The Stamp-in-Safety Program: A Behavioral Intervention to Reduce Behaviors that Can Lead to Unintentional Playground Injury in a Preschool Setting

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Objective To introduce and evaluate the Stamp-in-Safety program, a behavioral intervention designed to increase the quality of supervision by teachers on preschool playgrounds and to reduce the risk of unintentional child playground injury.

Methods A quasi-experimental time series design was used, with observational techniques, to evaluate behavior on the playground before, during, and after the intervention as well as during a 6-month post-intervention assessment.

Results Both applied behavior analysis techniques and inferential statistics suggest that the Stamp-in-Safety program resulted in behavioral changes likely to reduce the risk of child injury on the playgrounds of childcare centers.

Conclusion Results indicate promise for the Stamp-in-Safety program as a low-cost, easily implemented intervention to reduce pediatric playground injury risk at childcare centers. Suggestions for future research are offered.

Key words childcare centers; injury; intervention; playground safety; supervision.

Unintentional injury is the leading cause of pediatric mortality, killing more preschool-aged children than the next eight causes of death combined (National Safety Council, 2004). Leading health analysts (Sleet & Bryn, 2003; Tremblay & Peterson, 1999) and government agencies (National Center for Injury Prevention and Control, 2002) agree that child injury prevention is a national public health priority.

Almost 65% of 3- through 5-year-old American children—just under 8 million youngsters—spend their weekdays in childcare settings (Cohen, 2001), and therefore, injury prevention in childcare centers is of great public health concern. Staff at most childcare settings in the United States face a daunting task. They must maintain mandated adult to child ratios, comply with safety guidelines, and protect the safety of many young children, all while keeping tuition costs low, offering employees adequate salaries, and yielding profit for owners (Waibel & Misra, 2003). One or more aspects of this task often falter, creating a situation where the supervision of children is inadequate and children’s safety is compromised.

The risk of inadequate supervision is particularly concerning on the playgrounds of childcare centers, environments with multiple potential hazards, and large physical areas (Alkon et al., 1999; Phelan, Khoury, Kalkwarf, & Lanphear, 2001; Sosin, Keller, Sacks, Kresnow, & van Dyck, 1993). Recent reports suggest that over 200,000 American children require emergency care for injuries sustained on playgrounds annually, that over 70% of childcare centers report at least one annual playground injury requiring professional medical treatment for the child, and that playground equipment is the leading cause of injury in school and childcare settings (Alkon et al., 1999; Gratz, 1992; Mack, Hudson, & Thompson, 1999).

Prevention of playground injuries at childcare centers takes many forms (Hudson, Thompson, & Mack, 1999).
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have not been subject to rigorous empirical evaluation
(Hudson et al., 1999). In fact, of four priority playground safety interventions identified by the National Program for Playground Safety (Hudson et al., 1999), three involve changes to the playground environment: installation of energy-absorbing surfaces below climbing equipment, replacement of dangerous and outdated equipment, and installation of age-appropriate play areas.

There are limitations to interventions focused on playground engineering, however. Such changes are costly to implement and therefore beyond the budget of many childcare centers. Further, engineering changes do not prevent all injuries. To fully reduce the risk of childhood injury, one must implement passive environment-oriented interventions in conjunction with active person-oriented interventions designed to change the behavior of children and their adult supervisors (Hudson et al., 1999; Mack et al., 1999; National Center for Injury Prevention and Control, 2002). The fourth priority for playground safety identified by the National Program for Playground Safety, adequate adult supervision of the playground, supports this recommendation (Hudson et al., 1999).

Previous attempts to reduce playground injuries by using active person-oriented interventions are few (MacKay, 2003). Those that have been implemented have not been subject to rigorous empirical evaluation and typically rely on education programs to alter the behavior of elementary school children and their adult playground monitors (MacKay, 2003; Pless & Arsenault, 1987; Wortel, DeGeus, Kok, & van Woerkerk, 1994). In one study on an elementary school playground, for example, a classroom lecture on how to use slides and climbing equipment safely yielded a slight decrease in dangerous behavior on that equipment over the subsequent few weeks (Heck, Collins, & Peterson, 2001). In another study, both students and playground monitors were trained on safety through teacher education over the course of several weeks (Lewis, Colvin, & Sugai, 2000). Post-intervention, there was a modest decrease in problem behavior by the children, but no significant change was noted in the behavior of the playground monitors.

The Stamp-in-Safety Program

Active person-oriented interventions designed to change behavior on the playground of childcare centers can focus on one of two targets, the children or the adult supervisors. In the case of preschoolers, efforts to change children’s behavior prove problematic because of the developmental level of the children. Young children have a limited capacity to understand, remember, and follow safety rules. For example, 4- to 6-year-old children spontaneously recall only about half of their parent’s home safety rules (Morrongiello, Midgett, & Shields, 2001). Also, young children tend to be temperamentally impulsive and undercontrolled (Rothbart & Bates, 1998), to the point where they might behave dangerously even if they recognize a hazard (Morrongiello & Rennie, 1998; Plumert & Schwabel, 1997). Thus, although attempts to teach preschool-aged children safe playground behavior are worthwhile, and may have some positive effect, they are unlikely to yield desired playground safety.

The alternative is to improve the behavior of supervising adults. Behavioral interventions to improve children’s safety through changes in adult behavior have been effective in other domains, most prominently in the automobile seat belt and child seat literature (Roberts, Alexander, & Knapp, 1990; Roberts & Fanurik, 1986; Roberts & Layfield, 1987; Roberts & Turner, 1986). Like the behavioral rewards used in Roberts’ work, the Stamp-in-Safety program introduced in this paper includes a behavioral reward system for children’s safe behavior on the playground; in fact, a secondary objective of the program is to train children on safe behavior by providing them attractive ink-stamps as reinforcement for safe playground behavior. Underneath the surface, however, lies the primary objective of the Stamp-in-Safety intervention: to encourage playground supervisors to be interactive, engaged, and attentive monitors of playground safety. The Stamp-in-Safety program requires teachers to recognize and then reinforce children’s safe behavior with attractive ink-stamps; in doing so, teachers develop attentive and engaged supervisory habits. They notice and prevent dangerous behavior as well as reinforcing safe behavior.

In this study, the Stamp-in-Safety program was implemented on the playground of a suburban childcare center. Using a quasi-experimental time series design (Campbell & Stanley, 1966), the authors collected observational data before, during, and after the intervention as well as during a follow-up assessment 6 months after the intervention. The primary research question was straightforward: can an intervention, grounded in behavioral techniques and emphasizing increased attentiveness of supervising adults, result in behavioral changes that reduce preschool-aged children’s risk of unintentional playground injury?
Methods

Sample

Children and teachers at a Birmingham, Alabama area childcare center comprised the sample. Every teacher (N = 12) who supervised 3- and 4-year-old children on the center’s playground over the course of the study participated. The teachers were all women, had a mean age of 38 years (SD = 14, range = 20–58), had been childcare professionals for a mean of 5 years (SD = 6, range = 0–19), and were primarily white (83% Caucasian, 8% African American, and 8% Asian American). Parents of 44 children who were enrolled in the 3- and 4-year-old classrooms at the childcare center provided consent for their children’s participation in the research. There were somewhat more girls (64%) than boys enrolled in the preschool. They came from middle- to upper-middle-class backgrounds (52% reported income over $80,000; 14% between $40,000 and $79,000; and 12% under $40,000; 21% declined to answer) and were moderately diverse ethnically (71% Caucasian, 12% African American, 7% Asian American, 5% Hispanic, and 5% of other ethnicities).

Parents of four children declined consent for their children to participate in the study. Those children remained on the playground during the study, but their behavior was not coded. The center director reported that the nonincluded children were not appreciably different in any way from the included children, but ethical limitations prohibited quantitative comparisons of the groups. All aspects of the study were approved by the IRB at University of Alabama at Birmingham.

Playground Environment

Because Birmingham has a temperate climate, children played outdoors on the same playground year round. The playground environment covered approximately 1,000 ft² in a fenced rectangular shape and was located behind the preschool building. At the center of the playground was a large climbing structure that included several slides, ladders, stairways, and bridges. Surrounding the climbing structure, and several feet from its edges, was a concrete sidewalk used frequently by the children for tricycle riding. To one side of the playground area was a smaller play area that included two swings and a sun shelter.

The playground structures were modern, and the playground environment had been updated 6 months before the start of the study. Following the renovations, just weeks before the start of this study, the playground was inspected and approved by a certified playground safety inspector from the Playground Safety Institute of the National Recreation and Park Association. Climbing structures were age appropriate. With the exception of the concrete sidewalk perimeter, all ground surfaces were comprised of several inches of energy-absorbing mulch.

Before beginning the study, three “target” areas were identified as the most dangerous locations on the playground. These areas were chosen by the research team in consultation with the preschool director and anonymous written reports from teachers concerning which areas in the playground they believed to be most dangerous. Target Area 1 included the three slides on the playground, all clustered on one side of the climbing structure, and the immediate surrounds. Target Area 2 included three sets of stairs and ladders clustered on one side of the climbing structure, and the immediate surrounds. Target Area 3 included the two-swing swing set and surrounding area, located on the edge of the playground.

Procedure

The experimental protocol was divided into seven phases: desensitization, reliability, pre-intervention, intervention, postintervention, interim period, and follow-up. Coding of playground behavior took place during all phases except the interim period, and experimenters were governed by three policies: (a) avoid interaction with teachers or children to the extent possible, (b) stand on the fringes of the playground and remain as unobtrusive as possible, and (c) avoid prolonged eye contact directed toward any single child or teacher. Coding took place during daily morning playground sessions. If children were unable to play outside because of inclement weather (17% of potential coding days), data collection was canceled; all decisions to stay indoors during playground time were made by the preschool staff, independent of the research team. Data collection was occasionally canceled because of special events (e.g., local fire department visit in their fire trucks; 4% of potential coding days). Each of the seven protocol phases is described below in turn.

Desensitization lasted 1 month. During this phase, two experimenters attended the childcare centers’ morning playground time on a daily basis. On several occasions, a third experimenter (the principal investigator) was also present. During desensitization, coding strategies were developed, but no data were collected. The primary goal of this phase was to permit teachers and children to become accustomed to the presence of the coders on the playground and for their behavior to normalize despite the presence of researchers. Secondary goals included development of precise coding categories and coder training.
Immediately following desensitization, coders transitioned into a 1-week reliability phase. Both coders rated the same teacher or playground quadrant, as detailed below, to ensure reliable coding of categories. Data collected during the reliability phase were not used in analyses.

The third phase of the protocol was a 3-week pre-intervention phase. During this phase, coders rated playground behavior before any implementation of safety interventions. Teachers and children were unaware of the transitions between the desensitization, reliability, and pre-intervention phases, further increasing the likelihood of normalized behavior despite the presence of the coders.

The fourth phase of the protocol was a 1-week intervention. A half-hour meeting was scheduled with teachers. During that meeting, investigators praised the teachers about existing safety on the playground and then reviewed basic playground monitoring skills (e.g., use of positive language to redirect children away from dangerous environments, staying physically close to children, focusing attention on playground activity, and minimizing time spent chatting with other teachers). During the brief meeting, the Stamp-in-Safety intervention was also introduced to teachers, as outlined below.

The intervention itself lasted a week and was implemented for each playground session during the week following the meeting with teachers. Children wore small white nametags similar to those used to advertise individual’s names at meetings. Teachers carried small handheld self-inking stamps that showed an attractive smiling face (得意顔) when stamped. Each teacher used a stamp of a different color to permit researchers to record the number of stamps given by each teacher. Throughout the playground session, teachers were instructed to give children a stamp when children were “caught” playing safely. Teachers were permitted to define safe play and to distribute stamps according to their own preferences, but were guided that an appropriate goal would be to give each child at least one stamp during the 45-min playground session and to give stamps at a constant and regular pace throughout the session. “Stamping days” were held on a daily basis throughout the 1-week intervention period. Across all sessions, each teacher gave an average of 36.03 stamps per hour, or just over one every 2 min (SD = 18.98, range = 12.77–72.95).

The fifth phase of the protocol was a 3-week post-intervention phase, which occurred immediately upon the termination of the intervention phase. At this point, the active part of the Stamp-in-Safety intervention was curtailed (i.e., stamps were no longer used). Teachers were encouraged to continue using any supervisory techniques they might have developed or learned during the intervention phase of the program.

The sixth phase of the protocol was a 6-month interim period. No experimenters were present on the playground during this time. Teachers were encouraged to hold occasional “booster” stamping days every few weeks during the interim period. The preschool director reported that these days occurred rarely (e.g., about once every 2 months), but not as frequently as recommended by the research team.

The seventh and final phase of the experimental protocol was the follow-up assessment, which lasted 4 weeks. The follow-up phase was divided into two parts. The first lasted 1 week and was used to reestablish reliability between the two observers and again desensitize teachers and children to the presence of observers on the playground. Behavior was coded, but data were not analyzed. The second part of the follow-up phase was a 3-week active data collection period, during which behaviors were coded in the same manner as previous data collection phases. Teachers and children were unaware of the transition between the re-desensitization and active data collection phases. During the 4-week follow-up phase, teachers were permitted to have stamping days, but they chose not to.

**Measures**

During each of the data collection phases (pre-intervention, intervention, postintervention, and follow-up), coders recorded six playground behaviors—teachers talking to other adults, teachers warning children about dangerous activity, teachers explaining to children why an activity was dangerous, teachers redirecting children away from dangerous activities, teachers’ locations on the playground, and children’s unintentional injuries—at regular and frequent intervals during playground time. Each category is defined below.

**Talking to adults** was recorded if the teacher was actively engaged in a conversation with another adult, most commonly a fellow teacher but occasionally a parent or the preschool director.

Teacher verbalizations about safety were divided into three nonoverlapping categories: warnings, explanations, and redirections. **Warnings** were defined as statements warning a child or children not to do something and did not include explanations about why the activity should be avoided or redirection to other safer activities. Examples of warnings include “Don’t do that!” “Climbing up the slide is not allowed,” and “Stay away from the swing area.” **Explanations** warned children of
danger, but included a statement about why a dangerous activity should be avoided. Examples include “Don’t go near the swings because you might get kicked by Mary,” “Remember, we can’t run on the sidewalk because you might trip and hurt yourself,” and “One step at a time on the ladders, children who try to do two steps at once sometimes fall.” Redirections included a statement concerning danger but also redirected children, usually verbally but occasionally physically, toward a safer activity. Examples include “Don’t go down the slide backward, why don’t you try feet first instead?” “Remember we have to go up and down the ladders one step at a time, let me show you the best way to do it [teacher physically helps child step safely],” and “Playing near the swings is dangerous, Johnny, let’s come over here to play with the shovel and pails instead.”

Each teacher’s location was marked live by experimenters with an “x” on a scaled map of the playground. Later, maps were coded using a three-point scale. A “1” on the scale indicated that a teacher was located in the core area of the playground where children’s behavior could be easily monitored; a “2” represented a teacher on the periphery of the core area of the playground where children’s behavior could be monitored reasonably well; and a “3” represented a teacher outside the periphery of the core area of the playground, where it was difficult to adequately monitor children’s behavior.

Unintentional injuries were recorded if a child experienced an injury that caused tissue damage or pain lasting more than 10 min (Peterson, Harbeck, & Moreno, 1993).

**Coding Logistics**

Two coders were present on the playground during all data collection. To ensure that the maximum amount of behavior on the playground was recorded with minimal intrusion, coders followed a carefully prescribed rotation pattern. Rotations occurred at 30-s intervals, timed using synchronized vibrating wristwatches.

Two sets of coding targets were developed, playground areas and playground supervisors. As described above, the three playground area targets—the slides, the ladders, and the swings—were considered the most dangerous areas on the playground. They were coded in a clockwise manner around the playground. The second coding target was the adults supervising the playground; they were coded in the numerical order of their experimental code numbers. To avoid coding the same target at the same time, coders started in a staggered order (e.g., one coder started by rating teachers and the other by rating target areas). This system permitted the coverage of twice the activity on the playground without overlap between coders—while one coder watched children at a target area, the other watched teachers.

Playground target areas were observed at 90-s intervals (three watch vibration cycles). During the intervals, coders recorded in real time all instances of teacher warnings, redirections, and explanations directed toward children in the target area. When coding teachers, coders relied heavily on the vibrating wristwatches. As soon as they felt a vibration (every 30 s), the coders looked at the next teacher to be coded and remembered where she was standing and what she was doing. Over the next 30 s, the coder recorded the teacher’s location and whether she was talking to an adult. When the watch vibrated again 30 s later, the coder rated the next teacher in a similar manner. This pattern continued until all teachers on the playground were rated once, at which point the coder moved to the next playground target area and the process repeated itself.

Injuries occurred very rarely during coding. When they did, one coder (on a rotating basis) interrupted his or her coding activity. Once childcare center staff verified that the child’s medical condition was stable, the coder recorded relevant information about the injury and then returned to routine coding after conferring with the other coder to maintain a staggered rotation.

The coding system, although complex, ensured that observation of both target playground areas and teachers was minimally invasive and allowed coders to gather the maximum amount of information. The benefit of further randomizing the order of coding target areas or teachers, though desirable from a research design perspective, was outweighed by the risk of coder error. Coders were required to record large volumes of material in short amounts of time, for two 45-min playground periods consecutively (the 4-year-old children entered the playground area shortly after the 3-year-olds vacated it). Having to consult randomized order lists would have added a significant burden to an already intellectually demanding task.

**Interobserver Reliability**

Reliability in observer coding was established during the reliability phase at the start of the study and reestablished immediately before 6-month follow-up data collection. In each case, the two coders observed the same playground activity at the same time. Effective reliability based on correlations is the recommended technique to compute reliability for count data because it offers an aggregate reliability of both observers and avoids the problems of percent agreement or single-judge measures.
Reliability of teacher location was established by examining the location scores marked on-site by each of the observers. Two independent coders reviewed the markings using the three-point categorical scale described above from 20% of the days available and achieved adequate intercoder reliability, $\kappa = 0.91$. Disagreements were resolved by using data from the primary coder, who coded the full sample after reliability was obtained.

**Results**

Data analysis was divided into three steps. First, the mean of each variable was considered across the four phases of the study (Table I). Just one injury occurred, in the pre-intervention phase. Other trends suggest reduced risk for child injury in the postintervention and follow-up phases compared with the pre-intervention phase.

Second, applied behavior analysis techniques were used to plot behavior change. Figure 1 illustrates trends in both the warnings and the redirections plus explanations variables. As shown, warnings were common pre-intervention and decreased during and after the intervention. Redirections and explanations were relatively rare pre-intervention, increased during the intervention when teachers actively instructed children about safety, and then decreased post-intervention.

Figure 2 illustrates the amount of time teachers talked to adults. As shown, the amount of time teachers talked to adults varied greatly across days but was highest before intervention, dropped during the intervention, and remained moderately low following the intervention. Figure 3 illustrates trends in teacher’s locations across phases of the study. Teachers were closest to the core of the playground during the intervention and remained at roughly the same distance from the core during the other three phases.

The third step of data analysis was to conduct inferential statistics to extend visual impressions from the behavior analysis techniques (Table I). Univariate ANOVA, with phase considered as a random within-subject factor, was applied to the data. Results suggest that the intervention was successful. As expected, behaviors associated with risk to children changed during and especially after the intervention. Warnings about dangerous behavior were most common before the intervention, decreased during the intervention, and decreased to a statistically significant degree immediately after intervention. Although the rate of warnings increased somewhat 6 months later during the follow-up assessment, it remained statistically lower than the pre-intervention rate.

Explanations showed a slightly different pattern. During the intervention, when teachers were most actively involved with children, explanations were greatly elevated. The rate decreased from pre-intervention to postintervention, although not to a statistically significant extent, and returned back to pre-intervention levels by the 6-month follow-up assessment. Redirections showed a pattern similar to that exhibited by explanations, but differences were not statistically significant.

Other measures also supported the intervention as a successful means to improve teacher supervision and decrease children’s risk-taking. The amount of times teachers were seen talking to other adults dropped to a

| Table I. Descriptive Statistics and ANOVA Comparing Phases of Intervention |
|----------------------------------|-------|-------|--------|--------|---------|---------|---------|
| Dependent variable              | Pre-intervention mean | Intervention mean | Postintervention mean | Follow-up mean | $F(3, 32)$ | Partial $\eta^2$ |
| Injuries (per hour)             | 0.07  | 0.00  | 0.00   | 0.00   | 0.74    | 0.07     |
| Warnings (per hour)             | 1.89† | 0.56  | 0.13†  | 0.33†  | 3.40*   | 0.24     |
| Explanations (per hour)         | 0.29† | 1.44‡ | 0.00‡  | 0.29§  | 5.94**  | 0.36     |
| Redirections (per hour)         | 0.25  | 1.12  | 0.36   | 0.18   | 1.37    | 0.11     |
| Sum of explanations and redirections (per hour) | 0.55† | 2.56‡ | 0.36‡  | 0.47§  | 4.57**  | 0.30     |
| Talking to adults (per hour)    | 36.44‡¶ | 12.88‡¶ | 22.53‡ | 20.47§ | 6.02**  | 0.36     |
| Teacher location$^a$            | 2.59† | 2.22‡ | 2.53‡  | 2.50§  | 8.80**  | 0.45     |

Values with the same symbols indicate that paired contrasts are statistically different in posthoc LSD pairwise comparisons.

$^*$Coded as: 1, core of playground activity; 2, outskirts of playground activity; 3, fringes of playground activity.

$p < .05$, $**p < .01$. 

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statistically significant degree from pre-intervention to intervention, and then increased somewhat, although not to a statistically significant degree, during postintervention assessments. Measures of teacher location were similar during pre-intervention, postintervention, and follow-up assessments. Not surprisingly, they were statistically lower during the intervention, reflecting the fact that teachers were approaching children in the core area of the playground to give stamps during that phase of the study.

Discussion

Results indicate that the Stamp-in-Safety program resulted in behavioral changes likely to reduce the risk of child injury on the playground of childcare centers. The single injury observed during playground play was during the pre-intervention phase. Perhaps more telling, teachers offered warnings to children about dangerous behavior most frequently before the intervention and with decreasing frequency during and afterwards. Teachers’ explanations about playground dangers and redirections to safer behavior peaked during the intervention, when they were training children on safe behavior, and declined during postintervention assessments. Teachers spent less time talking to other adults during and after the intervention compared with before the intervention, although they remained on the periphery of the playground core during all research phases except the intervention phase, during which they were actively interacting with children as part of the intervention.

Previous attempts to increase children’s safety on playground environments generally relied on environmental manipulations (Roseveare et al., 1999; Sacks et al., 1992) or educational lectures and materials given to supervisors and children (Heck et al., 2001; Lewis et al., 2000; MacKay, 2003). Environmental interventions are moderately effective but fail to prevent all injuries. Educational techniques reduce injuries somewhat, particularly in the short term, but fail to have lasting effects. The Stamp-in-Safety program differs from other programs in its reliance on changing teachers’ behaviors without lecturing them in an educational format. Instead, the Stamp-in-Safety program uses teachers to reward children for safe behavior and, in doing so, trains teachers to monitor the playground carefully. Also, the program differs from other programs in that it is
designed to become a permanent part of playground supervision. Stamping days should occur regularly, as behavioral boosters to reinforce safe behavior in children and careful supervision by teachers.

Data from this study indicate initial promise for the Stamp-in-Safety program as an intervention to promote playground safety. Anecdotally, it appeared that children enjoyed receiving ink-stamps and teachers enjoyed giving them. Financially strapped childcare centers could employ the intervention without significant cost or extra labor, and overscheduled center directors could initiate and maintain the intervention without spending large amounts of valuable time. Altogether, these initial results indicate that the Stamp-in-Safety program may be an effective, cost-efficient, and noninvasive means to reduce risky child behavior patterns that lead to playground injury at childcare centers.

**Future Investigation**

Some aspects of this study’s results require further investigation. The number of explanations and redirections provided by teachers, for example, peaked during the intervention and then decreased after intervention. One interpretation of this finding is that the teachers used explanations and redirections during the intervention to train children on safe behavior. When this proved successful, teachers experienced reduced need for explanations and redirections because children were behaving more safely. An alternative interpretation is less satisfying but also plausible: During the intervention, teachers were encouraged to use behaviorally effective verbalizations with children and did so, but following the intervention, teachers quickly reverted to less effective disciplinary techniques (warnings such as “No playing near the swingsets, Johnny”), as witnessed in previous intervention attempts (e.g., Heck et al., 2001). Although the observed reduction in warnings supports the first hypothesis more than the second, further study is required to understand better the observed changes in teacher explanations and redirections.

Another topic in need of further investigation is what optimal supervision of a childcare center playground might entail. How often should teachers talk to other adults, for instance? In this study, teachers’ talking to other adults was high during the pre-intervention phase and significantly lower during all other phases of the study. Some discussion between teachers is clearly
necessary and healthy; other discussion is extraneous but might provide teachers with a short break and ultimately improve supervision capacity. Similarly, it is unclear what proximity between teachers and children on the playground offers the best supervision of children. With the exception of the 5-day intervention period, during which teachers interacted closely with children to provide stamps, teachers’ locations remained stable throughout the research phases in this study. Close adult proximity might prevent unintentional injuries (Morrongiello & House, 2004; Schwebel & Bounds, 2003) as well as bullying, teasing, and intentional injury. Also, close proximity might permit teachers to serve in other beneficial roles, for example, encouraging cognitive development by engaging in pretend play sequences or encouraging motor development through jumping or reaching activities.

The issue of optimal supervision, both in terms of how often teachers should talk to each other and in terms of how close they should be to children, remains in need of further study. Process analysis techniques and epidemiological research might both contribute to a fuller scientific understanding of optimal preschool teacher playground supervision strategies.

Limitations
This study had several limitations. First, it relied on teacher behaviors as a proxy for children’s risk of unintentional playground injury. Injuries occur rarely in playground settings and therefore cannot readily serve as the primary outcome variable in intervention research. In this study, adult behavior served as a proxy because the intervention was designed primarily to change adult behavior. Future research should consider child risk-taking behaviors as well as adult behaviors as proxy measures of injury risk.

Second, the study established reliability between coders before the pre-intervention and follow-up phases but did not verify reliability during active data collection phases. This technique maximized the amount of data collected but failed to adjust for the possibility that changes in behavior would not be recorded similarly by the two coders.

Third, the study was conducted at a preschool with comparatively rich resources, including a recently renovated playground environment. One consequence of studying change in such an environment was the very low rate of injury incidence. Future work should be conducted at preschools with more limited resources and
more dangerous playground environments, contexts where injury rates are higher and good supervision may be more critical to child safety.

The Stamp-in-Safety program itself has limitations that warrant mention, many of which emerged in this initial study of the program. Most prominently, the Stamp-in-Safety program is designed to become a permanent part of playground supervision, with stamping days held periodically for an indefinite time period. Such booster sessions are recommended from an operant conditioning standpoint (Sulzer-Azaroff & Mayer, 1977) and serve to habituate teachers to the benefit of careful playground supervision. For booster stamping days to occur, however, someone—presumably a center director or head teacher—must decide when they will occur and remind staff members of those occurrences. This extra burden is easily forgotten or postponed by busy administrators, as observed during the 6-month follow-up period of this study (no information was collected from center personnel on why more frequent booster stamping days were not held). In this study, rare stamping days were held between the postintervention and 6-month follow-up measurement phases and some key behavioral changes—most notably reductions in teacher warnings and in teachers talking to other adults—were maintained at the 6-month follow-up assessment. Other behavioral changes, including teacher redirections and explanations, were not maintained in follow-up assessment. Future tests of the Stamp-in-Safety program will require more careful implementation of a reminder or reward system to motivate teachers to have booster stamping days indefinitely.

Other potential weaknesses of the Stamp-in-Safety program were not noticed in this study but could arise in other settings or if program monitoring continued beyond 6 months. First, children might tire of receiving stamps and the behavioral reinforcement mechanisms for both children and teachers would therefore falter. In this case, other behavioral reinforcements might be substituted (different-colored or -shaped stamps, stickers, etc.). Similarly, teachers may tire of providing stamps to children. The behavioral reward system for teachers in the Stamp-in-Safety program is weaker than that for children. Individuals who choose careers in childcare are likely to enjoy making children happy—as giving attractive ink-stamps accomplishes—but this enjoyment may subside if the program was continued indefinitely. The counter to this weakness is that the Stamp-in-Safety program is designed to become a routine part of playground activity, not an occasional special event. In this sense, holding stamping days might be viewed as part of the teacher's job responsibility. Teachers would expect stamping days to occur just as other periodic job responsibilities (e.g., redecorating classrooms or purchasing new art supplies) occur.

Future work is planned to test the Stamp-in-Safety program more rigorously and to overcome program weaknesses. In particular, future work will assess children's risky behaviors directly as well as assessing teacher behaviors; will include lengthier pre-intervention and postintervention assessment periods; will use a longer intervention phase, with a tapering rather than abrupt stop to stamping days; will use reminder systems to ensure that booster stamping days occur regularly postintervention; and will include a comparison group that does not receive the intervention.

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