for which it was designed-in the weeks and months following a disaster or mass violence incident. Once development of the full intervention has been completed, and if support for efficacy is achieved, it will be important to translate the intervention content and materials for delivery via other modes (e.g., brochures, videos, media broadcast) in order to reach individuals who do not have access to the Internet. Translation and adaptation also may be warranted for other victimized populations (e.g., interpersonally victimized adults and youth, parents of victimized youth) because much of the content within each module of the intervention is directly applicable to these populations. By taking these and other steps in future research, we will understand much more than we do now about the ability of brief Web-based interventions to reduce risk for the range of mental health and substance use problems that are prevalent in the aftermath of disasters, terrorism, and other traumatic stressors.

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