2.1.2. Observation-based Safety Programs

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2.1.2. Observation-based Safety Programs

Mining companies are continuously working striving to find new ways to improve their safety culture and reduce injuries and fatalities. One of such ways is observation-based safety programs which have been utilized for several years in mining and other industries. This form of safety program generally aims to shift organizational safety practices from a traditional reactive, failure-oriented approach (e.g., chastising employees for making mistakes or sustaining injuries) to a proactive, achievement-oriented approach (e.g., reinforcing safe behaviours, offering constructive feedback for unsafe behaviours, etc.; Geller, 2011) to create strong safety motivation in employees, improve culture of safety, and ultimately reduce incidents and fatalities. Although many forms of observation-based safety programs exist, behaviour-based safety (BBS) is the most common in both industry and literature; thus, the term BBS is used interchangeably with observation-based program in this chapter. Despite overall enthusiasm about these programs, relatively little research has been conducted to explore its mechanisms, effectiveness, and idiosyncrasies of its implementations. The purpose of this review is to examine available literature regarding behavior-based safety programs across industries and countries.

The question that guided our scoping review was: "Can observation-based safety programs effectively improve workplace safety and organizational safety culture?"

Method

Search strategy. Unlike most topics, articles selected for this chapter were not retrieved using a standard database search and formal search strategy. This is because it was originally thought that all existing safety interventions would be included under one Topic. However, given, the multitude of existing literature, specific interventions such as observation-based programs were extracted into their own chapter. Consequently, articles on observation-based safety programs were extracted from the pool of literature obtained through all other search strategies conducted by the U of S team (i.e., already included and screened within other U of S topics).

The majority of articles included in this chapter were retrieved through the search strategies created for the original "Behaviour Changing Strategies" and "Existing Safety Interventions" topics that were since re-structured for the final report. The search strategies developed for these original topics were:

- Program (safety program, applied psychology, engineering psychology, environmental psychology, "industrial and organizational psychology", social psychology, strategies, safety approach, intervention, group intervention, safety procedures, safety protocols, program evaluation, program development, evaluation, evaluation criteria, safety intervention, accident prevention)
- Specific types of programs (tool box talks, safety observations, safety meetings, workplace incentives, incident investigations, standard operating procedure, safety talks, safety manual, safety messages, management by walking around, goal setting, problem solving, feedback)
- Incentives and punishment (incentives, awards, merit, goals, reinforcement, professional

recognition, bonuses, token economy programs, criticism)
- Clinical strategies (psychotherapy, cognitive behavioural therapy, behaviour modification, classroom behaviour modification, contingency management, fading, omission training, overcorrection, self-management, time out, behaviour therapy, cognitive restructuring, change strategies, behaviour change, social support, behaviour/behavior based safety)
- Other strategies (conditioning, behaviour analysis, evidence based practice, behavioural economics, mindfulness, hypnosis)
- Safety engagement (see General Method section).

The searches were undertaken between September 2014 and April 2015.

Screening strategy. Articles ultimately included in this chapter were first screened within the topic they were originally included under; thus, articles were already excluded based on publication date (e.g., published before 2010), irrelevant records (e.g. non English), irrelevant mediums (e.g., book reviews, letters to editor, etc.), and irrelevant safety domains (e.g., sexual risk taking, gambling, etc.) were already removed. Articles were only added to this chapter if they were specifically relevant to this type of intervention; thus, no further screening was needed and inclusion/exclusion criteria were not developed.

Results

Description of included articles. A brief summary of each article including its location, population studied, main issue addressed, comparison group, and primary outcomes is provided in Appendix G. The following is an overview of the included articles.

Table 1. Number of Articles by databases searched for original Behaviour Changing Strategies and Existing Safety Programs topics combined; articles selected for review were divided into all current safety program topics.

Database	Articles found from original searches combined	Articles Selected For Review	Final article Selection
ABI	3061	7443	18
Academic Search Complete	4762		
CBCA Complete	1407		
CINAHL	3162		
EMBASE	4694		
MEDLINE	2932		
ProQuest Dissertations & Theses	5522		
PsycINFO	12033		
Scopus	3347		
SocINDEX	2316		
Sociological Abstracts	422		

Web of Science	2935

Table 2. Observation-Based Safety Programs Number of Articles by Type, Country, and Population

Type of Publication:	**Country of Publication:**	**Population Studied:**
- 10 original research articles - 6 summary discussions - 2 systematic reviews **Type of Original Research:** - 8 program evaluations - 2 surveys	- 6 USA - 3 India - 2 South Africa - 1 North America - 1 UK - 1 Poland - 1 Slovakia - 1 China - 1 Mexico - 1 Mozambique	- 5 Industrial (unspecified) - 3 Construction - 3 Manufacturing - 2 Processing - 2 Nuclear Energy - 4 general employees (i.e., did not distinguish between job type or industry)

Although no research has been conducted on mining employees specifically, knowledge obtained in other industries/workplaces may be generalized to this population.

Description of identified factors. Based on a descriptive analysis of the selected articles conducted in Stage 1, five themes emerged: BBS procedure, mechanisms of BBS programs, effectiveness of BBS programs, critical BBS program factors, and BBS feedback. Other factors, such as motivation and general feedback were also evident in the included literature but are discussed under different topics. The primary results and potential applications of each identified factor are discussed. All definitions of concepts as used in the current literature are provided in Appendix D.

Observation-based Safety Program Procedure. Nine articles contained information on the procedure of BB programs**.** BBS programs primarily consist of routine employee observations to identify unsafe behaviours, followed by constructive feedback sessions (Branco, 2013; Pacaiova, Anna, and Markulik, 2013). Observations are usually made by specially trained employees (e.g., Branco, 2013), though some organizations train all employees on observation methods, enabling everyone to observe and report unsafe peer behaviours (e.g., Chen & Jin, 2012); either method is acceptable (Krause, Seymour, & Sloat, 1999).

Observation-based safety programs tend to follow four broad steps represented by the acronym, DO IT: define (determine critical workplace safety behaviours), observe (collect safety behaviour data), intervene (provide feedback concerning observed behaviours), and test (determine intervention effects; Geller, 2011; Pacaiova et al., 2013; van Loggerenberg, 2014). To illustrate, in mining it is critical for employees to wear hearing protection in noisy areas. A BBS program could include hearing protection in a checklist that observers consult as they monitor the workplace (define). Observers might note employees failing to use necessary protection (observe), prompting the observer to offer feedback to these offenders (intervene; e.g., notify them of the safety violation, why protection is important, encourage them to reflect on the pros and cons of using protection, etc.). The effectiveness of this feedback could be measured by subsequent observations or other means (test; e.g., regular employee audiometric testing).

Behavioral observations are primarily made in BBS programs to collect behavioural data and gauge workplace safety (the *observe* and *test* steps of *DO IT*, respectively) but they also serve as motivation for employees (Branco, 2013). To be most effective, BBS observers should use a checklist with strategically categorized items. A well-designed observational checklist is a critical element of BBS (Geller, 2011; Pacaiova et al., 2013). A basic checklist discussed in the literature includes one column listing common operating procedures accompanied by two blank columns to record safe and unsafe behaviours (Geller, 2011). Observations can be made more effective by strategically categorizing checklist items by their association with past injuries (e.g., behaviours that frequently cause injury listed first followed by those that have recently caused injury and those that have led to injury in the past), allowing attention and resources to be directed toward behaviours according to greatest priority (Wirth & Sigurdsson, 2008). Previous research indicates this approach to be more effective and efficient than alternatives (e.g., creating categories of similar behaviours), especially in large industrial settings (Wirth & Sigurdsson, 2008).

Once multiple rounds of observations have been completed, particularly frequent or problematic observed unsafe behaviours may be addressed through an ABC analysis. An ABC analysis identifies the antecedents (A) and causes (C) of behaviours (B), supplying potential targets for later observations or other interventions (van Loggerenberg, 2014). For example, if employees are frequently observed working without required fall protection (behaviour), it may indicate that workers are unaware of what height necessitates protection use (antecedent) or have never been injured while working from heights without protection (consequence). Either antecedent or consequence could be corrected in an intervention. Although ABC analyses are helpful, they occupy valuable time and may sacrifice quantity for quality (Branco, 2013). To help reach a balance between quantity and quality, Galloway (2014) recommends limiting observer focus to 4-7 behaviours.

An inadvertent benefit of observation programs is that their mere enactment tends to motivate employees (recall that motivation is integral to creating lasting behavioural changes; Bowen, 2014; Branco, 2013). The well-evidenced Hawthorne Effect suggests that one's mere knowledge that they are being observed motivates them to exhibit desired behaviours (Branco, 2013). People may know from personal experience that there are exceptions to this psychological phenomenon such as when people feel they are being spied on. However, there are often remedies to such aversive situations—for instance asking an employee for permission before observing his or her behaviour (Galloway, 2014).

The tendency for observations to go beyond their evaluative function by motivating employees is notable but attention must also be directed toward the quality and efficiency of BBS observations, perhaps best organized on checklists by their association with previous injuries. As a fundamental component of BBS programs, observations enable identification of problematic behaviours leading to the subsequent stage of behavior based programs: employee feedback.

Mechanisms of BBS programs. Seven articles were related to the underlying mechanisms of BBS programs. To better understand the mechanics behind BBS programs, their psychological foundation should be considered. Behaviour-based safety can be traced back to operant conditioning (Skinner, 1938), which views human behaviour as a product of external reinforcements: rewards and

punishments (Chen & Tian, 2012; Geller, 2011; Tuncel et al., 2006). Behaviours are reinforced by providing a reward (positive reinforcement) or removing an aversive stimulus (negative reinforcement). For example, an employee's safe behaviour (e.g., wearing a respirator mask) could be reinforced by managerial approval (positive reinforcement) or the restriction of hazardous exhaust fumes (negative reinforcement). BBS feedback sessions provide ample opportunity for employee reinforcement which instigates learned behavioural changes over time (van Loggerenberg, 2014). This learning process becomes more complex when personal emotions or attitudes come into play and when punishment is used instead of positive reinfocement; these factors go beyond the scope of this chapter.

BBS not only shapes employee behaviour through operant conditioning principles, it also fosters the motivation necessary to create sustained behavioural change (Branco, 2013). The Transtheoretical Change model (Bowen, 2014) proposes five stages through which individuals must sequentially pass in order to change behaviour: pre-contemplation (no intention to change/unaware of need to change), contemplation (considering change), preparation (established plans to change), action (committing new behaviours), maintenance (new behaviours have been enacted for at least six months). According to Bowen (2014), many safety programs that target behavioural modification skip the first three stages in the model. By skipping these initial stages, an employee may lack sufficient motivation to perform his or her duties (Branco, 2013). For example, an employee may not be sufficiently motivated to perform new behaviours safely when working alone or unsupervised. Self-determined motivation is best achieved by asking questions, during feedback sessions for example, that encourage employees to think about their current behaviours, the impact they have, and the pros and cons of changing their behaviour (Bowen, 2014). Sensitizing employees to BBS concepts during feedback sessions can also develop intrinsic motivation, for instance by exemplifying how BBS principles could have prevented past workplace injuries (Lal, 2014). Making apparent the ability of BBS programs to save lives and improve organizational safety culture by encouraging independent thoughts could appeal to resistant employees who are at the pre-contemplation stage for change and help move them to the next stage. ,

The success of observation-based feedback in changing behaviours may also be due in part to the psychology of conformity. Because humans are social beings, they strongly desire to be accepted by those around them; some research indicates this desire dates back to a primitive need to travel in groups in order to enhance survival (Bowen, 2014). Providing employees with cues of what is normal in the work group (i.e., safe behaviours) offers them a chance to conform (be a "team-player") and receive acceptance. Thus, feedback effectively changes employee behaviour by capitalizing on the human tendency to conform while providing motivation and reinforcement.

Thus, the utility of BBS programs to improve workplace safety has been backed by psychological theory and a wealth of international literature utilizing various study designs. To maximize efficacy, organizations should strive to implement additional safety procedures, adjust BBS components as the organization evolves, and diligently train observers.

***Effectiveness of BBS programs*.** Fourteen articles were related to the effectiveness of BBS programs. The included articles predominantly suggest that organizations worldwide benefit from implementing BBS programs. Although a small amount of evidence is in disagreement, indicating that

BBS programs either have no effect or negatively impact organizational safety, a far larger proportion and wider range of studies suggest their effectiveness and indicate that rigorous training and continuous revisions help to maximize efficacy.

Evidence supporting BBS programs comes from a variety of sources (e.g., program evaluations, correlational studies, meta-analyses, etc.). One meta-analysis studied 73 North American industrial facilities that had each implemented a BBS program for at least one year (Krause et al., 1999). This meta-analysis combines data from several different but related studies, increasing the number of participants involved and confidence of results. Results showed that after implementing a BBS program, these facilities experienced a decline in workplace injuries by an average of 26% from baseline in the first year and reached an average 69% reduction from baseline by the fifth year. Whether or not there is a limit to how far injury rates could have further declined is unknown as the study only considered up to five years of data for each facility. Nonetheless, these results indicate that not only do injury rates decline following BBS program implementation, but they continuously decline as the program remains active. Similar findings were reported in another meta-analysis of eight studies that saw significantly lower workplace injuries following adoption of a BBS program (Tuncel et al., 2006). Meta-analysis results clearly suggest that BBS programs benefit workplace safety, yet meta-analyses are limited by several factors: their inability to manipulate the design of involved studies (e.g., ensuring a control group is included; Tuncel et al., 2006), the relative levels of baseline safety (e.g., organizations may have significantly differed in safety at baseline; Tuncel et al., 2006) and lack of common definitions (e.g., one study could define *injury* as any bodily harm while another could define it as bodily harm requiring first aid). As a result, other methods of research must be considered.

Chen and Jin (2012) evaluated a BBS program, Safety4Site, adopted by an American construction contractor to reduce workplace injuries and hazards. Through training sessions regarding safety awareness, accountability, and positive safety attitudes and behaviours, Safety4Site prepared all employees to record and report peer safety violations Sixteen months after Safety4Site was implemented, the contractor's safety violation rate had linearly dropped to nearly half of baseline rate. Additionally, the contractor's incident rate (i.e., injuries requiring more than basic first aid) significantly decreased from baseline. Similar positive results have been obtained from several other BBS program evaluations (Hermann, Guillermo, & Hopkins, 2011; Lal, 2014; Pęciłło, 2012). It must be noted that while the BBS program reported by Chen and Jin significantly improved workplace safety for the general contractor, no significant changes were recorded for associated subcontractors whose employees received Safety4Site information in informal meetings, indicating that rigorous training is necessary to affect change.

Human behaviour may be a ubiquitous cause of workplace injuries around the globe; indeed, at least 88% of workplace incidents in the U.S. are caused by unsafe human behaviours (Branco, 2013; Chen & Jin, 2012; Pacaiova et al., 2013) comparable to 94% in the U.K. (Tuncel et al., 2006) and 90% in India (Kaila, 2010). Accordingly, BBS programs have been adopted by organizations beyond the West in countries such as South Africa (e.g., Branco, 2013), China (e.g., Chen & Tian, 2012), Mexico (e.g., Hermann et al., 2011), and India (e.g., Kaila 2010, 2011; Lal, 2014). In one instance, a BBS program was implemented in a South African oil company; data from this program indicated a strong positive

correlation between at-risk behaviours and incident rates as well as between observations performed and safe behaviours observed (Branco, 2013). Thus, findings suggest that, in this South African company, increasing at-risk behaviours accompany a growing injury rate but that increased observation rounds accompany improved safety behaviours (Branco, 2013). These findings replicate those found in Western sites.

Despite consistent support for BBS programs in the current literature, they are not infallible. Tuncel et al. (2006), whose supportive meta-analysis results were previously discussed, also reported that two of 13 BBS applications did not result in statistically significant decreases in injury rates and one study showed a slight increase. However, there are some caveats to these negative findings: the increase reported in the latter study was only 0.13 accidents per 10,000 working hours following BBS implementation and it was not stated whether this increase reached statistical significance; in addition, none of these studies included a control group, limiting their ability to implicate the BBS program as the problem; finally, it is not known whether the studied organizations employed additional safety programs. BBS, like most safety programs, is not sufficient on its own in ensuring workplace safety, requiring the inclusion of additional organizational safety procedures and protocols (Branco, 2013; Hermann et al., 2011; Pacaiova et al., 2013). For example, Hermann et al. (2011) took an innovative approach to workplace safety at a Mexican automobile manufacturing plant by merging BBS principles with traditional safety methods such as weekly safety reviews, safety posters, safety audits, and injury investigations. Compared to baseline and control group levels, the evaluation showed significantly fewer injuries post implementation (from 31.8 per 200,000 work hours at baseline to 2.5 seven years post-implementation), lost time injury cases (from 7.35 per 200,000 work hours at baseline to an average of 2 during the seven years following implementation), and reduced severity of injuries (from an average 51.3 days lost per year at baseline to an average of 15.4 during the seven years following implementation). Thus, combining BBS with traditional approaches to safety can deepen the impact on workplace safety.

Critical factors in BBS program success. Seven articles were related to critical BBS program factors. A recurring theme throughout the BBS literature is that there are many variables influencing program success. In their review of existing operational health and safety systems, Pacaiova et al. (2013) concluded that for BBS programs to be effective, an organization must follow program rules, regulations, and goals but also make adjustments as new staff, technology, and procedures are introduced in the organization. For example, negative results of a BBS program, ATOMICS, implemented at a New Mexico nuclear facility were recorded over several years (Cournoyer et al., 2011, 2013). Results suggest that the facility updated staff, routines, and critical technologies in this time but failed to make associated changes to observer protocol (e.g., method of providing feedback) or tools (e.g., checklists). Updating BBS guidelines and ensuring adherence to them is likely to sustain program effectiveness (Pacaiova et al., 2013).

Organizations may also benefit from relaying BBS principles and outcomes through various channels as relying on few channels may become boring or repetitive for employees (Bowen, 2014). For example, providing observers solely with a printed manual to explain their duties could result in them missing or skipping vital observational information. Contrarily, workshops, brief instructional videos,

publicly displayed progress charts, online content, and personal emails and letters in addition to a printed manual may further sustain employees' interest and engagement. A multitude of communication formats is more likely to draw attention from individuals, enhancing their interest, performance, and, in turn, program effectiveness (Bowen, 2014).

Another potential BBS issue involves dishonest observers (Lal, 2014). Observers could submit fraudulent data to fabricate favourable results, avoid work duties, play favourites with particular employees, or any number of additional reasons. To preserve observation quality, observers should be trained, monitored, and receive random quality checks (Lal, 2012). As well, multiple observations from several observers should be made if associated staffing is available (Pacaiova et al., 2013).

Dishonest observers, failure to adhere to program requirements, employee resistance, or insufficient communication modes could each partially account for the negative or null results of BBS evaluations in the current literature (e.g., Cournoyer et al., 2011, 2013; Tuncel et al., 2006). BBS observation and feedback also critically affect BBS program success and are discussed below. Establishing a safety committee, especially during the development and design stages of BBS programs, also strongly contributes to improved safety performance (Wirth & Sigurdsson, 2008).

BBS feedback. Four articles were related to BBS feedback. Similar to observations, feedback motivates employees to engage in safe behaviour. In addition, feedback forms the primary BBS component to instigate behavioural change by correcting observed unsafe behaviours and reinforcing safe behaviours (the *intervene* step of *DO IT*).

There is little mention in the current literature on how to best provide feedback, though some researchers suggest it should occur between only the employee and observer, shortly after an observation (Pacaiova et al., 2013), in a friendly and objective manner (Branco, 2013). Whether to ask employees for their reasoning behind behaviours is a contested issue. Some researchers claim it is important to uncover an employee's reasoning behind observed unsafe behaviours in order to find variables for subsequent intervention objectives (Galloway, 2014; Pacaiova et al., 2013). Professionals may do this by walking an observed employee through an ABC analysis (Branco, 2013). Conversely, a content analysis of East Indian BBS field reports suggests that the reasoning behind unsafe behaviours is unimportant (Kaila, 2011). However, this analysis seems subjective, open to cultural differences, and unable to identify negative effects of obtaining reasoning, indicating it may be best to obtain reasoning from employees as, according to previous research, there is no associated harm but there is potential to benefit safety.

Although there is evidence backing the effectiveness of BBS feedback sessions in changing behaviours, further research is needed to identify the optimal methods to provide feedback. In the meantime, feedback sessions should sensitize employees to BBS concepts and encourage independent thought in order to foster an intrinsic motivation toward committing safe behaviours.

Discussion

Including a BBS program within an organizational safety framework is a promising step towards reducing injuries and unsafe behaviours. The mechanics of BBS are an application of operant conditioning wherein feedback sessions shape employee behaviours through reinforcement. Behavioral observations supply data to direct feedback and evaluate workplace safety; both feedback and

observations serve to motivate behavioural change. A BBS program's success depends on applying known effective factors (e.g., strict adherence to program guidelines, periodic program revisions, communicating program materials through diverse formats, etc.) and controlling for known limitations (e.g., employee resistance, dishonest observers, etc.) while enacting effective employee observations and feedback. When implemented successfully, BBS programs can notably improve workplace safety through reduced injuries and unsafe behaviours, increased safe behaviours, and improved employee perceptions of control over safety.

Evaluations of BBS programs are overwhelmingly positive (e.g., Chen & Jin, 2012; Chen & Tian, 2012; Geller, 2011; Kaila, 2010, 2011; Lal, 2014; Pęciłło, 2012; Tuncel, Lotlikar, Salem, & Daraiseh, 2006), with only two articles to the contrary (e.g., Cournoyer et al., 2011; Tuncel et al., 2006). Success of BBS is owed in part to its foundation in social psychology, namely operant conditioning (Skinner, 1938) which views human behaviour as a product of behavioural reinforcement (Chen & Tian, 2012; Geller, 2011; Tuncel et al., 2006). The effectiveness of BBS programs can be increased by avoiding particular barriers (e.g., employee resistance, dishonest observers, etc.), capitalizing on previously identified supporting factors (e.g., presenting BBS principles through diverse formats, strict adherence, necessary revisions, etc.), and ensuring quality observations and feedback. Observers can utilize an ABC (antecedent, behaviour, consequences) analysis to identify the roots of especially frequent or problematic behaviours (van Loggerenberg, 2014). ABC analyses can gather increasing amounts of behavioural data the more they are executed but organizations must be cautious not to sacrifice quality for quantity (Branco, 2013). Observers can utilize ABC analyses as part of a feedback session with observed employees (Branco, 2013). Whether using an ABC analysis or other method, it is wise to uncover the reasoning or causes of an employee's unsafe behaviour in order to acquire target variables for subsequent observations or interventions (Galloway, 2014; Pacaiova et al., 2013).

Gaps in the literature.

Generalizing findings to the Canadian mining industry. None of the 18 articles reviewed in this chapter included mining employees. Employees in industries similar to the mining industry (e.g., general processing, manufacturing, construction, etc.) were sampled in 11 articles. Thus, the generalizability of the provided results to the mining industry should be made with cautions and mining companies and associations should initiate their own systematic evaluations of BBS programs in order to close this gap

Although such gaps in empirical research are common (i.e. between a population of interest and samples studied), it limits the generalizability of results to the target population. As there are no studies in this chapter involving Canadian mining industry members, the present literature is not optimally applicable to this topic's research questions. To address this, any program that draws information from this chapter must undergo rigorous evaluation so that adjustments, if necessary, can be made as soon as possible.

Optimal BBS program duration. There is no consensus in the current literature on the optimal duration for BBS programs. Many past studies state the time frame of data collection with no mention of program duration (e.g., Chen & Jin, 2012; Cournoyer, 2013; Krause et al., 1999). One exception is a meta-analysis that analyzed BBS program effectiveness, recording program durations ranging from nine

weeks to 12 years; however, this study did not statistically examine whether there was a relationship between duration and safety-related outcomes (e.g., injury rate; Tuncel et al., 2006). Previous research states that continuous programs are more likely to maintain positive effects on workplace safety than one-time programs (Chen & Jin, 2012; Krause et al., 1999; Wirth & Sigurdsson, 2008), but continuous programs constantly consume resources. There may be a point in time when the safety-increasing potential of a BBS program "maxes out" and the costs of its continuation outweigh the benefits. Thus, the resource efficiency of Canadian mining organizations could benefit from future explorations of BBS program duration.

Reliance on statistical data. Although these findings are encouraging, they are correlational and therefore cannot confirm a cause-and-effect relationship; that is, correlational evidence confirms that observations and safe behaviours increase at the same time but does not indicate the direction of the relationship (e.g., whether completing observations improves safety behaviours or whether sites with pre-existing safe behaviours tend to conduct more observations). Additionally, correlational research cannot rule out a third variable (e.g., a drop in oil demand that may cause the increase in safe behaviours and observations). Indeed, only 9.7% of variance in incident rates could be explained by BBS outcomes (Branco, 2013) suggesting that additional variables are major contributors to incidents. Finally, correlational studies does not provide researchers with information about mechanisms through which these programs work.

Recommendations. Behaviour-based safety programs are used to proactively reduce workplace incidents by replacing employees' unsafe behaviours with safe alternatives through raising safety awareness, creating an interdependent culture of safety, and thus improving safety outcomes. Targeting employee behaviours has been shown as an effective method to improve workplace safety (Branco, 2013; Chen & Jin, 2012; Chen & Tian, 2012). Based on the current scoping review, future safety efforts may include an integration of the following BBS strategies:

- Consider implementing a BBS program. Implementation of BBS has been associated with reduced injury rates (Chen & Jin, 2012; Krause et al., 1999; Tuncel et al., 2006) and unsafe behaviours (Chen & Jin, 2012; Kaila, 2010, 2011; Lal, 2014; Pęciłło, 2012), increased safe behaviours (Chen & Tian, 2012; Geller, 2011; Kaila, 2010, 2011; Lal, 2014; Pęciłło, 2012), greater perception of control over the safety of self and others (Geller, 2011), identification of areas in need of improvement (Cournoyer et al., 2011), improved accident accountability of employees (Chen & Jin, 2012), and improved employee commitment, responsibility and awareness, and quality of coworker relations (Pęciłło, 2012). Furthermore, reductions in injuries do not only endure, but may also improve over time (Krause et al., 1999). Although a small amount of conflicting evidence suggests BBS programs are ineffective (Cournoyer et al., 2011, 2013; Tuncel et al., 2006), confounding variables may have influenced results in these studies (e.g., environmental changes, evaluation design, etc.).
- Implement BBS on a continuous basis. Safety performance can decline if interventions cease, suggesting that continuous promotion is necessary to establish lasting safety improvements (Chen & Jin, 2012; Krause et al., 1999; Wirth & Sigurdsson, 2008).
- Make BBS one of several organizational safety practices. A BBS program is not sufficient on its own

in ensuring workplace safety; thus, additional safety protocols and procedures within an organization's safety framework are important (e.g., safety reviews, safety audits, injury investigations, etc.; Branco, 2013; Hermann et al., 2011; Pacaiova et al., 2013). For instance, Hermann et al. (2011) created an integrative program combining traditional safety methods with BBS elements with positive results.

- Adjust BBS protocol as the organization evolves. Organizations must adhere to BBS rules, regulations, and goals but should also make adjustments as new staff, technology, and procedures are introduced into the organization (Pacaiova et al., 2013). For example, if a new type of machine is used, BBS checklists must be adjusted to account for risks associated with this new machinery. Furthermore, observation checklists are more effective if constantly refined to target the most prevalent unsafe procedures and behaviours (Geller, 2011).
- Present BBS content through several formats. In order to maximize the positive effects that BBS has on workplace safety, present BBS content through a variety of formats (e.g., verbal presentations, posters, public graphs, personal emails or letters, etc.; Bowen, 2014). This is more likely to retain employment interest, also important to BBS program effectiveness (Bowen, 2014).
- Expect at least some resistance to BBS. Employees resistant to behavioural changes may be persuaded to comply through personalized coaching, education, and sensitization to BBS concepts (e.g., exemplifying how BBS principles could have prevented past workplace injuries; Lal, 2014). The most common reasons for employee resistance to BBS programs is target pressures (e.g., production quota), overwhelming audits, excessive time involvement, and lack of available resources (e.g., personal protective equipment; Lal, 2014). Addressing any of these factors increases the likelihood of stakeholders accepting BBS implementation.
- Ensure quality of observers and observations. Both observers and observation methods must be of high quality for BBS to positively impact workplace safety. To ensure quality, multiple observations can be made by several observers (Pacaiova et al., 2013), observers can limit observations to no more than seven at one time (Galloway, 2014), observers can ask permission before observing an employee's behaviour to avoid "spying" on them (Galloway, 2014), and observers can undergo stringent training and random quality checks (Lal, 2014). In addition, BBS programs are more effective if observers cultivate and encourage employees' correct safety behaviour rather than punish them for unsafe behaviour (Chen & Tian, 2012). Punishing undesirable behaviour with punitive consequences can do more harm than good by creating negative attitudes toward the organization, discouraging reporting of subsequent incidents or near-misses (Geller, 2011).
- Encourage independent thought of observed employees during feedback sessions. Independent thought (e.g., analyzing current behaviours, the impact they have, the pros and cons of changing behaviour, etc.) contributes toward intrinsic motivation, a fundamental component of behavioural change (Bowen, 2014).
- Once identified, determine the causes of or reasons for unsafe behaviours. Frequent causes of unsafe employee behaviours vary by industry but often include inadequate awareness of hazards, fast pace of work, or low quality of training (Pęciłło, 2012) any of which may be targeted through safety intervention. However, while some researchers insist it is important to discuss employees' perceived

causes of unsafe behaviours (Galloway, 2014; Pacaiova et al., 2013), others suggest that employees should not have to explain themselves (Kaila, 2011). Observers may incorporate ABC analyses into feedback sessions to help observed employees understand the roots of their unsafe behaviours (Branco, 2013).

- Discuss both safe and unsafe behaviours with observed employees. Giving positive feedback to employees for taking "correct" safety actions is just as important as identifying undesirable behaviours (Galloway, 2014). At least 4 - 5 feedback sessions between observer and observed employees should be expected before unsafe behaviours improve (Kaila, 2011).

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