8-31-2023

Mining safely: Examining the moderating role of safety climate on mineworkers' mental health and safety behavior nexus

Emmanuel K. Amoako

Saviour A. Nubuor

Abdul-Razak Suleman
Edith Cowan University

Amin A. Bawa

Bridget Akwetey-Siaw

10.1108/K-06-2023-1067

This is the Authors Accepted Manuscript version of an article published by Emerald in *Kybernetes*. The published version is available at https://doi.org/10.1108/K-06-2023-1067

Amoako, E. K., Nubuor, S. A., Suleman, A. R., Bawa, A. A., & Akwetey-Siaw, B. (2023). Mining safely: Examining the moderating role of safety climate on mineworkers' mental health and safety behavior nexus. *Kybernetes*. Advance online publication. https://doi.org/10.1108/K-06-2023-1067

emerald PUBLISHING

Kybe

Mining Safely: Examining the Moderating Role of Safety Climate on Mineworkers' Mental Health and Safety Behavior Nexus

Journal:	*Kybernetes*
Manuscript ID	K-06-2023-1067.R2
Manuscript Type:	Research Paper
Keywords:	Human Resource Management, Healthcare Management, Behaviour

Mining Safely: Examining the Moderating Role of Safety Climate on Mineworkers' Mental Health and Safety Behavior Nexus

Abstract

Purpose – The study investigates the impact of anxiety and depression (dimensions of mental health) on mineworkers' safety behaviors (safety compliance and safety participation) while examining the moderating role of safety climate on these relationships.

Design/methodology/approach - A quantitative research approach with an explanatory cross-sectional survey research design was adopted. A total of two-hundred and seventy-four (274) purposively selected mineworkers participated in the study. Responses were obtained from participants through a structured questionnaire which was analyzed using the partial least square structural equation modelling.

Findings - Anxiety had a significant negative effect on safety compliance but not participation. However, depression was found to have a significant negative effect on both mineworkers' safety compliance and participation behaviors. The findings of the study also show that safety climate moderates the relationships between the dimensions of mental health and mineworkers' safety behavior except for the relationship between anxiety and mineworkers' safety participation behavior.

Originality/value – The study offers an account of the negative effect of mental health on mineworkers' safety behavior whiles highlighting that safety climate is an important construct to mitigate the negative effects of mental illness on the safety behaviors of mineworkers'.

Keywords: Safety Climate, Mental Health, Employee Safety Behavior, Mineworkers', Gold Mining.

Paper type Research Paper.

Introduction

Occupational injuries, work-related diseases and fatalities are disastrous incidents that disrupt the operational activities of organizations (Shafique and Rani, 2020). Whilst efforts are being made to eradicate or minimize the occurrences of these incidents, the last decade has witnessed an increasing trend in work-related diseases and occupational injuries (International Labour Organization (ILO), 2017). The ILO provides that work-related diseases and occupational injuries have increased from 270 million in 2013 to an estimated 330 million in 2016 (ILO, 2017). They also argued that internationally, more than 2.3 million men and women die from an occupational accident or illness every year. Fatal accidents are responsible for over 350,000 deaths and almost 2 million deaths are attributed to work-related diseases. Additionally, absence from work, loss of productive work hours and serious injuries attributable to non-fatal occupational accidents are estimated to be more than 313 million employees. Further, the ILO provides that annually, the total number of work-related diseases reported cases is 160 million. These figures suggest that the approximate number of people who die from workplace injuries or illnesses every day is 6,400 and that 860,000 people worldwide are injured at work daily.

In Africa, the ILO estimates 1 million deaths are associated with workplace injuries and work-related diseases which are recorded predominantly from the construction industry (ILO, 2017). In Ghana, available statistics from the Ghana Chamber of Mines reveals that first aid injuries in 2019 was 197 whiles the number of serious injuries stood at 28 even though there were 3 recorded cases of fatal injuries (as against 7 recorded in 2018) and the incidence of near-miss cases fell from 407 in 2018 to 326 in 2019 (Ghana Chamber of Mines, 2020). Similarly, the Ghanaian construction industry recorded 558 cases of industrial sector accidents in 2019 (Simpson and Sam, 2020) an indication that occupational accidents are predominant in the various industries of the Ghanaian economy. The increasing number of reported cases of occupational injuries and accidents is a source of worry to many organizations as its ergonomic implications are excruciating (Agyekum *et al.,* 2020; Cheng *et al.,* 2020; Quartey, 2017).

Employees' safety behaviors are important actions to reduce occupational accidents and injuries at the workplace (Amponsah-Tawiah *et al.,* 2020). Safety compliance and safety participation are critical safety behaviors essential in achieving superior safety performance and reduced workplace injuries and accidents. Mental health and safety climate are important constructs in creating and maintaining safety behaviors at the workplace (Lingard *et al.,* 2019; Singh and Misra, 2020).

The mining industry values the health and safety of its employees (Amponsah-Tawiah and Mensah, 2016) and continues to invest hugely in the health and safety of its operations. For example, organizations in the Ghanaian mining industry continue to procure the best safety types of equipment for their employees to work with and spend huge sums of money to train their employees to safely man these pieces of equipment (Ghana Chamber of Mines, 2020). Employees after going through such training are expected to comply with safety rules in manning these types of equipment.

Organizations in the mining industry posit that if they cannot mine safely, then they will not mine at all and this indicates their willingness to invest heavily in the safety of their work (Amponsah-Tawiah *et al.,* 2013). After these investments in safety, one would expect that accidents and workplace injuries would reduce but the industry continues to record cases of accidents and workplace injuries. Despite the safety processes and procedures being developed and implemented, available statistics demonstrate that the goal of zero accidents is yet to be achieved, suggesting a gap in the way safety is viewed and managed (Yaris *et al.,*2020).

In every twelve months period, 20 percent of the world's population would experience anxiety and depression disorders (Considine *et al.,* 2017). Sankoh *et al.* (2018) further posit that an estimated 18.5 million years are lost to disability due to mental health problems in Africa as 2 million Ghanaians screen for anxiety and depression symptoms in twelve months (Amponsah-

Tawiah *et al.,* 2023; Kyei *et al.,* 2020). Against this background, it was imperative therefore to examine the mental health of employees in the mining industry and how it affects their willingness to comply with safety regulations and participate in safety activities as most of these investments in health and safety in the mines are targeted to improve upon the physical safety of the employees to the neglect of their mental health (Street *et al.,* 2019).

The economic development of Ghana and the performance of the Ghanaian economy cannot be discussed without the greater contribution of the mining industry. The mining industry excluding the oil and gas sector accounted for a 12.6 percent contribution to Gross Domestic Product (GDP) in 2019 according to data from the Ghana Chamber of Mines. Specifically, the mining industry generated direct domestic revenue of GH¢ 4.02 billion and US$ 6.678 billion from the export of minerals in 2019 for the Government of Ghana whiles offering 11, 899 direct jobs to Ghanaians (Ghana Chamber of Mines, 2020).

These notwithstanding, the mining industry compared with other industries provides some unique issues – physical hazards, high job demands, remote work locations with limited access to support services, breakdown of family ties, type of mine, rostering, high strain and active jobs, shift length (Aram, 2021), commute type, repetitive jobs exposure to high risk to injury and male-dominated (Douine *et al.,* 2018; Salas *et al.,* 2015) that may impact the mental health (anxiety and depression levels) of employees in the industry (Asare-Doku *et al.,* 2020).

Other researchers postulate that employees in the mining industry tend to experience higher forms of anxiety and depression than other employees from different industries (Bowers *et al.,* 2018; Mclean, 2012). Consequently, these unique issues which are ever present in the Ghanaian mining industry afford us the opportunity to access the prevalence and effect of mental health on the safety behaviors of mineworkers'.

The positive effect of safety climate on accidental and behavioural consequences is well documented in the safety literature (Xia, et al., 2023). Smith *et al.* (2019) for example found organizational-level safety climate and workgroup safety climate to have predicted safety compliance and safety participation behaviours positively. This is consistent with the findings of earlier studies which found a positive effect of safety climate on safety behaviours (Schwatka and Rosecrance, 2016; Smith and Dejoy, 2014). Against this background, the current study envisages exploring whether safety climate can mitigate the negative impact of mental health on mineworkers' safety behaviours. This is crucial because, safety climate pertains to the shared perceptions and attitudes of individuals within an organization regarding safety practices, policies, and their significance (Aram, 2021). As such, we argue that when safety climate is strong, employees perceive safety as a shared or collective priority. In this context, a positive safety climate can enhance mineworkers' awareness of the importance of safety behaviors and will prioritize safety actions despite their mental health challenges. This can lead to a more conscious effort to adhere to safety compliance and participate actively in safety initiatives, irrespective of their anxiety and depression levels. Again, an organization with a favorable safety climate is likely to provide support mechanisms and resources that address employees' well-being, including mental health (Asare-Doku *et al.,* 2020). According to Smith *et al.* (2019, a robust safety climate fosters an environment where employees feel valued and supported, reducing the stigma associated with mental health struggles. As a result, mineworkers experiencing anxiety and depression are more likely to seek help and engage in safety behaviors in an organization with a good safety climate. Thus, a positive safety climate creates an atmosphere of trust and openness, which can mitigate the impact of mental health challenges on safety compliance and participation.

Even though some of the study variables have received appreciable attention from researchers in Ghana, such studies were conducted in the construction industry (Agyekum *et al.,* 2020; Simpson and Sam, 2020), manufacturing industry (Amponsah-Tawiah *et al.,* 2020; Quartey, 2017) and the power distribution industry (Addo and Dartey-Baah, 2019; Dartey-Baah and

Addo, 2018; Dartey-Baah *et al.,* 2020) with little research on the variables in the Ghanaian mining industry. Further, less is known about the moderating role of safety climate on the relationship between the dimensions of mental health and safety compliance and safety participation. The purpose of the current study is therefore to first examine the impact of anxiety on safety compliance and safety participation. The second objective is to access the impact of depression on safety compliance and participation and finally to examine the moderating role of safety climate on these relationships. The rest of the paper is structured as follows; theoretical background and hypotheses development, methods, results, discussion, implications, limitations, direction for future research and conclusion.

Theoretical background and hypotheses development

Mental Health

Mental health is defined as a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community (WHO, 2018). Compared with individuals with mental health problems, employees who are found to be mentally healthier are found to be productive (Milner *et al.,* 2018), can concentrate at work (Cieri and Lazarova, 2020) and are more likely to engage in safety citizenship behaviors (Street *et al.,* 2019). On the other hand, poor mental health is associated with lost productivity (Lu *et al.,* 2020), workplace injuries (Amponsah-Tawiah *et al.,* 2013), employee turnover (Haslam, *et al.,* 2005) and mental illness-related presenteeism and absenteeism (Tynan *et al.,* 2018).

Given the social and economic benefits of getting employed in the mines, individuals employed in the mining industry tend to have better mental health (Tynan *et al.,* 2018). However, Bowers *et al* (2018) postulate that employees in the mining industry tend to experience higher forms of anxiety and depression than other employees from different industries. Similarly, Considine *et al* (2017) avert that the prevalence rates for anxiety and depression in Australian mineworkers' are relatively higher than other forms of mental illness. More so, anxiety and depression symptoms are predominant in mineworkers' particularly male workers compared with their female colleagues (Sayers *et al.,* 2019). In addition, though mental health problems such as job stress, burnout, job insecurity and psychological distress feature mainly in mental health research (Tynan *et al.,* 2016), depression and anxiety are found to be more predominant in the mine population (Hulls *et al.,* 2020; Ohrnberger *et al.,* 2017).

The current study defined anxiety as an aversive state which emanates from the feelings of being unable to predict, control or obtain desired outcomes whereas depression is classified as a mood disorder that involves the consistent feeling of sadness and hopelessness in line with McHorney and Ware (1995) conceptualisation. Depression and anxiety are two of the most common mental health diseases in the world, with each having a 30 percent lifetime prevalence (Olaoluwa, 2021).

Depression and anxiety disorders are extremely common in primary care settings. Half of the persons with one condition are thought to have signs of the other (Weaver *et al.,* 2018). Many risk factors are shared by depression and anxiety, including cognitive biases, environmental exposures, and genetic impacts (Olaoluwa, 2021). In line with the above evidence from the literature, the current study conceptualized anxiety and depression to be the main dimensions of mineworkers' mental health.

Safety Behavior

Safety behavior is a major concern to most organizations in the world and Ghana in particular due to its ability to influence several organizational outcomes such as achieving superior safety performance and the reduction of accidents and workplace injuries (Amponsah-Tawiah and Mensah, 2016). Employee safety behaviors are conceptualized to be an integral feature of

safety performance such that as employees exhibit safety behaviors, then they are undertaking safety and work performance (Cheng *et al.,* 2020). Evidence from the literature suggests a consensus on the dimensions of employee safety behaviors.

The categorization of safety behaviors was drawn on the model of work performance propounded by Borman and Motowidlo (1993). Based on this model, Griffin and Neal (2000) assert that the main constituents of employees' safety behaviors were safety participation and safety compliance. Since its classification, safety behaviors have been studied as safety compliance and safety participation (Addo and Dartey-Baah, 2019; Cheng *et al.,* 2020; Dartey-Baah *et al.,* 2020; Kvalheim and Dahl, 2016; Xue *et al.,* 2020).

Broadly, safety compliance refers to the core safety activities that are performed by individuals in the organization in order to create and maintain safety at the workplace whiles safety participation is explained as those voluntary behaviors that help to create and maintain an organizational atmosphere that supports safety (Griffin and Neal, 2000).

Safety Climate

Zohar (2000) asserts that safety climate is the perception that the workforce of an organization has regarding the level of safety. Similarly, safety climate is conceptualized as individual assessments of an organization's policies, procedures and practices enacted to ensure that workers perform their functions in a safe work environment and further explained as the employees' discernment of their organization's value for safety (Goldenhar *et al.,* 2019) which is articulated through organizational safety policies, adherence to safety practices and safety procedures (Sinclair, et al., 2010).

Safety climate describes an employee's perception of the value his or her organization places on safety and how its values safety issues (Griffin and Neal, 2000). The safety climate literature has largely focused on the association between safety climate and safety behaviors– safety compliance and safety participation as well as the prevention of accidents and injuries. Studies have shown that a good safety climate is positively related to employees' safety behaviors but adversely related to injuries and accidents (Saedi *et al.,* 2020; Sinclair *et al.,* 2010).

Relationship between anxiety, safety compliance and safety participation

Premise on the fact that workplace relationships generate numerous lasting exchanges between the organization and their employees and among employees themselves (Tsai and Kang, 2019), the social exchange theory Blau (1964), is applied in examining these exchanges that may be economic or uneconomic in nature. In line with the norm of reciprocity (Cropanzano et al., 2017; Kyei-Frimpong *et al.,* 2023) of the social exchange theory, the current study argues when organizational systems, policies and practices are geared towards the improvement of mineworkers' mental health in an attempt to eradicate the hazards and factors that cause mineworkers' to be anxious (Dodoo et al., 2021), then mineworkers in return will comply with safety rules and participate in safety activities.

For example when mining organizations develop and implement mental health support programs like assistance in times of bereavement, marital problems and mass casualties, mineworkers' will feel that their organizations are ready to assist them when any mental health issue emerges which makes them feel loved and thereby engaging in safety behaviors. Conversely, when such programs are absent, mineworkers may feel that their organizations do not have them at heart and do not care about their well-being and hence withdraw from engaging in any extra-role safety behaviors. Accordingly, we theorized that;

H_{1a} Anxiety will have a negative effect on mineworkers' safety compliance.
H_{1b} Anxiety will have a negative effect on mineworkers' safety participation.

Relationship between depression, safety compliance and safety participation

Although the relationship between depression, safety compliance and safety participation has been rarely examined in the literature, we sought support from the theory of planned behavior (Ajzen, 1991) in our hypotheses formulation. The theory posits that the performance of an action is influenced by the intention to do so which is largely affected by attitude towards the behaviour, the subjective norm and perceived behavioural control (Sussman and Gifford, 2019). Arguing from the theory of planned behavior, the current study postulates that when mining organizations fail to minimize the depression of mineworkers, their attitude and perceived control will be greatly affected. This reduces their intention to engage in extra-role safety behaviours which subsequently affect their compliance with safety rules and their participation in safety activities. For instance, Considine *et al.* (2017) advanced that, in the context of safety compliance, individuals experiencing depression may exhibit reduced concentration, increased fatigue, and a lack of interest in tasks. This could lead to lapses in following safety protocols, neglecting safety procedures, or making errors due to diminished cognitive focus. Thus, the lack of mental energy and motivation may hinder their willingness to adhere to safety guidelines, increasing the likelihood of non-compliance. Likewise, Olaoluwa (2021) argues that depression often leads to emotional distress, including feelings of hopelessness, sadness, and disinterest. In terms of safety participation, these emotions can affect an individual's willingness to engage proactively in safety initiatives. Thus, depressed individuals might lack the emotional resources required for active involvement in safety-related activities. Therefore, they may feel disconnected from their work environment and be less motivated to take part in safety meetings, training sessions, or reporting potential hazards. Consequently, the study hypothesized that;

H_{2a} Depression have a negative effect on mineworkers' safety compliance
H_{2b} Depression have a negative effect on mineworkers' safety participation

The moderating role of safety climate

The health belief model (Strecher et al., 1997) averts that a protection behavior is predicted by perception variables which include beliefs relating to a perceived threat, outcome expectation and self-efficacy. The application of the health belief model can enhance our understanding of the factors that can moderate the negative effect of anxiety and depression on safety compliance and participation.

The facets of the model are mental events (Yuen et al., 2020) which could be greatly affected by the anxiety and depression levels of mineworkers (Solomou & Constantinidou, 2020). Consequently, we argue that though mineworkers can be depressed and anxious within the context of mining organizations, a good safety climate can facilitate a positive self-efficacy which will in tend encourage mineworkers to comply with safety rules and participate in safety activities.

Similarly, the subjective norm facet of the theory of planned behavior could be enhanced through a strong safety climate by mining firms in an attempt to induce safety intentions of mineworkers which eventually leads to their safety compliance and participation. Safety climate had been found in the Ghanaian context to have a positive effect on construction professionals' occupational safety behaviours (Novieto, 2021). In a literature review, (Xia, et al., 2023) asserted that the impact of safety climate on behavioural and accident consequences is well documented in the literature. Hence, we argue that a positive safety climate creates a conducive environment that empowers mineworkers to overcome the challenges posed by anxiety and depression, enabling them to prioritize safety compliance and participation in line

with the organization's safety goals. Subsequently and in line with the theory of planned behaviour and the health belief model, the following hypotheses are theorized.

H_{3a} Safety climate moderates anxiety, safety compliance and safety participation nexus.
H_{3b} Safety climate moderates depression, safety compliance and safety participation nexus.

Conceptual framework
The conceptual framework of the study is shown in Figure 1 below based on the hypothesized relationship.

(Insert Figure 1 Here)

Methods

In line with the positivist quantitative research approach, an explanatory cross-sectional survey research design was adopted to solicit respondents' opinions about the study variables. The explanatory research design was appropriate for the current study because the research set out to understand the study variables by establishing the causal relationship (Saunders *et al.,* 2011; Adu *et al.,* 2020) that exists between anxiety and safety compliance and participation as well as the nexus between depression and safety compliance and safety participation.

Research Participants
Mineworkers from four large gold mining companies in Ghana who were directly involved in mining activities such as heavy industrial equipment operators, crusher operators, truck drivers and safety managers participated in the study. A stratified sampling technique was used to select the four mining companies. Arguing the fact that the selected companies had different safety policies and frameworks that differentiated them, each company was treated as a separate stratum within which a sample was drawn for the study using the purposive sampling technique. The study's total population comprised of 320 mineworkers who were directly involved in mining from which 274 participants were selected as the sample based on Miller and Brewer's (2003) sample size determination formula.

Measurement Instruments
Anxiety and depression scales were adapted from McHorney and Ware's (1995) general mental health scale. Mineworkers' safety behaviors (safety compliance and safety participation) were assessed using Griffin and Neal's (2000) safety behaviors scale. The safety climate that existed in the various companies was assessed using Zohar's (2000) safety climate scale. The measurement instruments are summarized in Table 1.

(Insert Table 1 Here)

Analysis of Data
The data were analyzed with Statistical Package for Social Sciences (SPSS v.23) and Partial Least Squares (SmartPLS v.4). Descriptive statistics such as frequencies and percentages were used to describe the demographic characteristics of the respondents using SPSS. The Partial Least Squares Structural Equation Modelling (PLS-SEM) was used to test the direct relationships between anxiety and depression and safety behaviors as well as the moderating role of safety climate on the anxiety-safety behaviors and depression-compliance and safety participation relationship.

Ethical Consideration

The researchers explained the rationale and objectives of the study and sought their consent before administering the survey to the respondents. Also, they were made known that participation in the study was voluntary and hence no respondent was forced to participate in the study. To ensure anonymity, the questionnaire was designed such that respondents were not asked to divulge information that will appear to reveal their identity. Participants were further assured that the data collected were meant for research purposes and that no other individual will have access to the research data. To this end, the researchers went to the mine site to collect the completed questionnaires personally and have hence been kept under lock.

Results

Demographic Characteristics of the Respondents

Characterized by a youthful population and early-career employees in their developing stages, the mining industry could be considered as a male-dominated industry in Ghana with the majority of the respondents having received some form of formal education and thus were able to read, understand and respond to the survey appropriately. The demographic characteristics of the participants of the study are summarized in Table 2.

(Insert Table 2 Here)

Reliability and Validity of Measurement Instruments

The Cronbach Alpha, Composite Reliability and Average Variance Extracted (AVE) as shown in Figure 2 were computed (Table 3) to assess the reliability and validity of the scale items. This was to ensure that the scales adopted for the study would yield consistent results on recurrent trials. Conventionally, the Cronbach alpha values – which should be 0.7 or more have been used to determine the reliability of measurement scales (DeVellis, 2003; Suleman *et al.,* 2022).

(Insert Figure 2 Here)

The results showed that the scales used were reliable as the composite reliability values for all the variables exceeded the recommended minimum value of 0.7 with the highest being 0.949 (depression). More so, the data was free from discriminant validity problems as the average variance extracted values were 0.5 or more with the highest being 0.824 for depression.

(Insert Table 3 Here)

The Fornell-Larcker procedure for examining discriminant validity was employed (results presented in Table 4) to assess whether the research variables were exhibiting discriminant validity or otherwise. In their view, Fornell and Larcker (1981) suggested that for a scale to have discriminant validity, the square root of its average variance extracted of the latent variable is greater than the squared correlation coefficient between the latent variables. The results of the Fornell-Larcker criterion for discriminant validity are presented in Table 4 below which indicated that the scales were discriminately valid.

(Insert Table 4 Here)

Correlation among Anxiety, Depression, Safety Climate and Safety Behaviors

The results of the correlation analysis (Table 5) show that anxiety had a low negative association with safety compliance ($r = -.168$, $p < 0.01$) which indicates that an increase in mineworkers' anxiety will result in a reduction in safety compliance. Similarly, anxiety had a low negative relationship with safety participation ($r = -.171$, $p < 0.01$), indicative of the fact that a reduction in the depression levels of mineworkers will motivate them to participate in safety activities.

Also, depression had a moderate negative relationship with safety compliance ($r = -.225$, $p < 0.01$) and safety participation ($r = -.318$ $p < 0.001$) which indicates that an increase in the depression level of mineworkers will lead to a reduction in their safety behaviors. More so, safety climate had a significant positive relationship with mineworkers' safety behaviors ($r = .127$ $p < 0.05$; $r = .143$ $p < 0.05$).

(Insert Table 5 Here)

Results of Regression Analysis

The structural equation model output The impact of mineworkers' anxiety and depression levels was examined (summarized in Table 6) on mineworkers' safety compliance and participation behaviors. Anxiety had a significant negative effect on the mineworker's safety compliance ($\beta = -0.140$, t-statistics = 1.659, $p < 0.10$) indicating support for H_{1a}. Safety participation behavior was negatively predicted by anxiety, the result was however not statistically significant ($\beta = -0.064$, t-statistics = 1.596, $p > 0.10$) which means that H_{1b} was not supported. Depression had a significant negative effect on mineworkers' safety compliance behaviors ($\beta = -0.106$, t-statistics = 3.906, $p < 0.000$). This meant that depressed mineworkers' are less likely to engage in safety compliance behaviors and hence H_{2a} was supported. Depression had a significant negative effect on mineworkers' safety participation behaviors with the original sample ($\beta = -0.129$), statistics ($t = 4.796$) and significant level ($p < 0.000$) indicating support for H_{2b}.

(Insert Table 6 Here)

Moderating Role of Safety Climate

Safety climate was examined to determine whether it mitigates or enhances the negative impact of anxiety and depression on mineworkers' safety compliance and participation behaviors. The results of the moderation analysis are summarized in Table 7.

(Insert Table 7 Here)

Safety climate had a significant effect on the relationship between anxiety and safety compliance ($\beta = 0.148$, t-statistics = 1.899, $p < 0.10$). A poor safety climate worsens the negative effect of anxiety and mineworkers' safety compliance behaviors. The result of the interaction effect as shown in Figure 3 further indicates that when mineworkers are anxious but perceive that their organization is concerned about their safety, then they will be motivated to comply with safety rules and regulations. This indicates that one of the two hypotheses (H_{3a}) was supported.

(Insert Figure 3 Here)

Also, results showed that safety climate had no significant effect on the relationship between anxiety and safety participation (β = 0.051, t-statistics = 1.922, p > 0.10). The results revealed that safety climate had a significant effect on the relationship between safety compliance and mineworkers' anxiety levels (β = 0.586, t-statistics = 4.937, p < 0.000). A good safety climate as shown in Figure 4 mitigates the adverse effect of depression on safety compliance behaviors.

(Insert Figure 4 Here)

Safety climate had a significant effect on the relationship between depression and mineworkers' safety participation behaviors (β = 0.416, t-statistics = 3.840, p < 0.000). The interaction effect (Figure 5) shows that the negative impact of depression on mineworkers' safety participation behaviors is mitigated by a good safety climate indicating acceptance for H_{3b}.

(Insert Figure 5 Here)

Discussion

The first objective of the study was to examine the impact of anxiety on safety compliance and safety participation behaviors. The results of the study indicated that anxiety has a significant negative impact on mineworkers' safety compliance behaviors. This means when mineworkers continue to be anxious, restless and nervous, they tend not to comply with safety rules, regulations and procedures. The significant negative impact of anxiety on safety compliance among mineworkers' is consistent with the findings of previous studies (Cheng and Mccarthy, 2018; Nauman, *et al.,* 2019) which established that compliance with safety rules and regulations declined in anxious employees but predominant among less anxious workers. The negative impact of anxiety on safety compliance behaviors may be attributed largely to the age of mineworkers. The study found that the majority of the respondents (159 which constitute 58%) were in the age range of 21 – 30 years and given the youthful nature of the population, there is a greater tendency to ignore safety rules mainly due to youthful exuberance, curiosity in finding new ways to doing things, peer influences and lack of proper understanding of safety rules and how these rules help to prevent workplace accidents and incidents (Mccarthy *et al.,* 2015; Mcphee *et al.,* 2019).

Though the study found a negative impact of anxiety on safety participation behaviors, the effect was insignificant. This means being anxious, impatient, tense and nervous may not necessarily lead to non-participation in safety activities and initiatives. Being nervous for example about how to operate a new machine at the workplace may even motivate the employees to participate in safety training as a means to learn how to operate the said machine. However, workers can withdraw from safety activities such as attendance to safety meetings and briefings, discussion of safety issues with supervisors and performing a voluntary task to help improve workplace safety when they feel restless, impatient and anxious. The negative impact of anxiety on safety participation behaviors provides evidence to support other research findings (Ng *et al.,* 2019; Zhang *et al.,* 2018) which have established that anxiety promotes unethical behaviors, deviant or unsafe behaviors and counterproductive work behaviors.

The norm of reciprocity propounded by the social exchange theorists (Blau, 1964; Cropanzano and Mitchell, 2005) argues that social exchange in the organization should involve the reciprocity of good gestures for good gestures and when one party receives bad treatment, the party is expected to reciprocate in the like manner. In line with this assertion, when organizational processes, systems and procedure seeks to reduce anxiousness among the mineworkers, mineworkers' are expected to reciprocate by engaging in safety compliance and safety participation behaviors. Similarly, when organizational systems, procedures and processes ignore the mental health and safety needs of the workers, mineworkers' are expected to reciprocate this treatment by withdrawing from safety activities and initiatives and non-compliance with safety rules and regulations.

In line with the second objective of the study, the study found that depression had a significant negative effect on mineworkers' compliance behaviors. This means that when mineworkers are depressed, downhearted, and moody and have very low spirits towards work, compliance with safety rules and regulations is likely to decline. The negative impact of depression on safety compliance behaviors is consistent with findings in previous studies (Beseler *et al.,* 2013; Woo Kim, *et al.,* 2011) which found that compliance with safety regulations and the procedure is enhanced when employee depression is improved. The study further found that withdrawal from the attendance of safety meetings, the unwillingness of workers to discuss safety problems with their supervisors and reduced commitment to engage in voluntary tasks to help improve workplace safety were rampant when workers self-reported that they were depressed which provides support for evidence documented in the literature (Alroomi and Mohamed, 2021; Weaver *et al.,* 2018).

The significant negative effect of depression on safety behaviors can be attributed to some demographic factors – age, years in the organization and the gender of workers. As indicated earlier, the study's respondents were characterized by the youthful population. This age bracket is characterized by curiosity and disregards safety rules due to youthful exuberances and greater peer influences (Mcphee *et al.,* 2019) which ultimately affects their levels of compliance with safety rules, standards, procedures and regulations. Similarly, the study found the majority of the respondents to be male and given that male workers are less likely to report mental illness and to seek treatment due to their muscular nature (Considine *et al.,* 2017) it affects their ability to concentrate at work, comply with safety rules and procedures, participate in safety-related activities and remain productive at work.

The negative effect of anxiety and depression on safety behaviors revealed that within the context of the social exchange theory's norm of reciprocity, the organizational processes, procedures and systems ignored the safety needs and mental well-being of mineworkers' which necessitated the non-compliance with safety procedures, regulations, rules, standards and the intentions of miners to work safely as well as participate in safety activities, attend safety meetings and undertaking safety initiatives.

Finally, the study found that the interaction effect of anxiety and safety climate had a significant effect on mineworkers' safety compliance but not participation behaviors. This means that a good safety climate which is demonstrated by management commitment to safety mitigates the negative effect of anxiety on safety compliance behaviors. This further illustrates that though employees may be anxious, however when they perceive that their management is committed to their safety needs which reassures them of management's determination to improve workplace safety, then mineworkers will comply with safety rules, regulations and standards. Though the study found some form of moderation, the effect was not significant thereby

concluding that safety climate does not moderate the anxiety-safety participation relationship. These findings are consistent with earlier studies (Amponsah-Tawiah *et al.,* 2020; Schwatka *et al.,* 2020; Smith, *et al.,* 2019) that have documented a positive effect of safety climate on employees' safety compliance behaviors and provided support for the claim that safety climate help to strengthen the positive effect of other variables such as organizational culture and leadership styles on safety behaviors and help to mitigate the negative impact of other variables such as job stress, anxiety, depression and general mental illness on employees safety compliance and participation as well as safety citizenship behaviors.

The study found safety climate to moderate the relationship between depression and safety compliance and the depression-safety participation relationship. These results indicate that mining companies should endeavour to improve their safety climate by addressing promptly, the safety needs of their workers, providing safety leadership and creating, maintaining and staying committed to safety issues at the workplace. This finding provides support for the growing body of knowledge (Hulls *et al.,* 2020; Lyu *et al.,* 2018) that safety climate is an important construct that can help to buffer the relationship between positive work and organizational factors and safety behaviors in employees is safety climate.

Arguing from the norm of reciprocity as explained by the social exchange theory (Mitchell *et al.,* 2012), when organizational systems and procedures cause the anxiety and depression states of workers to deteriorate yet the same system seeks to address the safety concerns of the employees and have demonstrated their commitment to creating a conducive and safe working environment, employees will reciprocate their management commitment to the creation of a safe working environment by complying with safety directives and regulations as well as engaging in safety citizenship behaviors. This provides support for the findings of the study that safety climate moderates the mental health-safety behaviors relationship.

The implications of research findings

The findings of the study contribute to the growing body of knowledge about mental health by highlighting the prevalence of anxiety and depression in the Ghanaian mining industry. This study further illustrated the impact of anxiety and depression on mineworkers' safety compliance and safety participation behaviours. Also, the study found the mechanisms through which the negative impact of anxiety and depression on safety compliance and safety participation behaviours could be mitigated. The final implication of the study to existing knowledge lies in its ability to use the social exchange theory, theory of plan behaviour and the health belief model to predict the impact of the dimensions of mental health on safety compliance and safety participation behaviours.

The research findings provide an understanding to management of mining companies about the prevalence rate of mental illness among the population particularly mining workers and the need to develop drastic measures to assist employees with mental health challenges. Due to the male-domineering nature of the mines (less likely for victims to report), efforts should be made to detect and diagnose mental illness earlier in an attempt to assist employees with mental illness to reduce the prevalence rate. Given the adverse effect of mental health on safety compliance and safety participation behaviours as found in the study, efforts should be made by practitioners and management of companies in the Ghanaian mining industry to endeavour

to mitigate the negative effect of mental illness on safety compliance and participation behaviours. This could be done when a good safety climate exists in their organizations.
Finally, the findings of the study have policy implications particularly, on how policymakers should consider incorporating mental health care into the primary health care delivery largely because workers find it a bit difficult to walk into isolated mental health care to assess treatment for mental health challenges (Mcphee *et al.,* 2019). Policymakers should also consider legislation that will oblige organizations to also integrate mental health care and absorb some of the cost of mental illness treatment. These measures will contribute greatly to reducing mental ill-health at the workplace and the general population at large.

Study Limitation and Direction for Further Studies
Despite the insightful findings and contributions of this study, it is not free from drawbacks. For instance, using the cross-sectional survey research design, the current study collected data from mine workers of four mining companies at one point in time. This did not allow the researcher to assess the changes in responses of research participants as a result of changes in time. Consequently, future research could collect data at different periods (longitudinal) on the current study variables to assess the effect of time on the relationships between the study's constructs and to limit the effects of potential common method bias. Again, arguing from a positivist research paradigm and a quantitative research approach, the current study collected numeric data to establish the relationships between the dimensions of mental health and the dimensions of mineworkers' safety behaviours. This made it impossible for the researcher to probe further to identify the underlying causes of these relationships. Consequently, a future researcher can replicate the current study using mixed methods or a more detailed study using the qualitative approach to assess the underlying causes of the relationships between the research variables.
Also, owing to the fact that the current study collected data only from the mining industry, the findings of the study can only be generalized to mine workers of this industry and so future research could replicate the current study in different industries in Ghana in order to provide a better understanding of mental health issues in Ghana. Finally, the current study examined the impact of the dimensions of mental health on mineworkers' safety compliance and participation behaviours. However, future studies could examine the reverse causality between the research variables to assess whether the mineworkers' engagement in safety compliance and participation affects their mental health.

Conclusion
Extant literature underscores the importance of safety behaviors in minimizing workplace accidents, injuries and fatalities. Whereas the focus of mining companies has been on the physical aspects of health and safety in accidents prevention, concrete steps should be taken to assess the impact of the other aspects of health and safety on mineworker's safety behaviors to foster a better discussion of health and safety. Empirically, the study found anxiety to be a significant predictor of mineworkers'' safety behaviors but safety participation. The study also found depression to be a significant predictor of mineworkers'' safety compliance and participation behaviors. Considering that mineworkers' that are screened for anxiety and depression concomitantly withdraw from safety compliance and participation behaviors, management of mining firms are to invest in the mental health of their workers to improve their

mental health conditions and get them to comply with safety requirements and participate in safety activities to reduce workplace accidents, injuries and fatalities.

References

Addo, S. A., & Dartey-Baah, K. (2019). Leadership in the safety sense : where does perceived organisational support fit ? *Journal of Management Development*, *39*(1), 50–57. https://doi.org/10.1108/JMD-04-2019-0136

Adu, I. N., Boakye, K. O., Suleman, A. R., & Bingab, B. B. B. (2020). Exploring the factors that mediate the relationship between entrepreneurial education and entrepreneurial intentions among undergraduate students in Ghana. *Asia Pacific Journal of Innovation and Entrepreneurship*, *14*(2), 215-228.

Agyekum, K., Ghansah, F. A., & Tetteh, P. A. (2020). *The role of project managers (PMs) in construction health and safety implementation in Ghana*. https://doi.org/10.1108/JEDT-04-2020-0122

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Alroomi, A. S., & Mohamed, S. (2021). Predictors of mental health and fatigue among isolated oil and gas workers. *Safety and Reliability*, *40*(2), 80–98. https://doi.org/10.1080/09617353.2020.1858390

Amponsah-Tawiah, K., Boateng, A. K., & Tetteh, S. D. (2020). Safety climate and employees ' voluntary work behaviours : the moderating role of employees ' voice. *International Journal of Workplace Health Management*, *2*(1), 41–62. https://doi.org/10.1108/IJWHM-05-2019-0078

Amponsah-Tawiah, K., Jain, A., Leka, S., Hollis, D., & Cox, T. (2013). Examining psychosocial and physical hazards in the Ghanaian mining industry and their implications for employees' safety experience. *Journal of Safety Research*, *45*, 75–84. https://doi.org/10.1016/j.jsr.2013.01.003

Amponsah-Tawiah, K., Lartey, J. K. S., & Suleman, A. R. (2023). Drug abuse and suicidal thoughts among employees: an emerging economy perspective. *Kybernetes (Ahead-of-Print)*.

Amponsah-Tawiah, K., & Mensah, J. (2016). Occupational health and safety and organizational commitment: Evidence from the Ghanaian mining industry. *Safety and Health at Work*, *7*(3), 225–230.

Aram, S. A. (2021). Managing occupational health among goldminers in Ghana: Modelling the likelihood of experiencing occupational related health problems. *PLoS ONE*, *16*(7 July), 1–15. https://doi.org/10.1371/journal.pone.0254449

Asare-Doku, W., Rich, J., Kelly, B., & James, C. (2020). Mental health interventions in the mining industry : a narrative review. *MENTAL HEALTH REVIEW JOURNAL*, *25*(2), 153–167. https://doi.org/10.1108/MHRJ-10-2019-0039

Beseler, C. L., Stallones, L., & Beseler, C. L. (2013). Structural Equation Modeling of Pesticide Poisoning , Depression , Safety , and Injury Structural Equation Modeling of Pesticide Poisoning , Depression , Safety , and Injury. *Journal of Agromedicine*, *18*, 340–349. https://doi.org/10.1080/1059924X.2013.826117

Blau, P. M. (1964). Social exchange theory. *Retrieved September*, *3*(2007), 62.

Borman, W. C., & Motowidlo, S. M. (1993). Expanding the criterion domain to include elements of contextual performance. In N. Schmitt, W. C. Borman, & Associates (Eds.), *Personnel selection in organizations* ((Eds.), pp. 71–98). San Francisco: Jossey-Bass.

Bowers, J., Lo, J., Miller, P., Mawren, D., & Jones, B. (2018). Psychological distress in remote mining and construction workers in Australia. *Medical Journal of Australia*, *208*(9), 391–397.

Cheng, B. H., & Mccarthy, J. M. (2018). Journal of Applied Psychology Understanding the Dark and Bright Sides of Anxiety : A Theory of Workplace Anxiety Understanding the Dark and Bright Sides of Anxiety : A Theory of Workplace Anxiety. *Journal of Applied*

Psychology, *2*(1), 1–24.
Cheng, L., Guo, H., & Lin, H. (2020). The influence of leadership behavior on miners ' work safety behavior. *Safety Science*, *132*(May 2019), 104986. https://doi.org/10.1016/j.ssci.2020.104986
Cieri, H. De, & Lazarova, M. (2020). Human Resource Management Review " Your health and safety is of utmost importance to us ": A review of research on the occupational health and safety of international employees. *Human Resource Management Review*, (October), 100790. https://doi.org/10.1016/j.hrmr.2020.100790
Considine, R., Tynan, R., James, C., Wiggers, J., Lewin, T., Inder, K., … Kelly, B. (2017). The Contribution of Individual , Social and Work Characteristics to Employee Mental Health in a Coal Mining Industry Population. *PLoS ONE*, *12*(1), 1–15. https://doi.org/10.1371/journal.pone.0168445
Cropanzano, R., Anthony, E. L., Daniels, S. R., & Hall, A. V. (2017). Social exchange theory: A critical review with theoretical remedies. *Academy of Management Annals*, *11*(1), 479–516.
Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *Journal of Management*, *31*(6), 874–900.
Dartey-Baah, K., & Addo, S. A. (2018). Charismatic and corrective leadership dimensions as antecedents of employee safety behaviours. *Leadership & Organization Development Journal*.
Dartey-Baah, K., Quartey, S. H., & Adotey, A. (2020). Examining transformational and transactional leadership styles and safety citizenship behaviors in the power distribution sector : evidence from Ghana. *International Journal of Energy Sector Management*, *30*(1), 1–18. https://doi.org/10.1108/IJESM-07-2020-0008
Dodoo, J. E., Surienty, L., & Zahidah, S. (2021). Safety citizenship behaviour of miners in Ghana: The effect of hardiness personality disposition and psychological safety. *Safety Science*, *143*(September 2020), 105404. https://doi.org/10.1016/j.ssci.2021.105404
Douine, M., Mosnier, E., Le Hingrat, Q., Charpentier, C., Corlin, F., Hureau, L., … Aucouturier, A.-L. (2018). Illegal gold miners in French Guiana: a neglected population with poor health. *BMC Public Health*, *18*(1), 1–10.
Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50.
Ghana Chamber of Mines. (2020). *The Performance of the Mining Industry in 2019*.
Goldenhar, L. M., Schwatka, N., & Johnson, K. (2019). Leadership skills for strengthening jobsite safety climate. *Journal of Safety Research*, *70*, 263–271. https://doi.org/10.1016/j.jsr.2019.04.011
Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology*, *5*(3), 347–358.
Haslam, C., Atkinson, S., Brown, S. S., & Haslam, R. A. (2005). Anxiety and depression in the workplace: Effects on the individual and organisation (a focus group investigation). *Journal of Affective Disorders*, *88*(2), 209–215. https://doi.org/10.1016/j.jad.2005.07.009
Hulls, P. M., Richmond, R. C., Martin, R. M., & de Vocht, F. (2020). A systematic review protocol examining workplace interventions that aim to improve employee health and wellbeing in male-dominated industries. *Systematic Reviews*, *9*(1), 1–7.
Kvalheim, S. A., & Dahl, Ø. (2016). Safety compliance and safety climate : A repeated cross-sectional study in the oil and gas industry. *Journal of Safety Research*, *59*, 33–41. https://doi.org/10.1016/j.jsr.2016.10.006
Kyei, K. A., Oswald, J. W., Njoku, A. U., Kyei, J. B., & Vanderpuye, V. (2020). Anxiety and Depression among Breast Cancer Patients Undergoing Treatment in Ghana. *African*

Journal of Biomedical Research, *23*(2), 227–232.

Kyei-Frimpong, M., Kodwo Amoako, E., Akwetey-Siaw, B., Owusu Boakye, K., Nyarko Adu, I., Suleman, A. R., & Abdul Bawa, A. (2023). Employee empowerment and organizational commitment among employees of star-rated hotels in Ghana: does perceived supervisor support matter?. *Journal of Work-Applied Management (Ahead-of-Print)*.

Lingard, H., Zhang, R. P., & Oswald, D. (2019). Effect of leadership and communication practices on the safety climate and behaviour of construction workgroups. *Engineering, Construction and Architectural Management*, *26*(6), 886–906. https://doi.org/10.1108/ECAM-01-2018-0015

Lu, Y., Zhang, Z., Yan, H., Rui, B., & Liu, J. (2020). *Effects of Occupational Hazards on Job Stress and Mental Health of Factory Workers and Miners : A Propensity Score Analysis*. *2020*.

Lyu, S., Hon, C. K. H., Chan, A. P. C., Wong, F. K. W., & Javed, A. A. (2018). Relationships among safety climate, safety behavior, and safety outcomes for ethnic minority construction workers. *International Journal of Environmental Research and Public Health*, *15*(3), 484.

Mccarthy, J., Trougakos, J. P., & Cheng, B. H. (2015). Are Anxious Workers Less Productive Workers ? It Depends on the Quality of Social Exchange. *Journal of Applied Psychology*, *August 10*, 1–13.

McHorney, C. A., & Ware, J. E. (1995). Construction and validation of an alternate form general mental health scale for the medical outcomes study short-form 36-item health survey. *Medical Care*, *33*(1), 15–28. https://doi.org/10.1097/00005650-199501000-00002

Mclean, K. N. (2012). Mental health and well-being in resident mine workers: Out of the fly-in fly-out box. *Australian Journal of Rural Health*, *20*(3), 126–130.

Mcphee, D., Samnani, A., & Schlosser, F. (2019). *A moderated-mediated model of youth safety*. (2017). https://doi.org/10.1108/PR-10-2018-0394

Miller, R. L., & Brewer, J. D. (2003). *The AZ of social research: a dictionary of key social science research concepts*. Sage.

Milner, A., Scovelle, A. J., & King, T. (2018). *Treatment-seeking differences for mental health problems in male- and non-male- dominated occupations : evidence from the HILDA cohort*.

Mitchell, M. S., Cropanzano, R. S., & Quisenberry, D. M. (2012). Social exchange theory, exchange resources, and interpersonal relationships: A modest resolution of theoretical difficulties. In *Handbook of social resource theory* (pp. 99–118). New York: Springer.

Nauman, S., Malik, S., & Jalil, F. (2019). How Workplace Bullying Jeopardizes Employees ' Life Satisfaction : The Roles of Job Anxiety and Insomnia. *Fontiers in Psychology*, *10*(October), 1–13. https://doi.org/10.3389/fpsyg.2019.02292

Ng, T. W. H., Sorensen, K. L., Zhang, Y., & Yim, F. H. K. (2019). Anger , anxiety , depression , and negative a ff ect : Convergent or divergent ? *Journal of Vocational Behavior*, *110*(May 2018), 186–202. https://doi.org/10.1016/j.jvb.2018.11.014

Novieto, D. T. (2021). Safety climate and occupational safety behaviours: the mediating role of psychological ownership among construction professionals. *Engineering, Construction and Architectural Management*, (ahead-of-print).

Ohrnberger, J., Fichera, E., & Sutton, M. (2017). The relationship between physical and mental health : A mediation analysis. *Social Science & Medicine*, *195*(November), 42–49. https://doi.org/10.1016/j.socscimed.2017.11.008

Olaoluwa, S. A. (2021). Applying Cognitive Therapy for Depression and Anxiety in Mathematics Education for Students' Sustainable Performance. *Creative Education*, *12*(6), 1407–1418.

Quartey, S. H. (2017). Examining employees ' safety behaviours : an industry-level investigation from Ghana. *Personnel Review*, *46*(8), 1915–1930. https://doi.org/10.1108/PR-06-2016-0146

Saedi, A. M., Majid, A. A., & Isa, Z. (2020). Relationships between safety climate and safety participation in the petroleum industry : A structural equation modeling approach. *Safety Science*, *121*(March 2018), 240–248. https://doi.org/10.1016/j.ssci.2019.08.045

Salas, M. L., Quezada, S., Basagoitia, A., Fernandez, T., Herrera, R., Parra, M., … Radon, K. (2015). Working conditions, workplace violence, and psychological distress in Andean miners: a cross-sectional study across three countries. *Annals of Global Health*, *81*(4), 465–474.

Sankoh, O., Sevalie, S., & Weston, M. (2018). Mental health in Africa. *The Lancet Global Health*, *6*(9), e954–e955. https://doi.org/10.1016/S2214-109X(18)30303-6

Sayers, E., Thy, B., Rich, J., Rahman, M., Kelly, B., James, C., … Thy, O. (2019). *Does Help Seeking Behavior Change Over Time Following a Workplace Mental Health Intervention in the Coal Mining Industry ? 61*(6). https://doi.org/10.1097/JOM.0000000000001605

Schwatka, N. V, Goldenhar, L. M., & Johnson, S. K. (2020). Change in frontline supervisors ' safety leadership practices after participating in a leadership training program : Does company size matter ? *Journal of Safety Research*, *74*, 199–205. https://doi.org/10.1016/j.jsr.2020.06.012

Schwatka, N. V, & Rosecrance, J. C. (2016). Safety climate and safety behaviors in the construction industry : The importance of co-workers commitment to safety. *Work & Stress*, *54*, 401–413. https://doi.org/10.3233/WOR-162341

Shafique, I., & Rani, T. (2020). *Examining the impact of ethical leadership on safety and task performance : a safety- critical context*. *41*(7), 909–926. https://doi.org/10.1108/LODJ-07-2019-0335

Simpson, K. B., & Sam, A. (2020). *Strategies for health and safety management in Ghana*. *18*(2), 431–450. https://doi.org/10.1108/JEDT-07-2019-0189

Sinclair, R. R., Martin, J. E., & Sears, L. E. (2010). Labor unions and safety climate : Perceived union safety values and retail employee safety outcomes ☆. *Accident Analysis and Prevention*, *42*(5), 1477–1487. https://doi.org/10.1016/j.aap.2009.11.003

Singh, A., & Misra, S. C. (2020). A Dominance based Rough Set analysis for investigating employee perception of safety at workplace and safety compliance. *Safety Science*, *127*(December 2018), 104702. https://doi.org/10.1016/j.ssci.2020.104702

Smith, T. D., & Dejoy, D. M. (2014). Safety climate , safety behaviors and line-of-duty injuries in the fire service. *International Journal of Emergency Services*, *3*(1), 49–64. https://doi.org/10.1108/IJES-04-2013-0010

Smith, T. D., Dejoy, D. M., Dyal, M., & Pu, Y. (2019). Multi-level safety climate associations with safety behaviors in the fi re service. *Journal of Safety Research*, *69*, 53–60. https://doi.org/10.1016/j.jsr.2019.02.005

Solomou, I., & Constantinidou, F. (2020). Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: Age and sex matter. *International Journal of Environmental Research and Public Health*, *17*(14), 1–19. https://doi.org/10.3390/ijerph17144924

Strecher, V. J., Champion, V. L., & Rosenstock, I. M. (1997). The health belief model and health behavior. In *Gochman DS, eds. Handbook of health behaviour research 1* (1st ed., pp. 71–91). Plenum Press.

Street, T. D., Lacey, S. J., & Somoray, K. (2019). Employee stress, reduced productivity, and interest in a workplace health program: A case study from the Australian mining industry. *International Journal of Environmental Research and Public Health*, *16*(1), 94–107.

Suleman, A. R., Bingab, B. B. B., Boakye, K. O., & Sam-Mensah, R. (2022). Job rotation

practices and employees performance: do job satisfaction and organizational commitment matter?. *SEISENSE Business Review*, *2*(1), 13-27.

Sussman, R., & Gifford, R. (2019). Causality in the Theory of Planned Behavior. *Personality and Social Psychology Bulletin*, *45*(6), 920–933. https://doi.org/10.1177/0146167218801363

Tsai, J. C.-A., & Kang, T.-C. (2019). Reciprocal intention in knowledge seeking: Examining social exchange theory in an online professional community. *International Journal of Information Management*, *48*, 161–174.

Tynan, R. J., Considine, R., Rich, J. L., Skehan, J., Wiggers, J., Lewin, T. J., … Kelly, B. J. (2016). Help-seeking for mental health problems by employees in the Australian Mining Industry. *BMC Health Services Research*, *46*, 1–12. https://doi.org/10.1186/s12913-016-1755-1

Tynan, R. J., James, C., Considine, R., Skehan, J., Gullestrup, J., Lewin, T. J., … Kelly, B. J. (2018). Feasibility and acceptability of strategies to address mental health and mental ill‐health in the Australian coal mining industry. *International Journal of Mental Health Systems*, *12*(66), 1–10. https://doi.org/10.1186/s13033-018-0245-8

Weaver, M. D., Vetter, C., Rajaratnam, S. M. W., O'Brien, C. S., Qadri, S., Benca, R. M., … Barger, L. K. (2018). Sleep disorders, depression and anxiety are associated with adverse safety outcomes in healthcare workers: A prospective cohort study. *Journal of Sleep Research*, *27*(6), 1–9. https://doi.org/10.1111/jsr.12722

WHO. (2018). Mental health : strengthening our response. Retrieved April 13, 2021, from Mental health : strengthening our response website: https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response

Woo, J., Kim, W., Hwang, T., & Frick, K. D. (2011). Impact of Depression on Work Productivity and Its Improvement after Outpatient Treatment with Antidepressants. *JVAL*, *14*(4), 475–482. https://doi.org/10.1016/j.jval.2010.11.006

Xia, N., Ding, S., Ling, T., & Tang, Y. (2023). Safety climate in construction: a systematic literature review. *Engineering, Construction and Architectural Management*.

Xue, Y., Fan, Y., & Xie, X. (2020). Journal of Loss Prevention in the Process Industries Relation between senior managers ' safety leadership and safety behavior in the Chinese petrochemical industry. *Journal of Loss Prevention in the Process Industries*, *65*(August 2019), 104142. https://doi.org/10.1016/j.jlp.2020.104142

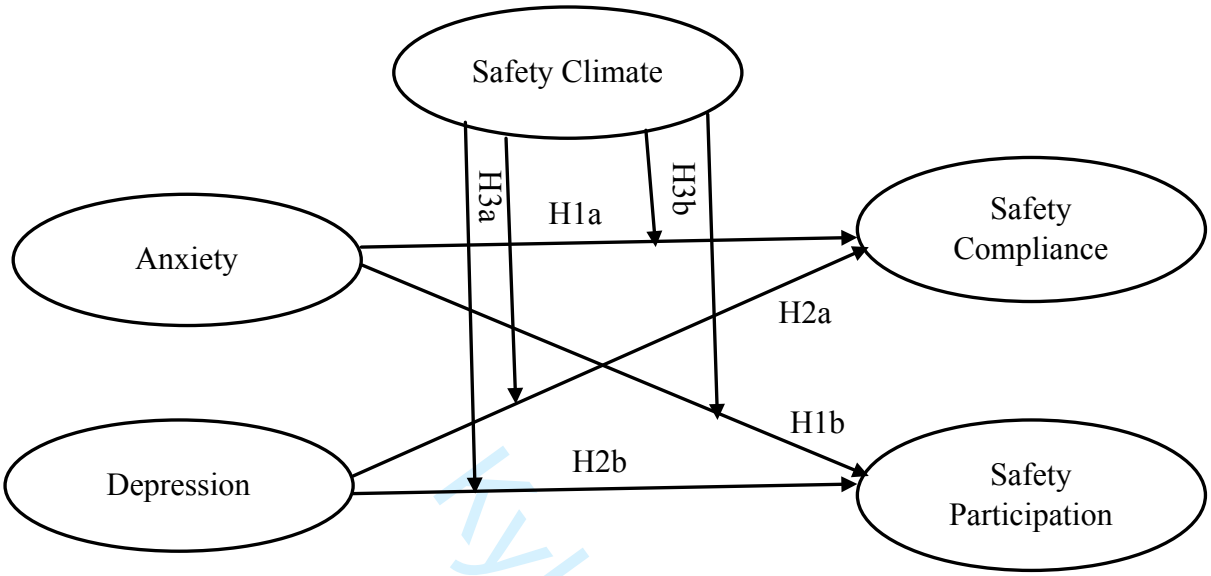
Yaris, C., Ditchburn, G., Curtis, G. J., & Brook, L. (2020). Combining physical and psychosocial safety : A comprehensive workplace safety model. *Safety Science*, *132*(September), 104949. https://doi.org/10.1016/j.ssci.2020.104949

Yuen, K. F., Li, K. X., Ma, F., & Wang, X. (2020). The effect of emotional appeal on seafarers' safety behaviour: An extended health belief model. *Journal of Transport and Health*, *16*(May 2019), 100810. https://doi.org/10.1016/j.jth.2019.100810

Zhang, H., Shi, Y., Zhou, Z. E., Ma, H., & Tang, H. (2018). Good people do bad things : How anxiety promotes unethical behavior through intuitive and automatic processing Good people do bad things : How anxiety promotes unethical behavior through intuitive and automatic processing. *Current Psychology*, 1–9. https://doi.org/10.1007/s12144-018-9789-7

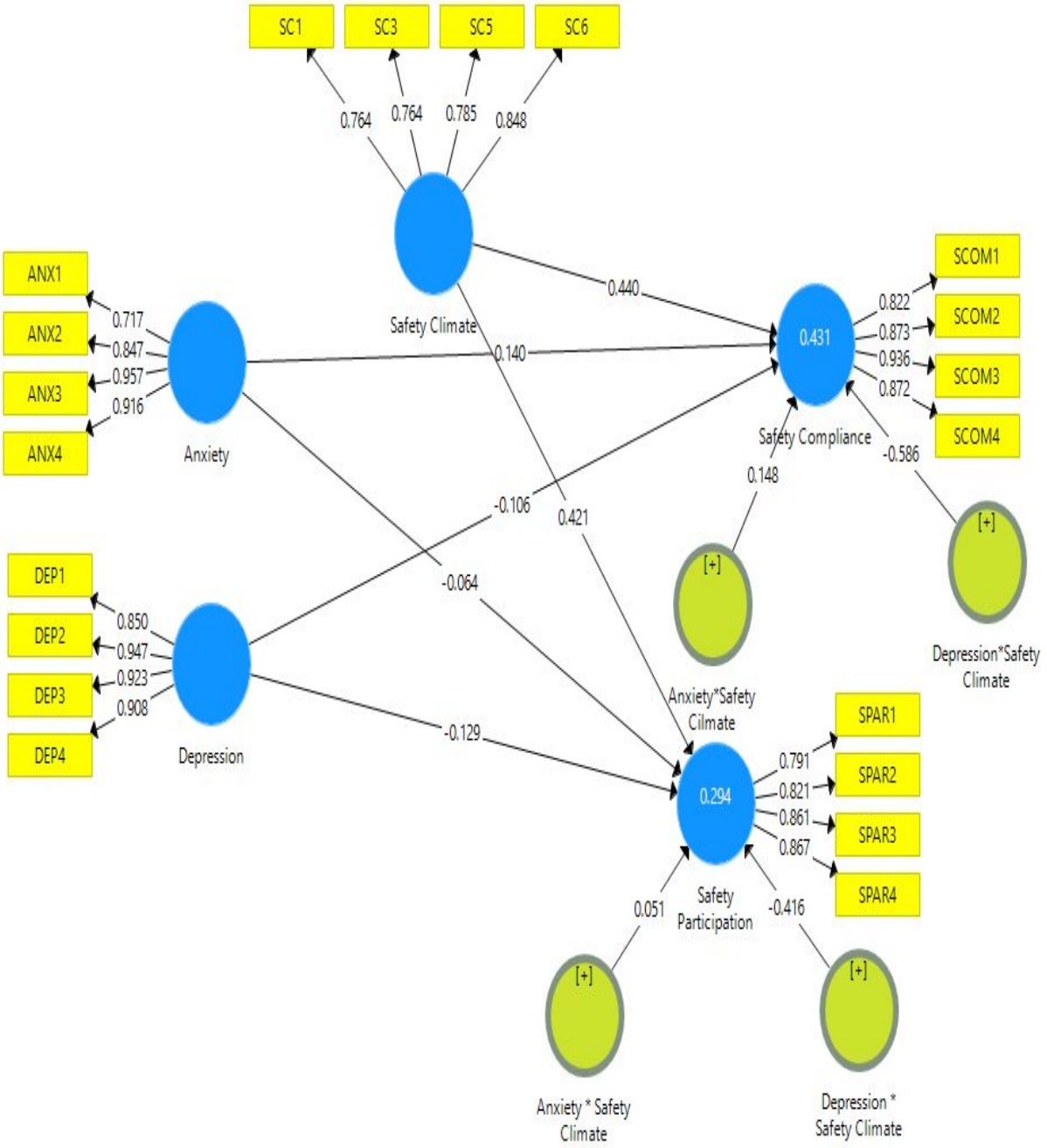
Zohar, D. (2000). A group-level model of safety climate: testing the effect of group climate on microaccidents in manufacturing jobs. *Journal of Applied Psychology*, *85*(4), 587–596.

Figure 1: Proposed model based on the study's hypotheses



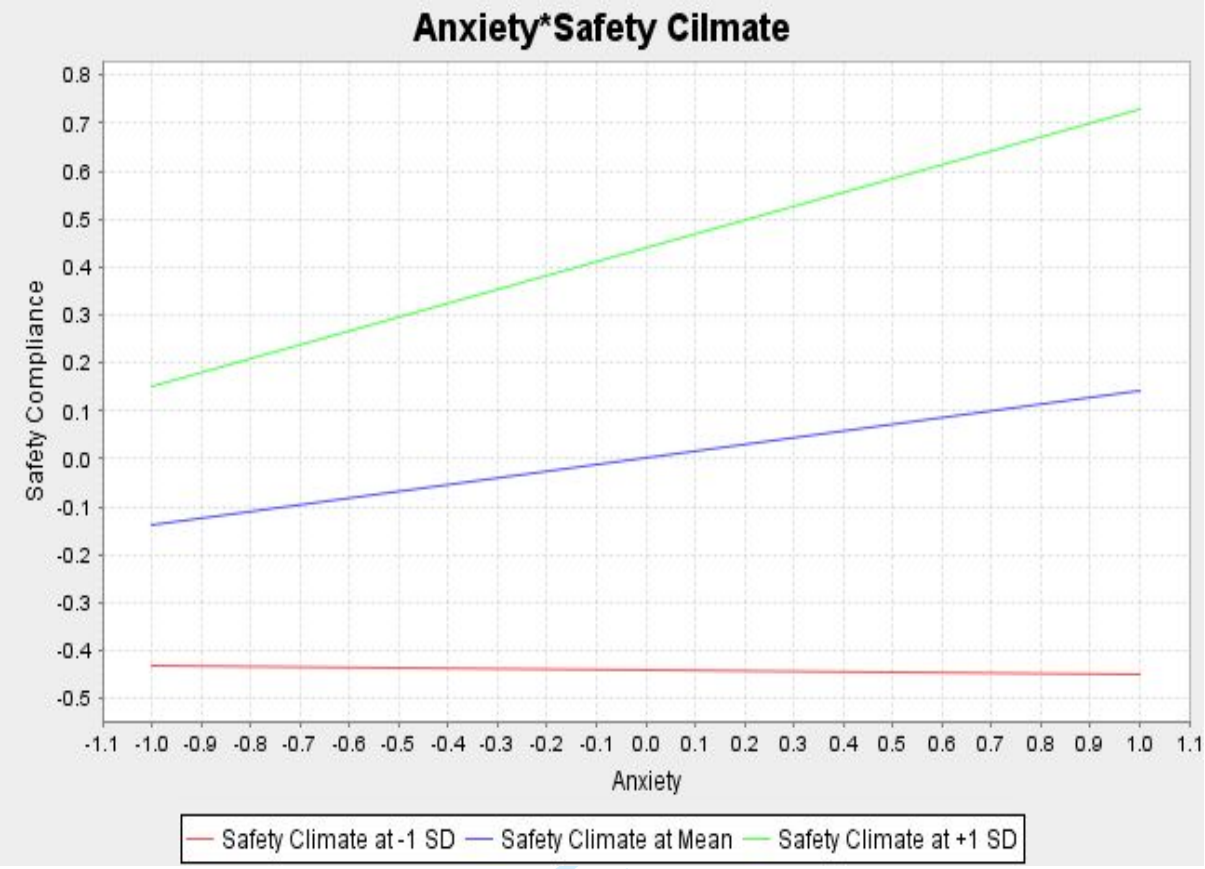
Source: Author(s) Construct (2023)

Figure 2: Results of structural model assessment



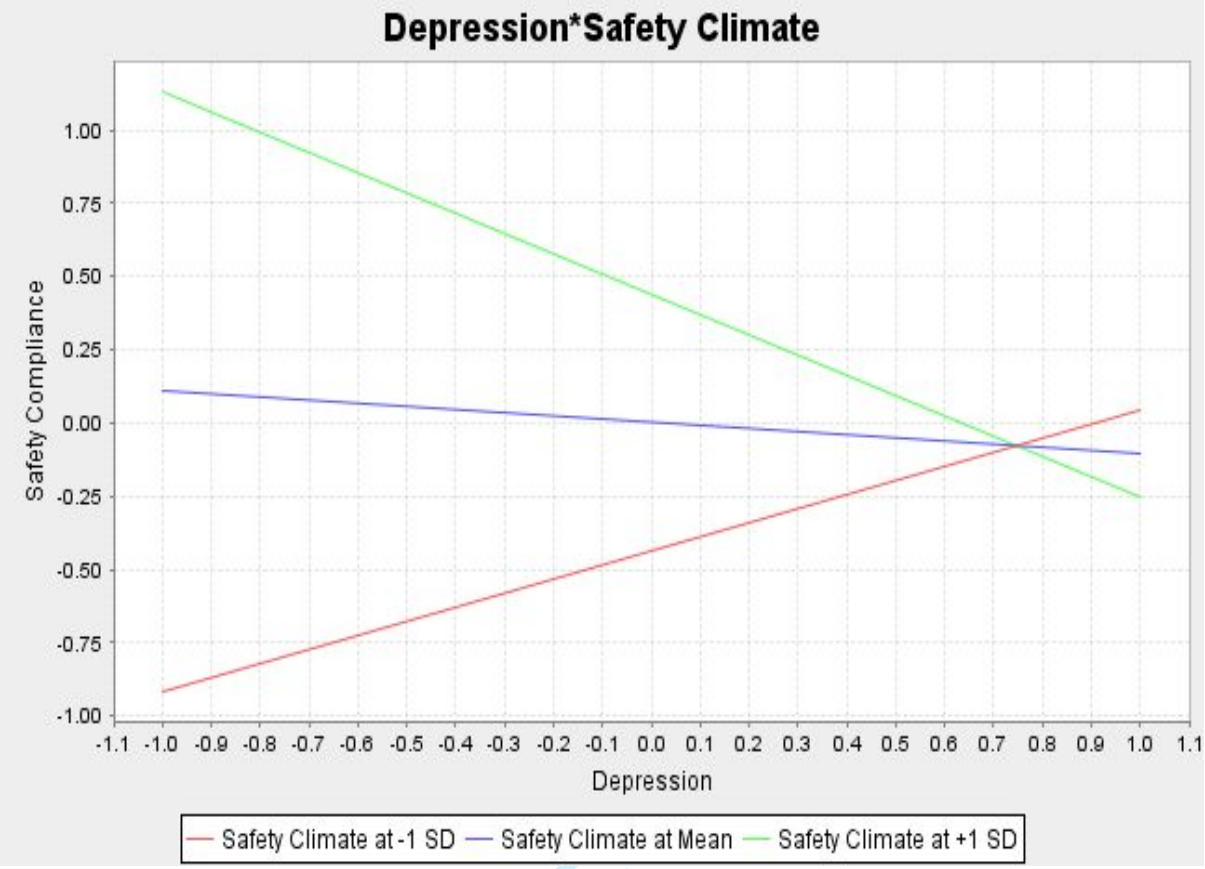
Source: Field Data (2023)

Figure 3: Moderation effect of safety climate on anxiety-compliance relationship



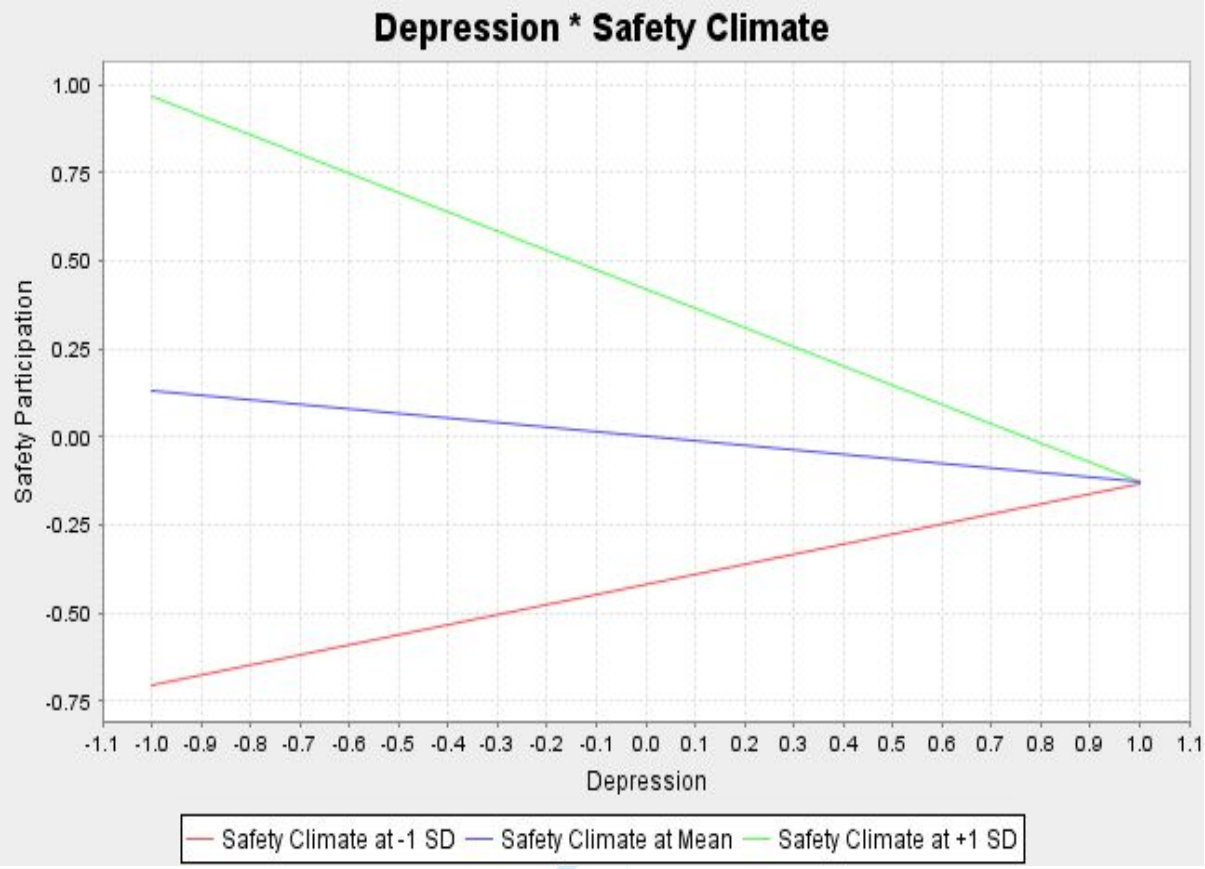
Source: Field Data (2023)

Figure 4: Moderation effect of safety climate on depression-compliance relationship



Source: Field Data (2023)

Figure 4: Moderation effect of safety climate on depression-participation relationship



Source: Field Data (2023)

Table 1: Measurement Instruments

Construct	Role	Description	Items
Safety Behaviours (Griffin & Neal, 2000)	Dependent Variable	Safety Compliance (4 items); Safety participation (4 items) 1= Strongly Disagree; 5= Strongly Agree	**Safety Compliance**
			I use all the necessary safety equipment to do my job
			I use the correct safety procedures for carrying out my job
			I ensure the highest levels of safety when I carry out my job
			I always comply with the safety standards and procedures
			Safety Participation
			I attend safety meetings and briefings
			I voluntarily perform tasks that help to improve workplace safety
			I promote the safety program within the organization
			I frequently discuss safety problems with my superiors
Mental Health (McHorney & Ware, 1995)	Independent Variable	Anxiety (4 items); Depression (4 items) 1= Never; 5= All of the time	**Anxiety**
			My job has made me a very nervous person in the past few weeks
			My job has made me felt tense in the past few weeks
			My job has made me anxious or worried in the past few weeks
			My job has made me felt restless, fidgety, or impatient
			Depression
			My job has made me felt downhearted in the past few weeks
			My job has made me to have very low spirits
			My job has made me feel depressed in the past few weeks
			My job has made me moody or brooded about things
Safety Climate (Zohar, 2000)	Moderating Variable	10-item scale 1= completely Disagree 5= Completely Agree	My supervisor says a good word whenever he sees a job done according to the safety rules.
			My supervisor seriously considers any worker's suggestions for improving safety
			My supervisor approaches workers during work to discuss safety issues.
			My supervisor gets annoyed with any worker ignoring safety rules, even minor rules.
			My supervisor watches more often when a worker has violated some safety rule.

	As long as there is no accident, my supervisor doesn't care how the work is done
	Whenever pressure builds up, my supervisor wants us to work faster, rather than by the rules
	My supervisor pays less attention to safety problems than most other supervisors in this company
	My supervisor only keeps track of major safety problems and overlooks routine problems
	As long as work remains on schedule, my supervisor doesn't care how this has been achieved

Source: Authors' Construct (2023)

Table 2

Demographic Characteristics of the Respondents

Variable	Frequency (n)	Percentage (%)
Gender		
Male	247	90.1
Female	27	9.9
Age		
21 - 30 years	159	58
31 - 40 years	47	17.2
41 – 50 years	40	14.6
51 – 60 years	28	10.2
Educational Level		
SSCE/WASSCE	103	37.6
Diploma/HND	21	7.7
First Degree	120	43.8
Master Degree	19	7.0
Professional Certificate	11	4.0
Others	4	1.5
Number of Years in Organization		
Less than 1 year	52	19
1 - 3 years	91	33.2
4 - 7 years	65	23.7
8 – 10 years	42	15.3
11 – 13 years	10	3.6
14+ years	14	5.1
Total	**274**	**100**

Source: Field Data (2023)

Table 3

Assessment of Reliability and Validity of Retained Items

Variable		Factor Loadings	Cronbach Alpha	Composite Reliability	Average Variance Extracted
Anxiety	ANX1	0.717	0.901	0.921	0.746
	ANX2	0.847			
	ANX3	0.957			
	ANX4	0.9I6			
Depression	DEP1	0.850	0.930	0.949	0.824
	DEP2	0.947			
	DEP3	0.923			
	DEP4	0.908			
Safety Compliance	SCOM1	0.822	0.899	0.930	0.768
	SCOM2	0.873			
	SCOM3	0.936			
	SCOM4	0.872			
Safety Participation	SPAR1	0.791	0.857	0.902	0.698
	SPAR2	0.821			
	SPAR3	0.861			
	SPAR4	0.867			
Safety Climate	SC1	0.764	0.807	0.870	0.626
	SC3	0.764			
	SC5	0.785			
	SC6	0.848			

Source: Field Data (2023)

Table 4

Fornell-Larcker Standard for Discriminant Validity

	1	2	3	4	5
1. Anxiety	**0.864**				
2. Depression	0.795	**0.908**			
3. Safety Compliance	0.003	0.121	**0.877**		
4. Safety Participation	0.200	0.184	0.362	**0.863**	
5. Safety Climate	0.165	0.254	0.435	0.557	**0.791**

Source: Field Data (2023)

Table 5

Pearson's Correlation Matrix of the Study's Variables

Variable	1	2	3	4	5
1. Anxiety	1				
2. Depression	.766**	1			
3. Safety Compliance	-.168**	-.225**	1		
4. Safety Participation	-.171**	-.318**	.680**	1	
5. Safety Climate	-.146*	-.265**	.127*	.143*	1

**. Correlation is Significant at 0.01 *. Correlation is Significant at 0.05

Table 6

Path Coefficients Results with their bootstrap values and 'T' Values

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Anxiety ---> Safety Compliance	-0.140	-0.141	0.115	1.659	0.098
Anxiety ---> Safety Participation	-0.064	-0.065	0.115	1.596	0.111
Depression ---> Safety Compliance	-0.106	-0.104	0.136	3.906	0.000
Depression ---> Safety Participation	-0.129	-0.128	0.121	4.796	0.000
Safety Climate ---> Safety Compliance	0.440	0.441	0.094	4.700	0.000
Safety Climate ---> Safety Participation	0.421	0.393	0.058	7.264	0.000

Source: Field Data (2023)

Table 7

Moderation Effects Results with their bootstrap values and 'T' Values

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Anxiety*Safety Climate ---> Safety Compliance	0.148	0.146	0.188	1.899	0.058
Anxiety * Safety Climate---> Safety Participation	0.051	0.049	0.128	1.922	0.155
Depression*Safety Climate ---> Safety Compliance	-0.586	-0.582	0.111	4.937	0.000
Depression * Safety Climate ---> Safety Participation	-0.416	-0.415	0.130	3.840	0.000

Source: Field Data (2023)

Mining Safely: Examining the Moderating Role of Safety Climate on Mineworkers' Mental Health and Safety Behavior Nexus

Emmanuel Kodwo Amoako[1*], Saviour Ayertey Nubuor[2,] Amin Abdul Bawa[3], Abdul-Razak Suleman[4], Bridget Akwetey-Saiw[5]

University of Ghana Business School – Department of Organisation and Human Resource Management, Legon-Accra, Ghana[123&5]

Edith Cowan University – School of Business and law, Joondalup, Australia[3]

***Corresponding Author**: Emmanuel Kodwo Amoako; [redacted]