IDENTIFYING CONSTRUCTION WORKERS INJURY PREDICTORS: A THEMATIC CONTENT ANALYSIS

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Construction is a dangerous industry globally, with high rates of fatal and non-fatal injuries. Furthermore, there is paucity of analytical research that considers the predictors of injuries among construction workers in South Africa construction industry and in the developing countries. The objective of this paper is to review existing research literature to identify the variables that are considered to be predictors of occupational injuries among construction workers. It also aimed to identify the gaps that exist in the current literature. The review spanned two decades between the periods January 1995 to 2015. The search was based on a systematic keyword combination search in two databases that is- emerald and science direct and in google. Twenty one quantitative and mixed method research studies were adjudged relevant for analysis in this current study. They were analysed using thematic content analysis, by identifying themes. All the studies reviewed had different predictors of construction workers injury. Furthermore, no study identified the safety leadership characteristics of the construction workers especially the tradesmen, hence a further gap identified in the current literature. Despite the gaps identified, five broad themes were adjudged to be good predictors of construction workers injuries, these were: work related variables, demographic variables, unsafe health and safety (H&S) behaviour, poor safety climate, and psychosocial factors. A further study is advocated to develop a predictive model for injury occurrence among construction workers in South Africa using logistic regression analysis. The model to be tested will also include the safety leadership characteristics of the construction workers.

Keywords: construction workers, injury, predictors, thematic analysis.

INTRODUCTION

According to Statistics South Africa (2014), the construction industry contributed about 2.7% year on year of the total Gross Domestic Product (GDP) to the South Africa economy in the third quarter of 2014. Hence, the importance of the construction industry in the economy of South Africa cannot be underestimated.

Despite the importance of the construction industry to the economic development of different nations, its construction H&S performance has for many years been a concern to industry stakeholders (Rajendran and Gambatese 2009; Lingard and Rowlinson, 2005) largely because construction projects are generally complex and hazardous. They are complex (Lingard and Rowlinson, 2005) because of the extensive use of sophisticated plant, equipment, modern methods of construction, and its multidisciplinary workforce and multi-tasked aspects of its project team and workforce (Debrah and Ofori, 2001). The industry is hazardous because of the high incidence of accidents and fatalities (Bakri et al., 2006). Hinze (1997) opined that when compared with other labour intensive industries, construction industry has historically experienced a disproportionately high rate of disability injuries and fatalities for its size. Haupt (2001) indicated that construction workers were two to three times more likely to die on the job than workers in other industries, while the risk of serious injury was

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almost three times higher. The International Labour Organization (ILO, 2005) further indicated that 25 to 40 per cent of fatalities in the industrialised world workplace occur in construction industry.

The incident rate for fatal accidents in most countries in the construction industry is high (Ling et al., 2009; Abudayyeh et al., 2006). In the United Kingdom, the Health and Safety Executive (HSE) reported that in 2010/2011, 50 fatal injuries occurred in construction compared to an average of 61 in the previous five years (HSE, 2012). However, despite this decrease the number of fatalities is still unacceptable. In the United States of America (U.S.A), the number of work-related fatalities declined by 10% in 2010. However, the construction industry still accounted for far more fatal work injuries than any other industry sector with 774 fatal work injuries at an average rate of 9.8 per 100, 000 workers in 2010 (Bureau of Labour Statistics (BLS, 2011). From 2011 there was gradual increase of work related fatalities. The numbers of fatalities were: 781, 849 and 856, in the years: 2011, 2012 and 2013 respectively (BLS, 2015).

In South Africa the most recent data by the Department of Labour (2012), indicated that during the period 2007-2010 there were 171 fatalities and 755 injuries. Furthermore, the construction sector paid out more than R287 million (about USD34 million, 1USD = ZAR8.441 this rate was in the year 2012) on claims for injuries and illnesses, that were work-related in the period ending March 2012. In a recent accident on June 4th 2015 in Pretoria South Africa, five construction workers were injured when the scaffold collapsed at approximately 10-15 meters high (Africa News Agency, 2015).

The construction industry in South Africa continues to pose an inherent risk to the H&S of its employees. This negatively impacts on the employee morale, resulting in productivity loss and reputational risk. Hence, the industry needs to address the causes of workers injuries.

PROBLEM STATEMENT

Despite the benefits of the construction industry highlighted in this paper. The construction industry is viewed as a dangerous working environment, which would lead families losing their loved ones or leaving them permanently or temporarily injured or disabled. This could eventually lead to the loss of financial support of the family especially when one was a bread winner. In relation to this problem this current study is a literature discourse to unearth information from previous studies related to the determinants of injuries in relation to construction workers. The research question to be addressed is:

What are the predicators of a construction worker being injured on site?

METHODOLOGY

The literature search spanning two decades in the period January 1995 to December 2015 was undertaken. This was based on systematic keyword combination search in a number of databases namely; emerald and science direct. The researcher also utilized google search. Advance search was used for the data base engines and basic search for google. The keywords used for the data base search of articles were; “injury predictors” AND “construction workers”. The keywords used for basic search were “injury predictors for construction workers”. The search in the data bases retrieved 4888 articles. However, after filtering the articles only 16 were relevant. Google search retrieved 390 000 articles and reports. Five relevant articles and report which were not duplicates with those obtained from emerald and science direct search were used as tabulated in Table 1. It is however acknowledged that searching process was a limitation, as limited key words were used.

The criteria for including the article or report were: the article/report should be peer-reviewed, be written in English, it should state the aim of the study, method used, present the results and conclusion; and finally, report or contain results relating to the aim of this literature review. This approach is similar to the study of Gildberg et al., (2010) which was considered to be rigorous.

The non-experiential data was analyzed using thematic content analysis. The articles were read to obtain a sense of the content and the emerging themes were noted. The themes were further categorized into sub-themes. According to Baxter (1994) themes are threads of meaning that recur in domain after domain.

LITERATURE REVIEW ON CONSTRUCTION WORKERS INJURY PREDICTORS

According to Choi, (2015) age predicted the type of injury of construction workers. The study indicated that older workers and younger workers sustained different types of injuries. Older workers sustained increased sprains/strains. Furthermore, the type of occupation/trade was found to be linked with high injury rate. The highest rates of injuries were linked to labourers, carpenters, iron workers, and operators. Holte et al., (2015) in Norway established that prevalence of injuries was high among apprentices in companies that employed 10-19 employees. Hence, the size of company was a predictor of employees getting injured. Holte et al., (2015) study deduced that employees in electrical trade companies, employing between 10-19 employees and those employees in building trade in companies employing 20-49 employees were at risk of getting injured. This result is not a surprise as these companies are small because of they employ less than 50 employees. Furthermore, the study implied that apprentices who had been employed between 19 to 24 months in the company had the courage to report an injury when it occurred. The study further, suggested that an apprentice working in the company for three months and less, are not courageous to report the injury incurred. It can therefore be suggested that as an employee, in order to report an injury you need to have worked in the company for more than one and half years. Holte et al., (2015) study focused mainly on company size and prevalence of injury among apprentices. Hence, reporting different predicators in comparison with the study of Choi et al., (2015).

Hon et al., (2014) implied that positive workforce safety attitude and acceptance of safety rules and procedures were significant predictors of injury occurrence. The prediction deduced that an increase in the positive workforce safety attitude and acceptance of safety rules and procedures would decrease injury occurrence. Further, the study established that reasonable production schedule was a predictor of injury occurrence. Management commitment and effective safety management were good predicators of injury occurrence. It can therefore be suggested from this findings that negative safety climate among construction workers has a likelihood of increasing injury occurrence. This suggestion concurs with the study of Moore et al., (2014) in the USA. They indicated the causes of accidents to be lack of fall protection or their incorrect use. Further, the study implied that minimal H&S planning, lack of H&S training to the roofers and little or no adherence to the Occupational Safety and Health Administration legislation led to workers injuries. The predicators of injury occurrence established by Moore et al., (2014) and Hon et al., (2014) examined safety climate influence on injury occurrence. However, the studies focused on different areas. Hon et al., (2015) focussed on repair, maintenance, minor alteration and addition works (RMMA), whereas Hon et al., (2014) examined fatal events in residential roofing.

According to Adane et al., (2013), concluded that occupational injuries were common among building construction workers in the study area; the prevalence of the injuries were associated with lack of personal protect equipment (PPE), working overtime, lack of vocational training, workers dissatisfaction with their job. Gender and age were also contributing factors to workers injuries. The findings can be categorized as demographic, safety climate and psychosocial factors. Schofield et al., (2013) found that drug testing programs were predictors of lower injury for the pre-employment/post-accident employees. Unionized and non-unionized employees did not predict lower injuries. Abbas et al., (2013), indicated that working overtime, poor safety climate, short duration of work, job dissatisfaction, young age, and job stress were good predictors of occupational injuries. However, it is interesting to note that sleeping disturbance, and poor machine maintenance and design did not predict occupational injuries among the construction workers. Yoon et al., (2013) found that when occupational health and safety management system (OHSMS) is implemented there was reduction of work related accidents and fatal accidents rates. It can therefore be suggested that when OHSMS is poorly implemented or not implemented there will be increase in accidents among construction workers.

Dong et al., (2013) established that the type of occupation predicts accident occurrence. Construction labourers, construction helpers, ironworkers and roofers are the most dangerous occupations with the highest death rates for falls from roofs. Other types of occupation that were to some extend predictors of accidents were: carpenters, sheet metal and welders. Furthermore, working on residential roofs predicted accidents. In addition age predicted accidents when working on roofs. Workers who were younger than 20 years or older than 44 years were vulnerable to accident occurrence. Race and the citizenship of the worker predicted accidents when working on roofs. Hispanics and immigrants had a high death rate of falls from roofs. It can be argued that immigrants might be in position to compromise the H&S at work in order to earn a living. Lingard et al., (2013) found that immediate

factors, that is- site layout, unsafe actions, and communication failure were predictors of plant related fatalities. Furthermore, shaping factors like site constraints, inadequate supervision, plant design and skill of operator were deemed good predictors. Finally they inferred that originating influences that is- safety culture and construction process design were good predictors of plant related fatalities in Australia.

Cheng et al. (2012) undertook a non-experimental quantitative study on factors contributing to occupational injuries in the construction industry. They implied that the causes of accidents leading to injury were: source of injury, unsafe condition, accident location, unsafe acts, project type, gender, safety and health management, worker age and enterprise size. Leung et al., (2012) found that construction workers injuries were predicted directly by lack of goal setting and the safety behaviour of construction workers. The study further implied that safety behaviour is directly influenced by emotional stress, physical stress and inappropriate safety equipment. It is important to note that workers behaviour is influenced by other factors hence leading to workers injuries. Zhang (2012) opined that in China the predictors of injury occurrence among immigrant workers were; training, gender, contract of employment and the age of the workers. The difference of findings in the studies of Cheng et al., (2012); Leung et al., (2012) and Zhang (2012) was a result different focus areas. Furthermore, Leung et al., (2012) did not include demographic variables in their study.

In a study conducted in Norway, young workers are at a higher risk to be involved in workplace injuries compared to older workers, hence age can be deemed to be a predictor of workers injuries. Physical demands that is-(vibration and heavy lifting) and control over the pace of work are associated with increased risk for injuries. However, safety climate was not associated with predicting injuries (Kjestveit et al., 2011). Abbe et al., (2011) implied that injuries were influenced by job control, responsibility for safety of others, safety climate, training, job certainty and personal safety compliance. The study also posited that physical symptom (headache) and psychological symptom (feeling sad on the job) were associated with injury occurrence. Im et al., (2009) established that gender, age, duration of employment; company size and cause of injury e.g. fall from height, structure collapse, and electric shock were injury predictors of construction workers. The type of occupation was also a predictor of injury. This was influenced by falling from heights. The trades mostly affected were painters, plasterers and scaffolders. It can be suggested that frequent training should be offered to this group of tradesmen.

Wong et al., (2009) found that factors leading to fall accidents were, lack of experience, fatigue, the equipment used that is- the ladder, and the negative attitude of workers, or a “don’t care attitude”. Dong et al., in (2009) focused on fatal falls among Hispanics construction workers. The results implied that age, job tenure, occupation, size of organization, ethnicity and types of construction project had an influence in workers falling, therefore leading to injuries. Hinze et al., (2008) opined that injury related to the eyes was influenced by not wearing eye protection. Furthermore, injury on the right or the left eye was influenced by the type of work equipment used. They implied that when grinding metal, 66% of injuries affected the right eye. However, when hammer was used it was associated with the left eye injury. It is important to establish types of tools and equipment that may cause injury on the construction worker. Age was also a determinant of eye injury. Workers in the age group between 25 and 35 were prone to eye injury. Further, close to 65% of operators were injured compared to 35% of bystanders. It can therefore be indicated that the work environment is a contributor to injury. Despite this findings Hinze et al., (2008) study differed from the study of Abbe et al., (2011); Kjestveit et al., (2011); Wong et al., (2009); Dong et al., (2009); and Im et al., (2009) as Hinze et al., (2008) focused on eye injury predictors. Furthermore, the study focused on the type tool that caused injury on either the right or left eye.

In a study by Nissen (2007) immigrant workers had experienced a workplace injury which resulted in loss of work of a day or more. Thirty-nine percent had witnessed a worksite accident serious enough to cause a fellow worker to be taken to the hospital. In their entire construction work career (average length: approximately seven and a half years), eighteen percent had witnessed a death at a worksite where they worked. In Gillen et al., (2002) study implied that the union workers, safety climate, and psychological job demands were the factors adjudged in influencing severity of injury.

Table 1: Literature matrix

Authors, Year	Objective**(s)**
Holte et al., (2015)	To determine injury risk among apprentices in different sized enterprises within different building and construction trades
Choi, (2015)	To identify any trends of injury type as it relates to the age and trade of construction workers
Hon et al., (2014)	To compare the level of safety climate of workers, supervisors and managers in the RAMM sector and explaining/predicting the impact of safety climate on injury occurrence of workers, supervisors and managers
Moore et al., (2014)	To investigate the factors associated with residential roof fatalities
Lingard et al., (2013)	To investigate the circumstances and causes of fatal incidents involving plant in the Australian construction industry
Adane, et al., (2013)	To determine the magnitude and factors related to work related injuries among building construction workers
Abbas et al., (2013)	To determine the magnitude, pattern and risk factors of non- fatal occupational injuries and to explore the level of safety climate and its relationship with occupational injuries
Yoon et al., (2013)	To investigate the status of OHSMS and the effect of OHSMS on accident rates. To determine the differences of awareness of safety issues among site general managers, OHS managers.
Dong et al., (2013)	To investigate the factors associated with roof falls

Continuation Table 1: Literature matrix

Authors, Year	Objective(s)
Schofield et al., (2013)	To evaluate the impact of active company drug testing programs on the rates and severity of injuries sustained by workers in small construction firms
Zhang (2013)	To determine the effect of individual factors, occupational training on occupational injury of migrant workers
Leung et al., (2012)	To identify the impact of various organizational stressors and stress on construction workers safety behaviours and injury incidents.
Cheng et al., (2012)	To establish potential cause-and-effect relationships regarding serious occupational accidents in the industry
Kjestveit et al., (2012)	To explore risk factors for injuries among workers in the Norwegian construction industry, focusing on young workers
Abbe et al., (2011)	To investigate the relationship existing among occupational stressors, psychological/physical symptoms and accident/injury and work days lost outcomes as experienced by manual workers engaged in a range of industrial construction occupations
Wong et al., (2009)	To investigate the problems associated with fall of person from height in the construction industry
Im et al., (2009)	To explore the attributes of fatal occupational injuries
Dong et al., (2009)	To examine deaths resulting from fall injuries among Hispanic workers
Hinze et al., (2008)	To identify factors that are associated with eye injury causation
Nissen, (2007)	To provide a portrait of South Florida immigrant construction workers: demographics, incomes, safety conditions on the job, and employer treatment in other ways that may be related to their safety conditions
Gillen et al., (2002)	To evaluate injured construction workers perception of workplace safety, psychological job demands, coworker support and the relationship with injury severity

RESULTS AND DISCUSSION

Five broad central emergent themes were identified, that is- demographic variables, work related variables, unsafe health and safety behaviour, poor safety climate and psychosocial factors. The subsequent themes are discussed hereto.

Demographic variables

Demographic variables have been indicated to be good predictors of injury. The demographic variables constitute of, gender, age, educational level, job tenure of employee, ethnicity, size and type of company. Zhang (2012) posits gender has an influence in injury occurrence of construction workers. Male migrant workers are 10% more likely to be injured than their female counterparts. Adane et al., (2013) concurs with this result. Lingard et al., (2013) found that most decedents occurred on male workers. It can therefore be opined that majority of male workers get injured or die on construction sites than female workers. Therefore, attention by policy makers needs to focus on male workers by offering them more H&S training.

Age of the worker also influenced construction related injury (Dong et al., 2013; Adane et al., 2013; Zhang, 2012; Dong et al., 2009; Hinze et al., 2008). However, the age groups were categorized differently in all the studies. Adane et al., (2013) posited that workers older (>45 years) were likely to be injured than those in the age group 14 to 29 years. Hinze et al., (2008) implied that workers in the age group 25 to 35 were prone to eye injuries. Kjestveit et al., (2011) indicated that young workers less than 25 years were at a higher risk of workplace injuries compared to older workers. Hence, age is a predictor of workers injuries. According to Lingard et al., (2013) most fatal incidents occurred to workers aged between 46 and 55. Dong et al., (2013) attest that the high rate of roof fatalities was high among young (<20 years) and older (>44 years) construction workers. However, it is interesting to note that older workers were also prone to injuries in some studies. This could have been enhanced by older workers losing concentration through fatigue because of their advanced age. It is important to state that Adane et al., (2013) implied that lack of vocational training is a good predictor of worker injury. In connection with this discussion, it can be suggested that construction workers of any age should be reminded or trained on H&S in the workplace.

In view of tenure of employment, those workers who had worked for 1 year or less were susceptible to fatal incident. Hence, it can be suggested that workers who are new in the company should be thoroughly inducted on H&S. These workers should constantly be reminded of the H&S hazards and dangers in their workplace. This could prevent accidents from occurring. Further, ethnicity was deemed to be a good determinant of fatal accidents Dong et al., (2009). In their study they implied that Hispanics were more likely to incur fatal injuries than their white non-Hispanics workers. It can be suggested that education and training on H&S is invaluable for the Hispanic construction workers. In relation to a diverse cultural environment like South Africa with four distinct ethnicities, H&S training for all construction workers should be administered frequently. This will curb injury occurrence of their workers.

Furthermore, the type of company according to Dong et al., (2013) and Dong et al., (2009) would be susceptible with high fatality rate. They found that roofing contractors working in residential construction sites were vulnerable to fatal incidents. Workers working at heights need to be informed of the hazards they will encounter at work. Rigorous H&S training and planning of such construction activities is crucial in order to stifle any form of accidents. Further, Dong et al., (2013) and Dong, et al., (2009) posited that companies employing 10 or fewer workers are likely to incur more fatal accidents. In the context of South Africa definition of small construction organizations, these sizes of company reported are small. This finding is not surprising, it has been suggested that small companies in the construction industry lack the required resources to maintain good H&S practices (Construction Industry Development Board, 2004). The government should support small companies with necessary resources so that they are not constrained in their H&S.

Work related variables

The subthemes of work related variables unearthed in this study are; type of occupation, hours of work, degree of physical effort required in doing the work, type of plant/machinery or equipment used. These sub-themes are adjudged to be good determinants of construction worker injury. Holte et al., (2015) and Choi (2015) asserted that the type of occupation is a catalyst of worker injury. According to Choi (2015) the occupation most affected are labourers, carpenters, iron workers and operators. Dong et al., (2013) indicates that ironworkers and roofers incurred fatal accidents. Holte et al., (2015) on the other hand posits that electrical trade and building trade were most affected. According to Kjestveit et al., (2011) injury in young workers is catalysed by the physical demand of work activities when using vibrating tools, lifting heavy objects, repetitive movement, and working with arms above shoulders. The work task between different age groups has an impact on the type of injury occurrence. This sentiment is supported by Choi (2015). It can therefore be suggested that work tasks in relation to the type of occupation should be assessed for any hazards before commencing any activity. The workers should be trained on the types of tools and equipment they are using. They should be informed of the H&S risk that they might incur while using those tools. This will assist the workers not to incur any injuries while working.
Lingard et al., (2013) found that drivers/operators were susceptible to fatal incidents. They further attested that different types of plant used led to incidents on site. The most frequent plants causing the incidents were cranes, excavators, and trucks. The plant operators need to be trained in order to stifle the prevalence of accidents on construction sites. Abbas et al., (2003) indicated that poor machine design and inadequate maintenance influenced occupational injury of workers. It should be the prerogative of the company to ensure that when their workers are using any machine it should be in good working condition. The machines need to be maintained and damaged machines should not be used. Construction companies should not focus on profits alone but should ensure their workers welfare is also taken into consideration. Further, Adane et al., (2013) found that the likelihood of injury occurring is exacerbated when the construction workers work for more than 8 hours a day. It is imperative to note that workers should not be forced to work for more than 8 hours a day. Working long hours i.e., more than 8 hours a day could lead to worker fatigue. Hence, the employee may lose concentration which could lead to injuries. The company policies or collective agreement between the employer and the trade union on working time should be developed thoughtfully, to ensure all construction workers are not overworked.

Unsafe health and safety behaviour

The unsafe worker behaviour in H&S has a likelihood of predicting injury occurrence. This is supported in the study of Moore et al., (2014), Abbas et al., (2013) and Hinze, et al., (2008). According to Hinze et al., (2008) workers defiance of not using PPEs led to different types of injuries. Hinze et al., found that the lack of wearing safety goggles led to construction workers injuring their eyes. Furthermore, they opined that when workers use damaged or unmaintained equipment and machinery there is possibility of injury occurrence. However Abbas et al., (2013) findings are not in support of Hinzes' findings. Despite the contrary finding of Abbas et al., (2013), it can be argued that any iota of unsafe H&S behaviour should not be condoned at any level of the construction process on site. Workers who do not obey the H&S best practices at work should be disciplined. The form of discipline would remind workers to be cautious of good H&S practices that have been enshrined in the company H&S policy. Moore et al., (2014) attests that poor behaviour, for example not adhering to H&S standards would predict injury or fatal accident.

The health behaviour of the worker was deemed not to be a predictor of injury occurrence among the construction workers (Adane et al., 2013; Abbas et al., 2013). The health behaviors examined were: drug abuse which included smoking, and alcohol abuse. However, organizations should inform their workers of the dangers of substance abuse and provide counselling to workers who are addicts. Schofield et al., (2013) opined that drug testing programs are associated with lower injury rates. It can therefore be suggested that when drug testing is not undertaken the likelihood of injury happening among construction workers is high.

In the context of job satisfaction, Adane et al., (2013) and Abbas et al., (2013) posited that job dissatisfaction influenced injury occurrence among construction workers. This could be as a result of the employees working without focusing in their delegated work. When workers are not satisfied with their work the employer should render appropriate advice and counsel. The employer should not be silent and hope that dissatisfaction of work by employees will sort itself.

Poor safety climate

Lingard et al., (2013), Abbas et al., (2013) and Hon, et al., (2014) implied that when upstream measures are lacking, the possibility of fatalities occurrence on construction site increases. Hon et al., (2014) found that upper management personnel prioritized production more than the workers safety. This finding suggests the reason for worker injury on site. Nevertheless, Kjestveit et al., (2011) found that safety climate was not a good predicator of workers injuries. Despite this contrasting finding, it is important to note that poor safety climate will influence injury occurrence. Safety climate is the measure of safety culture of the organization. When safety culture is observed in any organization by top management it trickles down to the workers on the lower level of the organizational structure. It is therefore imperative that safety culture is inculcated in the organization. This will stifle injury occurrence on construction sites.

Psychosocial factors

According to Leung et al., (2012) when workers incur emotional and physical stress at work it influences their safety behaviour. Further, they found that injury is indirectly caused by emotional and physical stress. Abbe (2011) found that physical stress as a result of the worker suffering from headache predicted injuries. Abbas et al., (2013) implied that job stress predicted workers occupational injuries. In contrast to Abbe et al., (2011) study, Abass et al., (2013) did not test two separate variables that is- emotional and physical stress. Nevertheless, it can be argued that any work stress experienced by construction workers should be attended to. Caring organizations should assist their employees in periodic medical check-up. This will ensure that workers are healthy to undertake their work.

Social support is defined as a sub-theme of psychosocial factor. In the study of Kjestveit, et al., (2011) and Gillen et al., (2002) social support did not predict workers injury. However, according to Abbe et al., (2011) it predicted self-reporting when an injury occurred. It can be stated that, companies should encourage self-reporting of injuries by their workers, without being punished. Workers should not be fearful when they have been injured, but bold enough to report the injury. Those who report any form of injury should be supported, through advice and counsel. This will assist in stifling injury occurrence in the construction industry.

CONCLUSION AND RECOMMENDATIONS

The studies reviewed had different combination of predictors of construction workers injury. This was as a result of a range of study focus from roof fatalities to general view of injury occurrence on workers on site. Further, some of the studies had contrasting findings. For example Abbas et al., (2013) and Hinze et al., (2008) did not agree, that unsafe H&S behaviour predicted injury occurrence. Furthermore, no study has considered the safety leadership characteristics of the labourers and artisans.

Despite these gaps and contrasting findings in the reviewed literature, five broad injury predictors were determined. These predicators could be significant to construction workers injury occurrence on construction sites in South Africa and other parts of the world. These predictors are; work related variables, demographic variables, unsafe H&S behaviour, poor safety climate, and psychosocial factors.

Based on this identified themes the authors recommend the need to develop a predictive model that will predict construction worker injury occurrence in the South African construction industry, using logistic regression analysis. Logistic regression analysis is preferred to multiple regression analysis. This is because the dependent variable will be categorical, that is- asking if the worker was injured/or not injured. In such a case, multiple regression analysis is not suitable. The latter method is suitable when the dependent variable is continuous, that is in a Likert scale.

In developing this model the authors recommend the inclusion of the safety leadership characteristics of employees in relation to the other predictors identified of injury occurrence. The safety leadership characteristics are proposed because they influence the safety culture of the organization (Krause, 2005), which if not observed might lead to H&S injuries. It is therefore imperative to establish the safety leadership characteristics of the labourers and artisans and determine their influence on

occupational injury occurrence. The authors argue that in all construction workers, safety leadership characteristics may or may not exist. Hence, the characteristics that will be examined are:

- Credibility – what leaders say is consistent with what they do;
- Action orientation – leaders act to address unsafe conditions;
- Vision – leaders paint a picture for safety excellence within the organisation;
- Accountability – leaders ensure employees take accountability for safety-critical activities;
- Communication – the way leaders communicate about safety creates and maintains the safety culture of the organisation;
- Collaboration – leaders who encourage active employee participation in resolving safety issues promote employee ownership of those issues; and
- Feedback and recognition – recognition that is- soon, certain and positive encourages safe behaviour (Krause, 2005).

EXPECTED MANAGERIAL IMPLICATIONS

The envisaged model is an upstream management tool that will assist the construction companies H&S department in preventing workers injury at work. It is further contemplated that the model will determine the predictors of workers injury. This will assist top management in different organizations in South Africa and even in other developing countries to channel their H&S resources in the right area to stifle injury occurrence.

LIMITATIONS OF THE STUDY

The research presented in this paper has a number of limitations. First, the search for relevant studies was from 1995 to 2015. This search period could have omitted other important or seminal researches that were conducted prior to 1995. Second, the search engines that were used were three in number i.e. emerald, science direct and google. It is accepted if other search engines were used additional studies could have been obtained. Third, the limited number of keywords used in the search for relevant papers, is further limitation. If other keywords were used such as “causes/reasons of injury” this could have improved the number of relevant papers that were used. In light of these limitations the authors suggest the duration of search period to be increased to 1985, search engines and the keywords to be improved. These adjustments will ensure a comprehensive literature review is discussed and a robust model is tested.

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