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Comparison of the Effectiveness of Different Observation Methods and an Exploratory Analysis of the Importance of Accuracy of Various Observations on Safety Performance

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COMPARISON OF THE EFFECTIVENESS OF DIFFERENT OBSERVATION METHODS AND AN EXPLORATORY ANALYSIS OF THE IMPORTANCE OF ACCURACY OF VARIOUS OBSERVATIONS ON SAFETY PERFORMANCE

by

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Behavior Based Safety (BBS) applies various types of safety observation to improve occupational safety in business. The purpose of the following study was to examine and compare different observation foci: peer-observation, self-observation and a combination of both options as well as supervisor observations and observations of employee behavior obtained by research assistants (RA). Participants were unionized employees of the facilities management department at a Midwestern university. Target behaviors included safe lifting and vacuuming. The dependent variables were safety performance and the discrepancy between the different observation types. Incident data were also reported. The different observational methods were investigated via a counterbalanced group design. The results show that (a) regardless of checklist type, the best conditions for improvement were the first condition after baseline and the supervisor intervention. (b) That participants and supervisors over-reported their safety performance in comparison to observations by RAs. (c) That the BBS process was associated with decreases in incidents and modest safety improvements. (d) That no significant relationship existed between discrepancy, improvement and participation. Implications of these findings on the importance of accuracy, training and culture are discussed in relationship to the behavior change measured by RAs. The importance of observations in comparison with other hypothesized variables, such as employee buy-in, are also discussed in comparison with current findings and available research.

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Introduction

A major concern of today's businesses is safety. Workman's compensation for injuries at work cost employers over $40 billion each year, while harm to those injured can negatively impact their lives in a multitude of ways (American Society of Safety Engineers, 2002). In 2014 alone, there were a total of 2,953,500 recordable, occupational injuries and illnesses in the United States according to Bureau of Labor Statistics, with about a third of these cases resulting in days lost from work (Bureau of Labor Statistics, 2016). A recordable incident is defined as a work-related injury and/or illness that includes days away from work, loss of consciousness, medical treatment or more serious outcomes such as disability or death (Bureau of Labor Statistics, 2012). The most commonly recorded occupational injuries are strains, sprains, falls, slips and injuries to the back, which are prevalent in custodial or facilities management settings (Bureau of Labor Statistics, 2012; Ping; Bureau of Labor Statistics, 2016). Annual U.S. health-care spending has reached record highs, which illustrates that safety is also an important financial factor for businesses to consider and mitigate (National Institute for Occupational Safety and Health, 2012).

Behavior Based Safety (BBS) is one of the main approaches employed to reduce worker injuries (Cooper, 2009; Gravina, Austin, Schoedter, & Loewy, 2008; Sulzer-Azaroff & Austin, 2000). The universal goal of BBS is to reduce incidents and severity rates that are triggered by unsafe acts or at-risk behavior (Sulzer-Azaroff & Austin, 2000; Cooper, 2009). Unsafe behaviors are often immediately reinforced by saving time via an unsafe shortcut, or reduced effort while the safe response usually takes longer to complete or requires more effort, which makes changing unsafe work behaviors challenging (Austin, Kessler, Riccobono J.E., & Bailey, 1996). Further difficulties result from complacency and the belief that (certain) accidents do not happen enough to warrant extra effort to prevent them (Olson & Austin, 2001; McSween T. E., 2003). BBS approaches this challenge by identifying and measuring safe and unsafe behaviors, and by attempting to increase the amount of safe acts by employing behavioral techniques, such as

training, prompting, observations and feedback (e.g. Olson & Austin, 2001; Cooper M. D., 2009; Agnew & Snyder, 2008; Sulzer-Azaroff & Austin, 2000).

Measuring Safe Behaviors via Observations

The ultimate measure of the efficacy of BBS is a reduction in incidents. Measuring incidents provides a clear account of how many people were hurt in a specific timeframe, and also allows for an analysis of severity and injury duration. However, focusing on injury rates alone is not sufficient, as an insignificant number of unsafe acts actually result in injuries (Sulzer-Azaroff & Fellner, 1984). The second approach to assess success in BBS programs is by monitoring safe behaviors (Sulzer-Azaroff & Austin, 2000; Cooper, 2009). The measure of safe behavior is derived from observations of the employees engaging in their regular work tasks while an observer rates their behaviors as safe or unsafe. Observations have also been called the "core of BBS," because safety observations combined with other interventions are believed to result in an increase in safe behaviors, which is assumed to lead to less related injuries (Komaki, Barwick, & Scott, 1978; Sulzer-Azaroff & Santamaria, 1980; Austin, Kessler, Riccobono J.E., & Bailey, 1996; Cooper, 2009). One advantage of this approach is that scoring safe behavior and providing feedback can proactively reduce unsafe behaviors, preventing the future occurrence of more serious and rare injuries or incidents (Komaki, Barwick, & Scott, 1978).

The most common sources for observations include employees and researchers. In practice, employee observations and feedback are more frequent in applied studies, but most research studies have utilized researchers or outside personnel for observations and supervisors to provide feedback (e.g. Agnew & Snyder, 2008; McSween, 2003; Komaki, Barwick, & Scott, 1978; Sulzer-Azaroff & M., 1980). Authors of BBS textbooks that describe real-life applications are strong advocates for employee observations and provide several successful case studies (Agnew & Snyder, 2008; McSween T. E., 2003). However, these case studies do not provide objective measures of safe behaviors. The values based safety approach typically includes

management and employees in the design of the BBS process, as well as setting improvement goals, but employees alone are the main observers (McSween T. E., 2003). Common types of employee observations are: peer-observations, self-observations and workgroup-observations (Cooper, 2009; Gravina, Austin, Schoedter, & Loewy, 2008).

Occasionally, supervisors have performed safety observations on their subordinates and provided feedback accordingly (Cook & McSween, 2000; Zohar & Luria, 2003). Cooper (2006) had supervisors fill out a "visible ongoing support" checklist that guided supervisor engagement to actively support participation in the BBS process and promote the importance of safety. Results suggested that supervisors' visible support to engage in the BBS process improves safety performance of the employees, but has no effect on the number of completed employee observation checklists. Zohar and Luria (2003) encouraged supervisor interactions with their employees about safety, which they measured by surveying the subordinates. Medium to strong significant negative correlations were found between supervisor interactions and employees percentage of unsafe behavior. Cook and McSween (2000) found that high supervisor participation correlated with high participation of their employees. Their interpretation was that supervisor participation indicated support for the BBS process. Further, Cook and McSween (2000) hypothesized that due to their participation, supervisors were better equipped to support employee participation and to provide the needed resources for employee participation. Overall, supervisor involvement tends to have positive effects on employee safety performance.

One question that arises when looking at the measure of safe behavior is the credibility of the source of the observations. Reviewing existing literature revealed that no field study has used a second objective source for peer-observations that the participants were unaware of to measure the accuracy of safety observations. Several laboratory studies have investigated the accuracy issue with various degrees of surreptitious monitoring (Sasson & Austin, 2005; Alvero, Bucklin, & Austin, 2001; Alvero, Rost, & Austin, 2008; McCann & Sulzer-Azaroff, 1996). However, only one applied study examined the reliability and accuracy of self-observations, that was

surreptitiously recorded by RAs and found discrepancies between the self-observations and the RA observations between 2% and 69% (Olson & Austin, 2001).

Observer Effect

The observer effect, which is the underlying assumption of promoting employee observations, refers to an improvement in an observer's own performance resulting from previously having them evaluate someone else's safety performance (Alvero & Austin, 2004). The behavioral literature has not identified the exact mechanism responsible for this effect. Observing others could serve as a discriminative function, as a prompt, as a motivating operation or as feedback (Gravina, Austin, Schoedter, & Loewy, 2008; Olson & Austin, 2001). Following this logic, the typically higher effect sizes of peer-observations over self-observations could be attributed to the peer modeling the correct behavior while reviewing the safety rules. This modeling effect, together with the prompt, may provide an explanation for the observer effect, which would explain the lack of accuracy-performance relationship found in peer-observation studies. However, the success of this proposed explanation depends on the employees believing that it is important to change the target behavior ("buy-in").

Another interpretation views the reactivity effect that occurs when the presence of the observer functions as a discriminative stimulus for the person performing the safe behavior (e.g. Gravina, Austin, Schoedter, & Loewy, 2008; Lebbon & Austin, 2013; Olson & Austin, 2001; Robek, 2007). However, there is literature documenting an observer reactivity effect when workers record their own behavior while being observed by someone else, such as a supervisor (Olson & Austin, 2001). Lebbon & Austin (2013) found that the presence of an observer, who does not provide consequences, will not evoke reactivity effects after a certain time has passed.

Applied studies using employees as their main observers have found support for the importance of peer-observations in BBS by showing a negative correlation between the number of peer-observations and incident rates (Cooper, 2006; Lebbon, Sigurdsson, & Austin, 2012).

Gravina et al. (2008) have pointed out that not all jobs are conducive to leaving one's work site to conduct an observation. Many times this variable is dictated by the work environment, which determines the most practical or feasible observation type. Assuming that the evaluation of safety performance is the most important part of the observer effect, the subsequent reduction in injuries should depend on how many times each employee has the chance to perform observations (Alvero & Austin, 2004). However, none of these studies verified the accuracy of these observations or investigated the specific function of observations. It should be noted that the support for the existence of the observer effect comes solely from the laboratory (Alvero & Austin, 2004; Alvero, Rost, & Austin, 2008) and the only comparable applied study, Olson and Austin (2001), found greatly attenuated effects.

Observation Types and Accuracy

There have been mixed results and contradictions about the relevancy of accuracy in observations and the observer presence. Accuracy in safety observations is hypothesized to be a predictor of future performance of the observer (Alvero & Austin, 2004; Gravina, Austin, Schoedter, & Loewy, 2008). The assumption is that knowing the correct behavior leads to a correct evaluation of the observed behavior which would then lead to improved safety performance (observer effect) and thus lower incident rates.

Self-observations. Self-monitoring or self-observation refers to the observational focus of the observer's own behavior and is often used with employees who work alone (Gravina, Austin, Schoedter, & Loewy, 2008). Typically, there is a delay between the behavior and recording the self-observed performance, which may result in participants having a harder time remembering the finer details of their past behavior, particularly as the time between the response and the recording of the response increases (Olson, Hahn, & Buckert, 2009). As self-observations do not require another employee to record the work tasks, it is less costly to implement than peer-observation as less work time is spent on observing. While the self-observation literature

generally agrees that there is an accuracy-safety performance relationship (Gravina, Austin, Schoedter, & Loewy, 2008), some have found it may not be crucial but only has an enhancing effect on behavior change (McCann & Sulzer-Azaroff, 1996; Olson & Austin, 2001).

Peer-observations. In peer-observation, all employees typically receive observer training; in workgroup approaches, only a few selected employees receive the observer training. Thus, peer-to-peer approaches generally allow for more opportunities for each employee to engage in observing safe behaviors and providing feedback than the workgroup approach (Cooper, 2006). However, it is notable, that the relationship between accuracy and safety performance has only been examined in applied settings with self-observations. Robek (2007) as well as Alvero and Austin (2004) found no relationship between accuracy of observations and behavior change in a laboratory studies that looked at simulated peer-observations. Likewise, Alvero et al. (2008) found that inaccurate observations still lead to correct safe behaviors, further confirming the lack of an accuracy-behavior change relationship for peer-observations. This study hypothesized that different repertoires and trainings are needed for evaluating the posture of others correctly vs. one's own posture. Thus, participants were unable to differentiate between safe and unsafe observed behaviors, but able to perform the safe behaviors themselves (Alvero, Rost, & Austin, 2008).

Another possible explanation for the lack of an accuracy and behavior-change relationship may lie in employees trying to make themselves look good on the observations by reporting inflated scores, not wanting to make their peers look unsafe or avoiding situations in which corrective feedback would have to be delivered. For this reason, incentives or rewards are generally not recommended in combination with BBS as it often results in unintended consequences such as dishonest observations and a post-reinforcement pause which shows in decreases in safety performance after receiving an incentive (Ludwig, Biggs, Wagner, & Geller, 2002; McSween T. E., 2003). Thus, the lack of relationship between accuracy and safety performance may be the result of dishonest observations resulting from incentives for high

percentages of safety or number of observations (Johnston & Hayes, 2005; McSween T. E., 2003). While this may explain the aforementioned difference between observer accuracy and safety performance, it should be noted that all of these studies were conducted in a laboratory environment and one cannot be sure that a change in behavior in an applied setting would result from inaccurate observation.

Feedback on Safety Performance

While employee-driven observations are assumed to have the most potential for allowing BBS processes to be sustainable in the long term, there are many other variables that contribute to the success of the BBS process (Sulzer-Azaroff & Santamaria, 1980). These variables include the use of prompts, type of feedback, frequency of feedback, goal setting and the degree of employee involvement. Feedback on safety performance based on observations can assist in making a BBS program successful and sustainable (Sulzer-Azaroff & Santamaria, 1980; Cooper, 2009). A review of feedback in BBS processes revealed that a combination of different feedback mechanisms showed the biggest effect on incident rates: verbal feedback, posting of observational results in graph form and weekly meetings to discuss safety issues (Cooper, 2009).

Alvero et al. (2001) also found the combination of verbal and graphic feedback to show very high, consistent effects on performance in a general review of feedback. Furthermore, effective feedback delivery should be relevant and include or imply salient contingencies, such as a social comparison component (Ludwig, Biggs, Wagner, & Geller, 2002; Sulzer-Azaroff & Santamaria, 1980). Feedback on group performance consistently produced the highest effect compared to individual performance feedback or was found to be at least equally advantageous (Alvero, Bucklin, & Austin, 2001). From a response effort perspective, the higher effort needed to generate individual feedback was often considered not worse the small additional effect on performance. Public posting is a form of social comparison feedback which is especially effective in evoking social interactions, which can motivate and create social contingencies (e.g.

cooperative spirit) (Van Houten, 1980). Goal setting is an additional consideration that enhances feedback effectiveness and aligns with BBS' goal to increase safety performance (Balcazar, Hopkins, & Suarez, 1986). Cooper's (2009) review concluded that feedback is most successful when provided at least a few times per week (intermittently). Chhokar and Wallin (1984) also assessed the effect of feedback frequency and found that performance was equally effective regardless of whether feedback was delivered weekly or biweekly. One way to increase feedback frequency is by automating feedback by designing materials, such as safety checklists, in a way that provides immediate feedback when filling them in (Van Houten, 1980). It should be noted that feedback studies in other areas are typically based on objectively measured behavior or performance (Balcazar, Hopkins, & Suarez, 1986).

Summary

Various gaps were found in the BBS literature: the settings were limited to laboratories; and in an applied setting, there was no verification of behavior change or accuracy of peer-observations without the awareness of the participants. Only one study verified the accuracy of self-observation in an applied setting (Olson and Austin, 2001). This study found self-observation to be inaccurate and only detected moderate changes in safe behavior. The effects of self-observations and peer-observations have not yet been compared in applied setting. Therefore, the purpose of this study is to objectively measure the accuracy of different types of observation, in an applied setting by using RAs as observers. Differences in the efficacy of peer-, self- and supervisor observations are compared across groups to see whether observations are associated with increases in the safe behaviors being measured. The hypothesis is that there is an accuracy-safety performance relationship with self-observation being least accurate, peer-observation somewhat more accurate, and data collected by RAs being most accurate.

Method

Participants and Setting

The research was conducted within one of three separate units of the facilities management department of a public university in Michigan. The custodial unit, responsible for cleaning the campus buildings, was chosen as the treatment site due to prior work engagement of the main researcher with this unit, and the opportunity of affecting the largest number of employees. The custodial unit employs about 160 custodians, while the landscape unit employs about 45 and the maintenance unit employs approximately 120 employees. All participants were unionized employees and worked mostly as two-person teams as part of groups who each reported to a supervisor. Most employees performed certain tasks together in two person teams and others independently. Groups consisted of between 20 and 25 employees who were responsible for cleaning several buildings in various locations on campus. In collaboration with the management team, three experimental groups of frontline employees within the custodial unit were determined based on schedule and other factors. The unionized employees of the maintenance and landscape units served as control groups for injury data only. These two groups were selected as the control because they had a similar work and supervisory structure.

Dependent Variable

Target behaviors. The safety assessment which was conducted according to McSween's guidelines (2003) revealed several behaviors that were associated with severe injuries or high numbers of injuries. The specific target behaviors were chosen among these based on meeting the following criteria: ease of surreptitious observations, occurrence in publicly accessible places on campus and frequency of occurrence. The target behaviors, vacuuming and lifting, were then scrutinized to ensure they were easy to understand and use and captured the correct and safety-relevant behavior. The measures of safe behaviors were divided into separate behavioral components of each behavior.

Safe behavior was measured in two ways. First, RAs surreptitiously recorded behavior and incorporated an inter-observer agreement (IOA) between two independent observers. Second, employees either observed themselves (self-observation) or were observed by a peer (peer-observation). As is typical in the industry, no IOA were recorded on the self or peer data. The type of observation depended on the assigned phase as part of the new safety program. The dependent variable of safe behavior was calculated as shown below.

$$\%\, Safe = \frac{Number\ of\ Safe\ Behaviors}{Number\ of\ Safe\ Behaviors + \ Number\ of\ Unsafe\ Behaviors} \times 100$$

RA observations were made without the awareness of the employees. As the majority of the employees' lifting and vacuuming behavior occurred publicly on campus, the RAs were scoring public behavior, therefore avoiding invasion of privacy. This rationale was also applied when Olson (2001) had RAs perform objective observations of the bus drivers that performed self-observations. Because the uniforms and the behavior itself clearly identified the custodial personnel, it was ensured that the RAs recorded the correct employees. The organizational chart and assignment log were used to determine suitable times and places for observations and revealed rough time frames for observations. The custodian's work schedule was influenced by different variables, such as availability, work schedules, building type, and the assigned tasks of the custodians, which led to a varying number of data points per employee. The RAs collected data on the selected treatment groups during all phases. The RA data were used as the standard because: 1) They received extensive training until they reached a specified high criterion; and 2) There were frequent calculations of inter-observer agreement (20% of RA observations).

The employees were trained in how to perform safety observations and in the definitions and practice of safe behaviors. RAs were trained in how to record observations on the target behaviors, as well as how to blend into the environment and not attract any attention while observing. These observations were intended to provide an objective sample of the percent of safe work behavior and were used to assess the accuracy of employees' observations. The training

included practice sessions with videos of the target behavior for observations to ensure reliability and 90% Inter-Observer Agreement (IOA) in 5 continuous observations before recording employees' behavior. In addition, the RAs had to pass a test on definitions and observation procedures before being certified for observations. IOA was obtained during 20% of the observations and in order to ensure reliable data, the targeted agreement rate was 80%. IOA was calculated the following way:

$$Inter - Oberserver\ Agreement = \frac{Agreements\ in\ Observations}{(Agreements\ in\ Observations + Disagreements\ in\ Observations)}\ x\ 100$$

In order for the RAs to stay undetected, they acted as students using their smart phones or writing in notepads while sitting or walking in the area where custodial behavior was being performed. Data were recorded on the smart phones using a website to record their observation. The actual purpose of the activity was to fill out the safety checklist. Because using smart phones or writing in notepads as well as sitting or walking in hallways is a common occurrence on a university campus, these activities were used as cover while observing to avoid raising any suspicion. Reactivity effects were not expected as students were often near custodians. The RA observers were also shuffled between sites to prevent the custodians from becoming too conspicuous. In addition, the director of custodial services and the main contact at Environmental Safety and Emergency Management (ESEM) were the only people outside of the research team who were aware of the occurrence of RA observations. The specific guidelines for RA observations can be found in Appendix F. Inter-Observer Agreements was attempted to be collected for 20% of all probed observations. The identities of those observed were coded upon completion of data collection.

The custodial safety committee developed additional checklists to address safety concerns such as safely climbing and setting up a ladder, safe restroom cleaning, and walking on ice safely, which were only observed by the employees because they were difficult to be observed without attracting attention or because they rarely occurred in publicly available places. In

addition, a mopping category and general safe work behavior category had been developed. While these were part of the RA data collection, insufficient data were collected on these measures, and thus, the data were excluded from further analysis.

Vacuuming and lifting behaviors and its criteria were used on RA, self, peer, choice and supervisor observation checklists. A self-observation occurred after the behavior has been performed, while all other observations occurred while the behavior was being performed. Each checklist requires scoring of each listed sub component of the safe behavior as safe or unsafe (or not applicable) when observing a safe behavior. The safety checklist asked the observer to record their name, the person being observed and the type of observation. RAs used an electronic form of the checklists, while the custodial employees used a paper checklist to score safe behavior. The administrative support staff entered the paper-based observations into the database for further analysis. The measures collected from the employees were publicly posted on an 11 by 17 in. chart on a safety bulletin board in the hallway where employees punched in. In addition, this information was shared bi-weekly with safety committee members and supervisors to encourage specific follow up. Supervisors were also given a track sheet to follow up with the employees about meeting the checklist goal. The specific definitions and all of the checklists themselves, including the sub criteria, can be found in Appendix G and H.

Lifting. This category included all components of safe lifting and was assessed via whole interval recording. When the employee positioned himself or herself in front of the item to be lifted, this signaled the starting point for the observation. The end point for the observation was defined as putting down the load or walking further than 25 feet with the load. The first criterion was to spread the feet shoulder wide to establish a stable base. The load of a box should be kept close to the body, whereas a (garbage) bag should still be close but not touch the body. The actual lifting required squatting down and up with a straight back so that the load was lifted by the legs. For the whole duration of the lifting, the body, especially hips and shoulders, should be in alignment to avoid twisting the body.

Vacuuming. This category included various target behaviors, outcomes and observation methods. The observation began when the employee either started vacuuming or was already vacuuming when the observers arrived. The existence of a cord snake and the cord not obstructing the pathway for building occupants were the first two outcomes recorded using discrete categorization. A cord snake prevented the cord from coiling and ensured that the cord was neatly uncoiled when more cord was required. Safe vacuuming motion for an upright vacuum was to move it forwards and backward while extending arm and leg together with the forward motion and then retracting the arm and leg when moving backwards. Safe motion for operation of a back-pack vacuum consisted of a side to side golf like motion, which required alignment of the upper body and the legs. The cord management was defined as walking in front of the cord and, if needed, stepping over the cord. Both of these behaviors needed to be performed continuously during vacuuming. The RAs observed motion and cord management for one minute, which was subdivided in six 10-second intervals. The subdivision in intervals and tallying provided further details about the observed behavior. A self-recorded mp3 file prompted the beginning of the intervals and allowed the RAs to solely focus on the vacuuming behaviors. When RAs were able to record safe behavior in the bathroom, they recorded these behaviors according to the predefined behaviors and recording methods for motion and cord management in vacuuming. Due to the small and inconsistent number of these observations, the collected data were treated as a partial vacuuming observations. The peer observers observed these behaviors for two to three minutes and then recorded the observed behaviors as safe or unsafe accordingly. Self-observation consisted of a checklist that was completed after the tasks. The use of the cord snake was recorded again at the end of the observation using discrete categorization. If unplugging the cord occurred during the observation it was to be categorized as safe if the plug was removed in a controlled motion with the hand close to the socket.

Number of observations. The number of performed observations by employees was recorded to track whether the mandatory amount of observations per person was performed.

Compliance with the goal of two mandatory observations per week (later one per week) was required. These were monitored and if an employee failed to comply, follow-up on part of the safety committee or supervisor was initiated. The supervisor distributed and collected the observation checklist. Designated administrative support staff kept track of the overall numbers of observations and RAs linked the RA observations with the employee's observations together in one database. The employees' observations were treated confidentially. The calculated measure of compliance helped in the analysis of the effectiveness of the different treatment conditions as it relates to frequency and numbers.

Incidents. A behavior change in the area of BBS is only valid if it leads to a reduction in injuries or events that could have led to an injury. An incident involving death, days away from work, restricted work or job transfer, medical treatment beyond first aid, or loss of consciousness was automatically considered an OSHA recordable (Department of Licensing and Regulatory Affairs, 2002). A slip and fall that only led to a bruise would only by considered an incident as it does not meet the requirements for an OSHA recordable. The numbers of injuries were recorded by the university's ESEM unit which classified each injury according to OSHA guidelines (Bureau of Labor Statistics, 2012). Incident rates were calculated according to OSHA's formula (Bureau of Labor Statistics, 2012).

$$Incident\ Rate = \frac{Number\ of\ Injuries\ and\ Illnesses}{Hours\ Worked\ by\ Employees} \times 200{,}000$$

The factor of 200,000 relates the number of hours 100 employees typically work in a given year (= 100 x 40 x 50) and is used to show the rates of injuries per 100 employees per year to increase visibility and readability across different sites. Hours worked per year, lost time through injuries, and the amount of employees were provided by the payroll program, ESEM and human resources. In order to show detailed data and provide insight into potential seasonal changes, the incident rate was calculated for each trimester, which corresponded with semesters at the

university. The trimester incident rate was based on the actual injuries in the respective period, and thus, the multiplier was adjusted to reflect the hours for a trimester (66,666 = 200,000 * 1/3). A separation of the data of the past years from the treatment groups at the custodial site was not possible for several reasons: frequent changes in shifts and groups as well as a reorganizations during baseline. Therefore, it was only possible to show whether the overall program produced a change in incidents and a separation only occurred for the treatment groups during baseline.

Social acceptability. The social acceptability of the safety program was assessed via surveys administered at the end of baseline as well as after the final treatment phase. These surveys contained several questions regarding the employees' attitudes towards the safety program itself, knowledge of how to work safely, and self-reported health and wellness (see Appendices C and D).

Independent Variable

The main independent variable in this study was the introduction of the BBS program. However, the specific independent variables in this study were the different types of observations: self-observations, peer-observations, choice observations and supervisor observations.

BBS training. The purpose of the BBS training was to ensure that all employees were knowledgeable about how to perform work tasks safely and were able to correctly evaluate the observed performance when filling out the safety checklist. The training content was closely modeled after McSween's (2003) recommendations. The part of the training that covered the BBS process itself included the respective observation types, the expected number of observations per week, where to hand in completed observations, as well as other administrative aspects. The safe procedures training topics included lifting, vacuuming, ladder and general safe work behavior. Another component of training focused on feedback, such as providing positive and constructive feedback to co-workers after performing an observation. The training included discrimination training of safe vs. unsafe procedures, as well as exercises that included an

opportunity to practice observing each other and giving feedback. The training was given by safety committee members with support of management personnel, union representatives and the main researcher. The employee training duration was 3.5 hours and included practice opportunities for performing lifting or vacuuming, and the opportunity to observe as well as provide feedback for their peer. Afterwards, regular observations as part of the BBS process were performed by the employees and were organized by the employee's supervisors and the safety committee. The privacy and confidentiality of the information on the observation checklists were ensured and management emphasized that no data would be used for discipline purposes.

Types of employee observation. This independent variable was the type of observation employed: peer-observations, self-observation, and a combination of both, i.e., the employees had some choice between both options during the combination condition. All conditions used a similar checklist in regard to observed behaviors (see Appendix H). The goal of observations per week was shared and publicly reported weekly. The supervisor and the safety committee interacted with the employees to provide prompts, to encourage them to meet the observation goals, and provided specific suggestions for improvement of safety performance or for observation opportunities. The specific time within the week they performed the observations were up to the employees' preference and availability.

Peer-observation. In this condition, employees used peer-observations to observe safe behaviors. The training for this independent variable included the different recording methods, such as discrete categorization momentary time sampling and whole interval recording. Additionally, the employees received training on how to conduct a peer-observation and appropriately deliver feedback to the observed peer. Peers would announce the observation before starting it.

Self-observation. In this condition, employees used self-observations to observe their own safe behaviors. The training for this observation type introduced the checklist and how to perform a self-observation, as well as how one could prompt self-observations. Because the

checklist was filled out retrospectively, this observation type used discrete categorization. Instructions on how to score and summarize the observation to deliver self-feedback were part of the training.

Combination of self-observation and peer-observation. This condition included using both types of recording methods. The hypothesis was that due to the enhanced exposure to observations and feedback, safe performance would increase more than in the other conditions. Training included the units as mentioned above with the extension of how to use both approaches and how to decide when to use which observation type. The number of observations to be performed per week was identical to the groups above half of the employees were expected to be self-observation, while the other half were to be peer-observation.

Supervisor checklist. This independent variable introduced weekly safety checklists with the goal of involving supervisors and managers in the BBS process and communicating that safety is a priority while reinforcing safe behaviors by custodians. The supervisors were provided with instructions on the completion of the supervisor checklists and a reminder of the important criteria of the vacuuming, walking on ice, mopping and lifting checklists. The checklists focused only on the one criterion for each behavior that was considered to be the most important for possible incidents. The checklist as seen in Appendix H has four categories: 1) minimum of 5 observations for lifting, vacuuming, mopping and walking on ice, 2) general comments and feedback, 3) addressing safety concerns and removing safety barriers with their employee, and 4) communication with the safety ambassador. The checklists were turned in at the end of the week and the comments and completion percentage were discussed in the weekly supervisor meetings. The completion and observed safety percentage were posted publicly.

Hype. Hype refers to awareness of the behavior safety program by employees still in the baseline condition. Because safety data and the checklists were publicly posted on the safety board near the time clock where all of the employees punch in and out of work, and employees in baseline frequently asked when they would receive the training, there was considerable spillover

of information between the treatment groups and groups still in the baseline condition. This effect was likely enhanced by the sharing of information between employees in the BBS training and those who had not yet to receive BBS training at the location where employees congregate, at the beginning or end of their shift. This location was directly adjacent to the safety board where all antecedents and feedback for the safety program were posted. The hype condition was an unintended condition, which occurred during Phase 2 when Group 3 was technically still in baseline. However, the data especially for lifting indicated a clear change compared to the pure baseline phase, which led to this phase being characterized as hype condition.

Experimental Design

The experimental design, as seen in Table 1, was intended to be a counterbalanced multiple baseline design across three treatment groups plus two control groups. However, due to practical constraints, such as the hype condition and small number of data points collected by RAs, we decided to prioritize the number of data points over design restrictions and the design ended up losing the characteristics of a true multiple baseline design. Injury data from the previous five years were gathered, and the baseline phase for RA observations began in the 2014 spring semester when the final groups were determined. During the baseline phase, the safety measures were observed in the absence of a BBS program. The end of the spring semester signified the start of the preparatory phase. The treatment phase began at the start of the 2014 fall academic semester, which introduced self and peer-observations in a staggered manner. In the 2015 spring semester (end of Phase II to Phase V), the independent variables of choice and supervisor checklists were introduced. Due to semester break, RA observers collected data in 42 of the 46 weeks.

Table 1: Experimental Design for Custodial Groups

<table>
<tr><td>Phase</td><td>I</td><td rowspan="2">Summer 2014</td><td>II</td><td>III</td><td>IV</td><td>V</td></tr>
<tr><td>Dates</td><td>Spring 2014</td><td>Fall Semester till 11/17 for 1 & 2 and 11/19 for 3</td><td>(till 1/23/15)</td><td>(till 2/15/15)</td><td>End of April</td></tr>
<tr><td>Weeks</td><td>Week 1-14</td><td>Week 15-25</td><td>Week 26-33</td><td>Week 34-36</td><td>Week 37-46</td></tr>
<tr><td>Group 1</td><td>Baseline</td><td rowspan="3">Preparatory Phase: BBS Imple-mentation</td><td colspan="2">Self</td><td rowspan="2">Choice</td><td>Supervisor</td></tr>
<tr><td>Group 2</td><td>Baseline</td><td colspan="2">Peer</td><td>Supervisor</td></tr>
<tr><td>Group 3</td><td>Baseline</td><td>Hype</td><td colspan="2">Self</td><td>Supervisor and Choice</td></tr>
</table>

Data Analysis

The percentages of safe behavior were analyzed visually in order to determine whether a change in safety performance had occurred. Weekly data were summarized to present data from at least two group members in the group charts. Specific analyses for the treatment groups only considered employees with baseline and data in at least one treatment phase. Improvement was defined as a change in safety performance of more than 0%. Weekly data and analysis of group effects were compared in Appendix J. The all groups summary included every employee. In addition, descriptive statistics and the effect size (Cohen, 1988) were calculated where feasible and sufficient data were available. The incident data were also compared across the three sites. The comparison of the two different sources of safe behaviors occurred visually.

Furthermore, the survey data were summarized by reporting the data for each response. Correlational analysis such as Pearson coefficient investigated possible relationships between average discrepancy of the RA observation with the respective report for self- and peer-observations, the improvement throughout the intervention, and the compliance with the goal for observations. Only employees with both scores for baseline and treatment were included in the analysis. Also a minimum of five data points was required for the data to be included in the correlational analysis. Significant correlations were marked with an asterisk in the tables. For the correlational comparison of data sources, up to five missing weekly data points were substituted with the average of the three previous weeks.

Procedure Used to Introduce Behavior Based Safety

Baseline. RAs collected baseline data on all custodians in buildings, where the observers could remain undetected and blend into the environment while still observing target behaviors. Three custodial groups were suitable for RA data collection. The number of data points varied between employees and their behaviors as the RA data collection was often unpredictable and relied on luck due to changing routines, schedules and work assignments of the custodians.

Preparatory phase. The preparatory phase began with the administration of the anonymous pre-survey to all custodians. After the data analysis of the survey, the results were presented to all employees on all shifts together with a brief presentation on BBS in order to recruit interested employees and supervisors for the safety committee. A safety committee of 15 members from the union, plus volunteers from the management team, was formed. In order to ensure experimental control, the safety committee members were asked for confidentiality regarding any information discussed in this meeting.

The safety committee followed McSween's (2003) suggestions for its agendas, roles, and responsibilities in designing a BBS process. The safety committee under guidance of the main researcher worked on establishing mission, values, and milestones for the process, creating the safety observation process, designing feedback and involvement procedures, and planning the training process. The main researcher ensured certain key variables were incorporated in the plan, while maintaining support of the committee. Examples of the key variables were the two target behaviors or the observations types. The safety committee obtained the union leadership's feedback once the BBS process was developed, and this feedback was implemented where valid and feasible.

After a final review with management and the union, the safety committee prepared and delivered BBS training on the checklists to the custodial groups that covered basic information on BBS, behavioral principles, how to give feedback, and the assigned observation type. Additional

information on supporting the BBS process and how to meet the goal of observations was provided for the supervisors at the beginning of the BBS process. During the summer months, when the preparatory phase occurred, the custodial tasks mainly consisted of detail (in-depth) cleaning the buildings on campus, because fewer students were around; thus, RAs did not collect data during the preparatory phase due to unsuitable recording conditions.

Treatment phase. The BBS training signaled the start of the treatment phase for each group. The BBS training was given according to the experimental design in Table 1. At the beginning of phase 3, additional checklists on mopping, restroom cleaning and walking on ice were made available. Group 3 started the checklists with a 3-week delay. In Phase 5, the goal of observations was reduced to one per week, because employees were complaining about the high quantity and data indicated, that observations may not be the crucial variable. RA observations were continued throughout the duration of the treatment phase with the exception of semester breaks. As employees changed building assignments and a few employees had left custodial, there were employees for which only baseline or only treatment data were collected. Whenever possible, the new building assignments were tested and if surreptitious observations were possible, the site was included in RA data collection to ensure pre- and post-treatment data.

Results

Overall, self-observations showed better correspondence with RA observations than peer-observations, which almost always reported their peers being 100% safe. Correlational analyses between data sources revealed a moderate positive correlation for Group 1 of $r= 0.374$ ($p= 0.06$) between the overall safety performance for self-observation and RA observations. All other Groups showed no significant correlations.

Safe lifting performance as measured by the RAs increased by 12% and vacuuming performance by 10% (excluding motion) when looking at all groups across the BBS intervention. Some components of each of these behaviors showed reliable increases while other showed considerable overlap with baseline performance. There were also notable differences in safety

performance between groups, criteria and conditions as seen in Appendix K. An analysis of outliers revealed that low safety performance coincided with returns from break or low number of RA observations in that week.

RA and Employee Observations of Safe Vacuuming Performance

Vacuuming performance for Group 1, as seen in the upper frame of Figure 1, was at 61% in baseline, which increased to an average of 86% after the introduction of self-observations with the exception of one dip shortly after the introduction. Vacuuming performance showed the least improvement during choice condition with 75% and rebounded during supervisor condition to performance at 83%. The sub criteria improved from 12% to 20%. The self-observations showed close correspondence to the RA observation data. The self-reported safety performance fluctuated above and below objective results reported by RAs.

The vacuuming line graph for Group 2 in the middle frame of Figure 1 shows an overall improvement from 79% during baseline to an average of 87% during peer-observation, and also shows less variation than during baseline. Slight decreases and stabilization occurred in the following choice and supervisor conditions. The individual criteria showed improvements from 5% to 12% compared to baseline. Peer- and self-observations were constant at 100% safe performance, which resulted in poor correspondence with RA observations.

The lower frame of Figure 1 displays the vacuuming line graph for Group 3, which shows an overall improvement from 68% during baseline to an average of 77% during hype condition, but fluctuated weekly. The following phase of self-observations showed an increase to 85% safety performance, which maintained throughout the supervisor condition at 81%. The sub criteria showed improvements from 1% to 14% compared to baseline. Peer- and self-observations were mostly constant at 100% safe performance, which resulted in poor correspondence with RA observations.

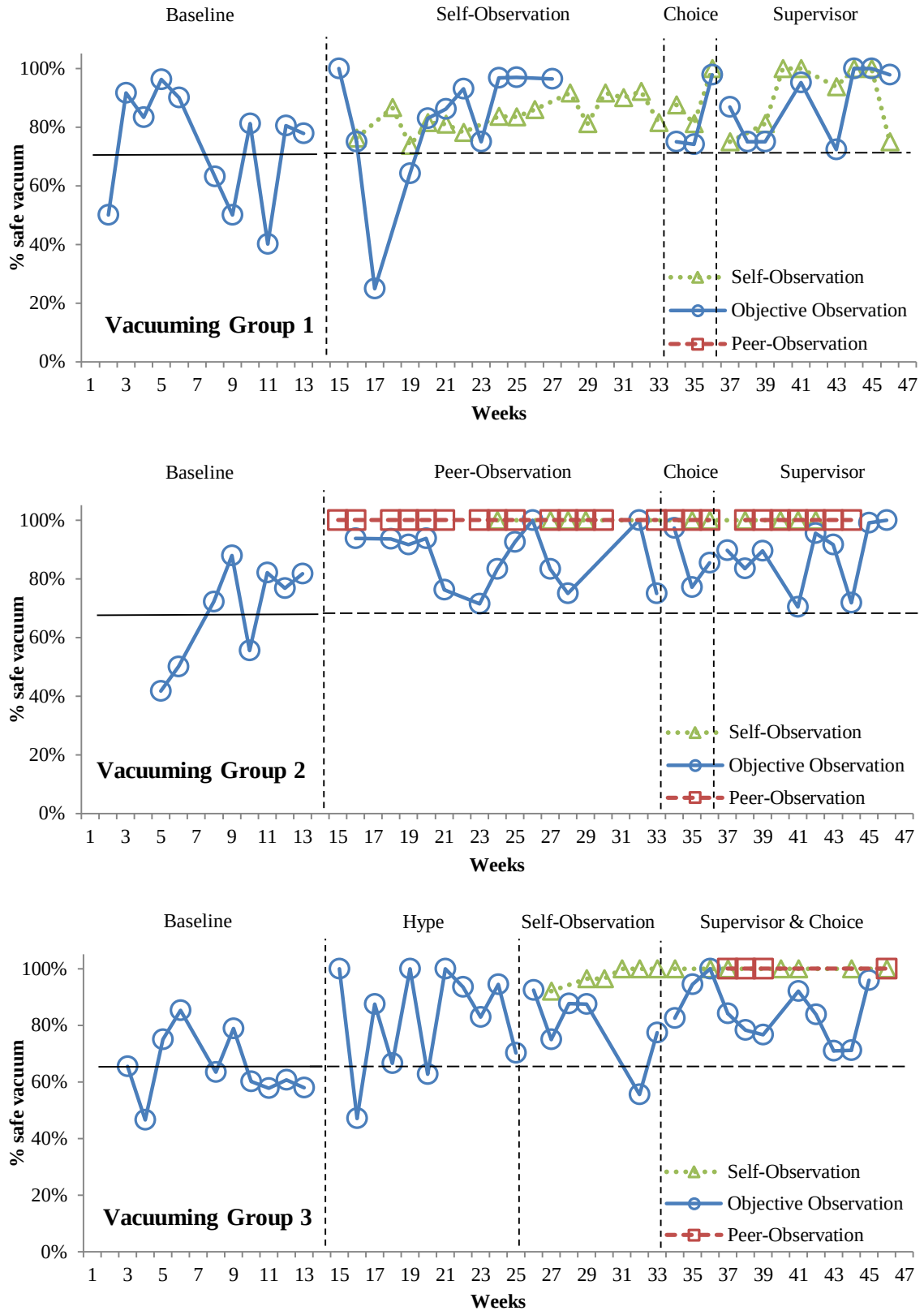


Figure 1: Line Graphs for Vacuuming Across Groups

RA and Employee Observations on Vacuuming Criteria: (Cord) Snake Safety Performance

The snake line graph of Group 1 in the upper frame of Figure 2 shows increasing performance of almost 30% over baseline during the self-observation condition and a decrease after winter break that lasts throughout the choice condition. Slight variance during the choice, but continued improvement during the supervisor condition led to an improvement of 37% of this criterion compared to baseline. Initially, self-observations showed some correspondence with RA observation data, but throughout the self-observations condition, self-reported data locked in at 100%. The line graph for Group 2 in the middle frame of Figure 2 shows initial improvement for snake performance, but then data continues the variable data pattern from baseline with fluctuations of -3% to 3% performance during peer-observation and choice conditions. The final supervisor condition showed improvements of 11% compared to baseline. The peer-observations from Group 2 all reported 100% safety performance. The line graph of Group 3 in the lower frame of Figure 2 shows increased performance by 5% during hype condition, which stabilized toward the end and continued to improve by 30% above baseline after introduction of self-observation condition. The snake performance during the supervisor condition was slightly lower with 11% above baseline performance. Steady reports of self- and peer-performance at 100% for Group 3 demonstrated poor correspondence with RA observation data.

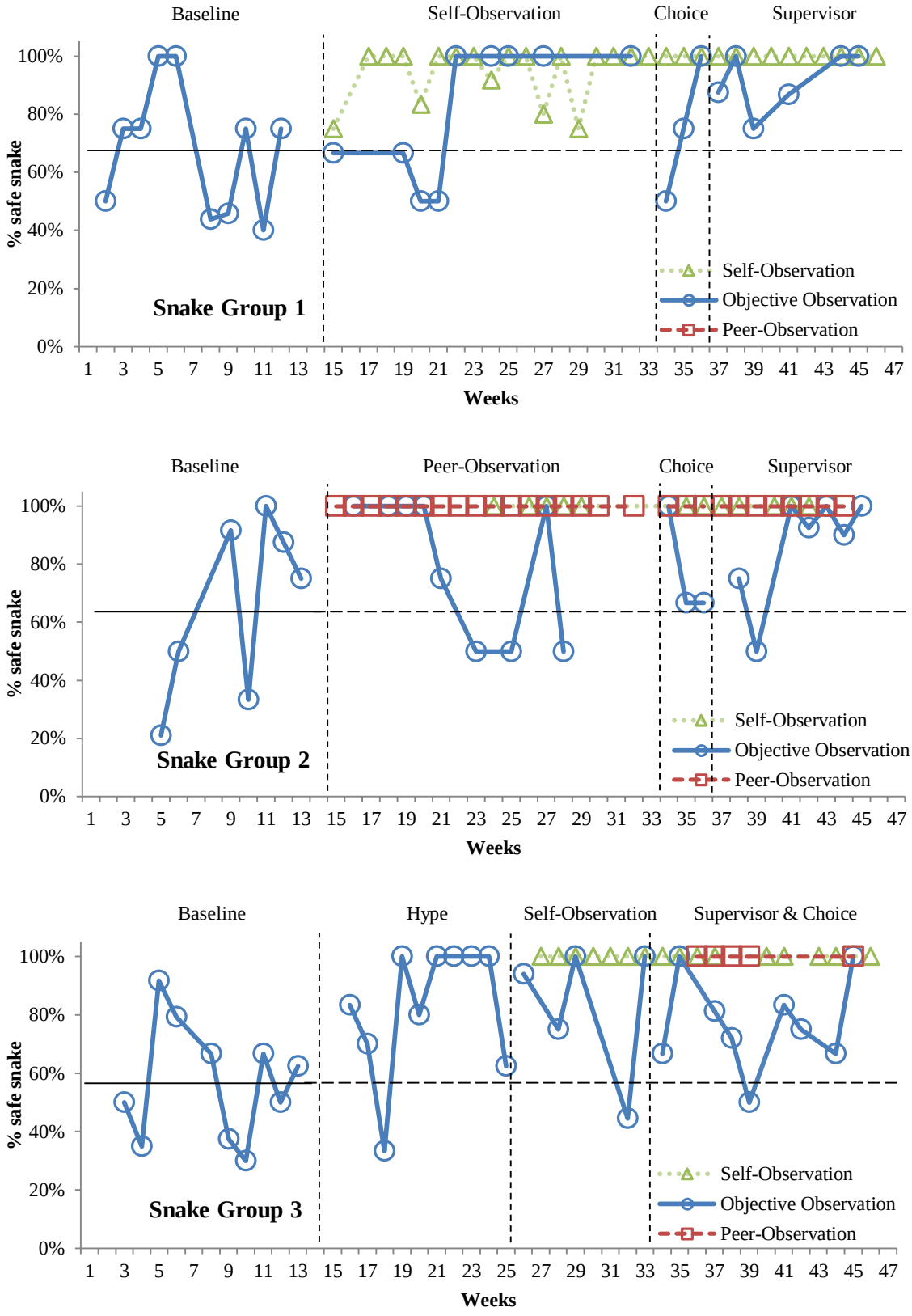


Figure 2: Line Graphs for Snake (Vacuuming Sub Criterion) Across all Groups

RA and Employee Observations of Safe Lifting Performance

The upper frame of Figure 3 shows that the safe lifting performance as measured by the RAs for Group 1 increased from an average of 62% in baseline to an average of 73% after the introduction of self-observations. The line graph shows a steady increase of performance that levels at around 80% with a dip after winter break in week 32. Lifting performance recovers during choice condition and maintains during the supervisor condition at 76%. The sub criteria showed modest improvements from 1% to 8% with the exception of twist, which showed a 24% improvement compared to baseline. The self-observations initially showed closer correspondence to the RA observation data, but correspondence disappeared over time and moved towards sustained high levels of performance. Generally, self-observations reported inflated safety performance.

The middle frame of Figure 3 shows data for Group 2. The data collected by the RAs showed an overall improvement from 67% during baseline to an average of 78% during peer-observation, which showed less variation than during baseline. Slight improvements follow during choice and supervisor conditions. The dip in performance during the final weeks coincided with the union's intervention discouraging participation in observation. The sub criteria showed improvements from 7% to 14% and marked improvement for twist with 37% improvement compared to baseline. Peer-observations were constant at 100% safe performance, which resulted in poor correspondence with RA observations.

The lower frame of Figure 3 shows the lifting line graph for Group 3, which showed an overall improvement from 64% during baseline to an average of 85% during the hype condition, which showed stable performance. The following phase of self-observations showed a decrease to 76% safety performance, which maintained throughout the supervisor condition. The dip in performance during the final weeks coincided with the union's intervention to discourage participation. The sub criteria showed improvements from 7% to 15% and a larger improvement

for lift with 20% improvement compared to baseline. Peer- and self-observations were mostly constant at 100% safe performance, which resulted in poor correspondence with RA observations.

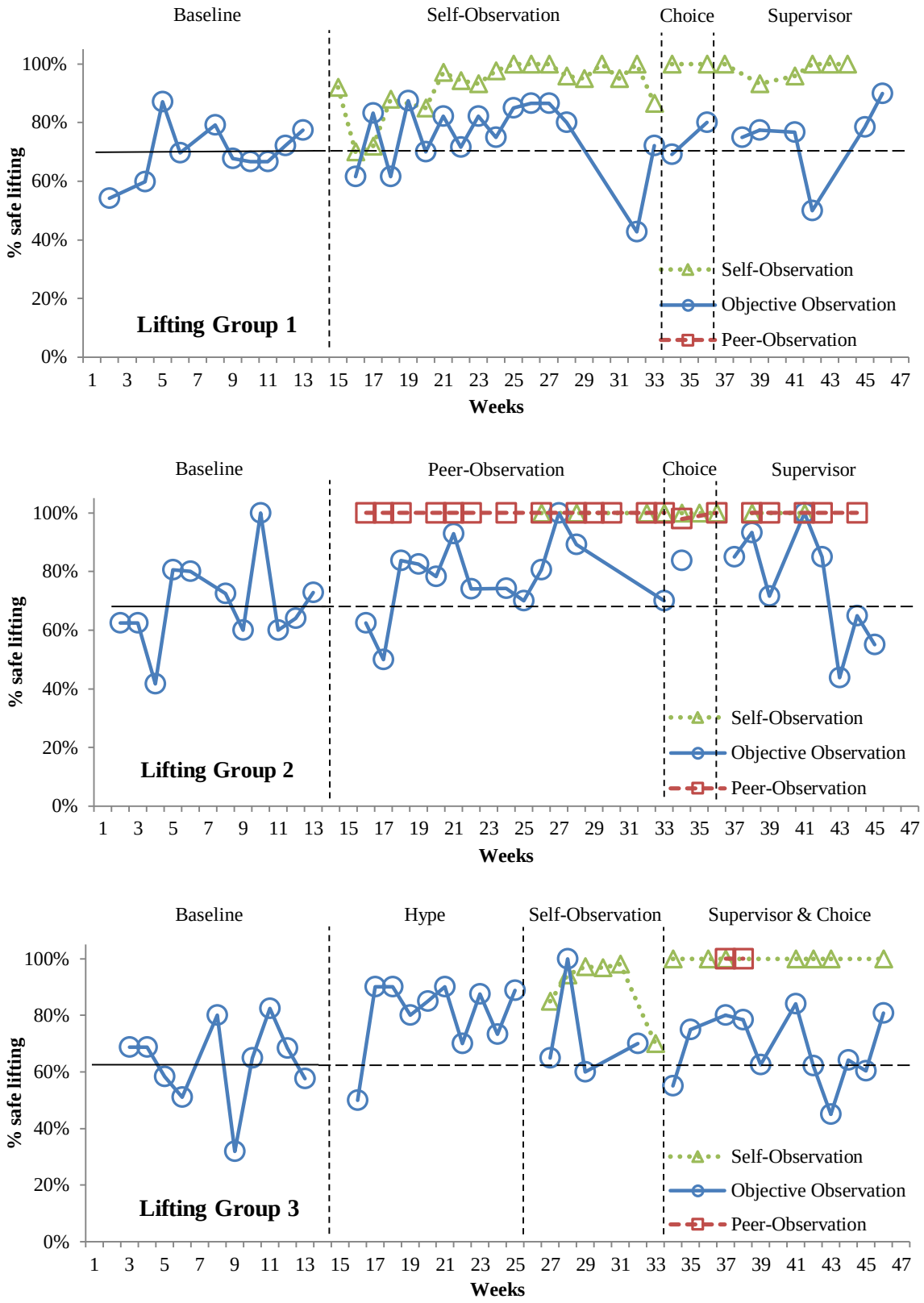


Figure 3: Line Graphs for Lifting Across Groups

RA and Employee Observations on Lifting Criteria: (No) Twist Safety Performance

As sub criteria only had the ratings of safe or unsafe, the graphs are characterized by more fluctuations in performance. The twist line graph of Group 1, shown in the top frame of Figure 4, shows increasing performance of 24% with an overlap between the self-observation condition and a decrease after winter break that lasts throughout the choice condition. Twist performance recovered to initial self-observations levels during the supervisor condition. Initially, self-observations showed some correspondence with the data measured by the RAs, but throughout the self-observations condition, self-reported data moved towards 100% safe. The middle frame of Figure 4 shows the performance for Group 2. Not twisting increased by 32% during peer-observation condition, with a slight increase during choice condition to 100% safety performance. The final supervisor condition continued to show high levels with 29% improvement compared to baseline. The peer-observations from Group 2 all reported 100% safety performance. The line graph of Group 3, shown in the lower frame of Figure 4, shows increased performance by 16% during hype condition, which deteriorates a few weeks after introduction of self-observation condition. The twist performance during the supervisor condition was slightly above baseline with a 4% increase. Steady reports of self- and peer-performance at 100% for Group 3 demonstrated poor correspondence with RA observation data.

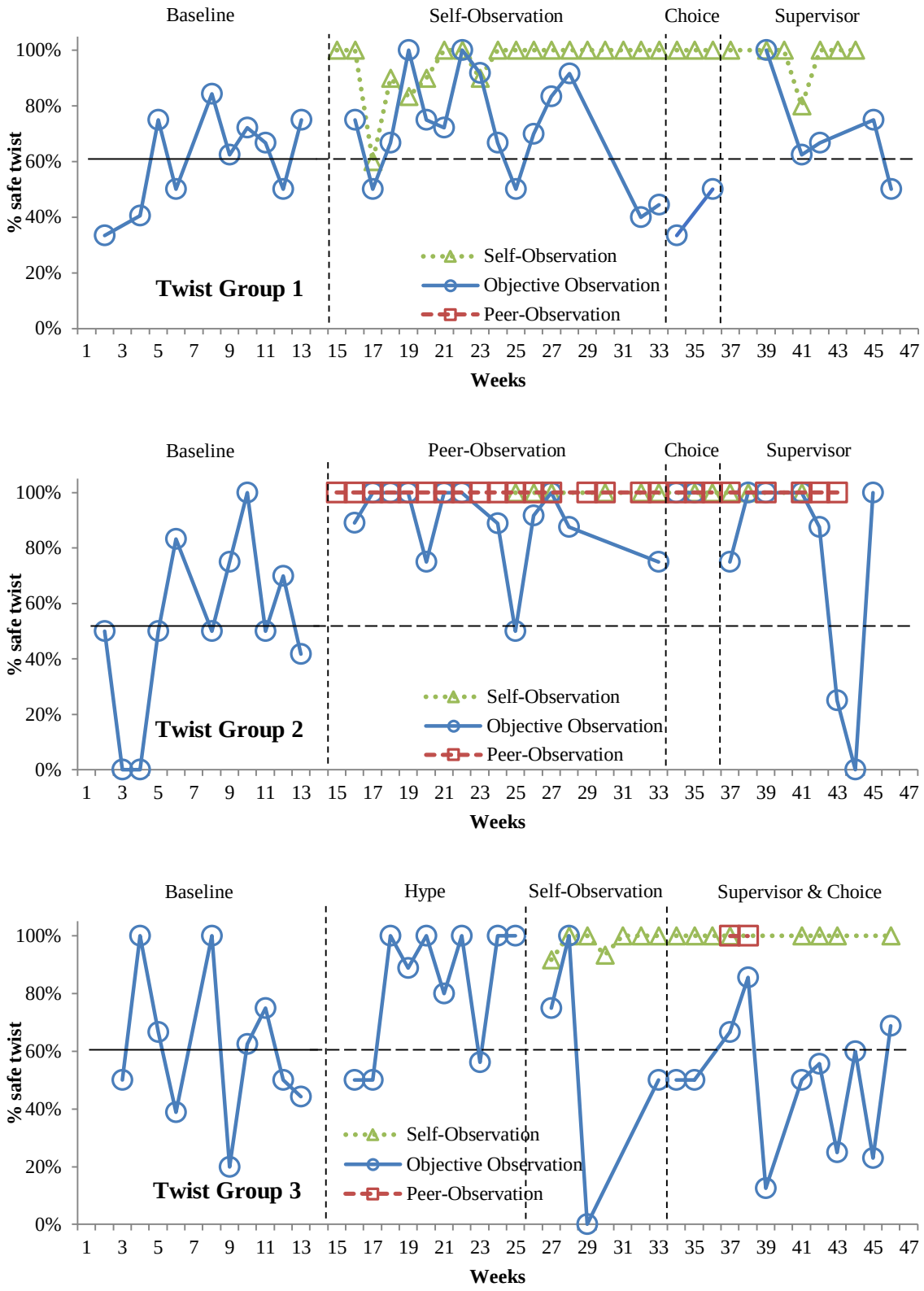


Figure 4: Line Graphs for Twist (Lifting Sub Criterion) Across all Groups

Employee Compliance, Preference of Observations and Number of Observations.

Employee compliance with observation goals. Figure 5 shows that the number of observations increased in the beginning phases of the intervention for all groups. Overall, Group 1 had a compliance of 77% while Group 2 and 3 had an average compliance of 61%. While Group 1 maintained the highest levels of observations, there was a marked reduction in the number of observations completed by Group 1 in the remaining phases. As employees were able to complete more than two observations per week, levels above 100% were possible. In the middle of phase 5, the union announced that observations were not mandatory and names were not required, which led to a reduction in total number of observations. The graphs show little effect, because around that time the weekly goal of observations was reduced by 50% and in the first few weeks many employees continued to do two observations per week.

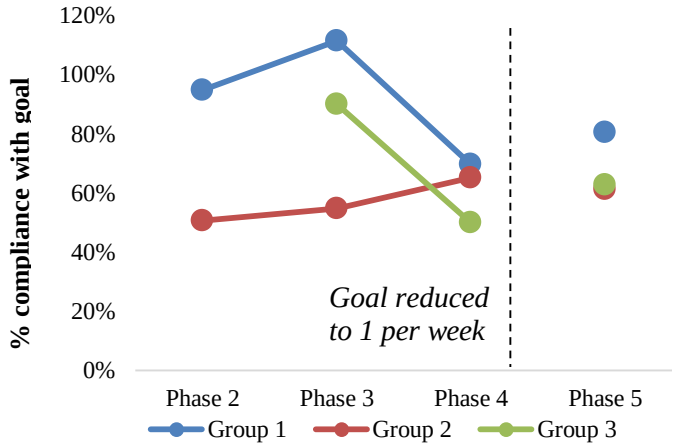


Figure 5: Employee Checklist Compliance Across Phases

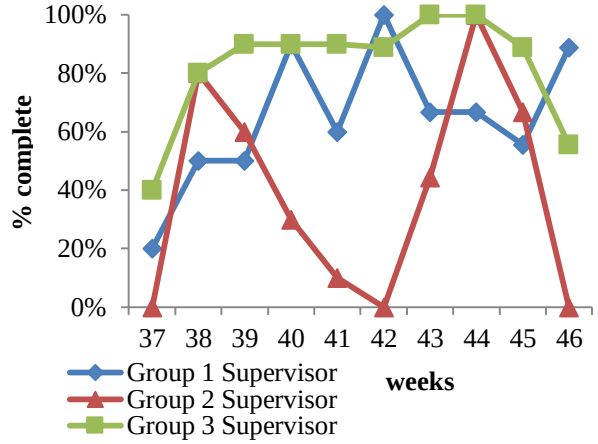


Figure 6: Supervisor's Checklist Compliance

When employees were surveyed for the ideal number of observations per month, week or day, the mean number selected per day was 0.7, per week was 1.2 and per month was 2.8. However, adjusting the weekly and daily responses, the ideal number yielded inconsistent results with 8.4 observations per months, which approximately yields a goal of 2 per week. Supervisors' compliance with the supervisor checklist, as seen in Figure 6, increased steadily in the beginning for Groups 1 and 3 with a slight decrease for the supervisor of Group 3 towards the final weeks. The compliance of Group 2 was fluctuating across the weeks, going along with varying supervisors throughout this period.

Table 2: Number of Observations

Research Assistant Observations			
	Lifting	877	
	Vacuuming	927	
	Mopping	354	
	TOTAL	**2,158**	
TOTAL Employee Observations		**2,558**	
		Self-Observations	**Peer-Observations**
	Lifting	520	266
	Vacuuming	576	301
	Mopping	199	84
	Restroom	206	61
	Ice	96	25
	Ladder	213	11
	TOTAL	**1,810**	**748**
Supervisor Observations			
	Group 1 Supervisor	134	
	Group 2 Supervisor	110	
	Group 3 Supervisor	192	
	TOTAL	**436**	

Number of observations. Table 2 shows that the RAs collected a total of 2,158 observations over the entire study. Adequate data samples for visual analysis via line graphs were only collected for lifting and vacuuming behaviors. IOA was 95% over the course of the study with IOA data collected for 17% of all RA observations. RAs never observed employees or supervisors conducting any type of observation.

Most of the 2,558 employee checklists that were turned in were vacuuming and lifting checklists. As seen in Figure 7, only 23% of all peer-observations were not lifting or vacuuming, while self-observations had about twice as many (39%) checklists for mopping, restroom, ladder, and walking on ice. Lower scores on mopping, ice and restroom checklists may stem from a later introduction in Phase 3. Employees reported rarely using the ladder and setting it up only to complete the checklist to practice the safe ladder practices.

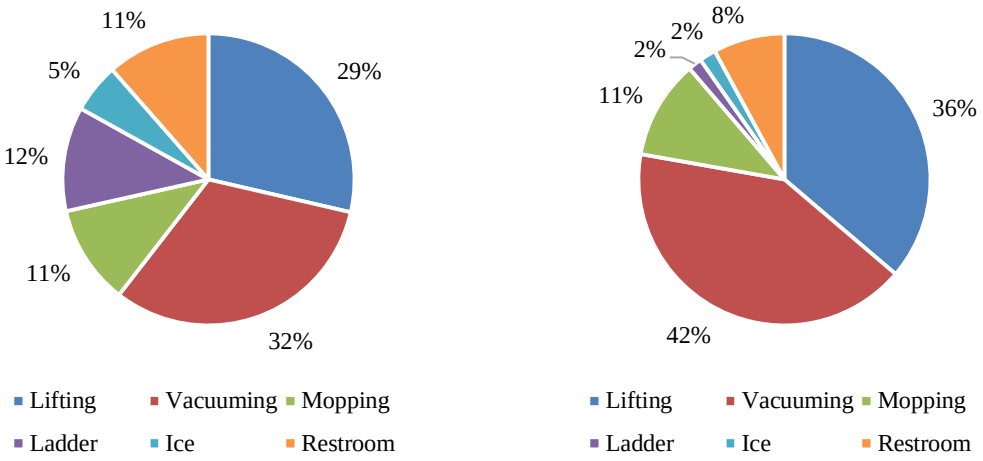


Figure 7: Behavior Checklists Across Observation Type. Left: Self-Observation Checklist by Behavior. Right: Peer-Observation Checklist by Behavior.

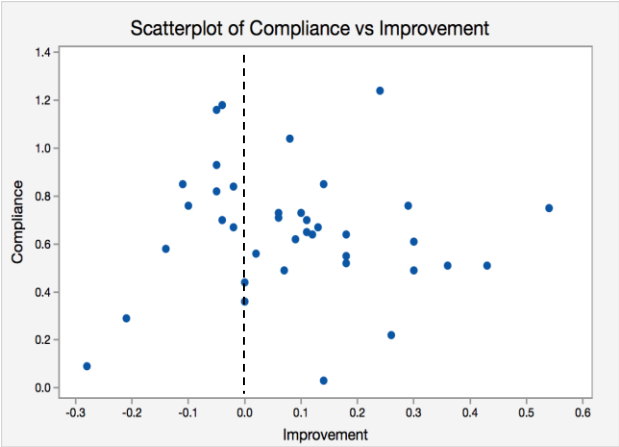


Figure 8: Scatterplot of Compliance and Improvement for all Groups and Overall Safety Performance

Relationship between compliance and improvement. The correlational analysis between compliance with the goal of the number of observations completed and improvement in safety performance revealed no positive significant correlations. The visual analysis of scatterplots as seen in Figure 8, revealed no relationship between the two variables. Appendix I shows that compliance with the goal of observations had either no effect or weak negative effect on the overall improvement during the BBS intervention.

Preference of observation type. In the choice condition, employees chose 75% self-observations and 25% peer-observations. Notably, Group 1, which started in self-observation, continued to almost exclusively use self-observations (99%). Group 2 started using self-

observations after the start of the choice condition, in which 31% were self-observations. Group 3 which started in self-observations, continued to mostly use self-observations, but also completed 22% peer-observation checklists. The preference of observation type was also assessed in the post survey. As seen in Figure 9, 78% preferred self-observation over peer-observation, and 73% of all filled in checklists in the choice condition were self-observation. When asked about the effectiveness of each observation type, 62% believed self-observations to be more effective. The lifting checklist was rated as most helpful, followed by the ladder and the walking on ice checklists.

Compliance with the assigned observation type was 100% in the self-observation condition (Groups 1 and 3). The peer-observation group achieved compliance of 95%. Peer-observation checklists were considered self-observation, when either the employee name was left blank or a self-checklist was turned in. Vice versa, a self-checklist with more than 1 name would have been rated as a peer-observation.

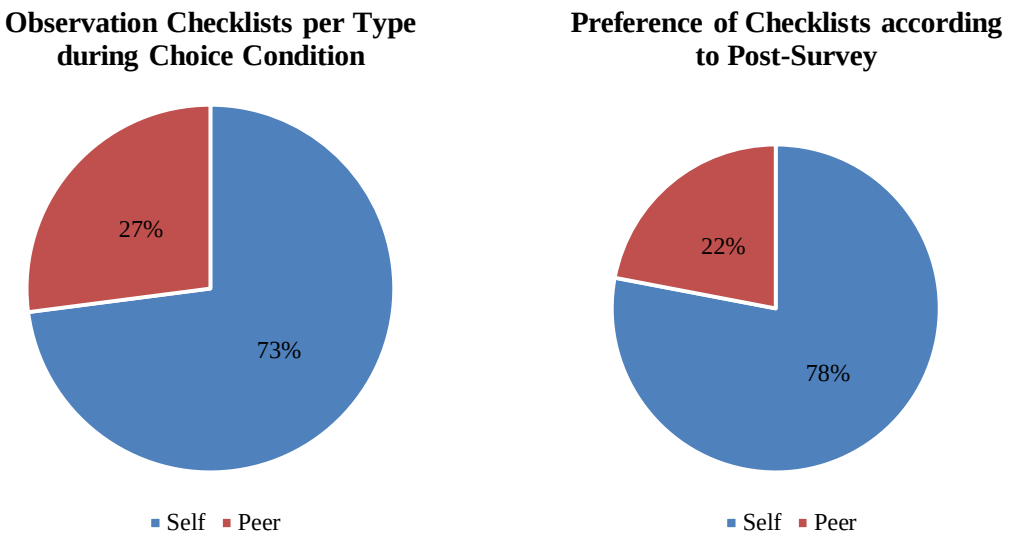


Figure 9: Observation Type Preferences by Checklist and Post-Survey. Left: Observation Checklists per Type During Choice Condition. Right: Preference of Checklists According to Post-Survey

Comparison of Independent Variables

Observation type. The independent variable of self-observations improved lifting performance by 11% compared to baseline and vacuuming by 15%. Sub criteria such as base (12%), twist (15%) and snake (18%), as well as cord (12%) had the most improvements in this condition. The remaining sub criteria varied between 2% and 8%. On average, 64% of the employees improved their lifting performance compared to baseline performance and 68% improved their vacuuming performance. The independent variable of peer-observations improved lifting performance by 10% and vacuuming performance by 12% compared to baseline condition. Sub criterion twist (29%) was the most improved in this condition with the remaining criteria varying from -3% to 11% performance change. Individual improvements in this condition were seen for 67% regarding lifting performance and 38% for vacuuming performance. The independent variable of choice between observations improved lifting performance by 6% and vacuuming performance by 11% compared to baseline. Sub criteria such as base (11%), twist (11%), snake (15%), and unplug (15%) had the most improvements in this condition. The remaining criteria's performance changed between -2% and 7%. Individual employees' performance improved by 50% for lifting and 45% for vacuuming.

Supervisor intervention. The supervisor intervention yielded safety improvements of 14% for lifting and 11% for vacuuming. The most improved sub criteria were the lifting criteria twist (20%) and lift (14%). Overall, employees reported more interactions and satisfaction with their respective supervisors compared to baseline. Helpfulness and availability increased by 6%, active support by 5% and overall happiness by 7%. About 68% of the employees had better lifting performance than during baseline condition and 71% had better vacuuming performance.

The supervisor of Group 1, who also was a safety committee member, had an overall checklist compliance of 65%. Daily check-ins in their respective buildings were reported by 73% of their employees, 77% reported receiving safety feedback from their supervisor and 45%

reported help with filling out the checklist. Overall, 5% reported that the supervisor did not care about safety. The supervisor intervention resulted in improvements of 14% for lifting and 22% for vacuuming. The vacuuming criteria snake (40%) and lifting criteria twist (26%) showed marked improvements after a decrease in the previous choice condition. No performance decreases were observed with the remaining improvements compared to baseline ranging from 0% to 22%.

Overall checklist compliance of Group 2's supervisors was 39%. Varying supervisors did not correlate with changes in compliance. Daily check-ins in their respective buildings were reported by 75% of their employees, 54% reported receiving safety feedback from their supervisor, and 29% reported help with filling out the checklist. Overall, 21% reported that the supervisor did not care about safety. Group 2 improved their vacuuming by 5% and their lifting performance by 14% during the supervisor condition. The most improvement of 29% was seen for the lifting criterion twist. The remaining sub criteria ranged between 1% and 19% improvement.

According to the employee survey, Group 3 supervisor reportedly checked in daily with 38% of the employees while maintaining 82% compliance with weekly checklists. Feedback and help with filling out the checklist from this supervisor was reportedly received by 52% of the employees. Overall, 19% reported in the survey that their supervisor did not care about safety. The group improved their lifting performance by 12% and their vacuuming performance by 13% during the supervisor condition. The lifting criterion upper body improved by 23% and the criterion lift by 18% compared to baseline. The remaining sub criteria ranged between 1% and 14% improvement.

Hype. In the hype condition, Group 3 improved by 21% for lifting, and 85% of the employees improved compared to baseline, which was the most improved condition. Vacuuming showed moderate change with 9% improvement. Considering all first conditions as part of hype

led to improvements of 71% for lifting and 47% for vacuuming regardless of the specific condition.

Safety committee. As seen in Figure 10, the observable members of the safety committee showed a positive level change in overall safety performance during the treatment phases. Overall, lifting performance increased by 30% and vacuuming performance by 31%. The initial phase after introduction led to the most changes, with safety performance slowly decreasing for lifting while vacuuming remained stable. Discrepancies between RA and employee reported performance was 16% for lifting, which was 5% to 13% less than the average discrepancy for the treatment groups. Vacuuming discrepancy was at 20%, which was 5% less than the Group 1 and 2 average discrepancy, while Group 3 had only 14% average vacuuming discrepancy. The safety committee's checklists were reporting unsafe conditions and behaviors 31% of the time, which made the safety committee members the top reporters of unsafe conditions. The safety committee was accountable for four out of the ten peer-observations that reported concerns.

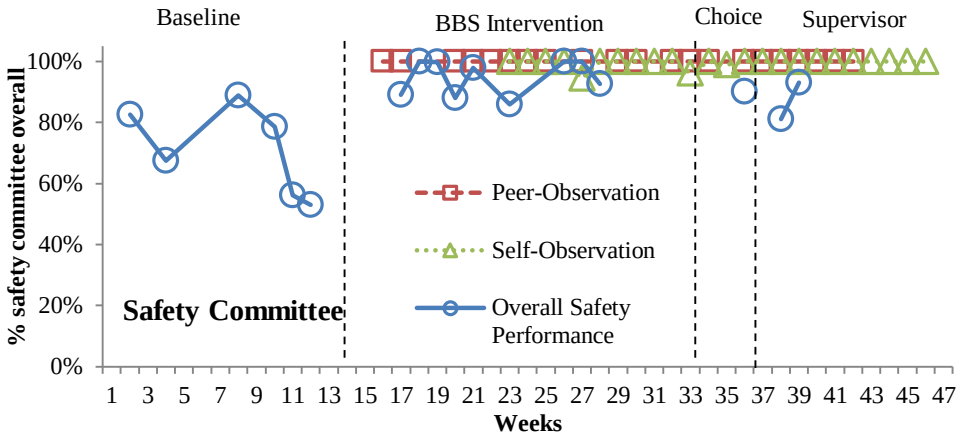


Figure 10: Overall Safety Committee Data Across Interventions

Incident Numbers

The incident numbers, as shown in Figure 11, declined throughout the treatment phase during the fall 2014 and the spring of 2015. It should be noted that the last two custodial groups received BSS training mid spring 2015. The average number of reported incidents for fall and

spring trimester was 19, of which 9 would be OSHA recordable injuries. A total of 20 incidents were reported during treatment, of which 7 were OSHA recordable injuries. Of these injuries, only 7 (2 OSHA recordable injuries) occurred with people who had already been exposed to the BBS program.

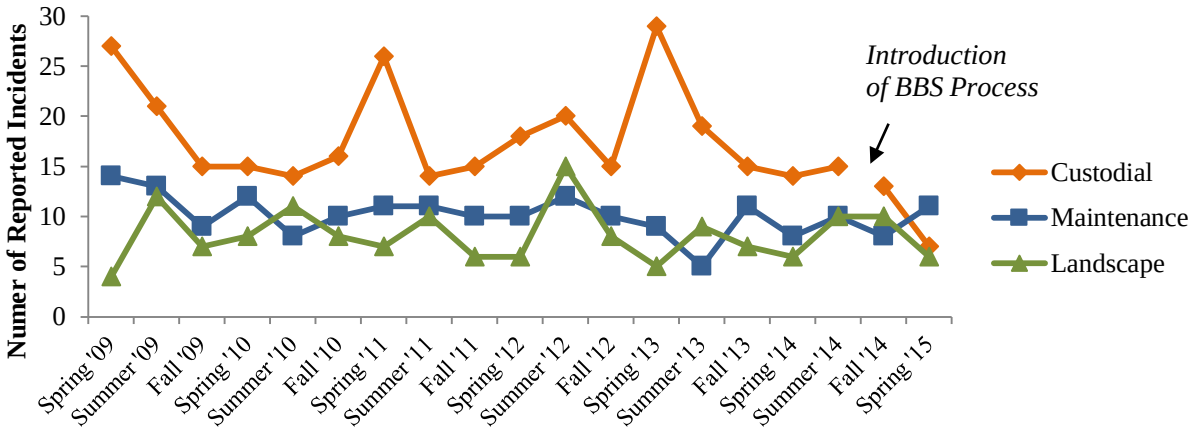


Figure 11: Number of all Reported Incidents in Comparison 2009 – 2015

As seen in Figure 12, overall, OSHA recordable injuries declined in the spring trimester of 2014 by 84%, and they declined by another 67% in 2015. There was no notable change in fall trimesters.

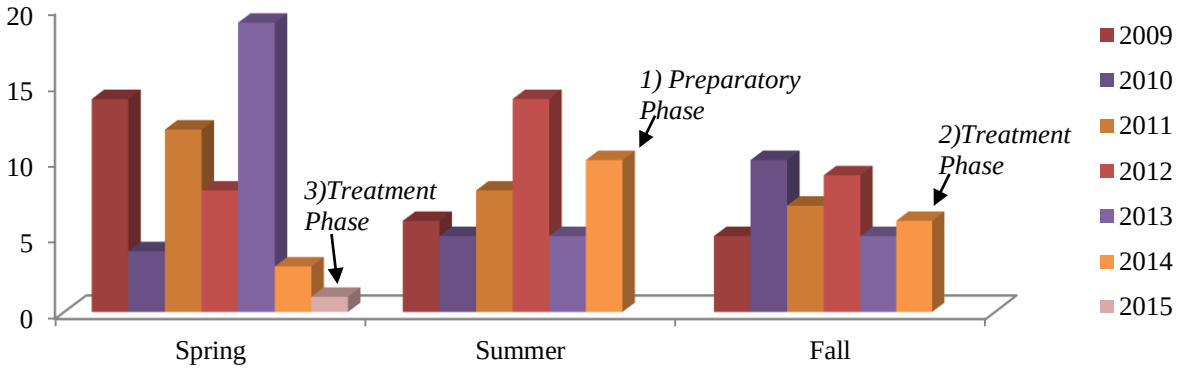


Figure 12: Recordable Incidents by Season for Custodial OSHA Recordables

Overall, restricted days and days away from work decreased in 2012 and continued a downward trend throughout the BBS program. Incident rates reduced to an all-time low in spring 2014, as can be seen in Figure 13, which breaks down incident rates in trimesters for all three

sites. Maintenance showed steady incident rates with no change for fall 2014, while Landscape showed reduction in incidents which remained consistent with the previous spring trimester.

Table 3: Overview of Different Safety Metrics in Custodial Unit

	2009	2010	2011	2012	2013	2014	2015*
Days Away	227	556	556	230	162	46	0
Days Restricted	444	321	938	267	236	198	7
Total No of Incidents	63	45	55	54	62	42	12
No OSHA Recordable	25	19	27	31	29	19	1
Incident Rate for OSHA	22.7	15.9	21.2	23.5	24.5	15.0	0.7

* 2015 data only for spring trimester

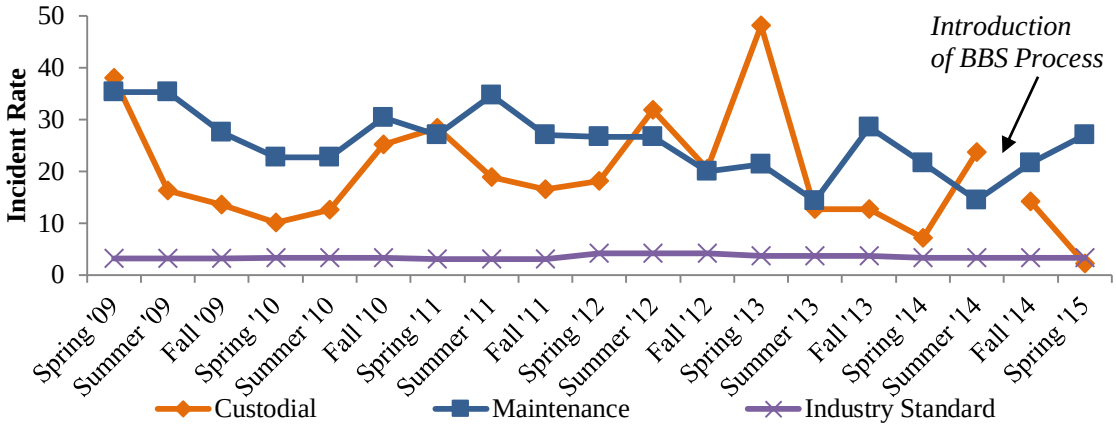


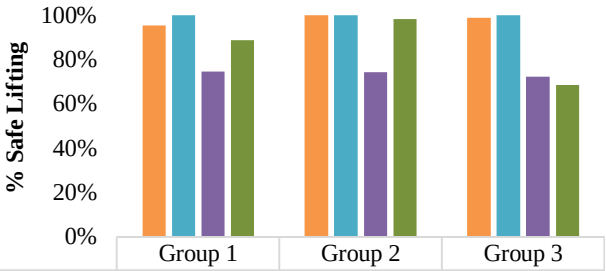
Figure 13: Incident Rates in Comparison from 2009 – 2015

Comparison of Discrepancies in Reporting Across Data Sources

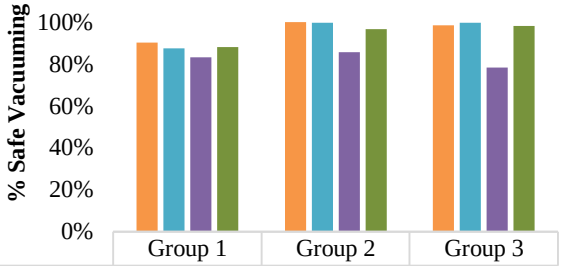
Three different data sources reported on safety performance during the treatment phase: RA, supervisors and employees. The data sources varied vastly in regards to correspondence with the observations that were collected by RAs. Supervisor observations had better correspondence while employee observations tended to provide inflated reports of their safety performance. Overall, Group1 had the best correspondence with RA observations for both supervisor observations and employee observations as seen in Figure 14.

The discrepancy between RA observations and Group 1 supervisor was 14% for lifting and 5% for vacuuming. Notably, Group 3 supervisor's discrepancy for lifting performance was only 3%, but this did not transfer to vacuuming observations, which yielded a discrepancy of

20%. When looking at the calculation of the discrepancy measure, it becomes apparent that due mostly to 100% safe employee observations, the discrepancy solely represented the difference between the objective RA observations and 100%. However, Group 1 employees, which reported 80% of their concerns during the first condition, had a peer-observation discrepancy of 6% and a self-observation discrepancy of 8% for safe vacuuming. This represents the closest correspondence of employee observations with RA observations. An analysis of the criteria for employee observations showed that criterion lift yielded the largest discrepancy (37% to 69%) across all groups and the closest correspondence was found for unplug (0% to 17%).



	Group 1	Group 2	Group 3
Self Report	95.44%	100.00%	98.88%
Peer Group	100.00%	99.84%	100.00%
Objective Observation	74.66%	74.36%	72.21%
Supervisor	88.67%	98.30%	68.57%



	Group 1	Group 2	Group 3
Self Report	90.19%	100.00%	98.44%
Peer Group	87.50%	99.83%	99.78%
Objective Observation	83.18%	85.55%	78.22%
Supervisor	88.00%	96.60%	98.21%

Figure 14: Comparison of Different Data Sources Across Behaviors

Overall, only 247 (10%) self-observation checklists and 10 (0.01%) peer-observation checklists reported unsafe behaviors or conditions. Average discrepancy for self-observations was 17% and 16% for peer-observations with detailed criterion discrepancies listed in Appendix I. In

the post-treatment survey, about 90% of the employees reported being safe at all times. In addition, 30% of the employees admitted to filling out checklists without an observation. An analysis for employees, which had completed at least one observation with a concern, showed that overall safety improvements were correlated to less compliance (r= -0.432; p=0.039). Compliance with the goal of safety observations was positively correlated with higher discrepancy (r= 0.266; p=0.116). Thus, according to the correlations, the more employees improved, the less discrepancy between RA observations and their own existed (r= -0.347; p=0.105). Complete tables with Pearson's rho and p-values can be found in the Appendix I.

Discussion

The present study showed moderate effects of BBS on lifting and vacuuming safety performance and incident reductions after the complete introduction of the BBS process. The question arises which independent variable was most successful and what role variables, such as compliance with goal of observations, accuracy of observations, or other accompanying variables played in producing the changes. Other possible influencing factors in a BBS process, such as the possibility of a ceiling effect on possible safety performance or under-reporting of incidents will also be discussed.

Research has shown the effect of BBS in a variety of industries, including those with unionized employees, but analysis of the efficacy of specific components in a BBS program is often lacking (e.g. Cooper, 2006, Lebbon et al., 2012). This study provides support for the effectiveness of BBS in regards to safety improvements, and showed improvements comparable to the 12% improvement reported by Olson and Austin (2001), which is the only other study that collected data surreptitiously by RAs in an applied setting.

Effects of Different Components in a BBS Program

The comparison of the different types of observations and components revealed that the specific type had little effect on behavior change. Instead, the first condition across all groups

resulted in the largest overall safety improvement. Group 3 did not receive any BBS training in this phase, but still showed a marked behavior change for lifting, resulting in the characterization of this phase as 'hype' condition, because many features of the program were shared by word of mouth or visible on an announcement board. One of the reasons for this behavior change may be attributed to buy-in, hype or even novelty. This interpretation for behavior changes is supported by the following studies. McSween and Matthews (2001) highlighted the importance of involvement of employees in the design process as this is one way to build buy-in and long-term sustainability of a process, especially since employees tend to imitate their colleagues' safe behaviors (Olson, Grosshuesch, Schmidt, Gray, & Wipfli, 2009). Lebbon et al. (2012) brought up the importance of open and transparent communication with the union to ensure continued engagement and collaboration. Support for the lack of importance of safety observations comes from the performance of the safety committee members who volunteered and were actively engaged in supporting and building the process. Their safety performance increased by roughly 30% which implies the possibilities of an effective BBS process. A decline in behavior change and participation throughout the study in general, that coincided with declining safety performance, indicate challenges with the focus on buy-in, as the general effect of hype or buy-in may lose its novelty effect over time. In this context, buy-in is understood as seeing the need for a change in behavior rather than the behavior change itself. The motivating operation leads to people being willing to invest the extra effort to behave safely. However, even this interpretation may require antecedents (reminders to work safely) or refreshers to maintain the motivating variable, and consequences to maintain the BBS approach for example against competing contingencies. At this point observations may be a great tool to achieve the maintenance of the motivating operation and to achieve safe-behavior improvements.

As incident numbers decreased throughout the study, a behavior change can be deduced if one follows the logic that unsafe behaviors lead to incidents. Even though the majority of the behavior change was observed in the first trimester, the incident numbers did not decrease until

the introduction to the complete site in the second trimester. This raises the question whether or not buy-in to behavior change existed. For example, the change in incidents may come from change in behaviors that were not observed by the RAs. The hypothesis that the ultimate impact of BBS is seen in incident reductions rather than observed behavior change comes from the data presented in Cooper's (2009) meta-analysis of BBS process design factors. Almost all the variables (e.g. type of observation) in that study showed a larger effect on injury reductions than with behavior change. In the few reversed cases, where the behavior change was greater than the incident reduction, the difference in effect was minor. As evidenced by the decrease in both total reports and OSHA recordables, there is also the possibility that employees stopped reporting incidents. In this study, no incentives were provided that may have encouraged underreporting. As serious injuries cannot be easily hidden, the accelerated decrease in days away from work and restricted days indicates that an actual behavior change is the more likely explanation.

The comparison of peer- and self-observations as well as a choice condition was intended to help develop recommendations regarding the effectiveness of the observation types. The choice condition may have yielded lower results because of the decline in participation and safety performance after the hype wore off rather than an effect of the choice condition. The choice condition demonstrated that each group continued to use the type of checklist assigned in the initial condition and after that new checklists were introduced. One possible side effect of adding these new checklists is that less attention was paid to lifting and vacuuming. While no marked differences between observations were detected for lifting behavior, a more pronounced difference existed for vacuuming which showed only 8% improvement for Group 2 and 25% for Group 1 and 18% for Group 3. Even though this makes the self-observations the most successful condition overall, little differences can be found. Thus, the recommendation is to leave the decision of the observation type up to the environmental conditions and/or preference of employees as this decision may help create buy-in.

Except for the initial phase, the supervisor intervention was the most effective in that it restored safety levels that had previously decreased and also yielded more stable improvements in employee's safety performance. Thus, the study's data supports Cook and McSween (2000) and Zohar's (2003) research in their findings of marked behavior change due to supervisor observations. This effect was especially prevalent in Group 1, which showed 15% lifting and 22% vacuuming improvement compared to baseline. Possible explanations include the high percentage of employees receiving safety feedback (77%) combined with Group 1 supervisor's interest in safety. Only Group 1 supervisor was a safety committee member. As the employees in the study's setting were spread out and daily contact on the job site was almost impossible, one can speculate that a different setting, which allows for higher contact rates, might produce even higher improvement in safety performance. This is in line with Cooper's (2009) finding that contact rates of more than once a week make BBS observations most effective.

The question, though, is what makes supervisor observations more effective in changing behaviors? One of the possible answers may be in the role of a supervisor, who can naturally provide consequences to employee's behaviors beyond the social contingencies used during employee observations. In addition, safety observations can be integrated into a supervisor's task list, and because checks and balances are typically already in place, this observation may be more easily and frequently maintained. It is possible that the attention and possible consequences provided by the supervisor established a motivating operation for the employees to behave safely. In a typical employee-observation process, trust, anonymity, and punishment-free reporting are core values, which combined with peer feedback, posting of observation data, and social contingencies are assumed to provide the framework of consequences and motivating operations. (McSween T. E., 2003; McSween & Matthews, 2001). One advantage of the supervisor approach is that a supervisor observation can easily become an embedded task in their regular workload. The challenge, however, is to avoid punishment for reporting of unsafe behaviors, to avoid a culture of negative reinforcement for behaving safely, and to discourage the employees' buy-in or

role of participating in the process. Thus, balancing the supervisor's focus on safe behaviors by maintaining a positive approach that reinforces safe behavior and reporting of unsafe occurrences, while still empowering employees and even continuing to integrate employee observations may be a recipe for BBS success. Other industries such as aviation, have shown that a consequence-based system combined with a "get out of jail free card" for reporting unsafe works is effective, and based on incident numbers in aviation, the approach works (Aviation Safety Reporting System; Boeing). Thus, it seems that maybe consequences are important while still being able to lead to trust in the system through experiencing consistent and rule based consequences that promote safety.

The present data showed either no relationship or a negative relationship between participation and safety improvements for the employees. Thus, the more observation checklists an employee did, the less safety improvements were observed. This seems to support a claim for quality data rather than the number of observations and possibly the importance of buy-in to the BBS process. Similarly, Cooper (2006) found that frequency of observations does not matter. However, studies such as Lebbon (2012) and Bogard, Ludwig, Staats and Kretschmer (2015), found that performing checklists leads to fewer incidents. On second glance though, the data sets from these studies span several years, which allows the hypothesis that this relationship develops over a longer time and cannot be found during a relative short span of time (Bogard, Ludwig, Staats, & Kretschmer, 2015). While the length of time may be one component, the quality of the data and the mandatory observation process also allow the interpretation that the quality of observations may be more important than pushing goals and participation in itself by making observation mandatory. Comparing the mostly perfect reports of safety performance with the data collected by the RAs, indicates that these reports were likely not accurate. Thus, McSween's and Matthew's (2001) call for a values based safety culture that allows that supports reporting of unsafe conditions and may be more suitable, especially considering the data in the present study that suggest that lower a discrepancy was correlated with higher improvements.

Discrepancy: Differences Across Observation Types and Interpretations

Self-observations involve a higher workload, because observers need to keep track of their task while performing it and then also need to remember later in detail how safely it was performed in order to fill out the observation checklist (Olson, Hahn, & Buckert, 2009). Thus, it is assumed that peer-observations would be more accurate. However, neither form of observation was found to correspond closely with the observations recorded by the RAs. Only self-observations showed, at least in the beginning, some correspondence with the data collected by RAs. Data from the initial phase for lifting in Group 1 indicate some correspondence between the data sources. This data confirm the peer-observation lab research that found no connection between accuracy and safety performance (Gravina, Austin, Schoedter, & Loewy, 2008; Alvero, Rost, & Austin, 2008). While the present study was unable to collect actual IOA with the employees, our measure of discrepancy between the data sources does compare actual data from an applied setting, in which employees had no reason to alter scores to meet any expectations of accuracy.

Another question is: What led to the decline in reporting of unsafe conditions and behaviors, or even prevented this from happening at all for peer-observations? There are several scenarios that may explain either the truthful reporting of safe conditions or the reasons for the discrepant perfect reports. One option is that checklists were not completed based on observations, but were made up by simply checking all safety boxes to meet participation goals. In the post-survey, about 30% of the employees admitted to filling out checklists without an observation, and looking at the number of perfect checklists, it is likely that the real number may be higher. Even though the RAs reported seeing the checklists on custodial carts, the probability of catching an observation was slim, considering employees could have performed observations at any time during the week. In addition, employees did report occasionally filling them out later in the break room, which would have been unobservable for the RAs.

A different explanation would be that behaviors were only correctly performed when the observation occurred because the employee was aware of the safety rules. In other words an observer reactivity effect may have occurred only when observations took place. In this case, actual accuracy would be high and the discrepancy scores would rather report the lack of transfer. Another third scenario is that the employees did not trust the statement that observations and the recorded information is discipline-free, even though it was mentioned countless times by management and the director. This interpretation is supported by the effect of diminishing checklists at the union intervention. Almost all safety committee members reported the union's concerns about anonymity, as well as the spreading of (false) rumors about the loss of workman's compensation when admitting to unsafe behaviors.

Similarly, possible avoidance of negative reactions from peers might explain some of the difference between the perfect safety performance with peer-observations and the slightly more frequent reporting of unsafe behavior with self-observations. In self-observations, the observers would only have to admit to themselves that they engaged in unsafe behavior. Group 1's occasional recording of unsafe behavior also may be explained by the supervisor's direct involvement with the safety committee. The last possibility would be that the employees could not accurately discriminate their own or their peer's safety performance. Similarly to Alvero et al. (2008), we wondered if observation and evaluation are part of a different repertoire than performing the safe work behavior.

In order to test which of the many possible solutions has merit, the main researcher initiated a further investigation to explore peer-observations in the field. A manager and the main researcher visited the employees at their work site and prompted them to perform a lift and fill out a safety checklist. When prompted by the manager, the employees said their lifting had improved thanks to the checklists and were willing to demonstrate how they would perform an observation. The three selected employees complied and performed a safe lift, which was rated as 100% safe by their respective peer. However, the main researcher's observations found concerns

with respect to lift for two individuals and twist for one individual, while the remaining items were in agreement. RA observations showed varying concerns across most lifting items for all employees. Thus, the peer-observation led to improvements in four out of five criteria for the individuals while one item that was reported as safe remained a safety concern. Follow up did not clearly reveal if they were unwilling to admit errors or if there was a knowledge gap.

When comparing the discrepancies in reporting between the different data sources, supervisors had less discrepancy than the employees. In addition, employees reported that supervisors indeed recorded their behavior with them and that supervisors discussed safety topics while completing their checklists. Group 1 and 3 supervisors showed lower discrepancy and higher improvements. Yet, all groups continued to improve during the supervisor condition, which might indicate that dedicated and truthful supervisor behavior and observation may lead to enhanced behavior change.

The lack of difference in discrepancy between Group 1's self-observation (17% overall, 13% in phase 1) and Group 2's peer-observation discrepancy (18%) is noteworthy considering that Group 1 had about 17% reports with unsafe behavior compared to Group 2 with almost none. The employees, who reported at least one safety concern, still had a discrepancy of 16%. Thus, even admittance of unsafe behavior does not seem to be an indicator of improved discrepancy with the RA observations. However, even in Group 1 the correspondence decreased over time, and particularly for lifting this coincided with a drop in safety performance. Gravina et al. (2008) reported accuracy levels of between 24% and 58% and Olson and Austin (2001) reported accuracy between 2% to 71% across participants. In comparison to these studies, the levels of discrepancy (16% discrepancy = 84% accuracy) in this study compares very favorably. At the same time Alvero et al. (2008) showed that at least in laboratories peer-observations can yield accuracy levels of up to 100% (range: 76.7% to 100%).

However, the question remains whether the differences between the present study and the previous studies result from better accuracy in the present study or simply higher levels of

performance than in the compared studies. If employees report mostly 100% safe behaviors, the discrepancy to RA observations merely represents the potential for improvement. This consideration may have been overlooked in past research and the variable of performance levels and its effect on accuracy may have been underestimated, especially when considering that employees tend to overestimate their own performance (Gravina, Austin, Schoedter, & Loewy, 2008; Olson & Austin, 2001).

Limitations

In an applied study, there are many sources for limitations. First, RAs needed to change shift assignments in order to avoid participant's suspicion of being observed. It also seemed that most of the tasks were completed by newer employees, and as employees gained tenure they gave their tasks to the newer employees. Thus, RAs were also more likely to find new employees performing target behaviors, while seasoned employees were often found inactive, which made it hard to collect consistent data on many employees. Second, there were anecdotal reports of older employees being unable to perform proper safety procedures, e.g. bending knees while lifting, may have limited safe behavior improvements.

Third, the definitions of the safe behaviors pose another source of limitations for this study with regards to accuracy. The definition of safe grip for the lifting behavior was adjusted mid-baseline after a discussion with the physical therapist in order to focus only on the outcome of having a safe grip on the load. The data collected on safe grip until week 5 were discarded. Fourth, the criterion for motion was excluded from the vacuuming category due to disagreements with the employees, which reflected a lack of buy-in for the correct safe behavior. In this context, the possibility of the wrong focus of behaviors must be considered as well. Fifth, it is also possible that employees also changed behaviors other than the ones targeted by the research assistant observations (e.g. changes in walking on ice) or possibly only in certain situations when a lift is considered potentially dangerous, e.g. lift of a heavy box.

Sixth, the union's concerns about the checklists being mandatory and identifiable led to a sharp decrease in participation, and thus, may have changed the results of the supervisor condition. The concerns did not come from the treatment groups. This union announcement went along with misinformation about checklists being able to be used against an employee's claim for workman's compensation in the case of an injury. While the specific language referred to observations being 'strongly encouraged', the goal was to imply mandatory, but refocus attention to the goal and underlying concept of how BBS works.

Future Research

This study is the first of its kind in many ways. Only one study previously employed surreptitious data collection in an applied setting and it solely focused on self-observations (Olson & Austin, 2001). This study obtained similar results as Olson and Austin (2001) who reported moderate behavior change and varying accuracy scores. These findings challenge the assumptions that behavior change is produced by observations, and that change in target behavior produce the reduction in incidents and injuries. More applied research is needed to further explore how or which components of the BBS package are actually important. The present study and Olson and Austin's (Olson & Austin, 2001) studies indicate that observations may not be the core of BBS after all. Likely "buy-in" or "hype", combined with supervisor observations (and the provided consequences), may be more critical for behavior changes and incident reduction. As lab studies reach their limitation when trying to emulate such complex behavioral environments, the call for future research is directed at applied studies, especially considering that the present study further shows that the observer effect may not be as strong in applied settings (Alvero, Rost, & Austin, 2008; Gravina, Austin, Schoedter, & Loewy, 2008; Olson & Austin, 2001).

In addition, the perfect employee observation scores observed in this study raised many questions and revealed that no other articles had published the percentage safe reported by self- and peer-observations. Thus, it is possible that other studies decided to not report the employees'

reports due to the observation data likely not being credible. McSween (2003) also never showed employee data on percentage safe, although he does emphasize the importance of introducing the concept of IOA to employees. Future research and publications should focus on providing a complete picture of actual results with a BBS programs and how accuracy and truthfulness in reporting can be achieved.

One of the suggested solutions that might be worth further exploration is the concept of quality over quantity. As the data show, accuracy of reporting may not have the hypothesized effects on safety performance, but without qualitative data that accurately report on safe behavior and conditions, a BBS program cannot effectively improve these. The supervisor observations produced better results in regards to discrepancy and their completion may be incorporated into existing tasks. The feedback training in the present study followed McSween's (2003) suggestion, but could probably have been more regimented. However, too rigorous and artificially high standards are likely not sustainable in an applied setting. Thus, determining suitable standards of training on accurately identifying safe behaviors and meaningful participation in the BBS process that result in quality data is another area of research that requires more attention. Collecting accurate data through outside observers, as done in this study by the RAs, may produce accurate data, but feasibility and cost-effectiveness are possible challenges. Thus, the supervisor option may be able to accomplish both goals of quality data and behavior change. Supervisors can be trained and tasked with collecting data and even IOA can become part of the intervention. Depending on the environment, surveillance cameras may also present a suitable solution to obtain objective observations with less response effort than the surreptitious observations in this study. Secondly, observations may not be the driving variable underlying changes in incidents and injuries. The focus should rather be on safety interactions and introducing a safety reporting system that allows for resolutions of concerns in a discipline-free environment. This way, the consequences for qualitative observations would be in place and at the same time a trusting environment would empower employees to take charge of their own safety concerns. In addition,

the case study by Krause (1997) showed that supervisor observations, which were used to discuss IOA with employees, not only increased correspondence of the data sources, but also decreased incident rates (Alvero, Rost, & Austin, 2008).

Conclusion

The data show that BBS and observations effectively increased safe behavior, but unlike initially assumed, the type of observation may not matter. Rather, accompanying consequences and possibly safety interactions (e.g. feedback and positive reinforcement for talking about safety) that follow behaviors are what seem to affect the outcome of a BBS process. One advantage of this finding is that organizations can choose the most feasible type of observation for their environment and should rather focus on the system that builds in accurate observations. In addition, the findings about the importance of buy-in and the observation results indicate that meaningful safety interactions may be more important than the overall quantity of safety observations. Determining what factors ultimately lead to the highest safety performance and operationally defining variables such as buy-in, trust and consequences and how they possibly create a motivating operation are important steps to ensure replication of successful safety programs. More field studies are needed to verify these initial findings and hypotheses to confirm the best approach to ensure safety in the workplace.

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Appendix A

Human Subject Review Board Approval

WESTERN MICHIGAN UNIVERSITY

Human Subjects Institutional Review Board

Date: January 22, 2014

To: Ron Van Houten, Principal Investigator
Marlies Hagge, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: HSIRB Project Number 13-12-15

This letter will serve as confirmation that your research project titled "Comparison of the Effectiveness of Different Observation Methods and an Exploratory Analysis of the Importance of Accuracy of Various Observations on Safety Performance" has been **approved** under the **expedited** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may **only** be conducted exactly in the form it was approved. You must seek specific board approval for any changes in this project (e.g., ***you must request a post approval change to enroll subjects beyond the number stated in your application under "Number of subjects you want to complete the study***)." Failure to obtain approval for changes will result in a protocol deviation. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

Reapproval of the project is required if it extends beyond the termination date stated below.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: January 22, 2015

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Appendix B

Findings about the Observer Effect

Study	Setting	Observation type	Second source of observation?	Verified accuracy?	Observer effect: observing leads to higher safety performance	Observer effect only when observer is observed	Relationship: accuracy & safe behavior
Alvero & Austin, 2004	Lab	"Peer" from video tape	Yes, via camera (most likely obvious)	No	Support	/ (Only one condition)	/
Alvero et al ., 2008	Lab	"Peer" from video tape	Yes, via camera (most likely obvious)	Yes	/	Yes	No relationship, inaccurate observations, but correct behavior
Cooper M. D., 2006	Paper plant	Peer	No	No	Support	/ (Only one condition)	/
Gravina et al., 2008	Lab	Self-Monitoring	Yes, compared camera presence vs. secret camera	Yes	/	No consistent effect during camera presence	Yes, correlation between accuracy & safety performance (average 43%)
Lebbon, Sigurdsson, & Austin, 2012	Dining unit	Peer	No	No	Support	/ (Only one condition)	/
McCann & Azaroff, 1996	Lab (w transfer probes to office)	Self-Monitoring	Yes, via camera	Yes	/	/ (Only one condition)	Accuracy enhances effect of SM, but not needed
Olson & Austin, 2001	Bus driver	Self-Monitoring	Via secret observers	Yes	Support	Not only, but supervisor probes produced reactivity	Accuracy enhances effectiveness of SM (differed between 2-71%)
Olson et al., 2009	Truck driver	Self-Monitoring	Yes, via camera, but participants knew	Yes	Support	/ (Only one condition)	Reliable at self-monitoring
Robek , A., 2007	Lab	"Peer" from video tape	Yes, via camera (most likely obvious)	Yes	No	No	No relationship
Sasson & Austin , 2005	Office	Peer	Yes, obvious. Experimenter stood next to them.	No	Support, 50% of the employees who performed observations	/ (Only one condition)	Inconsistent results, no relationship

					had effect size double the ones only receiving FB		

Appendix C

Pre-Employee Survey

The employee survey contained many sections of questions about ongoing projects. The following excerpts include all relevant information regarding this dissertation including general information about survey participants.

General Information

1. Please indicate your gender.*
   - male
   - female

2. What shift do you typically work on?*
   - First Shift
   - Second Shift
   - Third Shift
   - I'd rather not say.

3. How long have you been working for Building Custodial & Support Services?*
   - Less than 1 year
   - 1 to 5 years
   - 5 to 10 years
   - 10 to 20 years
   - More than 20 years

Safety at BC&SS

10. Have you ever had a work injury at BC&SS?*
    - Yes
    - No

11. If you answered yes, how many injuries in total have you had at BC&SS?

12. Think about the last time you received feedback about working unsafely or not following safety guidelines. How would you describe the situation?
    Please select all that apply!*
    - The person showed concern for my safety.
    - The person was trying to get me into trouble.
    - The person wanted to show me that they know safety better than me.
    - The person was nice and courteous when giving feedback
    - The feedback was informative and helped me understand what I did wrong.
    - The person was unfriendly and short when giving feedback
    - I did thank the person for giving me feedback.

13. How do you feel about safety at BC&SS*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I feel that overall safety is very important at BC&SS.					
I feel that management takes safety seriously.					
BC&SS cares about my safety at work.					
BC&SS promotes working safely.					
I feel safe at work.					
My co-worker and supervisors look out for my safety.					
I know how to do my work safely and have received sufficient safety training.					
I apply safe practices on a regular basis.					

14. Safety Behaviors*

	100% - All the time	90 - 100% - Almost all the time	70 - 90% - Often	40 - 70% - About half the time	Less than 30 % - Only once in a while
Are you aware of the safety rules at BC&SS?					
How often do you lift safely?					
How often do you buckle your seat belt?					
How often do you wear gloves (when required)					

Safety at BC&SS

15. Thinking about your overall well-being in the following areas listed, do you have any reoccuring pains in this area?*

	Excellent - No problems	Good - Almost never have pain	Fair - Pain on a weekly or monthly basis which hinders my work	Poor - Frequent pain
Lower Back	○	○	○	○
Upper Back, Shoulder, Neck	○	○	○	○
Wrist, Hand, Finger	○	○	○	○
Ankle, Knee	○	○	○	○
Skin (allergic reactions, other bruises)	○	○	○	○
Other (Please specify below)	○	○	○	○

16. Please specify, if you chose other in the question above:

17. Please rate how satisfied you are with the following processes.*

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Reporting up a safety concern	○	○	○	○	○
Follow-up with the safety concern	○	○	○	○	○
Reporting an injury	○	○	○	○	○

18. What area would you like to have additional training on? Safety training or general training?

19. In your opinion, what is the biggest safety problem at BC&SS? What could be done to improve safety at work?

20. How would you rate your overall health?*

○ Excellent ○ Good ○ Normal ○ Fair ○ Poor

21. How often do you work out or engage in physical activity (including walks) outside of work?*

- ○ Daily
- ○ A couple times per week
- ○ Once a week
- ○ A few times a month
- ○ Less than monthly
- ○ Never

22. Which of the following should you NOT do while lifting objects?
Please select all that apply!
*

- [ ] Keep your back straight
- [x] Keep your feet together
- [x] Twist your body
- [ ] Tighten the stomach muscles

23. Which of the following are contributing causes of back injuries?
Please select all that apply!
*

- [x] Poor posture
- [x] Lifting objects incorrectly
- [x] Being physically unfit
- [ ] Splitting up heavy loads
- [ ] Bending knees while lifting
- [ ] Holding load close

24. Accidents and injuries should be reported immediately.*

- (•) True
- ( ) False

25. "Near-misses" should be reported. A near miss is an almost accident or a situation in which somebody could have possibly gotten hurt.*

- (•) True
- ( ) False

26. Slips, trips and falls can be avoided by
Please select all that apply.*

- [x] Cautiousness & walking slowly
- [x] Providing warning signs for wet floors
- [ ] Keeping equipment on stairways where they can be easily located
- [x] Cleaning and organizing passageways, service rooms, storerooms and places of employment
- [x] Point toes outward, bend forward slightly, move flat-footed

27. What does PPE stand for?*

- ( ) Premium Product Explanations
- ( ) Proper Personal Ethics
- ( ) Proactive Preventative Education
- (•) Personal Protective Equipment

28. What is incorrect about an upright vacuum?
Please select all that apply!*

- [x] Put tape on damaged cord
- [ ] Back and forth motion
- [x] Sideways motion
- [x] Step on cord
- [x] Unplug cord via yanking
- [ ] Make a cord snake

29. You can avoid repetetive motion injuries by switching hands, change the motion and stretching.*

(•) True ( ) False

48. Would you be interested in helping to improve safety at the work place at BC&SS?*

( ) Yes ( ) No

Appendix D

Post-Employee Survey

The employee survey contained many sections of questions about ongoing projects. The following excerpts include all relevant information regarding this dissertation including general information about survey participants.

General Information

1. Please indicate your gender.*
   - ○ male
   - ○ female

2. What shift did you work on the majority of your time in the past year?*
   - ○ First Shift
   - ○ Second Shift
   - ○ Third Shift
   - ○ I'd rather not say.

3. How long have you been working for Building Custodial & Support Services?*
   - ○ Less than 1 year
   - ○ 1 to 5 years
   - ○ 5 to 10 years
   - ○ 10 to 20 years
   - ○ More than 20 years

Checklists

10. Have you attended the Behavior Based Safety Training? (Checklists, Lifting & Vacuuming Training)*

Yes No

11. Please rate how much you agree or disagree to the following statements regarding the checklists.*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The checklists are easy to understand.					
The checklists are quick and easy to fill out.					
The checklists help with the safety of myself and my co-workers.					
I sometimes fill out a checklist without an observation.					

12. How many observations do you think would be a reasonable number?*

	Number of checklists
per day	
per week	
per month	

13. What can we do to make the safety process more effective? Is there anything missing?

14. Can you think of any new topics that should be made into checklists?

Observations and Final Thoughts

15. Please rate how much you agree or disagree with the following statements about observations.*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I enjoy performing observations.					
I understand what is safe/unsafe according to the definitions.					
I enjoy giving feedback.					
When getting feedback, I believe it was done professionally and was beneficial.					
I believe my behavior has changed for the better, and I have been working more safely.					

16. There are different types of checklists

	Self Observation Checklists	Co-Worker/Peer Observation Checklist
Which one do you prefer?		
Which one is more effective?		

17. Please rate how helpful each checklist was to keep you safe. *

	Really Unhelpful	Unhelpful	Neutral	Helpful	Really Helpful
Lifting					
Vacuuming					
Ladder					
Restroom Cleaning					
Mopping					
Walking on Ice					

18. Additonal comments, questions, concerns or thoughts you would like to share on the checklists:

19. How can the safety process be improved?

20. How have you seen the supervisor support the safety process?
Please select ***all*** that apply!*

- ☐ My supervisor helped me with my checklists.
- ☐ My supervisor gave me feedback or tips on being safe.
- ☐ My supervisor doesn't care about safety.

21. What are your thoughts on supervisor involvement in the safety process?

Safety Committee

22. Are you aware that there is a Safety Committee that conducts regular meetings and trainings? *

- ○ Yes ○ No

23. Have you interacted with the Safety Committee Ambassador (member) in the past year?*

- ○ Yes ○ No

24. Has the Behavior-Based Traning made you safer at work?*

- ○ Yes
- ○ No
- ○ Other, please specify

25. What would you like to see/discuss/changed within the Safety Committee?

26. If you are not already involved in the Safety Committee, would you like to be?*

- ○ Yes
- ○ No
- ○ I am already a part of the Committee
- ○ Other, please specify

Safety at BC&SS

27. Have you ever had a work injury at BC&SS? If yes, how many injuries in total have you had at BC&SS?*

- ○ 1
- ○ 2-5
- ○ More than 5
- ◉ I have never had a work injury at BC&SS

28. Think about the last time you received feedback about working unsafely or not following safety guidelines. How would you describe the situation?
Please select ***all*** that apply!*

- ☐ The person used a safety checklist to show me safe procedures.
- ☐ The person showed concern for my safety.
- ☐ The person was trying to get me into trouble.
- ☐ The person wanted to show me that they know safety better than me.
- ☐ The person was nice and courteous when giving feedback.
- ☐ The feedback was informative and helped me understand what I did wrong.
- ☐ The person was unfriendly and short when giving feedback.
- ☐ I thanked the person for giving me feedback.
- ☐ I have never received feedback.

29. How do you feel about safety at BC&SS*

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I feel that overall safety is very important at BC&SS.	○	○	○	○	○
I feel that management takes overall safety seriously.	○	○	○	○	○
BC&SS cares about my personal safety at work.	○	○	○	○	○
BC&SS promotes working safely.	○	○	○	○	○
I feel safe at work.	○	○	○	○	○
My co-worker and supervisors look out for my safety.	○	○	○	○	○
I know how to do my work safely and have received sufficient safety training.	○	○	○	○	○
I apply safe practices on a regular basis.	○	○	○	○	○

30. Where have you seen people being unsafe or being exposed to unsafe condition at BC&SS? e.g. not bending while lifting or hazardous equipment etc. Please specify:

Safety at BC&SS

31. Thinking about your overall well-being in the following areas, do you have any reoccuring pains in these areas?*

	Excellent - No problems	Good - Almost never have pain	Fair - Pain on a weekly or monthly basis which hinders my work	Poor - Frequent pain
Lower Back	○	○	○	○
Upper Back, Shoulder, Neck	○	○	○	○
Wrist, Hand, Finger	○	○	○	○
Ankle, Knee	○	○	○	○
Skin (allergic reactions, other bruises)	○	○	○	○

32. If the above options were not applicable and you have 'Other' reoccuring pains, please specify:

35. How would you rate your overall health?*

○ Excellent ○ Good ○ Normal ○ Fair ○ Poor

36. How often do you work out or engage in physical activity (including walks) outside of work?*

- ○ Daily
- ○ A couple times per week
- ○ Once a week
- ○ A few times a month
- ○ Less than monthly
- ○ Never

Safety at BC&SS

37. Which of the following are important for lifting objects safely?
Please select ***all*** that apply!
*

- [ ] Twist your body
- [x] Tighten the stomach muscles
- [ ] Keep your feet together
- [x] Keep your back straight

38. Which of the following are important for safely walking on ice?
Please select ***all*** that apply!
*

- [x] Point your feet out slightly
- [ ] Keep hands in pockets
- [x] Walk on designated walkways
- [ ] Take big, wide steps
- [x] Avoid wearing shoes with smooth soles

39. "Near-misses" should be reported. A near miss is an almost accident or a situation in which somebody could have possibly gotten hurt.*

- (•) True
- ( ) False

40. Which is correct about a **backpack** vacuum?
Please select ***all*** that apply!
*

- [ ] Back and forth motion
- [x] Sideways motion
- [x] Make a cord snake
- [ ] Put tape on a damaged cord
- [ ] Unplug cord by yanking
- [ ] Step on cord

41. How can you avoid repetitive motion injuries?
Please select ***all*** that apply!
*

- [x] Switching hands
- [ ] Keep hands in pockets
- [x] Changing the motion
- [x] Stretching
- [ ] Only using your dominant hand

Appendix E

Survey Results

Results from Pre- and Post-Survey									
2014: 147 – 28 responses					**2015:** 153 to 84 responses				
What is your gender?									
2014					**2015**				
Male		**Female**			**Male**		**Female**		
36.73% (54)		63.27% (93)			38.56% (59)		61.44% (94)		
What shift do you typically work on?									
2014					**2015**				
First Shift	**Second Shift**	**Third Shift**	**Rather not say**		**First Shift**	**Second Shift**	**Third Shift**	**Rather not say**	
76.87% (113)	6.12% (9)	15.65% (23)	1.36% (2)		74.51% (114)	6.54% (10)	16.34% (25)	2.61% (4)	
How long have you been working here?									
2014					**2015**				
Less than one year	**1-5 years**	**5-10 years**	**10-20 years**	**More than 20 years**	**Less than one year**	**1-5 years**	**5-10 years**	**10-20 years**	**More than 20 years**
11.56% (17)	23.13% (34)	11.56% (17)	28.57% (42)	25.17% (37)	11.11% (17)	26.8% (41)	15.69% (24)	23.53% (36)	22.88% (35)
Have you ever had a work injury at BC&SS?									
2014			**2015**						
Yes	**No**		**One**	**Two to Five**	**More than 5**	**Never**			
46.5% (72)	54% (83)		15.69% (24)	25.49% (39)	3.27% (5)	52.94% (81)			
Think about the last time you received feedback about working unsafely or not following safety guidelines. How would you describe the situation? Please select all that apply!									
			2014		**2015**				
The person showed concern for my safety.			29.96% (83)		13.4% (39)				
The person was trying to get me into trouble.			2.53% (7)		1.72% (5)				
The person wanted to show me that they know safety better than me.			4.33% (12)		5.5% (16)				
The person was nice and courteous when giving feedback.			23.83% (66)		16.84% (49)				
The feedback was informative and helped me understand what I did wrong.			14.08% (39)		14.09% (41)				
The person was unfriendly and short when giving feedback.			3.97% (11)		3.44% (10)				
I did thank the person for giving me feedback.			19.86% (55)		18.56% (54)				
The person used a safety checklist to show me the procedures.					7.56% (22)				

I have never received feedback.						18.9% (55)				
How do you feel about safety at BC&SS?										
	2014					**2015**				
	Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
I feel that overall safety is very important at BC&SS.	54.42% (80)	30.61% (45)	13.61% (20)	0.68% (1)	0.68% (1)	58.17% (89)	28.1% (43)	8.5% (13)	0.00% (0)	3.27% (5)
I feel that management takes safety seriously.	33.33% (49)	44.9% (66)	16.33% (24)	4.76% (7)	0.68% (1)	29.41% (45)	39.87% (61)	21.57% (33)	4.58% (7)	2.61% (4)
BC&SS cares about my safety at work.	30.61% (45)	46.94% (69)	18.37% (27)	2.72% (4)	1.36% (2)	32.68% (50)	39.87% (61)	19.61% (30)	3.27% (5)	2.61% (4)
BC&SS promotes working safely.	36.05% (53)	47.62% (70)	12.24% (18)	2.72% (4)	0.68% (1)	33.33% (51)	47.06% (72)	15.03% (23)	0% (0)	2.61% (4)
I feel safe at work.	29.93% (44)	53.06% (78)	14.97% (22)	1.36%(2)	0.68% (1)	32.03% (49)	46.41% (71)	14.38% (22)	1.96% (3)	3.27% (5)
My co-workers and supervisors look out for my safety.	29.25% (43)	53.06% (78)	14.29% (21)	2.72% (4)	0.68% (1)	30.07% (46)	44.44% (68)	19.61% (30)	0.65% (1)	3.27% (5)
I know how to do my work safely and have received sufficient safety training.	46.94% (69)	42.86% (63)	8.84% (13)	1.36% (2)	0% (0)	40.52% (62)	43.79% (67)	11.76% (18)	1.31% (2)	0.65% (1)
I apply safe practices on a regular basis.	51.02% (75)	44.22% (65)	4.76% (7)	0% (0)	0% (0)	44.44% (68)	45.75% (70)	6.54% (10)	0.65% (1)	0.65% (1)
Thinking about your overall well-being in the following areas listed, do you have any reoccurring pains in this area?										
	2014				**2015**					
	Excellent- No Problems	**Good- Almost never have pain**	**Fair- Weekly or monthly, hindering work**	**Poor- Frequent pain**	**Excellent- No Problems**	**Good- Almost never have pain**	**Fair- Weekly or monthly, hindering work**	**Poor- Frequent pain**		
Lower back	29.45% (43)	41.78% (61)	26.03% (38)	2.74% (4)	32% (48)	40% (60)	19.33% (29)	8.67% (13)		
Upper back, shoulder, neck	28.08% (41)	43.15% (63)	25.34% (37)	3.42% (5)	34.67% (52)	40.67% (61)	18% (27)	6.67% (10)		
Wrist, hand, finger	32.88% (48)	45.21% (66)	19.18% (28)	2.74% (4)	36.67% (55)	41.33% (62)	15.33% (23)	6.67% (10)		
Ankle, Knee	35.62% (52)	40.41% (59)	21.23% (31)	2.74% (4)	39.33% (59)	38.67% (58)	15.33% (23)	6.67% (10)		
Skin	56.85% (83)	30.82% (45)	9.59% (14)	2.74% (4)	58% (87)	35.33% (53)	4.67% (7)	2% (3)		
Other (Neck, hand, arm, elbow, asthma)	71.91% (105)	19.18% (28)	6.16% (9)	2.74% (4)						
How would you rate your overall health?										

2014					2015				
Excellent	**Good**	**Normal**	**Fair**	**Poor**	**Excellent**	**Good**	**Normal**	**Fair**	**Poor**
22.6% (33)	56.16% (82)	17.12% (25)	4.11% (6)	0% (0)	20% (30)	60% (90)	15.33% (23)	3.33% (5)	1.33% (2)

How often do you work out or engage in physical activity (including walks) outside of work?											
2014						**2015**					
Daily	**A couple times a week**	**Once a week**	**A few times a month**	**Less than once a month**	**Never**	**Daily**	**A couple times a week**	**Once a week**	**A few times a month**	**Less than once a month**	**Never**
41.1% (60)	39.04% (57)	7.53% (11)	7.53% (11)	3.42% (5)	1.37% (2)	42% (63)	36.67% (55)	5.33% (8)	10.67% (16)	2% (3)	3.33% (5)

Please rate how satisfied you are with the following processes.										
	2014					**2015**				
	Very Satisfied	**Satisfied**	**Neutral**	**Dissatisfied**	**Very Dissatisfied**	**Very Satisfied**	**Satisfied**	**Neutral**	**Dissatisfied**	**Very Dissatisfied**
Reporting up a safety concern	34.93% (51)	43.15% (63)	15.75% (23)	4.11% (6)	2.05% (3)	22% (33)	48% (72)	22.67% (34)	4% (6)	3.33% (5)
Follow-up with the safety concern	26.03% (38)	42.47% (62)	23.29% (34)	3.42% (5)	4.79% (47)	16.67% (25)	43.33% (65)	28.67% (43)	5.33% (8)	6% (9)
Reporting an injury	34.93% (51)	45.89% (67)	17.12% (25)	0.68% (1)	1.37% (2)	28.00% (42)	47.33% (71)	21.33% (32)	1.33% (2)	2% (3)
Discussing safety issues in meetings						21.33% (32)	46% (69)	22.67% (34)	4% (6)	6% (9)
Filling out safety checklists						17.33% (26)	35.33% (53)	31.33% (47)	6.67% (10)	9.33% (14)

Please rate how satisfied you are with your supervisor in regards to?										
	2014					**2015**				
	Very Satisfied	**Satisfied**	**Neutral**	**Dissatisfied**	**Very Dissatisfied**	**Very Satisfied**	**Satisfied**	**Neutral**	**Dissatisfied**	**Very Dissatisfied**
My supervisor is helpful and available to me when I need help or have questions.	43% (62)	33% (47)	19% (28)	2% (3)	3% (4)	44.97% (67)	36.91% (55)	12.75% (19)	0.67% (1)	4.7% (7)
My supervisor frequently provides me with constructive feedback so I can improve and do my job better.	31% (45)	31% (45)	28% (40)	6% (9)	3% (5)	28.19% (42)	34.23% (51)	29.53% (44)	2.68% (4)	5.37% (8)

My supervisor actively supports me in being able to do an excellent job.	39% (56)	34% (49)	21% (30)	4% (6)	2% (3)	40.27% (60)	37.58% (56)	14.77% (22)	2.01% (3)	5.37% (8)
My supervisor checks in with me at my building daily.	33% (48)	34% (49)	22% (31)	8% (12)	3% (4)	31.54% (47)	36.91% (55)	21.48% (32)	5.37% (8)	4.7% (7)
My supervisor clearly communicates instructions and expectations to me.	37% (53)	34% (49)	21% (30)	6% (9)	2% (3)	36.91% (55)	37.58% (56)	19.46% (29)	1.34% (2)	4.7% (7)
My supervisor allows me to make my own decision when possible.	35% (50)	34% (49)	24% (34)	3% (4)	5% (7)	33.56% (50)	40.94% (61)	18.12% (27)	2.68% (4)	4.7% (7)
I'm happy with my supervisor	47% (67)	26% (37)	20% (29)	4% (6)	3% (5)	49.66% (74)	28.86% (43)	14.09% (21)	2.68% (4)	4.7% (7)

Have you attended the Behavior Based Safety Training?		
	2014	**2015**
Yes		94.04% (142)
No		5.96% (9)

Have you attended the Behavior Based Safety Training?		
	2014	**2015**
Yes		94.04% (142)
No		5.96% (9)

How much you agree or disagree with these checklist statements						
	2014	**2015**				
		Strongly Agree	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
The checklists are easy to understand.		33.11% (50)	44.37% (67)	17.22% (26)	3.31% (5)	1.99% (3)
The checklists are quick and easy to fill out.		29.8% (45)	47.02% (71)	15.89% (24)	3.31% (5)	3.97% (6)
The checklists help with the safety of myself and my coworkers.		17.88% (27)	34.44% (52)	27.15% (41)	10.6% (16)	9.93% (15)
I sometimes fill out a checklist without an observation.		9.93% (15)	20.53% (31)	24.5% (37)	25.17% (38)	19.87% (30)

How many observations do you think would be a reasonable number?		
	2014	**2015**
Per day		0.77
Per week		1.2
Per month		2.8
Overall per month		8.4

How much do you agree or disagree about observation statements?		
	2014	**2015**

		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I enjoy performing observations.		5.3% (8)	24.5% (37)	35.1% (53)	21.19% (32)	13.91% (21)
I understand what is safe/unsafe according to the definitions.		39.74% (60)	43.05% (65)	13.91% (21)	1.32% (2)	1.99% (3)
I enjoy giving feedback.		11.92% (18)	25.83% (39)	45.03% (68)	5.3% (8)	11.92% (18)
When getting feedback, I believe it was done professionally and was beneficial.		15.89% (24)	36.42% (55)	35.76% (54)	5.96% (9)	5.96% (9)
I believe my behavior has changed for the better, and I have been working more safely.		16.56% (25)	39.07% (59)	28.48% (43)	8.61% (13)	7.28% (11)

There are different types of checklists.			
	2014	**2015**	
		Self	**Coworker/ Peer**
Which checklist do you prefer?		77.86% (109)	22.14% (31)
Which checklist is more effective		62.32% (86)	37.68% (52)

How helpful were the checklists?						
	2014	**2015**				
		Really Unhelpful	**Unhelpful**	**Neutral**	**Helpful**	**Really Helpful**
Lifting		12.58% (19)	9.93% (15)	29.14% (44)	39.74% (60)	8.61% (13)
Vacuuming		12.58% (19)	11.92% (18)	37.75% (57)	29.14% (44)	8.61% (13)
Ladder		13.25% (20)	9.93% (15)	34.44% (52)	31.79% (48)	11.35% (16)
Restroom		13.91% (21)	12.58% (19)	34.44% (52)	32.45% (49)	6.62% (10)
Mopping		12.58% (19)	11.26% (17)	37.09% (56)	32.45% (49)	6.62% (10)
Walking on ice		13.25% (20)	9.93% (15)	33.11% (50)	29.80% (45)	13.91% (21)

Which of the following should you NOT do while lifting objects? Please select all that apply.		
	2014	**2015**
Tighten stomach muscles	18.5% (27)	
Keep your back straight	13% (19)	
Keep your feet together	40.4% (59)	
Twist your body	85% (124)	

Which of the following ARE important for lifting safely? Please select all that apply.		
	2014	**2015**
Tighten stomach muscles		30.7% (46)
Keep your back straight		93.3% (140)
Keep your feet together		38.7% (58)
Twist your body		10.7% (16)

Accidents and injuries should be reported immediately.		
	2014	**2015**
Yes	97.9% (143)	

No	2.1% (3)	
"Near-misses" should be reported. A near miss is an almost accident or a situation in which somebody could have possibly gotten hurt.		
	2014	**2015**
Yes	78.08% (114)	82.67% (124)
No	21.92% (32)	17.33% (26)
Slips, trips and falls can be avoided by: Please select all that apply.		
	2014	**2015**
Cleaning & organizing places of employment	77.4% (113)	
Keeping equipment on stairways	12.33% (18)	
Providing warning signs	93.15% (136)	
Cautiousness & walking slowly	71.23% (104)	
Moving more flat-footed	22.6% (33)	
What does PPE stand for?		
	2014	**2015**
Personal protective equipment	82.88% (121)	
Proactive preventative education	13.7% (20)	
Proper personal ethics	1.37% (2)	
Premium product explanations	2.05% (3)	
What is incorrect about an upright vacuum? Please select all that apply!		
	2014	**2015**
Back and forth motion	7.53% (11)	
Unplug cord via yanking	82.19% (120)	
Make a cord snake	35.62% (52)	
Step on cord	65.75% (96)	
Sideways motion	46.58% (68)	
Put tape on cord	74.66% (109)	
Which is CORRECT for a BACKPACK vacuum? Please select all that apply.		
	2014	**2015**
Back and forth motion		27.33% (41)
Unplug cord via yanking		3.33% (5)
Make a cord snake		66% (99)
Step on cord		4.67% (7)
Sideways motion		81.33% (122)
Put tape on cord		9.33% (14)
How can you avoid repetitive motion injuries? Please select all that apply.		
	2014	**2015**
Switching hands		82% (123)
Keep hands in pockets		3.33% (5)

Changing the motion	**You can avoid repetitive motion injuries by switching hands, change the motion and stretching.** **True**: 92.22% (142) **False**: 7.78% (12)	72% (108)
Stretching		67.33% (101)
Only using your dominant hand		3.33% (5)
How have you seen the supervisor support the safety process?		
	2014	**2015**
My supervisor helped me with my checklists		38% (57)
My supervisor gave me feedback or tips on being safe		67.33% (101)
My supervisor doesn't care about safety		18% (27)
Are you aware that there is a safety committee that conducts regular meetings and trainings?		
	2014	**2015**
Yes		97.35% (147)
No		2.65% (4)
Have you interacted with the safety committee ambassador in the past year?		
	2014	**2015**
Yes		62.25% (94)
No		37.75% (57)
Has the behavior based training made you safer at work?		
	2014	**2015**
Yes		64.90% (98)
No		22.52% (34)
Other		12.58% (19)
If you are not already involved, would you like to be in the safety committee?		
	2014	**2015**
Yes		7.28% (11)
No		77.48% (117)

Appendix F

Guidelines for RA Data Collection

General Rules for Experimental Data Collection

- **Positioning**
  - Choose a location that is out of the way and non-suspicious of activities you are scheduled to observe.
  - Ensure that the location allows you maximum visual coverage of the area where behavior will occur (i.e. in the case of lifting observations, try to have 2 trashcans in your view, in case you miss the first one).
  - Good locations include: tables and/or chairs in common areas, hallway alcoves, and outside corners of hallways.
  - If you are unable to observe all criteria, only rate the criteria you have been able to observe as safe or unsafe. Thus, choose "N/A" for the criteria you are unable to observe.
- **Timing**
  - Whenever possible, be in the area where behavior is likely to occur (preferably, before the individual to be observed has arrived).
  - Arriving afterwards produces a noticeable change in the environment and decreases the likelihood that the opportunity to observe all necessary behaviors will occur.
  - Arriving early allows for time to set up your workspace, which includes; pen and paper, observation forms, phone (for use with excel sheet or partial interval recording mp3), and any other materials you might need.
  - Wait to leave the area until after the observed individual has left.
  - If you arrive when the individual is active in the environment, make sure to be engaging in "normal" activities, such as; studying, waiting for a class, reading a book, looking at your phone, getting a soda, or if in the bathroom; blowing your nose, fixing your hair, doing your makeup, washing your hands, etc.
- **Attire**
  - Wear clothing that is appropriate to the season, due to clothing conflicting with the weather may draw attention.
  - Vary clothing choices as possible; consider wearing business casual some days, and casual clothing others.
  - When appropriate, wear a brimmed hat. The brim allows you to keep your head down and still observe behavior while preventing the observed individual to take notice of you viewing them.
    - Caution: When wearing a brimmed hat make sure you track movement with your eyes and not with you head, as the hat brim can exaggerate small movements of the head.
- **Interaction with Custodian**
  - Preferred: No interaction
    - Do not make eye-contact.
    - Do not have unnecessary conversation with those you are observing.
    - When possible do not look directly at the individual, instead use peripheral vision.
  - If needed: Interaction
    - Do not look away quickly if eye contact is made.
    - Be polite, but not chatty
    - Have a strong cover story beforehand.

- For example, if noticed and questioned, simply name the class you are waiting/studying for, or that you are a TA waiting to meet with your professor. Never panic, keep calm.

  - Compromised
    - Do not admit to performing observations. If necessary, quietly collect belongings and leave the area.
    - If your covert status is compromised during observation, please contact your supervisor and Marlies immediately. Make a note in the comment section of the observation form.

- **Interactions with friends, family or colleagues**
  - Refrain from speaking to others outside of this study about the conditions of the study, particularly anything involving experimental observation.
  - If asked about the study, simply say that you are assisting in a behavior based safety study.
  - You may state that the study examines safe work behaviors through peer and self-monitoring and that your primary role is collecting and recording data.
  - If you have any questions, please ask your supervisor.
  - ***The only acceptable times to talk about this study is during the designated office hours among other observers behind closed doors. This is very important to keep confidential.***
- **What to put on my resume (Examples)**
  - Gained firsthand experience with Behavior Based Safety during hands-on data collection.
  - Evaluated accuracy of performance with behavioral guidelines.
  - Drafted weekly reports.
  - Participation in monthly focus group meeting to discuss performance issues, progress and receive feedback

CONFIDENTIALITY

1. Keep all research information shared with me (the research assistant) confidential by not discussing or sharing the information in any form or format (e.g., disks, tapes, transcripts) with anyone other than the primary investigator.
2. Hold in strictest confidentiality the identity of any individual that may be revealed during the course of performing the research tasks.
3. Do not make copies of any raw data in any form or format (e.g., disks, tapes, transcripts), unless specifically requested to do so by the primary investigator.
4. Keep all of the raw data that contains identifying information in any form or format (e.g., disks, tapes, transcripts) secure while it is in my (research assistants) possession.
   This includes:
   (1) Mini-checklists and excel sheet
   (2) Closing any computer programs and documents of the raw data when temporarily away from the computer
   (3) Permanently deleting any e-mail communication containing the data
   (4) Using closed headphones when listening to the mp3
5. Give all of the raw data in any form or format (e.g., excel, orange qc) to the primary investigator when I have completed the research tasks.
6. Destroy all research information in any form or format that is not returnable to the primary investigator (e.g., mini checklist) after a week of the data being collected. To ensure for glitches in data please hold on to these for a week.
7. Confidentially of this study is primary for its success.

8. When in the field, be sure to only speak in code words, you never know who could be right around the corner, and we cannot blow our cover. If cover is blown, please inform your team manager and the student in-charge of scheduling and we will remove you from that building for the rest of the semester
9. No matter who asks outside of the study, you are not allowed to talk about this study. If anyone asks why you are in a particular building that is outside of this study, just let them know you are aiding in research and can't say anything more
    - For example, reference the flyers that you have been handed
10. If you would like to talk to someone about this study or anything that is going on, feel free to come into office hours, contact your team managers directly or just make a friend in the study and talk to them. There are plenty of people to talk to in the BBS lab. Just make sure nobody overhears you when you talk openly.

Materials

Orange Qc

For electronic observations you will need to utilize Orange QC website via computer, tablet or your smartphone. You can access Orange QC by going to https://bcss.orangeqc.com. Login information is as follows:

For regular observations:
Username: safety
Password: spring

For IOA observations if you're the secondary observer:
Username: ioa
Password: spring
Even when logged into the IOA account be sure to specify that you are the IOA observer. You can notate this by putting your first and last name in the "Observer's name box", followed by IOA.

Dropbox

Observer information is available on the Dropbox application. Dropbox can be downloaded from the App Store for iPhone and accessed online at https://www.dropbox.com for other devices. This is accessible to laptop/desktop users from an internet browser if your mobile device fails. Observer information is a file that includes images of custodial, schedules of the custodial, the mp3 file, and the excel sheet. The supervisor will share the Dropbox files with observers to ensure reliable communication of frequent updates to schedules, new custodial, etc. Please join the folder and install the program/app on your phone. That way you can access the task sheets and photos any time in the field. **Please do not delete or edit any of the files.**

Identifications Photos

In Dropbox go to Observer Information folder and then select your building to find the pictures of the custodial staff. This will help you to identify who you are observing. If you can't find the person who you are observing, check the Floaters file to see if the janitor you are observing is in there.

Observations on the webpage are broken down into category (i.e. Safe Lifting, Safe Vacuuming, Safe Work Behaviors, and Safe Mopping); each category is separated into individual items to be observed. For each item, please mark Safe, Unsafe, or N/A as applicable by selecting the rating from the dropdown menu.

Alternately, you may utilize a writing utensil and the paper observation forms. These forms duplicate the items found on Orange QC, and may be provided to you by your supervisor on request. Please ensure any such requests are made with sufficient notice.

Providing multiple mediums of observation forms allows for flexibility in different observer work styles, and/or preference, while maintaining observation integrity. However, experimental observers are responsible for having the materials needed for observation.

Before you begin, make sure that:

- The mp3 is ready and both observers can hear it (in instances of IOA).
- You are in a position where you are out of the way, but can see areas where behavior will occur.
- Review the criteria for behavior you are about to observe.

Mini Checklist

The mini checklist is a sheet of paper that may help you record data in the field if you're phone is not cooperating or you simply prefer writing it down before entering it into Orange QC. The sheet is in Dropbox, but you can pick up free copies during office hours or from your supervisor any time. Be careful to not leave the sheets behind and make sure to shred them or return them to your supervisor.

Excel Sheet

Please use the excel sheet if Orange QC is not working. The sheet for electronic observations is in the Dropbox folder that you have been invited to.

If you can edit and save excel file on your phone, then you can send the filled out observation and send it to your supervisor right after. If you're unable to edit the excel file on your phone, please make sure that you have the mini checklist ready in order to note the observation there. Please put your notes in the excel file later that day and e-mail it to your supervisor.

Observation Shift Checklist

Before you begin, make sure that:

- The mp3 is ready and both observers can hear it (in instances of IOA)
- Located in a position where you are out of the way, but can see areas where behavior will occur
- Review the criteria for behavior you are about to observe
- Mini checklist for observations

1) **Arrive in assigned building on time**
    a. Meet up with IOA observer (if applicable)
        i. Refer to contact list with photo and phone number
2) Walk the building & find custodians
3) Determine observation availability of custodian (e.g. location, target behavior etc.)
4) **If observable, perform observation**
    a. Determine who IOA observer is and who the primary observer is
    b. Record observations separately (do NOT discuss until you both have completed the checklist)

c. Submit observations separately via the OrangeQC website (use IOA account if you are the IOA observer)
d. Repeat step 2

5) If not observable, repeat step 2

a. If you are unable to find custodians in your assigned building, chose another assigned building then repeat step 2.

6) Write report- Be specific and to the point

a. Include performed observations
b. Include building location
    i. Room numbers if possible
    ii. Which floor of building
c. Custodian's first initial and last name
d. The time in which the observation occurred
e. No luck recording observations?
    i. Why did "nothing happen?"
    ii. Example: Maybe you saw your custodian but they did not engage in target behaviors
f. Other events, tips and concern or suggestions
    i. Unusual events
g. Be sure to send in your shift reports to your team managers by **3pm at the latest** the same day unless you have made arrangements otherwise with your team managers.

You are responsible for having the materials needed for observation. If you need additional materials, contact your supervisor beforehand.

Recording Data

Momentary Time Sampling ("Snapshot" Method)

Imagine you've taken a snapshot of what is happening at this very moment. Compare that image to each of the criteria in question.

Partial Interval Recording

To perform these types of observation use the pre-recorded mp3 message to indicate the passage of 10 seconds. The mp3 will provide prompts over the next 90 seconds. The first prompt will indicate a 10 seconds window of observation. At the end of this time, you will have 5 seconds to record your data before the next 10 second observation window is prompted. The behaviors which are to be observed in these windows are as follows:

- In each of the 10 second intervals, numbered 1 through 6, record the number of unsafe behaviors which occur.

Safe Lifting Observations:

When you are observing lifting behaviors, make sure to watch for the whole duration. Doing so will enable you to capture each of the pinpointed behaviors, so that they can be marked as safe, unsafe, or N/A.

During this observation you should check for the following:

- Upper Body Position
- Feet spread/stable base
- Bend knees/lift with legs

- Good grip/break up load
- No Twisting

This may be an opportunity to observe other pinpointed behaviors, either before lifting occurs or after. Other behaviors which may be observed in the time surrounding lifting might be:

- Proper shoe wear
- Distraction free
- Clear and clean pathway
- Straight back
    - This particular behavior corresponds with bend knees/lift with legs and should match across categories

These observations utilize Momentary Time Sampling, or the "snapshot" method. Imagine you've taken a snapshot of what is happening at this very moment. Compare that image to each of the criteria in question. If you did not manage to capture some of the criteria, take another "snapshot" at a later time, and make sure to pay attention to what you missed before. It is better to take an additional snapshot then to fill in the blanks with what you think might have happened. This will become easier the more familiar you are with the behaviors to be observed, and the more practice you have with taking these snapshots.

You may also have the opportunity to observe the custodial walking into the environment before or after a lifting behavior. This may allow for an opportunity to observe the following behaviors:

- Normal speed
- Avoids Wet/Icy Areas

These behaviors both utilize Partial Interval Recording. To perform these types of observations, use the pre-recorded mp3 message to indicate the passage of 10 seconds. Count the number of steps which occur within this window of time and record it as [#of steps]/10s. Observe for the 10 second interval, or until the individual has traversed 15 feet. The number of steps may meet the criteria, but if other requirements listed for these behaviors were not met, the behavior should still be marked as unsafe.

Safe Vacuuming Observations:

Observing vacuuming will require both Momentary Time Sampling and Partial Interval Recording. The first behavior to observe is:

- Cord Snake

This observation utilizes the Momentary Time Sampling, or the "snapshot" method. Imagine you've taken a snapshot of what is happening at this very moment. Compare that image to each of the criteria in question.

Immediately after recording this behavior you should begin your Partial Interval Recording mp3. The mp3 will provide prompts over the next 90 seconds. The first prompt will indicate a 10 seconds window of observation. At the end of this time, you will have 5 seconds to record your data before the next 10 second observation window is prompted. The behaviors which are to be observed in these windows are as follows:

- Cord Management

- Vacuuming motion
    - Upright/Kaizen Bathroom Vacuum: backward/forward
    - Backpack: sideways

In each of the 10 second intervals, numbered 1 through 6, record the number of unsafe behaviors which occur. Each 10 second interval has a row for both Step over Cord/In Front of and Motion. After the 90 seconds of observing and recording vacuuming, you should once again observe the following behavior using Momentary Time Sampling:

- Cord Snake

When vacuuming is complete, you should observe the following behavior:

- Unplugging Cord

To observe this behavior properly, make sure you watch it for the entire duration to ensure each of the criteria has been met.
During the time before and after vacuuming, you may have the opportunity to observe other behaviors. The following may be observed during the process of vacuuming:

- Proper shoe wear
- Distraction free
- Clear and clean pathway
- Straight back
    - This particular behavior corresponds with bend knees/lift with legs and should match across categories

These observations utilize Momentary Time Sampling, or the "snapshot" method. Compare that image to each of the criteria in question. If you did not manage to capture some of the criteria, take another "snapshot" at a later time, and make sure to pay attention to what you missed before. Remember, it is better to take an additional snapshot then to fill in the blanks with what you think might have happened.

You may also have the opportunity to observe walking in the time before or after a vacuuming behavior. This may correspond to the following behaviors:

- Normal speed
- Avoids Wet/Icy Areas

These behaviors both utilize Partial Interval Recording. To perform these types of observation use a watch, stop-watch, or pre-recorded mp3 message to indicate the passage of 10 seconds. Count the number of steps which occur within this window of time and record it as [#of steps]/10s. The number of steps may meet the criteria, but if other requirements listed for these behaviors have not been met the behavior should still be marked as unsafe.

Mopping Observations

Observing mopping will require both Momentary Time Sampling and Partial Interval Recording. The first behavior to observe is:

- Bucket Management

This observation utilizes the Momentary Time Sampling, or the "snapshot" method. Imagine you've taken a snapshot of what is happening at this very moment. Compare that image to each of the criteria in question.

Immediately after recording this behavior you should begin your Partial Interval Recording mp3. The mp3 will provide prompts over the next 90 seconds. The first prompt will indicate a 10 seconds window of observation. At the end of this time, you will have 5 seconds to record your data before the next 10 second observation window is prompted. The behaviors which are to be observed in these windows are as follows:

- Pathing (the way you move while mopping)
- Mopping motion: side to side motion, figure 8 if possible

In each of the 10 second intervals, numbered 1 through 6, record the number of unsafe behaviors which occur. Each 10 second interval has a row for both Steps over Cord/In Front of and Motion. After the 90 seconds of observing and recording vacuuming, you should once again observe the following behavior using Momentary Time Sampling:

- Bucket Management

To observe this behavior properly, make sure you watch it for the entire duration to ensure each of the criteria has been met.
In the time before and after vacuuming, you may have the opportunity to observe the general safe work behaviors.

Pressure Washing Observation

Sometimes you will be able to observe pressure washing. A yellow machine is used for pressure washing, typically in the bathrooms. The correct motion is the same as for the upright vacuum with full body motion forwards and backwards. The correct pathing is the same as for mopping. As this only occurs rarely, there is no form in Orange QC. To record this, please use the excel sheet in Dropbox. Open it, save as, fill in your observation, and e-mail it to your supervisor and Marlies.

Safe Work Observations:

After Lifting and Vacuuming have been observed, take time to determine if any of these behaviors have not been recorded. If they have not, use this opportunity to observe the following using Momentary Time Sampling:

- Proper shoe wear
- Distraction free
- Clear and clean pathway
- Straight back
    - This particular behavior corresponds with bend knees/lift with legs and should match across categories

The following behaviors use Partial Interval Recording:

- Normal speed
- Avoids Wet/Icy Areas
- Uses Hand Rails

Definitions for Target Behaviors

Safe Lifting→whole interval recording (or if person walks further than 15ft with load)

Upper Body Position:

- Elbows placed just beyond rib cage
- Arms bent at the elbow at approximately 90 degree angle
- Hands approximately at the height of the sternum
- Keep load in middle of body (spine is straight, not bend to either side)
- **If load is a bag (heavy)**
    - Bottom and side of bag should not touch body
    - The correct distance to hold bag is an intermediate position of stretched and angled arms
        - May vary with size of bag
        - Back must still be straight, not hunched forward
    - Garbage bag may brush body for about 2 seconds
        - Not pressed against body
    - Brushing may be caused by walking motion which may move bag
- **If load is a bag (light)**
    - May carry one bag in each hand to balance load (spine is still straight)
    - May carry with one hand if upper body position is not compromised
        - No visible compensatory behaviors
            - Ex: Shaking, straining, readjusting load
    - Bottom and side of bags should not touch body
    - Arms at side
    - Elbows bent in natural position
    - Hands just beyond shoulder width
- **If load is a box**
    - Hands on opposite sides of the load
    - Closest face of box may press lightly against abdomen
- **If load is attached to the wall (some bathrooms have trash cans attached to the wall)**
    - Straight back, therefore, they do not engage or arch the back when removing the canister from the wall
    - Immediately places the canister onto the floor, thus, the custodial should not maneuver the canister immediately after displacement

Feet Spread/Stable Base:

- Begin position before picking up load
- Position present during lifting action
- Feet (heels) at shoulder width
- Feet angled outwards, up to 45 degrees
- Feet may be parallel, but one foot may also be in front of the other
- Knees in alignment with toes
- Discontinue for appropriate walking behavior
    - If "waddling" occurs, load may be too heavy or large for single lifter
- Re-establish position prior to setting down load
- End position when load has been set down
- Assume normal, standing posture

Bend Knees/Lift with Legs:

- Begin prior to lifting load, or reaching down
- **2 ways to lift with legs and pick up load**
    - Squat down

        - One foot might be in front of the other
    - Kneel down
        - Knee down on one leg
- Lower back remains straight → not engaged
- Height of person and trash can determine lift and how much of squatting is possible. If the environmental conditions require the bag to be lifted higher than the sternum, this is not considered unsafe.
- Torso not curved
- Hips remain aligned below shoulders
- Knees in alignment with toes
- End position when normal, standing posture has been reacquired

Good Grip/Break Up Load:

- Grip is firm and stable
    - No visible compensatory behaviors
        - Ex: Shaking, straining, readjusting load
    - Load does not shift within grasp
        - Ex: Box/Bag does not slide or slip in hands
    - Use full hand or all fingers to grab bag
- If load is a box
    - Hands occupy opposite sides of the load
- If load is a bag
    - Use both hands; gripping the top of the bag
    - If bag is light, one hand is considered safe
- If load is heavy
    - Break up load into lighter segment if/when appropriate
    - Ask for peer assistance with the load
    - Use mechanical means (such as a dolly or rolling cart) as needed

No Twisting:

- Begin when load is lifted
- Hips and shoulders remain in line
    - Mostly a turn of more 45 degrees requires more than one step → watch for it!
- Open foot toward direction of turn
- Maintain hip-shoulder alignment during step,
- End when **Bend Knees** begins

<u>Safe Vacuuming</u>

Cord Snake→ momentary time sampling

- Cord should be coiled in a manner in which slack line is naturally produced as needed
    - Note that the cord may not always allow for neat coiling
    - Goal: uncoils neatly when more cord is required
    - Organized and not tangled
- Make a new cord snake if:
    - A new plug is required
    - The cord snake becomes tangled
- If status of cord snake does not change, only record once.

Cord Management→ partial interval recording

- Begin when cord is plugged in
- Extended cord is close to wall
- Switch plug to nearest outlet available
- Cord does not cross over entire hall or pathway at any point
    - Unless it is unavoidable, check if another available outlet would have avoided obstruction
    - If it was not possible to avoid the cord crossing the hallway, we consider it "safe" as long as the criterion of awareness is present
- Awareness of passers-by (needs to be fulfilled to consider a cord crossing the hallway as safe)
    - Looking for pedestrians crossing hallway
    - Stopping the vacuuming motion if needed to allow safe crossing
    - Cord is flat on the ground, straight and not tangled in the middle of the hallway
    - If readjusting and moving cord, look behind to ensure that it doesn't obstruct pedestrians
- Cord should remain behind body, allowing for a cord free pathway for vacuuming
    - Vacuum should not touch cord
    - Feet should not touch cord
- Step and walk in front of cord
- Do not step on cord. Step over or walk behind cord
- Pushing the cord with vacuum or kicking it is unsafe due to the cord not being behind
- End when cord is unplugged

"Vacuum should not touch cord"

➔ No change for upright vacuum! This is dangerous as the beater bar could fray the cord and possibly lead to electrocution

➔ CHANGE with back-pack vacuum! After discussion with custodians, this is actually a great way to ensure a free pathway and showing it out of the way does not put much pressure on cord. Thus, please note in the comment box if the cord management interval is ONLY considered unsafe because of this. If it is unsafe for other reasons too, please include them in the comment box as well. As we cannot change our definition, this comment is essential in capturing this change.

Front and Back➔ partial interval recording

- Begin when vacuum is turned on
- Upright Vacuum; roll forward then back
- Kaizen Bathroom Vacuum; forward-backward motion
- Extend arm and leg together to move vacuum forward
- Retract arm and leg together to roll vacuum back
    - Avoid repeating motion in same space
- No twisting across body during motion
- Repeat forward to back motion on adjacent segment of floor

Side to Side➔ partial interval recording

- Begin when vacuum is turned on
- Backpack Vacuum; sweep stick to one side of body to the other side of the body

    - Avoid repeating motion in same space
    - Like golfing motion
- Repeat motion on adjacent segment of floor
- No twisting; legs (knees) and upper body should be in alignment
- On stair steps, corners, and/or close to the wall, the motion may vary, →N/A if person is only vacuuming stair steps in interval if partially, ignore and only evaluate opportunities for correct motion
- Lead hand should stop just outside of hip
- End when vacuum is turned off

Unplug the Cord→ whole interval recording

- Begin when machine is turned off
- Approach cord plug
- Assume position on either side of the plug
- Grab plug with hand
- Gently remove plug from outlet
    - No yanking or abrupt motion
    - Motion of cord should be controlled; no whip-like motion
- End when plug is removed from outlet

<u>Mopping</u>

Bucket Management → momentary time sampling

- Bucket is not in middle of the path
- Area surrounding the bucket is clear of spills
- Bucket placed near mopping endpoint

Pathing →partial interval recording

- Mopping begins in rear of area
- Path of mopping moves backwards, towards bucket location
- Path of mopping does not place employee on wet floor

Side to Side→ partial interval recording

- Begin when mop touches floor
- Sweep mop stick to one side of body to the other side of the body in a figure 8 motion
    - Small step back with each sweep motion
    - Upper body in alignment with mopping motion
    - Large mopping motion requires upper body alignment with legs and small step to avoid twisting
    - Figure motion requires change in wrist posture
- Repeat on adjacent segment of floor
- No twisting; legs (knees) and upper body should be in alignment
- On stair steps, corners, and/or close to the wall, the motion may vary
    - →N/A if person is only sweeping or walking up/down the stairs
    - On stairs, the correct motion is left to right
- Lead hand should stop on the outside of hip
- End when mop is placed in bucket

<u>Safe Work</u>

Normal Speed→ partial interval recording

- Less than 16 steps per 10 seconds
- Small steps; feet remain under body
    - If holding a yardstick in hand with the elbow touching rib-cage, feet should not pass beyond yardstick
- Lift feet to prevent tripping
- Do not shuffle

Straight Back:

- Begin prior to picking up item or reaching down
- Lower back remains straight
- Torso not curved
- Hips remain aligned below shoulders
- Knees in alignment with toes
- Squat down to pick up load and coming to rest just above and behind heel
- Reverse this motion to lift or stand up (no rotation of the leg)
- End position when a normal, standing posture has been reacquired

Clear and Clean Pathway → momentary time sampling

- Boxes, carts, equipment, etc. on edge of path and not in middle.
- No spills of visible debris in the middle of pathway

Distraction Free → momentary time sampling

- Not holding/using cell phone
- Not wearing ear buds, headphones or Bluetooth headset
- Eyes on path ahead when walking or on task being performed
- No conversation (via phone, radio or with another person) while lifting or vacuuming or other task such as mopping etc.
    - Before and after the activity it is considered safe (as some phone conversations are needed for job)

Proper Shoe Wear→ partial interval recording

- Shoe made of firm or man-made leather
    - Athletic shoes with flat treads (skateboard shoes) or running shoes are not acceptable.
- Covers entire foot
- Any fastenings or bindings (straps, laces, etc.) are securely tied or in place
- Tread is intact and not worn to sole
- Shoes are clean
- Sandals, spiked heels, thin-soled shoes, and canvas shoes do not meet requirements

Avoids Wet/Icy Areas:

- Less than 16 steps per 10 seconds
- Small steps; feet remain under body
    - With each step, the heel of the front foot should not pass the toes of the rear foot
- Eyes on path ahead
- Walk around ice-covered spots when possible
- "Penguin-walk" where necessary (according to http://bss.fnal.gov/fire/walking-safely-on-ice.pdf)
    - Shuffling feet

    - Feet spread and slightly outward angled
    - Hands out of pocket

Uses Hand Rails: → test the feasibility of this one when camera access is given

- One hand on rail when ascending or descending staircase
- Eyes on path

Personal Protective Equipment Gloves → momentary time sampling

- When cleaning bathroom
- Gloves are worn
    - Gloves fit properly
    - Gloves are not broken

Personal Protective Equipment Goggles/Safety Glasses → momentary time sampling

- When cleaning bathroom
- Regular glasses do not qualify, goggles should protect of splashes.
- Safety glasses or goggles are worn
    - Glasses fit properly
    - Glasses are positioned properly (cover eyes, not on top of head)

Appendix G

RA Data Collection Checklists

Lifting

[Lifting] Upper Body Position

whole interval

N/A

[Lifting] Feet Spread/Stable Base

whole interval

N/A

[Lifting] Bend Knees/Lift With Legs

whole interval

N/A

[Lifting] Good Grip/Break Up Load

whole interval

N/A

[Lifting] No Twisting

whole interval

N/A

Vacuuming

[Vacuuming] Make A Cord Snake

momentary time sampling

N/A

[Vacuuming] Cord Management Interval 1

partial inverval

N/A

[Vacuuming] Vacuuming Motion Interval 1

partial inverval

N/A

[Vacuuming] Cord Management Interval 6

partial inverval

N/A

[Vacuuming] Vacuuming Motion Interval 6

partial inverval

N/A

[Vacuuming] Make A Cord Snake

momentary time sampling

N/A

[Vacuuming] Unplugged Cord With Hands

Whole Interval

N/A

Mopping

[Mopping] Bucket Management

momentary time sampling

N/A

[Mopping] Pathing Interval 1

partial inverval

N/A

[Mopping] Mopping Motion Interval 1

partial inverval

N/A

[Mopping] Pathingt Interval 6

partial inverval

N/A

[Mopping] Mopping Motion Interval 6

partial inverval

N/A

[Mopping] Bucket Management

momentary time sampling

N/A

Pressure Washer

[Pressure Washer] Make A Cord Snake

momentary time sampling

N/A

[Pressure Washer] Pathing Interval 1

partial inverval

N/A

[Pressure Washer] Cord Management Interval 1

partial inverval

N/A

[Pressure Washer] Vacuuming Motion Interval 1

partial inverval

N/A

[Pressure Washer] Cord Management Interval 6

partial inverval

N/A

[Pressure Washer] Make A Cord Snake

momentary time sampling

N/A

[Pressure Washer] Pathing Interval 6

partial inverval

N/A

[Pressure Washer] Unplugged Cord with Hands

Whole Interval

N/A

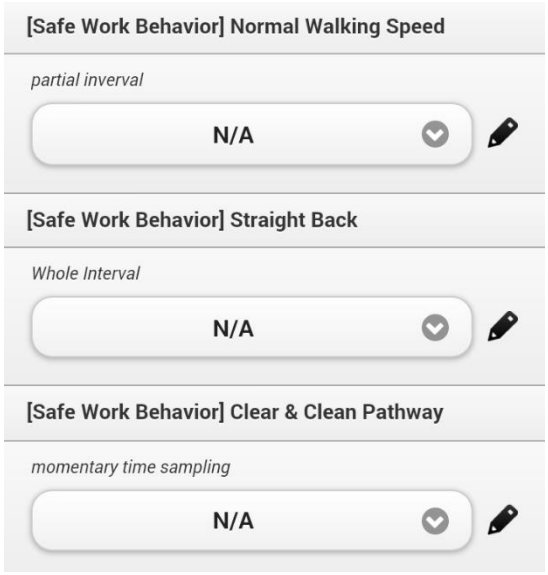
[Pressure Washer] Vacuuming Motion Interval 6

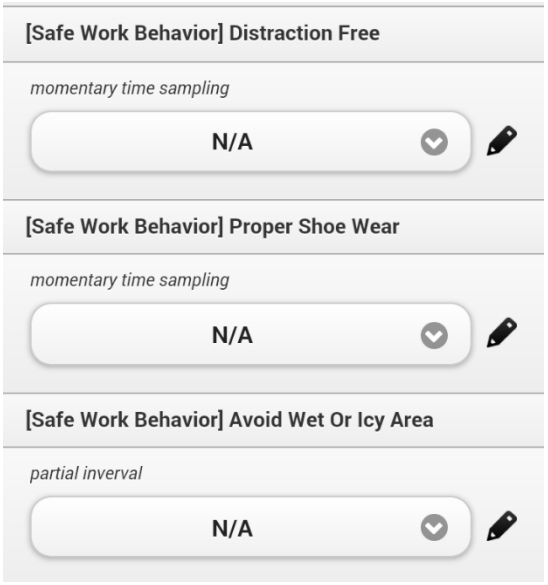
partial inverval

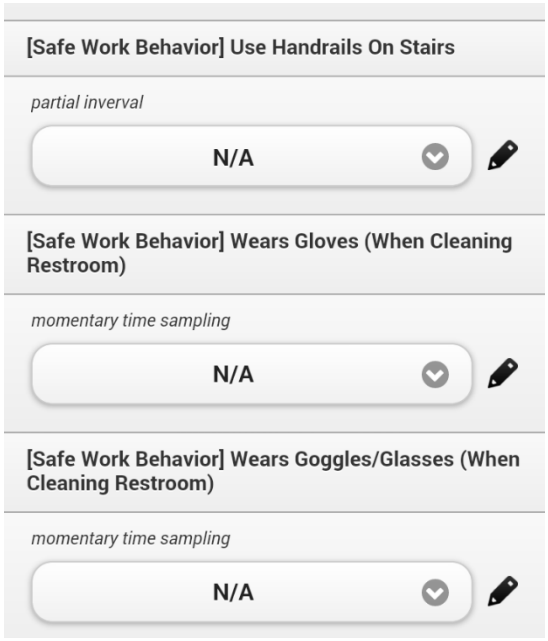
N/A

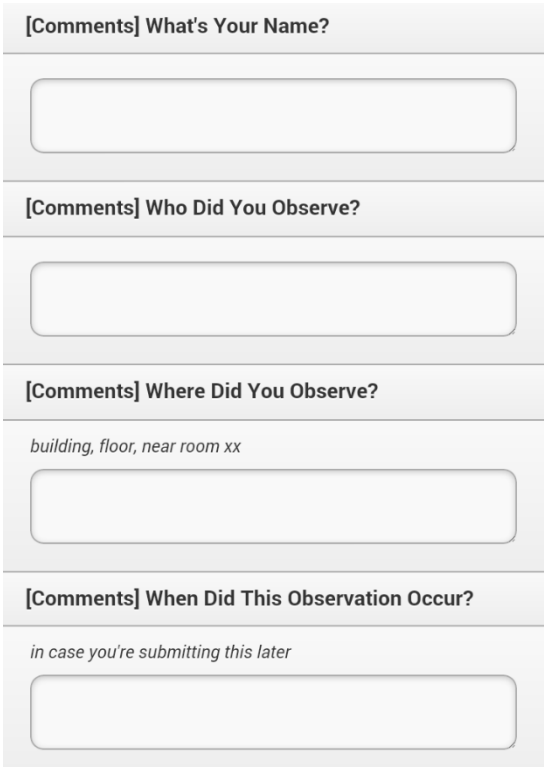
General Safe Work Behavior & General Information

These items can be found on all checklists.









Mini Checklist

Upper	U/S	Speed	U/S	Snake/Bucket	U/S
Base	U/S	Shoes	U/S	Unplug	U/S
Lift	U/S	Distract	U/S	Remake	U/S
Secure	U/S	Clear	U/S		
Twist	U/S	Straight	U/S		
		Avoids	U/S		
		Rail	U/S		

	Motion	Cord/Pathing
1		
2		
3		
4		
5		
6		

Appendix H

Checklists for Employees

Lifting

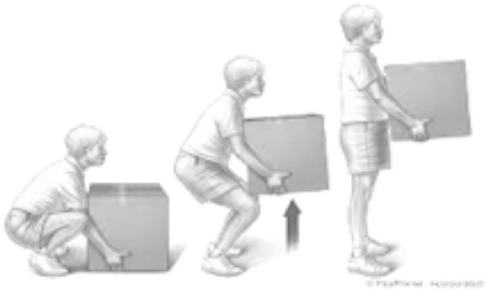
SELF OBSERVATION LIFTING CHECKLIST

Observer: _____ **Date:** _____ **Time:** _____

How soon after observation did you fill out the checklist?_____ **Location:** _____

Instructions:

- **REVIEW THE CHECKLIST → PERFORM THE LIFT → FILL OUT THE CHECKLIST**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box



My preparation before lifting	***Safe***	***Concern***	***Comments***
Tug test load			
Get help if needed			
Feet spread			

My lifting of the load was	***Safe***	***Concern***	***Comments***
Stable base			
Back straight/still			
Legs bent			
Good grip			

While handling the load, I did	***Safe***	***Concern***	***Comments***
Arms bent			
Spine straight			
Carrying the load close to body			
Move feet/ no Twisting			
Hip & shoulders move together			

General Safety	***Safe***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

→ **Number of Safe Practices** ☐

→ **Number of Concerns** ☐

General Comments:

CO-WORKER OBSERVATION LIFTING CHECKLIST

Observer: _____ **Date:** _____ **Time:** _____

Name of Co-Worker:_____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **FIND A PEER AND OBSERVE THE PEER'S SAFETY WHILE LIFTING!**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box or include praise
- for good performance

GETTING READY TO LIFT	***Safe Practices***	***Concern***	***Comments***
Tug test load			
Get help if needed			
Feet spread			

LIFTING THE LOAD	***Safe Practices***	***Concern***	***Comments***
Stable base			
Back straight/still			
Legs bent			
Good grip			

HANDLING THE LOAD	***Safe Practices***	***Concern***	***Comments***
Arms bent			
Spine straight			
Carrying the load close to body			
Move feet/ no Twisting			
Hip & shoulders move together			

GENERAL SAFETY	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

→ **Number of Safe Practices**	
→ **Number of Concerns**	

General Comments:

Last Updated 2014-10-01

SELF & CO-WORKER LIFTING OBSERVATION CHECKLIST

/

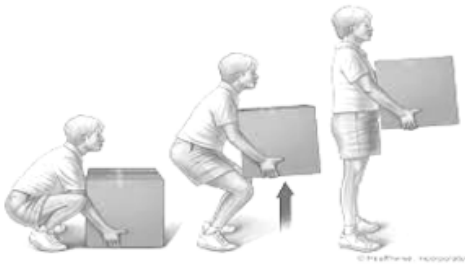
Observer: _____ **Date:** _____ **Time:** _____

Self ☐ **OR** **Co-Worker:**_____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- *After observation of each point, place a checkmark in the appropriate box*
  - o *"Safe Practices"*
  - o *"Concern".*
  - o *"NA" in the comments box.*
- *Explain the concern in the comments box or include praise for good performance*



Getting Ready to Lift	***Safe Practices***	***Concern***	***Comments***
Tug test load			
Get help if needed			
Feet spread			

Lifting the Load	***Safe Practices***	***Concern***	***Comments***
Stable base			
Back straight/still			
Legs bent			
Good grip			

Handling the Load	***Safe Practices***	***Concern***	***Comments***
Arms bent			
Spine straight			
Carrying the load close to body			
Move feet/ no Twisting			
Hip & shoulders move together			

General Safety	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

➔ ***No of Safe Practices*** ☐

➔ ***No of Concerns*** ☐

General Comments:

Last Updated 2014-10-13

Getting Ready to Lift

Test tug load	• Visually inspect load to see what it contains and assess weight • Lightly tug on the load to make sure it is not heavier or lighter than anticipated
Get help if needed	• Ask for peer assistance if/when appropriate • Use mechanical machines (such as a dolly or rolling cart if available) • Break up load into lighter segments if/when appropriate
Feet Spread	• Position during pick-up/putting down load • Feet at shoulder width slightly angled outwards • Knees in alignment with toe

Lifting the Load

Stable Base	• Feet maybe parallel, but one foot may also be in front of the other • Firm stand no waddling or loosing balance
Back straight/ still	• Lower back remains straight and not engaged/no movement • Torso is not curved
Legs bent	• Bending the leg leg is carrying the load • Squat down or Kneel down on one leg • Hips remain aligned below shoulders
Good Grip	• Grip is firm and stable • Load does not shift within grasp→ No shaking, straining, or readjusting! • Two hands are used when heavy or hard to handle needed

Handling the Load

Upper Body position	• Light load
	  o May carry one bag in each hand
	  o Arms & elbows bent naturally Spine remains straight
	• Heavy load
	  o Elbows placed just beyond rib cage
	  o Arms bent at right angle
	  o Keep load in middle of body

Spine straight	• Spine is straight, not bent to either side
Carrying the load close to body	• Keep load as close to body as possible • Trash bag should not touch the body (brief brush is OK)
Move feet/ No Twisting	• Open foot toward direction of turn
Hip & shoulders move together	• Maintain hip-shoulder alignment during step • Mostly a turn of more than 45 degrees requires more than one step

Vacuuming

SELF OBSERVATION VACUUMING CHECKLIST

Observer: _____ **Date:** _____ **Time:** _____

How soon after observation did you fill out the checklist?: _____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **REVIEW THE CHECKLIST → USE THE VACUUM→ FILL OUT THE CHECKLIST**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

How was my cord management?	***Safe***	***Concern***	***Comments***
Check for the closest outlet			
Make Cord Snake			
Free pathway (if possible)			
Awareness of passers-by			
No contact with cord			

***Check which type of vacuum is being used and answer questions accordingly**

UPRIGHT VACUUM ☐ ***BACKPACK VACUUM*** ☐

Vacuuming	***Safe***	***Concern***	***Comments***
Fit of the Backpack ***Backpack only**			
Forward and Back Motion ***Upright only**			
Side to Side Motion ***Backpack only**			
No twisting			***Comments***
Remove plug at cord base			

General Safety	***Safe***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

General Comments:

→ **Number of Safe Practices** ☐

→ **Number of Concerns** ☐

CO-WORKER OBSERVATION VACUUMING CHECKLIST

Observer: _____ **Date:** _____ **Time:** _____

Co-Worker: _____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **FIND A CO-WORKER AND OBSERVE THEIR SAFETY WHILE USING THE VACUUM!**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box or include praise for good performance

CORD MANAGEMENT	***Safe Practices***	***Concern***	***Comments***
Check for the closest outlet			
Make Cord Snake			
Free pathway (if possible)			
Awareness of passers-by			
No contact with cord			

***Check which type of vacuum is being used and answer questions accordingly**

UPRIGHT VACUUM ☐ ***BACKPACK VACUUM*** ☐

	Safe Practices	***Concern***	***Comments***
Fit of the Backpack ***Backpack only***			
Forward and Back Motion ***Upright Only***			
Side to Side Motion ***Backpack only***			
No Twisting			
Remove Plug at Cord Base			

GENERAL SAFETY	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

Number of Safe Practices ☐

Number of Concerns ☐

General Comments:

Last Updated 2014-10-01

SELF & CO-WORKER VACUUMING OBSERVATION CHECKLIST

/

Observer: _____ *Date:* _____ *Time:* _____

Self ☐ *OR* *Co-Worker:*_____ *Location:* _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- *After observation of each point, place a checkmark in the appropriate box*
  - *"Safe Practices"*
  - *"Concern".*
  - *"NA" in the comments box.*
- *Explain the concern in the comments box or include praise for good performance*

Cord Management	*Safe Practices*	*Concern*	*Comments*
Check for the closest outlet			
Make Cord Snake			
Free pathway (if possible)			
Awareness of passers-by			
No contact with cord			

**Check which type of vacuum is being used and answer the questions accordingly*

UPRIGHT VACUUM ☐ *BACKPACK VACUUM* ☐

Vacuuming	*Safe Practices*	*Concern*	*Comments*
Forward and Back motion ****Upright Only***			
Fit of the backpack ****Backpack Only***			
Side to side motion ****Backpack Only***			
No twisting			
Remove plug at cord base			

General Safety	*Safe Practices*	*Concern*	*Comments*
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

→ ***No of Safe Practices*** ☐

→ ***No of Concerns*** ☐

General Comments:

Last Updated 2014-10-13

Cord Management

Closet outlet	● Observe all outlets in your work area & determine if closest & most practical is in use
Make cord snake	● Cord is coiled in a manner in which slack line is naturally produced ● Start winding at machine ● Note cord may not always allow for neat coiling ● Organized not tangled, should uncoil neatly
Free pathway (if possible)	● Cord should remain behind body, creating a cord free pathway for vacuuming. ● Cord should never be laid out in a way that would cause unavoidable obstacle for passer-by.
Awareness of passers-by	● Looking for pedestrians crossing hallway ● Stopping the vacuuming motion if needed to allow safe crossing ● Cord is flat on the ground, straight and coiled at the side ● If cord is moved, look behind to ensure that it doesn't obstruct pedestrians
No contact with cord	● No stepping on cord or being tangled around operator body ● The vacuum should never touch or roll over the cord

Upright Vacuum

Front to back motion	● Roll forward and backward. ● Extend arm and leg together to roll vacuum forward. ● Retract arm and leg together to roll vacuum backward.
No twisting	● Hips and shoulders should be in alignment.
Remove plug cord at base	● Grab plug with hand and gently remove from outlet. ● No yanking or abrupt removal of plug from outlet ● Motion of cord should be controlled; no whip-like motion

Backpack Vacuum

Fit backpack	● Screw and straps is tightened ● Waistband and other straps are closed
Side to side motion	● Adjust the backpack to make sure it fits properly ● Sweep stick to one side of body to the other side of the body. ● Lead hand should stop just outside of hip ● On stairs steps or corners and close to walls, the motion may vary.
No twisting	● Hips and shoulders should be in alignment.

Mopping

SELF OBSERVATION MOPPING CHECKLIST

Observer: _____ **Date:** _____ **Time:** _____

How soon after observation did you fill out the checklist?: _____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **REVIEW THE CHECKLIST → MOP → FILL OUT THE CHECKLIST**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

Bucket Management	***Safe Practices***	***Concern***	***Comments***
Put up wet floor sign			
Place bucket near mopping endpoint and is out of way			
Clear any spills surrounding the bucket			
Drain bucket			
Rinse off mops			

Pathway	***Safe Practices***	***Concern***	***Comments***
Start mopping in rear of area			
Move backwards or sideways towards bucket location			
Stay on dry ground			

Mopping Motion	***Safe Practices***	***Concern***	***Comments***
Sweep mop stick in a figure 8 motion			
Full body motion (no twisting)			
Elbow in/close to body			

General Safety	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

→ **No of Safe Practices** | |

→ **No of Concerns** | |

General Comments:

CO-WORKER OBSERVATION MOPPING CHECKLIST

Observer:_____ **Date:**_____ **Time:**_____

Co-Worker:_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **FIND A CO-WORKER AND OBSERVE THEIR SAFETY WHILE MOPPING**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices"
  - "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

Bucket Management	***Safe Practices***	***Concern***	***Comments***
Put up wet floor sign			
Place bucket near mopping endpoint and is out of way			
Clear any spills surrounding the bucket			
Drain Bucket			
Rinse off mops			

Pathway	***Safe Practices***	***Concern***	***Comments***
Start mopping in rear of area			
Move backwards or sideways towards bucket location			
Stay on dry ground			

Mopping Motion	***Safe Practices***	***Concern***	***Comments***
Sweep mop stick in a figure 8 motion			
Full body motion (no twisting)			
Elbow in/close to body			

General Safety	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

General Comments:

→ **No of Safe Practices** ☐

→ **No of Concerns** ☐

Last Updated 2015-4-3

SELF & CO-WORKER MOPPING OBSERVATION CHECKLIST

Observer:_____ ***Date:***_____ ***Time:***_____

Self ☐ ***OR*** ***Co-Worker:***_____ ***Location:***_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- *After observation of each point, place a checkmark in the appropriate box*
  - *"Safe Practices"*
  - *"Concern".*
  - *"NA" in the comments box.*
- *Explain the concern in the comments box or include praise for good performance*

Bucket Management	***Safe Practices***	***Concern***	***Comments***
Put up wet floor sign			
Place bucket near mopping endpoint and is out of way			
Clear any spills surrounding the bucket			
Drain Bucket			
Rinse off mops			

Pathway	***Safe Practices***	***Concern***	***Comments***
Start mopping in rear of area			
Move backwards or sideways towards bucket location			
Stay on dry ground			

Mopping Motion	***Safe Practices***	***Concern***	***Comments***
Sweep mop stick in a figure 8 motion			
Full body motion (no twisting)			
Elbow in/close to body			

General Safety	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

General Comments:

➔ ***No of Safe Practices*** ☐

➔ ***No of Concerns*** ☐

Last Updated 2015-4-3

Bucket Management

Clear any spills surrounding the bucket	• Make sure that area surrounding the bucket is clean • There shouldn't be any spills
Place bucket near mopping endpoint and is out of way	• Start with placing a bucket near endpoint • Make sure the bucket is out of way
Drain bucket	• Use wet vacuum on kaizen to empty mop bucket • Do NOT lift heavy mop bucket by yourself (→ Use lifting checklist) • Get help if needed

Pathway

Start mopping in rear of area	• Walk to the rear area and start mopping there • Work your way towards the start point
Move backwards or sideways towards bucket location	• The path should be moving backwards or sideways • Work your way towards bucket location
Stay on dry ground	• You should always stay on dry ground • Your path shouldn't go though wet floor

Mopping Motion

Sweep mop stick in a figure 8 motion	• Sweep mop stick to one side of body to the other side of the body • Small step back with each sweep motion • Upper body in alignment with mopping motion • Large mopping motion requires upper bodily alignment with legs and small step to avoid twisting • Figure motion requires change in wrist posture
Full body motion (no twisting)	• Legs (knees) and upper body should be in alignment • Use full body motion • No twisting
Elbow in/close to body	• Lead hand should stop on the outside of hip

Restroom

SELF OBSERVATION RESTROOM CHECKLIST

Observer:_____ Date:_____ Time:_____

How soon after observation did you fill out the checklist?:_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **REVIEW THE CHECKLIST → PERFORM THE RESTROOM TASKS → FILL OUT THE CHECKLIST**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

Getting Ready to Clean	Safe Practices	Concern	Comments
Assesses the machine and cord for visible damage			
Put up a bathroom closed sign			
Test GFCI			
Wear the PPE: goggles & gloves			

Cleaning the Bathroom	Safe Practices	Concern	Comments
Unwind cord of pressure/wet vacuum			
Start to spray in the back of the room first then walk back to door Stay on → dry ground			
Rinse carefully when using chemical → NOT with Ozone			
Start vacuuming at the door, working way forward → Stay on dry ground			
Front to back motion with Kaizen wet vacuum			
Back is straight/ no twisting throughout Kaizen use			

General Safety	Safe Practices	Concern	Comments
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			

→ **No of Safe Practices** | |

→ **No of Concerns** | |

General Comments:

CO-WORKER OBSERVATION RESTROOM CHECKLIST

Observer:_____ **Date:**_____ **Time:**_____

Co-Worker:_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices"
  - "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

Getting Ready to Clean	***Safe Practices***	***Concern***	***Comments***
Assesses the machine and cord for visible damage			
Put up a bathroom closed sign			
Test GFCI			
Wear the PPE: goggles & gloves			

Cleaning the Bathroom	***Safe Practices***	***Concern***	***Comments***
Unwind cord of pressure/wet vacuum			
Start to spray in the back of the room first then walk back to door Stay on → dry ground			
Rinse carefully when using chemical → NOT with Ozone			
Start vacuuming at the door, working way forward → Stay on dry ground			
Front to back motion with Kaizen wet vacuum			
Back is straight/ no twisting throughout Kaizen use			

General Safety	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

→ **No of Safe Practices** | |

→ **No of Concerns** | |

General Comments:

Last Updated 2014-11-12

SELF & CO-WORKER RESTROOM CLEANING OBSERVATION CHECKLIST

Observer:_____ **Date:**_____ **Time:**_____

Self ☐ **OR** **Co-Worker:**_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- *After observation of each point, place a checkmark in the appropriate box*
  - *"Safe Practices"*
  - *"Concern".*
  - *"NA" in the comments box.*
- *Explain the concern in the comments box or include praise for good performance*

Getting Ready to Clean	Safe Practices	Concern	Comments
Assesses the machine and cord for visible damage			
Put up a bathroom closed sign			
Test GFCI			
Wear the PPE: goggles & gloves			

Cleaning the Bathroom	Safe Practices	Concern	Comments
Unwind cord of pressure/wet vacuum			
Start to spray in the back of the room first then walk back to door Stay on → dry ground			
Rinse carefully when using chemical & watch your step on wet ground			
Start vacuuming at the door, working way forward → Stay on dry ground			
Front to back motion with Kaizen wet vacuum			
Back is straight/ no twisting throughout Kaizen use			

General Safety	Safe Practices	Concern	Comments
Clean and clear pathway			
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free			
Proper shoe wear			

→ **No of Safe Practices** ☐

→ **No of Concerns** ☐

General Comments:

Definitions

Last Updated 2015-3-26

Getting Ready to Clean

Assesses the machine and cord for visible damage	● Check for frays or tangles in the cord ● Make sure the machine is running properly and is ready for use
Put up a bathroom closed sign	● Put bathroom closed sign outside the bathroom door ● Make it visible for all passers-by
Test GFCI	● Plug the vacuum in ● Click the test button ● If it clicks, this means that circuit is interrupted so you can start vacuuming ● If it doesn't click, do NOT use and inform appliance repair
Wear the PPE: goggles, gloves	● Has on safety glasses ● Wearing gloves ● Shoes are non-slip

Cleaning the bathroom

Unwind cord of pressure/wet vacuum and dry it	• First unwind the cord • Then dry it if it is wet.
Start to spray in the back of the room first then walk back to door **Stay on → dry ground**	● Go in the back of the room ● Start spraying there ● Work your way towards the door ● Stay on dry ground at all times
Rinse carefully with chemicals → NOT with Ozone	• Rinse the bathroom with chemicals • Make sure not to use Ozone
Start vacuuming at the door, working way forward → Stay on dry ground	● Begin at door and start vacuuming water ● Carefully and thoroughly work towards the back corner, stepping on dry floor at ALL time ● Avoid wet floor and cord at all times. ● Keep cord on dry ground
Front to back motion with Kaizen wet vacuum	• Roll forward and backward. • Extend arm and leg together to roll vacuum forward. • Retract arm and leg together to roll vacuum backward.
Back is straight/ no twisting throughout Kaizen use	● When maneuvering body while cleaning, back remains straight ● No hunching or twisting ● Hips remain aligned below shoulders

Ladder

SELF OBSERVATION LADDER CHECKLIST

Observer: _____ Date: _____ Time: _____

How soon after observation did you
Fill out the checklist?:_____ Location: _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **REVIEW THE CHECKLIST → USE THE LADDER → FILL OUT THE CHECKLIST**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

Safety Checks before starting	***Safe***	***Concern***	***Comments***
Inspect ladder before use			
Carry ladder parallel and close to the ground			

How did you set up your ladder?	***Safe***	***Concern***	***Comments***
Clean and clear pathway			
Ask for assistance if needed			

Using the ladder	***Safe***	***Concern***	***Comments***
Ladder is based on firm footing & stable			
Safe Climbing & 3 point contact at all times			
Tools carried in belt/pouch			
Over reaching prevented			

General Safety	***Safe***	***Concern***	***Comments***
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free area			
Proper shoe wear			

→ **Number of Safe Practices** ☐

→ **Number of Concerns** ☐

General Comments:

CO-WORKER OBSERVATION LADDER CHECKLIST

Observer: _____ **Date:** _____ **Time:** _____

Co-Worker:_____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **FIND A PEER AND OBSERVE THE PEER'S SAFETY WHILE USING THE LADDER!**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices" OR "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box or include praise for good performance

PRE-OPERATIONAL SAFETY CHECKS	***Safe Practices***	***Concern***	***Comments***
Inspect ladder before use			
Carry ladder parallel and close to the ground			

SETTING UP THE LADDER	***Safe Practices***	***Concern***	***Comments***
Clean and clear pathway			
Ask for assistance if needed			

USING THE LADDER	***Safe Practices***	***Concern***	***Comments***
Ladder is based on firm footing & stable			
Safe Climbing & 3 point contact at all times			
Tools carried in belt/pouch			
Over reaching prevented			

GENERAL SAFETY	***Safe Practices***	***Concern***	***Comments***
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free area			
Proper shoe wear			

→ **Number of Safe Practices** ☐

→ **Number of Concerns** ☐

General Comments:

Last Updated 2014-09-05

SELF & CO-WORKER LADDER OBSERVATION CHECKLIST

/

Observer: _____ **Date:** _____ **Time:** _____

Self ☐ **OR** **Co-Worker:**_____ **Location:** _____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- *After observation of each point, place a checkmark in the appropriate box*
  - *"Safe Practices"*
  - *"Concern".*
  - *"NA" in the comments box.*
- *Explain the concern in the comments box or include praise for good performance*

Pre-operational safety checks	Safe Practices	Concern	Comments
Inspect ladder before use			
Carry ladder parallel and close to the ground			

Setting up the ladder	Safe Practices	Concern	Comments
Clean and clear pathway			
Ask for assistance if needed			

Using the ladder	Safe Practices	Concern	Comments
Ladder is based on firm footing & stable			
Safe Climbing & 3 point contact at all times			
Tools carried in belt/pouch			
Over reaching prevented			

General Safety	Safe Practices	Concern	Comments
Normal walking speed			
Safe bending (plug or pick up)			
Distraction free area			
Proper shoe wear			

→ **No of Safe Practices** ☐

→ **No of Concerns** ☐

General Comments:

Last Updated 2014-10-13

Pre-operational Safety Checks

Inspect ladder before use	• Joints between step and side rails tight, all fittings secure, moving parts operating freely, all components of ladder are intact including side rails, steps, rungs, rubber feet, spreader • Don't place arms or hands between rungs • Check for stability → Take out damaged ladders • No wooden ladders
Carry ladder parallel and close to the ground → *See Safe Lifting Checklist*	• Carry single or extension ladders parallel to the ground and hold the side rail in the middle of the ladder to balance the load • Carry step ladders in the closed position and an extension ladder with the center balanced and resting on your shoulder with your arm through the ladder

Setting up the ladder

Clean and clear pathway	• Boxes, carts, equipment, etc. on edge of path not in middle. • No spills of visible debris in the middle of the pathway. • Barriers are set up if necessary to block a passageway, doorways, signs
Ask for assistance	• Spotter is needed if ladder is long, heavy • Spotter is needed if surfaces are uneven and for long tasks or hanging lights • Spotter has feet flat and stable base and is observant of climber • Spotter stands on bottom rung to anchor, arms secure on sides of the ladder

Using the ladder

Ladder is based on firm footing & stable	• <u>4 to 1 Rule:</u> Every 4 foot high, ladder placed 1 foot away from building • Don't place ladder on any other items to increase height such as boxes or tables Ladder based on firm footing and secured against slippage • Weight of the ladder places squarely on the ladder feet not on rungs • Keep away from power line
Safe Climbing & 3 point contact at all times	• Climb facing the ladder, center your body between rails & maintain firm grip • Never hurry or skip steps. Move one step at a time, setting one foot before moving other Only 1 person on ladder • Do not use the top of the ladder as a step • Two hands and a foot or two feet and a hand (when as/descending)
Tools carried in belt/in pouch	• Tools carried on a belt or in took pouch and materials hoisted • Be careful if you use a tool belt. Make sure tools do not catch on the ladder when climbing

Over reaching is prevented	● Ladder is re-positioned if needed, move materials with caution ● Limit side reaching ● Belt buckle/center of body should not be further than the side rail

Walking on Ice

SELF OBSERVATION WALKING ON ICE CHECKLIST

Observer:_____ **Date:**_____ **Time:**_____

How soon after the observation did you fill out the checklist?:_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **REVIEW THE CHECKLIST → WALK ON ICE → FILL OUT THE CHECKLIST**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices"
  - "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

Safety Preparations	Safe Practices	Concern	Comments
Winter Shoes			
Clothes			
Test the surface			

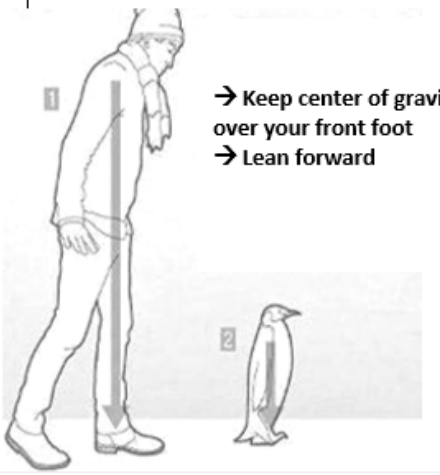
Walking on ice	Safe Practices	Concern	Comments
Avoiding icy/slippery areas			
Penguin Walk			
Penguin Posture (Falling preparedness)			

General Safety	Safe Practices	Concern	Comments
Clean and clear pathway			
Safe Bending			
Distraction free			

→ **No. of Safe Practices** | |

→ **No. of Concerns** | |

General Comments:



→ Keep center of gravity over your front foot
→ Lean forward

Last Updated 2014-11-14

CO-WORKER OBSERVATION WALKING ON ICE CHECKLIST

Observer:_____ **Date:**_____ **Time:**_____

Co-Worker:_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- **FIND A CO-WORKER AND OBSERVE THEIR SAFETY WHILE WALKING ON ICE!**
- After observation of each point, place a checkmark in the appropriate box
  - "Safe Practices"
  - "Concern".
  - "NA" in the comments box.
- Explain the concern in the comments box

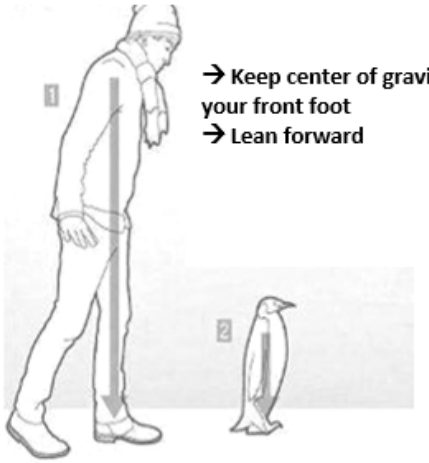
Safety Preparations	**Safe Practices**	**Concern**	**Comments**
Winter Shoes			
Clothes			
Test the surface			

Walking on ice	**Safe Practices**	**Concern**	**Comments**
Avoiding icy/slippery areas			
Penguin Walk			
Penguin Posture (Falling preparedness)			

General Safety	**Safe Practices**	**Concern**	**Comments**
Clean and clear pathway			
Safe Bending			
Distraction free			

→ **No. of Safe Practices** ☐

→ **No. of Concerns** ☐



→ Keep center of gravity over your front foot
→ Lean forward

General Comments:

Last Updated 2014-11-14

WALKING ON ICE CHECKLIST

Observer:_____ **Date:**_____ **Time:**_____

Self ☐ **OR** **Co-Worker:**_____ **Location:**_____

Please make sure to include at least one of the following: Name, Location, or Zone

Instructions:

- *After observation of each point, place a checkmark in the appropriate box*
  - *"Safe Practices"*
  - *"Concern".*
  - *"NA" in the comments box.*
- *Explain the concern in the comments box or include praise for good performance*

Safety Preparations	Safe Practices	Concern	Comments
Winter Shoes			
Clothes			
Test the surface			

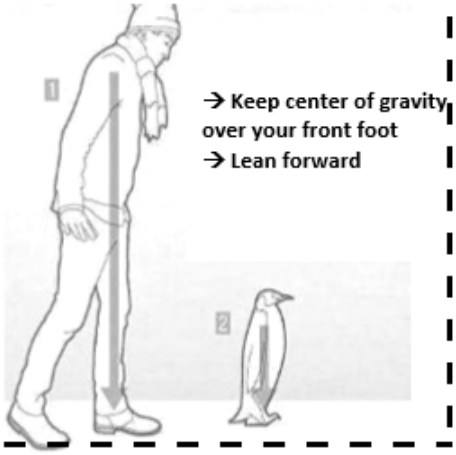
Walking on ice	Safe Practices	Concern	Comments
Avoiding icy/slippery areas			
Penguin Walk			
Penguin Posture (Falling preparedness)			

General Safety	Safe Practices	Concern	Comments
Clean and clear pathway			
Safe Bending			
Distraction free			

→ **No. of Safe Practices** ☐

→ **No. of Concerns** ☐

General Comments:



Last Updated 2014-11-14

General Safe Work Behaviors

General safe work behaviors are found on each of the checklists. These behaviors should always be present to ensure a safe work environment. These are on each checklist as these behaviors may occur during any task.

Clean and clear pathway	● Boxes, carts, equipment, etc. on edge of path not in middle. ● No spills of visible debris in the middle of the pathway.
Normal walking speed	● Small steps feet remain under body→ no Running ● Lift feet to prevent tripping → Do not shuffle
Safe Bending (plug or pick up)	● Reverse this motion to lift, or stand up (no rotation of the legs) ● Begin prior to bending, lower back remains straight (torso not curved) ● Hips remain aligned below shoulders ● Squat down to pick up load, unplug cord etc. ● Reverse motion to stand up
Distraction free	● Not holding/or using cell phone. ● Not wearing ear buds, headphones or Bluetooth headset. ● No conversations (via phone, radio or in-person) while performing tasks.
Proper shoe wear	● Shoe made of firm or man-made leather that covers entire foot ● Any fastenings or bindings are securely tied or in place. ● Tread is intact and not worn to sole and shoes are clean

Supervisor Checklists

Version I

Supervisor Safety Checklist

Observe the custodian & provide feedback on the crucial safety behaviors below & tally observations

Lifting (last week:____%)		Vacuuming (last week:____%)		Walking on Ice (last week:____%)		Mopping (last week:____%)	
Bend knees & keep back straight 		*Keep cord clear of pathway* 		*Walk like a penguin* 		*Stay on dry ground* 	
Safe	*Concern*	*Safe*	*Concern*	*Safe*	*Concern*	*Safe*	*Concern*

$$\frac{\text{No of Safe Practices}}{\text{No of Safe Practices + No of Concerns}} \times 100 = \square$$

General comments & Feedback:

I talked about the importance of safety, provide safety feedback or investigated/removed safety barriers:

- Who? _____ What?_____
- Who? _____ What?_____
- Who? _____ What?_____

I did interact with the zone's safety ambassador (_____) about _____

_____.

Supervisor Name: _____ *Zone:* ____ *Week of* _____

Version II

Supervisor Safety Checklist

Observe the custodian & provide feedback on the crucial safety behaviors below & tally observations

Lifting		Vacuuming		Mopping	
➔ last week:____%		➔ last week:____%		➔ last week:____%	
Bend knees & keep back straight 		*Keep cord clear of pathway* 		*Stay on dry ground* 	
Safe	*Concern*	*Safe*	*Concern*	*Safe*	*Concern*

I provide safety feedback, investigated/removed safety barriers or talked about the importance of safety with:

- Who? _____ What?_____
- Who? _____ What?_____
- Who? _____ What?_____

General Comments & Feedback:

$$\frac{\text{No of Safe Practices}}{\text{No of Safe Practices + No of Concerns}} \times 100 = \square$$

I did interact with the zone's safety ambassador (_____) about _____

_____.

Supervisor Name: _____ *Zone:* ___ *Week from* _____ *to* _____

Appendix I

Discrepancy and Correlational Analyses

Discrepancies Across Behavior and Criteria Listed by Observation Type

	All Groups - self	All Groups - peer	Group 1 - self	Group 2 - self	Group 2 - peer	Group 3 - self	Group 3 - peer	Safety Committee
LIFT	22%	22%	21%	32%	23%	19%	21%	16%
LIFT - Upper	22%	23%	22%	32%	17%	17%	14%	24%
LIFT - Base	11%	11%	8%	22%	13%	8%	6%	8%
LIFT - Lift	45%	49%	39%	69%	50%	37%	45%	25%
LIFT - Grip	13%	8%	15%	15%	7%	10%	8%	13%
LIFT -Twist	26%	21%	23%	24%	16%	31%	33%	13%
VACUUM	20%	16%	18%	12%	16%	20%	26%	17%
VAC - Snake	20%	20%	21%	10%	16%	24%	31%	6%
VAC - Cord	23%	19%	24%	24%	17%	22%	22%	17%
VAC - Unplug	4%	7%	1%	0%	3%	9%	17%	25%
MOPPING	25%	34%	19%	38%	34%	27%		
SAFE BX EXP	11%	11%	13%	12%	13%	8%	8%	3%
Total average without general safe behavior	17%	16%	17%	16%	18%	16%	13%	13%

Correlations between Compliance and Improvement

		All Groups	Group 1	Group 2	Group 3
LIFT	r=	-0.325*	-0.261	-0.481*	-0.436
	p=	0.053	0.368	0.082	0.136
LIFT – Upper	r=	-0.291*	-0.188	-0.257	-0.316
	p=	0.085	0.52	0.376	0.252
LIFT – Base	r=	-0.166	-0.221	-0.094	-0.729***
	p=	0.307	0.490	0.759	0.002
LIFT – Lift	r=	-0.075	-0.213	-0.468*	0.061
	p=	0.675	0.506	0.107	0.828
LIFT – Grip	r=	0.020	.116	-0.282	.413
	p=	0.913	0.705	0.351	0.161
LIFT –Twist	r=	-0.321*	-0.321	-0.420	-0.095
	p=	0.056	0.263	0.135	0.735
VACUUM	r=	-0.060	-0.371	0.440*	-0.271
	p=	0.718	0.235	0.101	0.395
VAC – Snake	r=	-0.127	-0.290	-0.061	-0.145
	p=	0.448	0.361	0.836	0.653
VAC – Cord	r=	-0.069	-0.174	0.601**	-0.177
	p=	0.674	0.428	0.018	0.582
VAC – Unplug	r=	0.260	.604	-0.798**	0.261
	p=	0.242	0.204	0.031	0.532
MOPPING	r=	0.005	0.806	-0.489	0.196
	p=	0.986	0.194	0.403	0.710
SAFE BX EXP	r=	-0.069	-0.362	0.410	0.381
	p=	0.677	0.185	0.115	0.161
Total average without general safe behavior	r=	-0.003	-0.196	0.016	-0.205
	p=	0.987	0.483	0.952	0.464

Correlations between Discrepancy and Compliance

		All Groups - self	All Groups - peer	Group 1 - self	Group 2 - self	Group 2 - peer	Group 3 - self	Group 3 - peer
LIFT	r=	-0.224	0.055	-0.103	-0.371	-0.050	0.896**	0.095
	p=	0.104	0.78	0.649	0.261	0.825	0.001	0.808
LIFT - Upper	r=	-0.108	-0.078	-0.055	-0.178	-0.156	-0.258	-0.298
	p=	0.439	0.694	0.809	0.600	0.489	0.258	0.436
LIFT - Base	r=	-0.006	0.384**	-0.073	0.311	0.408	-0.241	0.672**
	p=	0.97	0.044	0.76	0.351	0.059	0.292	0.047
LIFT - Lift	r=	-0.184	-0.036	0.119	-0.364	-0.071	-0.429*	0.042
	p=	0.191	0.859	0.617	0.271	0.754	0.052	0.914
LIFT - Grip	r=	-0.064	-0.029	-0.023	-0.389	0.036	-0.092	0.428
	p=	0.647	0.885	0.919	0.236	0.875	0.69	0.25
LIFT - Twist	r=	-0.189	-0.081	-0.075	-0.566*	-0.268	-0.061	-0.129
	p=	0.175	0.682	0.747	0.069	0.228	0.794	0.74
VACUUM	r=	0.169	-0.069	0.484	-0.511	-0.277	0.036	-0.018
	p=	0.246	0.716	0.111	0.300	0.318	0.911	0.973
VAC - Snake	r=	0.29**	0.062	0.524**	0.329	-0.159	0.04	0.036
	p=	0.037	0.752	0.015	0.353	0.458	0.864	0.92
VAC – Cord	r=	-0.134	-0.001	0.174	-0.421	-0.363*	0.403*	0.264
	p=	0.334	0.996	0.428	0.225	0.081	0.07	0.462
VAC – Unplug	r=	0.117	-0.406	-0.23		-0.308	-0.118	-0.026
	p=	0.51	0.106	0.496		0.214	0.676	0.95
MOPPING	r=	-0.139	0.048	0.068	-0.814*	0.132	-0.021	
	p=	0.442	0.876	0.818	0.093	0.638	0.95	
SAFE BX EXP	r=	0.122	0.229	0.236	-0.143	0.145	-0.052	0.132
	p=	0.337	0.161	0.278	0.571	0.500	0.815	0.625
Total average without general safe behavior	r=	0.049	-0.199*	0.362*	-0.493	-0.130	-0.124	0.152
	p=	0.702	0.099	0.089	-0.493	0.546	0.573	0.561

Correlations between Discrepancy and Improvement

		All Groups – self	All Groups – peer	Group 1 – self	Group 1 – peer	Group 2 – self	Group 2 – peer	Group 3 – self	Group 3 – peer
LIFT	r=	-0.468**	-0.733***	-0.224		-0.926***	-0.717***	0.41	0.308
	p=	0.012	0	0.44		0.008	0.004	0.21	0.614
LIFT – Upper	r=	-0.404**	-0.268	-0.545*		-0.350	-0.355	-0.143	-0.754*
	p=	0.033	0.266	0.044		0.496	0.212	0.612	0.083
LIFT – Base	r=	-0.596***	-0.634***	-0.317		-0.608**	-0.608**	-0.062	-0.904**
	p=	0.001	0.005	0.316		0.027	0.027	0.827	0.013
LIFT – Lift	r=	-0.707***	-0.682***	-0.779***		-0.930***	-0.696***	-0.619**	-0.67
	p=	0	0.002	0.003		0.007	0.008	0.014	0.145
LIFT – Grip	r=	-0.425**	-0.476*	-0.005		-0.793*	-0.556**	-0.524*	-0.53
	p=	0.03	0.062	0.987		0.060	0.049	0.066	0.47
LIFT – Twist	r=	-0.356*	-0.676***	-0.225		-0.607	-0.562**	-0.647***	-0.832**
	p=	0.063	0.001	0.44		0.201	0.036	0.009	0.04
VACUUM	r=	-0.48***	-0.454*	-0.412		-0.461	-0.340	-0.394	-0.462
	p=	0.008	0.051	0.184		0.358	0.215	0.206	0.357
VAC – Snake	r=	-0.565***	-0.62***	-0.32		-0.719***	-0.719***	-0.715***	-0.893**
	p=	0.001	0.008	0.31		0.004	0.004	0.009	0.017
VAC – Cord	r=	-0.263	-0.327	-0.085		-0.620	-0.353	-0.119	0.236
	p=	0.16	0.172	0.793		0.189	0.197	0.713	0.652
VAC – Unplug	r=	-0.576**	0.995***	-0.33				-0.872***	-0.902**
	p=	0.015	0	0.523				0.005	0.036
MOPPING	r=	-0.309	-0.015	0.021			0.040	-0.765*	
	p=	0.329	0.978	0.986			0.949	0.076	
SAFE BX EXP	r=	-0.581***	-0.224	-0.432		-0.630**	-0.212	-0.575**	-0.503
	p=	0	0.262	0.108		0.021	0.430	0.025	0.138
Total average without general safe behavior	r=	-0.265	-0.326**	-0.052		-0.294	-0.411	-0.594**	-0.575*
	p=	0.118	0.025	0.853			0.101	0.019	0.082

Correlations between Employee Reported Performance and RA Observations

		Group 1 – Self	Group 2 – Peer	Group 3 – Self
LIFT	r=	0.185	0.267	-0.134
	p=	0.366	0.178	0.586
VACUUM	r=	-0.04	Constant report of 100%	-0.188
	p=	0.844		0.442
Total average without general safe behavior	r=	0.374*	0.279	-0.243
	p=	0.06	0.159	0.316

For all correlation graphs above, the following criteria for the p-value was used,
< .1*
< .05**
< .01***

Appendix J

Safe Behavior Means, Standard Deviations, and Cohen's D Calculations

Calculations for Group 1

GROUP 1	BL All	Self	Choice	Super	OVERALL	Effect Size (Cohen's d)
LIFT	61%	73%	74%	75%	74%	1.34
SD	0.26	0.15	0.17	0.12	0.10	
LIFT - Upper	72%	73%	75%	74%	73%	0.05
SD	0.34	0.26	0.42	0.25	0.20	
LIFT - Base	85%	90%	67%	86%	89%	0.26
SD	0.28	0.15	0.58	0.38	0.14	
LIFT - Lift	45%	47%	33%	62%	53%	0.26
SD	0.30	0.26	0.58	0.49	0.30	
LIFT - Grip	81%	86%	100%	86%	87%	0.38
SD	0.28	0.19	0.00	0.33	0.15	
LIFT -Twist	50%	74%	50%	76%	74%	1.24
SD	0.38	0.18	0.55	0.27	0.19	
VACUUM	61%	86%	75%	83%	74%	0.45
SD	0.31	0.17	0.43	0.32	0.29	
VAC - Snake	55%	85%	71%	96%	78%	0.71
SD	0.43	0.21	0.49	0.12	0.31	
VAC - Cord	60%	85%	73%	80%	72%	0.45
SD	0.30	0.15	0.42	0.31	0.27	
VAC - Unplug	83%	100%	100%	95%	98%	2.45
SD	0.41	0.00		0.11	0.06	
Total average without BX Self	63%	78%	77%	78%	79%	2.04
SD	0.26	0.11	0.22	0.14	0.08	

Calculations for Group 2

GROUP 2	BL All	Peer	Choice	Super	OVERALL	Effect Size (Cohen's d)
LIFT	67%	78%	84%	81%	83%	0.96
SD	0.21	0.19	0.20	0.16	0.16	
LIFT - Upper	75%	87%	75%	76%	85%	0.55
SD	0.29	0.16	0.50	0.26	0.18	
LIFT - Base	79%	78%	100%	98%	86%	0.25
SD	0.30	0.37	0.00	0.07	0.28	
LIFT - Lift	43%	48%	33%	62%	57%	0.39
SD	0.39	0.41	0.58	0.42	0.36	
LIFT - Grip	84%	93%	100%	90%	93%	0.93
SD	0.21	0.11	0.00	0.16	0.10	
LIFT -Twist	52%	85%	100%	81%	89%	2.40
SD	0.42	0.30	0.00	0.17	0.16	
VACUUM wo motion	79%	87%	86%	84%	86%	0.53
SD	0.18	0.14	0.18	0.28	0.14	
VAC - Snake	76%	73%	79%	88%	83%	0.28
SD	0.29	0.45	0.39	0.15	0.26	
VAC - Cord	75%	84%	91%	93%	87%	1.25
SD	0.27	0.12	0.13	0.06	0.10	
VAC - Unplug	95%	100%	100%	100%	100%	
SD	0.13	0.00	0.00	0.00	0.00	
Total average without BX Safe	74%	74%	78%	79%	78%	0.56
SD	0.11	0.09	0.14	0.11	0.06	

Calculations for Group 3

GROUP 3	BL All	Hype	Self	Super	OVERALL	Effect Size (Cohen's d)
LIFT	64%	85%	77%	76%	79%	1.36
SD	0.16	0.12	0.19	0.17	0.11	
LIFT - Upper	69%	75%	75%	92%	84%	0.85
SD	0.33	0.34	0.33	0.13	0.17	
LIFT - Base	78%	94%	100%	79%	90%	0.97
SD	0.28	0.13	0.00	0.33	0.13	
LIFT - Lift	37%	74%	40%	55%	57%	0.60
SD	0.35	0.30	0.47	0.41	0.34	
LIFT - Grip	79%	97%	92%	85%	90%	1.05
SD	0.20	0.08	0.14	0.19	0.11	
LIFT -Twist	58%	75%	59%	63%	65%	0.22
SD	0.38	0.39	0.43	0.35	0.32	
VACUUM wo motion	68%	77%	85%	81%	82%	1.15
SD	0.20	0.17	0.18	0.17	0.12	
VAC - Snake	59%	64%	89%	70%	73%	0.42
SD	0.34	0.43	0.25	0.36	0.33	
VAC - Cord	71%	80%	83%	81%	79%	0.74
SD	0.26	0.15	0.19	0.18	0.11	
VAC - Unplug	83%	94%	78%	97%	84%	0.032
SD	0.24	0.11	0.40	0.06	0.34	
Total average without BX Self	65%	77%	79%	72%	76%	1.52
SD	0.11	0.12	0.10	0.13	0.07	

Calculations for Safety Committee

	BL All	Hype	Self	Super	OVERALL	(Effect Size) Cohen's d
LIFT	57%	100%	82%	60%	87%	1.69
SD	0.11		0.25		0.18	
LIFT - Upper	58%	100%	100%	100%	100%	
SD	0.12		0.00		0.00	
LIFT - Base	75%	100%	100%	0%	83%	0.35
SD	0.00		0.00		0.24	
LIFT - Lift	57%	100%	82%	60%	87%	1.69
SD	0.11		0.25		0.18	
LIFT - Grip	57%	100%	82%	60%	87%	1.695
SD	0.11		0.25		0.18	
LIFT -Twist	56%	100%	60%	100%	87%	1.61
SD	0.27		0.57		0.19	
VACUUM	44%	100%	78%	57%	74%	3.09
SD	0.04		0.14	0.10	0.10	
VAC - Snake	56%	100%	60%	100%	87%	1.61
SD	0.27		0.57		0.19	
VAC - Cord	44%	100%	78%	57%	74%	3.09
SD	0.04		0.14	0.10	0.10	
VAC - Unplug	100%		50%		50%	-0.71
SD	0.00		0.71		0.71	

Small Effect Size < 0.2

Medium Effect Size 0.2 - 0.5

Large Effect Size > 0.8

Line Graph averages in %

		LIFT	TWIST	VAC	SNAKE
Group 1	***BL***	70%	61%	73%	68%
	Self	75%	72%	81%	81%
	Choice	75%	42%	82%	75%
	Super	75%	71%	88%	92%
Group 2	***BL***	69%	52%	69%	64%
	Peer	78%	89%	87%	81%
	Choice	84%	100%	87%	78%
	Super	75%	73%	88%	87%
Group 3	***BL***	63%	61%	65%	57%
	Hype	80%	83%	82%	83%
	Self	74%	56%	79%	83%
	Super	68%	50%	85%	77%

XX if variances between line graph and group averages is greater than 5%