

2. Safety Programs and Training

2.1. Existing Safety Programs

2.1.1. Incentive Programs

Method	186
Search Strategy.	186
Screening Strategy.	187
Results	187
Description of included articles.	187
Description of identified factors.	188
Incentive program policy.	188
Thresholds of incentive programs.....	189
Criteria of incentive programs.	189
Targets of incentive program.	190
Senior manager incentive policies.	190
Incentives directed to groups and/or companies.	190
Occupational health and safety regulation.....	190
Incentive/penalty (I/P) provisions.....	191
Pay for safety schemes (PFSS).	191
Safety awards.....	192
Incentives directed to individual employees.....	192
Incentives and disincentives for reporting unsafe events.	193
Incentives specific to decreasing speeding.	194
Incentives specific to increasing seat belt use.....	195
Discussion	195
Gaps in the Literature.	196
Recommendations.	197
References	198

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2.1.1. Incentive Programs

Incentive-based safety interventions are programs that aim to increase the safety behaviour of individual employees and safety outcomes through the delivery of rewards (or punishments) contingent on some safety related metric. It is assumed that the offer of a reward will increase employees' motivation to work safely. Safety incentives include a range of rewards such as monetary bonuses, gifts, awards, meals, or non-tangible reinforcers such as flexible work schedules. These rewards are offered in return for performing desired behaviours (i.e., those that increase safety) and/or for safety records (i.e., number of days without a recordable injury) and can be given to individual employees, work teams, or companies.

For this topic, the question that guided our scoping review was: "How do incentive based programs affect safety engagement in the workplace?"

Method

Search Strategy. Unlike most topics, articles selected for Incentive-Based Safety Interventions were not retrieved using a standard database search and formal search strategy because incentive programs were not originally identified as their own unique topic. However, given the multitude of existent literature, it became apparent that research on incentive programs required its own topic chapter. Consequently, articles with the words "incentiv*", "reward*", or "bonus*" within their title 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) and added to this chapter. Additional incentive-based articles identified through the screening of other U of S topics were also added when appropriate.

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:

1. 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)
2. 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)
3. Incentives and punishment (incentives, awards, merit, goals, reinforcement, professional recognition, bonuses, token economy programs, criticism)
4. 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)

5. Other strategies (conditioning, behaviour analysis, evidence based practice, behavioural economics, mindfulness, hypnosis)
6. Safety engagement (see General Method section).

The searches were undertaken between September 2014 and April 2015.

Screening Strategy. The screening process was similar to other topics such that articles were excluded for publication date (e.g., published before 2010), irrelevant records (e.g. non English), irrelevant medium (e.g., book reviews, letters to editor, etc.), irrelevant safety domain (e.g., sexual risk taking, gambling, etc.), or other irrelevant content based on the inclusion exclusion criteria listed in Table 1. The inclusion and exclusion criteria were kept broad in that we did not specify the types of research methods to be included or excluded in order to capture as many research articles on the topic as possible.

Table 1. Incentive-Based Safety Interventions Inclusion/Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> • Incentive-based safety programs or methods • Punishment of unsafe behavior • Awards and honors for occupational safety • Rewarding lack of injury • It outlines, evaluates, or proposes a new workplace safety program • Involves how to implement a safety strategy or program • Outlines health <i>and</i> safety programs 	<ul style="list-style-type: none"> • Involves underage population (e.g.: children, adolescents) • Incentive program for behavior change not related to safety (e.g., to reduce depression or anxiety); or involves health programs at work but does not mention safety • Non-academic literature (e.g., newspapers) • Does not outline, evaluate, or propose a workplace safety program

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 2 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	30
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 3. Incentive-Based Safety Interventions Number of articles by type, country, and, population

Type of Publication:	Country of Publication:	Population Studied:
- 5 systematic literature reviews	- 11 USA - 2 Canada	- 10 Processing, manufacturing, or construction
- 2 summary discussions	- 2 Sweden	- 2 Health care
- 18 original research articles	- 2 Hong Kong	- 1 Undergraduate students
- 8 survey questionnaires	- 2 Europe	- 1 Amazon Mechanical Turk
- 7 experimental designs	- 1 UK	- 2 Broader national surveys
- 2 qualitative interviews,	- 1 India	- 1 Private insurance company
- 1 case study	- 1 Finland - 1 Scandinavia - 1 Netherlands	- 2 National safety organization

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

Description of identified factors. Based on a descriptive analysis of the selected articles conducted in Stage 1, six factors of incentive-based safety interventions emerged: incentive program policy; incentives directed to groups and/or companies; incentives directed to individual employees; incentives and disincentives to reporting unsafe events; incentives specific to decreasing speeding; and incentives specific to increasing seat belt use. The primary results and potential applications of each identified factor are discussed in the following sections. Definitions of the concepts as used in the reviewed literature are provided in Appendix D.

Incentive program policy. Five articles were related to safety incentive program policy. Safety incentives are broadly defined as programs that give employees and employers feedback and/or rewards about safety performance in order to increase motivation to create a safer work site (Sparer & Dennerlein, 2013). Incentive programs can vary widely on multiple characteristics, such as the thresholds at which rewards are given, the criteria on which rewards are based (i.e., whether rewards are given for safety outcomes or for safe behaviour itself), whether employees and employers are rewarded for “good” behaviour or punished for “bad” behaviour, and the ways in which incentives are earned (e.g., as a group or as individuals). Another issue is the use of safety incentives for senior managers and whether monetary bonuses impact safety decisions. Accordingly, the policies used to dictate safety incentives have

important implications for employees. Company executives and safety specialists may use the knowledge gleaned from this research to design incentive programs that are effective at increasing safety.

Thresholds of incentive programs. When designing safety incentive programs, the threshold at which rewards are given out must be determined. A reward threshold is thus a predetermined metric regarding performance that must be met in order to receive a given incentive (Sparer & Dennerlein, 2013). Given the variability of incentive program policies, reward thresholds can be set at many levels. For instance, incentives can be set and given to individual employees (referred to as an *individual bonus system*), to predetermined groups of employees (referred to as a *group bonus system*), for example, all members of each crew, all employees of a certain trade receive rewards; or to all employees of a company or worksite received rewards if the threshold is met (referred to as a *collective bonus system*). Similarly, incentives can be rewarded to all individuals of the same company owner, general contractor, project, or subcontractor. Within each of these approaches to bonuses, the reward thresholds can be the same or can vary. For instance, different crews of the same mine site can all be given the same target goal that, when reached, triggers the incentive. Alternatively, each crew of one mine site could be given this crew-specific goals, based on its previous performance, that need to be met in order to be rewarded. Mattson, Torbiorn, and Hellgren (2014) found that collective, group, and individual approaches to bonuses were all effective at increasing safety. At the same time, none of the approaches posed a threat to safety; these researchers did not find instances when injuries were not reported because bonuses could have been lost.

Additionally, Mattson et al. (2014) explained that when individual-level bonuses are used such that different goals are given to various employees, then the goals for each employee must be clear. In order for these types of incentive programs to be effective, each employee must have an accurate understanding of what he or she needs to achieve in order to receive the incentive. In another study, Sparer and Dennerlein (2013) found that the owner-based approach to rewarding incentives was fair, consistent, attainable, and competitive, and promoted the highest standard of safety. Often, collective bonus systems applied to people grouped by general contractor, project, subcontractor, trade, etc. consistently lacked at least one of these attributes (e.g., if it was seen as fair, it was not viewed as attainable, etc.). Additionally, the owner-based approach was also found to have the most competitive threshold with rewards being achieved only one-third of the time (Sparer & Dennerlein, 2013). This is important because employees should not view incentives as guaranteed rewards; rather, incentive programs should actually increase safety if they are to be effective. Based on the above research, using the same threshold for all workers on a work site likely makes the incentive easier to understand and follow and as a result, increases safety.

Criteria of incentive programs. The criteria on which incentive programs are based can differ. For example, employees can be offered a reward for performing specific safety behaviours or for achieving particular safety outcomes (e.g., going without injuries for a set duration of time). These approaches to incentive program criteria are based on either safety outcomes or past behaviours (*lagging indicators*) or safety behaviours in the present (*leading indicators*). Lagging indicators incentive programs are ones that use reward thresholds that indicate safety performance once a pattern of safety performance has been established, that is, after a safety incident (Sparer & Dennerlein, 2013). For example, an incentive may be

based on the number of recordable injuries at a worksite. On the other hand, leading indicators incentive programs are ones that use reward thresholds that precede a safety incident and are proactive in their nature (Sparer & Dennerlein, 2013). For example, in a leading indicator incentive program, incentives may be offered when proactive steps to working safe are performed, such as reducing physical hazards on a worksite. The most effective incentive programs *may* reward both leading *and* lagging indicators (Paladino, 2013); however, there is currently no research that directly addressed this comparison.

Targets of incentive program. Company safety incentive programs can be aimed at shaping safety behaviour through either a “carrot” or “stick” policy. A *carrot policy* is a company program that offers incentives for desired behaviour or outcomes (Tannenbaum, Valasek, Knowles, & Ditto, 2013). For example, a company may offer their workers less supervised work as a reward when safety procedures are followed. Alternatively, a *stick policy* is a company program that punishes undesirable behaviour or outcomes (Tannenbaum et al., 2013). For example, a stick policy may result in workers receiving more supervision when safety procedures are not followed. Carrot policies reinforce desired behaviour and stick policies punish undesired behaviour. In a study by Tannenbaum, Valasek, Knowles, and Ditto (2013) that looked at company policies for health behaviour, it was found that policies aimed at punishing people for undesirable behaviour communicated subtle biases against particular employees (in this case, overweight employees). Policies that offered incentives for desired behaviour were not associated with these biases (Tannenbaum et al., 2013). Thus, employees view carrot policies more favourably than stick policies and they may be more likely to change behaviour in response to them.

Senior manager incentive policies. One study examined the impact of safety incentive programs aimed specifically at senior managers (Maslen & Hopkins, 2014). This type of incentive policy is carried out by giving performance agreements to the managers and then giving them a bonus if all of their objectives are met. The bonuses are most commonly 30% to 80% of their salary but can be quite substantial (e.g., 200% of base salary for a CEO). Maslen and Hopkins (2014) explained that senior managers usually claim that decisions regarding safety are not impacted by the provision of bonuses because safety is guided by values and they intrinsically want to keep employees safe. However, case studies of 11 companies revealed that incentives actually do influence safety decisions because managers want recognition and have a need for approval (Maslen & Hopkins, 2014). The authors concluded that, because other aspects of the job are incentivized, safety must also continue to be incentivized.

Incentives directed to groups and/or companies. Nine articles were related to incentives offered to groups and/or companies. These are often launched by various levels of government, non-profit organizations, and/or developers, in the form of grants, tax reductions, insurance premium variations, awards, and financial incentives (Kankaanpaa, 2010).

Occupational health and safety regulation. There are several ways that government level policies can offer incentives for better occupational health and safety on worksites. One is to actively enforce occupational health and safety regulation. The other is to use the experience rating of employees and employers to impact workers’ compensation insurance (i.e., those with more experience, pay less for insurance). It is thought that both of these approaches provide additional motivation to companies to focus on health and safety issues because there are clear economic consequences for not doing so.

Verbeek (2010) asserted that an incentive approach to safety might be more effective than a regulation approach to occupational health and safety. Verbeek (2010) explained that OH&S regulations are often considered complex and bureaucratic and they require a controlling agency to check whether employers are following these regulations, which costs money and can be resource consuming because of a large number of employers in a given region. In addition, Verbeek (2010) stated that it is unclear whether regulations of OH&S are effective. Therefore, a non-regulatory, incentive approach to safety could be an optional approach to increase safety.

In a review of the literature, Tompa, Trevithick, and McLeod (2007) found clear evidence that actual citations and penalties reduced injuries. However, there was mixed evidence that enforcement of OH&S regulation reduced injuries also. This means that having an inspector visit a worksite but not actually give out citations does not appear to have an impact on safety. There was also evidence that the impact of OH&S enforcement decreased over time (Tompa et al., 2007). In addition, one study by Elsler et al. (2010) found evidence that lower insurance premiums for companies with higher experience ratings appeared to reduce injuries. However, they also concluded that although these insurance incentives are effective, they tend to be quite expensive.

Lastly, Elsler and Eeckelaert (2010) examined factors that may influence the transferability of these types of incentives across countries in Europe. They found that although there were differences in how the incentives were funded and cultural differences between countries in terms of uncertainty avoidance, future orientation, and distribution of power, there were few differences in terms of the OH&S incentives. This indicates that cross-cultural differences may play a role in the design and perception of various OH&S incentives when implemented in other countries.

Incentive/penalty (I/P) provisions. I/P provisions are company safety incentives that offer awards for good OH&S performance and penalties for unsafe acts and unsafe working conditions (Hasan & Jha, 2013). In a study on Indian construction projects, Hasan and Jha (2013) found that projects utilizing I/P provisions were significantly safer than those that did not use I/P provisions. When using I/P schemes, there are several attributes that impact safety; therefore, the following suggestions should be followed. First, proper labour training must be provided to all workers and special attention should be given to risky situations, such as confined spaces. Second, safety committees should be operating on all sites. Third, specialized tools and equipment should be available at all times. Lastly, penalties should be given for every occurrence of unsafe work and should be high to prevent their occurrence (Hasan & Jha, 2013).

Pay for safety schemes (PFSS). PFSS is an activity-based safety incentive program wherein payment is made to developers and contractors once certain safety requirements have been performed, which are agreed on at the outset (Chan, Chan, & Choi, 2010). These requirements commonly include drafting a safety plan, providing safety training to workers, and holding weekly safety walks. Two studies have been conducted to examine the benefits and difficulties in adopting a PFSS in Hong Kong. Chan, Chan, and Choi (2010) found that the benefits of PFSS include increased safety training, reduced accident rates, better safety culture, stronger safety awareness and safety commitment, enhanced safety attitude of workers, and improved safety-related communication between different contracting parties. Choi, Chan, and Chan (2012) found several difficulties with PFSS, including the paperwork required for certifying

payment to contractors, complicated contract documents, and a rushed schedule. Additionally, they found that contractors have more difficulty implementing PFSS than client organizations (Choi, Chan, & Chan, 2012).

Safety awards. A safety award is a safety incentive given to companies for outstanding performance in one or several aspects of safety (Meinke & Morata, 2012). Meinke and Morata (2012) completed a study on a safety award for hearing loss prevention. They found that offering awards to companies for particular aspects of safety may provide others with increased safety knowledge. As a result, the award not only recognizes a company for outstanding safety performance but also provides opportunities to help other companies increase their safety performance through public awareness.

Incentives directed to individual employees. Seven articles were related to incentives directed towards individual employees. Incentives often include *material rewards* (e.g., money, gift cards, durable goods, etc.), *natural rewards* (e.g., performance feedback, employee-determined work schedules, independent work, etc.), token rewards (small tangible rewards that can be accumulated and exchanged for desired items of money). It is important to take into account the type of incentives that are offered to employees as well as the way in which employees can earn them.

One study examined the use of natural versus material incentives. Winn, Seaman, and Baldwin (2004) found that offering natural incentives was more effective than material incentives in encouraging safety behaviour at a construction worksite, even though employees indicated that they preferred material incentives. When material incentives are offered, Paladino (2013) explained that gift cards are likely more effective than cash rewards. This is because cash is often spent on everyday expenses and as a result employees are less likely to experience a cash reward as a “special occasion” or to associate the reward with a sense of accomplishment. When offering bonuses to employees, though, management must insure that there are no unintended consequences. For instance, Melo and Dinis (2010) found that the safety performance of a group of workers who did not receive bonuses was better compared to the group that received the productivity bonus. Therefore, bonuses should not be offered simply for productivity.

Another form of incentive commonly given to individual employees is a *token reward system*. With this type of incentive, workers are given small, tangible rewards for achieving safety goals. Then, these tokens can be exchanged for a desired item or amount of money. Baker (1998) found that the use of a token economy was effective in increasing safe behaviour with an industrial population. In a review, Cameron and Duff (2007) concluded that both natural and material incentives were effective in increasing safety in industrial settings. They cautioned that the use of token economies can be somewhat controversial because they can be viewed as paying for safety. They also cautioned that behavioural safety checklists on which these rewards are based often focus on the most common safety incidents and ignore those that are less common but potentially disastrous. Lastly, Cameron and Duff (2007) asserted that incentive programs need to be supported by management in order to be effective.

As mentioned above, some incentives are still offered to individual employees, but employees may be divided into larger groups in order to earn them. These are referred to as *lottery safety incentives*. Although each individual is offered the opportunity to earn a reward, the incentive will only be received by certain employees or teams of employees and this is often determined by random draws or

competitions (Haisley, Volpp, Pellathy, & Loewenstein, 2012). In one study, Haisley, Volpp, Pellathy, and Loewenstein (2012) examined whether a behavioural economic approach to incentive design (i.e., the use of a lottery) was more effective than a direct economic payment of equivalent value (i.e., a grocery gift certificate) in encouraging employees to complete health risk assessments. For the lottery condition, employees were placed into teams of four to eight people. When an employee completed the health risk assessment, they were given \$25 (the same amount as in the individual condition). In addition, if the team was randomly drawn after a period of time, then each employee on the team who had already completed the health risk assessment received an additional \$100. Alternatively, if 80% of the team had already completed the health risk assessment, then the amount received by each member increased to \$125. Haisley et al. (2012) found that the completion rates of the health risk assessments were significantly higher in the lottery condition than in the grocery gift certificate and comparison conditions. They believed that the lottery condition was effective because of the social nature of grouping employees into teams such that each member encouraged others to complete the health risk assessment.

In another study on the lottery approach, employees of a milk manufacturing plant were divided into 25-member teams and spread between the three main areas of operations: manufacturing, distribution, and cooler (Yeow & Goomas, 2014). Incentives were offered using a tiered approach: if no one on the team had an injury claim, each team member was given a \$20 gift card (Tier 1); if all teams in an area went one full month without any injury claims, there were 10 random draws for \$100 gift cards (Tier 2); and, if all teams in an area went three consecutive months without any injury claims, 50 random draws for \$100 gift cards were made (Tier 3). In addition to the tiered rewards which offered incentives for safety outcomes, there was also a behavioural component to the intervention. Basic safety precautions and behaviours were presented to the workers and they were encouraged to praise and/or reprimand one another. Team statistics and overall statistics were displayed and updated on a central bulletin board. After the implementation of the safety program, there was a statistically significant decrease in the number of recordable injury claims from baseline to 1 year (42% decrease) and 2 years (33% decrease). There were no statistically significant changes in the comparison plant. Similar to Haisley et al. (2012), Yeow and Goomas (2014) concluded by saying that a tiered-system can be used to provide incentives while also offering the opportunity for employees to socially influence one another in safe behaviour and to provide peer feedback on safety behaviour. The observations in this study also indicated that employees were engaged in the intervention. Thus, based on the research reviewed above, having employees participate in safety incentive programs in groups may positively impact safety behaviour and/or outcomes, and overall workplace climate with regards to the importance of safety.

Incentives and disincentives for reporting unsafe events. Three articles were related to incentives and disincentives for reporting unsafe events. Although employees are responsible for reporting unsafe events that happen in the workplace, sometimes these events go unreported. For instance, as a result of incentive programs, some employees may avoid reporting unsafe events because it may result in the loss of a reward for themselves and/or others.

Only one study examined incentives to reporting unsafe events. Brubacher, Hunte, Hamilton, and Taylor (2011) examined safety event reporting in emergency departments. They found that nurses and

nurse managers were more likely to report unsafe events (defined in this case as events occurring during medical care that include near misses, no harm events, and adverse events) when: staff could perceive that such reports were valued (i.e., educating staff on patient safety, the value of reporting, what to report, and providing time for staff to report incidents); safety events could be reported in multiple ways (i.e., alternatives to standardized forms such as safety huddles, anonymous drop boxes, and a safety whiteboard where anyone could indicate a concern); and, when staff could see positive change as a result of reporting (i.e., prompt feedback and actual change as a result of reporting).

However, barriers that prevent employees from reporting injuries were more common than incentives to promote reporting injuries. Barriers that discourage safety event reporting by nurses and nurse managers in the Brubacher et al. (2011) study included: time constraints, futility, fear of reprisal, lack of education on what to report, inaccessibility of reporting forms, and viewing reports as indicators of their own incompetence. Among a study of carpentry apprentices, barriers to reporting included: increased likelihood of future drug testing, discipline by supervisors, production pressure, and future implications (e.g., increased likelihood of being laid off; Lipscomb, Nolan, Patterson, Sticca, & Myers, 2013). In an industrial sample, disincentives to reporting included: being labeled as a complainer and being viewed as weak, being assigned to lighter jobs, loss of overtime pay, and separation from co-workers, (Pransky, Snyder, Dembe, & Himmelstein, 1999).

The disincentives to reporting unsafe events have been found to translate into decreased reporting. Injury reporting was 50% lower on sites where injured workers were disciplined for reporting (Lipscomb et al., 2013). On another site, 85% of those employees interviewed reported work injuries but only 5% had reported the injury to the employer (Pransky et al., 1999). These results have important implications for the future health and safety of the employees.

Incentives specific to decreasing speeding. Four articles were related to decreasing speeding. In addition to incentives designed to increase a variety of safety behaviours, identified research also examined incentives for specific behaviours such as speeding when driving. An Intelligent Speed Adaptation (ISA) system is a special equipment designed to keep drivers from speeding. ISA provides a driver of a vehicle with information on speeding (e.g., whether they have exceeded the speed limit) by linking the vehicle speed with speed limits of the roads on which the vehicle is travelling using GPS (Reagan, Bliss, Van Houten, & Hilton, 2013; Stigson, Hagberg, Kullgren, & Krafft, 2014). Commonly, drivers are alerted to their speeding behaviour by an auditory and/or visual alert and by reviewing their speeding behaviour on a website at a later time. There are two types of ISA: mandatory and voluntary. Mandatory ISA is a system that physically limits the speed of a vehicle to the current speed limit and alerts the driver that they are speeding in order to keep the driver from speeding (Chorlton, Hess, Jamson, & Wardman, 2012). Voluntary ISA is a system that limits the speed of a vehicle to the speed limit and alerts the driver that they are speeding, but allows the driver to disengage the system if they choose (Chorlton et al., 2012). Often, ISA is studied in terms of whether it is effective to present drivers with feedback on their speeding behaviour by having them review it on a website. ISA is also often paired with financial incentives to reduce speeding. These include having drivers pay for the amount of speeding they engage in or offering insurance discounts for not speeding.

Reagan, Bliss, Van Houten, and Hilton (2013) examined the use of speeding feedback and a monetary incentive. In the feedback condition, they presented drivers with information about their speeding through a use of a visual and auditory alerts. The drivers in the monetary incentive group began the study with \$25 baseline bonus. Their bonus declined by 3 cents for every 6-second period they drove 5 to 8 miles per hour faster than the speed limit. They also received visual and auditory alerts when they were speeding. These alerts were provided on a visual display similar to those used in taxicabs. Reagan et al. (2013) found that both the automated feedback and the monetary incentive reduced speeding but that speeding was reduced most within the incentive group. Similarly, Stigson, Hagberg, Kullgren, and Krafft (2014) found that visual warnings when speeding combined with the offer of reduced insurance premiums resulted in less speeding. Furthermore, Ellison, Bliemer, and Greaves (2015) found that risky driving behaviour decreased when participants were aware of their driving behaviour and a pay-as-you-drive scheme was implemented. Individual users had mixed views on the use of ISA; some individuals are opposed to ISA devices and would require large monetary incentives before using them whereas others view them favourably and would actually pay money to have one installed in their private vehicle (Chorlton et al., 2012). Whether these views would be similar if ISA was used at worksites is unknown.

Incentives specific to increasing seat belt use. Three articles were related to incentives that specifically targeted increased use of seat belts. Incentives for employees use of seat belts included token gifts such as food and coffee mugs, to gift cards and money ranging from \$1 to \$500, to round trip plane tickets (Eddy, Fitzhugh, Wojtowicz, & Wang, 1997). For most of these incentive programs a significantly increase in the use of seat belts was found (Geller, Rudd, Kalsher, Streff, & Lehman, 1987). Continuous safety incentives are those that are offered to employees on an ongoing and indefinite basis, rather than intermittently or for a limited amount of time. Immediate reinforcement occurs when the safety incentive is awarded to the employee soon after the incentivized behaviour occurs – in this case, using a seat belt. Continuous incentives of significant money value and immediate reinforcement to employees for safety belt use are most effective (Eddy et al., 1997; Geller et al., 1997; Hagenzieker, Bijleveld, & Davidse, 1997). This is contrasted to delayed reinforcement, when the incentive is awarded to the employee after some amount of time has passed since the desired behaviour occurred (Geller et al, 1997; Hagenzieker et al., 1997).

Although most of the studies sustained a beneficial impact after the intervention, most of the studies also showed relapse in use of seat belts. However, the decrease in use of seat belts did not usually go back to the baseline measures (Eddy et al., 1997; Geller et al., 1997; Hagenzieker et al., 1997). The mean effect sizes of incentive treatments reported in the literature amount to 12.0% and 9.6% increased use of seat belts over baseline for short- and long-term effects, respectively (Hagenzieker et al., 1997). This research indicates that incentives are an effective way to increase employees' use of seat belts.

Discussion

Although there is considerable research in psychology about how to change individuals' behaviour, there is not a lot of studies specifically targeting the use of incentive programs to increase safety behavior of employees. Studies that have been conducted on incentive-based safety interventions have occurred largely overseas and in industries such as construction. Therefore, there is a need to

systematically assess incentive programs for safety on Canadian mine sites to determine if they are effective. Additionally, the research to date can be used to develop new safety incentive programs and to modify existing ones.

Gaps in the Literature. Despite the high number of incentive-based safety programs in place in various industries, there is little research examining and comparing their design, effectiveness, and mechanisms of influence. There have been few replications of the existing research and minimal research within the mining industry and in Canada has been found. Although much of the literature reviewed here has been experimental in nature, there are significant gaps in our knowledge of incentive-based safety programs.

One of the current controversies in this area is whether paying for or incentivizing safety is ethical. While one study concluded that safety should continue to be incentivized just as other aspects of work are (Maslen & Hopkins, 2014), another group concluded that rewarding employees with tokens for safe behaviour was somewhat immoral because individuals should behave safely regardless of potential rewards (Cameron & Duff, 2007). How employees, managers, and the public view safety incentives in Canada and in regards to mine sites is unknown and represents a significant gap in our knowledge. This line of research may have important implications for the design and implementation of future incentive programs in Canada.

Another gap in the knowledge is how to implement and modify various incentive programs for Canadian mine sites. For example, whether and how various incentive programs can be transferred from other countries to Canada is unknown. One study determined that cross-cultural differences between countries may have an impact on the incentive programs implemented in various countries (Elsler & Eeckelaert, 2010). This is an important topic because much of the research reviewed here was conducted outside of Canada. Another relevant gap in the knowledge is related to modifying existing safety incentive programs. For instance, research showed that natural incentives were more effective than material incentives even though employees indicated that they preferred material incentives. Whether and how an existing program can be shifted from the provision of material to natural incentives is unknown. There may be a negative response from employees who are accustomed to receiving material incentives. Yet another gap in the literature is the difficulty faced when adopting a new program in Canada. For instance, many difficulties were identified for contractors when adopting a pay-for-safety-scheme (PFSS) in Hong Kong. Whether similar difficulties would be faced in Canada when attempting to implement new safety incentives is unknown at this time.

A topic that will be important to examine in the future is the focus of incentive-based safety programs – that is, whether it is effective for incentive programs to be focused on a limited number of specific behaviours or outcomes or more global safety behaviours or outcomes. A potential problem with focusing on specific behaviour or metrics is that other behaviours or metrics will necessarily be ignored. Similarly, the peripheral or unintended consequences of incentive programs are seldom measured or discussed in the literature. For example, as discussed, Yeow and Goomas (2014) reported a 42% decrease in injury *claims* as evidence of a successful tier based incentive program; however, the potential side-effect of a poor reporting culture, which may have also contributed to these results, was not directly

measured. Yeow and Goomas (2014) theorized that the use of a small reward (maximum \$100) coupled with the nature of a random draw (i.e., no guarantee of actually getting the money) would prevent under-reporting. However, that was not actually studied by them and remains a real gap in the literature. Thus, focusing on safety incidents and claims as a measure of program effectiveness has inherent limitations. The question remains whether diverting attention from non-measured safety behavior or underreporting poses more danger to the employees and whether it is best to focus on global outcomes and decrease the emphasis on specific aspects.

In regards to the research that was targeted to specific behaviours (i.e., decreasing speeding and increasing seat belt use), a current gap is whether this knowledge and technology could be adapted to mining equipment. For example, are there specific unsafe behaviours that need to be decreased when particular mining equipment is in use? If so, then the use of a mandatory type of program that prevents such behaviour may be effective in decreasing it. Whether this type of technology would be supported or opposed by employees is unknown. Based on the results of the research reviewed above, it is likely that there will be some employees who embrace it and others who oppose it regardless of incentives offered for using it (Chorlton et al., 2012).

There is no systematic research on comparing effectiveness of lagging indicators-based incentive programs versus leading indicators-based programs in relation to overall companies' goals of improving safety culture, safety communication, and achieving high standards of safety.

Lastly, a significant gap in the work on incentive-based safety interventions to date is a lack of employees' perspectives. Future use of qualitative research focused on gaining the perspectives of individual employees in the Canadian mining industry may represent an important step to obtaining richer information. Because they are often the individuals performing (or not performing) the safety behaviour, participating in incentive programs, and making safety-related decisions, it is important to understand employees' perspectives on this topic.

Recommendations. Based on the current scoping review, the following recommendations should be followed in order to increase the effectiveness of safety incentive programs:

- Performance agreements for senior managers should be manageable (up to five priorities), reviewed by them on at least a weekly basis, include indicators that are SMART (specific, measurable, attainable, realistic and time-related), and translated into visible format and carried throughout the day or displayed in office (Maslen and Hopkins, 2014).
- When incentives are offered, thresholds for achieving them need to be determined. The most appropriate threshold is probably when all employees on a mine site are working towards the same goal (Sparer & Dennerlein, 2013).
- Policies and incentives that offer rewards for desirable behaviour rather than those that punish poor behaviour are likely more inclusive and beneficial to employees (Tannenbaum et al., 2013).
- Because gift cards are viewed as being a “special occasion,” they should be given out as rewards, rather than cash (Paladino, 2013).
- Natural incentives are more effective than material incentives, even though employees state that they prefer material incentives (Winn et al., 2004).

- To encourage employees to report safety events, they must be provided with adequate time to do so. The reporting itself should be easy to complete. Reporting can also be encouraged by making changes to current work practices when indicated by safety event reports received. There should not be any discipline, overt or subtle, given as a result of safety event reporting (Brubacher et al., 2011; Lipscomb et al., 2013; Pransky et al., 1999).
- Individual opinions of ISA systems are likely to influence voluntary use of them although this may be irrelevant if required at work. Automated feedback and monetary incentives would likely reduce speeding among employees (Chorlton et al., 2012; Reagan et al., 2013; Stigson et al., 2014).
- Offering incentives to increase employees' use of seat belts while at work will likely result in increased use of seat belts (Eddy et al., 1997; Geller et al., 1987; Hagenzieker et al., 1997).
- The most effective incentives are likely those that are used continuously because they may sustain increased safety behaviour over the long term (Eddy et al., 1997; Geller et al., 1987)

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