

An Evaluation of Two Procedures for Training Skills to Prevent Gun Play in Children

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ABSTRACT. *Objective.* Unintentional firearm injuries threaten the safety of children in the United States. Despite the occurrence of these injuries, few studies have evaluated the effectiveness of child-based programs designed to teach children gun-safety skills. This study compared 2 programs that were designed to reduce gun play in preschool children.

Methods. A between-groups no-treatment control design was used. Children were randomly assigned to either 1 of 2 firearm-injury prevention programs or a no-treatment control condition. Participant recruitment, training, and data collection occurred in preschools and children's homes located in a midwestern city with a population of approximately 80 000. Thirty-one 4- and 5-year-old children participated in the study. The effectiveness of the National Rifle Association's Eddie Eagle GunSafe Program and a behavioral skills training program using instruction, modeling, rehearsal, and feedback was evaluated. Children were issued 0 to 3 ratings on the basis of their ability to say correctly the safety message and similar ratings on the basis of observations of their ability to perform correctly the skills in the classroom and when placed in a realistic simulation.

Results. Both programs were effective for teaching children to reproduce verbally the gun-safety message. The behavioral skills training program but not the Eddie Eagle GunSafe Program was effective for teaching children to perform gun-safety skills during a supervised role play, but the skills were not used when the children were assessed via real-life (in situ) assessments.

Conclusions. Existing programs are insufficient for teaching gun-safety skills to children. Programs that use active learning strategies (modeling, rehearsal, and feedback) are more effective for teaching gun-safety skills as assessed by supervised role plays but still failed to teach the children to use the skills outside the context of the training session. More research is needed to determine the most effective way to promote the use of the skills outside the training session. *Pediatrics* 2004;113:70–77; *gun safety, gun play, Eddie Eagle, behavioral skills training, injury, prevention, children.*

ABBREVIATIONS. NRA, National Rifle Association; BST, behavioral skills training; SD, standard deviation.

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Studies have found that when children find guns, they often play with them.^{1,2} Unfortunately, unintentional injury or death sometimes results from such behavior. With approximately half of US households storing firearms,³ testimonial accounts of such injuries are easy to find. The most recent national statistics calculated by the Centers for Disease Control and Prevention⁴ reported that in the years 1993 through 1998, an average of 162 children (aged 0–14 years) were involved in fatal firearm accidents each year. To compound the problem, the same report indicated that, on average, 1459 children under the age of 14 were involved in unintentional, nonfatal injuries during those same years. Annett et al⁵ reported that for children under the age of 14, nonfatal injuries outnumber fatal injuries 4.2 to 1.

On a positive note, this problem has received attention. Several organizations have proposed programs to reduce the occurrence of such accidents. Typically, these programs have focused on altering the behavior of the parents who own the firearms (eg, removing firearms from the home, unloading/locking firearms out of children's reach) to prevent children from finding guns and possibly playing with them. Becker et al,⁶ for example, distributed posters and brochures to clinics, pediatricians' offices, and stores that sell guns; distributed letters written to children's parents and health care professionals; and used public radio and television broadcasts in an attempt to persuade parents to engage in safer gun ownership and storage practices.

The success of this parent-based approach is less than encouraging, however. Several studies have reported that gun-owning parents continue to leave firearms loaded and unlocked. It is estimated that 20% to 50% of gun-owning parents engage in unsafe storage practices.^{3,7–9} The limited success of these programs has led to recent attention on child-based approaches to prevention. The focus of this approach is to teach children that guns are not toys and that they should not play with them. Unfortunately, however, only a handful of child-based programs exist, and only a subset of those have been systematically evaluated for their effectiveness.

One child-based program, the National Rifle Association's (NRA's) Eddie Eagle GunSafe Program, is one of the most widely recognized and implemented. This program uses a variety of age-appropriate activities to teach children safety behaviors when they encounter a gun. Specifically, the program instructs

the children to, "Stop. Don't touch. Leave the area. Tell an adult." Since its development in 1988, the NRA estimates that the Eddie Eagle program has reached 15 million children and is currently used to teach firearm injury prevention to 700 000 children each year.¹⁰

Despite its continued implementation, the Eddie Eagle GunSafe Program's developers offer little evidence concerning its effectiveness. The lack of support for its effectiveness has resulted in skepticism and, in some instances, opposition. The American Academy of Pediatrics Committee on Injury Prevention,¹¹ for example, cautions against the widespread use of such programs until there is more concrete evidence on their effectiveness. Furthermore, they are skeptical of such programs, stating that certain developmental characteristics of children (eg, curiosity, impulsivity, imagination, poor judgment) may prevent these programs from being effective in reducing gun-handling behaviors and/or gun-related injuries. In their report, they state that these characteristics of children "cannot be overcome by changes in gun design or education" and that such characteristics "cannot be addressed effectively by such programs" (p. 788).

To date, only 2 published studies^{1,2} have evaluated the effectiveness of programs that are designed to teach young children not to play with firearms. Hardy et al² observed and recorded children's gun-play behavior before and after an education-based intervention and reported that the intervention failed to reduce significantly the children's gun-play behavior. Although not evaluating the Eddie Eagle GunSafe Program specifically, the intervention used in this study used various procedures and materials that are similar to those that compose the Eddie Eagle program.

One limitation of the study by Hardy et al² is that it did not include active learning approaches involving repeated rehearsal of the skills (do not touch, walk away, and tell an adult when a firearm is found) with subsequent feedback until criterion responding was achieved. Instead, the program used an information-giving educational approach. Active learning approaches (behavioral skills training procedures) have been successful in teaching a variety of safety skills to children, including pedestrian safety skills,¹² home safety skills,¹³ emergency fire safety skills,^{14,15} emergency telephone skills,¹⁶ abduction prevention skills,¹⁷⁻¹⁹ and sexual abuse prevention skills.²⁰⁻²⁴ In addition, Poche et al²⁵ showed that active learning is more effective than educational approaches (eg, videotape presentation, classroom discussion) in teaching abduction prevention skills.

In a more recent study, Hardy¹ evaluated the effectiveness of a skills-building approach for teaching gun-safety skills to 4- to 7-year-old children. The program evaluated 4 of the 11 components of the Straight Talk About Risks program developed by the Center to Prevent Handgun Violence. This program focused on teaching real gun versus toy gun discrimination, resolving problems without aggressive behavior, and making appropriate and safe decisions. Although the researchers reported that children ob-

served and practiced the activities and received rewards for correct responding, the children were not less likely to play with the firearms as a result of the training.

Although Hardy¹ did evaluate a program that incorporated active learning approaches, the program focused on a broad number of skills ("making good choices, resisting peer pressure, and preventing aggressive conflicts" [p. 72]) rather than a discrete chain of behaviors needed to keep a child from touching a firearm. Given the success of behavioral skills training to teach other important safety skills (eg, say no, run away, and tell an adult when presented with an abduction lure), it is important for researchers to evaluate behavioral skills training procedures for teaching young children specific safety skills to use when encountering a firearm.

Whatever methods are used to teach children safety skills, the program must teach children 3 hierarchical skills. First, the child must be taught which behavior(s) or skills the trainer wants him or her to perform. Second, the child must be taught actually to perform the skills and must be corrected if incorrect performance is evident. Third, the child's learning of the safety skills must culminate with the use of the skills when he or she is placed in a real-life situation. The present study examined 2 child-based firearm-injury prevention programs along these 3 dimensions. Specifically, the study had 3 primary objectives. First, it examined the effectiveness of the NRA's Eddie Eagle GunSafe Program. Second, it examined the importance of active rehearsal in the acquisition of firearm safety skills through the use of a behavioral skills training program. Third, it examined the extent to which firearm safety skills that were learned in a supervised classroom setting would also be performed in a naturalistic situation outside the training setting.

METHODS

Participants

This study was approved by the North Dakota State University Institutional Review Board for the Protection of Human Research Participants. Each 4- and 5-year-old child who attended 1 of 4 independent preschools took home a letter describing the purpose and details of the study and an informed consent letter. Approximately 90 consent forms were sent home to parents; 42 consent forms were returned. Children whose parents did not return consent forms engaged in activities in a separate room while training was being conducted. Children whose parents returned the signed consent form were eligible to participate in the study. One preschool site was removed from the study because not enough children were recruited to train children in groups. The final sample consisted of 31 children who attended 1 of 3 preschools. Age and sex breakdowns for each of the conditions are provided in Table 1.

TABLE 1. Demographic Information by Condition

Condition	Male	Female	Mean Age (Months)
Control	n = 6	n = 4	57.0
Eddie Eagle	n = 7	n = 4	60.9
BST	n = 7	n = 3	57.2
Total	n = 20	n = 11	58.4

Setting

All training was conducted in the children's classroom. Assessments occurred either at the child's preschool or in the child's home. When permission was not granted for in-home assessment, the assessment occurred in a novel room in the preschool. The room used for the assessment was one that the child did not frequently visit. Eight children were assessed in the home, and 23 were assessed at their preschool.

Experimental Design

The design was a posttest only control group design with a control group and 2 treatment groups, Eddie Eagle GunSafe Program (level 1) and behavioral skills training (BST).

Procedures

Random Assignment

Participants were randomly assigned to 1 of the 3 conditions (control, Eddie Eagle, or BST). Eleven children were assigned to the Eddie Eagle group, 10 children were assigned to the BST group, and 10 children were assigned to the control group.

Training

Training was conducted in the children's classrooms at the preschools. Children were trained in small groups of 2 to 5 children. The only exception to this occurred when a child missed a training session. When this occurred, children were provided with an individual session to bring them to the level of the rest of the group.

Eddie Eagle GunSafe Program (Level 1)

The Eddie Eagle GunSafe Program is an education-based training program developed and distributed by the NRA and is designed to aid educators in training children to, "Stop. Don't touch. Leave the area. Tell an adult," when they encounter a firearm. The implementation of this program adhered to the suggested curriculum outlined in the "Instructional Procedures" section of the administration manual provided with the program materials. The only deviation from the protocol was that some children could not be trained on 5 consecutive days because of absences. When this occurred, the absent child(ren) participated in 2 training sessions during 1 day to advance them to the level of the rest of the group. Each of the 5 sessions lasted for the suggested time outlined in the manual (10–15 minutes).

The first and second sessions introduced general safety concepts and the Eddie Eagle GunSafe program. During the second session, children were introduced to the, "Stop. Don't touch. Leave the area. Tell an adult," safety message. The third session used most of the learning materials and was designed to teach the children the gun-safety message. The fourth session involved a review of the gun-safety message and assessed the children's acquisition of knowledge about the program using techniques such as asking, "What would you do if . . ." scenarios that required the child to respond with the safety message and specific information regarding how they would respond to the scenario. The final session was dedicated to a brief "awards" ceremony in which the children were rewarded with certificates and praise for completing the program.

BST

A BST program developed by the researchers was also used. The program involved the typical components of a BST program, including instruction, modeling, rehearsal, and praise/corrective feedback.¹⁹ The target skills trained in this program, similar to those of the Eddie Eagle GunSafe Program, included not touching the firearm, leaving the area, and reporting to an adult. Training in this condition occurred in 5 sessions. Before each training session, trainers briefly explained the danger of firearms and why it is important that children not touch them. The safety skills (don't touch, leave the area, tell an adult) were then introduced. For teaching the "don't touch" response, each child was told not to touch a firearm when he or she encounters one. A trainer then modeled the behavior by approaching a disabled firearm (obtained from the local police department) and saying out loud, "Don't touch." Each individual child then approached the firearm and said, "Don't touch." When a child did not engage in the response or engaged in the response incorrectly, the trainer cor-

rected the error and modeled the response again, and the child again practiced the correct response. This procedure was repeated until the child correctly performed the behavior. Praise from the trainer was delivered each time the correct response was performed. The same procedure was used to teach the "leave the area" and "tell an adult" responses. Once each child had demonstrated that he or she could correctly perform the entire response chain on finding a gun, he or she was required to practice the response in a variety of scenarios. These scenarios included the child's finding a gun in a drawer, in a closet, on a bookshelf, on a kitchen shelf, on a chair, in/by the garbage, lying on the ground, in a shoebox, and on a table. For each training trial, the child was provided with a verbal scenario corresponding to the placement of the gun. For example, the experimenter told the child to pretend that he or she was in a room in the child's home (eg, kitchen). The experimenter then handed the child a prop (eg, a fake bar of soap) and issued an instruction (eg, "Go put this away under the sink"). When the child complied, he or she found the gun. The child practiced with several instructions, props, and settings. In addition, the child practiced reporting to a variety of adults (eg, an unfamiliar researcher, a teacher, a familiar administrator). Training continued until the child correctly demonstrated the skills 5 consecutive times. Throughout training, corrective feedback was delivered and additional rehearsals were performed for incorrect or incomplete responses until criterion responding was achieved 5 consecutive times. In addition, praise was delivered for all correct responses.

No-Treatment Control

Children in the no-treatment control group did not receive any instruction before assessment. After their participation in an assessment, they received training with the BST procedure described above. Training continued until the child demonstrated proficiency in the target skills.

Target Behaviors

For the purpose of data analysis, participants' performance when they found a firearm was given the following numeric values: 0, handled the firearm regardless of subsequent responses; 1, did not handle the firearm but did not leave the area and/or tell an adult; 2, did not handle the firearm and left the area but did not tell an adult; 3, did not handle the firearm, left the area, and told an adult (criterion). Handling the firearm was defined as any touch of the firearm that resulted in the firearm's displacement from its resting location or any touching of the firearm's trigger mechanism. Leaving the area was defined as the child's removing himself or herself a distance of at least 10 feet from the firearm or a distance sufficient for the child to report the encounter to an adult within 10 seconds of seeing the gun. Telling an adult required the child to provide voluntary information concerning the encounter with the firearm (eg, "I found a gun," "There's a gun in there").

Assessment

Firearm safety skills were assessed using role plays, self-reports, and in situ assessments. The researchers conducting the training also conducted the role-play and self-report assessments. A confederate unfamiliar to the child (ie, not involved in training) conducted the in situ assessments. All assessments were conducted within 1 week of the completion of training. The order of the assessments was in situ assessment, role-play assessment, and self-report. Children were not provided with feedback about their performance until all 3 assessments had been completed.

In Situ

Within 1 week of the completion of training, children from each condition were assessed in a simulated situation either in their home or in a novel situation at the preschool. The child was naive to the assessment, and the parent(s) or a teacher and an unfamiliar confederate were present. The general procedure for in-home assessments involved prearranging a situation in which the child was instructed by a parent or a confederate to go to a separate room and retrieve a preferred item from a cabinet, drawer, table, etc. The requests were structured so that compliance with the request would necessitate the child's finding the gun. An example of one of the requests used is "[Name], mommy and daddy have to talk to our friend (the confederate). Please go wait in the kitchen. There is some candy on the table that you can have."

Before the request, a novel disabled firearm (obtained from the local police department) was strategically placed in such a way that if the child complied with the request, then he or she would see it. Assessments conducted at the preschool were structured so that a novel confederate (who was introduced as a new student teacher) retrieved the child from his or her classroom and told him or her that they would be doing some activities together. The experimenter then walked with the child until they reached the outside of the room, where the firearm was placed. The child was asked to go into the room and sit in a chair until the experimenter returned. The experimenter also told the child that he or she (the experimenter) would be in the hallway if anything was needed. The gun was placed so that if the child complied, then he or she would necessarily see it. For assessments at both sites, a video camera was hidden in the room where the firearm was located to record the child's behavior.

Role Play

Within 1 week of training, each child was assessed in a role-play situation. In this assessment, the researcher(s) who trained the child described a scenario and asked the child to imagine that he or she was involved in the situation. The physical layout of the assessment room was arranged so that, when asked, the child was able to "act out" the situation. The experimenter served as an appropriate adult to talk about the finding of the firearm. The child's behavior was videotaped and scored using the coding system described above.

Self-Report

Children in each condition were interviewed within 1 week of the completion of training. The interviewer presented the child with a novel firearm-safety scenario (ie, one that was not presented during training), and the child was asked to report how he or she would react in such a situation. Each scenario followed the general format of one of the scenarios used in the role plays. Responses were recorded verbatim and issued a numeric value according to the following guidelines: 0, indicated that he or she would touch the gun regardless of subsequent response; 1, did not say he or she would touch the gun, verbalized that he or she would not touch the gun but did not report any subsequent response, or indicated that he or she would tell an adult (but did not indicate that he or she would leave the area); 2, said that he or she would not touch the gun and would leave the area but failed to indicate that he or she would report to an adult; 2.5, said that he or she would not touch the gun, would leave the area, and would tell an adult, but did not indicate an appropriate adult to tell; 3, said that he or she would not touch the gun, would leave the area, would tell an adult, and identified an appropriate adult for the situation.

Any failure to achieve criterion performance on any of the 3 assessments resulted in a training trial involving corrective feedback and additional role plays until the child performed the behavior at the criterion level. This training trial was not conducted, however, until all 3 assessments were completed.

Interobserver Reliability

A second observer scored 25% of all recorded verbal and videotaped behavioral assessments across conditions. Agreement was calculated separately for each of the role-play, self-report, and in situ responses. Each observer reviewed the assessment and issued a numeric value. Agreement was calculated by dividing the number of agreed-on values with the total number of values. The figure was then multiplied by 100%. Interobserver reliability was 100% for all assessments.

RESULTS

The mean scores for each condition (control, Eddie Eagle, and BST) on each of the assessments (self-report, role play, and in situ) are plotted in Fig 1. The results of a Kruskal-Wallis test showed a significant overall effect for the role-play assessments ($H[2, n = 31] = 23.73; P < .01$) and the self-report assessments ($H[2, n = 31] = 17.39; P < .01$) but not for the in situ assessments.

Additional Kruskal-Wallis tests showed that for the self-report assessments, the Eddie Eagle group

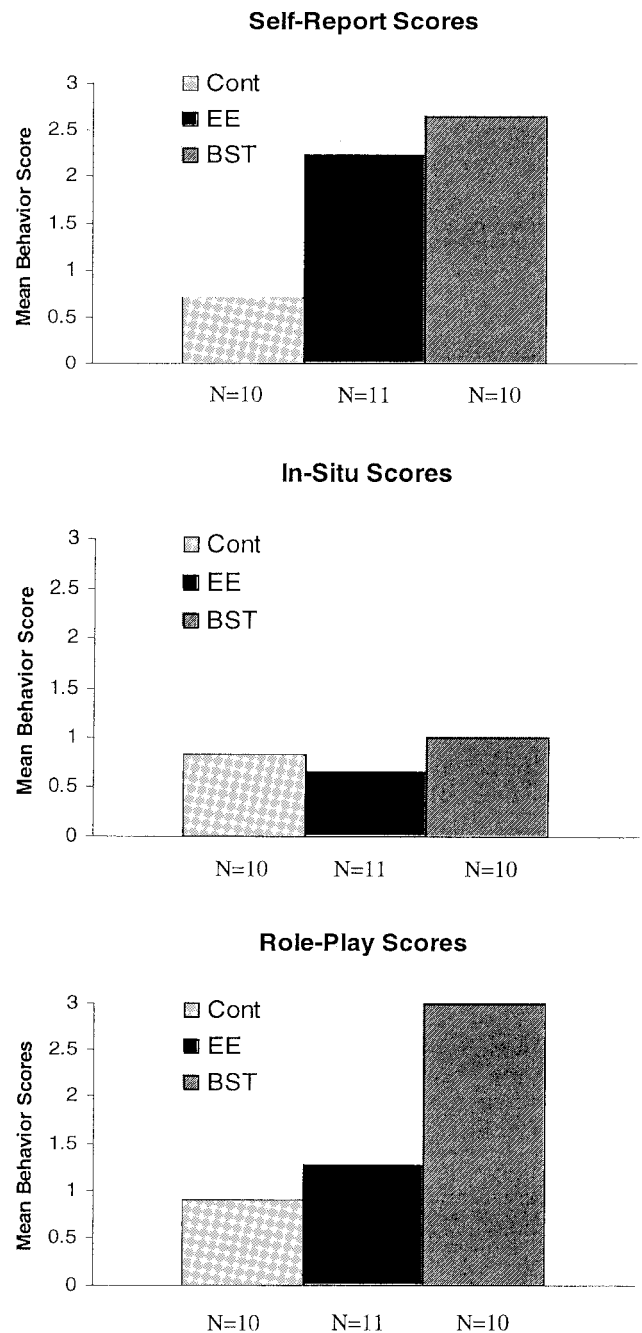


Fig 1. Mean assessment scores for the 3 groups for each of the 3 assessments (self-report, role play, and in situ). The top panel shows mean scores on the verbal measure, the middle panel shows mean scores on the in situ measure, and the bottom panel shows mean scores on the role play measure for all 3 groups.

(mean: 2.23; standard deviation [SD]: 0.88; $H[1, n = 21] = 10.67, P < .01$) and the BST group (mean: 2.65; SD: 0.41; $H[1, n = 20] = 16.03, P < .01$) scored significantly higher than the control group (mean: 0.70; SD: 0.48). This result shows that that children who were trained on both procedures learned to verbalize appropriately the target response. The Eddie Eagle and BST groups did not differ on this measure, however, indicating that the 2 training procedures were equally effective for teaching children to reproduce verbally the safety message when provided a hypothetical scenario.

For the role-play assessments, the BST group (mean: 3; SD: 0) scored significantly better than the Eddie Eagle group (mean: 1.27; SD: 0.65; $H[1, n = 21] = 15.91; P < .01$) and the control group (mean: 0.9; SD: 0.32; $H[1, n = 20] = 17.12; P < .01$). These results, combined with the aforementioned analysis, indicate that children who were trained with the BST procedure were able not only to describe the target response but also to demonstrate the response in a role play. The Eddie Eagle group and the control group did not differ, however, showing that although the Eddie Eagle program taught the children what to say, they were unable to perform the skills in a role play.

For the in situ assessments, the 3 groups (control, Eddie Eagle, and BST) did not differ significantly. This finding was consistent with our hypothesis that the Eddie Eagle program would not be successful for teaching children safety skills that they would use in real-life situations; however, this result did not confirm our hypothesis that BST would be more successful in teaching children to use the skills.

DISCUSSION

The purpose of the current study was to evaluate the effectiveness of 2 training programs that were designed to teach children safety skills to use should they ever find a firearm. The 2 programs evaluated included the NRA's Eddie Eagle GunSafe Program and a BST program developed by the authors. The former program is largely education based and uses a variety of age-appropriate materials to teach children to, "Stop. Don't touch. Leave the area. Tell an adult," should they ever find a firearm. The latter program was designed to teach the same repertoire but uses more active learning strategies, including instruction, modeling, rehearsal, and corrective feedback.

There are 3 necessary hierarchical components to a successful safety skills training program for children. First, the program must teach children a target safety message. Second, the program ensures that the children are able to perform the necessary target skills successfully. Third, the program ultimately teaches the children to use the skills outside the training setting, should the dangerous situation ever occur. The effectiveness of each of the aforementioned gun-safety programs was evaluated along these 3 dimensions using 3 different assessment methods. First, the effectiveness of each program for teaching children to reproduce the message verbally was evaluated using "what if" scenarios. Second, the effectiveness of each program for teaching children to perform the safety skills was conducted using realistic role plays. Third, each program was evaluated for its effectiveness in teaching children to perform the skills when placed in simulated dangerous situations using in situ assessments.

Three important findings were evident. First, results show that both programs were successful for teaching children to repeat the safety message. Compared with children who received no training, both children who were trained with the Eddie Eagle GunSafe Program and children who were trained

with the BST program were able to respond appropriately to "what if" questions. Second, children who were trained with the BST program successfully performed the skills in a supervised role play, but children who were trained on the Eddie Eagle GunSafe Program did not. Third, neither program was successful for teaching children to perform the safety skills when they were placed in a realistic situation. Of the 11 children who were trained with Eddie Eagle, 5 described the safety skills but only 1 engaged in the safety skills in a role play and none used the skills in a real-life situation. Of the 10 children who were trained with the BST program, 8 correctly described the safety skills and all 10 correctly performed the skills, yet only 2 actually used the behaviors when placed in a real-life situation.

There are a couple of potential explanations for why the BST program resulted in skill acquisition whereas the Eddie Eagle Program failed. First, although the Eddie Eagle Program focuses on teaching children that guns are dangerous and "tells" the children what to do should they ever find one, it does not ensure that children are able actually to perform the skills. Research has shown that active rehearsal of safety skills (ie, practice) is a more effective training strategy than using instruction alone.²⁵ The likely reason for this is that rehearsal allows learners the opportunity to perform the skills and allows trainers ample opportunities to reinforce correct responding. This is extremely important because it not only ensures that the child is able to perform the safety skills but also places the child in direct contact with reinforcement (ie, praise) for correctly performing the safety behavior, making it more likely that he or she will again perform the skills when placed in a similar situation in the future. Rehearsal also allows the trainer to observe each child and correct any mistakes that he or she may be making. The only behavior actively rehearsed during training on the Eddie Eagle program was the targeted verbal response, which is the only behavior that the children performed significantly better than children in the control group.

A second explanation for why the Eddie Eagle Program failed to teach the children the safety skills is that its curriculum may not be ideal given the children's developmental level. Several of the activities in the program seemed too difficult for 4- and 5-year-old children to understand. For example, the children are asked to draw a picture of what they learned from the program so that they could be displayed for the other children to view. Most, if not all, of the children in this study struggled with this project. Another example is the Eddie Eagle animated video. Although the children were very attentive during the video, when asked what they thought the important message was, most responded incorrectly.

As mentioned above, the BST program was successful for teaching the children to perform the safety skills in supervised role plays, but the children failed to perform the skills outside the training session. There are a few possible explanations for this. First and most likely, it is possible that the discrepancy

between the conditions in which the children learned the skills and the conditions in which the skills were assessed was too great. That is, the children may have learned that when the trainer was present in a training session, performing the safety skills would result in positive reinforcement (ie, praise) but when the trainer is not present (ie, at home) that reinforcement is not certain. Future research should evaluate the effectiveness of training in situations that more closely resemble the context in which the skills are likely to be needed (eg, in situ training in the home, a more detailed simulation of the home environment).

A second possible explanation for why the skills taught in the behavioral skills training were not used in the naturalistic assessment is that, during training, the researchers used imaginary simulations of real-life situations rather than placing the child in direct contact with the situation. When training the children with the BST procedure, the children were asked to "pretend" or "imagine" that they were in a variety of specific situations. The use of such procedures assumes that the child complies with the instructions to imagine the situations. This study did not include a measure of children's compliance with these instructions. If the children were not engaging in the "pretending" or "imagining," then it is possible that the skills would fail to generalize to settings that were significantly different from the setting in which the training was conducted. Future studies should examine procedures for maximizing the effectiveness of using imagery in combination with rehearsal to teach safety skills to children.

This study has several limitations that warrant discussion. First, the small sample size, both overall and within preschool sites, prevented meaningful comparisons between the training sites. Although the authors are not aware of any systematic differences between sites, it is possible that children from each site differed on important factors (eg, pretreatment knowledge about the dangers of firearms, exposure to firearms). Future research should evaluate any factors that may interact with training programs to make them more or less effective. A second limitation is that fewer than half of the consent forms were returned. This introduces 2 limitations. First, it is possible that children whose parents returned the consent forms were systematically different from those whose parents did not return the consent forms. No information was available in this study to examine this possibility. Second, the goal of any successful safety program is to reach as many children as possible. If there are factors preventing parents from allowing their children to participate in gun-safety programs, then this should be addressed. Although it is our experience that low return rates such as ours are not uncommon in this type of research, future research should examine methods for increasing parents' participation in child-based firearm injury safety programs and methods for addressing parents' reluctance to let their children participate in firearm-safety programs, should this be a concern. Third, the BST training program is a relatively new program. Although it has been adapted from existing

programs shown to be successful,¹⁹⁻²¹ this is the first study to examine its application with firearm safety. Fourth, the assessments used in this study examined children acting individually. It is unknown whether children will be more or less likely to perform the safety behaviors if a firearm is encountered in the presence of peers. Future research should address this concern.

Despite these limitations, the present study's findings have several implications for future research. First, it is common practice for researchers who evaluate safety programs to use children's self-report as a measure of effectiveness.^{26,27} Findings such as ours, however, suggest that effectiveness claims based on such evidence should be interpreted with caution and that researchers must measure actual skills, not just knowledge of skills, to demonstrate that children have truly learned the repertoire.

Another important issue in this study (and all safety skills research) is encouraging the use of skills outside the training context. This study demonstrates that children can be taught to perform firearm safety skills in the context of a training session. However, if these skills are not used in a real-life situation, then the participants have not truly benefited from the training program. The present finding that participants in the BST group were able to perform the skills in the presence of the experimenters but not during in situ assessments highlights this point and provides additional support for the use of in situ assessments as the primary measure of effectiveness for this type of research. In addition, future research should address methods for promoting the use of the skills in a real-world situation. Two possible techniques may be the use of multiple exemplars during training and in situ training.

The use of multiple exemplars has been shown to be effective for teaching a variety of safety skills. For example, Poche et al²⁵ used several types of abduction lures during training to successfully teach children to resist abduction lures during in situ probes. The present study conducted BST with multiple participants in 5 short sessions so that the training time and training resources would be comparable to those of the Eddie Eagle Program. Although the protocol did include the use of multiple scenarios, because of the time limitations, each child had limited practice rehearsing each one. Future programs might be more effective with longer sessions and/or more sessions so that each child is allowed the opportunity to practice more scenarios and also practice each one several times. Although the use of longer and/or more sessions raises the issue of the practical application of the program, we believe that it is an important first step in the development of a training program. It is our contention that the first step in developing an effective firearm-safety program is to demonstrate that the program is effective for teaching children to use the target skills should they ever be placed in a dangerous situation. Once this has been accomplished, the components of the program can be analyzed to determine which components of the program are necessary to achieve maximum program effectiveness while remaining practical in terms of

cost and resources. Once this objective is achieved, the most appropriate method of dissemination of the program can be determined (eg, teachers, trainers, parents).

A second technique that may be effective for promoting use of the skills in a naturalistic setting is the use of in situ training.^{20,21} For maximizing the likelihood that a child will perform the targeted safety skills when they are needed, training should be done in the environment that most closely resembles the environment in which he or she will need to use the skills. For example, if the most likely place for a child to find a gun is in the home, then training should be conducted in the home. Similarly, if the child is most likely to need to tell his or her parent, then the parent is the person whom the child should practice telling. Such training will allow stimulus control to be established with cues corresponding to those that will most likely be present when the skills are actually needed. Studies have shown in situ training to be significantly more effective than training conducted in an analog or simulated setting.^{20,21}

This study demonstrated that programs that use active skill rehearsal and reinforcement (eg, BST) can be effective in teaching children safety skills within the context of a role play, thus ensuring that the children are able to perform the necessary skills. Unfortunately, however, learning these skills is of limited value if the child does not use them in real-life situations. Therefore, future research should continue to evaluate the most effective way to teach firearm-safety skills and should pay particular attention to techniques that will ensure the use of the skills outside the training session.

In addition to examining techniques for increasing the effectiveness of a BST program for teaching firearm-safety skills to children, future research should examine methods for increasing the efficacy of the Eddie Eagle GunSafe Program. According to the NRA, the Eddie Eagle Program is already taught to a significant number of children each year. In addition, the program is readily available to trainers and the materials are well developed and user trainer friendly. If the program can be maximized to ensure the acquisition of skills and teaching children to use the skills in real-life situations, then it has the potential to have a substantial impact on firearm injury prevention.

Another consideration for future research is an examination of age differences. The present study targeted 4- and 5-year-old children because they are the target population of the Eddie Eagle Level 1 program and we believe that an early introduction to gun safety skills is important. However, this young population offers unique challenges to safety training. For example, it was, at times, difficult for the researchers to maintain the children's attention, especially when training was conducted in groups of 4 or 5 children. In fact, existing research has demonstrated that safety training is more effective for older children than it is for younger children.²⁷ Therefore, future research should address the effectiveness of training programs such as the Eddie Eagle GunSafe Program and BST for older children to determine

which interventions are the most effective. Although the current study with 4- and 5-year-old children shows both programs to be unsuccessful for teaching the use of the skills in a real-life context, the findings do not necessarily suggest that the programs in their current form will be unsuccessful for older children.

The unsuccessful, real-life use of the skills in this study points to the need for further development of a program that will teach children not to touch firearms should they ever encounter one. Findings of unsuccessful programs reported in the literature^{1,2} often lead authors to conclude with suggestions that child-based programs be abandoned and attention be returned to adults and their firearm storage practices. We disagree that child-based programs should be abandoned; rather, they should be implemented with caution until systematic evaluation using in situ assessment methods demonstrates them to be effective for teaching real-life use of the safety skills. We also agree, however, that these programs should not replace parent-based strategies for preventing firearm injury in children. Parents are the first line of defense for children, and programs that are designed to increase parents' safe storage of firearms are a must. It is our contention, however, that the development of child-based programs should parallel the development of parent-based programs until such programs are able to address successfully parents' unsafe gun-ownership and storage practices. Hopefully, with continued research on ways to promote the use of safety skills outside the training context, child-based skills training programs will be effective in teaching children what to do should they ever encounter a gun.

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