ASOCSA2016-047

Assessing Safety Performance of Construction Workers in Gauteng, South Africa

Chioma Sylvia Okoro[1], Innocent Musonda[2] and Justus Agumba[3]
[1,2&3]School of Civil Engineering and the Built Environment
Department of Construction Management and Quantity Surveying
University of Johannesburg, South Africa

Abstract

Purpose of this paper
The health and safety (H&S) of construction workers has been a subject of much deliberation and justifiably so, since construction workers are invaluable in construction processes. The paper presents findings on an assessment of safety performance of construction workers in the Gauteng province of South Africa.

Methodology
A field questionnaire survey was conducted to collect data regarding safety performance on sites. Participants were selected using heterogeneity and convenience sampling techniques. Data were analysed using Statistical Package for the Social Sciences, version 22 software. Mean values and standard deviation were computed.

Findings
The results of the study indicated that medical treatment beyond on-site first aid and limited work days were minimal among the participants. It was also found that poorer safety performance with regard to risk assessment before engaging in tasks and accepting any kind of work prevailed.

Value
The current paper identifies potential areas for improvement in construction workers' safety performance. Construction employers and stakeholders

would be enabled to develop measures to check the identified safety indicators and behaviours among their workers.

Keywords: construction workers, safety performance, South Africa

1. INTRODUCTION

The construction industry contributes immensely to the development of many economies. The sector accounts for about 10% of the global gross domestic product (GDP), 7 – 10% of the GDP in developed economies and 3 – 6% in underdeveloped economies (Murie, 2007; Giang & Pheng, 2011; Osei, 2013). It contributes about 4% to the GDP of South Africa (Statistics South Africa, 2014). Not only is the industry a great contributor to GDP, but it is also the second largest employer worldwide (after agriculture) (WIEGO, 2014), accounting for 7% of global employment, approximately 180 million construction workers worldwide (Murie, 2007; WIEGO, 2014), which is made up of about 75% in developing countries. In South Africa, the construction sector employs approximately 8% percent of the total labour force (Statistics South Africa, 2014). The construction sector provides much needed employment for many of the world's poorest and most vulnerable people (WIEGO, 2014) and by so doing, alleviates poverty and improves living standards.

However, despite the undeniable contribution of the sector, its safety performance continues to be a source of concern. This is in spite of government efforts to deal with the problem in the form of legislations and regulations (Murie, 2007; Agumba, 2013). Proper attention to workers' health and safety is beneficial and crucial since construction workers, especially craft workers (who are the focus in this study) are important human resources involved in the actual construction activities. Hence, more consideration should be given to the subject since injuries and fatalities can be reduced, employability of workers can be improved and productivity increased. Assessing safety performance of construction workers is an important consideration for improving H&S performance in the industry (Huang et al., 2013).

Attention has been given to construction worker safety performance and behaviours, for instance, Melia & Becerril (2009) who studied unhealthy behaviour of workers outside the work environment; Fugar et al. (2010) who focused on ways to improve safety behaviour; and Lipscomb et al. (2015) who explored perceptions of carpenters about reporting work injuries only. It appears that little literature has been devoted to actual safety performance and behaviours of the workers on worksites which contribute to the reported poor safety performance records, especially in South Africa. The objective of the present study is to evaluate safety performance of workers on construction sites in the Gauteng province of South Africa. Information on

workers' safety behaviour would aid in identifying potential areas of improvement, which will inform subsequent development of strategies to stimulate proactive behaviours, and thus reduce the risk and occurrence of accidents on construction sites. Stimulating healthy behaviour is essential to achieve safe workplaces (Melia and Becerril, 2009; Fugar et al., 2010).

2. REVIEW

2.1 Construction health and safety performance

Attention has been given to occupational accidents in many countries for over 100 years (Hamalainen et al., 2009; Cameron & Duff, 2007). Although a decline in the number of fatal injuries in recent years has been indicated, statistics still report unacceptably high rates of accidents, injuries and fatalities (Cameron & Duff, 2007; BLS, 2013; Health and Safety Executive (HSE), 2014). Compared to other industries, the construction industry has the highest rates of fatalities and injuries, being responsible for 30 to 40% percent of world's fatal injuries (Murie, 2007; Construction Industry Development Board (CIDB), 2009).According to the International Labour Organisation (ILO), one in every six work-related fatal accidents occurs on a construction site (CIDB, 2009).

In Britain, the construction industry accounts for 27% of fatal injuries and 10% of reported major injuries (HSE, 2013). Provisional statistics from the HSE revealed indicated that there were 46 fatal injuries in construction in Britain, approximately 12% of total fatal injuries to both workers and passers-by (HSE, 2014). In the United States of America (USA), the sector accounted for approximately 18% of total fatal work injuries in 2012, having recorded a total of 775 fatal injuries (Bureau of Labour Statistics (BLS), 2013). In South Africa, the situation is no different. The building and construction sector is one of the high risk sectors. According to Emuze and Smallwood (2013), construction motor vehicle accidents alone were 984 in 2010 and 892 in 2011. Construction related fatalities total about 150 a year and the industry suffers about 400 accidents a year (Prinsloo, 2013). According to the Department of Labour, in 2010, there were 9858 accidents and 93 fatalities; in 2011, 8099 accidents and 50 fatalities were recorded, and 258 accidents and 56 fatalities in construction were reported in 2012, in the construction sector in South Africa (Prinsloo, ibid.).

It is notable that construction H&S performance is universally poor, even in industrialized countries. The status quo established from even unreliable statistics of accidents is unacceptable, specifically with the South African construction industry which has seen an increase in accidents in recent years (Musonda, 2012). There is a collective need to improve H&S performance in order to benefit all and sundry. Effective improvement strategies therefore need to be identified if the status quo is to be positively altered, especially since accidents cost human lives and incalculably

devastating economic effects. The economy, employers and insurance companies not only face directly related accident costs (such as medical, hospital and rehabilitation expenses, workers compensation payments, and higher insurance premiums or even loss of insurability), but also long-term follow-up costs (for instance, loss in wages, loss of morale, legal costs, training costs, loss of skill/efficiency, administrative time, costs to repair damaged property) which are less obvious and usually greater than direct costs (Thepaksorn & Pongpanich, 2014).

2.2 Measures of health and safety performance

Traditionally, safety performance has been measured by such metrics as the Occupational Health and Safety Administration (OSHA) record of accidents, injury and ill-health statistics (HSE, 2001; Hinze et al., 2013). However, it has been argued that measuring H&S performance by the frequency of accidents and injuries is not always appropriate (HSE, 2001). This is particularly true in settings where there is a low probability of accidents but where major hazards are present, such as construction worksites (HSE, 2001). Moreover, gross under-reporting of accident and injury statistics renders such historical records unreliable and deceptive as indicators of safety performance. In some organizations, under-reporting occurs probably because health rates as a measure, particularly when related to reward systems, can lead to such events not being reported so as to 'maintain' performance (HSE, 2001). Therefore, injury rates often do not reflect the potential severity of an event, merely the consequence; they reflect outcomes, not causes (HSE, 2001). This implies that some indicators may be trailing (also called lagging indicators), providing data about incidents after the fact (Hinze et al., 2013), whereas others may be prevailing (called leading indicators), potentially leading to an injury or incident (Biggs et al., 2009). Both leading and lagging indicators reflect safety performance (Hinze et al., 2013; Lingard et al., 2013).

Therefore, in addition to accidents, injuries and ill-health statistics, other safety performance indicators which are related to worker safety performance have been identified from various studies, although these studies dwelt heavily on safety management systems. These identified worker safety performance indicators include the following:

- Use of correct personal protective equipment (PPE) (Biggs et al., 2009; Construction Industry Institute (CII), 2014).
- Risk assessment. Identification of the tasks, hazards and the risks of a job prior to work enables implementation of protective measures to ensure that work is done safely (Campbell Institute, 2014).
- Number of reported incidents/reporting of incidents or close-calls (Hinze et al., 2013; Campbell Institute, 2014).

- Medical treatment beyond first aid (Biggs et al., 2009; International Council on Mining and Metals (ICMM), 2014). First aid involves a particular level of treatment (such as cleaning and covering of wounds, use of non-prescription medication, etc.; whereas medical treatment occurs when an injury or disease requires a higher degree of care and management to ensure a full recovery, for instance, treatment of fractures, suturing of wounds and prescribing and providing drugs to manage symptoms (ICMM, 2014).
- Restricted activity days. Loss of working capacity or inability to perform normal or routine work functions on the next calendar day after an injury reflects poor worker safety performance (ILO, 2003).
- Lost work days. Absence from work due to an injury, for more than three consecutive working days is considered serious and compensable (ILO, 2003; Cameron & Duff, 2007).
- Non-injury incidents or near-misses (Biggs et al., 2009; Hinze et al., 2013; CII, 2014).

According to Atkins (2011), the use of a set of safety performance indicators provides a greater indication of safety performance than concentrating on one measure in isolation (or indeed a small number of random measures). Good safety performance indicators should be quantifiable and permit statistical inferential procedures and should be valid and representative of what is to be measured (Roelen and Klompstra, 2012).
The interpretations are related to the system and its operational context (Herrera, 2012). The above-mentioned indicators relate to construction workers, prior to or after an incident, and were therefore adopted as measures of worker safety performance, in the current study.

3. METHODS

After an extensive survey of literature related to H&S performance in the construction industry, a 5-likert scale questionnaire was developed. Safety performance measures were adapted from existing studies (as reviewed above). The questionnaire contained questions enquiring about safety performance on construction sites. The identified items related specifically to those measures which could be associated with unhealthy eating, since this was the purpose of the main study. The questionnaire, which consisted of 10 items, was pilot-tested, reviewed and revised by experts before being self-administered to construction workers on construction sites. The participants, selected through heterogeneity and convenience sampling, included workers who were actively engaged in the physical construction activities as opposed to the site managers and supervisors. This group was chosen as they were the most susceptible to poor safety performance on construction sites. Purposive sampling is based entirely on the judgment of the researcher

and there is greater chance of personal bias, which could however, give good results if done with care (Fugar et al., 2010).
Out of a total of 220 questionnaires distributed, 183 were returned and used for the empirical analysis. Cronbach's alpha was used to assess the internal consistency reliability of the scale. The alpha index was 0.83, indicating good internal reliability (Pallant, 2013). The questionnaire was considered to be reliable and representative of what is to be measured (Roelen and Klompstra, 2012). The response categories were assigned 1, 2, 3, 4 and 5, for "on every project", "more than two times", "two times", "once before" and "never", respectively. Therefore, higher scores represent a higher safety performance. Mean (M) and standard deviation (SD) values were computed for the variables.

4. RESULTS AND DISCUSSION

Respondents were asked to indicate the extent to which statements regarding their safety performance on construction sites related to them. From the table, it can be seen that 78% of the participants had *never* been treated medically for injuries (beyond first aid on site) (M=4.63, SD=1.262) or been asked to do limited work after an injury(M=4.60, SD=1.418), respectively. With their highest recorded Ms, it can be deemed that medical treatment and limited work days were minimal among the participants, since higher scores represent better safety performance (as stated earlier). On other hand, *failure to wear PPE* (M=4.24, S=0.972)*, failure to consider possible risks in a task* (risk assessment) (M=4.05, S=0.871)*,* and *accepting any kind of work, not minding the risk involved* (M=3.69, S=0.951) recorded the lowest Ms, suggesting poorer safety performance.

Although a good percentage (67%) of the participants reported that they never failed to wear PPE, 33% reported otherwise. A possible explanation for the 33% responses could be that the workers felt uncomfortable wearing PPE while working. This view was articulated in Arcury et al. (2014) in which participants believed that wearing PPE made them uncomfortable and hindered their productivity and thus work safety was jeopardized.

It is noteworthy that 19% of the participants accepted any kind of work *on every project*, irrespective of the risk involved. It can be deemed that the participants in this category have no misgivings about engaging in dangerous tasks as long as they are employed. The construction industry has no difficulty attracting labour even where the wages are very low (ILO, 2001). This further suggests that construction workers are low-paid and probably have no choice but to take any job even without considering the risks involved, as evinced by the 10% who reported failure to consider possible risks on every project.

Table 1: Findings on safety performance of the study participants

Measures	Responses (%)					Mean	SD
	On every project	More than two times	Two times	Once before	Never		
	1	2	3	4	5		
Been treated medically for injuries (beyond first aid on site)	2	2	4	14	78	4.63	1.262
Been asked to do limited work after an injury	1	5	5	12	78	4.60	1.418
Been involved in incidents or near-misses	2	5	3	16	74	4.53	1.615
Been away from work for more than three days due to an injury	3	4	6	12	75	4.53	.994
Failed to report an accident or incident	3	5	4	13	75	4.52	1.048
Been injured at work	3	6	6	22	63	4.35	1.023
Been sick at work	2	8	8	25	58	4.29	.843
Failed to wear personal protective equipment (PPE)	6	9	7	11	67	4.24	.972
Failed to consider possible risks in a task	10	11	6	11	62	4.05	.871
Accepted any kind of work, not minding the risk involved	19	9	9	10	53	3.69	.951

It is also notable that the responses were concentrated on the "never" category. This suggests that the respondents can be deemed to have had no incidence with regard to safety performance on construction sites. Such work injury records may either reflect safe work conditions or under-reporting (Lipscomb et al., 2015). Workers may be inclined to conceal incidences for fear of repercussions from management or fellow workers. That 75% of workers "never" failed to report an accident or incident corroborates findings from Lipscomb et al. (ibid.) which reported that the same proportion of the participants felt that they could report work-related injuries without fear of retribution, while some (nearly half) considered it best not to report minor injuries. In many developing countries, many accidents and injuries go unreported (Fugar et al., 2010). Formal and informal policies and practices on jobsites could also influence injury reporting (Fugar et al., ibid. Lipscomb et al., 2015).

5. CONCLUSION

The study set out to assess the safety performance of construction workers. This objective has been met. By identifying aspects of safety workers may be lacking in performance,potential areas for improvement in construction workers' safety performance have been highlighted. Construction employers and stakeholders would be enabled to develop measures to check the identified safety indicators and behaviours among their workers. Policies (formal and informal) and incentives could be effective in encouraging and motivating construction workers to improve on their safety performance.

The study is not without limitations. Firstly, it includes only participants in one province of South Africa and so the results may not be generalizable. Secondly, the study employed a quantitative approach which does not reveal further information about the reasons for some unsafe behaviours (especially with regard to the leading safety indicators). Therefore, future studies could conduct a more in-depth study using qualitative or mixed methods. More investigation is required to validate or refute the skewed responses (the "never" category). Additionally, future studies could expand the number of workers and explore differences in safety behaviour among different construction trades.

REFERENCES

Agumba, J. N. (2013). A construction health and safety performance improvement model for small and medium enterprises. *Doctoral Thesis*. University of Johannesburg: South Africa.

Arcury, T. A., Summers, P., Rushing, J., Grzywacz, J. G., Mora, D. C., Quandt, S. A., Lang, W. and Mills, T. H. (2014). Work safety climate, personal protective use and injuries among Latino residential roofers. American Journal of Industrial Medicine, 58(1):69-76.

ISBN

Atkins, W. S. (2011). Development of suitable safety performance indicators for level 4 bio-containment facilities: Phase 2. Health and Safety Executive (HSE).

Biggs, H. C., Dingsdag, D. P., Kirk, P. J. and Cipolla, D. (2009). Safety Culture Research: Leading indicators and the development of safety effectiveness indicator in the construction sector. *Proceedings of the 5th International Conference on Knowledge, Technology and Society,* 30Jan – 1 Feb., 2009. Huntsville, Alabama: Unites States of America.

Bureau of Labour Statistics. (2013). National census of fatal occupational injuries in 2012: Preliminary results. *News release.* Department of Labour: United States of America.

Cameron, I. and Duff, R. (2007). A critical review of safety initiatives using goal setting and feedback. *Construction Management and Economics,* 25(5):495-508.

Campbell Institute. (2014). Practical guide to leading indicators: Metrics, case studies and strategies. National Safety Council: United States of America.

Construction Industry Development Board (CIDB). (2009). Construction health and safety in South Africa. Construction Industry Development Board: South Africa.

Construction Industry Institute (CII). (2014). Measuring safety performance with active safety leading indicators. CII.

Emuze, F. and Smallwood, J. (2013). Construction vehicle accidents in SA: causes and impact. Proceedings of the 29th Annual conference held in Reading, United Kingdom. Smith, S. D. and Ahiaga-Dagbui, D. D. (eds.)

Fugar, F. D. K., Darkwa, J. O., Ohene, E. and Donkor, D. (2010). Encouraging safety work behaviour of construction workers: Which is the best approach? *The Surveyor*, 3(1).

Giang, D. T. H. and Pheng, L. S. (2011). Role of construction in economic development: Review of key concepts in the past 40 years. *Habitat International*, 35(1):118-125.

Hamalainen, P., Saarela, K. L., and Takala, J. (2009). Global trend according to estimated number of occupational accidents and fatal work-related diseases at region and country level. *Journal of Safety Research*, 40:125-139.

Health and Safety Executive (HSE). (2001). A guide to measuring health and safety performance. HSE Books.

Health and Safety Executive (HSE). (2013). Health and safety in construction in Great Britain: Work related injuries and ill health. HSE Books.

Health and Safety Executive (HSE). (2014). Statistics on fatal injuries in the workplace in Great Britain. HSE Books.

Herrera, I. A. (2012). Proactive safety performance indicators. *Doctoral Thesis*. Norwegian University of Science and Technology, Norway.

Hinze, J., Thurman, S and Wehle, A. (2013). Leading indicators of construction safety performance. *Safety Science*, 51(1):23-28.

Huang, Y. Zohar, D., Robertson, M. M., Garabet, A., Lee, J. and Murphy, L. A. (2013). Development and validation of safety climate scales for lone workers using truck drivers as examplar: Transportation research part F. *Traffic Psychology and Behaviour*, 12:5-19.

International Council on Mining and Metals (ICMM). (2014). Health and safety performance indicators. ICMM, London: United Kingdom.

International Labour Organisation (2001). The construction industry in the 21st century: Its image, employment prospects and skill requirements. Geneva: ILO.

International Labour Organization (ILO). (2003). Safety in numbers: Pointers for global safety culture at work. ILO, Geneva.

Lingard, H., Wakefield, R. and Blismas, N. (2013). "If you cannot measure it, you cannot improve it": Measuring health and safety performance in the construction industry. Proceedings of the 19th CIB World Building Congress, 5-9 May, Queensland University of Technology, Brisbane: Queensland.

Lipscomb, H. J., Schoenfisch, A. L. and Cameron, W. (2015). Non-reporting of work injuries and aspects of jobsite safety climate and behavioural based safety elements among carpenters in Washington State. American Journal of Industrial Medicine, 58(4):411-421.

Melia, J. L. and Becerril, M. (2009). Health behaviour and safety in the construction sector.*Psicothema*, 21(3): p.427+

Murie, F. (2007). Building safety: An international perspective. *International Journal of Occupational and Environmental Health,* 13:5-11.

Musonda, I. (2012). Construction health and safety performance improvement: A client-centred model. *Doctoral thesis.* University of Johannesburg, South Africa.

Osei, V. (2013). The construction industry and its linkages to the Ghanaian economy – Policies to improve the sector's performance. *International Journal of Development and Economic Sustainability*, 1(1):56-72.

Pallant, J. (2013). SPSS survival manual: A step by step guide to data analysis using IBM SPSS. 5th edition. Allen and Unwin, Australia.pp. 101, 193, 199 and 207.

Prinsloo, L. (2013). Death and injury stalk construction sites. *Business Times*. South Africa.

Roelen, A. L. C. and Klompstra, M. B. (2012). The challenges in defining aviation safety performance indicators. Preprint for PSAM II and ESREL, 25-29 June, 2012, Helsinki: Finland.

Statistics South Africa. (2014) Gross domestic product: Second quarter. *Statistical Release P0441.* Pretoria: Statistics South Africa.

Statistics South Africa. (2014). Quarterly labour force survey: Quarter 4. *Statistical release P0211.* Pretoria: Statistics South Africa.

Thepaksorn, P. and Pongpanich, S. (2014). Occupational injuries and illness and associated costs in Thailand. *Safety and Health at Work*, 5(2):66-72.

Women in Informal Employment: Globalizing and Organizing (WIEGO). (2014). Construction Workers in the Informal Economy. WIEGO.