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Translation of an Evidence-Based Tailored Childhood Injury Prevention Program

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Abstract

This article describes the process of translating Safe n' Sound, a computer-based program for parents of young children, for a general clinic environment. Safe n' Sound is designed to reduce the risk of unintentional childhood injuries, the leading cause of death among children older than 1 year in the United States. The evidence-based program produces tailored information for parents and their healthcare provider about burns, falls, poisoning, drowning, suffocations, choking prevention, and car safety. To offer Safe n' Sound to a broader audience, we translated the program from the form used for efficacy testing to a stand-alone application. Notable steps in this translation included (1) conducting an organizational assessment to determine the needs of the clinic staff and feasibility of implementation, (2) modifying the program to reduce length, prioritize risk areas, and update content, (3) repackaging the program to minimize cost and space requirements, and (4) developing promotional and instructional materials. Factors contributing to the success of this effort include strong collaborative partnerships, the relative advantage of Safe n' Sound over traditional materials, the modifiable design of the program, and the support of the clinic staff and providers. Challenges and areas for future work are discussed.

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Keywords

anticipatory guidance; childhood injury; injury prevention; translation

After their first birthday, children in the United States are more likely to die from an injury than from any other cause, a fact that has been documented since the early 1980s with the publication of *Injury in America: A Continuing Public Health Problem*.[1] In 2004, more than 2 600 children younger than 4 years died from an unintentional injury (a crude rate of 13 of every 100 000 children), which accounted for 19 percent of total years of life lost before the age of 65 years.[2] In 2005, 1 of every 10 children younger than 4 years was seen in an emergency department to be treated for an unintentional injury. The specific types and causes of injury vary by age; as children's risk for some types of injury decrease, while others increase with their development.[3,4] Thus, effective prevention requires focusing on the most likely causes of injury at a child's particular age and providing effective countermeasures to reduce those injury risks.

Countermeasures for preventing injury are most often directed at the individual level, specifically, parents of young children.[5-7] These efforts encourage parents to adopt injury prevention behaviors and incorporate safety devices in their children's physical environment. As with other health-promoting behaviors, there are substantial barriers to executing these activities, particularly for families with low income.[7] Barriers such as the cost of the safety supplies (eg, stair gates, car seats, smoke alarms), beliefs about the severity and susceptibility of injury, and conflicting parenting philosophies reduce the likelihood that parents will consistently and correctly use proven safety devices, engage in injury prevention behaviors, or have beliefs and attitudes that support injury prevention efforts. In one study,[8] 65 percent of parents reported unchecked or excessively high hot water temperature, 40 percent of homes with stairs did not have stair gates, and 27 percent had not checked or changed the batteries in their smoke detectors for over 6 months. So, while proven countermeasures exist, they are implemented at far less than optimal rates.

Randomized controlled trials have demonstrated that several communication approaches increase appropriate parental use of injury prevention devices and change prevention attitudes and beliefs about injury prevention. Physician counseling can positively impact behavior[9,10] and the American Academy of Pediatrics recommends that physicians provide anticipatory guidance for minimizing injury risk.[3] However, in spite of the recommendation that "pediatricians should include unintentional injury prevention as a major component of anticipatory guidance,"[3(p202)] several studies indicate that injury prevention is often not discussed or covered only briefly during the course of routine visits.[11] Unfortunately, the lack of attention paid to injury risk is not uncommon in the delivery of preventive services in general.[12] Another promising communication approach is the integration of tailored education materials, also shown to impact injury prevention practices.[8,13] Together with verbal guidance by the physician, they offer an opportunity for a focused exchange in a clinical context when there are time constraints and competing demands.[14-16]

To date, none of these approaches has been translated for general use or widely disseminated. According to the National Center for Injury Prevention and Control of the Centers for Disease Control and Prevention, the first crosscutting priority for the center is to "evaluate the most effective methods for translating research findings into public health programs and policies."[17(p13)] As noted by others in this issue, the literature on health promotion and disease prevention has focused largely on developing and testing behavioral intervention, whereas little attention has been given to the dissemination of successful interventions. With the recent development and application of theories and models to guide translation and dissemination

research (eg, RE-AIM),[18,19] public health can more quickly advance the delivery of successful interventions.

In this article, we describe specific steps in the translation of an injury prevention program suitable for pediatric clinics. This research allows us to assess how useful and feasible the program is in the real-world setting, which may be different from program effects under controlled research conditions.[20] By providing a case study of a successful translational effort, we hope to inform other dissemination work and accelerate the process from the discovery of efficacious approaches to more widespread behavior change,[21] and ultimately close the gap between what we know and using that knowledge to reduce the burden of injury on children.[19]

Program Development and Efficacy Trial

Program description

Safe n' Sound is a childhood injury prevention software program, originally kiosk-based, that produces tailored information for parents of young children and their healthcare providers about increasing car safety and preventing burns, falls, poisoning, suffocation, and drowning. Parents complete an assessment on the computer about their current safety practices and beliefs, allowing the computer to generate tailored information addressing their injury risks and beliefs. Parents then receive printed feedback about the two priority safety behaviors most important for them to adopt to keep their child safer.

The feedback is guided by constructs and processes of behavioral science (eg, consciousness raising, perceived susceptibility, benefits, social norms, outcome expectations, role modeling) and tailored to the age of the child and risk of injury for certain behaviors (a complete description of the intervention is provided elsewhere).[22] Every parent receives the first page of the feedback, which contains a summary of the child's highest injury risk areas and a message tailored to specific injury prevention beliefs. If two injury risks are identified, pages 2 and 3 provide information on each of these highest-priority injury prevention behavior changes, including general information on the importance and relevance of the injury topic, specific information about the priority risk behavior, and specific steps to reduce injury risk. A brief testimonial by a parent describing why he or she decided to engage in the particular behavior is also provided to model the desired behavior. If only one injury risk is identified, page 2 consists of information about that risk as described above and page 3 reinforces the parents' current injury prevention efforts. If no injury risks are identified, parents receive only one page of reinforcing feedback.

In addition to the feedback provided to the parent, the program prints a one-page summary of the priority areas for the parent to share with his or her healthcare provider. This summary allows the healthcare provider to reiterate the injury prevention information and address any relevant questions or concerns the parent has regarding the information or its implementation.

Program efficacy

Two previous studies conducted in pediatric primary care settings have found that Safe n' Sound is successful in persuading parents to adopt new safety behaviors.[8,22] As a first step in the discovery phase, a pilot evaluation was conducted of a preliminary version of the program developed for parents of children between 6 and 20 months and without provider feedback. Results from this pilot evaluation indicated that parents receiving the intervention demonstrated greater use of injury prevention practices than those receiving standard injury prevention information 1 month postintervention, with 65 percent of those receiving tailored information adopting a new injury prevention behavior in comparison with 41 percent of those receiving standard information. This study, involving 174 parents (86% African American) from a single

pediatric clinic, showed that although only 20 percent of parents discussed the tailored feedback with their physician, those that did were more likely to make behavior changes than those who did not.

The second project providing evidence for the efficacy of Safe n' Sound studied the full program in three clinical sites (n = 305, with completed follow-up) with the physician component and expanded age range (parents of children aged 0–4 years). Findings from this study also showed that parents who received the tailored feedback had greater behavior change postintervention than those who received standard injury prevention information. Of parents who received the tailored intervention, either with or without provider feedback, 49 percent and 45 percent, respectively, reported adopting a new prevention behavior in comparison with 32 percent of parents who received the generic feedback (χ^2 = 6.61; P = .04). Notably, these effects were greater in the population with lower education. In addition, those receiving tailored information were more likely to report behavior change of greater complexity (such as installing a car seat in comparison to using outlet covers). The full program includes the supplementary healthcare provider feedback designed to facilitate parent-provider communication; however, providers' and parents' reports of the extent of communication regarding the feedback were conflicting, with physicians reporting more frequent communication than parents. Physicians' responses to the program were favorable; they reported that the tailored feedback was useful both to them and to parents in directing their anticipatory guidance. Given the national priorities for translational research and the promising findings regarding the efficacy and acceptability of this program, the project team proceeded to plan and study the systematic integration of the program into routine clinical practice by undertaking the translational activities described next.

Translation Process

A 4-phase collaborative plan for the dissemination study was developed. Phases included preimplementation, pilot implementation, full implementation, and continuation. A summary of these phases is provided in Table 1. This article describes specific activities undertaken for the preimplementation phase, many of which were guided by existing planning approaches.[18,23]

The first step in this preimplementation phase was to identify partners who not only had an interest in providing injury prevention materials in a clinical setting, but also had access to these clinics and strong relationships with clinic administration. In the case of this project, a former investigator at the National Institute of Child Health and Human Development facilitated discussions among the clinics, National Institute of Child Health and Human Development, and investigators at Saint Louis University about the feasibility and capacity of the clinics to host such a program.

Five pediatric clinics from the Carolina Physician's Network served as the sites for this work, one of which served as the pilot implementation site. The practices are located in Charlotte, North Carolina, and are components of the Carolinas HealthCare System. The Carolinas Center of Injury Prevention is also part of the system, which facilitated the collection of the organizational information important to address when translating the program for clinic implementation. The sites were representative of the types of clinic settings where small children are seen for well-child visits: varied patient census, rural and urban geographic areas, and varied patient socioeconomic status and race. Together these 5 sites treat approximately 1 570 children younger than 5 years for well-child visits each year.

After establishing our partnership, we developed a protocol for dissemination and collectively revised and enhanced the program to facilitate its use outside the context of a research study.

Activities included (1) organizational assessment, (2) program modification, (3) program repackaging, and (4) promotional material development. These activities are described below.

Organizational assessment

To understand the needs of the physicians in the selected practices, we distributed a questionnaire to all pediatric providers to assess the technical capacity of the clinics (eg, the availability of wireless networks) and the types of computer arrangements most feasible in their specific clinic settings. Results from this survey, along with interviews of office managers, indicated that the largest concerns were space availability, utilization of staff time, ability of the parents to complete the program without interfering with patient flow, theft of devices, and the ability of devices to withstand use in a facility serving small children. Furthermore, we examined previously documented barriers to injury prevention office-based activities, conducted initial office visits to consult staff, observed office flow, and conducted audits of sample patient charts.

Program modification

Before initiating translation activities, it was important to consider the intended audience of the final product. The audience for the efficacy trial was parents of children visiting a pediatric clinic, who were recruited and enrolled by a research assistant. For the first phase of dissemination, we focused on pediatric clinics, which provided a natural transition from the population of the efficacy trial. We also determined that support from these healthcare organizations would be greater than other audiences and these were a potential venue for future "nationwide" dissemination. Recognizing that similar organizations can have different needs, we were able to address the needs of these particular collaborating organizations and incorporate those components into the program (eg, preferred wording, minimizing time, space requirements) as well as applicable local legislation (eg, pool fencing).

On the basis of previous research,[24] we understood that parents would be more likely to use the program if the process was short, and we learned that this was a priority of the participating clinics. Therefore, we revised the assessment to be completed in less than 10 minutes, which meant including measures used only for risk assessment and tailoring, and removing items used only to evaluate program outcomes (eg, hypothesized moderators such as number of children in the household). We also created a hierarchy of assessment items with programmed stopping rules, consistent with priority injury areas.[25] This allows the user to complete only as many questions as are necessary to determine which specific injury behaviors are the highest risk for their child. For instance, the hierarchy specifies that owning the correct car seat is the most important safety behavior that a parent can adopt. Therefore, the question about car seat ownership is the first safety behavior assessed. If the parent does not have the correct car seat for his or her child (as determined by age and weight algorithms that are incorporated into the program), this behavior is captured as the first priority behavior. The parent then completes additional questions (tailored to the age of the child) in the specified order until a second priority behavior is identified. Once two priority areas are determined, the remaining questions are skipped. The feedback then provides information about these two priority behaviors.

In addition to decreasing assessment length, we revised several questions to increase variability of responses. On the basis of findings from the efficacy trial, several behaviors (eg, child always strapped into high chair, swing, or stroller) were being performed by an overwhelming majority of the study population. Any behavior that more than 90 percent of the study population performed correctly either was omitted or the related question was reworded to allow for greater variability. We anticipate that this will result in a greater distribution of responses, thus increasing the power/utility of the tailored feedback.[26] Lastly, demographic questions were included to collect information about program usage to estimate program reach; however, again

on the basis of clinic feedback, we allowed users to skip them if time was short. The extent to which this reduces the demographic information provided remains to be seen.

Since the program is used in waiting rooms where the wait time is highly variable, we considered several pause and easy-exit options. Ideally, the program would allow the user to pause when called to the examination room. However, this would require collecting personal information from each user so that the program would be able to find the paused record, an option that would not have sufficiently protected individual information. As an alternative solution, we opted to include a manual restart button. While this meant that the user and the physician would not have the materials during the visit, the user could return to the program afterward and restart the program. The program allowed for a 3-minute pause to allow the parent to attend to a child or respond to clinic staff.

Because about 3 years had passed since the initial development, we updated the assessment and the message content to reflect changes in injury prevention practices and resources. For example, available car seat options had changed substantially, which necessitated revising the recommendations included in the parent feedback. We also enhanced the graphic interface of the assessment to include pictures of several risky situations to clarify the assessment questions (eg, a pool not fully enclosed by a fence).

Program repackaging

In addition to restructuring the assessment and algorithms, we addressed other program features. Given the expense of the computer kiosk system that was evaluated in the efficacy trial (about $8000) and the results of the physician surveys and staff interviews, we incorporated two alternative options. Both of these options addressed the barrier voiced by the providers of space and cost required for the kiosk. The first device is a tablet computer, which is portable and can be used in examination rooms at the discretion of office staff. When multiple tablets are utilized, it also allows more than one caregiver to use the program at any given time. However, logistics of multiple printouts directed to a common printer, the fragility of the devices in this type of setting, and the ease of theft may prove to be challenging. A stationary desktop version was chosen for the fixed device that would minimize theft and adhere most closely to the original efficacy designs while still being cost-effective. Both computers will be placed on a desktop that is at least 4 feet tall, has the printer stand above the monitor, and a CPU holder that faces away from the user to minimize potential disruption by the pediatric population. We designed the program to be hosted on any computer without additional software so that future adopters can explore many computing environment options.

In addition, we modified the graphics to give the program an updated look and edited the feedback messages so that they reflected the changes to the assessment. We considered fonts and the layout of the messages to enhance the attractiveness and readability of the program. One change we considered, but rejected, was to forgo the color paper template that we had used in the efficacy trial. While the cost differential was modest (about $2 000 more for color for 6 months), it was still a concern, particularly in clinics with lower operating budgets. Informed by our previous work[27] and the importance of peripheral features of health communication materials,[28] we decided to retain the color template for the initial translation effort. During the full implementation phase, we will evaluate the extent to which this cost impeded adoption or continuation, as has been the case with other injury prevention materials.[3,29]

Promotional material development

To draw attention to the program in the clinic waiting rooms, we designed a brochure that was consistent in theme with the tailored feedback. This was in part to serve the role that the research

assistant had in the efficacy trial, which was to direct parents to the kiosk and inform them of the opportunity. From an organizational perspective, the practices suggested a display at the front desk and the instructional sheet at the computer station to minimize staff time required to provide instructions on program use. Two other steps were taken to reduce staff time: placing the printer in the waiting room as opposed to the "back" office to make the parent responsible for retrieving the outputs and ensuring the incorporation of this program into the informational systems network so that IT support would be easily accessible and system downtime reduced.

Discussion

This article describes the translation of an evidence-based injury prevention kiosk program, from a program used in a highly controlled research environment to a product that can be adopted as a stand-alone resource in pediatric clinics. Table 2 describes features of the research design and computer-based program and their application in both the efficacy trial and the translation and dissemination phases. In this process, we were careful to attempt to retain the "active ingredients" of the program, the essential features that made the program successful in changing injury prevention behaviors of parents of young children.[21] When in doubt, we erred on the side of fidelity when it was unclear whether a specific feature was essential. This was the case with the color paper template—since the initial efficacy trial was not designed to evaluate the specific impact of the vibrant color, we do not know how "essential" this feature is. Although clinics would save a modest amount using the black and white design, we could not underestimate the importance of color to engage the reader.

The translation of this program for dissemination raised several important issues that must be addressed in dissemination work, including:

- determining the target environments for dissemination;
- identifying and understanding their specific needs and objectives to facilitate adoption;
- maintaining intervention fidelity outside the research setting while being flexible in implementation to maximize feasibility; and
- minimizing barriers to adoption and balancing the needs of all collaborators.

By carefully examining and describing these aspects of translational work, we are able to accelerate the adoption of this program into this and other clinical settings.

Addressing the needs of the healthcare sites has allowed us to define a process that program developers can use to customize (to some extent) the program for individual settings. Through this process, we were able to consider the "real-world" setting and make adaptations early in the translation process and study the resulting outcomes. Rather than a static program that requires the adopters to use the program as is, we have a clearly defined process that allows us to customize the program for adoptors. The support provided by the dissemination collaboration provided a mechanism to address common barriers such as program cost, technical support, and management of logistic issues. What is learned from this preimplementation phase is critical to consider during the later translation and dissemination phases to maximize sustainability of the adopted program.

There are several factors related to the success of this translation effort. First, we developed an exceptional collaborative relationship between the National Institute of Child Health and Human Development, Saint Louis University and the Carolinas Center for Injury Prevention, which reaches a network of 17 pediatric and family practice clinics. Carolinas Center for Injury Prevention demonstrated a great organizational commitment to injury prevention work, understood the research process, and was eager to engage in the translational process. Second,

the program offered substantial relative advantage over other similar injury prevention resources (typically generic brochures addressing general childhood injury risks). Physicians even considered this program a draw to the clinic, perhaps adding the benefit of increased revenue or billable services. Physicians reported that they valued the opportunity for "written documentation" of injury prevention topics, which they viewed as providing legal protection. The program costs are modest (estimated costs of about $3 000 start-up and $600 per 1 000 users in addition to requested customization), and while it may not generate a profit, the program certainly saves staff time researching and documenting injury prevention topics. Third, the program is easily modifiable (eg, built with options to print wirelessly and from a printing dock, hosted on any computer) and sustainable with minimal resources, adding to its appeal. Lastly, we were careful to include the office manager and the physicians in the planning process to understand the viewpoints of all involved parties. This integration with the clinical environment may add to the perceived credibility of the program.

As noted in Table 1, future steps in this work will be to study the effect of program adoption on the practices of healthcare providers, measuring the reach of the program and ultimately changes in morbidity and mortality due to injury. We are also exploring longer-term efforts by promoting Safe n' Sound to health fairs, in retail stores, via the Internet, and through a variety of outreach programs. Practitioners should know that it is feasible to provide tailored information to their clinic populations in order to extend and support their injury prevention message.

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TABLE 1

Goals and measures for each dissemination phase

Phase	Goals	Measures
Preimplementation (discussed in this article)	To assess relevant clinic information, examine current injury prevention anticipatory guidance and office flow patterns, modify and test program, and launch on desktop and tablet formats.	Chart audits Provider questionnaires Clinic staff interviews Focus groups
Pilot implementation	To test implementation procedures in a single site and determine methods to optimize integration into clinical practice. Conduct usage observations for desktop and tablet formats.	Chart audits User observations Provider questionnaires Clinic staff interviews Focus groups
Full implementation	To determine program utility, barriers to integration into clinical practices, provider use, and the effect on injury prevention anticipatory guidance. Assess each program format (desktop and tablet) in two clinic sites.	Chart audits User observations Provider questionnaires Clinic staff interviews Focus groups
Continuation	To assess the use of the Safe n' Sound program for 6 months after the study structure and expectations are removed, with sufficient material provided.	Chart audits User observations Provider questionnaires Clinic staff interviews

TABLE 2

Comparison of features for evaluation and dissemination

Feature	Evaluation phase	Translation and dissemination phase
Assessment	Extensive evaluation of all risks and covariates Longer completion time acceptable Response options exploratory, specific to study population	Includes only information necessary for tailoring Must be short and concise Response options applicable to general population
Feedback	Many printing options available	Must be printable at low cost
Program	Run on Mac platform Troubleshooting by research assistants	Must run on Mac and PC platforms Must be stand-alone
Process	Human consent required prior to completion Completion may be interrupted by office visit Cost covered by contract/grant Upkeep provided by study team Important to allow for pausing	Organization cooperation required for placement Parents complete at their leisure/convenience Cost covered by adopting organization Upkeep provided by adopting organization with support from project team Not important to allow for pausing, but exit options important
Outcome measures	Individual behavior change	Provider uptake and utilization Caregiver utilizes program without research assistance guidance
Challenges	Follow-up assessment completion Controlling experimental setting	Cost of hardware and program materials Maintaining program fidelity Training clinic staff in program use Integration of the program into clinic routines and tracking Technical support, maintenance, updating program