UNDERSTANDING ENGAGEMENT WITH A TRAUMA RECOVERY WEB INTERVENTION USING THE HEALTH ACTION PROCESS APPROACH (HAPA) FRAMEWORK

by

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Web interventions for the reduction of trauma related symptoms have been shown to be efficacious but have limited engagement. As the amount of engagement is linked to behavioral outcomes, understanding the factors that influence engagement may be an important step in improving their effectiveness. Specific features of web interventions have been shown to influence engagement, but little attention has been given to understanding this process under a theoretical framework. This study is the first to utilize the Health Action Process Approach as a motivational model for web intervention engagement. In this model pre-action self-efficacy, outcome expectancy, perceived need, and trauma symptoms influence the formation of intentions (i.e., motivational phase). Once intentions are formed, planning mediates the translation of intentions into engagement, moderated by the level of treatment self-efficacy (i.e., volitional phase). Models for the two phases were tested with trauma survivors from the Trauma Health and Hazards Center, national domestic violence and rape crisis center advocates, the national development and research institute list servers, and University of Colorado Colorado Springs students. Results indicated that the motivational phase model explained 42% of the variance and that perceived need ($\beta = .34$), outcome expectations ($\beta = .28$), pre-treatment self-efficacy ($\beta = .15$), and trauma symptoms ($\beta = .21$) were significant predictors of intention ($N = 216$). In the volitional phase, results of the moderated mediation model indicated that for low levels of treatment self-efficacy, planning
mediated the effects of intention on levels of engagement, $\beta = .18$, 95% CI[.02, .48] (N = 55). These results reveal the importance of social cognitive factors and planning on the level of engagement with a trauma recovery web intervention.

Keywords: web intervention, trauma, PTSD, health action process approach, social cognitive theory, self-efficacy, outcome expectations
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CHAPTER 1
INTRODUCTION

Over the past decade the world has seen an exponential increase in the level of Internet usage. With the rapid advances in computer technology and internet access there has been a growing trend in the provision of mental health treatment over the internet (Wells, Mitchell, Finkelhor, & Becker-Blease, 2007). Results of a recent survey found that 87% of American adults now use the internet and eight in ten of those users look online for health information, making it the third most popular online pursuit among all those tracked by the Pew internet Project (Fox, 2014). Likewise, availability and usage of online psychotherapeutic interventions has also increased (Barak, Hen, Boniel-Nissim, & Shapira, 2008). This increase may be due to several advantages offered by web interventions over other more traditional forms of mental health treatment such as reduced costs, waiting lists and travel time and increased autonomy, anonymity and accessibility.

One area of growth has been in the development of web interventions for the reduction of posttraumatic stress reactions (Steinmetz, Benight, Bishop, & James, 2012). Though research has shown these interventions are effective in decreasing distress symptoms in trauma survivors (Amstadter, Broman-Fulks, Zinzowa, Ruggiero, & Cercone, 2009; Benight, Ruzak, & Waldrep, 2008); limited participation and high attrition rates are common (Tate & Zabinski, 2004; Ybarra & Eaton, 2005). As the
amount of exposure to an intervention is strongly linked to behavioral outcomes (Leslie, Marshall, Owen, & Bauman, 2005), understanding the factors that influence engagement is an important step in improving their effectiveness. The proposed study is the first to utilize the Health Action Process Approach (HAPA) framework to examine how trauma symptoms, social cognitive factors and planning affect the level of engagement with a trauma recovery web intervention.

Research by the National Center for Posttraumatic Stress Disorder (PTSD; Norris & Slone, 2013) showed that exposure to potentially traumatic events is exceedingly common. By the onset of adulthood, at least 25% of the population will have experienced such an event, and by the age of 45, most of the population will have experienced such an event with many experiencing multiple events (Norris & Slone, 2013). Though many exposed to a traumatic event spontaneously recover, another potential trajectory is the development of PTSD (Solomon & Davidson, 1997). Estimates of the prevalence of PTSD in trauma populations are highly diverse and can range from 47% in rape victims 12 weeks post assault (Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992), to 10% in motor vehicle accident victims (Koch, 2002), to between 5% and 60% among victims of natural disasters (Neria, Nandi, & Galea, 2008). The lifetime prevalence of PTSD in the U.S. adult population was estimated at 6.8% with approximately 3.5% having had PTSD in the past 12 months (Kessler, et al., 2005).

Amongst individuals exposed to trauma, there is growing concern that those with more persistent mental health problems such as PTSD are reluctant to seek treatment (Litz, Bryant, Williams, Wang, & Engel, 2004). Some barriers to treatment are logistical, such as difficulty accessing a trained mental health care provider, scheduling and keeping
regular appointments (Pepin, Segal, & Coolidge, 2009). Other roadblocks include financial limitations and geographical constraints. Others do not pursue the care they need due to personal perceptions about themselves and others, including that one’s symptoms do not necessitate treatment (Hoge, et al., 2004); a lack of knowledge about or confidence in appropriate treatment options (Sayer, et al., 2009); a negative experience with providers; a lack of perceived ability to participate in treatment (i.e., self-efficacy); or fear that others will be judgmental about help seeking (Mojtabai, et al., 2011; Pepin, Segal, & Coolidge, 2009).

Overcoming these barriers can help empower individuals and has the potential to improve the well-being of those suffering from symptoms of PTSD. One promising development is the use of technology to deliver empirically supported therapies for PTSD. Web interventions can be readily standardized for wide dissemination of evidenced-based care across a number of individuals without decreasing the level of service or increasing costs with respect to therapist time and effort (Munoz, 2010). Clients can overcome barriers to care by avoiding the stigma of seeing a therapist, obtaining treatment at any time, and reviewing the materials as often as desired (Benight, Ruzak, & Waldrep, 2008; Cuijpers, Straten, & Andersson, 2008; Pepin, Segal, & Coolidge, 2009). Web interventions are particularly beneficial for those who are geographically isolated, need to travel long distances for therapy or who have injuries or disabilities limiting travel (Hoge, et al., 2004). By providing timely, cost effective services to those in need the public health burden of post trauma symptoms may be reduced (Kazdin & Blase, 2011).
Despite the high need, potential reach and efficacy, engagement with web interventions is very limited (Tate & Zabinski, 2004). Attrition from open access non-tracked websites can be very high, with as few as 1% of users completing a full course of online therapy (Eysenbach, 2005). Unlike therapist-delivered interventions, where the number and duration of sessions is usually standardized, users of web interventions have a great deal of freedom in how they use the intervention, in terms of number, frequency, and duration of visits, pages used, and active participation in online interactive tools. As a result, the degree of engagement (or lack thereof) can have a significant effect on key outcomes and impact on quality of life (Bennett & Glasgow, 2009). For these reasons, engagement is a critical and complex issue for web interventions that warrants further study.

**Research Questions**

The proposed study will examine two related research questions: (a) how intentions to engage with a web intervention are formed, and; (b) how these intentions are then transformed into the action. These research questions will be investigated using the Health Action Process Approach (HAPA) framework (Schwarzer, 1992).

HAPA is based on Social Cognitive Theory (SCT) (Bandura, 1997) and attempts to bridge the gap between intention and action by suggesting a distinction between the motivational and volitional phases of a health behavior (Schwarzer, 2008). In the case of the present study, treatment engagement is considered a health behavior. In the motivational phase intentions are formed and in the volitional phase the targeted behavior (e.g., engagement) is performed (Figure 1). According to Schwarzer (2008), different patterns of social-cognitive predictors may emerge in each phase. These patterns, as they
Figure 1. Proposed research model using the HAPA framework.

relate to web intervention engagement, will be explored in the proposed study. Before introducing SCT and the HAPA framework, a definition for and review of existing web interventions will be presented.

**Web Intervention Definition**

According to Barak and Klein (2009), the field of web interventions is diffuse and unstructured and difficult to compare efficacy due to a lack of accepted governing approaches, terminology, professional standards, and methodologies. Without a stated rationale and detailed description of interventions in terms of behavior change techniques and modes of delivery, evidence about efficacy and mechanisms of behavior change web interventions will be inconclusive (Dombrowski, Sniehotta, Avenell, & Coyne, 2007). As described in a 2009 review of computer-tailored health interventions delivered over the web, these interventions “have involved a great diversity of features and formats,”
and “further outcome research is needed to enhance our understanding of how and under what conditions these variations lead to positive health outcomes in online behavioral interventions” (Lustria, Cortese, Noar, & Glueckauf, 2009, p. 156).

In an attempt to promote clarity and consistency, a definition and categorization model was developed by Barak and Klein (2009) and defines a web intervention as:

“...a primarily self-guided intervention program that is executed by means of a prescriptive online program operated through a website and used by consumers seeking health- and mental-health related assistance. The intervention program itself attempts to create positive change and or improve/enhance knowledge, awareness, and understanding via the provision of sound health-related material and use of interactive Web-based components.”

This paper will review web-based interventions that fall under this definition. The key components of such interventions include program content, use of multimedia, interactive online activities, and guidance or supportive feedback (Barak & Klein, 2009).

**Web Intervention Review**

The internet is changing the face of health care and is becoming a valuable resource for the delivery of psychological interventions (Benight, Ruzak, & Waldrep, 2008). Since the turn of the century there has been a proliferation of web interventions developed for treating a variety of mental-health issues (Amstadter, Broman-Fulks, Zinzowa, Ruggiero, & Cercone, 2009). These interventions include schizophrenia (Rotondi, et al., 2010), depression (Christensen, Griffiths, & Jorm, 2004; Richards & Richardson, 2012), anxiety (Spek, et al., 2007; Tulbure, Månsson, & Andersson, 2012), panic disorder (Andersson, Bergstro¨m, Carlbring, & Lindefors, 2005), phobias
(Przeworski & Newman, 2004), post-traumatic stress (Amstadter, Broman-Fulks, Zinzowa, Ruggiero, & Cercone, 2009; Benight, Ruzak, & Waldrep, 2008; Brief, Rubin, Enggasser, Roy, & Keane, 2011; Hirai & Clum, 2005; Lange, Ven, & Schrieken, 2003; Litz, Bryant, Williams, Wang, & Engel, 2004) and substance abuse (Ruggiero, et al., 2006), to name a few. Each of these interventions vary greatly in their efficacy and design which makes studying engagement a challenging task. Some of the differences that may affect engagement are further described below.

**Web intervention efficacy.** Though some research of web interventions found no effect (Marks, et al., 2006), a majority of web-based interventions for health behavior change have found positive psychological, behavioral, and clinical outcomes (Cavanagh, et al., 2006; Tate & Zabinski, 2004). A meta-analysis of 21 studies across a number of disorders (e.g., PTSD, social phobia, panic disorder with agoraphobia, arachnophobia, acrophobia and aviophobia) found statistically large weighted effect sizes (Cohen’s \(d = 0.87\) to \(1.79\)) in terms of reduction of symptoms (Parsons & Rizzo, 2008).

A review of web-interventions for traumatic stress related problems found that web interventions are yielding effect sizes comparable to traditional psychosocial treatment (Amstadter, Broman-Fulks, Zinzowa, Ruggiero, & Cercone, 2009). Lange and coworkers studied the effects of a therapy assisted web intervention (Interapy) for the treatment of post-traumatic stress symptoms and found large effect sizes for the reduction of both intrusions \((d = 1.27)\) and avoidance \((d = 1.39)\) in their sample of highly traumatized people from the general population (Lange, et al., 2003). Hirai and Clum (2005) developed the Self-Help program for Traumatic event-related Consequences (SHTC). This study compared the efficacy of the SHTC \((n = 13)\) to a wait-list condition
and found significant post treatment differences between groups in the reduction of symptoms of anxiety ($d = 0.92$), depression ($d = 1.18$), avoidance ($d = 0.80$), and increases in relaxation ($d = 2.08$) and coping self-efficacy ($d = 0.91$). Wagner, Schulz and Knaevelsrud (2012) reported a highly significant decrease in symptoms of PTSD, $t(14) = -6.72, p < .001, d = 1.57$, for their therapist assisted intervention for Iraq citizens with a history of torture or trauma.

**Web intervention human support.** The level of therapist involvement can vary greatly and ranges from no assistance, or minimal therapist contact by email or telephone, to the amount of involvement as seen in classic individual therapy (Hassija & Gray, 2011). Engagement and effect sizes have been shown to be moderated by the level of professional assistance offered. In a meta-analytic review, Spek et al. (2007) examined 12 studies that tested the effectiveness of web-based CBT for depression and anxiety. They found a small-to moderate effect sizes for the treatment of depression ($d = 0.32$) and a large effect sizes for the treatment of anxiety ($d = 0.96$). Provision of therapist support (provided online) moderated these findings, as therapist support resulted in large effects ($n = 5; d = 1.00$) and no such support resulted in small effects ($n = 6; d = 0.24$).

Interapy consisted of 10 structured writing assignments analyzed by therapists to provide feedback and direction to the client (Lange, et al., 2003). Participants in the treatment condition ($n = 69$) improved significantly more than participants in the waiting-list control condition ($n = 32$). Litz, Williams, Wang, Bryant and Engel (2004) developed a therapist assisted, self-paced intervention for the treatment of PTSD. 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 56 days of online...
activities. This study did not present outcome data; however, they did report a 0% attrition rate and an average time online of eight minutes per visit for a total time of 3.4 hours ($SD = 2.5$), and an average number of days logged on as 38.1 ($SD = 18.5$) out of a total of 56 possible days. In a follow on study, they compared an eight week therapist assisted self-directed CBT based web intervention to a web based supportive counseling condition in a RCT for patients exposed to 9/11 attack and soldiers returning from Iraq and Afghanistan (Litz, Engel, Bryant, & Papa, 2007). The CBT self-management group had a higher attrition rate (40%) than the supportive counseling group (15%), yet the CBT group showed a significantly greater reduction in total PTSD symptoms ($d = 0.95$). This suggests that both therapeutic assistance and engagement are not the sole predictors of outcomes and that program dose and efficacy must also be considered.

**Web intervention complexity.** In addition to varying levels of human support, the level of computer complexity can influence the effect size and engagement. The complexity can vary from a simple static psychoeducation (Rotondi, et al., 2010), to more interactive, self-guided therapeutic intervention (Benight, Ruzak, & Waldrep, 2008), to a dynamic and artificially intelligent web intervention (Lisetti, Amani, Yasuvar, & Rishe, 2013). Static websites are online mental health “pamphlets” that provide facts about the mental health issue being investigated (e.g., symptoms, treatment, resources). The absence of dynamic and relevant interactivity typically results in low levels of user engagement (Neve, Collins, & Morgan, 2010).

The most sophisticated level of computer technology uses artificial intelligence and physiological indicators to provide individualized feedback and to design personalized health programs. These types of dynamic, interactive web interventions that
are tailored to the user’s needs provide the most effective experience to the user (Barak, Hen, Boniel-Nissim, & Shapira, 2008). With the use of machine learning techniques, interventions can accommodate changes in affect during the therapeutic process, potentially enhancing engagement and clinical outcomes (Grafsgaard, Boyer, & Lester, 2013).

In a study done by the Florida International University, a virtual, empathic therapist was developed that adapts its verbal and nonverbal communication messages to those of the user’s during the intervention. This study focused on user acceptance and found a 30% increase in intention to use the system compared to a less sophisticated, text-only version of the system (Lisetti, Amani, Yasuvar, & Rishe, 2013). No other outcome data were reported.

**Web intervention theory.** Along with human support and software complexity, interventions range in the theoretical basis of their approach. For example, Evers, et al. (2003) evaluated 37 online interventions in terms of whether they were designed as theory-based. The majority (72%) did not base their intervention on any theory at all (Evers, et al., 2003). Of those based on theory, Evers reported that five programs (14%) were using the stages of change theory. The other five programs used the theory of planned behavior, social learning theory, the theory of reasoned action or the transtheoretical model. A review of 24 web sites designed to promote physical activity (Doshi, Patrick, Sallis, & Calfas, 2003) found few of these sites were based on any type of health behavior change theory. No efficacy or attrition data was reported in these studies.
**Web intervention engagement.** Though effective, limited engagement with web interventions is also frequently cited. An intervention based on empirically supported CBT manuals for depression, reported low adherence; where participants signed on to the Web site an average of only two times, with 41% accessing the depression site only once (Tate & Zabinski, 2004). A meta-analysis of web interventions for the treatment of depression found an overall attrition rate of 57% across the 40 studies included in the review, despite the efficacy and effectiveness of the interventions, $d = .56$, 95% CI [.41, .71], $p < .001$ (Richards & Richardson, 2012).

For trauma related interventions, the results are similar. Studies done on the Interapy trauma intervention found that both the control and treatment groups experienced an attrition rate greater than 50% (Lange, Ven, & Schrieken, 2003). Hirai and Clum (2005) reported an attrition rate of 36% in their study of a self-help program for trauma related disorders. In a RCT for depression, a Computerized Cognitive Behavioral Treatment (CCBT) found that adherence to treatment was low, with only 20% of all participants completing the CCBT sessions (Gerhards, et al., 2011). Importantly, qualitative interviews revealed that a lack of perceived usefulness, risk awareness, social support and technology self-efficacy were the primary reasons for attrition. In a study of survivors of the 9/11 terrorist attacks, Ruggiero et al. (2006) demonstrated the feasibility of a stand-alone Web based program to provide mental health resources to survivors of disaster and terrorist assault. The intervention consisted of seven modules: posttraumatic stress/panic, depression, generalized anxiety, alcohol use, marijuana use, drug use, and cigarette use. Reported attrition rates ranged from 37-64%, depending upon the module accessed (Ruggiero, et al., 2006).
Culture also appears to have an affect engagement. Wagner and colleagues reported an attrition rate of 62% in their sample of Iraq citizens using the Interapy web intervention (Wagner, Schulz, & Knaevelsrud, 2012) as compared to a dropout rate of 41% in a Dutch sample (Lange, et al., 2003) and 16% in Western European countries using the same intervention (Knaevelsrudl & Maercker, 2007).

**Proposed approach.** The above review reveals the disparity of the field and the difficulty in conceptualizing and understanding web intervention engagement. A number of factors can influence engagement such as the intervention efficacy, complexity, dose, level of human assistance, and the theoretical basis. For these reasons, the proposed study investigated engagement from a theoretical framework that spans across all web interventions, regardless of the design and participant characteristics.

**Web Intervention Engagement Research**

Web interventions can be rich source of objective data on engagement and dropout, and, consequently, have the potential to inform adherence research (Christensen, Griffiths, & Farrer, 2009). Three general approaches have been undertaken to investigate adherence (i.e., engagement) of web interventions.

The first approach involves using correlational or regression analyses within trials to establish associations between adherence and various personality, demographic, and web intervention features (Christensen, Griffiths, & Farrer, 2009). As illustrated in the review, a number of features can affect the level of engagement such as therapy assistance, tailored messaging and software complexity (Webb, Joseph, Yardley, & Michie, 2010).
A second approach involves the use of post-test questionnaires to obtain retrospective analyses of people’s perceptions of the web intervention, barriers to the use of the treatment, and other factors (Donkin & Glozier, 2012). These factors include specific features of the web intervention that may have effected engagement.

A third approach involves the experimental manipulation of the various components of the web intervention believed to be causal in promoting adherence (Christensen, Griffiths, & Farrer, 2009; Couper, et al., 2010). Specific features of the intervention such as multimedia displays, gaming, and therapist support are manipulated to measure the effects on engagement and associated outcomes (Bickmore, Schulman, & Yin, 2010).

Each of these approaches are heavily tied to the unique aspects of the web intervention and few offer general theoretical frameworks for understanding the process of engagement. As a result, no clear model exists to explain what factors influence engagement in online interventions. Therefore, to the best of our knowledge, this is the first study to focus on the psychological process of web-intervention engagement, rather than the features of the intervention itself, using the theoretical frameworks of SCT and the HAPA.

**Social Cognitive Theory**

The focus of this proposal is to study the behavior of engagement with a web intervention. SCT and health behavior theory (e.g., HAPA) was used to study this behavior. SCT views human functioning as reciprocal interactions among behaviors (e.g., avoidance or engagement), environmental variables (e.g., stressors and web intervention), and personal factors (e.g., distress symptoms and self-regulatory
cognitions) (Bandura, 1997). SCT proposes that an individual’s ability to exert control over his or her own behavior and the surrounding world involves a reciprocal causation process where internal personal factors, behavior and the external environment reciprocally interact with each other to produce human action.

In this process, internal and environmental cues provide individuals with the feedback necessary to self-regulate and direct their behaviors toward desired outcomes (Bandura, 1997). SCT predicts that behaviors are performed if one perceives control over the outcome, few external barriers, and confidence in one’s own ability. Therefore, from a SCT framework this capability to self-evaluate and plan behavior may provide an important mechanism for understanding both the motivational and volitional phases of web intervention engagement.

Most social cognition models do not address post intentional factors (Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008), creating a gap between intentions and actions. This gap between intentions to perform a particular behavior and actual performance of the behavior is frequently cited as a conceptual limitation of social-cognitive theories. HAPA extends SCT to address this post-intentional gap.

Self-efficacy and outcome expectations are key constructs in the self-evaluative process where self-efficacy is the belief that one can execute the behavior and outcome expectations are the estimation that the given behavior, once performed, will lead to certain outcomes. Although SCT advocates the relationship of triadic reciprocity among the three determinants, (Bandura, 1997), this study is focused on the influence of personal and environmental factors on individual behavior. Specifically, this study will focus on the influence of trauma exposure, self-efficacy, perceived need and outcome expectancies
(i.e., personal factors) on both the motivational and volitional phases of engagement (i.e., behavior) with a web intervention for trauma recovery.

**Self-efficacy.** Bandura (1997) defined the construct of self-efficacy as the belief that one is capable of performing a given behavior. Self-efficacy occupies a pivotal role in the causal structure of SCT because efficacy beliefs affect adaptation and change not only in their own right, but also affect the activities and environments people choose to get into (Bandura, 1997). Such beliefs influence how one views their environment, whether they think positively or negatively, and whether they will engage in self-enhancing or self-hindering behavior.

According to Bandura (2004) a sense of personal efficacy is the foundation of human agency. Beliefs about whether one can produce certain actions are highly predictive of motivational processes such as effective goal setting and perseverence. Self-efficacy is a form of self-evaluation that influences decisions about what behaviors to undertake, the amount of effort and persistence to put forth when faced with obstacles, and finally, the mastery of the behavior (Bandura, 1997). These beliefs are critical when approaching novel or difficult situations or trying to adopt strenuous self-regimens. Motivation to act is rooted in the core belief that one has the power to produce effects by one’s actions; otherwise there is little incentive to act or persevere in the face of difficulties (Benight & Bandura, 2004). Therefore, self-efficacy could be a powerful motivational component in the engagement with a web intervention.

According to self-efficacy theory (SET), self-efficacy judgments are derived from four sources: mastery experiences (i.e., previous successful behavioral performance), vicarious success modeling (i.e., observation of successful behavioral performance),
verbal persuasion (i.e., social support), and physiological and affective states at the time of the self-efficacy rating (Bandura, 1997). Self-efficacy beliefs should be assessed in such a way that the beliefs correspond to the target performance and domains of interest (Bandura, 1997). Studies targeting task or phase specific self-efficacy appraisals generated more consistent results compared to studies that measured self-efficacy unrelated to coping with event-specific demands (Yi & Hwang, 2003). The proposed study investigated two phase specific self-efficacy perceptions that correspond to the motivation and volitional phases of engagement. Self-efficacy has been shown to play a central role in a number of health behavior theories such as the protection motivation theory, the theory of planned behavior (TPB) and the HAPA (Armitage & Conner, 2000).

**Health Behavior Theory**

Generally, there are two groups of health behavior theories: (1) continuum models (e.g., TPB, protection motivation theory, or SCT) and (2) stage models (e.g., transtheoretical model and the HAPA; Lippke & Ziegelmann, 2008). *Continuum* models try to identify predictors (such as perceptions, intentions or attitudes) for behavior or behavior change. These predictors are specific to the behavior rather than specific to the stage of the individual. These variables are typically combined into a linear prediction equation that places individuals along a continuum of behavior likelihood, depending on their level of the variables considered (Lippke & Ziegelmann, 2008).

*Stage* models assume that behavior change takes place in several discrete stages. These nonlinear models view behavior change as consisting of an ordered set of stages into which people can be classified. These stages reflect cognitive or behavioral characteristics, such as the intention to perform a behavior or maintain a behavior
(Schwarzer, Luszczynska, & Lippke, 2011). Unlike continuum models, the predictors are stage specific. According to stage models, there is a special equation within every stage that predicts the progression to the next stage (Schwarzer & Renner, 2000). Stage models break a continuous process down into discrete stages and allow for the understanding and analysis of these stages over time using standard regression analysis techniques. For these reasons, a stage model was used for the proposed study.

**Health Action Process Approach**

The *Health Action Process Approach* (HAPA) is a stage model that integrates SCT (Bandura, 1997), planned behavior theory (Ajzen, 1991), and stages of change theory (Prochaska, DiClemente, & Norcross, 1992) to predict engagement in health behavior. The HAPA has good predictive validity across a variety of different health behaviors, including nutrition (Schwarzer & Renner, 2000), low-risk single occasion drinking (Murgraff, McDermott, & Walsh, 2003), breast self-examination (Luszczynska & Schwarzer, 2003) and physical exercise (Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008). The proposed study is a novel application of the HAPA framework to the investigation of the health behavior of web intervention engagement.

The HAPA suggests that health behavior change is a process that consists of a motivational phase and a volitional phase (Schwarzer, 2008). The motivational phase is the process in which an individual forms an intention to either adopt an action or change a behavior. The subsequent volitional phase covers the processes of implementing intentions into actual behaviors and includes initiation, maintenance, and recovery.

The *motivational* phase in the HAPA is typically characterized by awareness of risk, outcome expectancies, and perceived task self-efficacy (i.e., pre-treatment self-
efficacy). Each of these social cognitive predictors contributes towards the formulation of an intention for a given behavior and is further explained below. Once an intention is formed in the motivational phase, it must be planned, initiated, and maintained in the volitional phase. Planning is a post-intentional and pre-initiation process and describes how individuals prepare for the intended behavior by developing scenarios of how and under which circumstances they could perform the behavior (Schwarzer, 2008). These plans have the structure, “When situation S arises, I will perform response R” and have been shown to improve cognitive links between situational circumstances or opportunities, and the goal behavior (Lippke, Ziegelmann, & Schwarzer, 2004). If the plan includes the appropriate opportunity for a desired action, the probability to initiate the intended behavior will increase. According to the theory, successful formation of intentions, combined with planning will affect the initiation (or action) of the behavior (Luszczynska & Schwarzer, 2003).

Once the behavior is initiated, effort and persistence is strongly dependent upon perceived treatment self-efficacy, which may be different than the pre-treatment self-efficacy in the motivational phase (Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008). This is because pre-treatment self-efficacy focuses on setting goals (i.e., intention) and treatment self-efficacy focuses on adjusting and maintaining goals when confronted with setbacks (i.e., action).

Many of the HAPA studies focus on long term prevention (e.g., breast self-examination, flossing, and sunscreen usage) rather than short term intervention (Arbour-Nicitopoulos, Duncan, Remington, Cairney, & Faulkner, 2014; Craciun, Schüz, Lippke, & Schwarzer, 2012; Luszczynska & Schwarzer, 2010). These prevention studies
incorporate all aspects of health behavior including intention formation, translation into action, maintenance and recovery. Additionally, these studies include perceived risk of developing the disease rather than perceived need for an intervention and exclude symptom severity because the symptoms of the disease or disorder are not yet present. On the other hand, this study focuses on a short, two week intervention for individuals with existing PTSD symptoms. For these reasons, this study targets the generation of intentions and the initial translation of intentions into action, thereby extending the existing HAPA model to include symptom severity and perceived need as predictors.

Figure 1 provides a graphical depiction of the HAPA model as a motivational model for web intervention engagement. In this model four variables are considered to play a major role in the formation of intention. These are: (a) pre-treatment self-efficacy, (b) outcome expectations, (c) perceived need, and (d) trauma symptoms. Once intentions are formed, planning mediates the translation of intentions into behavior (i.e., engagement), moderated by the level of treatment self-efficacy. Each of these components is further explained below.

**Phase Specific Self-Efficacy**

Perceived self-efficacy has been found to be important at all stages in the health behavior change process (Bandura, 1997), but it does not always constitute exactly the same construct (Schwarzer & Renner, 2000). During the course of health behavior change, different tasks have to be mastered, and different self-efficacy beliefs are required for successful mastery of these tasks. People harboring self-doubts might either fail to translate intentions into plans, or they might fail to act upon their plans. Therefore, phase-specific (i.e., stage-specific) self-efficacy is important when studying phases of
behavior such as intention, action, maintenance and recovery (Lippke & Ziegelmann, 2008). This is because there are different challenges as people progress from one phase to the next. In studies applying the HAPA model, phase specific self-efficacy differed in the effects on various preventive health behaviors, such as dietary behaviors (Schwarzer & Renner, 2000), breast self-examination (Luszczynska & Schwarzer, 2003), and physical exercise (Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008). This study will use two phase specific self-efficacy beliefs relevant to web intervention engagement, pre-treatment self-efficacy and treatment self-efficacy.

**Pre-treatment self-efficacy (PTSE).** In the motivation phase, *pre-treatment* self-efficacy reflects beliefs about the ability to initiate engagement. During this phase an individual does not yet act, but develops a motivation to do so. Individuals high in pre-treatment self-efficacy imagine success and are more likely to initiate a new behavior (Schwarzer & Renner, 2000). *Pre-treatment* self-efficacy has been found to be a strong predictor of behavioral intentions (Schwarzer, 2008). In our study, pre-treatment self-efficacy includes beliefs about initiating engagement with a web intervention despite barriers associated with using technology (Bhalla, Durham, Yeager, & Benight, 2014) and coping with trauma symptoms (Benight, et al., 2014).

**Treatment self-efficacy (TSE).** In the volitional phase, *treatment* self-efficacy reflects beliefs about coping with barriers and hurdles needed to maintain engagement. A new health behavior such as using a web intervention may prove to be more difficult to adhere to than expected, but a self-efficacious person responds confidently with better strategies, more effort, and prolonged persistence in overcoming such hurdles. Once an action has been taken, individuals high in treatment self-efficacy will invest more effort
and persist longer than those who are less self-efficacious. Studies have shown that
*treatment* self-efficacy moderates the mediation of intentions via plans (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009). For plans to mediate the intention-behavior relation, people must hold sufficiently high levels of self-efficacy. In our study, *treatment* self-efficacy includes beliefs about maintaining engagement with a web intervention despite barriers associated with using the technology (Bhalla, Durham, Yeager, & Benight, 2014) and coping with their trauma symptoms (Benight, et al., 2014).

Under the HAPA framework, pre-treatment self-efficacy is proposed to influence engagement indirectly through the formation of behavioral intentions. Several studies show self-efficacy to be a positive predictor of intentions (Garcia & Mann, 2003; Luszczynska & Schwarzer, 2003; Schwarzer & Renner, 2000). Therefore, it is predicted that pre-treatment self-efficacy will positively affect the formation of intention to engage in a web intervention. The predicted role of treatment self-efficacy will be further discussed in the planning section below.

**Outcome Expectancy**

The other central construct in SCT is *outcome expectancy*. Outcome expectancies are the judgments that one makes about whether engaging in a given behavior will produce a given outcome (Bandura, 1997). For our web-intervention, a positive expected outcome is an increase in the ability to cope with posttraumatic distress. According to SCT, outcome expectancies are clearly distinguished from self-efficacy because self-efficacy is the perceived ability to do a behavior, whereas outcome expectancies are judgments about the likelihood of the behavior leading to a specific outcome (Bandura, 1997). With each outcome, positive expectations can exist and serve as an incentive for a
particular behavior, whereas negative expectations are a disincentive. SCT suggests that outcome expectations play a larger role in the initiation of novel behaviors such as web intervention engagement, and less of a role in behavioral maintenance (Bandura, 1997). Research has found that outcome expectancies are a major determinant of web usage intention and engagement (Chau, 2001; Davis F. D., 1989; Donkin & Glozier, 2012), where the more engaged participants perceived the web application as more useful. For this study, outcome expectations are defined as the perception that using the proposed web intervention will increase one’s ability to cope with trauma.

Under the HAPA framework, outcome expectancies are proposed to influence engagement indirectly through the formation of behavioral intentions. Outcome expectancies have been shown to be important determinants in the formation of intentions (Schwarzer & Renner, 2000). Similar to self-efficacy, outcome expectations should be assessed in such a way that the perceptions correspond to the target performance and domains of interest (Bandura, 1997). Therefore, outcome expectations will be tied directly to the outcomes of the proposed web intervention. Outcome expectations are predicted to have a positive effect on the formation of intention.

Perceived Need

In addition to self-efficacy and outcome expectancy, another predictor of intention is the perception of need. A motivational process often begins with the awareness of a level of need (Schwarzer & Renner, 2000). Although perceived need is not a powerful predictor of behavior, it can lead to deliberations about behavior change. Perceived need has been shown to affect treatment adherence as low perceived need was reported by 44.8% of respondents with a disorder who did not seek treatment (Mojtabai,
Perceived need in itself is insufficient to enable a person to form an intention. Rather, it sets the stage for contemplating the new behavior (Schwarzer, Luszczynska, & Lippke, 2011). The initial perception of need seems to put people on track for developing a motivation to change, but later other factors such as self-efficacy and outcome expectancy become more influential (Luszczynska & Schwarzer, 2003).

In the proposed study, perceived need is defined as one’s perception of needing an intervention for trauma related symptoms such as anxiety, depression, and other PTSD symptoms. Because perceived need is specified as a distal antecedent in the motivational phase perceived need was proposed to have a positive, yet limited effect on intention.

**Posttraumatic Distress**

The DSM-5 criteria include PTSD symptoms in several categories: intrusion (intrusive distressing memories or dreams, or distress at trauma reminders), avoidance (of thoughts, feelings, people, and activities that are reminders of the trauma), dissociation (altered sense of reality of surroundings or oneself), changes in mood or cognition (persistent exaggerated negative expectations of self, others, or the world; persistent negative emotional state; and feelings of detachment from others), and changes in arousal (hypervigilance, exaggerated startle, sleep disturbance, or concentration difficulties) (American Psychiatric Association, 2013).

The degree of distress symptoms affects one’s perceived capability to manage one’s personal functioning or utilize available environmental resources following a traumatic event (Benight & Bandura, 2004). However, past research is unclear regarding the relationship between baseline mental health symptoms and treatment engagement (i.e., completers). Research has shown that PTSD symptom exacerbation has been
associated with dropout from prolonged exposure treatment (Schottenbauer, Glass, Arnkoffa, Tendicka, & Gray, 2008). Marks et al. (1998) found that dropouts had slightly more PTSD-symptoms at baseline in comparison with completers, whereas others found lower baseline PTSD-symptoms associated with dropout (Imel, Laska, Jakcupcak, & Simpson, 2013). As a result of these mixed findings, it was proposed that PTSD symptoms will have a varying yet overall positive effect on intention.

**Intentions**

The HAPA framework accounts for the empirical finding that intentions often inadequately predict behavior (Sheeran, 2002). Intentions are formed in the *motivational* phase, but may or may not be transformed into action in the *volitional* phase. In the motivational phase the HAPA specifies perceived need, positive outcome expectancies and self-efficacy as predictors of intentions. The proposed study investigated the relationship among these social cognitive predictors as well as trauma symptoms in the formation of intention.

Research shows that perceived need is a weak predictor of intentions, and that outcome expectancies and self-efficacy are stronger predictors of intentions (Schwarzer & Renner, 2000). Therefore, positive outcome expectancies and pre-treatment self-efficacy are hypothesized to have a greater positive relationship with intention formation than perceived need. Additionally, intentions were hypothesized to have a positive effect on engagement.

**Planning**

Before an individual will engage with a web intervention, they need to become motivated to do so. Intentions are a necessary prerequisite for engagement and comprise
a person’s motivation towards engaging. However, in a meta-analysis of meta-analyses, Sheeran (2002) found that intentions were necessary but not sufficient to predict behavioral change. The results of the meta-analysis found that almost 50% of participants who intended to use a condom, attend a cancer screening or exercise at a particular level subsequently failed to do so (Sheeran, 2002). Several reasons account for the discrepancy between intention and behavior such as unforeseen barriers and temptations. This phenomenon has been labeled the ‘intention–behavior gap’ (Sheeran, 2002).

Self-regulation skills are crucial for bridging this gap and translating intentions into action. Planning, also referred to as implementation intentions, is one such self-regulatory skill (Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008). Research has shown that planning helps to translate intentions into behavior particularly well in those individuals with average to high intentions, as they are more likely to act on their plans (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009).

According to Sheeran, (2002), planning involves a cognitive rehearsal or mental simulation of the link between a specific action and specific environmental cues. Planning specifies when, where and how a behavior will be implemented and can include situations where barriers might emerge that would prevent them from acting as previously planned (Schwarzer, Luszczynska, & Lippke, 2011).

Planning is seen as a mediating variable between intention and behavior and has been found to increase both the likelihood of performing a behavior as well as the speed of initiating the behavior (Sheeran, 2002). This relationship was moderated by treatment self-efficacy (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009). Therefore,
planning (Time 2) was hypothesized to mediate the translation of intention into behavior during the volitional phase and treatment self-efficacy is expected to moderate this mediating process.

**Engagement**

The primary outcome of this study is engagement with the web intervention. As Danaher, Boles, Akers, Gordon, and Severson (2006) note, “a key ingredient in determining the impact of any web-based behavior change program is the extent to which participants are exposed to the program.” In a review of the literature, Vandelanotte, Spathonis, Eakin and Owen (2007) found improved treatment outcomes when web interventions had more than five contacts with participants and when the time to follow-up was short (≤3 months; 60% positive outcomes). There were no clear associations of outcomes with other intervention attributes (Vandelanotte, Spathonis, Eakin, & Owen, 2007).

O’Brien and Toms (2008) found that engagement is a process comprised of four distinct stages: point of engagement, period of sustained engagement, disengagement, and reengagement. The present study focuses on the first two stages and will use both objective and subjective measures to operationalize engagement. Actual and perceived engagement levels will be measured to determine the overall level of engagement.

In summary, this study uses the HAPA model as a motivational model for web intervention engagement. In this model pre-treatment self-efficacy, outcome expectancy, perceived need, and trauma symptoms influence the formation of intentions to engage. Once intentions are formed, planning mediates the translation of intentions into web intervention engagement, moderated by the level of treatment self-efficacy. Within this
framework, the specific features of the web intervention play less of a role than the perceptions of the individual. However, in order to better understand the process of engagement, a brief overview of the web intervention is provided.

**Web Intervention – My Trauma Recovery**

To investigate engagement, this study uses the web intervention *My Trauma Recovery*, which is a self-guided, theoretically based, interactive web application with no interaction with a therapist (Benight, Ruzak, & Waldrep, 2008). *My Trauma Recovery* is based largely on social cognitive theory (SCT) where individuals are viewed as proactive agents who can choose their environments, seek out beneficial social networks, and engage in other self-management behaviors that allow them to achieve both initial change and long-term maintenance (Bandura, 1997).

The intervention focuses on increasing an individual’s ability to cope with trauma via six self-directed modules: (1) unhelpful ways of coping, (2) relaxation, (3) social support, (4) self-talk, (5) trauma triggers and memories and (6) seeking professional help. In addition, a self-test gives users the opportunity to gain feedback on their current emotional distress, and provides graphs that depict their assessment results. Throughout the six modules, the site utilizes mastery experiences, vicarious success modeling, verbal persuasion, and tools to monitor and regulate internal distress to increase users’ coping self-efficacy through interactive, tailored experiences (see Figure 2).

Individuals can use any or all of these modules as often as needed. The unhelpful ways of coping modules helps to reduce bad coping habits by providing psychoeducation regarding the kinds of coping that can make things worse and focusing on reducing or avoiding bad coping habits. In the relaxation module, guided audio and video exercises
Figure 2. The interactive components in the *My Trauma Recovery* website that raise coping self-efficacy beliefs.

are provided for techniques such as deep breathing, visual imagery, and progressive muscle relaxation. Users have the opportunity in the social support module to create an individualized, illustrative genogram to show the various people in their life to provide support. Negative thinking is addressed in the self-talk module and is used to identify and reduce personal negative thoughts and to learn about how to worry less. The triggers and memories helps individuals cope with memories, triggers, and reminders by providing education about how reminders trigger memories and how to manage triggers more effectively. The seeking professional help module models coping with a variety of
recovery-related concerns such as phoning a friend for support, talking to a professional counselor, and managing strong emotions through strategies such as journaling and physical activity. Lastly, the site emphasizes the utilization of quick access to recovery information. Fact sheets about trauma and the recovery process, links to resources for professional assistance, and information about online organizations are provided throughout the site.

Research Model

Using the HAPA framework as the theoretical foundation, this study investigated the formation of intentions and the mediating effects of planning on the translation of intention into action (i.e., web engagement), moderated by treatment self-efficacy. Figure 3 presents the proposed longitudinal research model. Based on this model several hypotheses associated with each phase of the engagement process were investigated.

Figure 3: Structural equation model with hypotheses labeled.
Motivational phase hypotheses. It is hypothesized that the HAPA model will support the following direct relationships:

Hypothesis 1 (H1): Pre-treatment self-efficacy will be significantly related to intention. Participants with high pre-treatment self-efficacy will experience higher levels of intention.

Hypothesis 2 (H2): Outcome expectations will be significantly related to intention. Participants with high outcome expectations will experience higher levels of intention.

Hypothesis 3 (H3): Perceived need will be significantly related to intention. Participants with high levels of perceived need will experience higher levels of intention.

Hypothesis 4 (H4): Trauma symptoms will be significantly related to intention. Participants with high levels of trauma symptoms will experience higher levels of intention.

Volitional phase hypotheses. The second phase of the research model is the translation of intention into action. Several hypotheses are predicted in the volitional phase.

Hypothesis 5 (H5): Intention will be significantly related to engagement. Participants with high levels of intention will experience higher levels of engagement.

Hypothesis 6 (H6): Intention will be significantly related to planning. Participants with high levels of intention will experience higher levels of planning.

Hypothesis 7 (H7): Planning will mediate the relationship between intention and engagement. Participants with high levels of planning will experience higher levels of engagement.
Hypothesis 8 (H8): Treatment self-efficacy will moderate the relationship between planning and engagement.
CHAPTER 2

METHOD

Participants

Participants were recruited from the Trauma Health and Hazards Center (THHC) trauma registry, national domestic violence advocate and rape crisis center registries, the national development and research institute (NDRI) list servers, and the University of Colorado at Colorado Springs student population. All participants included in the study directly experienced one or more traumatic events, had a PCL5 score greater than 0, were 18 years or older, had a private area to access the internet, and spoke English.

Table 1 displays the demographic information. Of the 384 who completed the Time 1 survey, 216 participants qualified for the study (mean age = 28.97 years old [SD = 13.44], 79.5% female). The participants who met criteria were 79% Caucasian, 11.2% Hispanic, 4.7% multi-racial, 6.5% African American, 3.6% Asian, and 5.3% other (some participants specified multiple races). Of those who qualified, 103 created an account on the website and 97 participated in the Time 2 survey (mean age = 29.91 years old [SD = 12.63], 81.4% female) and 66 participated in Time 3 (mean age = 30.00 years old [SD = 14.90], 84.8% female). Of the 66 who completed the Time 3 survey, only 55 actually created a web intervention account (mean age 29.91 years old [SD = 14.79], 85.5% female). Therefore, only those who created an account were considered for Time 3 analyses.
# Table 1

*Descriptive Statistics for Demographics for Time 1, Time 2, and Time 3*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Time 1 $(N = 216)$</th>
<th>Time 2 $(N = 97)$</th>
<th>Time 3 $(N = 55)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age in years $(SD)$</td>
<td>28.97 (13.44)</td>
<td>31.13 (15.03)</td>
<td>29.91 (14.79)</td>
</tr>
<tr>
<td>Age range in years</td>
<td>18-80</td>
<td>18-80</td>
<td>19-78</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>79.5% (172)</td>
<td>81.4% (79)</td>
<td>85.5% (47)</td>
</tr>
<tr>
<td>Male</td>
<td>20.1% (43)</td>
<td>18.6% (18)</td>
<td>14.5% (8)</td>
</tr>
<tr>
<td>Other</td>
<td>0.5% (1)</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Intimate relationship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>40.2% (88)</td>
<td>39.2% (38)</td>
<td>40.9% (27)</td>
</tr>
<tr>
<td>Committed</td>
<td>52.1% (114)</td>
<td>51.5% (50)</td>
<td>48.5% (32)</td>
</tr>
<tr>
<td>Other</td>
<td>7.8% (17)</td>
<td>9.3% (9)</td>
<td>10.6% (7)</td>
</tr>
<tr>
<td>Highest education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High School</td>
<td>47.9% (80)</td>
<td>44.3% (43)</td>
<td>40.9% (27)</td>
</tr>
<tr>
<td>Associates degree</td>
<td>22.5% (38)</td>
<td>24.7% (24)</td>
<td>31.8% (21)</td>
</tr>
<tr>
<td>Bachelor’s degree</td>
<td>19.5% (32)</td>
<td>20.6% (20)</td>
<td>21.2% (14)</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>8.9% (15)</td>
<td>10.3% (10)</td>
<td>6.1% (4)</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>25.1% (54)</td>
<td>22.7% (22)</td>
<td>21.8% (12)</td>
</tr>
<tr>
<td>Part-time</td>
<td>36.5% (80)</td>
<td>35.1% (34)</td>
<td>43.6% (24)</td>
</tr>
<tr>
<td>Full-time</td>
<td>34.7% (75)</td>
<td>34.0% (33)</td>
<td>25.5% (14)</td>
</tr>
<tr>
<td>Retired</td>
<td>3.7% (8)</td>
<td>8.2% (8)</td>
<td>9.1% (5)</td>
</tr>
<tr>
<td>Income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$0-$25,000</td>
<td>44.3% (96)</td>
<td>43.3% (42)</td>
<td>47.3% (26)</td>
</tr>
<tr>
<td>$25,001-$70,000</td>
<td>30.6% (66)</td>
<td>35.1% (34)</td>
<td>29.1% (16)</td>
</tr>
<tr>
<td>$70,001-$100,000</td>
<td>14.2% (31)</td>
<td>10.3% (10)</td>
<td>10.9% (6)</td>
</tr>
<tr>
<td>&gt; $100,000</td>
<td>10.5% (23)</td>
<td>10.3% (10)</td>
<td>10.9% (6)</td>
</tr>
<tr>
<td>Mental Health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment (Current)</td>
<td>19.6% (42)</td>
<td>17.5% (17)</td>
<td>16.7% (11)</td>
</tr>
<tr>
<td>Treatment (Past Year)</td>
<td>8.2% (18)</td>
<td>9.3% (9)</td>
<td>6.1% (4)</td>
</tr>
<tr>
<td>Treatment (Lifetime)</td>
<td>51.1% (111)</td>
<td>52.6% (51)</td>
<td>53.0% (35)</td>
</tr>
<tr>
<td>Trauma Frequency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 time</td>
<td>50.7% (109)</td>
<td>38.1% (37)</td>
<td>29.1% (16)</td>
</tr>
<tr>
<td>2-13 times</td>
<td>32.0% (70)</td>
<td>38.1% (37)</td>
<td>38.2% (21)</td>
</tr>
<tr>
<td>&gt; 14 times</td>
<td>12.3% (27)</td>
<td>16.5% (16)</td>
<td>23.6% (13)</td>
</tr>
</tbody>
</table>

*Note.* Single relationship includes widowed or divorced. Committed relationship included married couples and couples in a committed relationship. Some percentages do not add up to 100% due to missing data.
All participants who met criteria at Time 1 ($N = 216$) were directly exposed to one or more traumatic events either through experiencing or witnessing the event, including, for example, physical assault (68.7%), transportation accidents (68.1%), unwanted sexual contact (62.7%), sexual assault (50.9%), life-threatening illness or injury (53.9%), fire or explosion (38%), natural disasters (36.6%), sudden unexpected death of someone close (33.2%), serious accidents (32%), severe human suffering (31.9%), toxic exposure (17.2%), military combat (8.3%) and other traumatic events (66.2%). Participants experienced the same traumatic event with varying frequency, ranging from 50.7% who experienced the event once, to 12.3% who experienced the event at least 14 times.

**Measures**

**Demographics.** Demographic information such as participants’ ethnicity, age, gender, marital status, employment, traumatic brain injury, mental health treatment status and education were measured (see Table 1).

The following measures incorporated variables in the motivation and volitional phases of the HAPA model. The motivational components were available at Time 1 and included pre-treatment self-efficacy, outcome expectations, perceived need, trauma symptoms, and intention. The volitional phase components were available at Time 1, Time 2 and Time 3 and included intention, planning, treatment self-efficacy and engagement. In addition to the HAPA variables, participant website satisfaction was also gathered. All of the measures (with the exception of the trauma symptoms) were developed for this study as there were no measures currently available. The psychometric properties of these measures are shown in Table 2 and described below.
Table 2

*Number of Items, Scoring Range, and Cronbach’s Alpha for Time 1 (N = 216), Time 2 (N = 97) and Time 3 (N = 55) Measures*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of Items</th>
<th>Scoring Range</th>
<th>Cronbach’s α T1</th>
<th>Cronbach’s α T2</th>
<th>Cronbach’s α T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PCL5</td>
<td>20</td>
<td>0-80</td>
<td>.88</td>
<td>--</td>
<td>.94</td>
</tr>
<tr>
<td>2. Outcome Expectations</td>
<td>11</td>
<td>11-55</td>
<td>.84</td>
<td>.79</td>
<td>.81</td>
</tr>
<tr>
<td>3. Pre-treatment Self-Efficacy</td>
<td>8</td>
<td>8-40</td>
<td>.94</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>4. Perceived Need</td>
<td>6</td>
<td>6-30</td>
<td>.87</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>5. T1 Intention</td>
<td>5</td>
<td>5-25</td>
<td>.87</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>6. Treatment Self-Efficacy</td>
<td>8</td>
<td>8-40</td>
<td>--</td>
<td>.96</td>
<td>.94</td>
</tr>
<tr>
<td>7. Planning</td>
<td>4</td>
<td>4-20</td>
<td>--</td>
<td>.78</td>
<td>.80</td>
</tr>
<tr>
<td>8. Coping Self-Efficacy</td>
<td>9</td>
<td>9-63</td>
<td>.88</td>
<td>--</td>
<td>.88</td>
</tr>
<tr>
<td>9. Engagement</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>.65</td>
</tr>
<tr>
<td>10. Website Satisfaction</td>
<td>7</td>
<td>7-35</td>
<td>--</td>
<td>--</td>
<td>.92</td>
</tr>
</tbody>
</table>

**Pre-treatment self-efficacy (PTSE).** Pre-treatment self-efficacy was measured by eight questions that began with the sentence stem “I am confident that I can begin using a web intervention in the next two weeks…” followed by items representing technological and coping related barriers. The following four items measured technologically related barriers:

- Even if I limited time.
- Even if I have to learn how to use the intervention.
- Even if I have never used a web intervention before.
- Even if I am uncomfortable with using the internet.

The following four items measured coping with trauma related barriers:

- Even if I feel nervous and stressed.
- Even if I have trouble coping with important changes in my life.
• Even if I have difficulty handling the things I have to do.
• Even if I am having personal problems.

The answers were given on a five-point Likert scale ranging from (1) not at confident to (5) very confident. Cronbach’s alpha coefficient was 0.94 at T1.

**Outcome expectancies (OE).** Both positive (pros) and negative (cons) outcome expectancies were assessed with questions that started with the sentence stem “If I use the web intervention on a regular basis I expect that …” followed by the following items measuring possible pros:

• I will feel balanced in my daily life.
• It will help me to relax more.
• I will be less vulnerable to anxiety and/or depression.
• I will be able to take better care of myself.
• I will be less vulnerable to PTSD.
• I will be able to get more positive support from people in my life.
• I will feel more in control of my life.

Cons were assessed by the following items:

• It will take too much of my time.
• It won’t make any difference in how I feel.
• It will bring up bad memories.
• It will make me feel worse.

Responses were scored on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. Cons were reversed scored and the total score was computed by adding the answers over all items of the positive and negative outcome expectancies scales, respectively. Cronbach’s alpha coefficient was 0.84 at T1, 0.79 at T2 and 0.81 at T3.
**Perceived Need (PN).** Perceived need was measured with responses to the following statement: “Please indicate your perception of how much you believe you need an intervention for the following issues.”

- To feel normal again?
- To be able to deal with my emotions?
- To be able to manage distressing dreams or images about the traumatic experience?
- To be optimistic about my future?
- To get help from others about what happened?
- To feel connected to other people?

The answers were provided on Likert scales, ranging from (1) *strongly disagree* to (5) *strongly agree*. Items were added together to get a total perceived need score. Cronbach’s alpha coefficient was 0.87 at T1.

**Intention.** Behavioral intentions are explicit decisions to act in a certain way, and for this study they comprise a person’s motivation towards using a web intervention. Intention to perform a behavior should be assessed the same way as assessing the behavior itself (Schwarzer, Luszczynska, & Lippke, 2011). For engagement, intention to use the web intervention was measured by six questions that began with the sentence stem “During the next two weeks I intend to use the web intervention.” The first question measured frequency (in days) ranging from 0 (*never*) to 14 (*every day*). The next five questions measured intention to use specific aspects of the web intervention and included:

- To learn relaxation skills.
- To help learn how to take better care of myself (self-care).
- To help fight negative thinking (self-talk).
• To help manage my triggers or trauma reminders (trigger management).
• To get support from others (social support).

The answers to these items were given on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. The score for the intention measure was computed by adding the answers over all items. Cronbach’s alpha coefficient was 0.87 at T1.

**Planning.** For engagement, planning to use the web intervention was measured by four questions that began with the sentence stem “During the past two weeks my plan included ...” followed by:

• When I would use the web intervention.
• Where I would use the web intervention.
• What modules of the web intervention I would use.
• How often I would use the web intervention.

The answers were given on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree. The score for the planning measure was computed by adding the answers over all items. Cronbach’s alpha coefficient was .78 at T2 and 0.80 at T3.

**Treatment Self-Efficacy (TSE).** Treatment self-efficacy was measured by eight questions that began with the sentence stem “I am confident I could continue to use a web intervention ...” followed by three items measuring treatment self-efficacy related technology:

• Even if I cannot see any positive changes immediately.
• Even if I don’t like it initially.
• Even if it takes me a long time to learn how to use it.
The five items measuring coping self-efficacy related to trauma are:

- Even if I do not feel relaxed.
- Even if it brings up difficult memories.
- Even if I have difficulty applying the things I learn to my situation.
- Even if it makes me uncomfortable.
- Even if I have difficulty finding social support.

The answers are given on a five-point Likert scale ranging from (1) not at all confident to (5) very confident. The score for treatment self-efficacy was computed by adding the answers over all items. Cronbach’s alpha coefficient was 0.96 at T2 and 0.94 at T3.

**Engagement.** Engagement was measured both subjectively and objectively.

*Subjective measures* included the following questions regarding overall usage, frequency and duration assessed at Time 3.

Overall usage was measured by the question “Which of the following describes your use of the web intervention?” The response was scored on a five-point Likert scale ranging from (1) not at all to (5) very often.

*Frequency* was measured by the following questions:

- How often did you use the *unhelpful ways of coping* module?
- How often did you use the *relaxation* module?
- How often did you use the *social support* module?
- How often did you use the *self-talk* module?
- How often did you use the *trauma triggers and memories* module?

Responses were scored on a six-point Likert scale ranging from (1) *Never* to (6) More than Once per Day. Total score was be computed by adding the answers over all items. Cronbach’s alpha for engagement frequency was .85 for T3.
Duration was measured by the following questions:

- How many minutes did you use the *unhelpful ways of coping* module?
- How many minutes did you use the *relaxation* module?
- How many minutes did you use the *social support* module?
- How many minutes did you use the *self-talk* module?
- How many minutes did you use the *trauma triggers and memories* module?

Numerical responses were added to get a total duration score in minutes.

**Objective measures** consisted of automatically recorded data that quantified the frequency (number of pages visited) and duration (total number of minutes logged in) of web intervention usage (Couper, et al., 2010; Danaher, Boles, Akers, Gordon, & Severson, 2006). The data was stored in an online database. Numerical values for all objective and subjective measures were combined using exploratory factor analysis to generate a standardized engagement factor score.

**Satisfaction.** A user satisfaction scale was used to assess participant opinions and reactions to the various components of the web intervention. The measure consisted of 13 items asking participants to rate on a 5-point scale (1 = *strongly disagree*, 5 = *strongly agree*) their web intervention experience. Items assessed ease of use, effectiveness of the various modules, and overall quality of the web intervention. The satisfaction score was computed by adding the answers over all items. Internal reliability was excellent (α = 0.92) at T3.

**PTSD checklist for DSM-5 (PCL-5).** The PCL-5 was used to measure the distress symptoms associated with trauma. The PCL-5 is a 20-item self-report measure that assesses the 20 DSM-5 symptoms of PTSD (Weathers, et al., 2013). A sample item from the PCL-5 is “In the past month, how much were you been bothered by repeated, disturbing, and unwanted memories of the stressful experience?”. Responses range from
0=Not at all to 4=Extremely. The PCL-5 was scored using a total symptom severity score (range: 0-80) by summing the scores for each of the 20 items. Additionally, scores for each of the PTSD symptom clusters were computed. Internal reliability for the total score was $\alpha = 0.88$ at T1 and $\alpha = 0.94$ at T3.

**Procedure**

The study was approved by the UCCS institutional review board (IRB). UCCS psychology students signed up for this study via the SONA online system. Other participants were contacted via email or a flyer. All participants were provided with a brief statement explaining the procedure and purpose of the study along with a link to the Time 1 (T1) survey on Qualtrics. The participant flow chart is shown in Figure 4. After participants signed the informed consent form via Qualtrics, they completed the T1 questionnaire that included all measures assessing demographics, traumatic life events, posttraumatic distress, phase specific self-efficacy, outcome expectations, perceived need, intention and planning. Only those participants who had experienced traumatic life event were included in the study. Additionally, inclusion criteria originally required a PCL5 score of 30 (out of 80). However, after several months of running the study, the PCL5 requirement was reduced to greater than 0 and an amended IRB was submitted and approved. Reducing the PCL5 requirement provided a wider range of participants that would more accurately capture the effect of PTSD symptoms (high and low) on the generation of intentions. Participants who completed the T1 survey and who met the inclusion criteria were given access to the web intervention via e-mail. This e-mail provided participants with the website address and instructions on how to create a user account, log in to the site, and directed them to use the site as much as they would like
UCCS Psychology students see proposed research on UCCS SONA system. Non-psychology students are recruited via flyers or email.

Participant follows web links to project description, informed consent, and **Time 1** online survey. All UCCS psychology students who fill out Time 1 online survey are *awarded* 1.0 extra credit points.

**Participant does not meet criteria.**

**Participant meets criteria.**

Participant receives an email with *MyTraumaRecovery* website access and registration information.

**Participant does not create an account.**

**Participant creates an account.**

Participant receives an email one week later with a request to complete the **Time 2** online survey.

Participant receives an email one week after completing T2 survey with a request to complete the **Time 3** online survey.

Psychology students are *awarded* 3.5 *EC points*. Non-psychology students are entered into raffle for *1 of 4 $25.00 gift cards*.

*Figure 4.* Participant flowchart including Time 1, Time 2, and Time 3.
over the next two weeks. Engagement levels were tracked and recorded by the web intervention throughout the study.

One week after qualifying for the study, participants were sent an email and asked to complete the short Time 2 (T2) survey that measured their plans for using the intervention, their outcome expectations, and treatment self-efficacy. One week after completing the T2 survey, participants were prompted by e-mail to take the final Time 3 (T3) survey on Qualtrics. The T3 survey included many of the measures assessed at T1 along with the subjective engagement and user satisfaction measures. After completing the final survey, participants were debriefed and UCCS psychology students received additional extra credit (3.5 EC units). Non-psychology students were entered in a raffle for one of four $25.00 gift cards. Additional resources were provided to participants at the conclusion of the study (e.g., UCCS Counseling Center, Aspen Pointe Health Services).

Data Analysis

Due to the small sample size at T3 ($N = 55$) compared to T1 ($N = 216$), separate analyses were run for the motivational (T1) and volitional (T2, T3) phases. To test whether the data supported the motivational phase hypotheses (H1, H2, H3, H4), the model presented in Figure 5 was tested via Structural Equation Modelling (SEM) using AMOS v23.0 with maximum likelihood estimation. Two identical participants were identified, and the duplicates with missing data were removed. Data was assessed for outliers, normality and collinearity. Two outliers were identified using Mahalonobis distance and removed. Variables were relatively normal as shown by the histograms in Figure 6. Mardia’s critical ratio for multivariate normality was smaller than 1.96 (c.r. =
1.23) indicating that the coefficient of multivariate kurtosis is not significantly different from zero. The collinearity tolerance statistic was below 0.20 and there was no correlation between variables above 0.90, therefore, there was no indication of collinearity. Model fit was examined using the chi-square goodness of fit test, as well as the comparative fit index (CFI; Hu & Bentler, 1999), tucker-lewis index (TLI; Tucker & Lewis, 1973), and root mean square error of approximation (RMSEA; Browne & Cudeck, 1993). Cutoff points used for the fit indices were CFI > 0.96, TLI > 0.95 and RMSEA < 0.06. All parameter estimates are presented in standardized form. Missing value analysis via SPSS revealed no missing data. A second exploratory SEM analysis was also performed to investigate potential differences in predictors of intention for completers.

![Figure 5. HAPA Time 1 motivational phase model.](image-url)
To test whether the data supported the *volitional* phase hypotheses (H5, H6, H7, H8), a moderated mediation regression analyses was performed using PROCESS (Hayes,
PROCESS estimates the indirect effect coefficient for each indirect pathway between the independent variable (*Intention* at T1) and the dependent variable (*Engagement* at T3), accounting for the mediator (*Planning* at T2) and moderator (*Treatment Self-Efficacy* at T2). In this model, TSE was hypothesized to moderate the translation of plans into action (right arm of the mediation pathway). Two additional exploratory analyses were performed on the indirect pathway between *Intention* and *Engagement*, mediated by *Planning* using PROCESS model 7 (Hayes, 2012). The first exploratory analysis investigated whether pre-treatment self-efficacy moderated the generation of plans (left arm of the mediation pathway), and the second analysis used this same model to investigate whether baseline PCL5 symptoms moderated the generation of plans. Bootstrapping method was used to test inferences about the significance of mediation effects. The bootstrap approach is considered superior to normal theory-based Sobel’s test for the significance of the mediation (Hayes, 2012). Results of each of these analyses are presented as standardized regression coefficients for each parameter.

*Figure 7. HAPA volitional phase model.*
CHAPTER 3
RESULTS

Preliminary Analysis

Table 1 depicts the descriptive statistics for the demographic variables. Attrition analysis revealed that there were no significant differences between T1 and T3 in age $t(370) = -.108, p = .91$ and education $t(357) = .136, p = .89$. However, there was a significant difference in the frequency of trauma between the T1 ($M = 1.79, SD = 1.44$) and T3 ($M = 2.65, SD = 1.93$) groups, $t(322) = -3.97, p < .001$, where those who completed T3 had experienced a greater frequency of trauma. Table 2 shows the internal consistency of each of the measures used in the analyses, indicating that all measures, except engagement ($\alpha = .65$), had acceptable reliability.

Table 3 displays bivariate correlation coefficients, means, and standard deviations for the HAPA study variables of the motivational and volitional phases. The correlations between motivational phase predictors (T1) revealed that intention was significantly correlated with PCL5 symptoms ($r = .40, p < .001$), outcome expectations ($r = .45, p < .001$), pre-treatment self-efficacy ($r = .29, p < .001$) and perceived need ($r = .56, p < .001$) ($N = 216$). This lends support towards hypotheses 1, 2, 3 and 4 of the motivational phase. Examination of these same correlations with intention for completers only (below the diagonal in Table 3, T1, $N = 55$) revealed that PCL5 symptoms ($r = .56, p < .001$) and
Table 3

Correlations, Means and Standard Deviations of HAPA Variables for Time 1 (N = 216), Time 2 (N = 55) and Time 3 (N = 55)

<table>
<thead>
<tr>
<th>HAPA Variables</th>
<th>Time 1</th>
<th>Time 2</th>
<th>Time 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 5</td>
<td>6 7 8 9 10 11 12</td>
<td></td>
</tr>
<tr>
<td>1. PCL5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Outcome Expectations</td>
<td>.30*</td>
<td>.29**</td>
<td>.46**</td>
</tr>
<tr>
<td>3. Pre-treatment Self-Efficacy</td>
<td>.17</td>
<td>.41*</td>
<td>.13</td>
</tr>
<tr>
<td>4. Perceived Need</td>
<td>.63**</td>
<td>.40**</td>
<td>.02</td>
</tr>
<tr>
<td>5. Intention</td>
<td>.56**</td>
<td>.54**</td>
<td>.18</td>
</tr>
<tr>
<td>6. Planning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Treatment Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Engagement Factor</td>
<td></td>
<td></td>
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</tbody>
</table>

Note: Correlations in the upper diagonal region for Time 1 show values for all participants who met criteria at Time 1 (N = 216). Correlations in the lower diagonal region for Time 1 show values for participants who completed Time 3 (N = 55). *p < .05, **p < .01. Sub = subjective, obj = objective, eng = engagement.
outcome expectations ($r = .54, p < .001$) increased and pre-treatment self-efficacy ($r = .18, p > .05$) decreased and became non-significant. Perceived need was unchanged.

The correlations between the volitional phase predictors (T1, T2, T3) revealed that intention was significantly correlated with planning ($r = .27, p < .05$) and treatment self-efficacy ($r = .43, p < .01$), but not overall engagement ($r = .19, p = .17$) ($N = 55$). However, intention was significantly related to the subjective measure of engagement for frequency ($r = .28, p < .05$). Notably, treatment self-efficacy exhibited significant medium sized correlations with all of the motivational and volitional phase predictors.

Paired samples t-tests indicated that PCL5 symptoms significantly decreased from T1 ($M = 30.29, SD = 17.23$) to T3 ($M = 21.77, SD = 15.38$), $t(54) = 5.00, p < .001, d = 0.52$. Similarly, levels of treatment self-efficacy significantly decreased from T1 ($M = 30.00, SD = 8.07$) to T3 ($M = 26.20, SD = 7.45$), $t(54) = 3.30, p < .01$. There were no changes in outcome expectations between T1 and T3, $t(54) = -1.60, p = .12$.

**Motivational Phase Model**

**Proposed model:** To test the motivational phase hypotheses (H1, H2, H3, H4), a structural equation model was analyzed using T1 participants. The original independence SEM yielded a poor fit with $\chi^2(6, N = 216) = 132.69, p < .001, \text{CFI} = .491, \text{TLI} = .151, \text{RMSEA} = .311$ (90% CI [.266, .358]). Modification indices suggested that correlating the measurement errors of PCL5 scores and perceived need, outcome expectations and perceived need and outcome expectations and pre-treatment self-efficacy would improve overall model fit. These correlated errors were included in the final motivational SEM, producing an excellent fit, $\chi^2(3, N = 216) = 4.27, p = .23, \text{CFI} = .995, \text{TLI} = .98, \text{RMSEA} = .04$ (90% CI [.00, .13]) that explained 42% of the variance. Figure 8 shows the
standardized regression weights for each of the predictors of Intention and indicates support for all four of the motivational model hypotheses.

![Motivational phase Structural Equation Model](image)

*Figure 8.* Motivational phase Structural Equation Model for all Time 1 participants who met criteria ($N = 216$). Standardized regression weights all significant ($p < .01$). $R^2 = .42$.

**Exploratory analysis – completers only.** In order to assess differences between those who completed Time 1 and those who completed Time 3 a second T1 motivational model SEM was performed with completers only ($N = 55$). The reduced sample model produced an adequate fit, $\chi^2(3, N = 55) = 6.51, p = .09$, CFI = .96, TLI = .85, RMSEA = .09 (90% CI [.00, .30]) that explained 43% of the variance. Figure 9 shows that when compared to all Time 1 participants (Figure 8), completers’ estimates increased for Outcome Expectations, $\beta = .40, p < .01$ and PCL5 scores, $\beta = .34, p < .01$. Conversely,
Perceived Need, $\beta = .20$, $p = .14$ and Pre-Treatment Self-Efficacy, $\beta = -.02$, $p = .86$ were no longer significant predictors of intention. Although perceived need was the largest predictor of intention in the proposed model (all qualified T1 participants); this exploratory analysis suggests that expected outcomes was the largest predictor of T1 intention for those who actually engaged with the intervention.

![Motivational Phase Structural Equation Model for completers only (N = 55).](image)

**Figure 9**: Motivational phase Structural Equation Model for completers only ($N = 55$). Standardized regression weights significant for outcome expectations and PCL5 scores ($p < .01$). $R^2 = .43$. Results differed from the larger Time 1 sample in that standardized regression weights for pre-treatment self-efficacy and perceived need were no longer significant.

**Volitional Phase Model**

**Engagement latent construct.** Engagement included both subjective and objective measures of frequency and duration. Exploratory Factor Analysis (EFA) was
used to combine these measures into a single latent factor. Correlations between the subjective and objective measures were weak (see Table 3, items 8-11). Bartlett’s test of sphericity was significant ($\chi^2 (6) = 41.86, p < .001$). Principal components analysis was used to identify and compute composite scores for the underlying latent factor for engagement. Results revealed a unidimensional factor with all communalities above .30 further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was deemed to be suitable with the two subjective and two objective items. Correlations between the factor and the HAPA predictors revealed that the factor had significant moderate correlations with many of the HAPA predictors (see Table 3, item 12). The regression factor was saved in the SPSS data file and used as the dependent engagement variable in the volitional phase moderated mediation model.

To test the volitional phase model, three separate moderated mediational analyses were performed. The results of these analyses are listed in Table 4 and further described below.

**Proposed moderated mediation model.** To test the volitional phase hypotheses (H5, H6, H7, H8) a moderated mediation analysis was performed using T3 participants. Figure 10 shows the conceptual and statistical moderated mediation model (Hayes PROCESS model 14). In this model, TSE was hypothesized to moderate the translation of plans into action (i.e., right arm of the mediation pathway). The results of the analysis showed support for hypotheses 6, 7 and 8 but the direct effect of intention on engagement (hypothesis 5) was not supported. Specifically, the results revealed that the conditional mediation effect of T2 planning on T3 engagement moderated by T2 TSE was significant.
Table 4

Volitional Phase Moderated Mediation Results of Proposed and Exploratory Models

<table>
<thead>
<tr>
<th>Condition</th>
<th>Effect (SE)</th>
<th>LL 95% CI</th>
<th>UL 95% CI</th>
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</thead>
<tbody>
<tr>
<td>Proposed - Treatment Self-Efficacy (Model 14)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1 SD (19.19)</td>
<td>.18 (.12)</td>
<td>.022</td>
<td>.491</td>
</tr>
<tr>
<td>M (27.31)</td>
<td>.11 (.08)</td>
<td>0.018</td>
<td>0.352</td>
</tr>
<tr>
<td>+1 SD (35.43)</td>
<td>.05 (.10)</td>
<td>-0.082</td>
<td>0.351</td>
</tr>
<tr>
<td>Exploratory - Pre-Treatment Self-Efficacy (Model 7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1 SD (24.32)</td>
<td>.07 (.11)</td>
<td>-0.117</td>
<td>0.367</td>
</tr>
<tr>
<td>M (32.09)</td>
<td>.13 (.09)</td>
<td>0.010</td>
<td>0.386</td>
</tr>
<tr>
<td>+1 SD (39.86)</td>
<td>.18 (.12)</td>
<td>0.027</td>
<td>0.514</td>
</tr>
<tr>
<td>Exploratory - PCL5 Scores (Model 7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1 SD (12.99)</td>
<td>.01 (.02)</td>
<td>-0.012</td>
<td>0.076</td>
</tr>
<tr>
<td>M (30.27)</td>
<td>.03 (.02)</td>
<td>0.000</td>
<td>0.073</td>
</tr>
<tr>
<td>+1 SD (47.55)</td>
<td>.04 (.02)</td>
<td>0.004</td>
<td>0.100</td>
</tr>
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</table>

at low levels of TSE (M - SD = 18.76), β = .18, 95% CI [.02,.48]. The conditional indirect effect was non-significant at high levels of TSE (M + SD = 33.65, β = .05, 95% CI [-.09,.32]. The direct effect of intention on planning (β = .37, p < .05) and the direct effect of planning on engagement (β = .36, p < .05) were significant whereas the direct effect of intention on engagement (β = .10, p = .62) and the interaction between planning and TSE (β = -.19, p = .30) were not significant. According to Hayes (2012), the interaction does not have to be significant in order to interpret the conditional indirect effect. These results suggest that for those with lower treatment self-efficacy, the relationship between intention and engagement was mediated by planning.
Exploratory moderated mediation model. The above model proposed that TSE moderated the translation of plans into action. However, additional research has shown that self-efficacy can also influence the generation of plans (Arbour-Nicitopoulos, Duncan, Remington, Cairney, & Faulkner, 2014). Therefore, a second HAPA model was
analyzed (PROCESS Model 7) that specified the moderator on the left arm of the mediation pathway (see Figure 11). Research has shown that PTSE, rather than TSE, to be significantly related to the development of plans (Luszczynska & Schwarzer, 2003), therefore, this model used pre-treatment self-efficacy (PTSE) as the moderator between intentions and planning. Unlike the above analysis, results of the analysis revealed that the conditional mediation effect of planning (T2) on engagement (T3) moderated by PTSE (T1) was significant at high levels of PTSE, $\beta= .18, 95\% \text{ CI [.03, .52]}$. The conditional indirect effect was non-significant at low levels of PTSE, $\beta= .07, 95\% \text{ CI [-.11, .38]}$. The direct effect of planning on engagement was significant ($\beta= .35, p < .01$), whereas the direct effects of intention on planning ($\beta= .30, p = .12$), intention on engagement ($\beta= .12, p = .50$) and the interaction between intention and PTSE ($\beta= .18, p = .37$) were not significant. This suggests that for those with higher pre-treatment self-efficacy, the relationship between intention and engagement was mediated by planning.

**Exploratory moderated mediation model.** Additionally, Time 1 HAPA predictors were used to explore other possible moderators for the volitional phase model. Research has revealed varying effects of baseline PTSD symptoms and treatment dropout in traditional mental health settings (Imel, Laska, Jakupecak, & Simpson, 2013). This suggests that baseline PTSD symptoms may also have an indirect conditional effect on engagement. Exploratory analysis revealed that the mediation effect of planning on engagement was significantly moderated by PCL5 scores. Using PROCESS model 7, a significant interaction between T1 intention and T1 PCL5 scores was found ($\beta= .40, p < .05$). The conditional indirect effect of intention on planning was found to be significantly moderated at high levels of PCL5 scores ($M + SD = 47.56, \beta = .20, 95\% \text{ CI}$
Figure 11. Standardized coefficients of volitional phase moderated mediation Hayes
PROCESS model 7, N = 55. Conditional indirect effect of Intention (X) on Engagement
(Y) through Planning (M = b [a₁ + a₃W]), moderated by Pre-treatment Self-Efficacy (W).
Conditional indirect effect reveals that for high levels of PTSE (M + SD = 39.86),
planning mediates the effect of intention on engagement (β = .18, 95% CI [.03, .52]). In
this model PTSE is proposed as moderating the generation of plans. **p < .01.

[.02, .46]. This moderating effect was not found at low levels of PCL5 scores (β = .00,
95% CI [-.15, .09]. The direct effect of planning on engagement was significant (β = .35,
p < .01), whereas the direct effects of intention on planning (β = .32, p = .15), PCL5
scores on planning (β = .04, p = .85) and intention on engagement (β = .12, p = .50) were
not significant. These results indicate that for those with higher baseline PCL5 scores,
the relationship between intention and engagement was also mediated by planning. No other HAPA Time 1 predictors were found to significantly moderate the proposed mediation pathway.

**Exploratory correlations.** In addition to the proposed motivational model, the correlations of between additional demographic variables and intention and engagement were explored (see Table 5). Education was significantly correlated with intention \((r = .21, p < .01)\) and trauma intensity was significantly correlated with engagement \((r = .31, p < .05)\). The use of mental health services in the past year was negatively correlated with engagement \((r = -.45, p < .05)\), whereas the use of mental health services over the lifetime was negatively correlated with intention to use a web intervention \((r = -.18, p < .01)\).

Table 5

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
<td>1. PCL5 T1</td>
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\(^*p < .05, \quad **p < .01\)
CHAPTER 4
DISCUSSION

This study is the first to examine the associations between motivational and volitional predictors of engagement with a web intervention. By using a theoretical framework rather than specific features of the intervention the results of this study can be used to investigate motivators of engagement for a variety of web interventions.

Motivational Model

Testing of the motivation model revealed that PSTD symptom severity, outcome expectations, perceived need and pre-treatment self-efficacy were significant predictors of intention. As hypothesized, higher levels of pre-treatment self-efficacy at baseline were associated with greater intention to engage with a web intervention (hypothesis 1). Similarly, higher levels of outcome expectancies at baseline were also associated with greater intention (hypothesis 2). This supports the results of previous studies that used the HAPA model to predict engagement with other health behaviors such as physical activity, breast-self-examination, and rehabilitation (Arbour-Nicitopoulos, Duncan, Remington, Cairney, & Faulkner, 2014; Barg, et al., 2012; Luszczynska & Schwarzer, 2010).

According to the HAPA tenets (Schwarzer, 2008), outcome expectations and task self-efficacy both play influential roles in the prediction of behavioral intentions. However, Bandura’s social cognitive theory (Bandura, 1997) postulates that self-efficacy
has a stronger influence on behavioral intentions than outcome expectations, whereas our study found outcome expectations ($\beta = .28$) to have a greater influence on intentions than self-efficacy ($\beta = .15$). This may be due to stage specific vs. continuum conceptualizations of self-efficacy. Future studies should look at changes in self-efficacy over time.

Contrary to previous studies that found no association between perceived need and intention (Luszczynska & Schwarzer, 2010), higher baseline levels of perceived need were found to be associated with greater intention (hypothesis 3). In fact, perceived need was shown to be the strongest predictor of intention ($\beta = .34$) for T1 participants. This difference could be due to applying the HAPA model to an intervention (e.g., trauma recovery) versus a prevention behavior (e.g., breast self-examination, flossing, and sunscreen usage). Individuals who already are experiencing symptoms of the targeted condition appear to be motivated by different predictors than those who may be at risk of developing the condition. This study measured the perceived need for an intervention, whereas previous HAPA studies measured the perceived risk of developing the disease or disorder (Arbour-Nicitooulos, Duncan, Remington, Cairney, & Faulkner, 2014) and found perceived risk to be a distal antecedent to intention (Schwarzer, Luszczynska, & Lippke, 2011). Perceived risk was not a relevant measure for our study as the presence of baseline PTSD symptoms was initially part of the inclusion criteria. Additionally, by incorporating symptom severity, our results extended the HAPA motivational model where greater symptom severity (e.g., PTSD) was found to be associated with greater intention (hypothesis 4). These findings highlight the potential differences between prevention and intervention motivational factors.
Another interesting finding was differences in the motivational HAPA predictors for T1 participants vs. completers (Figures 8 and 9, respectively). For all qualified participants, the largest predictor of intentions was perceived need (β = .40), whereas for those who actually performed the targeted behavior the strongest predictor was outcome expectations (β = .40). Self-efficacy was not significant for completers, suggesting that for this application, perceptions regarding the expected outcome of the intervention were more important than perceptions about one’s ability to use the intervention. This provides some evidence on the changing nature of self-efficacy as people pass through different stages of change (Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008). Previous research has found that the influence of outcome expectations vanishes as individuals move from motivation to volition (Schwarzer & Renner, 2000), however, our study revealed no difference in outcome expectations between T1 and T3. Future studies should examine the differences in the motivational HAPA predictors for interventions versus preventions and the differential impact of these predictors over time.

**Volitional Model**

The volitional model also supported several hypotheses. High intentions were associated with higher levels of planning (hypothesis 6) and higher planning was associated with higher engagement (hypothesis 7). However, higher T1 intentions did not lead to higher T3 engagement (hypothesis 5) which suggests a mediated pathway via planning. Testing of the volitional model revealed that the mediator model works well in some groups but not in others. Specifically, this study found that for those low in treatment self-efficacy, planning mediated the effects of intention on engagement (hypothesis 8). In this model, treatment self-efficacy moderated the translation of plans
into action (right arm of the moderated mediation model – Figure 11). According to Schwarzer, Lippke and Luszczynska (2011), intenders are motivated to change, but do not act because they may lack the right skills to translate their intention into action. In support of this, our study found that for those intenders who do not have high confidence in their ability to continue to use a trauma recovery web intervention, additional self-regulatory strategies are needed, such as planning, to facilitate engagement with the intervention.

A second model was analyzed to explore the generation rather than the execution of plans (left arm of the moderated mediation model – Figure 11). Unlike the proposed model, this exploratory model found that for those high in pre-treatment self-efficacy, planning mediated the effects of intention on engagement. In other words, those who were confident in their ability to use the intervention were more likely to develop a plan. People with less confidence imagine failure, harbor self-doubts, and tend to procrastinate. Comparing the two volitional phase analyses suggests that those with high pre-treatment self-efficacy are more likely to develop a plan, whereas those with low treatment self-efficacy are more likely to require a plan to perform the behavior. This again provides support to phase specific nature of self-efficacy where high baseline pre-treatment self-efficacy predicated the generation of plans and low treatment self-efficacy predicated the execution of plans. In other words, those who had confidence in their ability to begin treatment developed a plan, whereas those who lacked confidence in their ability to continue treatment needed a plan in order to engage with the treatment.

In summary, within the HAPA framework, predictors of engagement were examined irrespective of the specific features of the web intervention. This novel
approach to intervention engagement research can be applied to other types of interventions in a variety of domains. The results of this study extended the HAPA behavioral health framework to include additional predictors of engagement. Perceived need, outcome expectations, pre-treatment self-efficacy and PTSD symptoms were all found to be significant predictors of intention, and planning mediated the translation of intention into engagement for those with low treatment self-efficacy. This study highlighted the differences in social cognitive predictors between interventions and preventions and also the changes in these predictors over time as one moves from pre-action to action. The results of this study will hopefully spark further exploration into these areas.

These findings have implications for mental health interventions. Improving engagement with therapy, whether in-person or online, can potentially lead to improved therapeutic outcomes. By understanding the impact of phase specific self-efficacy, perceived need, and outcome expectations, interventions can be designed to enhance these perceptions which in turn could lead to improved engagement. Specifically, these results suggest that communicating the expected outcomes of an intervention could have a significant impact on initial engagement. Additionally, for some individuals, including planning in intervention strategies may also improve treatment engagement. This, in turn, can potentially lead to decreased distress symptoms since intervention engagement is one of the more consistent predictors of positive outcomes (Vandelanotte, Spathonis, Eakin, & Owen, 2007). Additionally, symptom severity may affect the relative importance of these predictors and should be considered when designing web intervention strategies.
Limitations

This two week study examined the pre-treatment and treatment phases of the behavioral change process. The HAPA has also been applied to the maintenance and recovery phases where maintenance pertains to optimistic beliefs about one’s ability to deal with barriers that arise while maintaining the behavioral change and recovery self-efficacy pertains to one’s conviction to get back on track after being derailed (Luszczynska & Schwarzer, 2010). Extending this study to include these phases could be especially beneficial in the area of trauma recovery that often entails extended treatment and is subject to perceived setbacks during the recovery process. According to SCT, changes in trauma symptoms may have an effect on outcome expectancy, self-efficacy, planning and engagement. This reciprocal causation may play an important role in the maintenance and recovery stages of web intervention engagement.

However, in order to study reciprocal causation, an adequate sample size is needed. Of the 218 who completed the study, only 55 actually used the intervention. This attrition rate of almost 75% was not unusual for web interventions, but did affect the method by which the overall HAPA model was analyzed. Instead of looking at the model as a whole, two separate analyses were performed for the motivational and volitional phases. These separate models eliminated the possibility of examining the effects of the motivational predictors on the volitional phase of engagement.

Another limitation includes the bundling of both action and coping planning into the planning measure. Past research has revealed differential effects of the two planning processes on the translation of intention to action (Scholz, Schuz, Ziegelmann, Lippke, & Schwarzer, 2008). Future studies should look at these planning processes separately. In
addition, future studies should examine additional moderators to planning to determine for whom does planning work best? Interestingly, exploratory correlations revealed that higher education was associated with intention but not engagement (see Table 5) and those with previous therapeutic experiences had negative correlations with intention. Perceived trauma intensity versus trauma frequency was correlated with higher engagement. Surprisingly, website satisfaction was positively correlated with intention but not engagement. A further investigation into the relationship between demographic, mental health histories and social cognitive predictors for non-completers vs. completers may reveal valuable engagement related information.

Finally, and perhaps most importantly, the conceptualization of engagement needs further examination. This study conceptualized engagement as subjective and objective measures of frequency and duration, with no consideration of potency, outcome and user experience (Doherty, Coyle, & Matthews, 2010). Though there was a significant reduction in PTSD symptoms for those who engaged, this measure was not included in the latent construct for engagement. Additionally, the latent construct had adequate fit but poor internal reliability. Future studies should extend our definition of engagement that focused on measures of time to include dosage, outcomes, and usability metrics.
REFERENCES


APPENDIX

University of Colorado
Colorado Springs
Institutional Review Board (IRB) for the Protection of Human Subjects

Date: 2/17/2016
IRB Review

IRB PROTOCOL NO.: 15-127
Protocol Title: Evaluation of Interactions with a Trauma Recovery Web Intervention
Principal Investigator: Carolyn Yeager
Faculty Advisor if Applicable: Charles Benight
Application: Renewal
Type of Review: Expedited 7
Risk Level: No more than Minimal Risk
Renewal Review Level (If changed from original approval) if Applicable: N/A No Change
This Protocol involves a Vulnerable Population: N/A (No Vulnerable Population)
Expires: 3 March 2017

*Note, if exempt: If there are no major changes in the research, protocol does not require review on a continuing basis by the IRB. In addition, the protocol may match more than one review category not listed.
Externally funded: ☒ No ☐ Yes
OSP #: Sponsor:

Thank you for submitting your Request for IRB Review for renewal of an approved protocol. The protocol identified above has been reviewed according to the policies of this institution and the provisions of applicable federal regulations. The review category is noted above, along with the expiration date, if applicable.

Once human participant research has been approved, it is the Principal Investigator’s (PI) responsibility to report any changes in research activity related to the project:
- The PI must provide the IRB with all protocol and consent form amendments and revisions.
- The IRB must approve these changes prior to implementation.
- All advertisements recruiting study subjects must also receive prior approval by the IRB.
- The PI must promptly inform the IRB of all unanticipated serious adverse (within 24 hours). All unanticipated adverse events must be reported to the IRB within 1 week (see 45CFR46 101/9). Failure to comply with these federally mandated responsibilities may result in suspension or termination of the project.
- Renew study with the IRB prior to expiration.
- Notify the IRB when the study is complete.

If you have any questions, please contact Research Compliance Specialist in the Office of Sponsored Programs at 719-255-3903 or irb@uccs.edu

Thank you for your concern about human subject protection issues, and good luck with your research.

Sincerely yours,

Michelle Okun, PhD
IRB Reviewer

www.ucss.edu/researchethics/
Version 2/12/13
1420 Austin Bluffs Parkway Colorado Springs, CO 80918 719-255-3231 phone 719-255-3706 fax