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In-Person and Telehealth Behavioral Skills Training to Reduce Child Restraint System Misuse

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ABSTRACT

One of the leading causes of hospitalizations and fatalities for children in the United States is motor vehicle occupant injury. Risks are reduced when child restraint systems are properly used. However, child restraint system misuse is a continuing public health problem. A longitudinal quasi-experimental within-subjects group design was used across two experiments that recruited 2,448 paired participants to educate proper use of their child restraint system. Experiment one participants were randomly assigned to a behavior skills training or traditional training group. Results demonstrated that behavioral skills training participants reduced misuse more effectively than traditional training. Experiment two participants were assigned to a behavioral skills training in-person or virtual telehealth group. Results confirmed both groups were equally as effective in reducing misuse. A 9-month evaluation validated long-term maintenance of behavioral skills training to reduce misuse. This study demonstrates a method to improve certified child passenger safety training programs to reduce misuse.

KEYWORDS

Behavioral skills training; car seat; child restraint system; misuse; motor vehicle injury; telehealth

Motor vehicle occupant injury is one of the leading causes of hospitalizations and fatalities for children in the United States. In 2019, 1,053 children 14 years of age and younger were killed and 183,000 were injured (National Center for Statistics and Analysis, 2022). One in every four childhood fatalities is from motor vehicle crashes (WISQARS [Web-Based Injury Statistics Query and Reporting System], 2020). When a child is properly restrained in a correctly installed child restraint system (CRS), the fatality risk is reduced by 71% (National Highway Traffic Safety Administration, 2022). A CRS is defined as a rear-facing only car seat, convertible car seat (rear-facing and forward-facing), all-in-one car seat (rear-facing, forward-facing, or a belt-positioning booster seat), combination car seat (forward-facing only with a 5-point harness or belt-positioning booster), or a belt-positioning booster seat. Despite child passenger safety laws and educational efforts by certified Child Passenger Safety Technicians (CPST), critical CRS misuse continues to put child occupants at

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risk of injury and fatality. Since the early 2000s, CRS misuse continues to be a recognized public health problem (Biagioli, 2002; Graham et al., 1992; Gunnip et al., 1987; Hoffman et al., 2016; Manary et al., 2019; Ramsey et al., 2000; S. C. Rogers et al., 2012). A more recent, multistate study from community CRS checkup events found CRS misuse at 91% in rural areas and 83% in urban areas (Hafner et al., 2017). In this study, CRS "misuse" was defined as any characteristic of installation or use of a CRS that compromises its protective function and reduces the protection of the child passenger during a motor vehicle collision (Raymond, 2018). Misuse can be attributed to varying designs of CRSs and motor vehicle seat design, various methods of installation, misunderstood CRS instructions, or parent or caregiver inattention to safety (Mathieu et al., 2014; Wegner & Girasek, 2003). Further, when a parent or caregiver is not educated by a CPST, they are more likely to exhibit CRS misuse (Brown et al., 2011). However, Kuroiwa et al. (2018) found that the traditional didactic approach even with a demonstration provided by a CPST increases knowledge about CRS installation but does not provide the skill training necessary to properly install a CRS effectively. CRS education requires a hands-on, in-person approach, to best accommodate the technical and design variations of CRSs and models of motor vehicles approved for use in the United States.

Due to the intricate and detailed procedures of CRS education, traditional didactic teaching (i.e., didactic training) may not be best suited to teaching this skill. More specifically, the complexity of the steps to properly install and use a CRS correctly can be compared to a newly hired employee learning from their supervisor how to perform their role at a company. The supervisor and employee must review all the possible situations that may arise and problem-solve each situation. Based on the employee's performance they may receive multiple opportunities to model, receive feedback, and implement the changes before beginning the role independently. Similar to an employee learning a skill in the workplace, a caregiver must identify and implement all the steps correctly to decrease misuse with the assistance of their supervisor – a CPST. Behavior Skills Training (BST) can be a useful tool for teaching such complex CRS skills. BST is effective for teaching children and adults a wide range of skills, such as daily living and safety skills (Dickson & Vargo, 2017; Thomas et al., 2016). BST has been utilized across various groups, settings, and skills. More specifically, BST has been used to teach students (Barker et al., 2019), staff members (Belisle et al., 2016), and caregivers (Dogan et al., 2017). BST is a treatment package that consists of verbal instructions, modeling, rehearsal, and feedback (Miltenberger, 2016). When using BST, the educator verbally describes the skill and its purpose to the learner during the instruction component. During modeling, the educator demonstrates how the skill is to be performed and repeated. The learner performs the skill during rehearsal, while the educator provides feedback. Then, the learner repeats the skill until they have mastered the skill based on a predetermined criterion.

While BST is generally delivered in-person, recent studies have demonstrated the effectiveness of a virtual telehealth version of BST to teach skill-based learning (Boutain et al., 2020; Carnett et al., 2020; Edgemon et al., 2020; Rios et al., 2020; Sump et al., 2018). More specifically, the use of telehealth has been a necessity due to the COVID-19 pandemic. Early in 2020, the COVID-19 pandemic posed unprecedented challenges resulting in "Shelter-In-Place" orders that had the potential to further increase CRS misuse (Executive Order, 2020). While CRS education occurs within close quarters inside the parent's vehicle, this would violate orders and put parents at risk of COVID-19 transmission. At least during the first year of the pandemic in 2020, CPSTs were not available and this put expectant parents and their newborns at risk of CRS misuse. Studies estimate that 96% of parents believe that their CRS is correctly installed, but CRS misuse is over 46% (NHTSA Highlights Importance of Car Seats and Child Passenger Safety, 2020). Even during COVID-19, babies were still being born. On average, seven babies are born every 60 seconds in the United States, and most are driven home from the hospital (National Center for Health Statistics, 2022). Studies have also found that 95% of newborn babies are improperly restrained on their first ride home from the hospital (Hoffman et al., 2016). While CRS misuse was a problem before the pandemic, COVID-19 and the decreased availability of CPSTs increased the burden of injury even further. To help fill this gap, telehealth, a virtual remote method, could be used to deliver an educational intervention to help expectant parents with their CRS. Telehealth is not an intervention but rather a method to deliver an intervention effectively (Rios et al., 2020). Telehealth is well documented, applied to a variety of telecommunication platforms, and found to be equivalent to in-person sessions (Shigekawa et al., 2018). Additionally, the use and acceptance of telehealth significantly accelerated during the COVID-19 pandemic (Wijesooriya et al., 2020).

There has been evidence to support the effectiveness of BST when administered virtually with telehealth compared to in-person. Sump et al. (2018) used BST in-person and via telehealth to teach eight participants four different skills: setting up instruction, implementing antecedent strategies, conducting a preference assessment, and implementing consequences for student responses. These skills were each taught using a task analysis (TA) of approximately equal steps. During baseline, participants' responses in person and via telehealth were recorded on the number of different skills following a brief explanation, direction on material availability, and answers to questions the participant had throughout implementation. During the training condition, experimenters used BST, with the exclusion of written instructions, to train participants to implement the four different skills to mastery criteria. Post-training and maintenance probes were conducted following the implementation of BST to demonstrate the effects of using BST in-person and telehealth to teach the four different targeted skills. Results of this study demonstrated that telehealth and in-person BST were equally effective at teaching the skills within a similar number of teaching trials. Telehealth and in-person BST produced an equal number of training sessions needed; however, the duration of training was, on average, longer for sessions conducted via telehealth than in-person.

Giannakakos et al. (2018) taught participants to install a CRS using BST. This study included three participants that had little to no exposure to CRSs. A TA was used to measure the number of steps that participants completed correctly. During baseline, participants were given 15 minutes to review the instruction manual before installing the CRS with no assistance or feedback. In the belt training condition, experimenters used BST and self-monitoring to teach installation. The training condition consisted of a 15-minute review period similar to baseline, a checklist for self-monitoring, a video model, and positive and corrective feedback until all participants reached 100% of steps completed correctly. Extension probes were then conducted on front-facing and rear-facing CRSs which were conducted similar to baseline. If a participant did not complete 100% of the steps, feedback was provided, and BST and self-monitoring were introduced if 100% was not reached following feedback. Results of this study demonstrated that all participants made approximately four errors at baseline, and following the introduction of BST, participant's errors reduced to near zero levels. A limitation and area for future research addressed in this study were the need to assess maintenance of CRS skills. Additionally, this study was conducted with students as participants. It was, however, noted that future studies could include caregivers or prospective caregivers as participants.

Himle and Wright (2014) recruited 10 undergraduate students with moderate to no experience installing or using a CRS. The researchers measured participants' errors during the installation and use of a CRS for 10 specific target behaviors related to rear- and front-facing installation. During baseline, participants were provided with the manual to install and secure a test dummy in the rear-facing direction. Participants were not provided with answers to questions or feedback but were redirected to use the manual during baseline. During the BST condition, participants were provided with instructions, modeling, rehearsal, descriptive praise, and corrective feedback to install a CRS in a rear-facing position. BST continued until participants demonstrated correct responses to all steps for three consecutive sessions. Results of this study demonstrated that during baseline, participants made an average of 6.4 errors and following the introduction of BST, participants made zero errors. Limitations of this study included the use of only one CRS-vehicle combination, which did not account for the different models and slight variations in use and installation and, ultimately, generalization of the skill to other settings (i.e., vehicle and CRS variations). It was also not noted whether participants who learned to install the CRS properly could also teach others to install the CRS correctly (e.g., caregiver, spouse, family member, etc.). Finally, maintenance data were not collected. This provided an unclear indication as to whether participants would maintain the skills over a longer period.

Based on previous studies and data on CRS installation and use, it is important for expectant parents to develop the complex skills necessary to decrease CRS misuse. Providing effective CRS education that ensures appropriate implementation that can be maintained and generalized outside of the learning environment is equally important. Furthermore, given that there may be limited outlets for in-person CRS education, providing an alternative option for families who are seeking such training is equally as essential. Given the importance of appropriate CRS installation and use and need to address CRS misuse, the purpose of this study was to evaluate the effectiveness of BST in-person and via telehealth to teach parents how to install and use their CRS properly to reduce CRS misuse, improve retention, and evaluate the maintenance of installation and use, after a 9-month follow-up.

This study addresses operational issues, specifically providing an educational approach for CPSTs that can enhance the quality of educational services they provide to parents and caregivers to reduce CRS misuse. The National Highway Traffic Safety Administration (NHTSA) has designated Safe Kids Worldwide as the certifying organization responsible for managing the National Child Passenger Safety Certification Training program. In part, the nationally standardized child passenger safety curriculum provides certification training to CPSTs on how to teach parents and caregivers on the correct installation and use of CRSs, vehicle seat belts, Lower Anchors and Tethers for Children (LATCH), and occupant safety. CPSTs also maintain certification renewal every 2 years. CPSTs that provide service to parents and caregivers can be self-employed, volunteers, or employed by a public agency, hospital, company, or nonprofit organization. CPSTs educate parents and caregivers at NHTSA certified car seat inspection stations nationwide or at community car seat checkup events. The objective of a CPST is to educate parents and caregivers, by providing instructions and demonstrating how to install their CRS. This is followed by having the parent install the CRS while the CPST corrects any errors. Applying a BST treatment package to deliver CRS education can improve the quality of service and organizational performance to reduce CRS misuse.

The purpose of this study was to assess the long-term efficacy of CRS educational methods to effectively reduce CRS misuse. We attempted to measure the efficacy of BST as a method for CPSTs to effectively deliver traditional CRS education to reduce CRS misuse. We compared BST in-person and BST Telehealth to a non-BST in-person method of CRS education that is traditionally delivered by CPSTs.[1]

General method

We used a longitudinal quasi-experimental within-subjects group design. It consisted of two experiments that recruited 2,448 participants between June 1, 2015 and December 31, 2021 (Table 1). Participant pairs were recruited among those who had called into a NHTSA car seat inspection station, community library, or hospital, to have a CPST independently assist them with their CRS. Eligibility included 1) women in at least their 7th-month gestation and their partner (this also included adoptive parents, foster parents, grandparents, and other non-traditional caregivers) or women who had recently delivered, with a newborn no more than 3 months of age and her partner; 2) at the time of session had their child restraint system(s) and vehicle(s) available; and 3) consented to follow-up evaluation. All participants were individually scored with a 37-step TA to assess for CRS misuse during baseline, intervention/no intervention, and follow-up evaluation at 9 months (Table 2). Following intervention/no intervention, participant pairs were also provided additional child safety resources for expectant parents, a video review of securing their newborn, and their CPST contact information.

There are similarities between how a CPST delivers CRS education to a parent or caregiver and how it is delivered by a BST-trained CPST, with the BST treatment package. CPSTs deliver the education with a didactic instructional approach where the CPST provides instruction and demonstrates how to install the CRS. This is followed by the parent installing their CRS, while the CPST helps correct any errors. With this approach, it is assumed by observing the parent or caregiver trying to install the CRS and restrain their child with help by the CPST that the parent or caregiver understands how to use their CRS properly. With this traditional didactic approach, the CPST is not providing sufficient opportunities for rehearsal and role-play. Furthermore, it does not provide ample opportunities for feedback. The BST treatment package, however, has an advantage over the traditional didactic approach. The difference when using BST begins with teaching a mixture of knowledge and skills broken down into smaller steps by using a TA. Then, the BST-trained CPST provides instruction and modeling for each step. The parent or caregiver then rehearses each step while the CPST provides feedback until the knowledge and skill for each step are mastered.

Procedures

The CPST provided all four components of BST (instructions, modeling, rehearsal, and feedback) to teach the participant each step of the 37-step TA. Within the 37-step TA, a mixture of knowledge about the CRS and skill of installing the CRS was presented to the participant. For each of the four components of BST, every participant repeated installing their CRS and

Table 1. Behavioral Skills Training Child Passenger Safety Study Overview

			Data Scoring[f] (37-Step Task Analysis)				
	Learning Environment & Recruitment[a]	Comparison & Intervention Groups	Baseline	Intervention/ No Intervention	Follow-up	Study Dates	Number of Participants
Experiment-1 (n = 1,224)	Class/checkup event[b]	Non-BST In-person[d] (Controls)	Yes	Yes	Yes	June 1, 2015- May 30, 2016	612
	NHTSA Fitting Station[c]	BST In-person[e] (Cases)	Yes	Yes	Yes	June 1, 2016-May 30, 2017	612
Experiment-2 (n = 1,224)	NHTSA Fitting Station[c]	BST In-person[e] (Controls)	Yes	Yes	Yes	June 1, 2018-June 30, 2019	612
	NHTSA Telehealth[c]	BST Telehealth[e] (Cases)	Yes	Yes	Yes	April 1, 2020-December 31, 2021	612

[a]Recruitment was obtained throughout the study dates from parents and caregivers who called into a NHTSA Fitting Station throughout Los Angeles, Ventura, Orange, San Bernardino, and Riverside counties, or who requested assistance from community libraries or hospitals. Eligibility criteria included: 1) women in at least her 7th-month gestation and their partner (this also included adoptive parents, foster parents, grandparents, and other non-traditional caregivers) or women who had recently delivered, with a newborn no more than 3 months of age with their partner; 2) at the time of session had their child restraint system(s) and vehicle(s) available; and 3) consented to follow-up evaluation.

[b]Check-up event was part of a child passenger safety class advertised and hosted at community library parent-child workshops throughout Los Angeles and San Bernardino counties by appointment only.

[c]Fitting Station are National Highway Traffic Safety Administration (NHTSA) designated locations by zip code. These also can include services from these locations that also provide one-on-one home or hospital visits.

[d]CRS education provided by a certified Child Passenger Safety Technician (CPST) according to standards of the National Child Passenger Safety Certification.

[e]Behavioral Skills Training (BST) package used to deliver traditional method of child passenger safety education provided by a CPST according to standards of the National Child Passenger Safety Certification.

[f]Data is scored by using the 37-step task analysis for each participant during baseline, intervention, and follow-up evaluation.

Table 2. Target Behaviors and Task Analysis for Stages 1 and 2: Installing Child Restraint System (CRS) in the Vehicle and Securing Training Doll/Child in CRS

Stage I: Inside Motor Vehicle (14 steps)			Stage II: Inside Child Restraint System (23 steps)		
Occupant Protection Task (4 steps): Demonstrate occupant protection restrains systems	*Child Restraint System Task (5 steps):* Describe methods of installing CRS	*Install & Test Task (5 steps):* Install and test CRS	*Occupant Protection Task (5 steps):* Demonstrate basic CRS restraint functions	*Training Doll/Child Task (13 steps):* Secure training doll/child in CRS	*Duration of Use Task (5 steps):* Identify duration and use of CRS
1) Identify safest location for CRS 2) Identify the LATCH system in the vehicle 3) Identify and demonstrate seat belt locking mechanism 4) Identify air bag locations	1) Identify car seat LATCH system, lower anchors, and top tether 2) Identify belt path location for seat belt or LATCH 3) Identify how to level at 30- to 45-degree angle 4) Identify rear-facing and forward-facing recommendations 5) Identify if center buckle is adjustable	1) Identify the safest location in the vehicle 2) Level the CRS according instructions of CRS 3) Install CRS or base using appropriate LATCH or Seat belt 4) Test the CRS side-to-side at belt path & back to front less than 1-inch. If rear-facing: a) angle 45-degree, b) distance between back of CRS and back of front vehicle seat for rear-facing, c) other CRS specific manufacturer requirements 5) If infant CRS with base, install CRS without base, if permitted according to manufacturer instructions. Then test, similarly according to rear-facing testing methods	1) Identify how to adjust harness straps to fit properly 2) Identify how to adjust center buckle to fit child 3) Identify where the chest clip is to be located 4) Identify how long the newborn insert is to be used 5) Identify specific CRS manufacturer details	1) Demonstrate putting training doll/ child in CRS 2) Demonstrate adjusting harness straps at or below shoulders (rear-facing) or (at or above shoulders for forward-facing) 3) Demonstrate buckling center buckle 4) Demonstrate buckling chest clip 5) Tighten harness straps by pulling upward 6) Demonstrate sliding chest clip, pulling slack from the top 7) Demonstrate pulling center strap to tighten harness straps 8) Demonstrate pinch test on legs and shoulders (thumb and index finger pinch without pulling away from child) 9) Demonstrate chest clip to be level with child's arm pits 10) Repeat of the pinch test on legs and shoulders 11) Describe harness strap adjustment as the child grows 12) Demonstrate adjustment if child's chin is touching chest 13) Demonstrate when to use the newborn insert	1) Identify height limitation from label on CRS 2) Identify weight limitation from label on CRS 3) Identify when the child will outgrow the CRS 4) Identify how to register the CRS for recalls 5) Identify expiration of CRS

securing a doll or stuffed animal, until they mastered each knowledge and skill at 100%.[2] Once 100% correct, the participant repeated installing the CRS and securing the training doll at least three times correctly, to ensure mastery and not by chance. To control for order effects, counterbalancing modified the order of behavior sequences by randomizing CRS task objectives. Once the participant mastered installing their CRS and securing their training doll at 100% correct, these were repeated three times to improve competent performance. To reduce practice and repetition effects (where a participant could perform better on their second try or experience fatigue), once the participant was at 100% correct with their CRS, the educator began another task objective with the same BST process. Once at 100%, the participant would return to the previous task objective and repeat to master their skills again at 100%. Each participant completed Stage 1 (installing CRS in vehicle) while the other participant observed. During Stage 2 (restraining training doll/stuffed animal in CRS), to assess for observational effects, the partners would switch who went first during Stage 1.

Dependent variables and operational definitions

The dependent variable was the number of correct skills learned by each participant for installing the CRS in the vehicle and restraining the training doll in the CRS. The 37-step TA was designed specifically for this study. First, steps, processes, order of presentation, and educational terminology were assessed for understanding using focus group[3] testing and Cognitive Interviewing (CI).[4] Study subjects for focus groups and the CI were of similar demographics but were not participants in this study. The TA was designed for, and tested by, CPSTs who have the training to teach parents the principles of child passenger safety. The purpose of the TA was to provide 1) a framework for delivering child passenger safety education by a CPST; 2) an educational delivery platform that would accommodate the various types of CRS and motor vehicles and their varying methods of installation and use; 3) a method to collect data, while ensuring completion of steps; and 4) a mechanism for optimizing the 37-step TA learning concepts by breaking down the skill or knowledge into smaller steps and creating more opportunity for fluency of the CRS educational experience. The TA was divided into two stages. Stage 1 included installing the CRS in the vehicle, and Stage 2 included restraining the child or training doll in the CRS. As shown in Table 2, the TA includes 6 behavioral sequences of CRS education, including 3 in the motor vehicle (Stage 1) that included 14-steps (occupant protection systems-4 steps, CRS set up-5 steps, and CRS installation and testing-5 steps) and 3 in the CRS (Stage 2) that included 23-steps (CRS functions-5 steps, securing of training doll-13 steps, and newborn use of CRS-5 steps). Individual tasks were based on common misuse errors identified by NHTSA. Tasks also included CRS instructions, motor vehicle manufacturer's recommendations, and best practices by CPSTs. Individual participant performance for each task was measured and recorded by the CPST. The CPST recorded the number of correct and incorrect steps, and number of attempts for each participant. Performance definitions were used for scoring purposes for baseline, intervention/no-intervention, and follow-up. Each session lasted between 1.5 and 2 hours.

Data collection

For baseline, intervention, and follow-up, the CPST educator assessed misuse by scoring data with the 37-step TA. For each correct task, one was recorded, and for an incorrect step, zero was recorded. This process was repeated for each step of the 14-step TA for the CRS installation and for the 23-step TA with the training doll in the CRS. Secondary data were also collected on all sessions by two independent off-site observers and one camera/phone controller who collected secondary data on all sessions. Observers and the camera/phone controller were CPSTs and trained with mock sessions to practice data collection. Before each session, the observers had an Interobserver agreement (IOA) form emailed to them to print out. The IOA form included intervals designating each of the 37-steps. Each IOA observer viewed the educational session separately with WhatsApp.[5] The camera/phone controller held their smartphone to view each of the 37-steps. They were also pre-tested and trained on how to view participants, without distracting from the teaching session. The camera/phone controller also had a headset, to talk to the IOA observers if needed. This was necessary in the case there was a need to adjust the camera angle, so both observers could interact with each other and the camera/phone controller without any interference between observers. Trial-by-trial IOA was calculated by taking the number of trials with agreements divided by the number of trials with agreements plus disagreements and then multiplying by 100.

Experiment 1

Method

Participants

A total of 1,224 participants (618 females and 606 males, M_{age} = 30.5 years, age range: 18–43 years) participated in the current experiment. Among all participants 75% reported speaking English-only in the home, followed by 13% with some Spanish, 10% Chinese, and 2% other. Six participants required a self-designated translator, four Spanish and two Korean. Seventy-three percent of participants had some college education, followed by 18% with completed graduate education and 9% with high school education. Among these participants, 92% (1,126) were experiencing their first pregnancy, 99% reported having no experience with using a CRS, and 1% had rarely used a CRS. The remaining 8% (98) of expecting participants reported having one or more children. Among these, 64% were rear-facing only CRSs and 36% were forward-facing convertible CRSs. Only one CRS was scored per participant. Additional CRSs were included in the study for ethical purposes but not scored.

Non-BST in-person training group. A total of 612 participant pairs were recruited between June 1, 2015 through May 30, 2016, from 41 CPS checkup events held at community libraries throughout Los Angeles and San Bernardino counties. Each participant pair was educated by a non-BST trained CPST. A non-BST trained CPST teaches according to the standards set forth in the National Child Passenger Safety Certification curricula without any knowledge or previous training in BST.

BST in-person training group. This group was comprised of 612 participant pairs that were recruited between June 1, 2016 through May 30, 2017. Participant pairs were recruited from National Highway Traffic Safety Administration (NHTSA) car seat inspection stations in Los Angeles, Ventura, Orange, San Bernardino, and Riverside counties in California. Each participant pair received CRS education delivered by a CPST with in-person BST.

Materials and setting

Training included one-on-one educational sessions with the participant pairs and the CPST. Sessions were conducted at the participants' home, or in a few cases at the hospital after the baby was delivered and prior to being discharged. Participant pairs were asked to have their CRS and motor vehicle available, and vehicle parked on a flat surface in a safe location to open both driver and passenger doors, during the session. The CPST that provided training had an infant and convertible CRS with a training doll (for demonstration purposes), a Samsung™ smartphone, and a Samsung Galaxy™ tablet with the participant's specific CRS instructions available. Additional research staff included one CPST on-site to operate the smartphone camera and two additional CPSTs observing virtually with their laptops and/or smart phone from their home. All sessions were scored with the 37-step TA by the lead CPST.

Design

The experiment was conducted using a pretest-posttest design across two groups to assess the efficacy of BST In-person compared to a Non-BST In-person method of CRS education delivered by a CPST. Each participant in both groups was individually assessed for misuse. For baseline, intervention, and follow-up, the CPST assessed misuse by scoring data with the 37-step TA. For each correct step, one was recorded and for an incorrect step zero was recorded. This process was repeated for each step of the 14-step TA for the CRS and for the 23-step TA with the training doll.

Procedure

During recruitment, participant pairs were asked to have read the manufacturer's instructions of their CRS and CRS recommendations from their motor vehicle, prior to their scheduled session. Participants were provided with an electronic informed consent, a demographic form, and a brief questionnaire regarding their history of CRS use. An appointment reminder was sent via text message to the participant within 1 hour of their scheduled appointment to confirm the time and location of the session. Because each session included two participants (expectant woman/mother and partner), both were randomly assigned to baseline tiers of different lengths and assessed independently but contemporaneously. Each participant completed Stage 1 (installing CRS in vehicle) while the other participant observed. During Stage 2 (restraining training doll/stuffed animal in CRS), to assess for observational effects, the partners switched who went first during Stage 1. Each participant installed their CRS and training doll or stuffed animal while being observed by the CPST.

Baseline. When the participants arrived, they were asked to install the CRS in their motor vehicle, demonstrate testing, and secure the training doll or stuffed animal in the CRS harness straps while being observed and scored by the CPST.

Intervention. For the comparison group participants, a CPST with no prior BST training provided traditional non-BST CRS education in-person to the participant, using the standard method of teaching according to the nationally standardized child passenger safety curriculum. The intervention group participants received similar nationally standardized CRS education but delivered by a BST-trained CPST with BST in-person. CPSTs for this experiment were trained and evaluated to apply BST to CRS education. The CPST provided training by using all four components of BST (instructions, modeling, rehearsal, and feedback) to teach each participant every step of the entire 37-step TA. Each participant was required to demonstrate all steps in the TA three times with 100% accuracy. This was to ensure they had mastered the skill and knowledge steps and were not performing by chance. To control for order effects, counterbalancing modified the order of behavior sequences by randomizing CRS task objectives. Once a participant mastered installing their CRS and securing their training doll at 100% correct, these were repeated three times to improve competent performance. To reduce practice and repetition effects (where a participant could perform better on their second try or experience fatigue), once the participant was at 100% correct with the CRS, the educator began another target behavior with the same BST process. Once at 100%, the participant would return to the previous task objective and repeat in order to master their skills again at 100%. Each participant completed Stage 1 (installing CRS in vehicle) while the other participant observed. During Stage 2 (securing training doll/stuffed animal in CRS), to assess for observational effects, the partners switched who went first during Stage 1. Each participant installed their CRS and training doll while being observed by the CPST.

Follow-up. The same CPST who performed the initial baseline and intervention with each participant pair also conducted an in-person follow-up evaluation at 9 months. The CPST first assessed and recorded the status of the CRS installation and use by using the same 37-step TA for data scoring used at baseline and BST intervention. The CPST asked each participant, one at a time, to test, remove and reinstall their CRS without instruction from the CPST. The CPST then observed each participant secures their newborn baby into their CRS. Appointments were scheduled based on the most convenient time for the participant pairs and their child.

Results

Figure 1 shows the results from Stage 1 of the training for the BST In-person and Non-BST In-person groups. For each of the stages, data collected during baseline included the participant implementing all 37 steps of the TA. Stage 1 consisted of knowledge of occupant protection and installation of CRS in the vehicle. The results from baseline were 1.72% of correct steps for the BST in-person group and 44.5% of correct steps for the Non-BST in-person group. After the intervention was delivered, data for the knowledge of occupant protection resulted in 100% correct steps for the BST in-person group and 93.4% for the Non-BST in-person group. Following the Child Restraint System Installation for Knowledge of Occupant Protection phase, data were collected on the first trial of correct CRS installation in each step. Data resulted in 100% correct steps for the BST In-person group and 36% correct for the Non-BST in-person group. Results demonstrate that participants in the BST in-person group acquired the targeted skill more effectively compared to the Non-BST in-person group. After a 9-month follow-up, knowledge of occupant protection and CRS installation was maintained at 100% correct steps for the BST in-person group, whereas, for the Non-BST in-person group, knowledge of occupant protection resulted in 56.5% correct steps and 31.2% correct steps for CSR installation (Figure 2).

Figure 3 shows the results from Stage 2 of the training for the BST in-person and Non-BST in-person groups. Stage 2 consisted of properly restraining a training doll or child according to CRS. Baseline data resulted in 30% correct steps for the BST in-person group and 38.8% correct steps

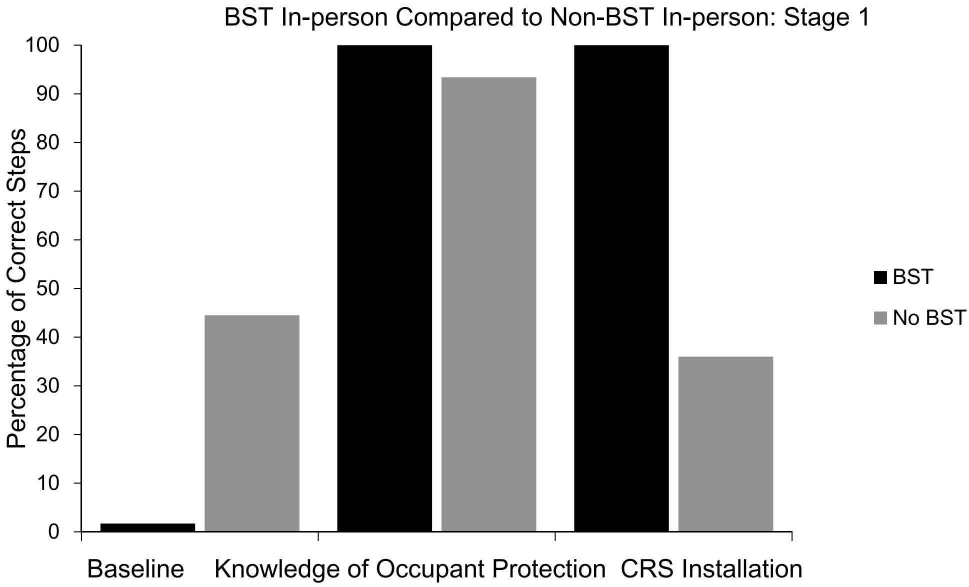

Figure 1. Correct steps comparing behavioral skills training In-person and non-behavioral skills training in-person groups for stage 1 – child restraint installation for baseline, knowledge of occupant protection, and child restraint system installation.

for the Non-BST in-person group. Following the intervention demonstration of properly restraining the training doll according to CRS resulted in 100% for the BST in-person group and 52.6% for correct steps for the Non-BST in-person group. After a 9-month follow-up, performance in the BST In-person group maintained at 100%, whereas performance in the Non-BST in-person group reduced to 33.8%.

Statistical analysis

Based on these results, learning the CRS skill was not dependent on whether it was taught in-person vs. telehealth. Data from baseline and intervention across both groups show the skill was acquired with BST. The single-factor ANOVA for Stage 1 shows no significant difference between BST in-person (mean = 91.17), and Telehealth and Non-BST in-person (mean = 70.77) during Stage 1 given that the p-value (0.36) is larger than 0.05. Performance across both groups in the initial Stage 1 showed minimal differences (Table 3). The single-factor ANOVA analysis for follow-up data for Stage 1 shows that there is a significant difference between BST in-person (mean = 99.9) and Non-BST in-person (mean = 33.2) since the p-value (0.0067) is smaller than 0.05. Performance in the BST in-person and BST Telehealth group performed significantly better during follow-up than the Non-BST in-person group (Table 4).

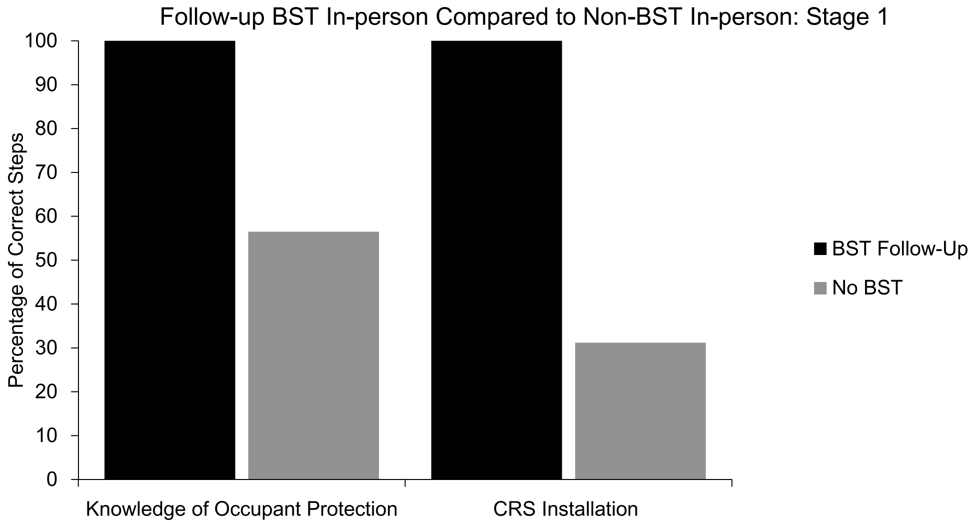

Figure 2. Correct steps during follow-up comparing behavioral skills training in-person and non-behavioral skills training in-person groups for stage 1 – child restraint system installation for knowledge of occupant protection and child restraint system installation.

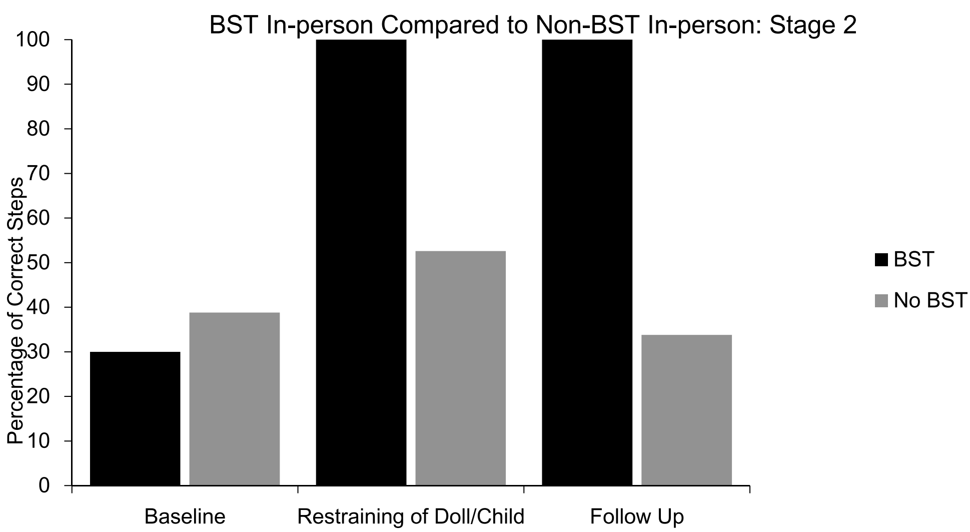

Figure 3. Correct steps during follow-up comparing behavioral skills training in-person and non-behavioral skills training in-person groups for stage 2 – restraining doll/child in child restraint system for baseline, restraining doll/child, and follow-up.

Discussion

This experiment was designed to compare Non-BST in-person to BST In-person to measure long-term effectiveness to reduce CRS misuse. Baseline performance for CRS installation resulted in a large difference between the BST in-person and Non-BST in-person groups, despite 100% IOA

Table 3. Single-Factor ANOVA for Behavioral Skills Training In-Person and Behavioral Skills Training Telehealth Compared to In-Person with No Behavioral Skills Training for Stage 1 (i.e., Knowledge of Child Restraint System and Child Restraint System Installation in Vehicle)

Groups	Count	Sum	Average	Variance		
SUMMARY						
Column 1	3	273.50	91.17	234.08		
Column 2	3	212.30	70.77	934.10		
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
ANOVA						
Between Groups	624.24	1	624.24	1.07	0.36	7.71
Within Groups	2336.37	4	584.09			
Total	2960.61	5				

Table 4. Single-Factor ANOVA for Behavioral Skills Training In-Person and Behavioral Skills Training Telehealth Compared to In-Person with No Behavioral Skills Training for Stage 1 Follow-Up (i.e., Knowledge of Child Restraint System and Child Restraint System Installation)

Groups	Count	Sum	Average	Variance		
SUMMARY						
Column 1	3	299.70	99.90	0.03		
Column 2	3	99.60	33.20	500.29		
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
ANOVA						
Between Groups	6673.34	1	6673.335	26.68	0.07	7.71
Within Groups	1000.64	4	250.16			
Total	7673.98	5				

agreement and randomization. While the Non-BST in-person group had a higher performance at baseline, this performance was not maintained as observed during follow-up. Among the Non-BST in-person group participants, while it was observed they obtained critical skills during their session, these skills were not maintained over time, resulting in CRS misuse of 66.2% for CRS installation and securing of the child. This is consistent with the range of CRS misuse in the United States, which is between 49% and 95% (Manary et al., 2019). While a participant could install and secure a training doll in their CRS with the assistance of a CPST during a session, when on their own and over time, these skills were not maintained as observed in the follow-up evaluation. Among case participants who received standardized child passenger safety education delivered with BST, long-term effectiveness was maintained, resulting in zero misuse for each participant maintaining correct CRS installation and restraining of their child. These findings suggest that the components of BST provide participants with the necessary hands-on critical complex skills to reduce misuse (Tessier, 2010). While findings resulted in 100% correct use observed during follow-up evaluation, research by Roane et al. (2015) has also demonstrated the ability of BST to maintain 100% long-term effectiveness. The results of applying BST to child passenger safety education are also consistent with earlier research. Our findings extend the understanding and confirm the long-term effectiveness of BST to CRS education. They provide evidence that BST can improve CRS education among a variety of CRS and vehicle manufacturer at child passenger safety checkup events and NHTSA car seat fitting stations (Giannakakos et al., 2018; Himle & Wright, 2014).

Experiment 2

Method

Participants

The second experiment included a separate group of 1,224 participants (614 females and 610 males, $M_{age} = 31$ years, age range: 23–43 years). Among all participants, 83% spoke English only at home, followed by 9% with some Spanish, 7% Chinese, and 1% other. Two participants used a self-designated translator, one Spanish and one Taiwanese. Seventy-two percent of participants had some college education, followed by 18% who completed graduate education and 9% who completed high school. Among participants, 89% (1,089) were experiencing their first pregnancy, and 99% reported having no experience using a CRS; 1% had rarely used a CRS. The remaining 11% (135) of expecting participants reported having one or more older children. Among these 135 who reported having older children, 52% were rear-facing convertible CRSs, and 48% were forward-facing CRSs. Similar to Experiment 1, only one primary CRS was scored per participant. Additional CRSs were included in the study for ethical purposes but were not scored. Participants were recruited from National Highway Traffic Safety Administration (NHTSA) car seat inspection stations in Los Angeles, Ventura, Orange, San Bernardino, Riverside, and San Diego counties in California.

BST in-person group. This group included 612 participant pairs recruited between June 1, 2018 and June 30, 2019. Each participant received traditional CRS education delivered by a CPST with in-person BST.

BST telehealth group. A total of 612 participant pairs were recruited between April 1, 2020, through December 31, 2021. Each participant received CRS education delivered by a CPST, with a virtual telehealth version of BST.

Materials and setting

Similar to Experiment 1, training consisted of one-on-one sessions with the participant pairs and the CPST, with sessions at the participants' home, or in a few cases at the hospital due to early child delivery. Participant pairs were also asked to have their CRS and motor vehicle available, and their vehicle parked on a flat surface in a safe location to have both driver and passenger side doors open for access. For the comparison group, the CPST had an infant CRS with a training doll for demonstration and testing purposes. All sessions were scored with the 37-step TA by the CPST. A second CPST had a smartphone to record the session for scoring and evaluation purposes. For the intervention group, participants were asked to have WhatsApp (a multiplatform communication application) downloaded on their device, their CRS, motor vehicle, and a doll or stuffed animal. During recruitment, participants were first interviewed about their experience with WhatsApp and were aided before the training session if needed. The researchers also inquired about internet service outside the participant's home. If internet service was poor due to living in canyon or rural areas, participants were asked to drive to a safe and quiet location near their home that had improved service, such as a nearby park or shopping center.

Secondly, participants were asked to have a doll or stuffed animal that was the size of a newborn baby. However, because newborn babies vary in size, having various sizes helped to educate the participant on how to adjust the CRS to fit the doll or stuffed animal. The training staff included one CPST to deliver training, and three additional CPSTs where one operated the smart phone camera, while the additional two CPSTs observed virtually to provide scoring with their laptops from their home. For the CPST trainer at their home, materials included an infant and convertible CRS, a Toshiba™ laptop, Samsung™ smartphone, a Samsung Galaxy™ 10.5-inch tablet with tripod mount, and LED ring studio light.

Design

We used a pretest-posttest design across the two groups; however, this experiment assessed the efficacy of a virtual telehealth version of BST compared to in-person BST to assess for CRS misuse. Each participant in both groups was individually assessed for misuse. Data collection was also conducted in the same format as in Experiment 1.

Procedure

During recruitment, participants were asked to read their CRS manufacturer's instructions and CRS recommendations from their motor vehicle prior to their scheduled session. They were provided with an electronic informed consent, a demographic form, and a brief questionnaire regarding history of

CRS use. Within 1 hour of each participant's scheduled appointment, a reminder was sent via text message. All sessions were performed at the participant's home or other previously approved designated address. Similar to Experiment 1, because each session included two participants (an expectant woman and her partner), both were randomly assigned to baseline tiers of different lengths and assessed independently but contemporaneously.

To control for order effects, counterbalancing modified the order of behavior sequences by randomizing CRS task objectives. Once the participant mastered installing their CRS and securing their training doll at 100% correct, these were repeated three times to improve competent performance. To reduce practice effects (e.g., repeating the same response after feedback), once the participant was at 100% correct with the CRS, the educator began another task objective with the same BST process. Once at 100%, the participant returned to the previous task objective and mastered their skills again at 100%. Each participant completed Stage 1 (installing CRS in vehicle) while the other participant observed. During Stage 2 (restraining training doll or stuffed animal in CRS), to assess for observational effects, the partners switched who went first during Stage 1. Each participant installed their CRS and training doll or stuffed animal while being observed by the CPST.

Baseline. Each participant was asked to install the CRS in their motor vehicle, demonstrate testing, and secure the training doll in the CRS harness straps while being observed and scored by the CPST. For the intervention group, because the session was virtual, participants began their session with the CPST calling the participants with WhatsApp. Once the video call was established, the CPST asked that one participant holds their camera on one side of the vehicle, while the other partner being trained was on the opposite side. The CPST began assessing their CRS installation and use by scoring each of the 37-step TA.

Intervention. Once the participant demonstrated each of the steps from the TA, each comparison group participant was provided with CRS education by a CPST with in-person BST, using all four components of BST to complete each skill and knowledge section of the 37-step TA. CPSTs for this experiment were also trained and evaluated to incorporate BST into CRS education. Intervention group participants received CRS education with a virtual telehealth version of BST via WhatsApp. This is a similar process to the in-person BST, with the exception that it was virtual. The CPST used very clear verbal and visual cues for each individual step of the 37-step TA while demonstrating, ensuring that the participant understood so the participant could move onto the next BST component and rehearse until correct.

Follow-up. Follow-up was conducted after 9 months from completion of Intervention. Follow-up data were similar to those in Experiment 1; except for the intervention group (BST Telehealth) in Experiment 2, follow-up was conducted virtually with WhatsApp.

Results

Figure 4 shows the results from Stage 1 of the training for the BST Telehealth group. Stage 1 consisted of knowledge of occupant protection and CRS installation. In baseline, participants demonstrated 25% of correct steps for knowledge of occupant protection and 0.01% for CRS installation. Following intervention, the knowledge of occupant protection and CRS installation resulted in 100% correct steps and maintained at 100% after a 9-month follow-up. Figure 5 shows the results from Stage 2 of the training for the BST Telehealth group. Stage 2 consisted of knowledge of CRS and properly restraining a training doll according to CRS. Baseline results demonstrated 1% of correct steps for knowledge of CRS and 23% for properly restraining a training doll according to CRS. Data for the knowledge of occupant protection and CRS installation both resulted in 100% correct steps and were maintained at 100% after a 9-month follow-up.

Figures 4 and 6 show the results from Stage 1 of the training for the BST in-person and BST Telehealth groups. Stage 1 consisted of two areas: knowledge

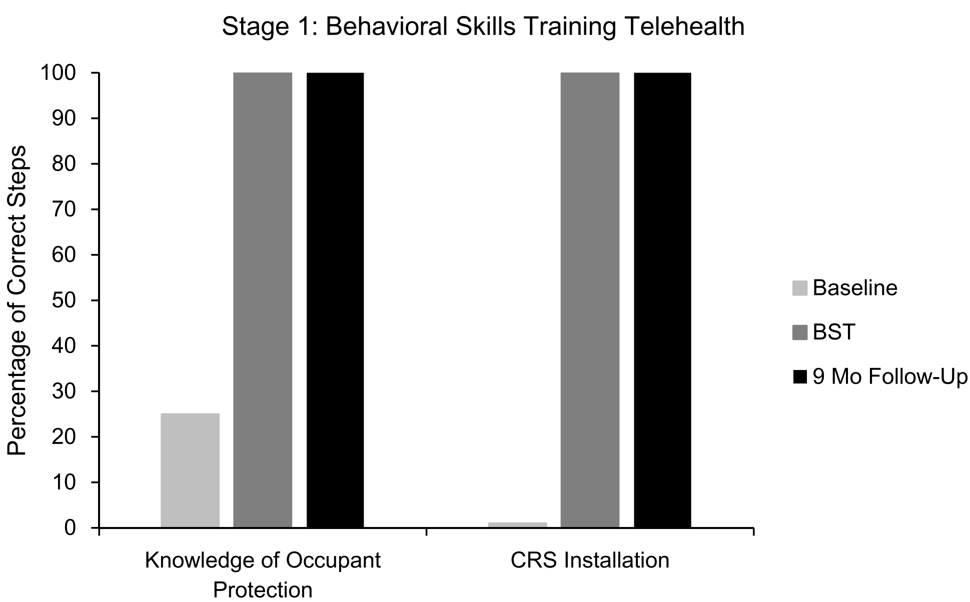

Figure 4. Correct steps for behavioral skills training telehealth group during baseline, intervention, follow-up for stage 1- child restraint system installation for knowledge of occupant protection and child restraint system installation.

of occupant protection and installation of the CRS in the vehicle. Cumulative percentages were collected for each area of Stage 1 given the different number of steps to complete per area. Data were collected across baseline, intervention of training the components of the 37-step TA, and follow-up data for this stage. Baseline showed similar results for in-person and telehealth at 27.5% and 25% of correct steps, respectively. Following intervention, both BST in-person and BST Telehealth group performance across knowledge of occupant protection and CRS installation resulted in 100% and were maintained at 100% after a 9-month follow-up.

Figures 5 and 7 show the results from Stage 2 of the training for the BST in-person and BST Telehealth groups. Stage 2 consisted of two areas: knowledge of CRS and properly restraining a training doll according to CRS. Baseline showed participants performed at 1.75% correct steps for BST In-person and 24.5% correct steps for BST Telehealth. After intervention, performance across both modalities increased to 100% and maintained at 100% after a 9-month follow-up.

Statistical analysis

The single-factor ANOVA analysis of the Stage 2 data shows that there is a significant difference between BST in-person (mean = 99.67) and Non-BST in-person (mean = 52.23) since the p-value (0.0081) is smaller than 0.05. The BST in-person and BST Telehealth group performance was significantly better during Stage 2 than the Non-BST in-person group (Table 5). The single-factor ANOVA analysis of the follow-up data for

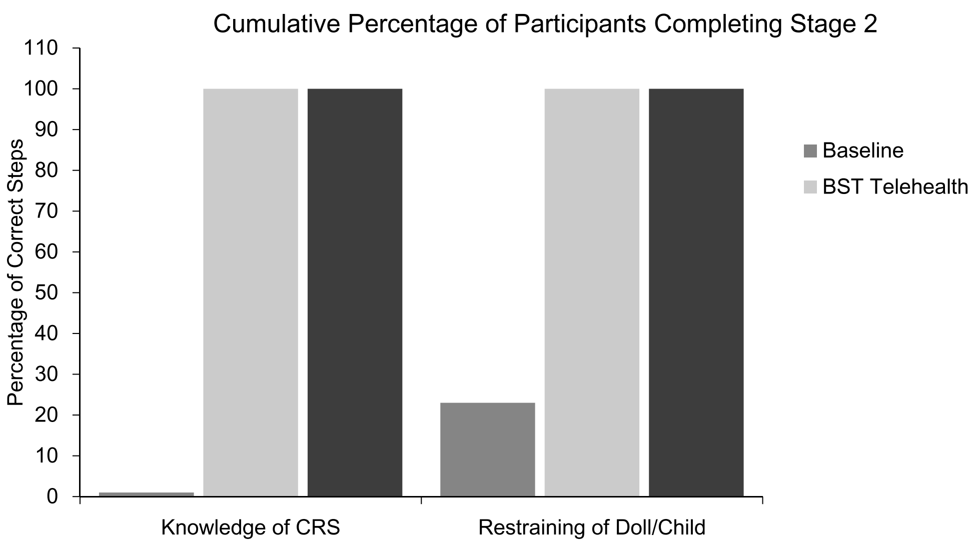

Figure 5. Correct steps for behavioral skills training telehealth group during baseline, intervention, follow-up for stage 2 – securing child in child restraint system for knowledge of child restraint system and restraining doll/child.

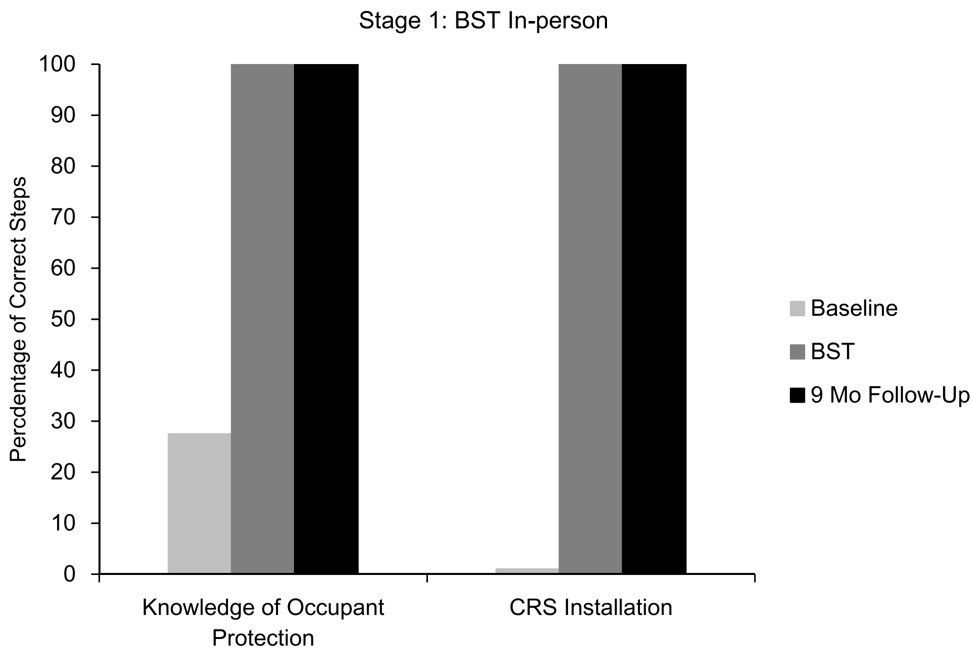

Figure 6. Correct steps for behavioral skills training group in-person during baseline, intervention, follow-up for stage 1- child restraint system installation for knowledge of occupant protection and child restraint system installation.

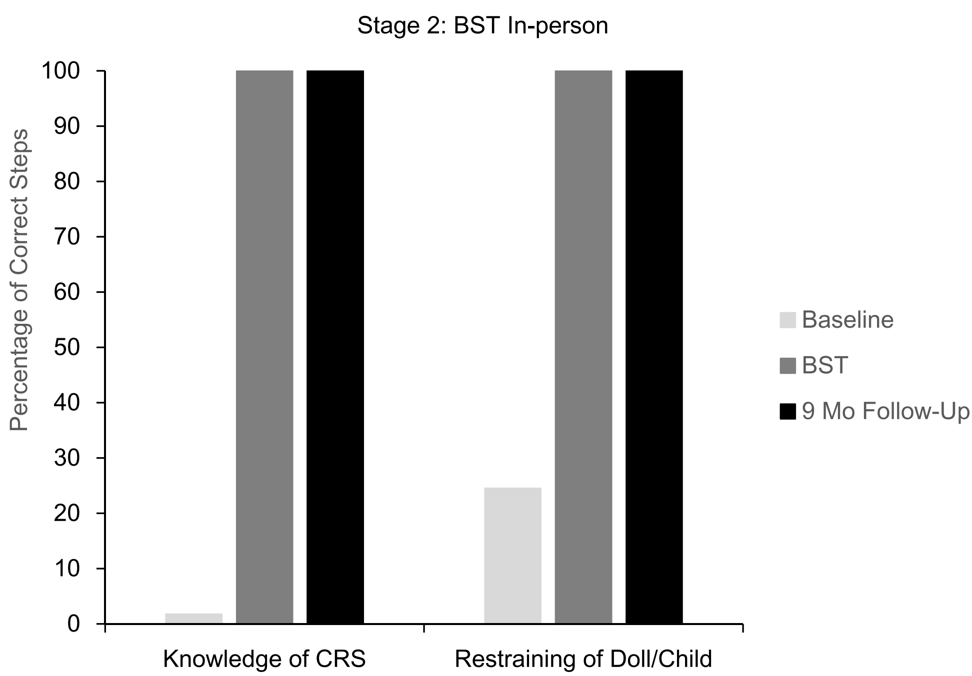

Figure 7. Correct steps for behavioral skills training in-person group during baseline, intervention, follow-up for stage 2 – restraining doll/child in child restraint system for knowledge of child restraint system and restraining of doll/child.

Table 5. Single-Factor ANOVA for Behavioral Skills Training In-Person and Behavioral Skills Training Telehealth Compared to In-Person with No Behavioral Skills Training for Stage 2 (i.e., Knowledge of Child Restraint System and Demonstration Restraining Training Doll/Child)

Groups	Count	Sum	Average	Variance		
SUMMARY						
Column 1	3	299.00	99.67	0.33		
Column 2	3	156.70	52.23			
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
ANOVA						
Between Groups	3374.89	1	3374.88	23.85	0.01	7.71
Within Groups	565.95	4	141.43			
Total	3940.84	5				

Stage 2 shows that there is a significant difference between BST in-person (mean = 100) and Non-BST in-person (mean = 37) since the p-value (0.00062) is smaller than 0.05. Performance in the BST in-person and BST Telehealth group was significantly better during Stage 2 follow-up than the Non-BST in-person group (Table 6).

Discussion

The purpose of this experiment was to compare BST in-person to BST Telehealth groups to assess long-term effectiveness of CRS training. Control group participants were a second group, who had similar characteristics and demographics to the BST in-person group in Experiment 1. Results showed long-term effectiveness, resulting in zero misuse during follow-up for maintaining CRS installation and restraining of children. Among case participants who received education with BST virtually with telehealth, results were similar to in-person BST (Schwebel et al., 2019; Sump et al., 2018). These findings reflect similar outcomes, before and during the COVID-19 pandemic, suggesting

Table 6. Single-Factor ANOVA for Behavioral Skills Training In-Person and Behavioral Skills Training Telehealth Compared to In-Person with No Behavioral Skills Training for Stage 2 Follow-Up (i.e., Demonstrating Restraining Doll/Child and Use of Child Restraint System Duration)

Groups	Count	Sum	Average	Variance		
SUMMARY						
Column 1	3	300	100	0		
Column 2	3	111.02	37.01	124.94		
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
ANOVA						
Between Groups	5952.24	1	5952.24	95.28	0.00	7.71
Within Groups	249.88	4	62.47			
Total	6202.11	5				

telehealth is an effective method of BST delivery with long-term effectiveness (Rios et al., 2020). Interestingly, during both telehealth BST and telehealth follow-up, we observed that the virtual approach with BST placed the responsibility on the participant, whereas, when the CPST is available in-person, the participant can request hands-on support from the CPST to assist with complex skills, such as adjusting harness straps or installing the CRS with a vehicle seat belt. When virtual, the participant is forced to complete the task without hands-on support. This is important as the participant is the one who will be 100% responsible for their child passenger. These results are consistent with previous and current research suggesting short- and long-term effectiveness of virtual telehealth delivery of CRS education (Gielen et al., 2018; Omaki et al., 2017; Pellegrino & DiGennaro Reed, 2020; Schwebel et al., 2019; Taylor et al., 2021).

General discussion

This study aimed to assess the efficacy and long-term sustainability of child passenger safety education delivery methods and their ability to reduce CRS misuse for both installation and securing a child. This study compared the long-term effectiveness of a traditional child passenger safety educational method to BST in-person and BST telehealth in their ability to reduce CRS misuse for both installation and securing a child. Baseline results for both experiments, across all 2,448 participants, found similarly high levels of CRS misuse for the CRS installation and restraining of a child. These results are comparable to common misuses found at NHTSA child passenger safety checkup events and car seat fitting stations (Greenwell, 2015). Further, the readability level of instructions and varying motor vehicle recommendations contribute to misuse (NTSB, 1996; Wegner & Girasek, 2003). By having written instructions set at a lower grade level, the instructions are presented clearer as a reference for the participant. By breaking down the skill into smaller steps, this pedagogical approach reduced the response effort to acquire the skill. Further, since the CPST provided instructions/modeling/rehearsal/feedback per step, there were more opportunities to demonstrate the correct task and mastery of skills. These experiments also underscore the importance and ability to perform outcome evaluation to measure the long-term effectiveness of child passenger educational programs and to ensure educational objectives have been met. Measuring the efficacy of the intervention and the method of educational delivery is vital to ensure long-term effectiveness and long-term compliance of the intervention among participants (Jullien, 2021).

We are fortunate to maintain 100% of participants across the entire length of the experiment. This effort was the result of early planning and development, including the use of REACH (Recruit, Engage and retAin Children in behavioral Health risk factor studies) strategies. Efforts included 1) building a partnership between the CPST and the participant pair to establish a relationship (Adubato et al., 2003; McFarlane, 2007; Schoeppe et al., 2014). This began following scheduling, with a text confirmation by their CPST, followed by a text reminder of the initial session, and after the session an acknowledgment text that included a reminder of the emailed resources and to call their CPST for any future questions; 2) study transparency; 3) providing video overview and child safety resources; 4) reducing participant burden by hosting sessions convenient to the participant (Tansey et al., 2007; Teague et al., 2018); 5) having their CPST being a resource and being available; and 6) a follow-up call to see how their baby was doing and to schedule follow-up, including text confirmation, reminder and post-follow-up text for future car seat questions.

Limitations

While training couples at the same time might seem that it could have resulted in a limitation, results found this not to be the case. When the participant holds the phone during BST telehealth, or watches during an in-person BST session, they are observing during intervention. This could have resulted in inadvertent observational modeling from seeing their partner performing their training. Once the first partner completed their task at 100%, participants would change places. As a result, the person who observed first could have had a faster acquisition rate compared to the participant who was first to be trained. This, however, would not have been a risk during baseline, since in baseline each participant was tested separately based on the 37-step TA. Also, teaching two participants at the same time could have presented a potential limitation, however observations found otherwise. For the participants who had the opportunity to observe their partner during their partners attempt, they vocally reported that they were surprised to learn that it was more difficult than it seemed just by observing their partner. It is likely that there could have been some observational learning; however, this did not provide them with necessary hand/eye and muscle coordination to meet mastery criteria more effectively and efficiently than their partner. Furthermore, viewing is a form of CRS didactic learning, which has been shown to increase knowledge but is poorly correlated with proper installation to reduce CRS misuse (Kuroiwa et al., 2018).

Implications for practice

The findings from both experiments suggest that in-person BST and virtual telehealth BST are effective methods for CPSTs to deliver long-term effectiveness of CRS education to reduce misuse. These results provide important implications for practice that can improve the effectiveness of child passenger educational services and programs. First, among participants who were trained with Non-BST in-person, while they mastered skills after the completion of their session, these skills were not maintained over time. This resulted in significant misuse for both CRS installation and restraining of their child. Among participants who received CRS education with BST in-person and BST telehealth, in addition to obtaining complex critical skills after their session, these were maintained with long-term effectiveness resulting in zero misuse at the 9-month follow-up evaluation. More specifically, the participants must properly install the CRS each time the infant is placed in the car resulting in multiple opportunities throughout the day to practice. As such, multiple opportunities contribute to the maintenance of the skill over time even though training may have ended months prior. Compared to another skill, such as brushing teeth that may occur multiple times a day, the social significance of missing steps, or even missing an opportunity for brushing teeth, results in less severe consequences compared to improper installation of a CRS. With a CRS, there are also multiple opportunities to engage in the target behavior daily. This could have contributed to the maintenance of high levels of correct CRS use during follow-up, since parents would have to restrain their child in the CRS for every trip in their motor vehicle, whereas it is likely that caregivers would have had a minimum of two opportunities per day to engage in and maintain this skill. To help improve the effectiveness of CRS education, both forms of BST can be incorporated into certification training for CPSTs to effectively address the long-term problem of CRS misuse. Second, participants who received education with virtual telehealth BST obtained similar results as to the in-person BST participants. This suggests that a virtual form of BST can be used by CPSTs to provide CRS education virtually while maintaining long-term effectiveness to reduce CRS misuse. Furthermore, the virtual telehealth BST approach helps to fill gaps in services where distance and lack of availability of CPSTs is a barrier. This is often observed among hard-to-reach populations, new parents who went into early delivery and have been discharged from the hospital before getting CRS assistance, emergency cases, and, Military, and rural communities. Third, telehealth enables CPSTs to provide CRS education without the risk of transmitting infectious disease. This is particularly important among expectant parents due to immunological changes that occur during pregnancy, which can increase the expectant woman's susceptibility and severity of infectious disease (Jamieson & Rasmussen, 2022; Jamieson et al., 2006). Fourth, telehealth is a cost-effective approach to administer outcome evaluation to demonstrate the long-term effectiveness of CRS educational programs. In-person follow-up evaluations can be a challenge. A virtual approach can overcome these barriers, especially among programs at law enforcement agencies and hospitals/healthcare organizations. While BST in-person and telehealth BST are shown to be effective in transferring CRS skills from the CPST to the participant, future research should be considered to study the efficacy of BST to effectively train CPSTs during certification and recertification.

The findings from this study also have direct operational implications when standardized CRS education is delivered with a BST treatment package. The BST approach enhances the quality of educational delivery resulting in sustained CRS correct use. This can have a positive effect on both the CPST and the parent/caregiver relationship, resulting in motivating CPSTs in their work capacity as an educator. Enhancing the quality of CPST education to parents and caregivers also has organizational implications. The BST treatment package can become a best practice recommendation to Safe Kids Worldwide, the NHTSA, and CPSTs who provide services independently, or at public agencies, hospitals, and organizations. The benefit of an improved educational delivery approach could also help to maintain CPSTs with a continued desire for recertification and attract interested professionals to become certified. In addition to operational implications within the United States, the BST treatment package also has implications for CPST certification training globally, to address CRS misuse more effectively in other countries. The BST treatment package can be incorporated into CPST certification training courses offered within Safe Kids Worldwide international alliances. Implementing and incorporating BST into CPST certification training would begin by developing a BST child passenger safety training protocol, which is currently being developed as part of the Occupant Protection section of the California Strategic Highway Safety Plan. The BST training curricula would have the ability to become a continuing education course for current CPSTs and eventually become part of the National Child Passenger Safety Training.

Conclusion

The results of both experiments suggest that in-person BST and BST telehealth are effective in their ability to sustain long-term effectiveness of child passenger safety education to reduce CRS misuse. When the CPST used either form of BST to deliver CRS education, the participant mastered the necessary skills to properly install and use their CRS. Mastery of skills among participants was retained even after 9 months, suggesting both forms of BST are an effective method to reduce CRS misuse. Research has suggested the importance of hands-on skill training; however, incorporating both forms of BST, combined with breaking down steps, significantly improved and redefined how CPSTs educate with individualized instruction, by using hands-on learning, and ensuring self-installation by the parent or caregiver, at checkup events, fitting stations, or other CRS educational sessions (Agran et al., 2004; Brown et al., 2011; Lane et al., 2000; Schwebel et al., 2019; Tessier, 2010).

The use of a virtual telehealth approach also provides an effective and sustainable method to deliver CRS education to parents remotely to reduce CRS misuse, disease transmission, and the risk of parents and caregivers driving to a location with their child not properly restrained (Schwebel et al., 2019). Furthermore, virtual telehealth also provides the ability to perform outcome evaluation remotely, that can be used in program evaluation, to ensure long-term effectiveness of CRS education programs while accommodating geographic, staffing, and other challenges among child passenger safety programs within law enforcement, hospital/healthcare, public agencies, or the private sector.

Notes

1. Traditional CRS education is the National Highway Traffic Safety Administration (NHTSA), National Child Passenger Safety Certification Training Program (CPS certification program) that certifies child passenger safety technicians and instructors provided by Safe Kids Worldwide.
2. The use of dolls or stuffed animals to represent children while learning to restrain a child in a CRS is common in the National Child Passenger Safety Technician Certification Training. While the size and shape of a doll or stuffed animal may vary, it is up to the CPST to model to the parent/caregiver how to adjust the CRS harness to fit correctly.
3. Focus groups are controlled interviews that include a select group of 5–12 individuals who have similar characteristics and are stakeholders (i.e., expectant women) of a specific topic of discussion (i.e., car seats, etc.).
4. Cognitive interviewing (CI) is a process led by a facilitator with one individual at a time to pretest written material and receive feedback that can be incorporated into final written material that is more understandable. For the purpose of this study, the CI presented individual participants with child restraint system and motor vehicle occupant protection terminology, and related educational materials, to ensure they understand the material in the way it was intended. Modifications were applied depending on the feedback of each individual.
5. WhatsApp is a commonly used, no cost, cross platform messaging and video calling app that uses mobile data or Wi-Fi.

Disclosure statement

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