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Abstract

Steel reinforcement work in building construction sites as a component of the larger construction industry is an important contributor to the overall social and economic development of the world. Steel reinforcement work therefore continues to impact negatively on the health of workers in building construction sites thus raising stakeholders concern. This study investigates the management of steel reinforcement works procedures impact on the health of workers in building construction sites. The objective of the investigation was to establish how management of steel reinforcement work procedures impacted on the health of workers in building construction sites. The study was premised on the hypotheses that there was no statistically significant relationship between management of steel reinforcement work procedures and the health of workers in building construction sites. Descriptive cross-sectional method was used for data collection. Testing for reliability of data collection instrument was done by use of Cronbach alpha formula. Data analysis and hypothesis testing were by descriptive and inferential statistical methods. Data presentation was in frequencies, tables, charts, and graphs. The main results of the investigation were that management of work procedures had the impact on the health of steel reinforcement work procedures in building construction sites. The Pearson correlation coefficient (r) had a positive value of 0.24 which was greater than 0.2 but not more than 0.4, indicative of a moderate positive linear correlation between SRW procedures and workers' health. From descriptive results it indicates that more than 67 % of the respondents were of the opinion that steel reinforcement work procedures in BCS affected their safety, health and wellbeing. While from inferential results indicates that a P value of 0.01 which was less than 0.05 and very close to 0 was attained implying that there was a statistically significant correlation between SRW procedure and workers' health in building construction sites. This implied that the existing management system for protection and safeguarding the health of steel reinforcement work procedures in building construction sites in Nairobi County, Kenya was out of balance. Review of this system in response to emerging building and construction sector specific needs was therefore recommended.

Keywords: *Management, Steel, Reinforcement, Procedure, Health, Building, Construction, Site.*

1.1 Background of Study

Work procedures in building and construction sites are a series of management established steps to be followed in accomplishing a task or group of asks so as to achieve a pre-determined outcome without harm to the health of workers. They include arranging tasks in the best sequence of steps to obtain optimum use of people, equipment, tools and materials. A number of research outcomes reviewed identified several workplace injuries and health problems suffered by workers attributable to work procedures. For instance, Rwamamara (2010) observed that force, posture, repetition and vibration often results into workers' body injuries. Simonies, St –Vincent & Chicoire (2003) observers that severity of such injuries depended on the body parts involved duration, frequency and intensity of exposure.

Globally the building and construction industry accounted for 7 % of total employment, 28 % of industrial employment, contributed more than 10 % to the gross domestic product (GDP) and more than 50% to the gross fixed capital formation of the European Union (Keith & Ankrah,2013). The construction chart book (2013) indicated that the building and construction industry contributed 3.5% to the total gross domestic product of the United States in 2010 compared to 4.9% in 2005.

In Kenya, the building and construction industry is among the key transformational economic growth and social development drivers as espoused in Kenya vision 2030 (G.o.K., 2016). It contributed an average of 6.35% to the country's gross domestic product between 2012 and 2017(G.o.K, 2016).

1.2 Problem Statement and Justification

The building and construction industry is complex and dynamic involving many players at various stages of development. The overall adverse effect of this phenomenon on workers' health in BCS has raised concern among stake holders such as project designers, building and construction site managers, clerk of works, SRW trade supervisors and workers on how to minimize or eliminate these risks in workplaces.

A survey report by EWCS (EU-27, 2005) showed that 35% of all building and construction industry workers within the European union were exposed to safety and health risks associated with handling of heavy loads, with a sectorial breakdown of the report indicating that 64% of them worked in the BCS (EWCS, 2005). 25% to 40% of work-related deaths in industrialized countries occur in building and construction sites and 30% of construction workers suffer from various musculoskeletal disorders (ILO, 2005). A study by Messing, Stock, & Tissot (2009), revealed that occupational health risks and injuries are a common feature among building and construction workers. Huhtala (2013) noted that good workplace ethics resulted in improved health of the workers in workplaces. Konchar & Sanvido (1998) concluded that the fragmented nature of the traditional construction industry where design is separated from construction impairs effective planning, management and monitoring of safety and health activities in building construction sites.

According to the study by Rwamamara (2005) observed that construction processes account for some of the highest occupational injuries and fatalities in both developed and developing nations. Kariuki (2012) opines that existing OSH administrative and enforcement instruments are apparently not sufficient or effective tools for protective management and control of the workplace health in Kenya. Kirombo (2012) asserted that outdated legislation, inadequate controls and enforcement, unethical practices and easy entry by unqualified people into the construction industry in Kenya has significantly contributed to the deterioration of health of workers in BCS. Doran (2004) observed that the ethical state of the construction industry in America was tainted by unethical acts.

Construction sites are unique and specific in terms of project promoters, financiers, designers, contractors, location, project design, size, complexity, construction time and budget (Baccarini 1996). SRW in BCS as a component of the larger building and construction industry is a major contributor to the overall social and economic development of a nation. Due to its temporary nature and unpredictable workloads, SRW in BCS in Kenya are often executed under informal labour arrangements where workers' safety and health compliance requirements are largely not strictly observed (Mitullah & Wachira, 2003).

Workers executing SRW in BCS are regularly exposed to various work related risks (ILO, 1998). Amongst this include intensive force exertion, awkward postures, repetitive work, body vibration and frequent unethical workplace practices detrimental to steel reinforcement workers' health. Manifest lead indicators to this include frequent workers' complaints about unusual tiredness, fatigue and pain in various parts of the body, resulting to low esteem, anxiety, lack of concentration, repeated task performance mistakes, increased irritability, poor workplace communication and co-operation, low productivity and absenteeism by the workers. This is in spite of there being OSH monitoring, evaluation and enforcement mechanism intended to minimize and

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control such occurrences in workplaces in Kenya (OSHA, 2007). In as much as adoption of new building technologies and innovations have been demonstrated to be effective in reducing or eliminating these risks, the building and construction industry is challenged with slow uptake of these changes (Allmon, et al., 2000; Goodrum & Haas,2004 & Harty, 2008).

ILO (2010), regional and national bodies like EWCS (EWCS, 2005) and NIOSH (2009) as well as international and local researchers has raised concern on the impact of these factors on the health of workers in the construction industry (Kheni, 2008; Muiruri, 2012). These concerns have also drawn attention of other stakeholders outside the construction industry who have organized seminars and workshops to discuss these matters (ICPAK, 2018). Whereas some research work has been done on the management of health and safety matters in building and construction sites generally, none of them has addressed the issue of management of SRW and its impact on workers' health in building and construction sites (ILO, 2013; Kibe, 2016 & Nohath, 2018). This investigation was therefore to address issues of management of steel reinforcement work and its impact on the health workers in BCS as a case study; Nairobi county, Kenya.

1.3 Research Question

The investigation was to examine the impact of management of steel reinforcement work procedures on the health of workers in BCS in Nairobi County Kenya by addressing the following question: How does management of SRW procedures impact on the health of steel reinforcement workers in BCS in Nairobi County, Kenya?

1.4 Research Objective

Establish how management of steel reinforcement works procedures impact on the health of steel reinforcement workers in building and construction site in Nairobi County, Kenya.

1.5 Hypotheses

HO_a: there is no significant relationship between the management of SRW procedures and the health of steel reinforcement workers in building and construction site.

H_b: there is a statistically significant relationship between management of SRW procedures and the health of steel reinforcement workers in building and construction site.

2.0 Literature Review

2.1 Effects of Steel Reinforcement Work Procedures on Management of Health of Workers

All Steel Reinforcement Works (SRW) procedures in Building and Construction Site (BCS) are designed for execution in compliance with established work procedures, relevant laws, drawings, specification standards and codes of practice (Kwamina & Small, 2013).

To realize this objective, developers, designers and builders are to plan, design, incorporate into bid documents, manage, regularly monitor and review workplace safety and health matters (Rwamamara, 2005). Effective scheduling should consider work methods; task autonomy, variety, significance, identity and feedback; knowledge characteristics such as job complexity, information processing, problem solving, skill variety and specialization; social characteristics such as social support, interdependency, interaction outside organization, performance feedback from others and work context in terms of workplace ergonomics, work conditions and equipment (Humphrey, Nahrgang & Morgeson, 2007). Fernandez and Marley, (1998); Goh, (2010) observes that matching of designs of workplaces, tools machinery and equipment, systems and environment with workers physical, physiological, biometrical and psychological capacities will achieve the desired standards of safety and health of workers in workplaces. The overall objective of these ergonomic actions is to fit tasks to workers and not workers to tasks. Inappropriate task and tools design exposes workers to workplace risks such as excessive force exertion, awkward posture, motion repetitiveness and excessive vibration which would impact on the health of workers (Rwamamara, 2005). The nature and severities of the impact depends on the risk type, part of the body involved, exposure duration, frequency and intensity (Simonies, St -Vincent & Chicoine, 2003). The Steel Reinforcement Works procedure is characterized with; force, posture, repetitiveness, and vibrations.

2.1.1 Force

Many SRW activities involve use of varying force loads depending on the task needs, body part and joints involved. The more force exerted on the body especially at close intervals, the greater the body stress levels leading to muscle tension, body fatigue, and increased risk of shoulder, neck, wrist or hand and low back injuries (CCOHS, 2017). Excessive use of force in task execution leads to muscle overuse and strain which, if unchecked, would lead to workers' health disorders (Vorvick et al., 2012).

Excessive force in executing steel reinforcement tasks has been linked to employment of inappropriate tools and equipment (Kirobo, 2013). Workplace health problems are also strongly linked to the degree of intensity or working at tight deadlines (EWCS, 2000). Heavy workloads require employment of youthful persons as the performance of older ones progressively diminishes due to continued muscle degeneration. Consideration of age as a risk factor for workers executing SRW in BCS is therefore important where the question of whether health problems are occasioned by prolonged exposure of the worker to work related risk factors or it is simply a matter of aging where muscle degeneration has occurred (Ohlsson et al., 1994).

2.1.2 Posture

Posture refers to the neutral, awkward or static position or bearing of the body whether characteristic or assumed for a special purpose (NIOSH, 2009; Korwowski, 2001). The ultimate posture adopted by a worker depends upon the work context, shape of tool and condition of use, access or ease of product reach and environmental conditions of the workplace (Simoneau, St-Vincent & Chicoine, 1996). In neutral postures, muscles are at or near their resting length with joints naturally aligned (Warren &Morse, 2008). Awkward postures occur when joints are not in neutral positions as in bending neck forward, raising elbows above the shoulder line, bending wrist, bending back forward or squatting (Simoneau *et al.*, 2003; NIOSH, 2009). Fathallah, Meyers & Janowitz (2004), stated that both work and equipment design features are the main causes of workers' health problems associated with awkward posture in construction workplaces. Awkward posture places excessive force on joints and overload the muscles and tendons around the affected joints resulting to worker's body injuries (Middlesworth, 2012). Static postures involve little or no body movement which limits blood flow and oxygen circulation in the body resulting to worker discomfort and fatigue (ILO, 1998). Various studies have positively linked both awkward and

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static postures to workers' health disorders such as low back, neck and shoulder pain (Rwamamara, 2010).

2.1.3 Repetitiveness

Repetition movement refers to the recurrence of an action or a sequence of motions by the worker when performing a task using the same part of the body over a period of time (Rwamamara, 2007). Work is considered repetitive when the duration (cycle) of a task motion recurs after every 30 seconds or less over a prolonged period of time. Where such cycles are longer than 30 seconds, the task motion is considered repetitive when the worker is performing the same motion for more than 50% of the cycle (Rafeemanesh *et al.,* 2015). Repetitive activities such as continuously holding of hand tools without adequate recovery time results in workers' muscle overuse, strain and fatigue. Any part of the body involving repeated musculoskeletal movement without adequate recovery time is at risk of injury. Rest or stretch breaks facilitates increased blood circulation and oxygen supply to all parts of the body and is necessary in reduction of fatigue (Simoneau et al., 2003).

2.1.4 Vibration

Vibration refers to involuntary oscillatory motion of either a specific part of a worker's body in contact with a vibrating object or whole body caused by an object or objects within the environment in which the worker is carrying out the task. Injury occurs when workers' exposure to vibration magnitude, frequency and duration exceeds the recommended safety limits set by a regulator or manufacturer of a tool or equipment in use (Brauch, 2015). Workers on a vibrating platform absorb most of the vibration energy through their legs, knees and trunks causing discomfort and injury (Kjellberg, Wikstrom, & Landstrom, 1994; Paddan et.al., 1999).

The adverse effects of adoption of inappropriate SRW procedures, use of excessive force, assuming awkward or static positions, performing repetitive work without break and body vibrations on the health of workers include; fatigue, body pain, swelling, numbness, stiffness and tingling effect leading to low productivity, medical claims, absenteeism and low work concentration (OSHA, 1999; Bond, 2010; Grzywacz, & Dooley, 2003). Fernandez & Goodman (1998) observes that application of ergonomic principles in the workplace increases productivity, improves safety, health and wellbeing of workers; enhances OSH compliance standards, improves job satisfaction, decreases absenteeism rate and lowers worker turnover and lost time at work.

2.2 The Workers Health

The Workers health is a person's state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity (WHO, 1948). Literature reviewed raised a number of health concerns for workers such as injuries, fatigue and burnouts, stress, low worker concentration, motivation and self-esteem, low job satisfaction, absenteeism and sick-offs in workplaces. Physical, mental and social wellbeing must therefore be the goal towards which we all work as essential means of fostering economic development, poverty reduction and overall social cohesion both nationally and locally (Krekel, et al., 2018).

2.3 Theoretical Framework of Systems Theory

The investigation was based on principals of Systems Theory (Von Bertalanffy, 1968), conceptual framework and Qualitative Data Analysis Models for both frameworks adopted from Littlejohn (1999). LeCompte & Preissle (1993) observed that a system is "a group of things relating and interacting between themselves, within their environment and making up a larger whole with function or purpose of the elements within the group affecting the function or purpose of the group as a whole" Johnson, Kast & Rosenzweig (1963) opines that a system is made up of four components; the input, transformation, output and feedback. The Systems theory helps us understand and explain various social and behavioral systems and processes encountered in daily lives (Infante, 1997). Smith & Sainfort (1989) suggests that every workplace has a work system defined by its environment, organization, tasks, technology and the human resource necessary to perform the tasks. Where connections or interaction between components is out of control, out of balance or broken, the system adjusts to the new demands and where not possible, the systems or its components' wellbeing and performance suffers.

The SRW is a dynamic organizational sub-system constantly interacting with its environment and interrelated parts working in balance with each other to accomplish the enterprise and individual participants' objectives and goals. The SRW sub-system is part of the larger construction site sub-system operating within a country's building and construction industry system which forms part of the global construction industry system. When hazards and risks are not effectively identified, assessed, and timely preventive measures taken in compliance with OSH laws and regulations, the interaction with and connections between the SRW sub-system components are disrupted.

2.4 Conceptual framework

A conceptual framework is a visual or written document explaining key factors of an investigation such as concepts, strategy, variables and their presumed relationships (Miles & Huberman, 1994). Rukwaro (2016) defines a concept as an image or symbolic representation of an abstracted idea. A group of ideas which explains why things happen the way they do forms constructs which are notions or images conceived for a given study but cannot be directly observed. Establishment of concepts and related constructs of a study aids in showing possible connections between different constructs which, when considered together forms a conceptual framework for the investigation.

The systems theory provided a conceptual framework for visualizing internal and external factors in management of steel reinforcement work that impacted on the health of steel reinforcement workers in BCS as a sub-system within the building and construction system. The literature reviewed revealed that though a lot of research has been done on safety and health matters in workplaces, designing work to fit the worker as a means of achieving positive workplace performance without risk to workers' health has been difficult to attain. The problem has been attributed to low-compliance with work procedures; failure to incorporate safety and health matters in the planning, managing and monitoring of building construction projects; unsatisfactory implementation or enforcement of occupational safety and health legislation and policies; poor workplace ethics, untamed work environment and related steel reinforcement work challenges. Whereas many conclusions and recommendations have been made on how to address these shortcomings, worker injuries and deteriorating health conditions continue to be witnessed in workplaces world over. This therefore calls for a comprehensive critique of existing research work so as to identify existing gaps and recommend new approaches to resolving the matter. Mthalane (2008) noted that where worker's personal characteristics such as physical and mental capacities, experience and skills, education and training, age and sex, needs and aspirations are not balanced against job and equipment design, work environment and work organization, the health of workers in workplaces is affected. A well-defined management system, application of ergonomic principals in task and workplace design together with recognition and promotion of workers' high efficacy is perceived to be logical means of improving workers' safety and health in workplaces (Bandura, 1997). And therefore information obtained from the literature reviewed was used to formulate hypotheses, define, identify and classify types of conceptual variables (constructs) for investigation and their relationships before categorizing and aligning them to the research objectives. Established conceptual variables were subsequently defined before being operationalized to create a measure of related constructs for purposes of informing the problem statement and guiding the investigation accordingly. In Figure 1 below Indicates the conceptual framework model for the study showing considered variables and relationships among them.

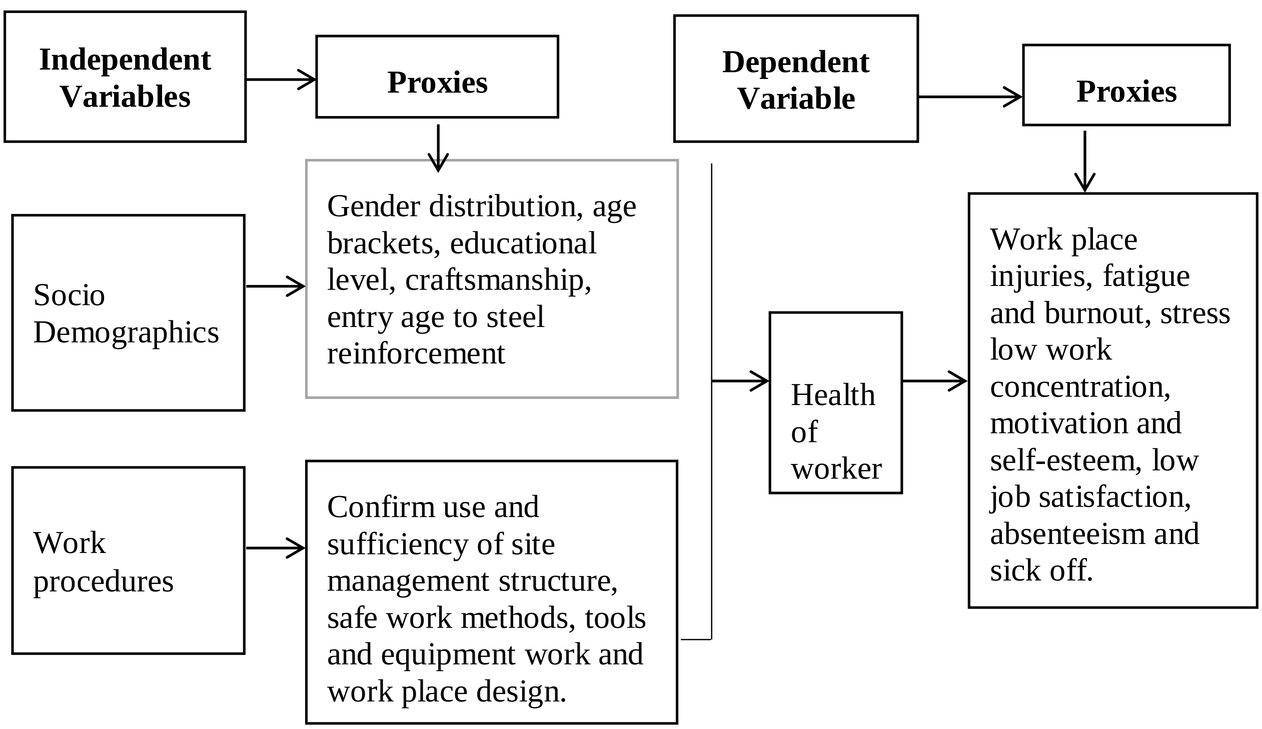

Figure 1: Conceptual Framework Model

Adopted from Little John (1999); Mthalane (2008) and Mugenda & Mugenda (2003).

3.0 Methodology

This study was based on a multiple-case study research design which is an empirical research inquiry on a contemporary phenomenon, within the real-life context which the researcher has no control over (Rukwaro, 2016; Mugenda & Mugenda, 2012;Yin, 1994).This was considered to appropriately address the research objectives and questions by enabling the researcher to collect necessary information to explain relationships between variables in management of SRW and their impact on the workers' health within BCS sites. Further, the multiple –case study has the advantage of covering the study objectives and allowing direct case replication including analytical external generalization of its results (Yin, 2003). Analytical generalization is the generalization of a particular set of results to some broader theory (Yin, 1994., Cavaye, 1996). The evidence from multiple cases was therefore considered to be more compelling, robust and therefore acceptable than single case evidence (Herrotta & Firestone, 1983).

Various practical and ethical techniques and instruments were applied to collect data from the study sample for analysis, interpretation, explanations and linking conclusions drawn to the initial study questions including allowing the researcher to transfer or generalize the conclusions to other settings or populations (Yin, 2003 & Kemper et al., 2003).

The study was conducted within the Nairobi County physical boundaries as shown in locational and county maps contained in appendices 5 and 6 of this study. Nairobi County was preferred because it is the capital and largest city in Kenya and second largest in the African Great Lakes region (World Population Review, 2017). It is the largest and most established commercial center in Kenya with approximately three and half Million inhabitants and home to about 1,758 (38.7%) out of the 4,543 registered contractors undertaking building construction works of various sizes and complexities in Kenya (G.o.K., 2016). Lastly, Nairobi County had some of the best and most accessible facilities for the research and was therefore the best area of choice for the study within the available time and budget constraints.

The primary sources of data for the study included questionnaires, interviews, observations, site records and physical artifacts (Yin, 2009). The secondary sources of data were documentary materials such as textbooks, manuals, journals and publications, past studies, libraries and internet (Rukwaro, 2016).

The unit of analysis for this study was building construction sites in Nairobi County which was the focus of the research inquiry (Yin, 2003; Babbie, 2001 & Mugenda & Mugenda, 2012).

The population for the study was the total number of steel reinforcement workers in building construction sites in Kenya. The target population was the study population listed in specific sites in Nairobi County.

Stratified random sampling technique was used because the study population was not homogeneous and could be subdivided into groups or strata to obtain a representative sample (Kothari, 2011; Mugenda & Mugenda, 2012). Stratified random sampling involved dividing the population into homogeneous subgroups and then taking a simple random sample in each subgroup for reliable estimates in each stratum and for the population as a whole (Cooper & Schindler, 2003). This sampling strategy was preferred because the target population was heterogeneous and not very much widely spread geographically.

Due to their dynamic, unique, complex and temporary nature, obtaining an updated and reliable database of active steel reinforcement work construction sites in Nairobi County being a challenge, a list of NCA registered and licensed building construction firms was obtained and used as a viable basis for selecting legitimate BCS for the study (G.o.K, 2016). This was because all steel reinforcement work was being carried out in BCS under the overall management of NCA registered building construction firms. With the probability of each registered firm managing one steel reinforcement building construction site, the total number of these firms was considered representative of the number of BCS of interest to this study. This approach accorded equal chances to workers for registered firms in all categories to be selected. However, no more than one building construction site under the management of one firm was considered. This was to avoid the error of duplication of steel reinforcement management styles in those sites.

Out of the 6,917 NCA Nairobi county registered and categorized building construction firms licensed to carry out business in Kenya, 196 of them fall under category NC1 and 2; 1,311 under category NCA3 to 5 and 5,410 under category NCA 6 to 8 as listed in the Kenya Gazette, Vol.CXVIII-No.41 of 15th April 2016, pp1415-1755.

To arrive at the number of steel reinforcement work building construction firms for sampling, the formulae n = (z2pq)/d2 were applied, where:

n = the desired sample size when the target population is > 10,000.

z = standardized normal deviations at a confidence level of 95% which is 1.96.

p= the proportion in the target population that assumes the characteristics being sought.

In this study, a 50:50 proportion was assumed which is a probability of 50% (0.5).

q = The balance from p to add up to 100%. That is 1-P, which in this case will be 1- 50% (0.5).

d = Significance level of the measure, that is at 90% confidence level the significance level is 0.1. This was in line with Mugenda & Mugenda (2003) statistical technique for selecting a sample from a population of less than ten thousand. Using the above formulae, the number of building construction firms undertaking steel reinforcement work to be sampled was calculated as below.

n = (1.962 X1.962 X 0.5 X 0.5)/ (0.1)2 = 96.

However, the target population in this study was less than 10,000, thus the sample size of 96 was adjusted using the formula below (Mugenda & Mugenda, 2003).

nf = n/(1+n/N); where:

nf - is the desired sample size when sample size is less than 10,000.

n - is the sample size when the target population is more than 10,000.

N- is the target population size.

nf = n/(1+n/N) = 96/ (1+96/6,917) =95.

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Using the above formulae, the number of registered and licensed building construction firms to be sampled was reduced to Ninety-Five (95) and thereafter proportionate stratified random sampling technique was used to select them from the strata. By apportioning the registered and licensed building construction firms in every stratum, the number of registered and licensed building construction firms to be sampled in every stratum were calculated as follows;

NCA 1 and 2: (196), 196/6917 x 95 = 3.

NCA 3 and 5: (1311), 1311/6917 x 95 = 18.

NCA 6 and 8: (5410), 5410/6917 x 95 = 53.

This gives a total of 74. The sample distribution of the number of registered and licensed building construction firms was as shown in Table 1

Table 1: Sample Distribution for Companies and Respondents

Classified site type	Targeted construction sites selected	Stratum sample size	Stratum Percent
NCA 1-2	196	3	4.05%
NCA 3-4	1311	18	24.33%
NCA 6-8	5410	53	71.62%
Total	6917	74	100%

Source: G.o.K, 2016

The above stratum sample size of 74 relates to registered and licensed building construction firms with the probability of each owning and managing a minimum of one building construction site, the optimum total number of BCS for the study across the strata was therefore 74 as shown in table 3.1 above. With the research being a multiple case study, 74 BCS were considered too large for the purpose. Whereas reviewed literature does not indicate the ideal number of cases for multiple case studies (Yin, 1994; Patton, 1990.P, 184), 20 information- rich cases across the strata were considered sufficient for the study and therefore selected using purposive sampling technique (Rowley, 2002). The selection was guided by the available budget and time constraints for the study. Using the stratified cluster stratum percentage shown in Table 3.1 the distribution of the selected sites proceeded according to stratified categories as follows NCA 1-2 4.05% * 20 = 0.81, NCA 3-4 24.33% *20=4.87 and NCA 6-8 71.62% *20 =14.32 as shown in Table 2.

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Table 2: Number of Building Construction Sites

Classified site type	Stratum Percent	Stratum sample size	Stratum sample number selected
NCA 1-2	4.05%	0.81	1
NCA 3-4	24.33%	4.87	5
NCA 6-8	71.62%	14.32	14
Total	100%	20	20

Source: G.o.K, 2016

The sample numbers required for each stratum were rounded off to whole numbers as shown in table 2 above since it is not feasible to work with fractions of sample sizes in this regard.

From the 20 multiple case studies targeted for sampling, a total of 20 respondents were selected in each building construction site as follows: site manager 1, clerk of works 1, steel trade supervisors 2, sorting and straightening 2, measuring 2, cutting and bending 4, assembling 2, and installation 6. The respondents were identified and selected due to their particular traits of interest essential for the study. The site manager was selected because of his role in enforcement of company policy and overall building construction site management, clerk of works (COW) due to quality assurance and control responsibilities on site, trade supervisors due to their role in overseeing steel reinforcement work, task allocation and supervision of workers, each in accordance with tasks assigned to them. The total number of respondents for the study was calculated as follows: Number of construction sites sampled (20) *Number of workers, supervisors and Managers (20) =400, and distributed as follows.

NCA 1-2 sites: stratum sample number (1) * number of respondents (20) =20

NCA 3-4 sites: stratum sample number (5) * number of respondents (20) =100

NCA 5-8 sites: stratum sample number (14) * number of respondents (20) =280

Total =400

This number was adjusted from 400 to the desired study sample size of 200 respondents by using the formulae (n = (z2pq)/d2) and further enhanced by formulae nf =n/(1+n/N). This is in line with Mugenda & Mugenda, (2003), statistical technique for selecting a sample from a population of less than ten thousand. The adjusted stratum respondent size was computed as follows.

NCA 1-2 sites: (20), 20/400*200 =10
NCA 3-4 sites: (100), 100/400*200 =50
NCA 5-8 sites: (280), 280/400*200 = 140
Total 200

Table 3: Adjusted Respondents' Sizes per Stratum

Classified site type	Stratum respondents size	Sample respondents sizes
NCA 1-2	20	10
NCA 3-4	100	50
NCA 6-8	280	140
Total	400	200

Source: G.o.K, 2016

Data was collected using interviews, questionnaires, observations and building and construction sites.

Descriptive analysis of the information was subsequently carried out to establish a logical chain of evidence by examining and understanding data trends and patterns through triangulation, data convergence and other methods of developing logical relationships (Cooper & Schindler, 2011). Inferential statistical tests were used to examine and establish relations between variables and interrelationships between different parts of the data. Pearson correlation coefficient was used for measuring linear correlation between two variables for relations, the closer the coefficient values were to 1.0, the higher the correlation. The significance of relationship between variables were measured using p values, the closer the value was to zero, the higher the significance. Pearson correlation method was preferred because of its appropriateness in measurements taken from an interval scale. The method was preferred because of its characteristic of measuring relationships between two categorical variables. And finally, short discussions and explanations were included so as to give meaning to the data analysis outcomes obtained.

4.0 Findings and Discussions

A total of 143 valid responses were received comprising 125 workers and 18 supervisors, translating to a response rate of 71.5%. According to Mugenda & Mugenda (2010), 50% to 60% response rate is considered sufficient, 61% to 70% good and above 70% excellent. The obtained response rate of 71.5% for the study was therefore good for the analysis to be undertaken.

4.1 Demographic Profile of Respondents

Table 4: Gender Distribution

	Frequency	Percent	Frequency	Percent
	Workers		Supervisors	
Male	118	94.4	12	66.7
Female	6	4.8	6	33.3
Total	125	100.0	18	100

Source: Author, 2019

In the workers' category, a total of 95% respondents were male while in supervisors' category, 66.7% respondents were male. The statistics show that majority of employees in steel reinforcement work in BCS were male, suggesting that efforts of various gender mainstreaming campaigns have not been successful in this respect.

Table 5: Age Bracket of the Respondents

	Age	Frequency	Percent
Workers	18-28 years	33	26.4
	29-40 years	64	51.2
	41-60 years	28	22.4
	Total	125	100.0
Supervisors	18-28 years	5	27.8
	29-40 years	9	50
	41-60 years	4	22.2
	Total	18	100

Source: Author, 2019

The results indicated that 78.6% of the respondents were between 18 to 40 years and 22.4% between 41 to 60 years of age implying that majority of workers in SRW were youthful. This outcome was supported by Ohlsson et al. (1994) who observed that age is a risk factor for worker's health. Youthful age group employees are suited for tasks requiring force exertion and frequent repeat motions as the older ones get weaker with continued muscle degeneration.

Table 6: Education Level

	Frequency	Percent	Frequency	Percent
	Workers		Supervisors	
Primary school	36	28.8	3	16.7
Secondary School	82	65.6	8	44.4
College	5	4.0	5	27.8
University	2	1.6	2	11.1
Total	125	100.0	18	100

Source: Author, 2019

The workers' Literacy levels are a key aspect in management of steel reinforcement work as is the basis for determining the type and level of induction and training programs requirement, influences worker learning and communication skills, ability to take instructions and effective perticipation in management and decision making in workplaces (OSHA, 2007). The statistics show that majority of respondents, 71.2% workers and 83.3% supervisors had attained secondary school level of education and above, indicative of their ability to effectively read the bar bending schedule and perform basic math, communicate, take instructions, learn and participate in management and decision making on workers health in their workplaces.

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Table 7: Craftsmanship

	Frequency Supervisors	Present	Frequency Workers	Present
Apprentice	3	16.7	40	32
Certificate	6	33.3	43	34.4
Diploma	5	27.8	5	4
Total	14	77.8	88	70.4
No response	4	22.2	37	29.6
Total	18	100	125	100

Source: Author, 2019

In the supervisor's category, 50.0% had attained certificate and below while 27.8% had diploma level of craftsmanship training. In the workers' category, a total of 66.4% had attained certificate and below while only 4.0% had attained diploma level of craftsmanship training. The high level of unresponsiveness indicates the respondents' inability to take instructions or reluctance in effective participation in management of SRW decision making. The statistics suggests a gap and therefore need for advancement in craftsmanship for steel reinforcement workers so as to enhance their skills. This indicates a higher demand for resources on employers who are under duty to induct, train and regularly refresh workers on the use of existing and new work systems, processes, technologies, tools and equipment for SRW in line with the organization's workplace policy and safe work method statement (OSHA, 2007).

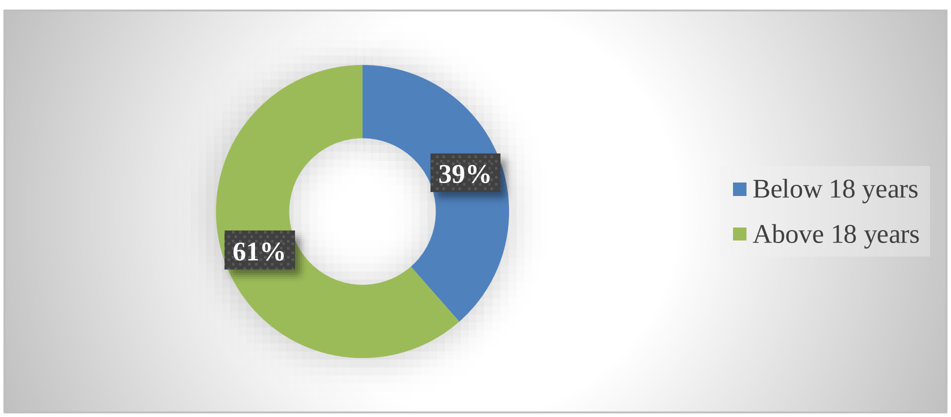

Figure 2: Age Steel Fixers Started Working

Source: Author, 2019

The results indicated that 39% of respondents started working when below 18 years and 61% above 18 years of age. The results suggest that a significant minority (39%) of the workers were employed before attaining the legal age of 18 years which was unethical and against OSH laws. Mathenge (2012) supports this study finding and affirms that lack of effective enforcement of

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professional code of practice and ethical conduct has encouraged unlawful practices in the construction industry in Kenya.

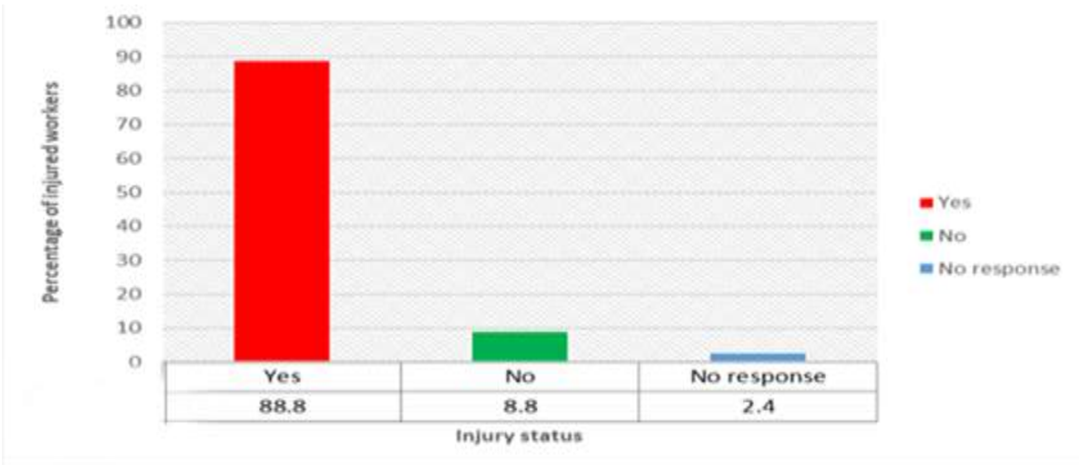

Figure 3: Health Problems at Work

Source: Author, 2019

A total of 88.8% respondents reported to have experienced health problems such as body part injuries, work stress etc. while 8.8% had not experienced any health problems within the first six months of employment in BCS. This implies that a majority of the steel reinforcement workers encountered health problems in BCS. The results suggest that there were risks in BCS that impacted on the workers' health within six months of employment. Literature reviewed indicated that workers are constantly exposed to health risks such as, force, posture, repetition and vibration in workplaces often resulting to workers' body injuries (Rwamamara, 2010). The nature and severities of these depends on the risk type, part of the body involved, exposure duration, frequency and intensity (Simonies-Vincent & Chicoine, 2003).

4.2 Descriptive and inferential Analysis of Steel reinforcement work procedures

Descriptive and inferential analysis techniques were used to measure effects of SRW procedures on management of workers' health in BCS.

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Table 8: Respondents' Opinion on Steel Reinforcement Work Procedures

Respondents' opinion		**Strongly disagree 5**	**Disagree4**	**Not sure 3**	**Agree 2**	**Strongly Agree 1**	**No Response**
There is a clear management structure for executing steel reinforcement work	%	32.8	43.2	.8	13.6	7.2	2.4
	N	41	54	1	17	9	3
There is safe work method (SWM) guidelines for use in steel reinforcement work	N	27	57	7	24	7	3
	%	21.6	45.6	5.6	19.2	5.6	2.4
There is use of some safe work methods in steel reinforcement work.	N	34	60	6	15	6	4
	%	27.2	48.0	4.8	12.0	4.8	3.2
There are appropriate equipment and tools for use in all steel reinforcement work	N	28	59	5	23	7	3
	%	22.4	47.2	4.0	18.4	5.6	2.4
Workers are regularly trained on new working skills in construction site.	N	79	31	5	7	3	
	%	63.2	24.8	4.0	5.6	2.4	0
There are various approved alternative methods of executing steel reinforcement work	N	37	66	2	10	7	3
	%	29.6	52.8	1.6	8.0	5.6	2.4
There are a wide range of steel reinforcement task variety to choose from in your building construction site	N	30	64	13	10	4	4
	%	24.0	51.2	10.4	8.0	3.2	3.2
There is team work amongst workers in executing steel reinforcement work	N	21	35	8	46	11	4
	%	16.8	28.0	6.4	36.8	8.8	3.2
There are scheduled work-breaks allowed in steel reinforcement repetitive work	N	10	18	7	65	19	6
	%	8.0	14.4	5.6	52.0	15.2	4.8
There are control measures to manage noise pollution and excess vibration energy in steel reinforcement workers on this site	N	77	20	2	14	7	5
	%	61.6	16.0	1.6	11.2	5.6	4.0

Source: Author, 2019

Opinion on whether there were clear management structures for executing steel reinforcement work in BCS, 76.0% of the respondents strongly disagreed or disagreed while 20.8% agreed or strongly agreed. On whether there were safe work method (SWM) guidelines for use in steel reinforcement work in BCS, a total of 67.2% respondents strongly disagreed or disagreed while 24.8% agreed or strongly agreed. On use of some safe work methods in steel reinforcement work in BCS, 75.2% of the respondents disagreed or strongly disagreed and 16.8% agreed or strongly agreed. On whether there were appropriate equipment and tools for use in all steel reinforcement work in BCS, a total of 69.6% respondents strongly disagreed or disagreed, 24% agreed, or strongly agreed.

On whether workers were regularly trained on new working skills, hazard protective and preventive measures in BCS, a total of 88% respondents strongly disagreed or disagreed while 8% agreed or strongly agrees. On whether there were various approved alternative methods of executing steel reinforcement work in BCS, 82.4% of the respondents strongly disagreed or disagreed and 13.6%, agreed or strongly agreed. On whether there was a wide range of steel reinforcement task variety to choose from in BCS, a total of 72.5% respondents strongly disagreed or disagreed while 11.2% agreed or strongly agreed. On team work amongst workers in executing steel reinforcement work, 44.8% of the respondents strongly disagreed or disagreed while 45.6% agreed or strongly agreed.

On whether scheduled work-breaks were allowed in steel reinforcement repetitive work in the BCS, 22.4% of the respondents strongly disagreed or disagreed and 67.2% agreed or strongly agreed. On whether there were control measures to manage noise pollution and excess vibration energy in BCS, 77.6% of the respondents strongly disagreed or disagreed while 16.8% agreed or strongly agreed.

This outcome indicated that more than 67 % of the respondents were of the opinion that steel reinforcement work procedures in BCS affected their safety, health and wellbeing. Fernandez & Marley (1998) and Goh (2010) supports the results and adds that fitting the task to match workers' capacity will achieve workers' safety, health and wellbeing in workplaces. The results were supported by observations in most building construction sites which confirmed that pulling, lifting and straightening of steel reinforcement bars was being manually handled without protective hand gloves, thus exposing workers to risks of injury. Vorvick et al. (2012) supports the results by observing that prolonged force exertions during task performance leads to overuse of muscles by workers resulting into muscle strain and increased propensity of low back pain. Kirobo (2013) concurs with this and adds that use of excessive force in executing tasks has been linked to employment of inappropriate tools and equipment. Site observations confirmed that cutting or reinforcement bars was by hack saws requiring repetitive motions without scheduled rest time which exposed workers to risk of injuries. Scheduled worker rests or stretch breaks during task performance provide an opportunity for increased blood circulation needed for body recovery (Simoneau et al., 2003).

Rudimental tying hooks and improvised site assembled steel reinforcement bars bending workstations requiring exertion of excessive force, frequent turns and twists and long standing were witnessed. Most tasks required frequent bending neck forward, raising elbow above the shoulder, bending wrist, bending back forward and squatting for long hours which exposed workers to risks of muscle strain and injuries. Middlesworth (2012) observes that awkward postures during task performance places excessive force on workers' joints and overload muscles and tendons resulting to body fatigue or injuries.

Workers prolonged exposure to machine vibration was also witnessed during disc-cutting and platform vibration during installation of steel reinforcement bars. Poorly connected and maintained hand power tools exposing workers to the risks of electric shocks and cuts were also observed.

Palmer & Bovenzi (2015) observes that injury occurs when worker's exposure to vibrations magnitude, frequency and duration exceeds the recommended safety limits set by a regulator or manufacturer of tool or equipment in use.

A study by Humphrey, Nahrgang & Morgeson (2007) concurs with the respondents' opinion on undue exposure to workplace risks adding that weak or inappropriate work procedures on workplace ergonomics, work conditions and equipment use, training and work management structure in workplaces impacts on workers' health. Weak or inappropriate work procedures also undermines fulfillment of the employers' duty to induct, train and regularly refresh workers on the use of existing and new work systems, processes, technologies, tools and equipment as required (OSHA, 2007). Fernandez & Goodman (1998) concludes that application of ergonomic principles in the workplace improves productivity besides the safety, health and wellbeing of workers.

4.3 Inferential Analysis

Pearson correlation analysis technique was used to determine the relationship between SRW procedures and health of the workers' in BCS**.** The variables are considered strongly related when Pearson's correlation coefficient is close to 1, at 95% confidence level; a relationship is considered statistically significant when Pearson's p value is equal to or less than 0.05.

The results from the findings are as shown in Table 9.

Table 9: Correlation between Steel Reinforcement Work Procedures and Health of Workers

		Workers health	**Steel reinforcement work procedures**
Workers health	Pearson correlation (r)	1	.238**
	Sig.(2-tailed)		.009
	N	121	125
Steel reinforcement work procedures	Pearson correlation (r)	.238**	1
	Sig.(2-tailed)	.009	
	N	125	125
** Correlation is significant at the 0.01 level (2-tailed).			

Source: Author, 2019

Sig. (2-tailed) - significance or **P** value of the relationship between the variables

N - The number of participants/respondents in the study.

(r)-Pearson Correlation coefficient.

From table 9 the Pearson correlation coefficient (r) gave a positive value of 0.24 which was greater than 0.2 but not more than 0.4, indicative of a moderate positive linear correlation between SRW procedures and workers' health. The results yielded a P value of 0.01 which was less than 0.05 and very close to 0 implying that there was a statistically significant correlation between SRW procedure and workers' health. This implies that increases or decreases in effectiveness of SRW procedures directly relate to increases or decreases in the impact of workers' health in BCS.

However, correlation only measures the strength of linear relationships without necessarily implying a relationship between the variables.

5.0 Conclusion

This study was on the impact of management of steel reinforcement work on workers' health in BCS: multiple case studies in Nairobi County, Kenya. Twenty NCA registered BCS were selected and stratified for purposes of generalization of the results to the rest of the general population. The literature reviewed for the study showed that very little research work had been done on the subject of this study. Data for the study was collected using questionnaires, structured interview and observation guidelines were formulated to direct and shade light on this new topic in Kenya. Results showed that management of steel reinforcement work procedures impacted on and hence were significant predictor indicators of steel reinforcement work procedures on health in BCS. The Pearson correlation coefficient (r) had a positive value of 0.24 which was greater than 0.2 but not more than 0.4, indicative of a moderate positive linear correlation between SRW procedures and workers' health. From descriptive results it indicates that more than 67 % of the respondents were of the opinion that steel reinforcement work procedures in BCS affected their safety, health and wellbeing. While from inferential results indicates that a P value of 0.01 which was less than 0.05 and very close to 0 was attained implying that there was a statistically significant correlation between SRW procedure and workers' health in building construction sites.

The study was carried out within the context of various competing interests. Construction companies out to stay in business and make profit, developers to realize projects within stated time, cost and quality and government to legislate and enforce laws and policies aimed at protecting workers' health and wellness in workplaces.

6.0 Recommendations

Based on the study discussions and conclusions, the study has various recommendations to Government on policy, academia and researchers to pursue and expand knowledge in management of SRW on workers' health in the BCS and related fields. The study recommends to the government in consultation with other stake holders in the building and construction industry to consider:

Enriching programs and cause to be published manuals and handbooks for continuous professional development of safety and health officers, and training of developers, designers, contractors and workers on safety and health matters including work and environment design and safe working methods in BCS.

The study highlighted the role and importance of steel reinforcement works as part of a workplace system defined by its environment, organization, tasks, technology and the human resource necessary to perform these tasks. It also identified weaknesses and risks associated with steel reinforcement work process, their impact on the health and safety of the worker including indicating ways and means of overcoming them in line with the concept of designing work to fit the worker. Results of this investigation would therefore be useful to academia as study reference material for skills training and understanding of management of health and safety matters relating to steel reinforcement work in BCS.

The study will be useful to other researchers wishing to expand knowledge on this study by carrying out further investigations to establish: The impact of management of steel reinforcement work procedures on the health of workers in building and construction site in other counties in Kenya and or other African countries.

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