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Systematic, theoretically-grounded development and feasibility testing of an innovative, preventive web-based game for children exposed to acute trauma

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Abstract

Background—Millions of children are affected by acute medical events annually, creating need for resources to promote recovery. While web-based interventions promise wide reach and low cost for users, development can be time- and cost-intensive. A systematic approach to intervention development can help to minimize costs and increase likelihood of effectiveness. Using a systematic approach, our team integrated evidence on the etiology of traumatic stress, an explicit program theory, and a user-centered design process to intervention development.

Objective—To describe evidence and the program theory model applied to the Coping Coach intervention and present pilot data evaluating intervention feasibility and acceptability.

Method—Informed by empirical evidence on traumatic stress prevention, an overarching program theory model was articulated to delineate pathways from a) specific intervention content

to b) program targets and proximal outcomes to c) key longer-term health outcomes. Systematic user-testing with children ages 8–12 (N = 42) exposed to an acute medical event and their parents was conducted throughout intervention development.

Results—Functionality challenges in early prototypes necessitated revisions. Child engagement was positive throughout revisions to the Coping Coach intervention. Final pilot-testing demonstrated promising feasibility and high user-engagement and satisfaction.

Conclusion—Applying a systematic approach to the development of Coping Coach led to the creation of a functional intervention that is accepted by children and parents. Development of new e-health interventions may benefit from a similar approach. Future research should evaluate the efficacy of Coping Coach in achieving targeted outcomes of reduced trauma symptoms and improved health-related quality of life.

Potentially traumatic events are common experiences for youth including exposure to violence, injuries, sudden medical illnesses, and painful medical treatments (Breslau, Wilcox, Storr, Lucia, & Anthony, 2004; Finkelhor, Turner, Ormrod, & Hamby, 2009). Although most children recover well after an acute traumatic event, many develop significant and persistent posttraumatic stress symptoms (PTSS). Prevalence rates of PTSS among children exposed to trauma range widely, from 12–19% of children with injuries or illnesses to 20–63% of children exposed to violence (Alisic et al., 2014; Dyregrov & Yule, 2006; Kahana, Feeny, Youngstrom, & Drotar, 2006). In addition to distress directly related to these symptoms, PTSS are also associated with functional outcomes including health-related quality of life (HRQOL) (Holbrook et al., 2005; Landolt, Buehlmann, Maag, & Schiestl, 2009; Zatzick et al., 2008). For instance, injured children with significant PTSS report poorer physical (e.g., somatic complaints), social (e.g., limitations in social activities), and emotional (e.g., sadness) functioning through one year post-injury (Holbrook et al., 2005; Landolt et al., 2009; Zatzick et al., 2008). Preventive interventions are essential to promote full recovery for children exposed to acute trauma.

Potential Mechanisms for Preventing PTSS and Promoting HRQOL

Specific to PTSS following acute traumatic events, risk and protective variables can be classified as pre-trauma factors (e.g., pre-existing trauma exposure or psychological functioning), peri-trauma factors (e.g., cognitive appraisals, acute heart rate, physiological arousal), and post-trauma factors (e.g., acute stress reactions, cognitive appraisals, types of coping) (Bryant, Salmon, Sinclair, & Davidson, 2007a, 2007b; Ehlers, Mayou, & Bryant, 2003; Kahana et al., 2006; Kassam-Adams, Garcia-España, Miller, & Winston, 2006; Landolt, Vollrath, & Ribi, 2002; Meiser-Stedman, Yule, Dalgleish, Smith, & Glucksman, 2006; Salmon, Sinclair, & Bryant, 2007; Zehnder, Prchal, Vollrath, & Landolt, 2006). Social and family support (Dyregrov & Yule, 2006; Keppel-Benson, Ollendick, & Benson, 2002; Ozer & Weinstein, 2004; Pat-Horenczyk, Rabinowitz, Rice, & Tucker-Levin, 2009) operate as a protective factors throughout the trauma recovery process. Innovative avenues for preventive intervention informed by empirical research include appraisals about safety and vulnerability to future harm (Bryant et al., 2007b; Ehlers et al., 2003; Meiser-Stedman, Dalgleish, Glucksman, Yule, & Smith, 2009), coping behavior such as social support

seeking (Stallard et al., 2001), and reducing early avoidance behaviors (Ebata & Moos, 1991).

While an extensive literature shows strong support for the effectiveness of cognitive-behavioral (CBT) interventions to treat mood and anxiety symptoms in children and teens (Cohen & Mannarino, 2008; Kenardy, McCafferty, & Rosa, 2006; March, Spence, & Donovan, 2009; O’Kearney, Kang, Christensen, & Griffiths, 2009), evidence has yet to be translated into widely accessible interventions to prevent negative psychological reactions following a trauma exposure. Of the few early preventive interventions for children exposed to trauma that have been developed and evaluated, few have explicitly delineated and tested their theoretical underpinnings (Kramer & Landolt, 2011).

Recommendations for preventive interventions for PTSS suggest providing psycho-education on the nature and course of traumatic stress reactions and adaptive coping strategies (Kassam-Adams, Marsac, & Winston, 2009; Kramer & Landolt, 2011). Additionally, evidence suggests that preventive interventions should enhance children’s social support systems and promote safe exposure to trauma-related reminders (Kassam-Adams et al., 2009; Kramer & Landolt, 2011). A recent meta-analysis indicated that for children and adolescents exposed to single traumatic events, early psychological interventions (i.e., delivered within one month) produced promising improvements with regards to dissociation, anxiety, and to some extent arousal, whereas intervention effects for PTSS/PTSD were largely small and non-significant (Kramer & Landolt, 2011). Of the seven studies included in this meta-analysis, only one study rated as “high quality” with regards to methodology (Berkowitz, Stover, & Marans, 2011) demonstrated medium-to-large intervention effects on PTSS. In this study, children who had recently experienced a potentially traumatic event were randomly assigned to a caregiver-child early intervention (Child and Family Traumatic Stress Intervention [CFTSI]) or supportive comparison condition (Berkowitz et al., 2011). Those in the intervention group demonstrated significantly fewer PTSD diagnoses at follow-up. However, the CFTSI intervention requires four in-person sessions delivered by master’s or doctoral-level clinicians, thereby limiting its accessibility.

Increasing Accessibility: Web-based Interventions

Unfortunately, only a small proportion of children exposed to acute medical trauma receive psychosocial or mental health resources. A number of barriers impede the delivery of evidence-based interventions for children exposed to trauma such as the limited number of clinicians trained in trauma-informed psychological interventions, high attrition with referral to psychological services after trauma, stigma associated with psychological treatment, and high cost of treatment and/or lack of insurance coverage. This underlines the need for innovative solutions to facilitate the dissemination of evidence-based interventions to promote recovery from acute trauma exposure.

The Internet provides a low-cost, easily accessible, and wide-scale delivery method for psychological interventions (Amstadter, Broman-Fulks, Zinzow, Ruggiero, & Cercone, 2009). Approximately 83% of US children aged 3–17 years have a computer in their home

(File, 2013). There is growing empirical support for the efficacy of using the Internet to deliver high quality interventions to children and parents (D'Alessandro, Kreiter, Kinzer, & Peterson, 2004; Ritterband et al., 2005). Web-based programs have improved symptom management and adherence to medical regimens for asthma, pain, encopresis, and obesity in children (Stinson, Wilson, Gill, Yamada, & Holt, 2009), as well as symptoms of anxiety and depression in children, adolescents, and adults (Spence et al., 2011; Donovan & March, 2014). With regards to posttraumatic stress, several e-Health interventions have been developed for adults utilizing PTSD treatment theory and/or techniques. For instance, the smartphone applications "PE Coach" (Reger et al., 2013) and "PTSD Coach" (Kuhn et al., 2014) were developed to facilitate treatment of PTSD among adults. Both of these programs are in early stages of evaluation. To date, there is no data available of functionality of PE Coach (Reger et al., 2013); PTSD Coach has shown to have high level of engagement and moderate to high ratings of perceived helpfulness (Kuhn et al., 2014). Far fewer interventions have been designed to prevent negative psychological sequelae in youth following trauma exposure. To date, the only web-based preventive intervention which has shown promise in preventing psychological symptoms in children exposed to acute medical trauma is "Kids and Accidents" (Cox & Kenardy, 2010). This intervention combined print information for parents with an informational website for youth. An RCT ($N = 56$) showed reductions in anxiety and a trend for reduced PTSS among higher risk children but also suggested a need for greater engagement (Cox & Kenardy, 2010).

Applying Program Theory to Intervention Development: Coping Coach

Based on empirical evidence described above, our team translated research on etiology and malleable risk and protective factors for posttraumatic stress into the Coping Coach intervention. Using program theory to articulate an intervention's key targeted outcomes (i.e., long-term goals), behavioral objectives (i.e., risk and protective factors), and target constructs (i.e., knowledge, beliefs, and skills that influence performance of behavioral objectives) can guide the development of specific intervention content and prepare the intervention for evaluation (Winston & Jacobsohn, 2010). This systematic, evidence-based approach to intervention development is grounded in behavioral science theory and utilizes features of established models for health promotion and disease prevention (Winston & Jacobsohn, 2010). Ritterband and colleagues suggested a similar approach to web-based interventions, with additional recommendations for user-testing for functionality and engagement throughout intervention development (Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009). More specifically, authors posit that the way in which users engage with Internet interventions varies as a function of user (e.g., cognitive factors, skills) and site characteristics (e.g., appearance, content delivery, functionality), as well as the support offered by the program (e.g., email, phone). Utilization of the website produces behavior change through various mechanisms (e.g., motivation, skill building). In turn, behavior change impacts target behaviors associated with the problem, leading to symptom improvement (Ritterband et al., 2009).

Following the recommendations of Winston and Jacobsohn (2010) and Ritterband et al. (2009), we developed a program theory model to outline our conceptualization of the hypothesized mechanisms of action linking Coping Coach's specific features to its

overarching goals (see Figure 1). More specifically, we established the long-term goals of Coping Coach as: (1) the prevention and/or reduction of persistent PTSS and (2) the promotion of HRQOL among children who recently experienced an acute, potentially traumatic medical event. To accomplish these goals, we outlined behavioral objectives based on empirical risk and protective factors (i.e., appraisals, avoidance coping, social support seeking). We then defined instrumental target constructs (e.g., specific knowledge) for meeting these behavioral objectives. Finally, our target constructs informed specific intervention content (i.e., skill building activities). In addition, our team considered the influence of each of the dimensions outlined in Ritterband and colleagues' (2009) behavior change model for internet interventions (i.e., specific user, environment, and website characteristics that could enhance utilization, mechanisms of action to promote behavior change, and ways to ensure treatment maintenance). Thus, by integrating program theory concepts with aspects of Internet-specific behavior change models, we developed a systematic and empirically-grounded plan for the development and evaluation of Coping Coach.

The objectives of this manuscript are to 1) describe the development of the Coping Coach intervention using program theory; 2) report on preliminary feasibility (i.e., ease and likelihood of child/family use) and acceptability of the intervention; and 3) identify necessary modifications of the intervention for future study.

Method

Coping Coach Intervention

The Coping Coach intervention integrates evidence-based components of cognitive behavioral treatment and Internet interventions, applying these to prevention by targeting adaptive/maladaptive appraisals, avoidance coping, and social support. Coping Coach utilizes an interactive, developmentally appropriate, game-like format to teach children adaptive coping strategies. Children are primary users of the intervention, with parents providing supervision. While children are primary users of Coping Coach, parents are encouraged to support their child's use of the intervention. The website which hosts Coping Coach also provides information for parents about how and when to seek professional help for their child. The Coping Coach intervention has gone through multiple revisions based on feedback from users and expert reviewers, resulting in two primary prototypes (described below).

Prototype 1—The initial Coping Coach prototype utilized an interactive, 3D format and was comprised of three primary modules: Appraisals, Avoidance, and Social Support. The Appraisals module provided psycho-education to teach children how to recognize and communicate feelings. For example, in the "Making Faces" activity, children used an interactive tool to build faces representing specific emotions (e.g., happy, worried, angry), with the aim of increasing children's ability to recognize and label feelings. The Avoidance module targeted reducing reliance on avoidance as a maladaptive coping response. Interactive activities included completing a quiz about the child's own avoidance, identifying "approach" or "avoidance" behaviors, and creating a coping plan incorporating

adaptive alternatives to avoidance. In the Social Support module, children “interacted” with a variety of support systems (e.g., family members, friends, school personnel) and identified the types of help these individuals can provide. This prototype version was evaluated in the United States only. User-testing suggested several functionality problems. While children liked the 3D format, associated technical difficulties created problems with usability and a significant barrier to intervention implementation.

Prototype 2—Based on results from user-testing with Prototype 1, we rebuilt the Coping Coach intervention, maintaining content while improving functionality (readability, ease of navigation) and acceptability (engagement via interactive activities, personable characters, and an overarching storyline). We implemented several major revisions. First, we translated the web-based activities included in the initial prototype into a web-based game (replacing “modules” with “levels”). As recommended by Baranowski and colleagues (2008) for promoting health-related behavior change, the second prototype uses a central story line to increase interactivity and to tie together individual intervention activities (Baranowski, Buday, Thompson, & Baranowski, 2008). Second, we decreased the amount of text to improve readability. Third, we modified skills practice so that children could practice multiple times before applying the skill to his or her own experience. Fourth, we integrated social support content throughout the intervention (rather than in a separate activity). Finally, we developed an adventure log that cuts across all modules to reinforce learning and skill-building. In developing Prototype 2, we conducted iterative testing of each game level and made revisions as necessary.

The final version of Prototype 2 included three game levels completed sequentially (see Fig. 1). Level 1 (feelings) focuses on recognition of emotions (target construct) and communication of emotions (behavioral objective) after potentially traumatic experiences. For example, users construct faces to represent emotions and help a group of townspeople label their emotions. Each townspeople presents a story of an acute traumatic event including an asthma attack, motor vehicle crash, violence exposure, and house fire (intervention content). Children also practice identifying their own emotions and complete sections of the adventure log to reinforce learning (intervention content). In Level 2 (appraisals), children learn about the cognitive triad (i.e., the relationship between thoughts, feelings, and behaviors; target construct) using fictional characters’ experiences and help the characters to identify and reframe maladaptive thoughts (content). Subsequently, children apply this skill to their own experiences by identifying their thoughts related to their own event and practicing ways to evaluate potentially inaccurate or unhelpful appraisals (behavioral objective). Level 3 (avoidance) aims to reduce reliance on avoidance as a coping response (target construct). In this game level, children learn about the benefits of safely approaching trauma reminders and the potential risks of avoidance by interacting with characters (intervention content). Children also learn to identify whether they may be avoiding trauma reminders and how to approach reminders safely (behavioral objective). Identifying and using social support is integrated throughout the three levels, as children engage with characters and provide and receive help and support.

Participants

Forty-two children (7 from Australia, 35 from the United States) with a recent acute medical event and their parents were recruited for the study (Prototype 1: $n = 9$; Prototype 2: $n = 33$). Fifty-seven percent ($n = 24$) were male. Children were eligible to participate if they were between 8 and 12 years old ($M = 9.89$, $SD = 1.49$), had experienced a potentially traumatic medical event within the past 60 days, and understood English well enough to complete the interview and questionnaire. Children who presented with a Glasgow Coma Score (GCS) of less than 12 or whose hospital visit was the result of suspected abuse or other family violence were excluded from the study. The majority of children in this sample were White (60%), with the remaining children identified as Black (24%), Asian (7%), and “Other” (10%). Twelve percent of children were of Hispanic origin. Children’s medical events included new medical diagnoses (e.g., appendicitis, diabetes), acute exacerbations of existing medical illnesses (e.g., asthma attack, sickle cell disease pain crisis), injuries, and burns. Thirty-seven (88%) of the parents in this sample were mothers. Parents were 28 – 51 years of age ($M = 38.11$, $SD = 5.88$). Relative to participants from the US, the Australia participants were more homogenous with regards to sex (i.e., male), racial and ethnic background (i.e., Caucasian), and type of acute medical event (i.e., burns). Additionally, the proportion of Australia participants falling within the highest household income bracket was less than that of the US sample. See Table 1 for participant demographics.

Procedures

Children hospitalized for a recent acute medical event at pediatric hospitals in the Northeastern region of the United States and in Queensland, Australia were identified by study personnel via electronic medical records. Potentially eligible children and their parents were invited to participate in the study. After obtaining parent consent and child assent, parents completed a brief demographics questionnaire. Children then completed pre-determined Coping Coach modules/levels. All children were guided by a trained research assistant through specific activities to be completed and provided support when difficulties arose (e.g., technical assistance, repeating or further explaining directions). Research assistants also wrote down any functional difficulties to be used in revising Coping Coach. Parents sat adjacent to youth in order to observe their child completing the Coping Coach activities. Children and parents were interviewed after each Coping Coach activity. Children and parents completed the Satisfaction Questionnaire to gather their overall impressions and suggestions for Coping Coach. Children and parents received a gift of \$10 value as compensation.

Measures

Coping Coach Semi-Structured Interview—This measure was created for the purpose of this study to gather parent and child feedback via open-ended questions (e.g., “What did you learn from this activity?”, “What would you change about this activity?”). Research assistants also recorded by hand behavioral observations (e.g., facial expressions, verbal utterances) as children completed activities to determine any difficulties with functionality. These behavioral observations were compiled and reviewed to identify specific areas and types of functionality problems that participants experienced.

Parent/Child Satisfaction Questionnaire—The Satisfaction Questionnaire (parallel parent and child versions) was designed to gather overall impressions of intervention materials post-intervention. It includes eight open-ended questions that elicit strengths and areas for improvement and 15 items rated yes/no or on a 3-point Likert scale (a lot, some, not at all) to assess the visual appeal, functionality, trustworthiness, and comprehensibility of the intervention.

Results

Coping Coach Prototype 1

Acceptability—Most children and parents reported that this prototype was an engaging, fun, and trustworthy tool that they would recommend to other children and families (see Table 2). For instance, one child reported, “I like [Coping Coach]. It’s very cool. It’s cool.com,” (female, age 12) while another elaborated, “It’s a good idea to have kids express [their] ideas and help them feel better” (female, age 9). One parent commented, “[Coping Coach] is good for parents. If [children] don’t want to talk to you, there’s a way that if they play this, the parent can get feedback [about] what the child wants” (mother, child age 10). Another parent noted, “[Coping Coach] has good ideas for fun ways to teach coping skills” (mother, child age 12).

Feasibility—Many children and parents encountered difficulties related to functionality (e.g., ease of use) when using Prototype 1 (see Table 2). For example, when asked for feedback on the faces activity, one child commented, “Whenever I clicked on something, the whole pane would move. It’s annoying,” (female, age 9). Additionally, another noted that slow loading speed of some 3D features hindered usability: “When the [user’s character] had to walk, they were very slow and the [other characters] were far away” (female, age 8). These challenges underlined the need to improve functionality in the subsequent Coping Coach prototype. Several children and parents reported that the directions were confusing (33% children, 25% parents) and that the Coping Coach modules had too many words (22% children, 44% parents). For instance, one parent commented, “[I thought it was] too wordy. I felt like I needed to be available to answer [my child’s] questions” (mother, child age 12). One parent noted that the intervention may be “a bit complex for a [hospital] setting or for younger kids” (mother, child age 8). Children had similar responses about age-appropriateness. One child commented, “I’m okay with [the reading level] but it would be very hard for smaller kids” (female, age 8). These data highlighted a need to clarify directions and reduce the amount of text. Therefore, we recreated Coping Coach using the same theoretical foundation but a completely different functionality, transforming it into an adventure game.

Coping Coach Prototype 2

Acceptability—As compared to the first prototype, a greater proportion of children and parents found Coping Coach Prototype 2 engaging, fun, and trustworthy (see Table 3). More specifically, 91% of children and 85% of parents reported that the intervention was fun to use, and all children and parents reported that Coping Coach gave good advice. For example, one parent commented, “I love it. [Coping Coach] is very helpful for children”

(mother, child age 10), while another appreciated that “it was considerate to all illnesses and injuries, genders, and ethnicities” (mother, child age 8). Children likewise responded positively to the intervention, commenting that Coping Coach “was a good way for people to express their feelings” (male, age 12) and that it helped children to “tell [their] parents what [they] feel and learn what to do when [they’re] scared” (female, age 9). Additionally, most children and parents would recommend Coping Coach Prototype 2 to other children and families (79% children, 84% parents). For instance, one parent commented, “I think it is a good tool for children who have been through traumatic events” (mother, child age 11). Although a larger proportion of participants from Australia reported that they liked the Coping Coach activities and characters, fewer found the information trustworthy and would recommend the intervention to others relative to the US participants.

Feasibility—Results suggest markedly improved functionality for Prototype 2 as compared to its precursor by both parent and child report (see Table 3). In particular, most children and parents reported that Coping Coach Prototype 2 was easy to use (94% children, 91% parents) and that they would use it again (73% children, 70% parents). Data suggest that children found the directions somewhat easier to understand than in Prototype 1, with 18% of children and 30% of parents reporting that directions were confusing in Prototype 2. One parent commented, “I think that it is a clear game. The language is clear for kids and parents, too. It [uses] familiar words that parents use at home,” (mother, child age 9). Likewise, one child noted, “I liked the way the questions were phrased. They were easy to understand. You didn’t really have to go back and read it again,” (male, age 12). On the other hand, a large proportion still reported that the intervention contained too many words (61% children, 52% parents). This was particularly true for participants from Australia, with relatively more reporting that the intervention was too text heavy and fewer indicating that they would use it again. For example, one child suggested that while the reading was not difficult for him, “it might be hard for some younger kids” (male, age 10). Thus, while results suggest that the changes made following Prototype 1 improved Coping Coach, additional revisions are needed to improve readability.

Discussion

Results from this study suggest that Coping Coach’s systematic, user-centered design and evaluation process resulted in marked improvement in functionality from the initial to the revised prototype. In particular, most participants found Prototype 2 to be an engaging, easy to use, acceptable tool that they would use again. Acceptability was high across both prototypes, with most families reporting that the intervention was fun to use, gave good advice, and provided trustworthy information. Additionally, most children and parents indicated that they would recommend Coping Coach to others. Overall, pilot testing demonstrates promising feasibility and high user engagement and satisfaction with the revised Coping Coach intervention.

Compared to other web-based interventions for children with healthcare conditions, the revised Coping Coach prototype demonstrated similar or better participant-reported functionality and acceptability. For instance, Krishna and colleagues (2003) investigated an Internet-enabled interactive asthma education program for children and caregivers and found

that 81–89% of children and caregivers reported that the web-based program was easy to use and 62–86% planned to use the program again. Similarly, studies of web-based interventions for children with encopresis as well as for those after accidental and brain injury indicate moderate to high ease of use and acceptability (Cox & Kenardy, 2010; Ritterband et al., 2008; Wade, Carey, & Wolfe, 2006). Our pilot testing of the revised Coping Coach intervention revealed comparable levels of functionality and acceptability among child and parent users.

Several factors likely accounted for the high usability and acceptability of the revised prototype among the US sample in particular. More specifically, the interactive, game-like format likely increased child engagement in the intervention content. Additionally, the addition of audio, engaging characters, and an overarching storyline to Prototype 2 helped tie together psycho-educational and skill building activities into a cohesive program. However, results also suggest that developmental appropriateness could be further improved by revisions to reduce the amount of text. By systematically evaluating Coping Coach during the development process, we were able to incorporate user feedback in revisions and identify future directions for further optimizing design and content in order to increase the potency of this intervention.

The successful use of a program theory and user-centered design and evaluation in improving intervention feasibility for the Coping Coach intervention may have implications for other e-health interventions and other interventions targeting medical traumatic stress. In particular, beginning intervention development by identifying program theory elements, as recommended by Winston and Jacobsohn (2010), sets the stage for evaluation throughout intervention development. The specific program theory utilized for the Coping Coach intervention (see Figure 1) may be able to be adapted for other traumatic stress intervention development. In regards to e-health interventions, our findings support the suggestion of Baranowski and colleagues (2008) that interactive features and storylines may be key to user engagement in internet-based interventions; thus, other e-health interventions may want to consider these components. Further, developers of e-health interventions may want to examine functionality early in intervention development, which can help reduce cost and time.

With regards to cross-cultural applicability of Coping Coach, findings suggest several differences in acceptability and feasibility between the US and Australian samples. In particular, a greater proportion of Australian participants indicated that the intervention had too many words, and relatively fewer reported that they would use it again. Although a larger proportion of participants from Australia reported that they liked the Coping Coach activities and characters, fewer found the information trustworthy and would recommend the intervention to others. While this may be due to slower internet speeds or other differences in the population (i.e., all burn patients, all male, fewer children in the highest SES group), findings suggest that Australian participants found the intervention somewhat less usable and engaging as compared to US participants. Thus, further Coping Coach intervention revisions are needed to ensure broad relevance across cultures.

Limitations of the current study include its small sample size and cross-sectional design. In addition, this pilot study did not assess potential relationships between biomedical,

psychosocial, and cognitive factors on intervention functionality and acceptability. For instance, it is possible that some Coping Coach features may be more challenging for younger school-aged children or for those with reading comprehension difficulties. It is also possible that the way in which children engage with the intervention may vary depending on type of acute medical event (e.g., new medical diagnosis vs. acute exacerbation of an existing illness) or the timing of administration. Additionally, this study did not evaluate cost-effectiveness, feasibility, or efficacy of home use of Coping Coach by families independently (i.e., without in-person support from research assistants). However, a randomized controlled trial (RCT) is currently underway to further examine acceptability and feasibility of Coping Coach delivered in the home and without direct support from study personnel (Marsac et al., 2013). Furthermore, the RCT will expand upon these pilot results by examining intervention efficacy as hypothesized in the program theory model in improving child recovery and preventing or reducing trauma symptoms (See Fig. 1).

Conclusion

The prevalence and impact of acute medical trauma on children's emotional health warrant innovative approaches to secondary prevention. Applying a systematic approach to the development of Coping Coach led to the creation of a functional intervention that is well-liked by children and parents. Using a clearly articulated program theory for intervention development allows for ease of planning the next steps in evaluation. Given its potential for broad distribution and easy implementation, Coping Coach is a promising method for promoting positive child health outcomes after pediatric acute trauma. Future research will evaluate the efficacy of Coping Coach in reducing trauma symptoms and improving health-related quality of life after medical events via a randomized trial.

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Figure 1.

Program theory model applied to the Coping Coach Intervention: Pathways from intervention content to targets to priority long-term outcomes

*Content described as organized in Prototype 2.

Table 1**Participant Demographics**

	US		Australia
	N (%)	N (%)	N (%)
Prototype	1	2	2
Number of participants	9	26	7
Child Characteristics			
Sex			
Male	4 (44)	13 (50)	7 (100)
Female	5 (56)	13 (50)	–
Race			
Black/African-American	2 (22)	8 (31)	–
White	6 (67)	12 (46)	7 (100)
Asian	–	3 (12)	–
Other	1 (11)	3 (12)	–
Ethnicity			
Hispanic	–	4 (15)	–
Non-Hispanic	9 (100)	22 (85)	–
Medical Event			
New Medical Diagnosis	2 (22)	16 (62)	–
Acute Exacerbation of Existing Illness	5 (56)	4 (15)	–
Injury	2 (22)	6 (23)	–
Burn	–	–	7 (100)
Parent Characteristics			
Sex			
Male	1 (11)	2 (8)	2 (29)
Female	8 (89)	24 (92)	5 (71)
Race			
Black/African-American	2 (22)	8 (31)	–
White	7 (78)	12 (46)	7 (100)
Asian	–	3 (12)	–
Other	–	3 (12)	–
Ethnicity			
Hispanic	–	3 (12)	–
Non-Hispanic	9 (100)	23 (89)	–
Education			
Full or Partial Completion of High School Degree	2 (22)	3 (12)	2 (29)
Full or Partial Completion of College Degree	4 (44)	19 (73)	4 (57)
Completion of Graduate Degree	3 (33)	4 (15)	1 (14)
Income			
\$15,000–\$49,999	4 (44)	4 (15)	2 (29)

	US		Australia
	N (%)	N (%)	N (%)
\$50,000–\$99,999	2 (22)	13 (50)	3 (43)
\$100,000 or More	3 (33)	7 (27)	1 (14)

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Table 2

Functionality and Engagingness for Coping Coach Prototype 1

	US	
	Child n (%)	Parent n (%)
Functionality: Usability		
Coping Coach is easy to use	5 (56)	5 (56)
Would use Coping Coach again	6 (67)	7 (88)
Coping Coach directions are confusing	3 (33)	2 (25)
Coping Coach has too many words	2 (22)	4 (44)
Coping Coach has too many pictures	0 (0)	0 (0)
Learned something new	4 (44)	4 (44)
Acceptability: Engagingness		
Coping Coach is fun to use	7 (78)	6 (67)
Likes appearance of Coping Coach	8 (89)	8 (90)
Likes Coping Coach activities	8 (89)	9 (100)
Likes the Coping Coach characters	8 (89)	8 (89)
Coping Coach gives good advice	7 (78)	8 (100)
Information is trustworthy	6 (67)	8 (100)
Recommends Coping Coach to other (kids/families)	6 (67)	6 (67)
Coping Coach characters are kids like (me/my child)	4 (44)	6 (75)

Table 3

Functionality and Engagingness for Coping Coach Prototype 2

	US		Australia	
	Child n (%)	Parent n (%)	Child n (%)	Parent n (%)
Functionality: Usability				
Coping Coach is easy to use	24 (92)	23 (92)	7 (100)	7 (100)
Would use Coping Coach again	21 (81)	20 (87)	3 (43)	3 (43)
Coping Coach directions are confusing	4 (15)	8 (36)	2 (29)	2 (29)
Coping Coach has too many words	13 (50)	10 (40)	7 (100)	7 (100)
Coping Coach has too many pictures	1 (4)	1 (4)	0 (0)	0 (0)
Learned something new	16 (62)	13 (54)	4 (57)	4 (57)
Acceptability: Engagingness				
Coping Coach is fun to use	24 (92)	22 (96)	6 (86)	6 (86)
Likes appearance of Coping Coach	26 (100)	20 (83)	4 (57)	4 (57)
Likes Coping Coach activities	20 (77)	14 (61)	7 (100)	7 (100)
Likes the Coping Coach characters	16 (62)	13 (57)	6 (86)	6 (86)
Coping Coach gives good advice	26 (100)	24 (100)	7 (100)	7 (100)
Information is trustworthy	24 (92)	25 (100)	4 (57)	4 (57)
Recommends Coping Coach to other (kids/families)	22 (89)	22 (92)	4 (57)	4 (57)
Coping Coach characters are kids like (me/my child)	19 (73)	21 (96)	5 (71)	5 (71)

* One missing response for each parent from Australia