1.5. Safety Management Regulations

1.5.1. Public Policy and Safety Engagement

To cite: Press, M., Sherban, S., & Perry, R. (2017). Public policy and safety engagement. In Chirkov, V., Anonson, J., Anderson, J., Press, M., Gerrard, A., & Ha, C. (Eds*.). Enhancing cultures of safety and safety engagement in the Saskatchewan mining industry: A collaborative and multidisciplinary inquiry* (pp. 114-122). Saskatoon, SK Canada: International Minerals Innovation Institute.

1.5.1. Public Policy and Safety Engagement

In this chapter, we looked at how public policies may influence safety engagement. Policies involve decisions made by government or legislative bodies either to act or not act; and may include laws, regulations, statutes, programs, management decisions, rules, and sustained or supported practices (Weible, 2014). Policies enacted in government or in business were included in this scoping review.

The question that guided our scoping review was: What is the influence of government or legislative policies on safety engagement of employees in the mining industry?

Method

A scoping search of the literature was undertaken using the following key words:

1. Miners (miners or workers or employees or "mining industry" or "mining community" or "resource extraction" or "energy industries") and
2. Government or legislative (govern* or legisla* or minist* or politic* or law or authority or jurisdic* or congress* or senat* or nomothetic or parliament* or statut* or polic* or regulat* or compliance or inspections or "government investigations") and
3. Safety engagement ("risk taking behavior/behaviour" or "safety behavior/behaviour" or safety or "high risk behavior/behaviour" or "safety engagement" or "safety rule violation" or "accident proneness" or "risk perception" or "perception of safety" or "safety device" or "accident prone" or "workplace safety" or "work safety" or "risk tolerance" or "safety equipment" or "accident prevention" or "industrial hygiene")

Search Strategy. The databases searched are listed in the results. From this search, we selected articles based on the inclusion/exclusion criteria. 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. In our search, we collected articles that were pertinent in this topic area. The broad inclusion and exclusion criteria allowed us to explore the literature in this area more completely, see Table 1.

Table 1. Public Policy and Safety Inclusion/Exclusion Criteria for Article Selection

Inclusion Criteria	Exclusion Criteria
• Articles with key terms in the title or abstract	• Editorials
• Peer reviewed	• Commentaries
• Within 5 years	• Book reviews
• English language articles	• Posters or conference abstracts without an article

Screening Strategy. The articles were checked for inclusion by two team members. The inclusion process was iterative in that the included/excluded articles were reviewed again for inclusion as the themes were developing. The team had final approval of the included articles. Those not applicable to the scoping review were excluded.

Results

A brief summary of each article including its location, population studied, main issue addressed, comparison group, and primary outcomes is provided in Appendix G. Table 2 is an overview of the scope of the review and articles identified.

Table 2. Public Policy and Safety Databases and Articles Selected

Database	No of articles found from search	Articles Selected for Review	Final article selection from article summaries
CINAHL	202	100	24
Medline	1		
Nursing and Allied Health	2		
Engineering Village	25		
PsychInfo	2		
CBCA Business	2		
Embase	19		
ABI Inform/CBCA Education	13		
Scopus	0		
Web of Science	0		
PubMed	83		
Public Administration Abstracts	28		
Justis, Mines Regulations, 2003 Sask. Files, Occupational Health and Safety Regulations	5		

Description of Included Articles. Table 3 provides an overview of the types of publications, country of publication, and populations studied.

Table 3. Public Policy and Safety: Populations, Country of Research, and Type of Study

Type of Study	Country of Research	Populations Studied
Quantitative studies • Pragmatic cluster randomized trial (1) • Repeat measures design (2) • Prospective cohort study (1) • Case controlled trial (1) • Randomly controlled trial (1) • Surveys (2) • Secondary analyses of data (5) Qualitative Studies • Case study (1) • Qualitative interviews (2) Other • Program evaluation (1) • Ergonomic work analysis (1) • Evaluation (1) • Articles (5)	India (2) USA (6) Kyrgystan (1) Netherlands (1) Belgium (1) Australia (3) China (1) Norway (1) Sweden (1) Brazil (2)	Unspecified workers (7) Miners (4) Safety inspectors/ advisors (2) Quarry workers (1) Young workers (1) Men (1) Businesses (1) Autopsies (1) Physicians (1)

Description of Identified Factors. In order to make it easier to describe the results of the scoping review, the articles were divided into four categories: impact of policies on safety, transmission of policy, enforcement of policy, and policy needs.

Impact of policies on safety. Six articles were identified which related to the impact policies may have on safety. Two articles found policies improved worker compliance. In a survey study of four companies and 249 employees, Bockstael, De Bruyne, Vinck, and Botteldooren (2013) found stricter policies resulted in better consistency of wearing hearing protection. They stressed management's responsibility in safety through adequate policy making. Hopkins (2011) stated, "There is an in-principle reason why rules are necessary." He affirmed decision-making dilemmas make it necessary for decision-makers (workers) to have rules. Pressure from managers may encourage risk-taking behavior, whereas rules may encourage workers to identify areas where safety may be at risk (Hopkins, 2011).

Three articles found policies and regulations improved safety and health of employees. In a study of lung function in high altitude miners, Vinnikov, Brimkulov, and Redding-Jones (2013) found an improvement in lung function after a workplace smoking ban was put in place. Previous to the ban, the lung function of these miners was decreasing rapidly; but in the two years following the ban, the improvement in lung function was significant. Thus, instituting a policy of this sort may have implications for the health and well-being of employees. In a secondary analysis of the data from the Pennsylvania Department of Labor and Industry, Haviland, Burns, Gray, Ruder, and Mendeloff (2010) found regulations improve not only the safety areas they are regulating but general safety as well. They also reported a better response from the industry in improving safety when they are cited for a deficiency. In a 2012 update of the data, they found that inspections with penalties reduced injuries annually on average 19-24 %. These findings applied to workplaces with more than 20 and fewer than 250 employees or for inspections without penalties. Vallyathan et al (2011) determined that regulations had a positive effect on decreasing prevalence and severity of rates of pneumoconiosis. Pathologists were engaged to examine lung tissue of (deceased) workers from the industry pre and post regulation implementation. They identified some shortcomings of the study (lack of accurate retirement dates in all cases, smoking as a confounding factor) but the study contributes to supporting and argument for regulations and standards.

One article did not find a change in safety. Monforton and Windsor (2010) conducted a secondary analysis of data to assess the impact of mandatory safety training on injury rates in federal mines (above ground). The study did not associate a decline in injuries with regulations and focused on organizational compliance not employee behavior.

Transmission of policy. Four articles were identified related to transmission of policy to employees. The articles discussed orientation of young people, safety education, and examples of policy not transmitted well. One article looked at how young people are oriented to policy. Holte and Kjestveit (2012) conducted qualitative case study interview research to explore how young people are received, orientated, and inducted into occupational health and safety in their construction workplaces. The study examined the transmission and acquisition of safety culture and attempted to reveal factors in establishing a culture of safety. The study acknowledged limitations arising from differences within disciplines in the construction industry and self-selection bias. Further, the study noted safety training capacities of larger companies differed from those of smaller companies and ranging from institutionalized in-house formal training and mentor for larger organizations to outsourced training and no structured mentoring for smaller organizations. The authors indicated the difference may mean smaller companies are not

legislated to include training and therefore may not value OHS training. One article looked at types of education to transmit safety policy. Adams et al (2013) compared enhanced to standard education. The enhanced education correlated to an increase in compliance with use of safety equipment (eyewear) and increased compliance showed a decrease in injuries. The longer the program was continued, the better the results.

Two articles looked at policies not well transmitted. Schenk and Antonsson (2015) studied the impact of a chemical regulations policy. They found the policy was not well known and safety data sheets were improved but not complete or sufficient in identifying how to use safely. Schenk and Antonsson described a lag in policy development and compliance, and they suggested more support and motivation is required for users to meet their obligations. Shi (2009) found there is a lag between policy implementation and effect on safety at the mine site. In a secondary analysis of data from the China Coal Industry Yearbook (CCII), Shi reported no effect on mortality rates but a significant impact on the frequency of accidents with a time lag of one year. The author concluded policy implementation impacts cost effective controllable accidents but may take longer to reduce overall mortality rates.

Approaches to policy enforcement. Eight articles were identified that were related to approaches to policy enforcement. The articles discussed inspection routines, positive means to enforcement, and punitive measures. One article discussed inspection routines. Levine, Toffel, and Johnson (2012), found that compared to controls, employers who were inspected on a random basis saw injury rates decline by 9.4% and a corresponding decrease in injury costs of 26%. Further, these improvements did not have a negative effect on employment, sales, credit ratings or survival of the firm. Levine et al. found a decline in injury rates and injury cost in those organizations which were randomly inspected compared to those which were not. They also found there was no increase in costs to the organization where improvements in safety were made.

Five studies reported on positive means to enforce policy. Tilbury and Sanderson (2012) conducted a program evaluation of good practice guidance for mining focused on the change from prescriptive to proactive approaches for injury prevention and management. The program focused on the development of workplace ‘champions’ / employees interested in health and safety. The potential benefits of this approach included sharing of good practice, plain English worker information, development of fact sheets and templates for coal mines, and raising the profile of worker engagement in safety solution design. In a 2012 Brazilian study, Evangelista et al evaluated the relationship between postural positions of workers and musculoskeletal disorders/injuries (MSD). Employers who demonstrated a concern for and commitment to employee safety and health were more attractive to employees. Employer provided training contributes to and is necessary for employee health and well-being and decreases accidents and MSD. In 2012, Tilbury & Sanderson evaluated the change from a prescriptive to a proactive program of injury prevention and management. Early results indicate that sites are benefiting from the focus on positive performance outcomes. Worker engagement in designing solutions amongst other strategies was seen as important. Kankaanpaa (2010) discussed the use of incentives as a policy tool, and she stated incentives work only if the occupational health and safety investment is not too high. She stated incentives on their own do not lead to improvement, and they should be clearly linked to outcomes.

Epstein (2012) discussed enforcement of safety policies and suggested a successful safety policy involves employees and management to develop educational programs about health and safety. In a survey study, Griffin and Hu (2013) found safety monitoring had a positive relationship with safety participation which can be moderated by safety learning. They reported safety monitoring is a source of external leadership that may inspire workers to participate in safety.

Two articles discussed punitive measures to enforce policies with different results. In a case study of New South Wales safety regulations, Gunningham and Sinclair (2009) found a change in the way safety was regulated after a fatal mining accident. Prior to the accident, regulation was based on a 'advise and persuade' approach. After the accident, the mine and the managers were successfully prosecuted, and the approach changed to punitive measures. Gunningham and Sinclair found the level of trust between the industry and the regulators decreased with the industry not sharing information that might get them in trouble and the regulators not trusting the industry to obey the rules. The punishments became more frequent and related to issues that may not result in injury. Gunningham and Sinclair called for a more balanced enforcement that would improve the trust between mines and regulators but still provide incentive for mines to ensure they follow regulations. The best method to ensure compliance with regulations was to punish managers rather than the organization because the organization just absorbed the cost and did not make the necessary changes (Gunningham & Sinclair, 2009). In a secondary analysis of data from the Pennsylvania workers' compensation program, Haviland, Burns, Gray, Ruder, and Mendeloff (2012) found inspections with penalties reduced workplace injuries for up to two years following the inspection. They suggested the impact of inspections on safety has increased since the 1990s.

Policy needs. Six articles were related to policy needs, and included organizational changes and employee considerations. Two articles discussed potential organizational changes. In a prospective article, Apostle, O'Connell, Vezeau (2011) provided a conceptual outline on how to employ occupational health nursing (OHN) authentically in order to promote safety for miners and communities. The author looked at OHS write largely (e.g. air and water quality safety) and outlined several roles and activities that could involve nurses. In a case controlled study, Maiti (2012) identified variables contributing to workplace injury using logical regression, which were then used to generate required improvements. Relationships between legislation and regulatory factors were amalgamated into organizational factors that could affect safety practice and included age, negative-affectivity, physical hazards, job dissatisfaction, and safety practice.

Four articles discussed employee considerations. In a review of the literature on immigrants and occupational health policy, Liebman et al. (2013) found a lack of policy for this vulnerable workforce, and they suggested a systematic policy approach which included both immigration policy and worker protection would strengthen occupational health and safety in the agricultural, forestry, and fishing sectors. De Arruda and Gontijo (2012) proposed a conceptual framework for mine safety through the use of ergonomic principles. The authors noted mining accounts for one percent of the worldwide workforce but accounts for eight percent of occupational fatalities and speculated that tension between profit-driven goals of workers and management (their behavior) should be accounted for or mitigated with OSH

standards. Sirikul, Bishop, and Nevett (2011) used a repeated measures design research study to assess difference in physiological and subjective responses of workers in PPE and found implications for OSH policy and legislative implications on work/rest periods for employees. Van der Molen et al (2012) undertook a prospective cohort study to determine the incidence of occupational disease. They found the most common injuries or diseases were mental health issues and muculoskeletal disorder/disease/injuries (MSD). They posit that knowing the incidence of occupational disease can inform preventative programs. Although there are limitations to the study (e.g., not all workers have access to or attend (occupational) physicians). The study resulted in evidence based guidelines for a few conditions (mental health, MSD< hearing, infectious diseases, skin, respiratory, and neurological conditions. If reporting requirements are considered employee/employer behavior this can be construed to fall under regulation/policy. Mining was found to have a high rate (placing 2nd) of injury after construction (first place), and before water and waste (3rd), and transport and storage (4th).

Discussion

In this scoping review of the literature, we investigated the impact of policy factors such as government and legislation on safety engagement. What we found in the literature was the impact of policy on safety, transmission of policy, approaches to policy enforcement, and policy needs. From the literature in these areas, it appears safety policies improve worker compliance and help with decision-making in complex situations. As well, there appears to be an additional safety benefit above what is covered by the particular policy.

Policies are transmitted best through education. The review found the better the educational program, the better the safety engagement of employees. When policies are not well transmitted, injuries occur. Enforcement of policies should be proactive, demonstrate a commitment from management, and focus on positive outcomes and positive performances. The literature was mixed on punitive measures. There appears to be a reduction in injuries with penalties, but also a reduction in trust and communication. A balanced method to enforcing policies would be best.

Gaps in the Literature. Although literature can be found on legislation, (safety) training, and enforcement of legislation, policy and standards we have identified a paucity of research and related information on any concerted efforts to integrate these topics. Certainly legislation, policy and standards for safety practice and accident prevention exist. There is a consensus in the literature that when sanctions are applied to violations that they are insignificant and do not result in companies changing their behavior. Authors either state outright, or it can be inferred from their work that if penalties were substantial and companies felt the force of the law that accident/disease prevention and health and safety promotion would have a higher value and emphasis placed upon them and that a corresponding change in behavior would be effected. Researchers have opportunities to investigate any links between regulations, training, and outcomes. Collaboration can occur with Human Resources and Training and Education Departments to both build in compliance and safety objectives into performance goals (individually and as a department) and to design training from the outset of orientation through to refresher sessions for employees. Training should be tailored to the position of the employee reflecting that a ‘one size fits all’ approach is not possible. Employees at different levels of responsibility have differing needs.

Recommendations. Based on the findings from this scoping review, the following are recommendations for the mining industry:

- Ensure comprehensive safety policies are in place and transmitted through quality education programs.
- Use a balanced approach to enforcement of policies, include positive and proactive measures as well as punitive.

References

Adams, J. S. K., Raju, R., Solomon, V., Samuel, P., Dutta, A. K., Rose, J. S., & Tharyan, P. (2013). Increasing compliance with protective eyewear to reduce ocular injuries in stone-quarry workers in Tamil Nadu, India: A pragmatic, cluster randomised trial of a single education session versus an enhanced education package delivered over six months. *Injury, 44*(1), 118-125. doi: 10.1016/j.injury.2011.10.001.

Apostle, E. P., O'Connell, M. E., & Vezeau, T. M. (2011). Health disparities of coal miners and coal mining communities: The role of occupational health nurses. *American Association of Occupational Heath Nursing Journal, 59*(7), 311-321. doi: 10.3928/08910162-20110624-05.

Bockstael, A., De Bruyne, L., Vinck, B., & Botteldooren, D. (2013). Hearing protection in industry: Companies' policy and workers' perception. *International Journal of Industrial Ergonomics, 43*(6), 512-517. doi: 10.1016/j.ergon.2012.08.009.

de Arruda, A. F., & Gontijo, L. M. (2012). Application of ergonomics principles in underground mines through the Occupational Safety and Health Management System - OSHMS OHSAS 18.001:2007. *Work-a Journal of Prevention Assessment & Rehabilitation, 41*, 4460-4467. doi: 10.3233/wor-2012-0119-4460.

Epstein, D. G. (2012). Does UK health and safety legislation rely upon a poorly-resourced enforcement agency, a limited scheme for employee involvement, and a misplaced emphasis on self-regulation? *Public Personnel Management, 41*(1), 61-77.

Evangelista, W. L., de Fátima Tinoco, I., de Souza, A. P., Minette, L. J., da Costa Baeta, F., da Silva, E. P., & Oliveira, L. A. (2012). Postural analysis of workers in a typical meat processing company in Brazil. *Work: A Journal of Prevention, Assessment and Rehabilitation, 41*, 5392-5394.

Griffin, M. A., & Hu, X. (2013). How leaders differentially motivate safety compliance and safety participation: The role of monitoring, inspiring, and learning. *Safety Science, 60*, 196-202. doi: 10.1016/j.ssci.2013.07.019.

Gunningham, N., & Sinclair, D. (2009). Regulation and the role of trust: reflections from the mining industry. *Journal of Law and Society, 36*(2), 167-194. doi: 10.1111/j.1467-6478.2009.00462.x.

Haviland, A., Burns, R., Gray, W., Ruder, T., & Mendeloff, J. (2010). What kinds of injuries do OSHA inspections prevent? *Journal of Safety Research, 41*(4), 339-345. doi: 10.1016/j.jsr.2010.03.005.

Haviland, A. M., Burns, R. M., Gray, W. B., Ruder, T., & Mendeloff, J. (2012). A new estimate of the impact of OSHA inspections on manufacturing injury rates, 1998-2005. *American Journal of Industrial Medicine, 55*(11), 964-975. doi: 10.1002/ajim.22062.

Holte, K. A., & Kjestveit, K. (2012). Young workers in the construction industry and initial OSH-training when entering work life. *Work: A Journal of Prevention, Assessment and Rehabilitation, 41*, 4137-4141.

Hopkins, A. (2011). Risk-management and rule-compliance: Decision-making in hazardous industries. *Safety Science, 49*(2), 110-120. doi: 10.1016/j.ssci.2010.07.014.

Kankaanpaa, E. (2010). Economic incentives as a policy tool to promote safety and health at work. *Scandinavian Journal of Work, Environment and Health, 36*(4), 319-324. doi: 10.5271/sjweh.3048.

Levine, D. I., Toffel, M. W., & Johnson, M. S. (2012). Randomized government safety inspections reduce worker injuries with no detectable job loss. *Science, 336*(6083), 907-911. doi: 10.1126/science.1215191.

Liebman, A. K., Wiggins, M. F., Fraser, C., Levin, J., Sidebottom, J., & Arcury, T. A. (2013). Occupational health policy and immigrant workers in the agriculture, forestry, and fishing sector. *American Journal of Industrial Medicine, 56*(8), 975-984. doi: 10.1002/ajim.22190

Maiti, J. (2012). Design for worksystem safety using employees' perception about safety. *Work: A Journal of Prevention, Assessment and Rehabilitation, 41*, 3117-3122.

Monforton, C., & Windsor, R. (2010). An Impact Evaluation of a Federal Mine Safety Training Regulation on Injury Rates Among US Stone, Sand, and Gravel Mine Workers: An Interrupted lime-Series Analysis. *American Journal of Public Health, 100*(7), 1334-1340. doi:10.2105/AJPH.2009.178301

Schenk, L., & Antonsson, A. B. (2015). Implementation of the chemicals regulation REACH - Exploring the impact on occupational health and safety management among Swedish downstream users. *Safety Science, 80*, 233-242. doi: 10.1016/j.ssci.2015.08.001.

Shi, X. (2009). Have government regulations improved workplace safety?: A test of the asynchronous regulatory effects in China's coal industry, 1995–2006. *Journal of Safety Research, 40*(3), 207-213. doi: 10.1016/j.jsr.2009.03.005.

Sirikul, B., Bishop, P. A., & Nevett, M. E. (2011). Thermoregulatory responses to layered personal protective clothing: Practical implications for oil spill clean-up and remediation. *Journal of Public Health Management and Practice, 17*(3), 288-290. doi: 10.1097/PHH.0b013e31820070d6.

Tilbury, T., & Sanderson, L. (2012). Using MSD prevention for cultural change in mining: Queensland government/anglo coal industry partnership. *Work: A Journal of Prevention, Assessment and Rehabilitation, 41*, 4457-4459.

Vallyathan, V., Landsittel, D. P., Petsonk, E. L., Kahn, J., Parker, J. E., Osiowy, K. T., & Green, F. (2011). The influence of dust standards on the prevalence and severity of coal worker's pneumoconiosis at autopsy in the United States of America. *Archives of pathology & laboratory medicine, 135*(12), 1550-1556. doi: 10.5858/arpa.2010-0393-OA.

van der Molen, H. F., Kuijer, P. P. F., Smits, P. B., Schop, A., Moeijes, F., Spreeuwers, D., & Frings-Dresen, M. H. (2012). Annual incidence of occupational diseases in economic sectors in The Netherlands. *Occupational and Environmental Medicine, 69*(7), 519-521. doi: 10.1136/oemed-2011-100326.

Vinnikov, D., Blanc, P. D., Brimkulov, N., & Redding-Jones, R. (2013). Five-year lung function observations and associations with a smoking ban among healthy miners at high altitude (4000 m). *Journal of Occupational and Environmental Medicine, 55*(12), 1421-1425. doi: 10.1097/JOM.0b013e3182a641e7.

Weible, C. M. (2014). Introducing the scope and focus of policy process research and theory. In P. Sabatier and C. Weible (Eds.), *Theories of the policy process* (3rd ed., pp. 3-24). Philadelphia, PA: Westview Press.