June 2022

Evaluating Behavioral Skills Training to Teach Identification of Choking Hazards to Substitute Caregivers

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by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science
with a concentration in Applied Behavior Analysis
Department of Child and Family Studies
College of Behavioral and Community Sciences
University of South Florida

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Date of Approval:
June 20, 2022

Keywords: babysitters, childhood injury, safety skills

Dedication

This manuscript is dedicated to my parents, John and Stacy Molve, who have supported me through every endeavor, large or small. This would not have been possible without their hard work to set me up for success. I would also like to thank Taylor Lovejoy for motivating me to keep going on rough days, and lending an ear whenever I needed.

Acknowledgements

I would like to acknowledge my committee members, Dr. Miltenberger and Dr. Zerger, both of whom provided valuable additions and perspective to this study. I would like to thank Asha Fuller, who was always there to solve problems and answer any of my questions, regardless of time of day. Finally, I would like to thank my advisor, Dr. Crosland, for her commitment to helping me complete my thesis and graduate. Dr. Crosland, thank you for going above and beyond your job description to guide me to the finish line. This would not have been possible without your dedication and compassion.

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Abstract

Choking is a leading cause of mortality in children (Committee on Injury, Violence and Poison Prevention, 2010). Over half of choking injuries occur due to food, and the remaining injuries involve common household objects (Chapin et al., 2013). Although studies have been conducted assessing the use of Behavioral Skills Training (BST) to teach hazard identification in substitute caregivers (Abarca, 2021), no studies have evaluated utilizing BST to identify choking hazards specifically. Thus, this study evaluated the efficacy of using BST to teach edible and non-edible choking hazard identification to substitute caregivers following guidelines from the Home Accident Prevention Inventory Revised Protocol (HAPI-R; Tertinger et al., 1984). The results found that all participants significantly improved their hazard identification and correction following BST in both phases. Generalization probes were high in baseline for all participants across phases, however, all participants scored 100% correct on the final generalization probes.

Chapter One: Introduction

Choking is a leading cause of unintentional injuries to people, especially in children under the age of five (New York State Department of Health, 2017). According to the American Academy of Pediatrics, choking is also a leading cause of mortality in children (Committee on Injury, Violence and Poison Prevention, 2010). Infants have the highest rate of choking incidents followed by children under three years old (Centers for Disease Control and Prevention [CDC], 2002). A study evaluating 165 child endoscopies by Rimell and colleagues (1995) found that coins were the most common non-food cause of choking, however balloons had the highest fatality rate. Like food, non-food items at higher risk for choking are typically round and smaller than 1.25 inches in diameter (Committee on Injury, Violence and Poison Prevention, 2010). In addition to the potential choking hazard of everyday objects, small toys also present a choking risk. Toys sold in retail bins or online may not include all the necessary warning labels to inform parents and other caretakers (Committee on Injury, Violence and Poison Prevention, 2010).

Considerable efforts have been made to reduce choking incidents. After preventative legislature like the Child Safety Protection Act of 1994 (U.S. Consumer Product Safety Commission, 1994) requiring choking hazard labels for toys and national choking prevention recommendations (Committee on Injury, Violence and Poison Prevention, 2010), overall deaths due to choking have slightly decreased for children and young adults ages 1-19 years old. However, a 2021 study conducted by Chang and colleagues alarmingly found over 300,000 injuries and 2,300 deaths were attributed to choking alone from 2001 to 2016. This study also found that rates of choking deaths did not decrease for 0-5-year-olds, which has been the primary risk group making up 75% of choking deaths. This suggests that interventions have not successfully impacted the target risk groups. Children under five are at a special risk due to factors including a smaller airway, common mouthing behaviors, absence of molars, as well as decreased knowledge of hazards (Committee on Injury, Violence and Poison Prevention, 2010; Smith et al., 2003). Over half of choking injuries in the United States are due to food, while the remaining injuries are due to common household items such as refrigerator magnets, small toys, and other small household items (Chapin et al., 2013).

More than 10,000 choking related emergency room visits occur each year in children from food (CDC, 2002). One contributing factor to these incidents may be lack of caregiver choking awareness. Surveys evaluating caregiver knowledge of choking hazards show food items are often overlooked as potential choking hazards (Higuchi et al., 2013; Nichols et al., 2012). About 60% of food-related injuries in children 1-14 years old occur under adult supervision (Susy Safe Working Group, 2012). High risk foods are typically those that are round and able to be condensed or compressed, including hot dogs, nuts, and grapes (Harris et al., 1984).

Factors such as quality of supervision have been shown to influence risk of overall unintentional child injuries including choking (Morrongiello et al., 2006). A cross over study evaluating the level of supervision (examining amount of distance, attention, and continuity of supervision from the caregiver) found children with lower supervision scores were more likely to experience injury (Anderst et al., 2015). Despite caregiver perception, supervision quality may also be lower than anticipated. Morrongiello and colleagues (2006) found in a study with 68 parents of children from 2-5 years old that children were not within sight of their primary caregiver about 20% of the time during waking hours, leading to potential increase in risk of injury.

Level and type of supervision also may play a role in injury outside of the home setting. Some literature suggests that children under 5-years-old may be at greater risk for injury when supervised by substitute caregivers (Davis et al., 2012). Davis and colleagues (2012) found that children between 2- and 5-years-old in daycare or receiving supervision from a nonrelative more than 10 hours a week had a higher rate of injuries than children supervised by parents at home, even after controlling for age, gender, ethnicity, parental education, healthcare support, and poverty level. It should be noted that literature surrounding risk of general childhood injury dependent on the type of caregiver (e.g., parental, day care center, babysitter) has yielded contradictory data, including some studies suggesting that risk of injury is lower for childcare centers (Kopjar et al., 1996; Schwebel et al., 2006). With respect to substitute caregivers, limited research suggests that the risk of injury increases when children are introduced to new environments or caregivers like a new babysitter (Kuhn & Damashek, 2015). While parents and permanent caregivers may have the necessary skills to identify hazards for their toddlers, substitute caregivers such as nannies and babysitters may also be less likely to know extensive safety skills (Kourany & LaBarbera, 1986; Schnitzer & Ewigman, 2008).

Even with a high level of child supervision, hazard identification is an essential part of preventing injury. However, effectively reducing the amount of safety hazards in an environment can be difficult. Although it is impossible to eliminate all potential injuries, research on child injuries suggests that most unintentional injuries are preventable through modification of the child's environment (Schnitzer, 2006). Several trainings have been created to address community awareness of choking prevention and hazards. For example, the CHOking Prevention Project

(Lorenzoni et al., 2019) is a school-based intervention focusing on different tiers of parental choking prevention education in 41 schools in Italy. The program evaluated three different educational strategies including information presented directly to families, teaching to school staff (who taught the parents), and teaching to health service staff (who taught school staff then families). The program included a lecture portion, a model of how to dislodge items, and an online review course. The authors found that all strategies were reported to be effective at increasing choking knowledge measured by a pre- and post-questionnaire.

Another recent choking intervention study was conducted by Bentivegna and colleagues (Bentivegna et al., 2018). This study evaluated the effects of an educational program designed to inform parents and prevent incidents of choking. One group of participants watched a brief video about choking prevention including edible and non-edible hazards, and the control group watched a general safety video. Participants (n=202) completed surveys containing choking knowledge questions before, immediately after, and 30 days after completing the video. The average difference in total scores between the pre, immediate post-test, and 30-day post-test were statistically significant between the intervention and control group. These results indicate that the video was effective at increasing parental knowledge of choking in the areas tested, including appropriate age groups for foods, appropriate food sizes, high risk foods, and high risk items like balloons and batteries.

Programs related to choking prevention have solely focused on educational or passive informational approaches, which might be less effective for teaching safety skills than including other teaching methods such as modeling and feedback (Himle et al., 2004). One widely used method of teaching skills is Behavioral Skills Training (BST). BST includes four main components: instructions, modeling, rehearsal, and feedback. BST has been used alone, and in combination with manualized safety trainings to teach a variety of safety skills including abduction prevention (Johnson et al., 2005; Johnson et al., 2006), firearm safety (Himle et al., 2004; Maxfield et al., 2019; Miltenberger et al., 2004; Novotny et al., 2020), looking for help when lost (Pan-Skadden et al., 2020), fire safety (Houvouras & Harvey, 2014) and general safety skills (Vanselow & Hanley, 2004).

Recently, BST has been used to teach caregiver safety skills to reduce home accidents, such as creating a safe infant sleeping environment (Carrow et al., 2020) and identification of hazardous items (Abarca, 2021; Giannakakos et al., 2020; Winterling et al., 1992). While BST has been used to teach a variety of skills, identifying choking hazards has yet to be individually evaluated using BST, specifically for substitute caregivers.

Multiple tools for measurement of home accident risk have been created, including the Home Safety Checklist (Dolgun et al., 2017) and the Home Accident Prevention Inventory (HAPI). The HAPI is a measurement tool to teach parents to identify hazards in the home (Tertinger et al., 1984). This inventory was revised to the Home Accident Prevention Inventory Revised (HAPI-R) by Mandel and colleagues to include falling and drowning hazards and now contains eight categories of accessible hazards in homes (Mandel et al., 1998). The HAPI-R has been used for safety assessment and aided in trainings primarily in the homes of parents reported for abuse and/or neglect (Barone et al., 1986; Metchikian et al., 1999). Metchikian and colleagues (1999) aimed to reduce the number of safety hazards in the home as identified in the HAPI-R by parents reported for neglect as a part of Project SafeCare, which is an evidence-based training program for parents who had been previously reported for maltreatment or are at risk of child maltreatment (Metchikian et al., 1999). Three families completed a safety training teaching skills including putting hazardous items out of reach, fastening safety latches on drawers, and locking up hazardous items. Items included those presenting risk for poisonings, electrical accidents, fire accidents, suffocation, small objects, sharp objects, firearms, fall accidents, and drowning accidents. All families showed a significantly reduced number of hazards in the home following training.

One sub-category, related to hazardous ingestible small objects of the HAPI-R provides information on how to evaluate non-edible choking hazards for infants and toddlers. The HAPI-R details how objects smaller than 1 and 6/8-inches in diameter (small enough to fit through a toilet paper tube) are potential choking hazards for young children. Although many previous studies have evaluated the use of the HAPI-R as an assessment tool to reduce home hazards, only one study to date has evaluated the use of the HAPI-R with substitute (as opposed to primary) caregivers. Abarca (2021) utilized BST to teach substitute caregivers hazard identification as identified by the HAPI-R. Abarca placed substitute caregivers in a room consisting of different hazards and measured participant identification of hazards pre and post BST using the HAPI-R protocol. All participants demonstrated increased hazard identification after BST, however, in vivo feedback was needed to reach high hazard identification. Overall, more research is needed to further evaluate the use of BST and the HAPI-R for substitute caregivers and specifically for choking hazards.

The purpose of this study was twofold. The purpose of phase one was to teach substitute caregivers to evaluate inedible household objects according to the HAPI-R protocol and identify objects that could be choking hazards. The purpose of phase two was to teach the same participants to identify whether prepared food was of adequate bite size for toddlers to consume and how to cut food into the appropriate size to prevent incidences of choking.

Chapter Two: Phase One Inedible Household Objects

Method

Participants and Setting

Three participants were recruited from a local four-year university institution. Participants ranged in age from 21 to 33 years old. Natasha was a 21-year-old female who was in her third year of classes. She had a little over one year of babysitting experience in high school. Hailey was a female student in her early 20's who did not report any prior babysitting experience before study participation. Jeremy was a 33-year-old male in his fourth year of classes who reported experience primarily with children older than nine years. Individuals who had a child or were a legal guardian for a child were excluded from this study. People who worked in preschool settings were also excluded. All pre-training, training, post-training, and generalization assessments were conducted in a small office type room on the university campus.

Dependent Measures

The dependent measure in this phase was the number of items correctly identified as hazardous or nonhazardous in an assessment converted into a percentage. If a nonhazardous item was incorrectly identified as hazardous, it was scored as incorrect. For example, 10 total items were presented, five of which were hazards. If the participant selected all five hazards, but also selected two nonhazardous items, they would score an 80% due to the two errors.

Items were selected from the Hazardous Items List (Appendix A) formed based on recommendations from the American Academy of Pediatrics (Committee on Injury, Violence, and Poison Prevention, 2010) and items that meet classification criteria for "small ingestible objects" identified in the HAPI-R. All hazardous items in phase one were common toys and household items smaller than 1.75 inches in diameter that also passed through the Safety-First Tester Tube with a total diameter of 1.25 inches and a slanted bottom depth of 2.25 inches. All items on the Nonhazardous Items List (Appendix B) did not fit through the tube and were larger than 1.75 inches.

Interobserver Agreement

A second data collector observed and scored a minimum of 75% of all baseline assessments, post-training assessments, and generalization probes for all participants. Interobserver agreement (IOA) was calculated on both the number of hazards correctly identified and the number of non-hazards incorrectly identified. IOA was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. An agreement occurred if both observers recorded that the participant correctly identified the item or recorded the participant incorrectly identified the item. A disagreement occurred if one observer recorded the participant as correctly identifying the item and the second observer recorded the participant as incorrectly identifying the item, or vice versa.

For Natasha, IOA was calculated for 100% of baseline assessments, 100% of post-BST assessments, and 75% of generalization probes, yielding 100% IOA overall. For Hailey, IOA was calculated for 100% of all baseline, post-BST and generalization probes, yielding 99.17% IOA overall. For Jeremy, IOA was calculated for 100% of all baseline, post-BST, and generalization probes, yielding 100% overall.

Treatment Integrity

A second observer also collected treatment integrity data on the implementation of BST by the experimenter according to the steps outlined in the Treatment Fidelity Checklist

(Appendix C) for a minimum of 50% of all trainings. Following the treatment integrity checklist, treatment integrity data were scored as either yes, no, or not applicable for each step.

For Natasha, treatment integrity was conducted for 33% of baseline assessments, 100% of trainings, 33% of post-BST, and 50% of generalization probes, with 100% treatment integrity. For Hailey, treatment integrity was conducted for 60% of baseline assessments, 100% of trainings, 33% of post-BST and 75% of generalization probes, with 100% treatment integrity. For Jeremy, treatment integrity was conducted for 66.67% of baseline assessments, 100% of trainings, 33% post-BST assessments, and 75% of generalization probes, with treatment integrity at 100%.

Design

A nonconcurrent multiple baseline across participants design was used to evaluate identifying items that were choking hazards.

Procedure

Baseline. In baseline, participants were presented with groups of 10 objects and asked to identify the objects that could be potential choking hazards. All sessions aside from the generalization probes were conducted in an office sized room. Participants sat at a desk opposite the researcher where items were placed one at a time on a desk containing two identical baskets, one labeled “hazardous” and the other labeled “nonhazardous”. Participants were asked to identify hazardous and nonhazardous items by putting each item in the basket it belonged. Across conditions, each assessment contained between 4 and 7 hazardous items out of the 10 items presented. Items for each assessment were selected from the hazardous items and nonhazardous items list. If the same item was selected three times, it was removed from the list.

Behavioral Skills Training (BST). Next, participants completed BST training using the HAPI-R protocol to identify and evaluate potential choking hazards. Training utilized the Safety-First small object choking hazard plastic tube (to simulate the size of a child's airway). Items that could pass through the tube were scored as choking hazards and items that could not pass through the tube were not choking hazards.

This training involved instructions, modeling the skill of evaluating potential choking hazards, role playing identifying hazards, and feedback on participant identifications. First, the experimenter provided 5 min of verbal instructions read from a written script including defining what a choking hazard is, which sizes it includes, steps the trainer takes when identifying a hazard, and some examples of hazards and non-hazards. Then, the trainer modeled the skill with the tube using items such as a quarter. For example, the trainer would pick up the quarter, identify if it was larger or smaller than the size of the tube, place it inside the tube, state if it went through or got stuck inside the tube, then place it in the corresponding box. Then, the participant would role play while using the tube, receiving positive or corrective feedback after each identification. After three role plays with 100% mastery using the tube, the participant practiced one probe without the tube. After achieving 100% correct identification without the tube, the participant would then practice identifying items in sets of five at a time (training assessments) like baseline and post-BST before receiving feedback. If participants met 100% correct identification for both hazardous and nonhazardous choking items, they proceeded to the next condition (post-BST). If participants did not meet mastery criteria, the trainer provided immediate feedback using the tube to demonstrate on the items. The participant would then complete another assessment probe without the tube.

Post-BST. After training, assessments were conducted with participants that were identical to baseline assessments. The plastic tube was not present during these assessments. Items were randomly selected from the lists of hazardous and nonhazardous items therefore some items were not the same as in the baseline assessments and other items were presented in baseline.

Participants had to meet 100% mastery criteria for three consecutive assessments for post-training assessments to be terminated. If they fell below 90% correct identification, participants were provided feedback. If participants scored below 90% twice, a booster BST session would have been provided, however this did not occur for any of the participants.

Generalization Probes. Participants were evaluated on their choking hazard identification during generalization probes. Two probes were conducted at the end of the baseline phase and post-BST phase for each participant, with the exception of Jeremy who only had one probe post-BST because he scored 100% on this probe. These probes consisted of a generalization assessment in a different setting, a simulated living room area consisting of only furniture, common large household items, and novel items that had not yet been presented. This assessment was the same as baseline assessments, with the exception that participants entered a living room area that contained a range of 4-7 new hazardous items and 21-29 nonhazardous items placed around the room simultaneously instead of at a table one at a time. A script was read to participants indicating that they should remove any items they considered a choking hazard and to leave any items in the room that they considered nonhazardous.

Social Validity

Upon completion of the final generalization probe, each participant was asked to complete a social validity rating scale. Part one of the Social Validity Survey (Appendix D) consisted of five questions regarding participant opinions scored on a one to five Likert-type scale. Questions included measures on how confident they felt identifying choking hazards, how confident they felt in their ability to prevent choking for the children they supervised, if they felt they had improved at identifying choking hazards after completion of the study, and if they believed identifying choking hazards was valuable or important.

Table 1 displays the results of the social validity survey for phase one. Both Natasha and Jeremy responded with the highest score of five ("very confident") for all questions, resulting in an average score of five. Hailey rated training feasibility at a four ("somewhat confident") and all other questions at a five, resulting in a mean rating of 4.67 overall. All participants reported they felt either somewhat confident or very confident in each validity category.

Chapter Three: Phase One Results

Figure 1 displays the phase one results for all three participants. Natasha correctly identified an average of 63.33% of items in baseline with a range of 60% to 70% correct. During BST, Natasha completed five training assessments without the tube until she met mastery criteria for BST termination to move on to the post-BST assessments. After BST, Natasha's percentage correct improved to correctly identifying 100% of items for three consecutive trials and meeting mastery criteria. Table 3 displays the results for the generalization probes. In pre-BST generalization probes, Natasha identified an average of 92.5% of items correctly, and an average of 94% in post-BST probes.

Hailey correctly identified an average of 66% items in baseline with a range of 50% to 80%. During BST, Hailey completed five training assessments without the tube before meeting mastery criteria to move onto post-BST assessments. After BST, she correctly identified 100% of items for three consecutive assessments meeting mastery criteria. Her pre-BST generalization probe average was 94.75% items correct, and her post-BST average was 96.15%.

Jeremy correctly identified an average of 61.67% of items in baseline with a range of 50% to 70%. During BST, Jeremy completed six training assessments without the tube before meeting mastery criteria to begin post-BST assessments. After BST, he correctly identified 100% of items for three consecutive sessions. Both his pre-BST and post-BST generalization probes were 100% correctly identified items. Overall, all participants met mastery criteria within three assessments after BST and generalized or maintained generalization of correct identification for both hazards and non-hazards in the generalization probes.

Chapter Four: Phase Two Edible Objects

Method

Participants and Setting

The same participants from phase one participated in phase two of this study. The same exclusionary criteria of parents, primary caregivers, and individuals working within school and preschool settings from phase one were maintained for phase two. All sessions were conducted in a room on a university campus.

Dependent Measures

The primary dependent measure was the number of foods (hazardous and nonhazardous) correctly identified in the array converted into a percentage. The secondary dependent measure was the number of foods cut into the appropriate size defined as pieces no larger than one-half inch converted into a percentage. All foods defined as cut into an appropriate size had to be smaller than a nickel in size. Such as in phase one, foods were selected from the List of Foods (Appendix E) for each assessment with a varying number of hazards and non-hazards in each array. Data were collected in the same manner as phase one.

Interobserver Agreement

A second data collector observed a minimum of 88% of all baseline assessments, post-training assessments and generalization probes for all participants. Interobserver agreement (IOA) was calculated for both primary and secondary dependent measures by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. An agreement for the primary dependent measure of correctly identified foods was scored if both observers recorded that the participant correctly identified the food or both recorded the participant incorrectly identifying the food. An agreement for the secondary measure of correctly cut foods was scored if both observers recorded the participant correctly cutting the item or both recorded the participant incorrectly cutting the item. A disagreement for correctly identified foods was scored if one observer recorded the participant as correctly identifying the item and the second observer recorded the participant as incorrectly identifying the item. A disagreement was scored for correctly cut foods if one observer recorded the participant as correctly cutting the food and the second observer recorded the participant as incorrectly cutting the food.

For Natasha, IOA was conducted for 75% of baseline assessments, 100% of post-BST assessments, and 100% of generalization probes, with IOA at 100%. For Hailey, IOA was conducted for 100% of all baseline, post-BST, and generalization probes, with IOA at 98.33%. For Jeremy, IOA was conducted for 100% of all baseline, post-BST, and generalization probes, with IOA at 100%.

Treatment Integrity

Treatment integrity data were collected for a minimum of 50% of trainings on the implementation of BST according to the steps outlined in Appendix F. Trainer BST steps completed were scored as either yes, no, or not applicable. Assessment implementation treatment integrity was conducted for a minimum of 33% of baseline, post-BST, and generalization assessments.

For Natasha, treatment integrity was conducted for 75% of baseline assessments, 100% of trainings, 100% of post-BST assessments, and 100% of generalization probes, with 100% treatment integrity. For Hailey, treatment integrity was conducted for 71.4% of baseline assessments, 100% of trainings, 33.33% of post-BST assessments, and 50% of generalization probes, with 100% treatment integrity. For Jeremy, treatment integrity was taken for 88.89% of baseline assessments, 100% of trainings, 100% post-BST assessments, and 100% of generalization probes, with 100% treatment integrity.

Design

A nonconcurrent multiple baseline across participants design was used to evaluate the skills of identifying edible choking hazards and correctly cutting them.

Procedure

Baseline. Participants were presented with sample bites on paper plates. Participants were asked to "identify the foods that could be potential choking hazards and make the environment safe for a toddler to eat." Each food was presented one at a time with five foods per trial including a range of two to four hazards, selected similarly to phase one. Like phase one, participants were seated at a table in an office-like room. Once presented the bite of food on a plate, the participants were instructed to verbally state if a food was either hazardous or nonhazardous and then to make the foods safe bite sizes for a toddler to eat. A knife and fork were present for the participant to cut foods identified as hazardous. Correctly identified foods and correctly cut foods (no larger than one half inch) were recorded in each array presentation.

BSTx. Next, participants completed BST to identify and evaluate food choking hazards and the correct size of bites for toddlers. This training involved instructions, modeling the skill of evaluating plates of food for choking hazards and correcting them, role playing the identification of hazards and creating appropriately sized bites, and feedback on their identifications. The training included using a nickel to create appropriate bite sizes using different foods. Participants were told and shown which sizes were too big and then provided the chance to practice with feedback. Participants were required to meet 100% mastery criteria on at least three role plays before ending training.

Like in phase one, verbal instructions were read following a script including what defined a choking hazard, what bite sizes presented a hazard, and common food hazards. Modeling included the trainer identifying if the bite was hazardous or nonhazardous, and demonstrating correct cutting by placing the nickel on the food and cutting off any excess parts. Role play and feedback were the same as in phase one, wherein the participant practiced identification and correction with the nickel following positive and corrective feedback, then moved on to practicing without the nickel during training assessments similar to baseline and post-BST.

Post-BST. After training, participants were asked to evaluate novel sample bites on paper plates and determine which items were potential choking hazards and to make the food items safe for a toddler (same as in baseline). Participants were required to meet 100% mastery criteria for three consecutive assessments for post-training assessments to be terminated. Like phase one, participants would have received a booster session if they scored below 90% for two consecutive assessments, however this did not occur for any of the participants.

Generalization Probes. Participants were evaluated on their ability to identify five potential choking hazards and creating size appropriate bites of food during generalization probes. One probe was conducted at the end of the baseline phase and one probe was conducted at the end of the post-BST phase for each participant. These were conducted in a different setting using a kitchen area wherein participants identified and cut food hazards placed on the counter in the kitchen. Participants entered a kitchen with foods including hazards and non-hazards on the counter and were told to "make a safe plate using five different foods." For example, a participant would identify a bunch of grapes on the counter as a potential choking hazard and cut them in half before placing them onto the plate. If a food hazard, such as an uncut grape, was not identified or was not cut into the appropriate size, the food was scored as incorrect.

Social Validity

After completion of the generalization probes, participants completed Part Two of the Social Validity Survey relating to food items (Appendix D). Table 2 displays the results of the social validity survey for phase two. All participants rated five (very confident) for all questions. This resulted in a mean rating of five for Natasha, Hailey, and Jeremy.

Chapter Five: Phase Two Results

Figure 2 displays phase two results for all three participants. In baseline, Natasha correctly identified an average of 95% of foods with a range of 80% to 100%. She correctly cut an average of 33% of foods with a range of 0% to 100%. During training, Natasha completed seven BST assessments without the nickel to reach the mastery criteria to advance to post-BST assessments. After BST, Natasha correctly identified and cut 100% of foods for three consecutive sessions, meeting termination criterion. Table 4 displays the results for both generalization probes. In pre-BST generalization probes, Natasha correctly identified 100% of foods and correctly cut 50% of foods. In the post-BST generalization probes, Natasha correctly identified and cut 100% of foods.

Hailey correctly identified an average of 88.57% of foods with a range of 60% to 100% in baseline. She correctly cut an average of 4.7% of foods with a range of 0% to 33%. During training, Hailey completed three BST assessments without the nickel to meet the mastery criteria. After BST, Hailey correctly identified and cut 100% of foods for three consecutive assessments. In the pre-BST generalization probe, she identified 80% of foods correctly, and cut 50% of foods correctly. In the post-BST generalization probe, she correctly identified and cut 100% of foods presented.

Jeremy correctly identified an average of 64.44% foods correctly in baseline with a range of 40% to 100%. He correctly cut an average of 88.78% foods in baseline with a range of 33% to 100%. During training, Jeremy completed three BST assessments without the nickel until meeting the mastery criteria. After BST, Jeremy correctly identified and cut 100% of foods for three consecutive assessments, meeting termination. In the pre-BST generalization probe, Jeremy correctly identified and cut 100% of foods. In the post-BST generalization probe, Jeremy maintained the same percentage of 100% correctly identified and cut foods. Overall, all participants met the mastery criteria after BST within three assessments. All participants generalized or maintained generalization of the skill in a new setting.

Chapter Six: Discussion

This study examined the use of BST to train substitute caregivers how to identify potential choking hazards for young children with both common household items and food. The results of this study found that BST was effective in increasing correct hazard and non-hazard identification for all three participants. Therefore, BST may be an effective intervention to train how to identify and correct choking hazards with this population to prevent incidences of choking in young children.

This study adds to the extended literature on BST and safety skills, as well as the HAPI-R protocol. Previous research using BST to teach safety skills found that although BST improved performance of the skill compared to baseline, BST alone may not be sufficient to reach and maintain high level skill mastery without the use of additional intervention, such as in situ training or in-vivo feedback. For example, in Miltenberger et al. (2004) and Novotny et al. (2020), which focused on teaching firearm safety skills, half of participants required in situ training in addition to BST. All participants in Abarca (2021), which used the HAPI-R protocol and BST to teach home hazard identification, required in-vivo feedback. However, all participants in the current study reached 100% correct identification without additional feedback.

All three participants were able to meet and maintain mastery within three assessments after intervention. While phase one had similar baseline averages for each participant, phase two showed some differences in participant responding. Jeremy had a higher average of correctly cut foods in baseline assessments than Natasha and Hailey. In several baseline assessments, Jeremy cut most of the foods presented into very small portions close to half the size of a nickel, even if he simultaneously identified them as nonhazardous. This resulted in higher identification and cutting scores, even if a food was nonhazardous and did not require cutting. Jeremy also made several comments about how he was cutting food “just to be safe” and remarked how he was comparing foods to Gripz snacks that he had seen his nephews eat safely. After BST, Jeremy did not cut any nonhazardous foods.

Phase two also had higher variability across baseline assessments overall. For example, Natasha correctly identified and cut 100% of foods in one baseline assessment, then proceeded to cut 0% of foods correctly in the following assessment despite the similar sizes presented.

This study has several limitations. One primary limitation in phase one is the high percentage of correct hazard identification for each participant in the baseline generalization probes before conducting BST. One potential reason for this may be the difference in number of hazardous versus nonhazardous items presented during all generalization probes. While baseline and post-BST trials had a range of 4-7 hazards out of 10 items in phase one, the probes were created to mimic a typical living room with 25-33 total items presented at a time, which only included a small range of 4-7 hazards. All participants incorrectly identified some nonhazardous items as hazardous before BST (false positives). A secondary reason for this may be relative size. During each generalization probe, participants viewed all items simultaneously, with the ability to manipulate and compare each item to the whole array. For example, one probe contained the game Trouble, including the fairly large game board (nonhazardous) and a game piece (hazardous). Participants were able to compare the size of the board and the piece, and potentially use the hazardous game piece as a guide to determine other hazards.

Hazard identification was also high in the phase two generalization probes before BST. In addition to what was previously stated, some phase two foods may have been correctly identified due to their shape or how they are typically eaten. For example, one array contained both mac and cheese and nuggets. Although mac and cheese bunches may be large, participants made a small nonhazardous scoop, despite making an incorrect bite size with the chicken nuggets which are typically larger and eaten by hand without utensils when creating a plate. These factors may have contributed to higher correct identification and cutting in generalization probes when participants were creating a plate instead of correcting one small bite at a time such as in baseline and post-BST trials.

Future research could extend these findings to other types of hazards and populations. Despite a plethora of research examining BST, this was the first study focusing on both choking hazards and BST. This study focused on only one category of the HAPI-R assessment tool. Future research could provide further information on training substitute caregivers in other areas of child safety, or possibly extend these findings to primary caregivers who were excluded from this study.

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Tables

Table 1. *Phase One Social Validity Results*

Item	Natasha	Hailey	Jeremy	Mean Rating
How confident do you feel identifying choking hazards?	5	5	5	5
How confident do you feel in your ability to prevent choking for the children you typically supervise?	5	5	5	5
How effective was the training in helping you learn to identify choking hazards?	5	5	5	5
How feasible was this training?	5	4	5	4.67
How important is knowing how to identify choking hazards?	5	5	5	5

Note. This survey used the following Likert scale. 1 = Very unconfident, 2 = Somewhat unconfident, 3 = Confident, 4 = Somewhat confident, and 5 = Very confident.

Table 2. *Phase Two Social Validity Results*

Item	Natasha	Hailey	Jeremy	Mean Rating
How confident do you feel identifying *food* choking hazards?	5	5	5	5
How confident do you feel in your ability to prevent choking *on food* for the children you typically supervise?	5	5	5	5
How effective was the training in helping you learn to identify *food* choking hazards?	5	5	5	5
How feasible was this training?	5	5	5	5
How important is knowing how to identify *food* choking hazards?	5	5	5	5

Note. This survey used the following Likert scale. 1 = Very unconfident, 2 = Somewhat unconfident, 3 = Confident, 4 = Somewhat confident, and 5 = Very confident.

Table 3. *Phase One Generalization Probes*

Participant	Baseline Probe 1	Baseline Probe 2	Post-BST Probe 1	Post-BST Probe 2
Natasha	97%	88%	88%	100%
Hailey	93.5%	96%	92.30%	100%
Jeremy	100%	100%	100%	-

Note. Participants identified a range of 25-33 items as hazardous or nonhazardous in a simulated living room. Only 4-7 items in each probe were hazardous to represent a realistic environment.

Table 4. *Phase Two Generalization Probes*

Participant	Baseline Probe Identified Foods	Baseline Probe Cut Foods	Post-BST Probe Identified Foods	Post-BST Probe Cut Foods
Natasha	100%	50%	100%	100%
Hailey	80%	50%	100%	100%
Jeremy	100%	100%	100%	100%

Note. Participants identified and cut groups of food on a counter to create a nonhazardous plate by using a simulated kitchen.

Figures

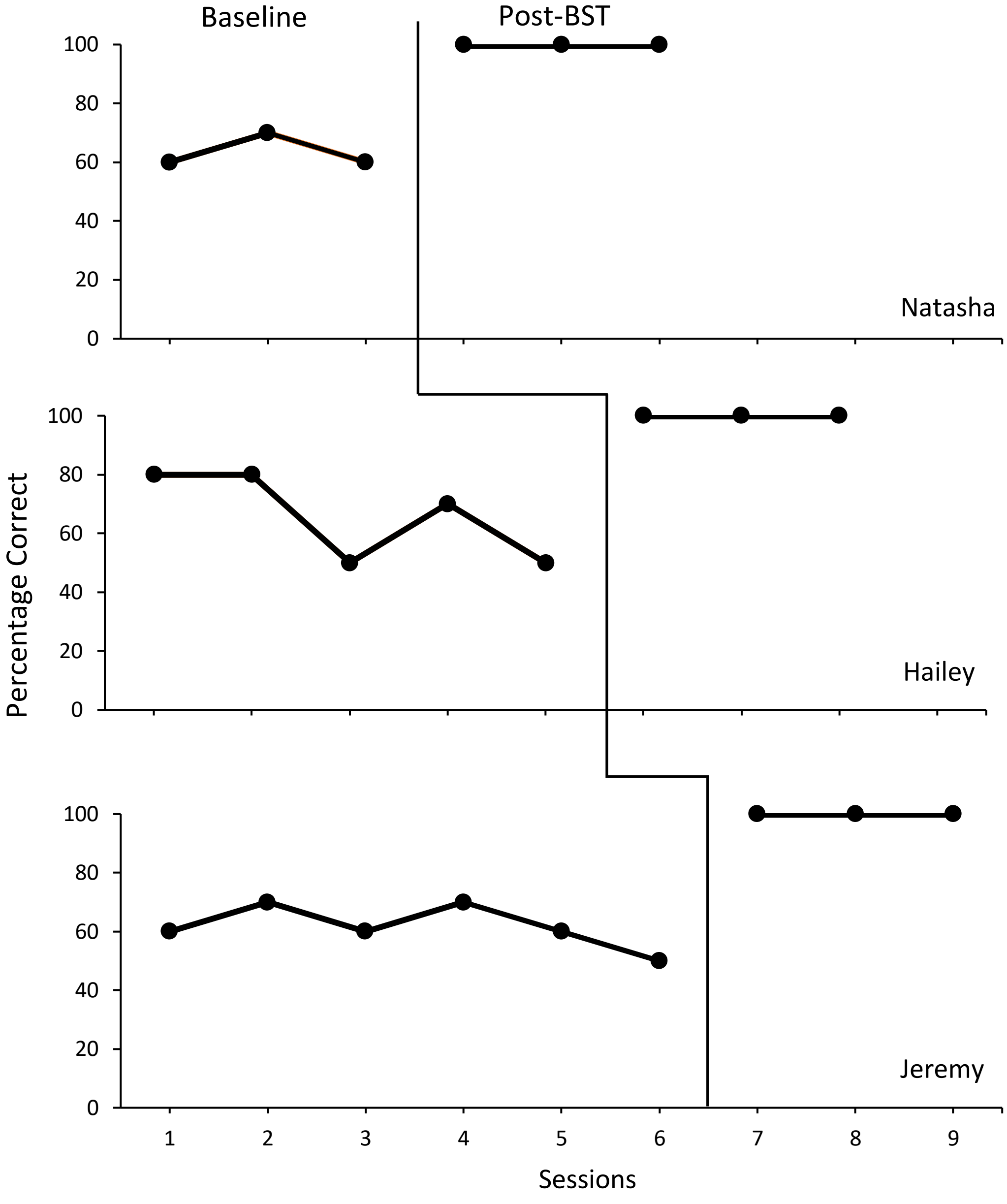

Figure 1. *Correctly Identified Items in Phase One*
Note. Phase one graph displaying percentage of items that were correctly identified for Natasha, Hailey, and Jeremy.
*The measure "correctly identified" in the array includes both hazardous and nonhazardous items. For example, if a nonhazardous item is identified as hazardous, that item would be scored as incorrectly identified

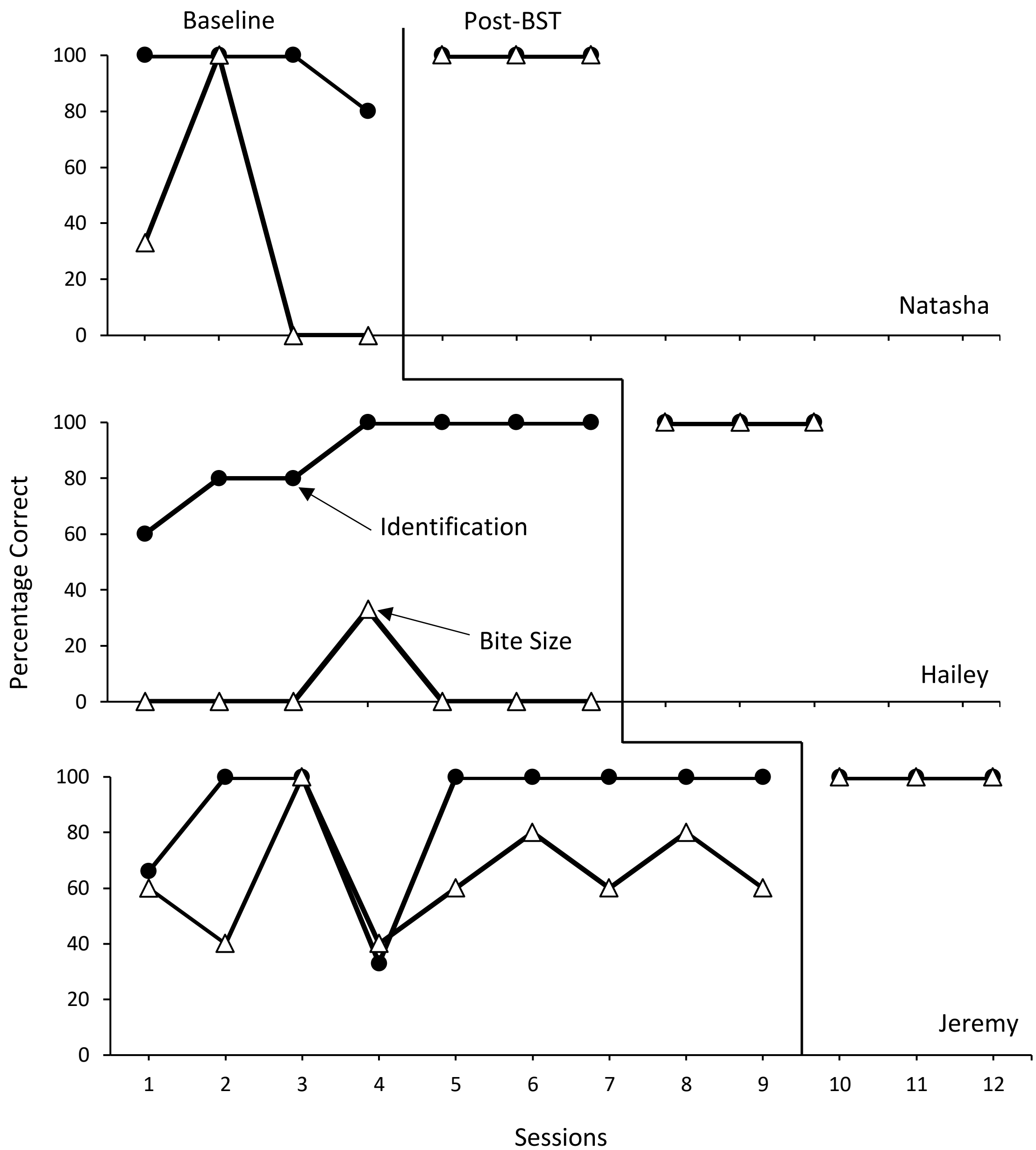

Figure 2. *Corrrectly Identified and Cut Food Items in Phase Two*
Note. Phase two graph displaying the primary dependent measure, the percentage of correctly identified foods (circle) and the secondary dependent measure, percentage of correctly cut foods (triangle) for Natasha, Hailey and Jeremy.
*Food scored as "correctly identified" and "correctly cut" in the array includes both hazardous and nonhazardous foods that were identified respectively. For example, if a nonhazardous item was identified as hazardous, that item would be scored as incorrectly identified.

Appendices

Appendix A: List of Hazardous Items

1. Quarter
2. Nickel
3. Penny
4. Dime
5. Earring
6. Bottle lid
7. Paper clip
8. Beads
9. Necklace
10. Ring
11. Bracelet
12. Balloons
13. Hair tie
14. Small eraser
15. Lipstick
16. Eyeliner
17. Mascara
18. Cotton ball
19. Contact case lid
20. Glue stick
21. Small rubber ball
22. Travel soap
23. Button
24. Mini Lego
25. Army men toy
26. Hair clips
27. Sticky tack (putty)
28. Birthday candle
29. Pencil sharpener
30. Di
31. Small ornament
32. Small chip clip
33. Flash drive
34. Chapstick
35. Crayon
36. Nail clipper
37. Pin
38. Chalk
39. Air pod
40. Eye drops
41. VapoInhaler
42. Barrette
43. Mini essential oil bottle
44. Ketchup packet
45. C battery
46. Tweezer
47. Ear plug
48. Lion figurine
49. Makeup brush
50. Jumbo glue stick
51. Scrunchie
52. Floss pick
53. Wine stopper
54. Concealer
55. Banana lip balm
56. Shell
57. Cocktail umbrella
58. Pen cap
59. AA battery
60. Travel shampoo
61. Pen cap
62. Travel perfume
63. Shower clip
64. Mini baby bottle
65. Beaded bracelet
66. Empty travel toothpaste
67. Mini sticky note
68. Camel figurine

Appendix B: List of Nonhazardous Items

1. Bottle of spray hand sanitizer
2. Floss container
3. Mini hand sanitizer
4. Small yellow candle
5. Small white candle
6. Full travel toothpaste
7. Nail polish
8. Saltshaker
9. Fidget spinner
10. Contact case
11. Mini spray deodorant
12. Car vent freshener
13. White out
14. Race car
15. Travel W-40
16. Blue hoop earring
17. Elf brush cleanser
18. Travel dry shampoo
19. Cat toy
20. Tape measure
21. BBQ sauce packet
22. Travel Musinex
23. Mini snow globe
24. Travel mouthwash
25. Travel spray
26. Binder clip
27. Travel lotion
28. Travel sunscreen
29. Travel Gorilla Glue
30. Tape roll
31. Mini eyeshadow palette
32. Keychain shoe
33. Prescription bottle
34. Cookie cutter
35. Gold hoop earring
36. Harmonica
37. Chip clip
38. Mario Badescu gel
39. Travel contact solution

Appendix C: Phase One Treatment Fidelity Checklist

Trainer:	Observer:	Participant initial:	Date:	Phase:

Baseline	**Yes**	**No**	**N/A**
Trainer presents array of 10 items consisting of both hazardous and nonhazardous items			
Tells participant to identify each food as hazardous or nonhazardous			

BST (with tube)	**Yes**	**No**	**N/A**
Provided verbal instructions			
Provided modeling			
Provided participant practice			
Provided feedback			
Provided training assessments until 3 assessments with 100% accuracy			
Provided assessment probe without tube			
Provided practice and feedback until 100% accuracy without tube			

Post-BST Assessment (without tube)	**Yes**	**No**	**N/A**
Presents array of 10 items consisting of both hazardous and nonhazardous items			
Tells participant to identify each item as hazardous or nonhazardous			
Provides feedback if accuracy is below 90%			
Provides booster training if accuracy is below 90% twice			

Generalization Probe	**Yes**	**No**	**N/A**
Trainer provides scatters items in novel setting consisting of both hazardous and nonhazardous items			
Tells participant to identify each item as hazardous or nonhazardous			

Appendix D: Social Validity Survey

Initials: __________   Date: ______________

Part 1: General Choking Hazards

1. How confident do you feel identifying choking hazards?
   - 5: Very confident
   - 4: Somewhat confident
   - 3: Confident
   - 2: Somewhat unconfident
   - 1: Very unconfident

2. How confident do you feel in your ability to prevent choking for the children you typically supervise?
   - 5: Very confident
   - 4: Somewhat confident
   - 3: Confident
   - 2: Somewhat unconfident
   - 1: Very unconfident

3. How effective was the training in helping you learn to identify choking hazards?
   - 5: Very effective
   - 4: Somewhat effective
   - 3: Effective
   - 2: Somewhat ineffective
   - 1: Very ineffective

4. How feasible was this training?
   - 5: Very feasible
   - 4: Somewhat feasible
   - 3: Feasible
   - 2: Somewhat feasible
   - 1: Very feasible

5. How important is knowing how to identify choking hazards?
   - 5: Very important
   - 4: Somewhat important
   - 3: Important
   - 2: Somewhat unimportant
   - 1: Very unimportant

Part 2: Food Choking Hazards

1. How confident do you feel identifying *food* hazards?
   5: Very confident
   4: Somewhat confident
   3: Confident
   2: Somewhat unconfident
   1: Very unconfident

2. How confident do you feel in your ability to prevent choking *on food* for the children you typically supervise?
   5: Very confident
   4: Somewhat confident
   3: Confident
   2: Somewhat unconfident
   1: Very unconfident

3. How effective was the training in helping you learn to identify *food* hazards?
   5: Very effective
   4: Somewhat effective
   3: Effective
   2: Somewhat ineffective
   1: Very ineffective

4. How feasible was this training?
   5: Very feasible
   4: Somewhat feasible
   3: Feasible
   2: Somewhat feasible
   1: Very feasible

5. How important is knowing how to identify *food* hazards?
   5: Very important
   4: Somewhat important
   3: Important
   2: Somewhat unimportant
   1: Very unimportant

Additional comments:

Appendix E: List of Foods

1. Grapes
2. Hotdog slices
3. Apple slices
4. Bananas slices
5. Deli meat
6. String cheese
7. Carrots
8. Swedish fish
9. Chips
10. Crackers
11. Cherry tomatoes
12. Fun size Milky Ways
13. Fun size 3 Musketeers
14. Fun size Snickers
15. Reese’s
31. Twinkies
32. Sliced peaches
33. Mini donuts
34. Donuts
35. Oreos
36. Mini muffins
37. Fun size Rice Crispies
38. Cheetos
39. Ding dongs
16. Fig bars
17. Strawberries
18. Honeydew
19. Cantaloupe
20. Pineapple
21. Orange
22. Chicken nugget pieces
23. Pasta
24. Sausages
25. Watermelon pieces
26. Mini pickles
27. Mozzarella sticks
28. Bagel bites
29. Pizza rolls
30. Fish sticks
40. Little Bites muffins
41. Graham crackers
42. Granola bars
43. Maraschino cherries
44. Pigs in a blanket
45. Croutons
46. Oranges
47. Chocolates

Appendix F: Phase Two Treatment Fidelity Checklist

Trainer:	Observer:	Participant initial:	Date:	Phase:

Baseline	**Yes**	**No**	**N/A**
Trainer presents plate of 5 foods consisting of both hazardous and nonhazardous foods			
Tells participant to identify each food as hazardous or nonhazardous			

BST	**Yes**	**No**	**N/A**
Provided verbal instructions			
Provided modeling			
Provided participant practice			
Provided feedback			
Provided training assessments until 3 plates with 100% accuracy			

Post-BST Assessment	**Yes**	**No**	**N/A**
Presents plate of 5 foods consisting of both hazardous and nonhazardous items			
Tells participant to identify each food as hazardous or nonhazardous			
Provides feedback if accuracy is below 90%			
Provides booster training if accuracy is below 90% twice			

Generalization Probe	**Yes**	**No**	**N/A**
Presents different setting with 5 foods consisting of both hazardous and nonhazardous items			
Tells participant to “make a safe plate using five different foods.”			

Appendix G: Letter of Approval

APPROVAL

January 3, 2022

Madison Molve
[redacted]
Astor, FL 32102

Dear Ms. Madison Molve:

On 12/19/2021, the IRB reviewed and approved the following protocol:

Application Type:	Initial Study
IRB ID:	STUDY003568
Review Type:	Expedited 7
Title:	Evaluating Behavioral Skills Training to Teach Identification of Choking Hazards to Substitute Caregivers
Funding:	None
IND, IDE, or HDE:	None
Approved Protocol and Consent(s)/Assent(s):	• Protocol V. 1 Clean • Social-Behavioral Consent Form Clean Approved study documents can be found under the 'Documents' tab in the main study workspace. Use the stamped consent found under the 'Last Finalized' column under the 'Documents' tab.

Within 30 days of the anniversary date of study approval, confirm your research is ongoing by clicking Confirm Ongoing Research in BullsIRB, or if your research is complete, submit a study closure request in BullsIRB by clicking Create Modification/CR.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

As a reminder, please contact USF IT at secops-help@usf.edu to set up your Box.com study folder before storing data on the cloud. You will need to include the name of the Principal Investigator (folder owner), study title, data to be stored, and a list of IRB-approved study team members in your email to USF IT. For additional information, please see Question 38 of HRP-103 - Investigator Manual.

Sincerely,

Katrina Johnson
IRB Research Compliance Administrator