Perceptions of Workplace Safety

Perspectives from miners and nonminers

By Seth Ayim Gyekye

RESEARCH ON PERCEPTION of workplace safety began in the early 1980s with Zohar's ubiquitous study, and has since received considerable attention in organizational and psychological literature. The shared perceptions about safety values, norms, beliefs, practices and principles of workers in their work environments has been termed safety climate [Cooper and Phillips; Silva, et al; Zohar(a); (b)]. These perceptions are often constructed from workers' idiosyncrasies (Cooper and Phillips; Silva, et al) and the causal features of the working environment (DeJoy, et al).

Given the critical importance of safety climate in the work environment, the extent to which safety perceptions differ among different workgroups, companies and institutions has been meticulously examined for the past 30 years. Examples of such studies include DeJoy, et al's analyses in healthcare settings, Diaz and Cabrera's analyses on airport ground handling operations and Niskanen's study in road administration. Additionally, comparative analyses between managers' and employees' perceptions (Prussia, et al), high- and low-accident organizations [Zohar(a)], individual-level and organizational-level climate perceptions (Hofmann and Stetzer; Zohar and Luria) and between blue-collar and white-collar workers (Morris, et al) have been conducted. Most of these studies revealed that workers differ in their attitudes to safety issues and in their perceptions of workplace hazards.

The importance of safety perception surveys can be gleaned from the literature [Coyle, et al; Cox and Cheyne; Flin, et al; Zohar(a)]. First, as leading indicators of safety performance, perception surveys have helped to identify precursors to accident occurrence and by so doing effectively decreased accident occurrence. Second, by providing proactive information about safety problems before they develop into accidents and injuries, safety perception analyses have provided guidance to help management develop specific safety programs. Third, compared to other proactive means of accident prevention, safety perception analyses are relatively inexpensive. Finally, they have provided information about safety management from employees' perspectives.

Recently, safety researchers have concerned themselves with the importance of safety perception as indices of organizational climate and context in safety perception analyses. A body of evidence suggests that safety perception is linked to safety performances (Copper and Phillips; Hofmann and Stetzer); compliance with safety management polices [Gyekye(c); Probst; Probst and Brubaker]; and work environment (DeJoy, et al). Several key dimensions of the work environment (e.g., exposure to physical hazards, exposure to extreme temperatures and noise, working with dangerous equipment, heavy workload and the degree of confinement) have been implicated in accident frequency and occupational injuries, and workers exposed to these elements have expressed negative perceptions regarding safety climate (DeJoy, et al; Flin, et al).

Work Environmental Factors & Safety Perceptions

One paramount factor in occupational accidents and injuries has been the characteristics of the work environment (Cheyne, et al; Holcom, et al; Sherry). Workplace studies have supported a link between workers' perceptions of the hazardous nature of their work environment and accident causality and responsibility [e.g., Gyekye(a); (b); Harrell; Sherry). While blue-collar, service and factory work have been considered the least dangerous, the mining occupation, with its long history of fatal accidents, is regarded as the most dangerous (Bell, et al; Leigh; National Safety Council), with an estimated disabling injury rate 2 to 3 times higher (Zimmerman).

The noted high incidence has been attributed to differences in the work environments. Unlike factories, mines are inherently dangerous and involve physically demanding operations. Additionally, they are confined, stressful, intimidating work environments that are constantly changing. Therefore, it

Seth Ayim Gyekye, Ph.D., *is a faculty member in the Department of Social Psychology at the University of Helsinki. He received both his M.A. and Ph.D. degrees from the University of Helsinki, Finland. Gyekye's primary research interests are in the areas of organizational behavior with particular emphasis on risk taking, industrial accidents, safety interventions and diversity management. He has had articles published in journals such as* Journal of Occupational Health and Safety, Safety Science *and* Social Behaviour and Personality: An International Journal.

seems logical to assume that the locational and environmental differences between mines and factories will affect workers' safety perceptions and their safety-related behaviors differently.

Unfortunately, prior research has not adequately addressed this relationship. Research on the impact of work environment on safety compliance is limited and conflicting. Workers' compliance has been shown to be a function of sociocultural influences, work environmental factors [Zeitlin(a)] and, hence, employees' perceptions of safety (Arboleda, et al; Hayes, et al). While theory and research on job stress suggest that safe work behaviors and safety management policies tend to be compromised under conditions of stress (Hofmann and Stetzer; Probst), resulting in accident occurrence (Probst; Probst and Brubaker). It has also been reported that workers in more hazardous and dangerous environments tend to exercise greater degree of safety vigilance, thereby reducing accident occurrence (Helmkamp and Bone).

Analyses of mining incidents have found serious safety violations on the part of miners that have either caused or exacerbated accidents [Braithwaite and Grabosky; Roylett, et al; Laurence; Zeitlin(a)]. Similarly, accident analyses from nonmining industries have equally noted a high violation of safety rules and human errors to account for accidents [Gyekye(a); (b); Gyekye and Salminen; Reason; Zeitlin(a); (b); Salminen and Tallberg].

Hypotheses

Consistent with the literature review and argumentations, three proposals were formulated.

- **Safety perception between miners and nonminers.** Despite the paucity of prior research, it is hypothesized that miners will have more negative perceptions than their counterparts from factories.
- **Compliance with safety rules.** Despite the paucity of prior research and the inconsistencies, it is hypothesized that miners will violate more safety rules than their counterparts in factories.
- **Accident involvement rate.** Consistent with previous observations, it is anticipated that mine workers will have a relatively higher accident involvement rate than their counterparts in the nonmining sectors.

The Current Study

The current study is part of a larger perception survey that focused on safety from the perspectives of Ghanaian industrial workers. It was designed to address the lack of research regarding the impact of physical conditions and organizational hazards in different work environments on safety perceptions.

Specifically, it compared safety perceptions of workers in the mining industry (underground mines: gold, bauxite and manganese) with those of their counterparts in nonmining sectors (textiles, timber and sawmill plants, breweries and food-processing plants). Workers in these two work settings were specifically chosen because they operate in starkly contrasting work environments with different levels of operational uncertainty and organizational hazards.

Additional investigations involved comparative analyses of compliance with safety management policies and accident frequency. The dearth of research in organizational safety in developing nations, particularly Africa, and the noted inconsistencies in findings in Western studies, constitute another reason for further examination.

The major instrument used was Hayes, et al's Work Safety Scale (WSS). This scale effectively captures the dimensions that safety experts have identified as having influence on employees' perceptions of workplace safety. These are management values, management and organizational practices, communication, worker involvement in safety and health, worker concern or indifference about safety, and the level of safety precautions within the company. By capturing these dimensions, WSS specifies where workers' perceptions of work safety may be poor and, therefore, present a need for improvement.

Methodology

Participants

The participants included 320 Ghanaian workers with the following characteristics: Miners (N = 102) and nonminers (N = 198). Participants from the factories were 65% male and 35% female; the miners were 100% male.

Thirteen percent of all participants had been at the workplace for less than 1 year; 22% between 1 and 4 years; 21% between 5 and 10 years; 25% between 11 and 14 years; and 19% more than 15 years. Regarding age, 22% of the workers were between 18 and 29; 25% were between 30 and 39; 43% were between 40 and 49; and 10% were 50 and older.

The questionnaire interview was presented in English. Where respondents were illiterate or semi-illiterate and had problems understanding English, a professional interpreter was used to present the information in the local dialect. To ensure accuracy of responses, particularly regarding counterproductive behaviors and noncompliant job behaviors, participants were assured of absolute confidentiality, and informed that no member of the organization's management was involved in the study.

Measures, Questionnaire Scoring & Reliability

Workers' Perceptions of Safety Climate

Workers' perceptions of safety climate were measured with the 50-item WSS (Hayes, et al). This instrument assesses employees' perceptions on work safety and measures five factorially distinct subsets: 1) job safety; 2) coworker safety; 3) supervisor safety; 4) management safety; and 5) satisfaction with the safety program. The participants responded to the scale using a 5-point response format (1 = not at all to 5 = very much). The higher a participant scored, the better his/her perception on that item.

Past research has shown this scale to have good psychometric properties (Milczarek and Najmiec). The authors reported a coefficient alpha of .91 for job safety; .91 for coworker safety; .95 for supervisor's safety; .95 for management safety practices; and .93 for satisfaction with safety program. Except for the

Abstract: *This study was part of a larger perception survey regarding safety from the perspectives of Ghanaian industrial workers. Despite the considerable interest in safety climate and the observation that workplace environmental conditions affect workers' safety perceptions, little attention has been given to the analyses of perceptions of workers in contrasting work environments. This study compared safety perceptions of mine workers with their counterparts in nonmining industries. It also compared the two groups of workers on compliance with safety management policies and accident involvement rate. The results point to the influential impact of work environment and hazard perceptions on workers' evaluations of safety. Implications for safety management are discussed.*

As leading indicators of safety performance, perception surveys have helped to identify precursors to accident occurrence.

score of .64 for coworker safety, all other responses to this scale in the current study produced satisfactory reliabilities of .90 for job safety; .97 for supervisor's safety; .94 for management safety practices; and .93 for satisfaction with safety program. The total coefficient alpha score was .97.

Compliance with Safe Work Behavior

These items were pooled from the extant literature. They consisted of four questions and assessed workers' compliance with safety management policies. Sample items were "Follow safety procedures regardless of the situation"; and "Encourage coworkers to be safe." Participants responded on a 5-point scale ranging from 1 = never to 5 = always.

Accident Involvement Rate

Participants were asked to indicate the number of times they had been involved in accidents in the past 12 months. All cases studied were accidents classified as serious by the safety inspection authorities.

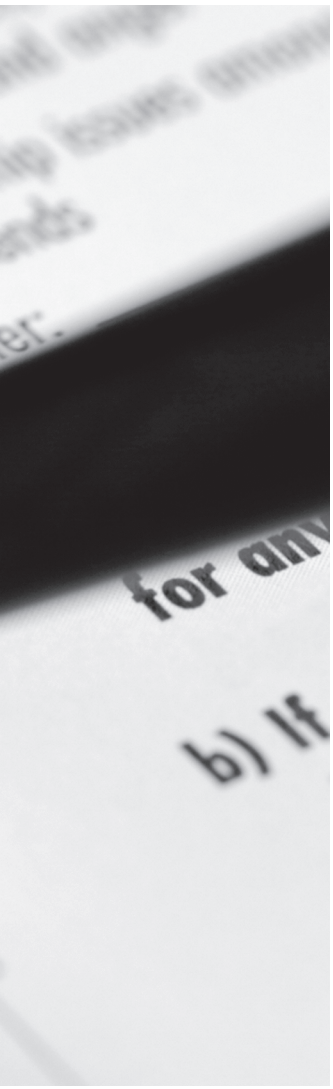
Data Analyses

Statistical analyses of the data were performed with SASv8-2001. The sum variables of the 5 subsets scales were calculated and subjected to a one-tailed *t* test analysis. Further differences between the two categories of workers were identified using item-by-item analyses on all 50 items on the WSS. Participant responses regarding compliance with safe work behavior were subjected to a similar process. Levels of significance were set at $p < .05$, $p < .10$, $p < .001$. Items that were not completed by the respondents were coded as missing values and excluded from the analyses.

Results & Analyses

The hypotheses focused on the relationships between miners and nonminers' safety perceptions, safe work behavior and accident frequency. Scores on the five subsets are presented first. This is followed by the item-by-item analyses that are displayed in tabular format in Table 1. Seven items on the work safety subscale were of statistical significance. Relative to their factory counterparts, the mine workers had negative views on safety in their workplaces ($t = 2.91$, $df = 196$, $p < .0001$). They significantly considered their job assignments to be dangerous ($t = 2.08$, $df = 199$, $p < .0001$); hazardous ($t = 1.45$, $df = 199$, $p < .0001$); risky ($t = 1.95$, $df = 198$, $p < .0001$); unhealthy ($t = 2.08$, $df = 198$, $p < .0001$); and unsafe ($t = 1.97$, $df = 198$, $p < .05$). Not surprisingly, they feared that they could get hurt ($t = 1.89$, $df = 198$, $p < .05$) and accordingly give thought to the possibility of being killed [chance of death ($t = 2.05$, $df = 198$, $p < .0001$)].

Regarding coworker safety, miners significantly observed and appreciated their coworkers' contributions toward safety ($t = 1.92$, $df = 196$, $p < .0001$). Five items indicated differences of statistical significance. More than their factory counterparts, miners remarked how their coworkers were safety-oriented



(t = 1.78, df = 198, p < .05); paid attention to safety rules (t = 1.98, df = 198, p < .05); followed safety rules (t = 1.97, df = 199, p < .05); looked out for others' safety (t = 1.62, df = 198, p < .05); and encouraged others to safety (t = 2.09, df = 198, p < .0001).

Regarding supervisors' contribution to workplace safety, miners significantly perceived their supervisors to be more active and supportive than did their counterparts in factories (t = 1.89, df = 196, p < .0001). Unlike supervisors in the factories, those in the mines discussed safety issues (t = 2.37, df = 197, p < .0001); updated safety rules (t = 3.97, df = 198, p < .05); trained workers to be safe (t = 3.58, df = 198, p < .05); enforced safety rules (t = 3.10, df = 198, p < .05); and acted on safety suggestions (t = 1.97, df = 198, p < .0001).

Differences regarding perceptions of management's commitment and attitude to safety were of statistical significance (t = 2.79, df = 196, p < .0001). More than their factory counterparts, miners perceived management to be more supportive of safety policies. From the analyses, management in the mining industry investigated safety problems (t = 1.97, df = 198, p < .0001); provided safe equipment (t = 2.24, df = 197, p < .05); provided safe working conditions (t = 1.83, df = 198, p < .05); responded quickly to safety concerns (t = 1.69, df = 198, p < .05); provided safety information (t = 3.61, df = 198, p < .0001); and kept workers informed about hazards (t = 2.58, df = 198, p < .0001).

With regard to satisfaction with safety practices, factory workers had more positive perspectives concerning the effectiveness of safety programs in their work environments (t = 2.75, df = 196, p < .0001). They endorsed the safety programs as worthwhile (t = 1.87, df = 198, p < .05); important (t = 1.58, df = 198, p < .05); help prevent accidents (t = 3.29, df = 198, p < .0001); and are effective in reducing accidents (t = 1.69, df = 198, p < .05). In the view of mine workers, however, safety programs were ineffectual; they did not work (t = 2.94, df = 189, p < .0001) and did not apply to their workplaces (t = 2.84, df = 198, p < .05).

Regarding the hypothesis about compliance with safety management policies, factory workers perceived that they were more committed to safe work practices than miners (t = 1.89, df = 197, p < .0001). With respect to accident frequency, as anticipated, miners registered a higher rate of accident involvement than their counterparts in the factories (t = 3.58, df = 197, p < .0001).

Discussion

The current study investigated safety perceptions between mine workers and their counterparts in nonmining industries. As indicated by the scores on the work safety subscale, which is a measure of the degree of safety inherent in their job assignments, the miners were rather negative regarding perceptions of safety as compared to their factory counterparts. They considered their job assignments to be dangerous, risky and hazardous.

The paramount reason that could conceivably have influenced perceptions of safety between these two categories of workers could be attributed to the contrasting work environments. While factory workers undertake their work assignments in an open environment, miners work in a closed environment that is inherently dangerous. Plausibly, the miners' evaluations were drawn from their exposure to their risky and dangerous work conditions.

With respect to coworker safety, miners were more positive than their factory counterparts concerning the extent to which they perceived their coworkers' contributions toward safety. Again, this observation could be attributed to differences in the work environments. In closed, confined mines, a high level of interdependence among workers is essential, obligatory and indispensable. Miners' safety does not depend solely on their personal expertise and skills; it also relies to a great extent on the effective coordination and efficacy of their coworkers. Emphasis on effective group work and efficient coordination, therefore, carries more importance in terms of safety than it may in factories. Thus, as Dwyer observed, for reasons that may relate to the protection of group safety, miners do not permit their coworkers to act unsafely.

Compared to the factory workers, the miners had better perspectives regarding management commitment and supervisors' contributions toward safety. Management and supervisors were relatively more committed to safety as they were more involved in safety issues and provided the much-needed managerial and supervisory support. As compared to their factory counterparts, the miners have lucrative conditions of service and are relatively well-paid.

However, a somewhat unexpected finding was recorded on the interrelationship between management attitudes, safety compliance and accident frequency. Drawing from previous studies on management

Social & Reciprocity Theories

Social and reciprocity theories essentially espouse that the expression of positive affect and concern to others creates a feeling of indebtedness and a corresponding sense of obligation to respond positively in return. Workers who perceive a high level of organizational concern and support from management have felt a sense of indebtedness and a need to reciprocate in terms that will benefit their organizations. In this direction, studies by Hofmann and Morgeson, and by Kelley and Hoffman have demonstrated that safety climate is associated positively with safety-related behaviors.

Table 1

Means & Standard Deviations on Work Safety Scale & Accident Frequency

	Miners			Nonminers			Statistical significance
	N	*M*	*SD*	*N*	*M*	*SD*	*t* test
A) Work safety[a]							
1) Dangerous	102	4.78	0.17	198	1.97	1.37	$p < .001$
2) Safe	102	3.04	1.22	198	3.66	1.38	*ns*
3) Hazardous	102	4.35	1.05	198	1.93	1.38	$p < .001$
4) Risky	100	4.74	0.57	198	1.73	1.34	$p < .001$
5) Unhealthy	102	4.78	0.75	196	1.73	1.22	$p < .001$
6) Could get hurt	101	4.79	0.65	195	2.74	1.22	$p < .05$
7) Unsafe	101	4.63	0.40	198	1.87	1.17	$p < .05$
8) Fear for health	102	3.78	1.59	196	1.93	1.24	*ns*
9) Chance of death	101	4.63	0.74	196	1.62	1.15	$p < .001$
10) Scary	102	3.70	0.69	197	1.68	1.33	*ns*
B) Coworker safety[b]							
1) Ignores safety rules	102	2.05	0.93	196	3.24	1.04	*ns*
2) Doesn't care about others' safety	102	1.82	1.06	195	2.43	0.86	*ns*
3) Pays attention to safety rules	100	3.80	0.55	196	1.65	0.78	$p < .05$
4) Follows safety rules	101	4.31	0.82	198	2.56	0.20	$p < .05$
5) Looks out for others' safety	102	4.48	0.70	197	2.46	0.31	$p < .001$
6) Encourages others to safety	102	4.87	0.80	198	2.51	0.19	$p < .05$
7) Takes chances with safety	100	2.15	1.00	198	3.24	1.18	*ns*
8) Keeps work area clean	102	2.30	0.97	198	3.72	0.82	*ns*
9) Safety-oriented	102	3.82	1.02	198	1.43	0.22	$p < .05$
10) Doesn't pay attention	100	2.43	0.56	198	2.51	1.18	*ns*
C) Supervisor safety[c]							
1) Praises safe work behavior	101	3.61	0.64	198	2.27	0.95	*ns*
2) Encourages safe behaviors	102	3.87	0.67	198	2.79	1.00	*ns*
3) Keeps workers informed on safety rules	102	3.89	1.08	198	2.53	0.10	*ns*
4) Rewards safe behaviors	103	2.61	0.59	198	1.82	1.07	*ns*
5) Involves workers in setting safety goals	103	2.76	1.28	198	2.81	0.87	*ns*
6) Discusses safety issues with others	103	4.19	0.69	198	2.91	1.09	$p < .05$
7) Updates safety rules	103	4.03	0.79	198	2.39	0.12	$p < .05$
8) Trains workers to be safe	103	4.71	0.86	198	2.03	1.05	$p < .001$
9) Enforces safety rules	103	4.17	1.06	198	2.42	0.21	$p < .001$
10) Acts on safety suggestions	103	4.23	1.01	198	2.37	1.12	$p < .001$
D) Management safety practices[d]							
1) Provides enough safety program	103	3.28	0.97	198	3.02	0.88	*ns*
2) Conducts frequent safety inspections	103	3.88	1.08	198	2.03	1.03	*ns*
3) Investigates safety problems	103	4.06	1.09	198	1.72	0.98	$p < .001$
4) Rewards safe workers	103	2.23	0.11	198	2.68	0.47	*ns*
5) Provides safe equipment	103	4.63	0.23	198	2.68	0.87	$p < .05$
6) Provides safe working conditions	103	3.89	0.98	198	2.07	1.02	$p < .05$
7) Responds to safety concerns	102	4.43	1.01	198	2.37	1.04	$p < .05$
8) Helps maintain clean area	103	2.45	0.82	198	2.47	0.98	*ns*
9) Provides safety information	103	4.23	0.98	198	1.73	1.01	$p < .001$
10) Keeps workers informed of hazards	103	4.57	0.16	198	2.01	1.04	$p < .001$
E) Safety programs (policies)[e]							
1) Worthwhile	103	1.45	0.98	198	3.45	1.03	$p < .05$
2) Helps prevent accidents	103	1.37	0.32	198	3.05	1.06	$p < .05$
3) Useful	102	2.53	0.80	198	3.03	1.12	*ns*
4) Good	103	2.31	0.77	198	3.74	1.06	*ns*
5) First-rate	103	2.87	1.34	198	2.98	1.33	*ns*
6) Unclear	102	2.08	0.97	198	2.51	0.32	*ns*
7) Important	103	2.56	0.10	198	4.76	1.11	$p < .05$
8) Effective in reducing injuries	103	2.21	0.38	198	4.37	1.03	$p < .05$
9) Does not apply to my workplace	103	3.01	1.26	198	1.82	0.05	$p < .001$
10) Does not work	103	4.37	0.87	198	1.79	1.01	$p < .001$

Note. [a]$t = 2.91$, df = 196, $p < .0001$. [b]$t = 1.92$, df = 196, $p < .0001$. [c]$t = 1.89$, df = 196, $p < .0001$. [d]$t = 2.79$, df = 196, $p < .0001$. [e]$t = 2.75$, df = 196, $p < .0001$.

commitment as key aspects of safety climate in promoting safety performance (DeJoy, et al; Flin, et al; Michael, et al; O'Toole), and the Social Exchange and Reciprocity theories (Blau; Gouldner), miners' positive perceptions regarding management commitment to safety should have elicited compliance with safe work practices and subsequently resulted in reduced accident rates.

Again, the recorded paradoxical interrelationship can be attributed to the differences in the two work environments. Mining tasks are undertaken in confined, stressful, ever-changing work environments that are inherently risky with an uncertain degree of safety. Consequently, miners work under great stress, which negatively affects their compliance with safe work behaviors and, subsequently, their accident and injury rate. According to Hofmann and Stetzer, safe work behaviors and safety management policies are easily compromised under such stressful conditions, thus causing miners to repeatedly violate safety rules and regulations in order to get their jobs done (Braithwaite and Grabosky; Laurence; Department of Mineral Resources; Hill and Stanek; Roylett, et al).

Interesting observations were made regarding perceptions on the satisfaction with safety practices subscale, which evaluated respondents' perceptions on the efficacy of the safety programs in place. While the factory workers noted and stressed the efficiency and effectiveness of safety practices in reducing accidents, the miners were rather fatalistic as they displayed a lack of control over being safe. For them, the safety regulations were ineffectual and worthless. Ostensibly, the long history of mine accidents, the unpredictable and intimidating conditions in the mines, and the feeling of being at the mercy of Mother Nature might have evoked a sense of helplessness and powerlessness, leading them to acquiescence, passivity and resignation.

This observation has been well noted and documented by the Department of Mineral Resources in Australia. According to its report, more than 90% of miners express misgivings about safety rules and regulations because the large majority of mine workers operate dangerous machinery every day in underground mines with a basic disposition that safety rules are irrelevant, superfluous, nonessential or excessive. This attitude apparently reflects personal skepticism about the importance of safety in the mining industry, and certainly discourages compliance with safety policies. The current observation gives further credence to earlier suggestions that employees' perceptions of safety influence their compliance with safety-related practices (Arboleda, et al; Bailey; Hayes, et al).

Regarding accident involvement, compared to their factory counterparts, the miners registered a higher rate. This observation is consistent with previous findings (Bell, et al; Leigh; National Safety Council). Taken together, these results, at a highly significant level of $p < .001$, lend credence to the influence of workplace environmental conditions as dominant factors in workers' perceptions of safety

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A high level of interdependence among workers is essential, obligatory and indispensable in mines. Miners rely to a great extent on the effective coordination and efficacy of their coworkers to stay safe.

and, thus, corroborate previous research (Cheyne, et al; DeJoy, et al; Flin, et al; Mueller, et al).

Implications for Safety Management Policies

A significant practical implication of the current study to workplace safety personnel, particularly those in the mining industry, is that strategies for enhancing safety compliance through attitude change should be taken to modify unconstructive beliefs about sense of helplessness, and reduce any cynicism over safety. Interventions aimed at promoting a sense of personal efficacy and sense of control could, therefore, be included in safety interventions for miners.

Conclusion

The research is limited by its dependence on cross-sectional and self-reported instruments. Therefore, it is possibile that the findings are distorted by participants' desire to respond in a consistent manner. However, recent meta-analytic research by Crampton and Wagner indictes that while this problem continues to be cited commonly, the magnitude of distortions may be overestimated. Self-reported measures have been used regularly and successfully in accident and safety analyses [Gyekye (a); (b); Neal, et al; Siu, et al]. Besides, while epidemiologic reports have been found to be faulty, biased and deficient because of poor documentation (Parker, et al; Veazie, et al), research reports have found self-reported accident rates to be closely related to documented accident rates (Smith, et al).

Notwithstanding these limitations, the current study reveals the influence that the work environment and hazard perceptions have on workers' evaluations of workplace safety. As this study is among the initial steps in attempts to explore safety peceptions between occupations, additional investigations in this direction are in order. ■

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