

Addressing the Issue of Falls off Playground Equipment: An Empirically-Based Intervention to Reduce Fall-Risk Behaviors on Playgrounds

Barbara A. Morrongiello, PhD and Shawn Matheis, BA
Psychology Department, University of Guelph

Objective The present study evaluated the impact of an intervention to reduce fall-risk behaviors on playgrounds among children 6–11 years of age. **Methods** Children completed posters indicating risky playground behaviors they would and would not do. In the intervention group, video and audio presentations were used to expose children to injury occurrences so that injury vulnerability was communicated in a fear-evoking way. In the control group, children only completed the pre- and post-intervention measures. **Results** Significant decreases in intentions to risk-take were obtained in the intervention, but not the control group. Effectiveness did not vary with children's age or sex, but was greater for those scoring high in sensation-seeking. **Conclusions** A fear-appeals approach proved successful to reduce intended fall-risk behaviors, particularly for children high in sensation-seeking whose risk-taking is motivated by affect arousal.

Key words behavioral intervention; children; falls on playgrounds; unintentional injury.

In many industrialized nations, unintentional injuries rank as the leading cause of death for children and a major cause of visits to emergency departments (Canadian Institute of Child Health, 2000; National Center for Injury Prevention and Control, 2005). Throughout childhood, falls is a leading cause of hospitalization and playground falls are particularly likely to require medical treatment. The aim of the present study was to develop an intervention to reduce children's fall-risk behaviors on playgrounds.

Falls on Playgrounds

Falls account for one-third of all injury-related emergency visits and 75% of all playground injuries that receive medical attention (Phelan, Khoury, Kalkwarf, & Lamphear, 2001). Many injuries result from falls from equipment (Bernardo, Gardner, & Seibel, 2001), which are more severe than playground injuries due to other causes (Phelan et al., 2001). Risk factors include height of the equipment and impact absorbency of the undersurface material. Hence, the primary approach to managing risk has been environmental modifications and improvements in

playground design, including revisions to safety standards (Canadian Standards Association, 1998; U.S. Consumer Product Safety Commission, 1997).

A focus on environmental modification is certainly appropriate, but this approach is unlikely to be sufficient. Upgrading playgrounds to meet safety guidelines is costly, hence, compliance with standards is often poor (e.g., Lesage, 1995). Moreover, high rates of injury from falls occur even on playgrounds that comply with safety standards (Mott et al., 1994). Thus, as long as children behave in ways that elevate risk of falls, they are likely to be at risk for experiencing injuries. Programs that target behavior change, therefore, also can contribute to reduce children's risk of serious injury (Heck, Collins, & Peterson, 2001; Schwebel, Summerlin, Bounds, & Morrongiello, 2006). These interventions, however, must be based on known determinants of children's risk-taking.

Determinants of Children's Risk-Taking

Most theories of health behaviors focus on cognitive determinants (Conner & Norman, 2005). In general,

All correspondence concerning this article should be addressed to Barbara A. Morrongiello, Psychology Department, University of Guelph, Guelph, Ontario, N1G 2W1, Canada. E-mail: bmorrong@uoguelph.ca.

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these theories postulate that behavior follows from a number of cognitions (e.g., appraisal of vulnerability) and that individuals are motivated to avoid harm. Hence, providing information that communicates heightened vulnerability will presumably reduce risk behaviors.

Research on children's risk-taking confirms the importance of cognitions. For example, Morrongiello and Rennie (1998) found that children who rated danger as high, perceived themselves as vulnerable for injury, and anticipated that injuries would be attributable to themselves, were more likely to avoid risk-taking, while risk-takers possessed the opposing characteristics (see also Hillier & Morrongiello, 1998). Similarly, beliefs about the potential severity of injury can affect children's risk behaviors when bicycling (Peterson, Oliver, Brazeal, & Bull, 1995). Thus, as has been found for adults (Glik, Kronenfeld, & Jackson, 1991; Peterson, Farmer, & Kashani, 1990) and adolescents (Moore & Gullone, 1996), cognitive factors play an important role in children's risk-taking decisions.

Of course, the critical issue then becomes how best to communicate messages to target these cognitive factors in order to evoke reductions in risk behaviors. Although few studies have considered this issue with regard to elementary-school children, there is evidence that messages communicated via different emotional displays significantly influence children's cognitive appraisals of danger and their risk decisions. Morrongiello and Rennie (1998) found that when a risk-taking model displayed a fearful facial expression, then children appraised risk as higher compared to when the model displayed a confident expression. Importantly, higher appraisals of risk were associated with less risk-taking. Similarly, recent research has documented that children's emotional responses in injury-risk situations influence decisions to take or avoid risks (Morrongiello & Matheis, 2004; Morrongiello & Sedore, 2005). Feelings of excitement predicted children's risk-taking, whereas feelings of fear predicted risk avoidance, just as has been shown with adults and adolescents (Zuckerman, 1994). These findings suggest that messaging that evokes fear might prove effective to communicate vulnerability and reduce injury-risk behaviors among children. Literature on behavioral interventions provides support for this notion.

Behavioral Intervention Approaches to Reducing Risk Behaviors

Recent reviews indicate that social-cognitive models are useful for changing health behaviors (Conner & Norman,

2005), but a variety of factors impact effectiveness. Specifically, effectiveness is enhanced by focusing on an issue of interest to the individual (Rothman, Salovey, Antone, Keough, & Martin, 1993) and negatively framing messages to communicate about loss or adverse consequences (Dunegan, 1993). In fact, some have argued that when an individual is invested in an issue, negative-framed messages are the *most* effective for behavior change (Maheswaran & Meyers-Levy, 1990).

The role that affect plays in eliciting behavior change has received relatively little attention in intervention research, although there is considerable research on effectiveness of fear-appeals in advertising (Luce, 1998). Also, evidence from laboratory studies demonstrate that affective dimensions of attitudes influence adults' susceptibility to persuasive appeals (Fabrigar & Petty, 1999) and that anticipated emotions influence decision making (Isen, 2001). Hence, messages that evoke fear can elicit changes in behavior (Gleicher & Petty, 1992). Drawing on these findings, it was hypothesized that a negatively-framed message on a topic of interest to children (i.e., playground play) that was presented in a way to evoke fear would be effective to reduce risky play behaviors. Literature suggested, however, that effectiveness might vary due to *sensation-seeking* (i.e., seeking risk experiences that are novel, intense, and emotionally arousing).

Sensation-Seeking as a Determinant of Risk-taking and Program Effectiveness

Sensation-seeking is associated with greater risk-taking in adults and adolescents (Zuckerman, 1994), as well as in children (Morrongiello & Lasenby, 2006; Morrongiello & Matheis, 2004; Morrongiello & Sedore, 2005; Potts, Martinez, & Dedmon, 1995). Whether sensation-seeking also influences the effectiveness of interventions to reduce injury-risk behaviors has not been considered with children, although work with adolescents indicates that high sensation seekers necessitate a different type of intervention than adolescents scoring lower in sensation-seeking. Specifically, for high sensation seekers interventions that are suspenseful, fast paced, and emotionally arousing are most successful to decrease risk behaviors (Donohew, Lorch, & Palmgreen, 1991; Everett & Palmgreen, 1995). Extending these findings to the current study, because the intervention was designed to be emotionally arousing, it was hypothesized that effectiveness might be greatest among high sensation-seekers.

Current Study

The present study had four goals: (a) to evaluate a program to decrease children's risk-taking on playgrounds by communicating information about negative consequences of these behaviors (injury) in fear-evoking ways; children in a control group did not receive the intervention and provided an index of spontaneous decreases in risk-taking; (b) to identify the mechanisms of change responsible for any program success by measuring emotional responses and cognitive appraisals in reaction to the intervention and determining if these predicted decreases in children's risk-taking; (c) to assess the scope of impact of the intervention by evaluating whether decreases in risk-taking were limited to behaviors targeted, or generalized to nontargeted behaviors; and (d) to determine if effectiveness varied due to sensation-seeking.

Method

Participants

Children were recruited from two schools, with schools selected in a purposeful way to obtain a diverse sampling of socioeconomic groups; type and cost of local housing was used as proxy indicators of economic status. Within each school, classes were randomly assigned to either intervention or control conditions (roughly in a 3:1 ratio, respectively) with the following constraint: If there was more than one class at a grade, then they were both designated to the same condition; this was done to reduce the risk of cross-contamination between intervention and control groups, because teachers and children reported that it was more likely that children would play with grade mates in other classes than with children in other grades. All children were fluent in English, in regular classrooms, and reported they had never been hospitalized for injury.

The intervention sample comprised 191 children (91 males and 100 females) distributed into three age groups: 6 years ($N=24$ males, 22 females; $M=6.57$ years, $SD=.34$), 8 years ($N=36$ males, 45 females; $M=8.57$ years, $SD=.50$), and 10 years ($N=31$ males, 33 females; $M=10.63$ years, $SD=.60$). The control sample comprised 67 children (32 males, 35 females) distributed into the same three age groups: 6 years ($N=11$ males, 13 females; $M=6.54$ years, $SD=.50$), 8 years ($N=10$ males, 12 females; $M=8.59$ years, $SD=.50$), and 10 years ($N=11$ males, 10 females; $M=10.80$ years, $SD=.64$). There were no age differences between intervention and control samples ($p > .05$).

Materials

Poster-Making Materials

To identify risk behaviors, observations were conducted on local playgrounds having swings, slides, seesaws, and monkey bars or climbers. We limited the focus to the two most frequently observed *moderate-risk-behaviors* (i.e., it was not appropriate use of equipment and could lead to a fall, e.g., going up the slide and stopping to lean way over the side of the slide and look underneath) and the two most frequent *high-risk behaviors* (i.e., it was not appropriate use of equipment and was very likely to lead to a fall and, in most cases, falls or near-events had been observed, e.g., leaning far over and rocking across the top bar of the climber with feet dangling and hands free) on each piece of equipment. We then took colored photos of child actors performing two each of the no-, moderate-, and high-risk behaviors; they received training in how to competently perform the risk-behaviors before being photographed. This produced six 8×10 photos (two no-, two moderate-, two high-risk behaviors) for each of the four types of equipment, with one set of 24 showing boys and another showing girls; the photos were cut in irregular shapes to make them more interesting poster material and they were laminated for durability with Velcro on the back so they could be easily stuck on posters. Pilot testing was conducted with children 6–11 years of age to confirm the consistent assignment of photos to categories (no-, moderate-, high-risk).

There were three sessions and all children (intervention and control) completed Sessions 1 and 3, during which time the risk-taking poster task was given. Participants used a set of 24 photos to create four different posters, one per type of equipment with six photos on each poster. To make a poster, the children placed each of the six pictures on the Playground Play poster having two areas (*Things I Would Do*, *Things I Would Not Do*). Markers and stickers were available for decorating the posters.

For assigning ratings about photos on the posters, rating scales were typed out and laminated so that children would have the scales in front of them when making their judgments.

Video Intervention Materials

Videotapes were used to expose the participants to falls from playground equipment that were contrived and presumably produced serious injuries to age mates. Child actors were used to make the videotapes, thus, no child actually was injured. Each videotape showed the child engaging in routine and appropriate play on a piece of equipment for several seconds, followed by

initiation of one of the moderate- or high-risk behaviors of which we had photos. Thus, there was a videotape for each of the two moderate- and two high-risk behaviors for each of the four pieces of equipment, with one set showing girls and another showing boys ($N = 32$ tapes). Once the child on the videotape initiated the risk behavior, the video scene was frozen on that behavior while the audio segment continued to play, allowing the observer to hear the child scream as she/he presumably fell, hear the child hit the ground, and then hear the child cry out in pain and state his/her serious injury.

Eight types of injuries were included: (a) broken arm; (b) broken leg; (c) cut needing stitches; (d) inability to breath well due to a cracked rib; (e) inability to stand up due to a back problem; (f) inability to sit up due to a neck problem; (g) smashed and broken fingers; and (h) smashed and broken toes. Each of these eight types of injuries were randomly assigned to two of the 16 videotapes with the constraint that different injuries occur for the two behaviors representing the same level of risk. Pilot testing of the videotapes with 64 children 6–11 years of age confirmed that they were uniformly fear-evoking ($M = 4.5$ on a 5-point scale), effective in communicating that a fall had occurred (100% recognition), and interpreted as resulting in a serious injury requiring medical attention (98% agreement).

For assigning ratings about aspects of the videotape, rating scales were typed out and laminated so that children would have the scales in front of them when making their judgments.

Questionnaire

The Sensation-Seeking Scale for Children (SSSC) consisted of 12 items, including 8 tapping Thrill Seeking and 4 tapping Novel-Experience Seeking (Morrongiello & Lasenby, 2006). Children are presented with opposing statements and select one that best describes them (e.g., I would like to jump or dive off a diving board versus I would not like the feeling you get when standing on a diving board). Higher numbers indicate greater sensation-seeking (range: 0–12). The internal consistency was .81.

Procedure

Approval of the study was obtained from the university and the school board. Principals and teachers then consulted with one another and decided whether to host the study. Parents granted consent and children were individually told about the project and gave verbal assent prior to any data collection.

A different procedure was followed in each of the three sessions. Children in the intervention group

received all three sessions, whereas those in the control group received only Sessions 1 and 3.

Session 1

To reduce disruptions to the class, children were removed from the class in groups of four, with group members randomly selected by one of the two research assistants. Instructions about making the playground play posters were then given to the entire four-member group and then members worked independently and physically apart from one another to make their individual posters; children could not view the posters of other children and they worked without the researcher watching them as they made their posters. The ordering of assignment of type of playground equipment depicted in the poster was randomized for one member of the group and the remaining members were then randomly assigned to receive one of the three remaining theme posters. Hence, no two members ever worked on the same theme poster simultaneously. Prior to making the posters, children were told that they would come to the playground in the future and demonstrate the behaviors on the poster, therefore, they needed to think carefully about what they would and would not do when making their poster.

Children were given the six photos and poster board for the playground equipment that was the focus of their poster. They were then asked to use the photos to make a *playground play* poster indicating which behaviors they would and would not perform. This constituted “baseline” or pre-intervention data.

After completing their four posters, children were individually and privately interviewed by one of the two research assistants; the other children worked on decorating their poster while waiting to be interviewed, and returned to their class after being interviewed. During the interview, the children reviewed the individual behaviors they would and would not do and assigned ratings for extent of danger (*How dangerous is it to do this?*), perceived injury vulnerability (*How likely is it that you would fall if you did this?*), and potential injury severity (*How hurt would you probably get if you fell?*), using a 5-point Likert scale (1 = none/not, 2 = a little, 3 = somewhat/some, 4 = fairly, and 5 = very). After the child completed all posters and the interview, an assistant then came and told the interviewer and child that the park was being cleaned and the child would have to demonstrate his/her *Would Do* behaviors at a later time.

At the conclusion of the session, the interviewer used a Likert scale (1–4; 1 = poor, 4 = excellent) to assign the child scores for attention and understanding of the task. Each child received a small gift.

Session 2

The intervention was delivered 2 weeks after Session 1 by a confederate research assistant, who participants believed to be from the Parks Department. Each child was seen individually at school, with the intervention limited to those who had endorsed at least two risk-behaviors (moderate- or high-risk) in one poster in Session 1; all children qualified. Children were told that they were going to see a videotape about playground play to familiarize them with some recent incidents on the playground. They were to see the videotapes individually so that there would be time for discussion. For children who had endorsed two risk-behaviors, one was randomly selected, with the other serving as the control condition to assess for spillover or generalization effects. For children who endorsed more than two risk-behaviors, one was randomly selected to serve as the control and the remaining behaviors were focused on in the intervention, with the children exposed to one videotape per risk-behavior (maximum = two videotapes).

Children were shown the videotape and then immediately gave ratings (1–5 Likert scale) of how scared they felt and how severe they believed the injury had been to the child on the video. They then listened to the assistant tell them about what happened to the child (e.g., her arm was very badly broken and she had to go to the hospital for surgery and to get a cast put on). The participants then completed ratings about their own vulnerability for injury when doing the behavior shown, and how hurt they believed they might get if they did the behavior and fell. Each child received a small gift at the end.

Session 3

This session occurred 2 months (8–10 weeks) later in order to allow for any immediate reactionary effects in the intervention condition to dissipate. As in Session 1, groups of four children were randomly selected from the classroom, instructions were given to the group, and then each child worked independently. They were given their posters back, in random order, and asked to check these over (i.e., photos sometimes fall off and get put in the wrong place, and we want to be sure everything was where they wanted it to be). They were told that now was the time to make any changes, such as moving photos around, before they completed decorating these. They were again reminded that they would have to come to the playground in the future to perform the behaviors they endorsed, so they needed to be sure they would do the behaviors endorsed; again, the assistant did not watch the child as she/he completed posters.

At the conclusion of the session, the interviewer used a Likert scale (1–4; 1 = poor, 4 = excellent) to assign the child scores for attention and understanding of the task. Each child received a small gift. After data for a school was completed, then children were fully debriefed about the study, using a class presentation and discussion format; they were particularly interested to hear about how we had made the “make believe” injury tapes. We did not measure anything that would alert us to students becoming fearful or avoiding playground play. However, during the debriefing, we specifically talked about how much fun it was to play on a playground, that it was good to do this (e.g., exercise, fun with friends), and as long as one played carefully there was no need to worry or not do so. None of the children demonstrated their poster behaviors on the playground. As part of the debriefing, we explained that we would not have the time to do this with them, that what they had told us was very helpful, and that their posters indicated what they planned to do and that was what was most important for us to know. Children were content with this explanation, wished us well in our research, and commented on how much they enjoyed participating.

Data Coding

Risk-taking scores were computed based on the *Would Do* photos for Session 1 (pre-intervention) and Session 3 (post-intervention). To compute these scores, each photo (2 each of no-, moderate-, high-risk) was assigned a score depending on the level of risk depicted (1, 2, or 3, respectively) and these were then averaged across the four different equipment posters to yield one score for risk-taking (maximum = 12).

Results

Data were collapsed across equipment type because there were too few data points per equipment. A Bonferroni correction was applied for multiple paired-comparison tests.

Preliminary Analyses

A separate Analysis of Variance (ANOVA), having condition (2) × age group (3) × sex (2) as between-participant factors, was applied to children’s attention and understanding scores (range: 1–4). Results revealed no significant effects. Children showed high levels of attention ($M = 3.5$, $SD = .45$) and understanding ($M = 3.58$, $SD = .50$). Hence, any significant variation in responding for other aspects of the data is not

attributable to differential attention to or understanding of the tasks.

Pre-intervention Risk-Taking Behaviors

An ANOVA with condition (2: intervention, control) \times age (3: 6, 8, 10) \times sex (2: male, female) as between-participant factors was applied to the risk-taking scores. Results revealed a main effect of age, $F(2, 250) = 4.86$, $p < .01$, $\eta_p^2 = .20$. Paired-comparisons indicated that 10-year olds showed more risk-taking than 6- or 8-year-olds ($M = 8.30, 7.64$, and 7.65 , $SD = 1.91, 1.72$, and 1.46 , respectively, $p < .05$).

Because the goal of the intervention was to decrease fall-risk behaviors, we sought to identify the best predictors of risk-taking scores in Session 1 (i.e., pre-intervention) for those children in the intervention condition, for later comparison with those predictors identified for Session 3 (post-intervention). The outcome variable was their risk-taking score in Session 1. Predictor variables included ratings of danger, vulnerability for falling, and potential injury severity (range: 1–5 for each) for the behaviors the children would perform. Preliminary

screening to test for meeting statistical assumptions (cf., Tabachnik & Fidell, 1989) was applied, and there were no concerns indicated. The mean and standard deviation values for predictor and outcome variables appear in Table I, along with the inter-correlations.

Using a hierarchical regression approach, age and sex were entered in Step 1 to control for these variables. For Step 2, ratings of danger, vulnerability, and injury severity were added. Finally, in Step 3, interaction terms involving age and sex with each of the variables entered in Step 2 were entered. As can be seen in Table II, Step 1 [$F(2, 671) = 22.76$, $p < .001$] accounted for 6% of the variance, with sex ($t = 6.22$, $p < .001$) and age ($t = 2.51$, $p < .01$) both contributing. Step 2 [$F(3, 668) = 36.58$, $p < .001$] accounted for an additional 13% of variance, with appraisal of danger ($t = 3.78$, $p < .01$) and vulnerability ($t = 3.32$, $p < .001$) both contributing. The interaction effects in Step 3 were not significant. Thus, the final model comprised sex, age, appraisal of danger, and vulnerability for falling and accounted for 19% of the variance in predicting children's risk-taking scores *before* the intervention.

Table I. Session 1 (Pre-Intervention) Data for Children in the Intervention Group ($N = 191$)

	<i>M (SD)</i>	2	3	4	5	6
1. Age	–	0.02	–.14**	–.13**	–.14**	0.10
2. Sex	–	–	0.09**	0.11**	0.05	0.23**
3. Danger	3.98 (0.74)	–	–	0.58**	0.61**	0.34**
4. Vulnerability	3.47 (0.85)	–	–	–	0.60**	0.33**
5. Severity	3.75 (0.84)	–	–	–	–	0.26**
6. Risk-taking	7.86 (1.69)	–	–	–	–	–

Data includes: Mean (*SD*) risk-taking score (range: 0–12) and ratings of danger (range: 1–5), vulnerability (range: 1–5), and severity (range: 1–5) for the behaviors they would not do, and the inter-correlations between variables that were entered into the hierarchical regression to predict determinants of initial risk-taking.

Sex: 2 = male, 1 = female.

** $p < .01$.

Table II. Summary of Hierarchical Multiple Regression Predicting Risk-Taking Scores for Session 1 (Pre-Intervention) for Children in the Intervention Group ($N = 191$)

Step	Predictor	<i>B</i>	<i>SE</i>	<i>R</i> ² change
1	Demographic factors			0.06**
	Age**	0.21	0.08	
	Sex**	0.78	0.12	
2	Ratings			0.13**
	Danger**	0.34	0.09	
	Vulnerability**	0.25	0.08	
	Severity	0.09	0.07	
3	All interaction terms			0.01

Sex: 2 = male, 1 = female.

** $p < .01$.

Table III. Frequency of Originally Endorsed Risk-Behaviors ($N = 651$ Behaviors) that Children Still Endorsed (i.e., Continued Risk-Taking) versus Rejected (i.e., Shifted to Avoid the Risk-behavior) as a Function of Whether the Behavior was Targeted (507 Behaviors) or not Targeted (144 Behaviors) in the Intervention

Behavior	Post-intervention	
	Still endorsed the risk-behavior	Rejected the risk-behavior
Targeted	204 (40%)	303 (60%)
Not targeted	101 (71%)	43 (29%)

Percentage scores are indicated in parentheses.

The percentage of risk photos that children in the control group spontaneously changed between Sessions 1 and 3 was only 1%.

Post-Intervention Changes in Risk-taking

Table III shows the frequency of initially endorsed risk behaviors that children continued to endorse (continued risk-taking) versus rejected (shift to risk avoidance) as a function of whether or not the behaviors were targeted in the intervention. Thus, these data address both the issue of effectiveness of the intervention (i.e., did it reduce risk-taking?) and the scope of this effect (i.e., was the decrease in risk-taking limited to the behaviors targeted or did it generalize to similar risk behaviors?).

As shown, there was a significant decrease in risk-taking for behaviors targeted in the intervention (i.e., 60% of risk-behaviors they would do initially shifted to become behaviors they would avoid). There also was a positive spillover or generalization effect such that the intervention evoked reduced risk-taking of about 29% of risk-behaviors not directly targeted. One-sample t -tests comparing these change scores to 0 revealed a significant decrease in risk-taking for both ($p < .01$). The fact that children seldom spontaneously changed risk-behaviors is supported by the Control group: only 1% of photos children *Would Do* in Session 1 changed to *Would Not Do* in Session 3 ($p > .05$). Thus, the decrease in children's risk-behaviors in the Intervention group presumably occurred due to the intervention.

Second, we directly compared the magnitude of shift from *Would Do* to *Would Not Do* for the intervention versus nonintervention behaviors. Comparing proportion scores ($M = .60$ vs. $.29$) to control for base rate differences revealed significantly greater reductions in risk-behaviors for targeted than nontargeted behaviors, $Z = 15.50$, $p < .01$. Thus, though there was evidence indicating that the intervention produced a general decrease in risk-taking, the greatest impact was for behaviors directly targeted.

Finally, one-sample t -tests were conducted to determine if risk-taking scores significantly changed from the pre-intervention to the post-intervention session for both the moderate- and high- risk behaviors targeted during the intervention. Results revealed significant decreases in risk-taking for both those moderate- and high-risk behaviors that were targeted in the intervention (M decrease = 1.04 and 1.49, $SD = 1.89$ and 2.50, $t = 10.17$ and 7.01, respectively, $p < .01$).

How Did the Intervention Effect These Behavioral Changes?

A hierarchical regression was conducted in which we sought to predict the decrease in risk-taking scores between Session 1 and 3 (pre- to post-intervention) from ratings about the videotapes shown in Session 2. Separate regression analyses were conducted for moderate- and high-risk behaviors. Age and sex were entered on Step 1 to control for these. For Step 2, videotape ratings (fear, actual injury severity, personal vulnerability for falling, and potential injury severity to self) were added. In Step 3, interaction terms involving age and sex with each of the variables from Step 2 were entered. The means, standard deviations, and inter-correlations are given in Table IV. The regression results appear in Table V.

For the moderate-risk behaviors, for Step 1, age and sex did not predict reductions in intentions to risk-take. Step 2, however, added significantly to the model [$F(4, 386) = 5.75$, $p < .001$], accounting for 26% of variance, with ratings of fear ($t = 3.27$, $p < .01$) and vulnerability for falling ($t = 3.23$, $p < .001$) both contributing. The interaction effects in Step 3 did not contribute significantly. Thus, the final model comprised fear and vulnerability ratings in response to the video and accounted for 26% of the variance in predicting children's post-intervention reductions in moderate-risk behaviors.

For the high-risk behaviors, age and sex also did not significantly contribute to the model. However, Step 2 was significant, $F(4, 122) = 11.31$, $p < .01$, with ratings of fear ($t = 3.36$, $p < .01$) and vulnerability for falling ($t = 5.64$, $p < .001$), accounting for 27% of the variance. In summary, both emotional and cognitive changes in response to the intervention contributed to predict reductions in risk behaviors.

Did the Effectiveness of the Intervention Vary with Sensation-seeking?

Finally, to address the question of whether the effectiveness of the intervention (i.e., extent of decrease in overall risk-taking from pre- to post-intervention) varied due to

Table IV. Mean (*SD*) Scores for the Intervention Group (*N* = 191) and Inter-Correlations between Age, Sex, Children's Ratings of the Video Interventions for Fear Evoked, Injury Severity, and Vulnerability for Falls, and Decrease in Risk-Taking (Rt) Score (Pre- to Post- Intervention) for the Moderate- and High-Risk Behaviors

	<i>M</i> (<i>SD</i>)	2	3	4	5	6
Moderate-risk behaviors						
1. Age	–	0.06	0.04	0.06	0.05	0.02
2. Sex	–	–	–0.02	–0.06	–0.07	0.02
3. Fear	4.31 (1.00)	–	–	0.48*	0.47**	0.02
4. Severity	4.99 (1.77)	–	–	–	0.48**	0.02
5. Vulnerability	3.98 (1.92)	–	–	–	–	0.04
6. Decrease in RT	0.82 (0.48)	–	–	–	–	–
High-risk behaviors						
	<i>M</i> (<i>SD</i>)	2	3	4	5	6
1. Age	–	0.18*	–0.13	–0.37**	–0.28**	–0.05
2. Sex	–	–	–0.05	–0.13	–0.05	0.07
3. Fear	4.20 (1.40)	–	–	0.17*	0.27**	0.13
4. Severity	4.56 (0.64)	–	–	–	0.41**	0.19**
5. Vulnerability	3.94 (1.40)	–	–	–	–	0.40**
6. Decrease in RT	0.80 (0.48)	–	–	–	–	–

Sex: 2 = male, 1 = female.

p* < .05; *p* < .001.**Table V.** Summary of Hierarchical Multiple Regressions Predicting Decreases in Risk-Taking in The Intervention Group (*N* = 191) for Moderate- and High-Risk Behaviors from Ratings Given in Reaction to the Videotaped Intervention

Risk behavior	Step	Predictor	<i>B</i>	<i>SE</i>	<i>R</i> ² change
Moderate	1	Demographic factors			0.01
		Age	0.03	0.09	
	Sex	0.04	0.14		
	2	Video ratings			0.25**
		Fear**	0.17	0.05	
		Severity	0.07	0.01	
3	Vulnerability**	0.19	0.06		
High	1	All interaction terms			0.00
		Demographic factors			
		Age	0.04	0.06	
	2	Sex	0.11	0.11	
		Video ratings			0.26**
		Fear**	0.09	0.03	
		Severity	0.03	0.02	
Vulnerability**	0.19	0.03			
3	All interaction terms			0.00	

Sex: 2 = male, 1 = female.

***p* < .001.

the attribute of sensation-seeking, a hierarchical regression was conducted. Age and Sex were entered first, and did not contribute significantly. The addition of sensation-seeking, however, resulted in a highly significant Step 2, $F(1, 173) = 133.61$, $p < .001$. In fact, sensation-seeking ($b = .67$, $SE = .003$; $t = 11.56$, $p < .001$) accounted for 44% of the variance in predicting the extent of effectiveness of the intervention. Consistent with

this interpretation, when a median split based on sensation-seeking scores was conducted to create a *low* and *high* group and we then examined the percentage of children in each group who decreased risk-taking in reaction to the intervention, results revealed that in the low sensation-seeking group 32% of children did so, whereas in the high sensation-seeking group 87% of children did so. In contrast, the overall effectiveness rate

of 60% did not vary with age group (6 years: 61%, 8 years: 60%, 10 years: 59%) or gender (boys: 63%, girls: 57%). Thus, this emotionally-arousing intervention program was comparably effective to reduce intentions to risk-take among boys and girls 6–11 years of age, but effectiveness was greater for high sensation-seekers than those lower in sensation-seeking.

Discussion

Falls from playground equipment are a significant cause of childhood injuries. Most approaches to intervention emphasize environmental modifications. Although these approaches can significantly reduce the severity of falls, how children behave on the playground also contributes to injury risk. The positive findings obtained in the present study demonstrate the potential usefulness of a behaviorally-focused approach to managing risk of falls from playground equipment.

Implications

The need for empirically-based interventions is well-established. However, this is particularly so in the area of injury prevention, where the translation of knowledge into prevention programming lags far behind. The intervention developed for this study involved the manipulation of known determinants of children's risk behaviors, including emotions and cognitions (Morrongiello & Lasenby, 2006; Morrongiello & Matheis, 2004; Morrongiello & Rennie, 1998; Morrongiello & Sedore, 2005). Communicating injury risk via videotapes proved a useful methodology to evoke fear regarding falls on playgrounds. Although a fear-appeals approach may produce undesirable effects by resulting in defensive reactions and/or anxiety, which then interferes with processing of the information being communicated (Eitel & Friend, 1999), there is also evidence that it can motivate detailed processing of information (Chaiken, Liberman, & Eagly, 1989), thereby enhancing the impact of persuasive messages (Wegener, Petty, & Klein, 1994), particularly if the person is interested in the target issue (Maheswaran & Meyers-Levy, 1990). Mood and feelings provide information about one's current situation (Schwarz, 1990) and the fact that this influences perceptions of vulnerability and appraisal of risk is well-established (Salovey & Birnbaum, 1989). The present study extends these findings by demonstrating their application to children and the usefulness of manipulating emotions to communicate about injury risk and evoke reductions in

children's risk-taking. The fact that the intervention was comparably effective for boys and girls between 6 and 11 years of age attests to the potential usefulness of this approach for broad application in injury prevention.

Mechanisms of Change

In order to identify the critical aspects of the intervention that were responsible for decreases in intentions to risk-take, measures were taken of children's cognitions and emotions in reaction to the intervention. Analyses confirmed that the intervention was fear evoking and that it led to changes in perceptions of injury vulnerability, which both independently predicted decreases in risk-taking. These findings add to the accumulating evidence that risk-decisions by children are driven not only by their cognitive appraisals of risk, but also by their emotional reactions (Morrongiello & Lasenby-Lessard, in press; Morrongiello & Matheis, 2004). Hence, researchers need to move beyond a singular focus on cognitions in formulating behavior-change interventions for youth. This is especially important for effecting changes in the risk-behaviors of children high in sensation-seeking.

Program Effectiveness as a Function of Sensation-seeking

Interestingly, there were no age or sex differences in the percentage of children who showed a decrease in intentions to risk-take in reaction to the intervention. However, among low sensation seekers, ~32% of children showed a decrease in risk-taking after the intervention, whereas among high sensation seekers this reached 87%. To our knowledge this is the first intervention study with elementary-school children to demonstrate the differential impact of sensation-seeking on program effectiveness.

Prior research with adolescents has revealed similar effects. For example, adolescents high in sensation-seeking show preferences for certain types of messages (e.g., novel, suspenseful, fast paced, explicit, or graphic) that elicit greater affective responses (Donohew et al., 1991; Zuckerman, 1994). Interventions that incorporate such emotion-focused messaging have proven more effective to produce changes in sensation-seekers' attitudes and risk-taking (Donohew et al., 1991; Everett & Palmgreen, 1995; Palmgreen, Donohew, Lorch, Hoyle, & Stephenson, 2001).

Thus, across a broad age range (elementary school years through high school), sensation-seeking is an attribute that can moderate effectiveness of prevention interventions and should be considered in the

development and evaluation of such programs. If one is targeting a risk-behavior that high sensation-seekers are more inclined to do than low sensation-seekers, then the content, pacing, and delivery of the program needs to reflect their specific needs. Similarly, group estimates of effectiveness may be masking differential rates of effectiveness among low versus high sensation-seekers. Hence, the extent of effectiveness of programs that aim to reduce risk-behaviors may vary substantially for low versus high sensation-seekers, and this merits consideration when planning program evaluations.

Scope of the Impact of the Intervention

The present intervention produced both specific and more generalized effects with regard to risk avoidance. Although the rate of rejection for targeted risk behaviors (60%) was higher than that for nontargeted risk behaviors (30%), both rates exceeded chance level and were significantly greater than that shown by children in the control group (1%). This finding indicates that children were able to infer, based on the injury exposure information given, that fall-risk behaviors generally should be avoided. Possibly, exposure to greater injury information (e.g., experiencing more than one or two videotapes about injury) would produce even more extensive generalized rejection of fall-risk behaviors. Suffice it to say, the fact that the effects of the intervention were not limited solely to those behaviors targeted indicates that injury information is highly salient to children and is interpreted as having implications for decisions about risk-taking that extend beyond the specific examples presented. This is a very important finding.

If exposing children to information about specific risk-behaviors only effected changes in those risk-behaviors, but did not generalize to other similar risk-behaviors, then a behavioral intervention would not be highly cost effective or tenable, particularly if one needed to target a set of behaviors that varied widely from one another. The present findings, however, indicate that a behavioral intervention can apply broadly and be used to target an entire class of distinct behaviors (e.g., fall-risk behaviors). Thus, behaviorally-focused programs can contribute substantially to reduce falls on playgrounds.

Limitations and Directions for Future Research

Although this study significantly advances our knowledge, there are several limitations that merit consideration in interpreting the results and planning future studies. First, we cannot be sure that what children reported on this

intentions-to-risk-take task actually corresponds to what they would do. There is evidence revealing very close correspondence between children's self-reported intentions and actual measures of risk-taking across the age range studied (Morrongiello, 2004). In addition, precautions were taken to address this issue in the present study by telling children they would have to demonstrate these behaviors for us. Nonetheless, in future research it would be useful to incorporate observational measures to address this issue directly. Second, no direct information on socio-economic status (SES) was taken. Children in different SES groups may have differential experience with injuries, resulting in exposure to injury via the intervention having differential impact. Thus, SES is an important consideration for planning future research on injury-prevention programming. Finally, the present study focused only on sensation-seeking. However, it would be useful in future research to identify other child attributes that can aid in the identification of children at higher risk for injury on playgrounds (e.g., perceptual-motor skills, cognitive development level). Environmental modifications of playgrounds is essential to reduce risk of childhood injury, but research identifying child behavioral attributes that differentially elevate risk also can contribute to our understanding of playground injuries and the development of strategies to prevent these events.

Conclusions

Many injury-prevention specialists believe that playground safety can best be realized by advocating for changes in environmental design and product safety standards. The simplicity of this approach is appealing. However, to the extent that children's behaviors also create risk, environmental modifications to playgrounds are not likely to be sufficient to prevent injury. Thus, it is useful to question the extent to which it is productive to speak in terms of environment *versus* behavioral interventions. Based on the success reported for the behavioral intervention reported on herein, it is evident that behavioral approaches *can* successfully reduce fall-risk-behaviors on playgrounds. Thus, integrating environment with behavioral interventions is likely to produce the greatest reductions in children's fall on playgrounds.

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