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An Evaluation of Feedback-Based Interventions on Promoting Use of Personal Protective Equipment in a School

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ABSTRACT

Employees working in human services are more likely to receive injuries on the job than in many other industries. Human service organizations that serve individuals who engage in dangerous behavior often require employees to adhere to safety guidelines, including utilizing protective equipment to minimize the risk of injuries. Despite protective equipment being prescribed in students' treatment plans at a private day school, employees were often observed working with students without the prescribed protective equipment. Results from a Performance Diagnostic Checklist-Safety assessment varied across three classrooms. Therefore, individualized treatment packages were implemented in each classroom. Results indicated increased use of prescribed protective equipment across all three classrooms and an overall decrease in staff injuries sustained by student contact.

KEYWORDS

Behavioral safety; functional behavior assessment; human services; injury prevention; performance diagnostic checklist—safety (PDC-Safety)

In 2018, the Bureau of Labor Statistics reported an injury rate of 3.9 per 100 full-time employees for those working in human services (BLS.gov). A human service employee is 1.26 times more likely to get injured on the job than the average worker across all industries. One factor contributing to injuries that is somewhat unique to human services is the need to interact and keep individuals safe who engage in severe problem behavior such as aggression or property destruction (Lin, Luiselli, Gilligan, & Dacosta, 2012). Despite the clear need, behavioral safety programs in human service settings appear to be relatively rare; likely, this is due to the need to implement procedures that are individualized to the organization (Jasiulewicz-Kaczmarek, Szwedzka, & Szczuka, 2015) resulting in costly programs in an industry with slim margins.

In a review of behavioral safety programs, 77% contained a pre-intervention assessment (Grindle, Dickinson, & Boettcher, 2000). In the same review, the authors found that while assessments noted in the literature often included examining injury records, reviewing existing safety material, interviews with

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employees, and direct observation of employees, there was often a lack of detail and specificity required to reproduce the assessment. An assessment that allows for an individualized safety program is often time-consuming and primarily based upon recommendations from practitioners and not empirical data (Wirth & Sigurdsson, 2008). However, a new safety assessment has recently been developed by expanding upon a widely used, and empirically evaluated tool.

The Performance Diagnostic Checklist (PDC) has been used to evaluate factors contributing to employee performance problems (Austin, 2000). It has successfully selected interventions in a number of settings such as a medical clinic (Gravina, VanWagner, & Austin, 2008), restaurants (Amigo, Smith, & Ludwig, 2008), and a department store (Eikenhouot & Austin, 2004), among others. Recently, two extensions of the PDC, the PDC-Human Services (Carr, Wilder, Majdalany, Mathisen, & Strain, 2013) and PDC-Safety (Martinez-Onstott, Wilder, & Sigurdsson, 2016), have been developed to address specific variables that are unique to these applications.

The PDC-Safety was developed by Martinez-Onstott et al. (2016). Martinez-Onstott et al. used the PDC-Safety to select an intervention for university groundskeeping crews. The PDC-Safety differed from the original PDC in that several questions were re-worded to focus on the failure to use protective equipment and adhere to safety guidelines. The assessment indicated a lack of consequences as being responsible for low rates of personal protective equipment (PPE). Therefore, participants received graphic feedback of their performance during the intervention, which was effective in increasing the use of PPE.

Cruz et al. (2019) implemented an updated PDC-Safety across a group of three behavior therapists working in a facility serving individuals diagnosed with autism spectrum disorder (ASD). Based upon the PDC-Safety results, Cruz et al. evaluated both an indicated and non-indicated intervention for appropriate handwashing. The indicated intervention, an e-mail prompt, was effective in increasing handwashing for two of three participants; the third required an additional feedback component to improve performance.

Although the nascent research conducted using the PDC-Safety indicates utility similar to that of the PDC, there remain avenues for further research. First, studies to date have not examined the degree to which the assessment can generate specific interventions for different groups of employees in human service settings. Additionally, research using the PDC-Safety has yet to demonstrate that the increase in safe behavior decreases injuries suffered by employees. The hallmark of behavioral safety programs is that by increasing safe behavior in employees, there are fewer injuries over time (McSween, 2003). The purpose of the current study was to increase the use of prescribed personal protective equipment for groups of employees in a private school

setting within an ABA agency. Specifically, behavioral and outcome data related to the interventions that were influenced by the results of the PDC-Safety are presented.

Method

Participants and setting

This study was conducted at a private day school serving individuals diagnosed with ASD and other related developmental disabilities. At the onset of data collection, the school served 187 students and employed 184 staff members (150 direct care staff, 26 teachers, and eight behavior analysts). The school was divided into eight distinct programs based on students' age, academic capabilities, and intensity of challenging behavior. Each program consisted of two to four classrooms, with each classroom supporting four to eight students, four to eight direct care staff, and one teacher. The teacher supervised the direct care staff members, who were primarily responsible for implementing learning programs throughout the school day. A behavior analyst supervised each program. The individuals identified to participate in this study consisted of 21 direct care staff members and three teachers from three classrooms across three different programs. Classroom selection criteria included a group of at least three students with prescribed PPE for staff to wear in their treatment plans. The 21 direct care staff who participated in the study were each assigned to one of the three classrooms. They were informed as to the nature of the study during the administration of the PDC-Safety. However, formal consent was not obtained as the targeted behavior was a component of their daily job responsibilities. At the end of the study, the staff members were debriefed and informed of the results for their individual classrooms.

Dependent variable

Data were collected on the percentage of intervals the direct care staff adhered to PPE requirements while working with their assigned students in each classroom. PPE consisted of jean jackets, arm guards, helmets, head coverings, and blocking pads. Staff members were required to utilize items individually or in combination, dependent on students' target behavior. For example, a student who had a history of pinching and pulling hair might require the staff member to wear a jean jacket and head covering. Each injury in the school (including in these classrooms), regardless of severity, was recorded on an incident report form. Types of injuries included, but were not limited to, bite wounds, scratches, lacerations, contusions, and non-specified pain. The injury reports were reviewed by the first author and school nurse each day. Each report was evaluated, and only injuries resulting from students who required

staff to wear PPE and then made contact (e.g., bite on arms obtained during an instance of aggression by a student who required staff to wear armguards) were counted in the study. Injuries caused by contact from students who did not require PPE or injuries sustained by alternative means (e.g., slipped on ice in parking lot) were not counted in the study.

Data collection

Data collection occurred approximately twice per week at varying times in each classroom. Prior to each session, the data collectors reviewed the class schedule and determined the staff members who were assigned to students who required PPE. Since data were collected at varying times of the day and the schedules rotated each hour, the staff members assigned to students with PPE also varied. However, due to the dynamic nature of the classroom, staffing and scheduling assignments had the potential to change unexpectedly during observations. Therefore, PPE requirements were fluid each day and the data were collected in 10-min sessions utilizing momentary time sampling with 10, 1-min intervals. This allowed researchers to capture changes in staffing and, thereby, changes in PPE requirements. Every minute during the 10-min recording session, a timer would quietly sound to the data collectors, who would then observe each direct care staff assigned to a student whose treatment plan required PPE. The scoring criteria required staff to utilize all of the PPE items for their assigned students. The data collectors would record "yes" (the staff was appropriately using all prescribed PPE) or "no" (the staff was not using all prescribed PPE correctly) for each staff member who was working with a student where PPE was prescribed. If the direct care staff was not present when the timer signaled (e.g., they were using the restroom), observers indicated that by recording "not applicable" on the data sheet. At the end of each session, the individual staff data were compiled and calculated to generate an average percent of the group's PPE adherence. Data collectors did not observe and record data on direct care staff assigned to students whose treatment plans did not require PPE.

General procedures

A modified consecutive case series design (Hagopian, 2020) was used across three classrooms to evaluate feedback-based interventions. During baseline, no programed consequences were delivered for using PPE. After the third session in baseline, the authors administered, via direct individual interviews, the PDC–Safety to the teachers and all direct care staff in each classroom. Table 1 presents the results of the PDC-Safety. The scores for each question are presented for each classroom, including the teacher's rating and the mean of the direct care staff's responses. Lower ratings on questions within the PDC-

Table 1. Teacher and staff ratings on performance diagnostic checklist-safety (PDC-S).

	Classroom 1		Classroom 2		Classroom 3	
PDC-S item	Teacher	Staff (M)	Teacher	Staff (M)	Teacher	Staff (M)
Antecedents and Information						
1. Do personnel receive formal safety training before they are allowed to begin their job?	2	3.8	5	4.8	5	3.6
2. Is there a safety manual in the employee's work environment?	No	-	Yes	-	Yes	-
3. Are there safety prompts in the employee's work environment?	4	3.2	4	4.0	4	3.6
4. Are there any safety programs or processes currently taking place?	2	4.5	3	3.8	5	3.7
5. Are mangers involved in any of the safety programming?	5	4.3	5	4.8	5	4.9
6. Is there a challenging yet attainable safety goal set? Can the employee tell you what this goal is?	1	4.0	1	4.0	4	3.0
7. Does the organization have a safety mission that is clearly stated?	1	4.0	5	3.8	1	2.9
8. Are safety values clearly established?	4	5.0	5	4.5	5	3.6
9. Are employees involved in the safety process in any way?	2	4.8	3	4.6	4	4.7
Equipment and Processes						
10. If equipment is required, does it conform to safety inspections?	4	4.2	5	4.3	5	3.7
11. Are there medical resources available in case they are needed?	5	4.0	5	4.6	5	4.4
12. Is any PPE required?	Yes	-	Yes	-	Yes	-
13. If applicable, is the PPE accessible?	4	4.2	5	4.6	5	4.7
14. Is the work area generally free from environmental hazards?	4	4.0	4	4.4	5	4.1
15. How quickly are safety concerns addressed, such as equipment problems or hazards in the work area?	3	3.2	5	3.3	5	3.9
16. Is the equipment ergonomically correct and does it encourage safe use?	4	2.7	4	4.0	5	4.1
17. Are employees required to demonstrate fluency in safe performance before beginning work?	3	4.5	5	4.5	5	3.7
18. Are there any obstacles that are keeping the employee from completing the task safely?	3	4.5	4	4.5	5	4.7
Knowledge and Skills						
19. Can all employees physically demonstrate safety routines required for their job?	4	4.3	5	4.4	4	4.0
20. How often are safety incidents reported?	5	4.8	4	5.0	5	4.9
21. Are injury reports collected and analyzed?	5	4.8	5	5.0	5	4.1
22. Are safety assessments conducted?	1	4.2	4	4.1	5	3.6
23. Is there a safety manager/department?	Unsure	-	Unsure	-	Yes	-
24. Can the employee recite the mission or values (as they relate to safety) of the company?	1	1.0	1	1.0	1	1.0
Consequences						
25. Are accidents investigated and, if something can be changed to prevent future accidents, are changes made?	5	3.8	5	5.0	5	4.4
26. Are there consequences delivered contingent on safe behaviors?	3	4.0	4	4.4	3	3.7
27. Are consequences delivered contingent on being free from accidents?	5	4.7	5	4.6	4	5.0
28. Are there any safety incentive programs currently in use?	1	1.5	1	1.9	2	1.4
29. Are there any competing contingencies supporting unsafe task performance?	4	4.0	3	4.1	4	4.6

(*Continued*)

Table 1. (Continued).

PDC-S item	Classroom 1		Classroom 2		Classroom 3	
	Teacher	Staff (M)	Teacher	Staff (M)	Teacher	Staff (M)
30. Are managers present to give feedback on safe behaviors?	4	3.7	5	4.8	5	3.9
31. Is there a response effort associated with performing a task safely?	3	2.8	1	2.1	1	2.4

Items 2 (Yes/No), 12 (Yes/No/Unsure), and 23 (Yes/No/Unsure) do not accrue points during administration of the PDC-Safety, therefore staff means are not reported on those.

Safety indicated barriers to safe staff performance and the potential need for intervention. The results of the PDC-Safety indicated consequences as a primary barrier to staff adhering to safety guidelines. Although there were questions from other categories that received low ratings from staff, the authors drew on their working knowledge of the organization's practices and information obtained during baseline observations to select the targeted interventions in each classroom. Similarly, the authors discovered that the 24th question, which asks the employee to share the safety mission of the organization, received the lowest rating across all three classrooms. At the time of administration, the school did not have an identified safety mission and thus made it impossible for employees to score that question as they could not be familiar with something that did not exist. Since the remaining questions in that section did not indicate barriers to safe performance, a training intervention was not developed. An examination of the responses to the questions, combined with the authors' clinical judgment and working knowledge, suggested that feedback in classroom 1, additional PPE and an incentive program in classroom 2, and feedback and an incentive program in classroom 3 would be effective and parsimonious interventions.

The intervention in classroom 1 included both positive and corrective feedback delivered by the teacher three times per day. The teacher provided the feedback at varying times to account for different staff and student pairings. The positive feedback consisted of verbal praise delivered contingent upon the staff member wearing the prescribed PPE. The corrective feedback consisted of verbally informing the direct care staff of the missing PPE and offering to work with the student while the direct care staff retrieved the appropriate PPE.

The intervention in classroom 2 consisted of reviewing students' treatment plans followed by inventorying, purchasing, and assigning staff-specific PPE. The second component of the intervention was an incentive plan that consisted of daily checks, during which time the teacher recorded data on the use of PPE for each direct care staff assigned to a student who required PPE in their treatment plan. At the beginning of the following week, the teacher delivered a voucher to exchange for 30-min of leave to each direct care staff who demonstrated 100% adherence the previous week.

The intervention in classroom 3 consisted of positive and corrective feedback identical to that in classroom 1, except for feedback occurring one time per day, due to teacher recommendations, in the initial implementation of the intervention phase. After five sessions, it was determined that feedback needed to increase to three times per day. The intervention also consisted of an incentive program identical to classroom 2.

Interobserver agreement, treatment integrity, and social validity

A second observer independently recorded the percentage of intervals in which staff utilized PPE during 84.13% of sessions across baseline and intervention. Interobserver agreement was calculated by dividing the total number of agreements for each interval by the total number of agreements plus disagreements for each interval multiplied by 100. Mean agreement across baseline and intervention was 99.74% with a range of 95% – 100%.

The authors also collected treatment integrity data on the implementation of the interventions by each teacher utilizing procedural checklists. Data were collected on the following components: whether positive and corrective feedback was delivered contingently, the accuracy in their recording of staff adherence to using prescribed PPE, and whether the vouchers were accurately distributed to staff who met criteria. Treatment integrity data were collected during an average of 35% of intervention sessions. Interventions were implemented with 100% accuracy across all three classrooms.

At the conclusion of data collection, social validity questionnaires were distributed to all of the participants who were still employed by the organization, including all three teachers and 17 direct care staff. Each questionnaire consisted of five questions that assessed the effectiveness of the interventions, willingness to suggest the intervention be used in other classrooms, willingness to receive the interventions again, the degree to which there were negative side-effects associated with the interventions, and preference for the interventions. The participants anonymously rated each question using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Results

Figure 1 displays the results of PDC-Safety identified interventions across 3 classrooms. During baseline, the direct care staff in classroom 1 utilized prescribed PPE an average of 4% of the observed intervals. The introduction of positive and corrective feedback resulted in an immediate increase in staff's utilization of prescribed PPE. On average, staff members were observed utilizing PPE in 96.83% of intervals, with correct utilization occurring at 100% for 16 of 18 sessions during intervention. During one session in the intervention, a staff member was observed utilizing PPE for 0% of intervals, which resulted in a group average of 50%. The staff member who did not wear all of the protective equipment was not assigned to a student who required PPE per the classroom schedule. However, they assumed responsibility for the student who required PPE from another employee and therefore, should have donned the appropriate PPE.

The direct care staff in classroom 2 were observed utilizing prescribed PPE an average of 1.67% of observed intervals during baseline. Following the

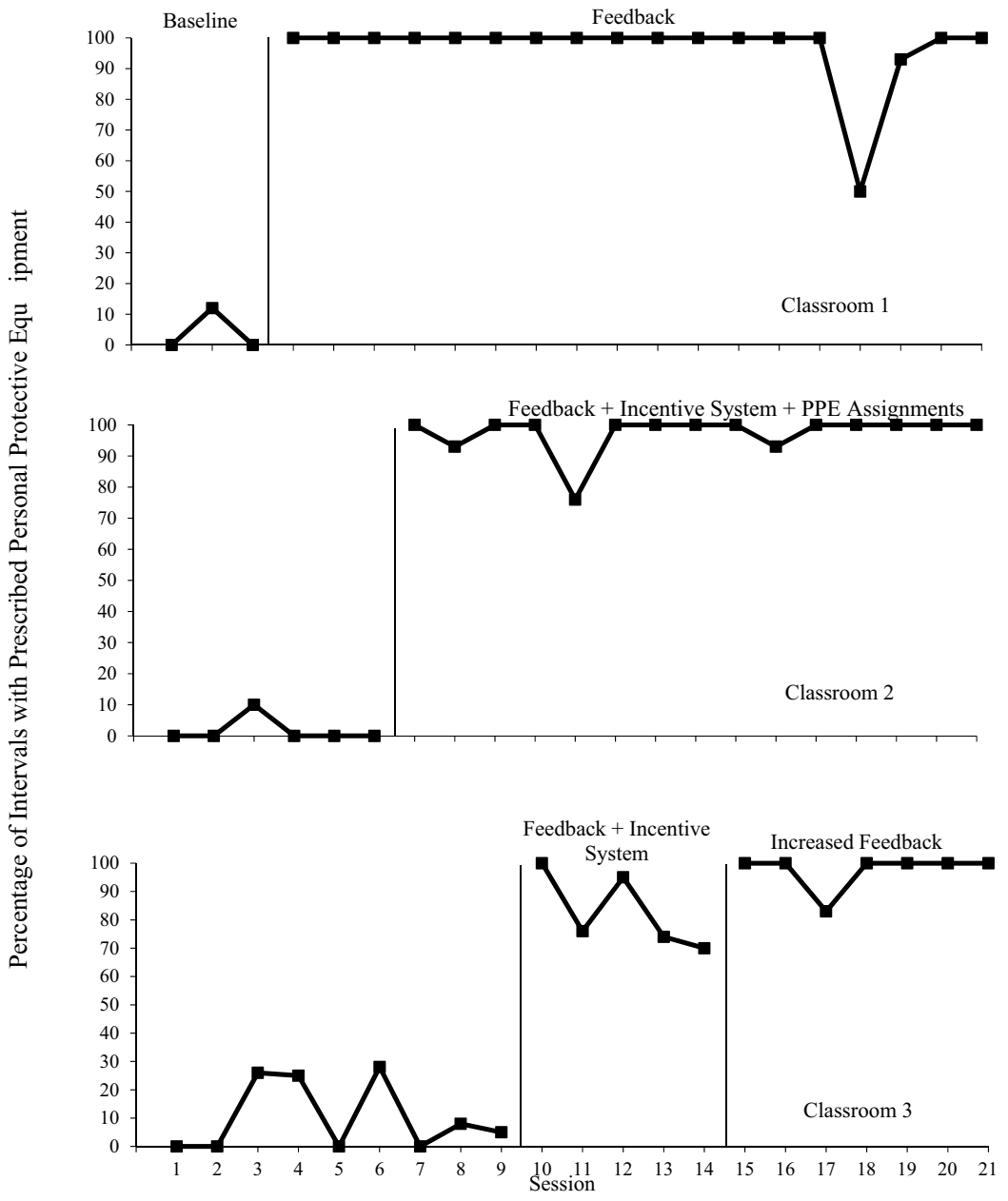

Figure 1. Percentage of intervals with prescribed personal protective equipment (PPE). *Note*. Each session was comprised of 10, 1-min intervals. Each data point represents the percentage of intervals in which the group adhered to PPE requirements.

purchase and assignment of prescribed PPE as well as the introduction of an incentive system, utilization of prescribed PPE increased to an average of 97.47% of observed intervals. Staff members were observed utilizing PPE during 100% of intervals on 12 of 15 sessions.

Table 2. Protective equipment related injuries per school day.

Classroom	Baseline	Intervention
1	0	.02
2	.19	.05
3	.14	.03

*Note.*Number of injuries related to the improper use or absence of personal protective equipment were divided by the number of school days in each condition.

During baseline in classroom 3, direct care staff utilized prescribed PPE an average of 10.20% of intervals. The initial introduction of feedback and an incentive system increased utilization of prescribed PPE to an average of 81.20% of intervals, with a range of 75.61% to 100%. Due to inconsistencies in staff's utilization of PPE, the authors determined that more frequent feedback was warranted. The teacher increased the frequency of feedback from one time per day to three times per day, allowing her to address more staff and student pairings. The staff then utilized prescribed PPE an average of 97.57% of observed intervals with utilization occurring at 100% for 6 of 7 sessions.

Table 2 displays the number of staff injuries per school day that were related to the improper use or absence of protective equipment and sustained by student contact in each condition. In classroom 1, staff sustained 0 injuries during baseline and .02 injuries per day during intervention. In classrooms 2 and 3, staff injuries decreased from baseline to intervention. In classroom 2, staff sustained .19 injuries during baseline and .05 injuries during intervention. In classroom 3, staff sustained .14 injuries during baseline and .03 during intervention. Overall, there were four injuries in the intervention, compared to 11 in baseline.

For the five questions assessed in the social validity questionnaire, the teachers' average ratings ranged from 4.7 to 5 and the direct care staff's average ratings ranged from 3.9 to 4.2. All three teachers and most direct care staff agreed or strongly agreed (N = 14) that the interventions were effective in increasing the use of PPE. All three teachers and the majority of direct care staff (N = 13) agreed or strongly agreed that they would recommend the use of the interventions to other classrooms. When asked if they would be willing to use the interventions again, all three teachers and the majority of direct care staff (N = 13) agreed or strongly agreed that they would be willing to use or receive the interventions again. All three teachers and the majority of direct care staff (N = 13) agreed or strongly agreed that there were no negative side-effects associated with the interventions. Lastly, all three teachers and the majority of direct care staff (N = 12) agreed or strongly agreed that they liked the interventions.

Discussion

Although the modified consecutive case series design did not produce optimal experimental control, results of the current investigation appear to replicate earlier work demonstrating that the PDC-Safety can be effective at selecting specific interventions that increase safe behavior for groups of employees. Additionally, an increase in safe behavior may have been responsible for a decrease in injuries related to interactions with students. This finding is important and merits future replications as workplace injuries cost billions of dollars each year in the United States (Leigh, Markowitz, Fahs, Shin, & Landrigan, 1997). Furthermore, injuries cause pain and suffering for the employees and could have additional unknown consequences in schools (e.g., the loss of an experienced employee while they are recovering from an injury could result in the compromised implementation of behavior intervention plans). Burnout has been noted to be a factor in human services (e.g., Plantiveau, Dounavi, & Virués-Ortega, 2018), and it is not unreasonable to suspect that injuries sustained while working with students who engage in significant problem behavior, or relatedly, having an increased workload while a fellow employee recovers from an injury, could contribute to burnout. Future research should identify potential unknown consequences of employee injuries and conduct a cost-benefit analysis to evaluate the cost of PDC-identified interventions relative to the potential savings of a long-term decrease in employee injuries.

While the safe behavior data were collected in 10-min sessions approximately two times per week, the injury data were obtained from analyzing daily incident reports throughout the duration of the study (across several months). The injury data suggest that injury to any employee is a fairly rare occurrence even when interacting with students who have a history of aggressive behavior and necessitate the prescription of PPE for the employees. It has been hypothesized that safe behavior is more effortful than unsafe behavior and often does not yield a marked improvement in safety for any one employee (McSween, 2003). This appears to be the case in the current study as the risk of injury was low. It was only through an analysis of all employees over time that decreases in the overall injury rate related to proper use of PPE became apparent. However, preventing even a single injury by increasing adherence to prescribed interventions was considered socially significant.

As a report from the field, this investigation has several limitations. First, no control interventions were included (i.e., a non-indicated intervention as identified by the PDC-Safety) and different interventions were used across classrooms. It could be that any intervention would have improved safe behavior, although other research has found non-indicated interventions were not effective in improving safety-related behavior (Cruz et al., 2019). Second, the administration of the PDC-Safety may not have been necessary to determine the

interventions in each classroom. A simple ABC analysis may have resulted in selection of the same interventions. More research is required to compare the PDC-Safety with the results of descriptive or experimental assessments. Third, the authors did not record the specific types of PPE that were omitted during baseline or intervention and, therefore, were unable to evaluate if some items were more or less likely to be utilized. Aspects that contribute to low rates of PPE usage such as response effort required to don equipment and comfortability, may have been missed in the current study. Future researchers may wish to evaluate if employees are more likely to omit specific types of PPE and if so, determine the variables responsible for that omission. Fourth, this intervention occurred over a relatively short period of time; therefore, it is unclear whether the results would have maintained long-term. More research is required to determine if the effects of interventions selected by the PDC-Safety will persist over time, particularly as consequence-based interventions are systematically thinned. Fifth, the authors used the original PDC-Safety (Martinez-Onstott et al., 2016) to conduct employee interviews since the time of administration occurred prior to the publication of the revised PDC-Safety by Cruz et al. (2019). It is possible that the revised version, which modified wording of questions to make them more specific, would have highlighted different barriers, thus possibly resulting in different interventions and results. Finally, in classroom 1, injuries appear to increase slightly from baseline to intervention; however, classroom 1 spent the least amount of time in baseline and the longest time in intervention, relative to the other two classrooms.

There are many unique challenges associated with keeping individuals safe while they engage in significant problem behavior, and the use of appropriate PPE can mitigate some of the risk for employees. While more research is needed to develop cost-effective and easy-to-implement procedures to address the safety of employees working in this industry, the PDC-Safety may be a helpful tool within the assessment process. It can be administered relatively quickly and easily (each interview took approximately five minutes) and identify potential interventions across industries. However, it may miss key variables contributing to unsafe behavior among employees. For example, specific wording on the PDC-Safety related to the use of safety equipment may impact whether employees indicate opportunities for improvement. More specifically, asking if the equipment is comfortable may evoke different responses when compared to asking if the equipment is ergonomically correct. Additionally, specific questions may lead to responses that suggest an intervention is unlikely to affect safe behavior. As noted earlier, the question regarding the organization's safety mission received the lowest rating. However, the authors determined that the addition of a safety mission would function as an antecedent-based intervention and predicted that it was unlikely to change PPE use.

Working with children who engage in significant problem behavior requires experienced, healthy staff members to implement educational programs.

Increasing the use of PPE can provide protection for staff when students engage in significant problem behavior directed toward others. The results of this study suggest that some staff members may not utilize prescribed PPE when it is required in a student's treatment plan. Therefore, additional interventions may be required, and feedback-based interventions may be helpful in assisting organizations to increase safety adherence.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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