UNIVERSITY OF NAIROBI

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MANAGEMENT OF STEEL REINFORCEMENT WORKS' IMPACT ON THE HEALTH OF WORKERS IN BUILDING CONSTRUCTION SITES: CASE STUDY, NAIROBI COUNTY, KENYA.

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DECLARATION

This is my original work and has not been presented for the award of a degree in any other university**.**

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This thesis has been submitted for examination with our approval as a University.

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Supervisor.

DEDICATION

I dedicate this work to my late father, Nyamboki; Mother, Kerubo; Wife, Nyamisa; Sons, Tengeri, Nyandega and Ongwae; and granddaughters, Maya and Siobhan.

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LIST OF ACRONYMS AND ABREVIATIONS

BCS: Building construction sites

CDMR: Construction design and management regulations
COW: Clerk of works

CCOHS: The Canadian centre for occupational health and safety

EWCS: European foundation for the improvement of living and working conditions

G. o. K: Government of Kenya

ICPAK: Institute of certified public accountants of Kenya

ILO: International labour organization

KNBS: Kenya national bureau of statistics

NCA: National construction authority

NIOSH: National institute of occupational safety and health

OSH: Occupational safety and health

OSHA: Occupational safety and health act

OSHL&P: Occupational safety and health legislations and policies

PSHSA: Public services health & safety association

SPSS: Statistical package for social sciences

SRW: Steel reinforcement work

SWM: Safe Work Methods

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. Due to the temporary nature and unpredictable workloads, Steel reinforcement work in building construction sites in Kenya are often executed under informal labour arrangements where workers' safety and health compliance requirements are largely not strictly observed (Mitullah & Wachira, 2003). Steel reinforcement work therefore continues to impact negatively on the health of workers in building construction sites thus raising stakeholders concern. Reviewed literature revealed that not much research work had been done to address this concern. This study was therefore to investigate the management of steel reinforcement works' impact on the health of workers in building construction sites. Objectives of the investigation were to: establish how management of steel reinforcement work procedures impacted on the health of workers in building construction sites; evaluate how management of occupational safety and health legislations and policies impacted on the health of steel reinforcement workers in building construction sites; evaluate how management of workplace ethics impacted on the health of steel reinforcement workers in building construction sites and establish how management of workplace challenges impacted on the health of steel reinforcement 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 and the health of workers in building construction sites, that there was no statistically significant relationship between management of occupational safety and health legislations and policies and the health of steel reinforcement workers in building construction sites, that there was no statistically significant relationship between management of workplace ethics and the health of steel reinforcement workers in building construction sites, and that there was no statistically significant relationship between management of workplace challenges and the health of steel reinforcement workers in building construction sites. Descriptive cross-sectional method was used for the inquiry and data collection was by interviews, questionnaires, observations, text books, manuals, journals, publications, past studies, libraries, internet and site records. Testing for reliability of data collection instruments was by Cronbach alpha -SPSS. 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 workplace challenges had the highest impact on the health of steel reinforcement workers in building construction sites followed by occupational safety and health legislations and policies, workplace ethics and work procedures. This implied that the existing management system for protection and safeguarding the health of steel reinforcement workers 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.

CHAPTER ONE

INTRODUCTION

1.1 Background.

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., 2013). It contributed an average of 6.35% to the country's gross domestic product between 2012 and 2017(G.o.K, 2013-2017). Reviewed literature on safety and health indicated that though globally, the building and construction industry accounts for only 6% to 10% of the workforce.

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.

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.

1.2 Problem Statement and justification

The building and construction industry is complex and dynamic involving many players at various stages of development. 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 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).

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. ILO (2010), regional and national bodies like EWCS (EWCS, 2005) and NIOSH (2009) as well as international and local researchers have 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 BCS. (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 questions

The investigation was to examine the impact of management of steel reinforcement work on the health of workers in BCS in Nairobi County Kenya by addressing the following questions:

i) How does management of SRW procedures impact on the health of steel reinforcement workers in BCS in Nairobi county, Kenya?

ii) How does management of occupational safety and health legislations and policies impact on the health of steel reinforcement workers in BCS in Nairobi county, Kenya?

iii) How does management of workplace ethics impact on the health of steel reinforcement workers in BCS in Nairobi county, Kenya?

iv) How does management of workplace challenges impact on the health of steel reinforcement workers in BCS in Nairobi county, Kenya?

1.4 Research objectives

The specific objectives of the study were to:

i) Establish how management of steel reinforcement work procedures impacted on the health of steel reinforcement workers in BCS in Nairobi county, Kenya.

ii) Evaluate how management of occupational safety and health legislations and policies impacted on the health of steel reinforcement workers in BCS in Nairobi county, Kenya.

iii) Evaluate how management of workplace ethics impacted on the health of steel reinforcement workers in BCS in Nairobi county, Kenya.

iv) Establish how management of workplace challenges impacted on the health of steel reinforcement workers in BCS in Nairobi county, Kenya.

1.5 Hypotheses

The study was guided by the following propositions or hypotheses:

$HO_{1.}$ There was no significant relationship between the management of SRW procedures and the health of steel reinforcement workers in BCS. The alternative hypothesis (H_{a1}) was that there was a statistically significant relationship between management of SRW procedures and the health of steel reinforcement workers in BCS.

$HO_{2.}$ There was no significant relationship between management of occupational safety and health legislation and policies and the health of steel reinforcement workers in BCS. The alternative hypothesis (H_{a2}) was that there was a significant relationship between management of OSH legislation and policies and the health of steel reinforcement workers in BCS.

$HO_{3.}$ There was no significant relationship between management of workplace ethics and the health of steel reinforcement workers in BCS. The alternative hypothesis (H_{a3}) was that there was a statistically significant relationship between management of workplace ethics and the health of steel reinforcement workers in BCS.

$HO_{4.}$There was no significant relationship between management of challenges and the health of steel reinforcement workers in BCS. The alternative hypothesis (H_{a4}) was that there was a statistically significant relationship between management of challenges and the health of steel reinforcement workers in BCS.

1.6 Significance

Results of this investigation established the need for review of existing OSH policies, laws and regulations to include other key project team members for better planning, management and monitoring of OSH, set performance standards, enrich OSH training curriculums to cover developers, designers, builders, workers and safety and health officers, enhance recruitment of adequate number of OSH officers for regular project monitoring, enforcement and evaluation of OSH regulations including strengthening surveillance to curb violation of workers' employment rights and recruitment of workers below 18 years of age in BCS.

The results would be useful to academia as reference materials for training on: The role and importance of steel reinforcement work management as part of BCS workplace system, weaknesses and risks associated with steel reinforcement work process, their impact on the health and safety of workers in BCS including indicating ways and means of overcoming them in line with the concept of designing work to fit the worker.

The outcome of this investigation identified existing information gaps on management of steel reinforcement work that would require further study. The information obtained would therefore be useful to other researchers wishing to expand knowledge on such areas as the designers' pre-construction inputs, project team training, consultation and engagement of principal contractors and workers and their impact on the health of steel reinforcement workers in BCS.

1.7 Assumptions

The inquiry was planned and proceeded on the assumption that the cause of steel reinforcement workers' health problems were either strongly or not related to the SRW undertaken by workers in BCS; the researcher would be given free access to BCS and accorded necessary corporation by BCS management, SRW and supervisors. The respondents would give the required information honestly and truthfully and there would be no disruption of SRW or the research processes during the entire period of investigation.

1.8 Scope and limitations

The study was based on the stated research questions, objectives, hypotheses, methods, theoretical and conceptual frameworks, data source and collection methods and analysis. The limitations of the study included availability of literature review materials, budget and timelines, data accessibility and integrity of research subjects. To address some of the noted limitations, a pilot test was conducted to determine the type, quality and quantity of resources required for successful undertaking of the exercise. The basis of site selection was on NCA classification of principal contractors in charge, accessibility and proximity to each other and richness in information desired for intended investigation purposes.

1.9 Definition of terms

Building construction sites: Workplaces within which and or where measuring, cutting, fabrication of steel reinforcement is carried out for in situ incorporation into vibrated reinforced concrete work.

Designers: This includes project architects, structural engineers, quantity surveyors and all those employed by or working directly under them for project design, documentation and construction management purposes.

Legislation: A written statement of intent, implemented as a procedure in order to achieve rational outcomes on such matters as workplace health.

Principal designer: An organization or individual appointed by a developer to take a lead control over the design and management of a building construction project.

Principal contractor: An organization or individual appointed by a developer to take a lead control over the construction of a project a building involving more than one contractor.

Health of workers: As defined in the preamble to the World Health Organization's 1948 constitution refers to a state of complete physical, mental and social well-being of the worker and not merely the absence of disease or infirmity.

Workplace: The area where works are being prepared and executed.

Risk factors: Work tasks or processes that are likely to impact on the health of a worker in a workplace.

1.10. Organization

The study comprised of five chapters: Chapter one contains the background of the study, problem statement and justification, research questions, objectives and hypotheses, significance, assumptions, scope and limitations, definitions of terms and organization of the study. Chapter two addresses reviewed literature on effects of steel reinforcement work, occupational safety and health legislations and policies, workplace ethics and challenges on the health of workers, theoretical and conceptual framework, operational definitions of variables and conceptual model. Chapter three focuses on research methods which include research design, geographical area or location of the study, data sources, sampling design, research tools and data collection techniques, pilot study, data analysis and presentation, logical and ethical considerations. Chapter four deals with results on response rates, demographic profile of respondents, steel reinforcement work procedures, occupational safety and health legislation and policies, work ethics, challenges in management of steel reinforcement work, regression analysis, analysis of variables and hypothesis testing. Chapter five is on discussion and summary of results, conclusion, recommendations and the areas for further study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter contains reviewed literature on management of SRW procedures, OSH legislations and policies, workplace ethics and workplace challenges and how they impact on the health of steel reinforcement workers in BCS; theoretical and conceptual framework, variables, operational definitions and conceptual model of the study.

2.2 Effects of SRW procedures on management of health of workers.

All SRW in BCS are designed for execution in compliance with established work procedures, relevant laws, drawings, specification standards and codes of practice (Kwamina & Small, 2013). The employer is under duty to induct, train and regularly refresh workers on the use of existing and new work systems, processes; appropriate technologies, tools and equipment for SRW in line with an organization's workplace policy and safe work method statements (OSHA, 2007). 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). Project scheduling is the alignment of scope with required resources to start and complete a given task or group of tasks in a BCS. 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).

2.2.1 Force

Many SRW activities involves 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).

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

2.2.3 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).

2.2.4 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.

2.3 Occupational safety and health legislation and policies

Under articles One to Four of its 1985 Geneva Convention, ILO is mandated to promote and protect workers' safety and health in workplaces on behalf of the international community through regional and national governments (ILO, 1985). Subsequently, guidelines on OSH management systems for establishing, implementing and improving OSH in workplaces were issued (ILO-OSH, 2001).

In the United States of America, review panel on the effectiveness of the OSH Act, 1970 revealed that the adverse effects of workplace occupational health hazards on workers' health was due to management systems failure requiring systems solutions to fix. In Malaysia, Deros, Ismail & Yusof (2012) noted that only a few of the management personnel from SMEs had the knowledge, skill and ability in carrying out OSH regulation within their respective organizations. In Sweden, Rwamamara (2005) observed that lack of incorporation of workplace safety and health issues at project design stage undermines implementation of safety and health programs in building and construction sites. Goldie (2001) espouses that the Australian Standard 4801-2000 has established an OSH management system incorporating objective setting, planning, evaluation and monitoring of performance standards of health, safety and environment matters in BCS.

In Great Britain, the government amended provisions of existing health and safety regulations on construction projects coordination and management to include**:** developers' duties in relation to managing projects, principal designers' duties as the overall coordinators of all health and safety matters relating to the pre-construction phase in addition to the overall planning, management and monitoring of the pre-construction phase of the project and the principal contractors' duties as the safety and health coordinator for the project execution stage as required (CDMR, 2015).

In Kenya, the OSH legislation (OSHA, 2007), was enacted to regulate and control the management of OSH matters in workplaces in line with the Kenya National OSH policy 2012 objectives. However, Kariuki (2012) and Kirombo (2012) opine that existing OSH workplace administrative and enforcement instruments are apparently not sufficient and effective tools for protective management and control of the workplace health in Kenya. This has resulted to unsafe workplaces and poor worker protection leading to poor workers' health, injuries and accidents, low productivity, high worker absenteeism, corruption, poor data collection and loss of state benefits. A review of the administrative and enforcement structure of these instruments is therefore recommended (Muiruri & Mulinge, 2014 and Muiruri, 2012).

Factors impacting on worker's health and safety in BCS in Kenya include lack of training and enforcement of safety and health regulations, lack of strict operational procedures, lack of adequate personal protective equipment, lack of effective organizational commitment and lack of adoption of new building materials and technologies (Kemei, Kaluli & Karubo, 2013). A survey by ILO (2010) revealed that weaknesses in the implementation of the OSHA (2007) included: inadequate enforcement personnel, low or lack of awareness in its provisions for site record keeping and notification by employers, workers and other stakeholders and lack of centralized advisory centers for providing information on health issues to employers and employees among others. Kirombo (2013) opined that building construction sites in Kenya required a good health and safety management system for the construction industry which provides for development of a sustainable health and safety policy setting, monitoring and reviewing standards needed to address or reduce safety and health risks; planning and implementation of performance standards, targets and procedures; performance review to enable evaluation of performance against objectives and targets and audit to assess compliance and identify areas for improvement. Alhajeri (2011) stated that a work policy statement sets out intentions of an organization in terms of aims, objectives and targets. It clearly indicates the structure, duties and responsibilities of the management and employees on health and safety matters. It is signed and dated by a senior management official of the enterprise to confirm the management's commitment and posted in a prominent building construction's notice board.

Instruments for monitoring and evaluation of safety and health performance in workplaces include: Task and environmental design; frequency and quality of training of management personnel and workers; structure and quality of supervision; instructions and guidance to workers; supply and maintenance of appropriate and adequate tools, machinery and equipment including personal protection equipment; construction methods; technologies and systems; worker participation in decision making; establishment of health and safety committees; risk management; accidents, incidents and sickness recording and reporting; project audit; OSH compliance notices and feedback.

2.4 Workplace ethics

Ethical culture inspires effective communication, promotes integrity, honesty, fairness, fair reward, reliability, objectivity and accountability within an organization **(**Mintz, 2014*)*. The workers benefit in this respect include improved health, training and promotion, job satisfaction and workers' self-efficacy (Huhtala et al., 2013).

The ethical state of the construction industry in America, as asserted by Doran, (2004) established that the industry was tainted by unethical acts. A survey by the Chartered Institute of Building (2006) revealed that such practices as cover pricing and collusion were "not common at all" or "not very common" in the United Kingdom construction industry. An Australian study (Vee et al., 2003) demonstrated that where the popularity of the use of ethics codes in the construction industry is high, unethical practices are very low. Brockman (2012) stated that most construction sites where large construction projects are underway, conflicts among workers such as disagreements, misunderstandings and sometimes fighting are inevitable.

Mathenge (2012) affirms that lack of effective enforcement of professional code of practice and ethical conduct has encouraged unethical practices in the construction industry in Kenya.
Valentine and Fleischman (2008) observes that in a robust ethical work climate where top management encourages and supports the practice of workplace ethics by upholding Ethics codes and ethics training, workers' job satisfaction is high. On the other hand, unethical actions such as discrimination, bullying, low wages and lack of incentive scheme programs for workers impacts negatively on the workers wellbeing (Agervold & Mikkelsen, 2004; Aina, & Adesanya, 2015; Abdulsalam, Faki & Dardau, 2012). Discrimination could be either at individual, or systemic level (Krieger, 1999). Unhealthy symptoms associated with discrimination include cardiovascular reactivity, sleep problems anxiety and mental health troubles. Bullying could be threatening and or humiliating behavior that is unrelenting and malevolent towards another person or supervisors, (Thomas et al., 2006). Victims of bullying suffer from depression low self-esteem, anxiety, job-induced stress and insomnia, the effects of which can persist over a long period of time and may

even be permanent (Vega & Comer, 2005). Repeated episodes of procedural, distributive and interactional organizational injustices can trigger stress that is linked to increased morbidity and mortality, coronary heart disease, sleep disorders, and sickness related absenteeism (Kivimäki et al., 2005).

Workplace unethical behavior may not only affect the wellbeing of victims but also that of perpetrators themselves, witnesses to the act and others indirectly involved such as coworkers, family and friends (Evans et al., 2007). Perpetrators may be stressed by personal guilt, fear of being caught or anxiety about the shame they may face thus experience harm to their wellbeing (Byrne, 2003). Witnesses of unethical acts, may suffer from shock of witnessing an immoral act (Bloom, 1995) or vicarious harm by virtue of an empathic attachment to someone cared about (Greenberg, 2001).

For an unethical act to negatively impact one's wellbeing, that person must perceive it as unethical and determine the act to be of sufficient magnitude to have an impact on them (Magley et al., 1999). Magnitude may be influenced by the duration of an unethical act (Shrubsole, 1999), the number of times it occurred or the extent of the injury or life disruption it is perceived to have caused (Bolin, 1985).

2.5 Workplace challenges

Workplace challenges refer to unforeseeable factors that influence effective planning and management of workers' health in BCS. In steel reinforcement works, they include: new construction methods or technologies, price changes due to project variations and market demands, extended working hours, geographical site location and worker mobility.

The building and construction industry is complex and dynamic involving many players at various stages of project development (Al Hajeri, 2011). The traditional project delivery method is fragmented with project design process being separated from the construction work process (Mohd & Mohd, 2014). Lack of participation of builders during project planning and design stage hampers incorporation of innovative construction methods, technologies and programs for effective management of workers' health in BCS (Mahbub, 2012). Lack of engagement of an ergonomist in SRW to study, design and evaluate human work systems with the goal of optimizing performance and safety of those systems during project construction stage compromise work design to fit the worker procedures that promotes and protect the health of the workers in BCS.

Available new technologies for use in construction sites include; Prefabrication which is an offsite industrial process of manufacturing and assembling various building materials and components for final site installation; mechanization which involves deployment of machinery to ease human workload; automation (Parker, 1989 & Navson, 1996) for complete takeover of tasks performed by the labour using machinery and robotics which perform diversified tasks by themselves. Use of these technologies improve working conditions by circumventing dangerous work likely to impact on workers' health in BCS (Gassel & Maas 2008) thus reducing workplace health and safety risks and improving productivity.

Procurement and use of new technologies require heavy investment with no guarantee of the builder's return on investment by securing projects to match the improved capacity (Hamid et al., 2008). Other challenges impeding adoption of these technologies include required additional resource allocations for personnel training in operations and maintenance, incompatibility with existing traditional construction practices and operations, increased transfer of risk to contractors, over preference for lowest bidders, low technology literacy of project participants and lack of sufficient skill acquisition training centers for skilled workers (Ikediashi et.al., 2012; Wong, Ng, & Chan, 2010) and restrictive government policies, regulations and code of practice.

Proponents of traditional technology are faced with shortage of tools, plant and equipment or use of outdated, malfunctioning and poorly maintained tools, plant and equipment for operation on site due to conservative enterprise culture (Attar, Gupta & Desai, 2012; Enshassi et al., 2007; Aibinu, & Jagboro, 2002; Funso, Sammy & Gerryshom, 2016), they include Medium or small building construction enterprises who are often reluctant to buy new plant and equipment on the pretext of poor return on investment because regular building construction workflow is not guaranteed.

The fragmented approach to project design and delivery encourages subtle adversarial tendencies amongst project team members which impacts on effective workplace safety and health planning, communication (Konchar & Sanvido, 1998), coordination (Alashwal, Rahman & Beksin,2011), documentation (Alhajeri, 2011), monitoring and delivery programs. It has been observed that casual involvement of project developers and designers in the planning and implementation of work environment requirements hampers effective workers' safety and health management in BCS (Alhajeri, 2011). Non-inclusion of a comprehensive workplace safety and health and proposals in bid documents including bidders' past performance records as a condition for bid award, impacts on project pricing and subsequent delivery of a healthy worksite (Kirombo, 2012).

Prolonged project delays due to design changes, obtaining approvals, issuance of requisite instructions, construction details and payment for work done impacts on the cost of implementing builder safety and health delivery programs including keeping skilled workers on site (Hickson & Ellis, 2014; Moselhi, Assem & El-Rayes, 2005; Jarkas & Radosavljevic, 2013).

Construction sites are a one-off temporary outfit, unique in character, complexity, with a defined budget, start and completion time and geographically dispersed. The health of workers in workplaces depends on among other factors, the number of trained workers deployed for skilled tasks, quality of supervision and enforcement of OSH regulations and policies. The demand and availability of skilled workers, supervisors and OSH enforcement agents in BCS is constrained by their scarce market supply (ILO, 2010). Attractiveness of skilled workers to geographically dispersed project locations is reliant upon available market supply, employment emoluments in terms of wages, free transport, site accommodation and meals, welfare facilities, local socio/cultural practices and language barriers, project complexity and duration. (Adamu, Dzasu, Haruna & Balla, 2011; Funso, Sammy & Gerryshom, 2016; Doloi, Sawhney, Iyer & Rentala, 2012).

Systematic and regular training programs covering all workers and management personnel are key to upholding workplace safety and health values beneficial to the health of workers in BCS (Hughes & Ferrett, 2015). However, these efforts are often frustrated by the high worker-turn over or mobility. Management of steel reinforcement workers' health in BCS can be regularly reviewed and timely improvement or corrective actions taken where supporting accurate site reports and records are kept. However, a report by ILO (2010), indicates that the OSHA (2007) requirement on site record keeping and notification including keeping of a centralized advisory centers for providing information on health issues to employers and employees is not being complied with.

Practice of honesty in reporting unethical practices in the building and construction industry is a challenge where non observance of provisions of ethical code of conduct exists (Mason, 2009). Similarly, determination of fair treatment and reward of workers is a challenge as this is reliant on individual perception and organization's goals and objectives. On the other hand, unethical act, if it happened behind closed doors or was couched in palliative terms at work may always not be perceived as unjust because workers may rationalize such behaviors as part of the job (Anand, Ashforth & Joshi, 2005). Where unethical act is not explicit, individuals try to maintain a sense of personal control by diminishing recognition of its effects, thus impacting on effective monitoring and evaluation and reporting on the health and safety of workers' matters in BCS (Landau & Freeman-Longo, 1990). Project delays leads to working overtime to meet the projects revised timelines resulting in workers' muscle strain, fatigue, loss of leisure time and travel time constraints (Dembe et al., 2005).

2.5.1 Steel reinforcement Workers' health.

The overall output of this study on workers' ill health and injuries were lag indicators, symptomatic of inherent deficiencies in management systems of workers' health in building construction sites (CSTE, 2005; Kreis & Bödeker, 2004; WHO, 2010 & Kariuki, 2012).

2.5.2 Feedback.

The existing system seemed to be reactive rather than proactive to management of the health and safety of workers in BCS. This investigation therefore sought to identify lead performance indicators for assessment of the health and safety of steel reinforcement workers in BCS against established OSH management performance standards. This was for purposes of identifying existing OSH management shortcomings and determining the type and level of interventions required to eliminate or reduce workers' illness and injuries in BCS (Frazier et al., 2013 & Fernandez-Muniz et al., 2012). The proactive measures integrated into such systems decreases effects of OSH risks thus improving organizational OSH performance in workplaces

(Mohammadfam et al., 2017). However, there are currently no standards for measurement of OSH performance on the health and safety of workers in BCS in Kenya (Cillian de Roiste, Schmitz-Felten & Palmeka, 2016). The workplace safety and health mantra being "What gets measured, gets managed" (Väyrynen, Hakkinen & Springer, 2015)

2.6 Theoretical framework

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).

2.6.1 Systems Theory

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.

2.6.1.1 Research Gap

Literature reviewed confirms concerns by various stake holders on increased injuries and other work related health problems suffered by workers in construction sites world over. For instance, a study by Messing, Stock & Tissot (2009) revealed that occupational health risks and injuries are a common feature among building construction site workers. Rwamamara (2005) observed that construction processes accounts for some of the highest occupational injuries and fatalities in both developed and developing nations. The investigation noted that lack of incorporation of workplace safety and health issues at project design stage undermined effective implementation of OSH programs on the health of steel reinforcement workers in BCS.

Goldie (2001) observed that the Australian Standard 4801-2000 has established an OHS management system for building and construction industry incorporating objective setting, planning and performance measurement, proactive approach in risk management, people involvement in problem identification and resolutions, and continual improvement based on evolving new need. Adoption of the new system eliminated duplication of efforts and resources wastage by harmonizing existing standards and legislation relating to health, safety, and environment management. Kariuki (2012) stated 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.

Steel reinforcement works in BCS is an important contributor to the overall social and economic performance of a nation. Steel bar reinforcement has been providing tensile strength in reinforced concrete works in construction sites for over 100 years (Lowe, 1999). When workers' injuries and health concerns within the subsystem are not effectively identified, assessed, and eliminated or minimized, the interaction with and connections between the SRW sub-system components are disrupted.

2.6.2 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, 1977, 1986 and1997).

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.

2.6.2.1Variables

A variable is anything that has a quantity or quality that varies. Variables used in this investigation included demographics, SRW procedures, OSHA legislation and policies, workplace ethics and challenges as independent while the health of steel reinforcement workers in BCS was the dependent variable. Independent variables can be manipulated to determine their effects on other variables while dependent variables are a measure of the effect of independent variables (Mugenda & Mugenda, 2003). All operationalized variables of the study were evaluated on various measurement scales. The purpose of the foregoing classification of variables was for selection of appropriate statistical test for use in data analysis.

2.6.2.2 Conceptual definitions of variables

A conceptual definition outlines what the concepts for the study means in abstract or theoretical terms.

2.6.2.2.1 Population demographics

These are statistical data of respondents in the studied population engaged in SRW in BCS in terms of gender, level of education, skills and age.

2.6.2.2.2 Work procedures.

These 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) avers that severity of such injuries depended on the body parts involved, duration, frequency and intensity of exposure. Humphrey, Nahrgang & Morgeson (2007) concluded that adoption of appropriate job/work design in workplaces positively impacted on the health of workers in workplaces. However, the studies did not relate results to causes and effects of the manner of compliance to OSH legislation and policies, impact of workplace ethics and other workplace challenges as important predictors to workers' health in workplaces. The studies failed to consider the role and benefits associated with application of work and environmental design ergonomics principles and practices in management of safety and health in workplaces. They also did not identify or suggest performance based measurable safety lead indicator inputs and corresponding output standards necessary for pre-emptive evaluation and assessment of set targets and objectives in management of work procedures in workplaces without risk to workers' safety and health.

2.6.2.2.3 OSH legislations and policies.

These are government statements of intent, established laws, regulations and guidelines aimed at guarding, protecting and rendering harmless, the safety and health of workers in workplaces. Kemei, Kaluli & Kabubo (2013); Kariuki (2012) & Kirombo (2012) opined that existing OSH workplace administrative and enforcement instruments are apparently not sufficient and effective tools for protective management and control of the workplace health in Kenya. Survey results by Deros, Ismail & Yusof (2012) revealed that majority of workers were not conforming to the basic requirements of OSHA and only a few of the management personnel had the knowledge, skill and ability in carrying out OSH regulation within their respective organizations. However, the studies did not consider effects of work procedures, work ethics and contextual challenges in the management of steel reinforcement workers' health in workplaces. Further, the studies did not pinpoint which specific aspects of the structure and process of work management systems (structure and process) required rectification and how such actions will improve workers' safety and health in workplaces. For instance, they did not identify or suggest how to measure and evaluate existing management systems' lead indicators against established standards so as to pinpoint gaps for necessary pre-emptive corrective actions.

2.6.2.2.4 Workplace ethics.

Ethics are moral principles by which a person or organization is guided. Valentine & Fleischman (2008) observed that where top management encourages and supports good ethical practices, workers' job satisfaction is high. On the other hand, unethical actions or workplace injustices impact negatively on the workers well-being (Agervold & Mikkelsen, 2004).

2.6.2.2.5 Steel reinforcement workplace challenges.

Workplace challenges refer to unforeseeable factors that influence effective planning and management of steel reinforcement workers' health in BCS. Whereas various management challenges such as construction industry fragmentation (Nawi et al., 2014; Konchar & Sanvido, 1998), lack of reliable OSH national information database (ILO, 2010), inefficiencies in worker training, project audit, conflicting performance standards (Kariuki, 2012; and Kirombo, 2012) and subtle ethical characteristic in workplaces (Mason, 2009; Anand, Ashforth & Joshi, 2005) exist, ways on how these challenges can be measured and evaluated against available standards so as to identify need gaps for review or improvement on workers' safety and health management in BCS have not been established.

2.6.2.2.6 Workers health.

This 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).

Table 2.1 shows graphical presentations of the studied phenomenon, structural dimensions and empirical indicators of constructs for study.

Table 2. 1 Studied phenomenon, structural dimensions and proxies of the study

Studied phenomenon	**Structural dimension**		**Empirical surrogates.**
Impact of management of steel reinforcement work on workers' health in BCS.	Independent variables	Demographics	Gender distribution, age bracket, education level, craftsmanship, age of entry into SRW
		Work procedures	SRW management structure; appropriate safe work methods, tools and equipment; skill matrix; ergonomics principals in work and workplace design and management; worker skills and training; teamwork; work breaks and control of noise pollution, adverse weather and excess vibration energy.
		OSH legislation and policies	Work charter, workplace policies, industry-wide code of practice, risk management programs; SRW monitoring, evaluation and enforcement of safe work method guidelines; safety and health emergency response and first aid programs; SRW under hazardous conditions; worker decision making in management matters; reporting and recording of workplace injuries and sickness; welfare facilities for workers; regular OSH training and awareness campaigns in workplaces.

Table 2.1 Continued

Studied phenomenon	Structural dimension		Empirical surrogates.
		Workplace ethics	Rules and regulations on workplace ethics and code of conduct; training, awareness campaign, monitoring, evaluation, enforcement and feedbacks on workplace ethics, employment policy on gender equality and child labour; fair and impartial treatment of all workers by management; discrimination, bullying or ethical injustices amongst workers; complaints and disciplinary committee; and reward and punishments schemes for unethical practices.
		Workplace Challenges	New construction methods and technologies, bid pricing and affordability, Project site geographical location, worker mobility and extended working hours
	Dependent variable	Workers health	Workplace injuries, fatigue and burnouts, stress, low worker concentration, motivation and self-esteem, low job satisfaction, absenteeism and sick- offs.

Source: Author, 2019.

2.6.2.2.7 Operational definitions of variables

This is a statement of procedure on how each of the variables in the study were measured. In this study, variables were categorized into two groups; independent and dependent variables. Independent variables were further divided into five sections; Demographics, work procedures, Occupational Safety and Health Legislation and policies, work ethics and challenges.

Under demographics, data was collected on gender distribution, age brackets, educational level, craftsmanship, the age of entry to steel reinforcement work and health problems at work. Gender distribution was in terms of dichotomous scale of “male” and “female”, age brackets was divided and measured in three unequal intervals between 18 to 60 years for workers and supervisors, educational levels in four categories from primary school to university degree, craftsmanship in three skill categories from apprentice to diploma and health problems at work on a dichotomous scale of “yes” or “no”.

Gender, education level and craftsmanship were measured in terms frequency and percentage and presented as detailed in Tables’4.3.1 to 4.3.4, pages 51 to 54 of this study. The age steel fixers started carrying out SRW and health problems at work was measured in terms of frequency and percentage and presented in form of pie and bar charts respectively as shown in figures’ 4.2 and 4.2 of this study.

Other independent variables for this study viz; work procedures, occupational safety and health legislation and policies, work ethics and challenges were measured in terms of ranked correspondents’ opinion based on the Likert scale. This is a rating system used in social science to measure people’s attitudes, opinions, or perceptions based on questionnaires. Subjects choose from a range of possible responses to a specific question or statement provided. The respondent anchors for this study were “strongly agree,” “agree,” “not sure”, “disagree,” and “strongly disagree” (Bowling, 1997; Burns, & Grove, 1997). This scale was preferred because of the ordinal nature of the data sought, that is to say; it was not possible for the respondents to attach a quantitative value difference between say “strongly agree” and “agree”. However, the respondents’ answers were assigned a number to give meaning to the information obtained. The numbers assigned to the respondent anchors in this study were; 5 for “strongly agree”, 4 for “agree”, 3 for “not sure”, 2 “disagree” and 1 for “strongly disagree”. These numbers were subsequently used in various statistical methods of the study to calculate the mode, median, range including generating bar charts, frequency and percentage tables required for data interpretation and application for the study. Site observations were made and photographs taken particularly on work procedure activities for data triangulation purposes (Bogdan, & Biklen, 2006). Due to the impracticality of direct measurements of the study variables, respective proxies were selected as a basis for data collection purposes.

Proxies used for data collection on work procedure included; availability in BCS of clear management structure for executing SRW; safe work methods guidelines; appropriate equipment and tools; regular training on new working skills; approved alternative methods of executing SRW; task variety; teamwork; work-breaks; management of noise pollution and excess vibration application as indicated in Table 4.6 of the study. Proxies for ooccupational safety and health legislation and policies included; availability of work charter, building construction industry-wide code of practice and guidelines, regular monitoring, evaluation and enforcement of SRW safe work method guidelines, worker participation in important decision making regarding SRW, designated risk management personnel, safety and health emergency response and first aid teams, workers report to management all incidents and potential hazards in SRW, right of worker refusal to execute SRW under hazardous conditions, regular reporting and recording of workplace injuries and sickness, adequacy of welfare facilities for workers and regular local OSH training and awareness campaigns in workplaces as shown in Table 4.8 of the study.

Proxies for data collection on work ethics included; rules and regulations signed by employer and worker on workplace ethics and code of conduct, regular training including awareness campaign by management on good ethical practices, no unethical practices amongst workers, reward for whistle blowers on unethical practices, punishment by management of unethical conduct, and complaints and disciplinary committee to attend to workers matters as shown in Table 4.10. Proxies selected for data collection on workplace challenges included; new construction methods and technologies, price competitiveness, geographical location of BCS, workers' mobility and working hours as indicated in Table 12 of the study. Workers health as a dependent variable of the study was measured in form of ranked respondents' opinion on the variable's associated predictors. Proxies for data collection on this variable included workplace injuries, fatigue and burnouts, stress, low worker concertation, motivation and self-esteem, low job satisfaction, absenteeism and sick- offs. The data was presented in a bar chart.

However, not considered in this study were a group of intervening variables that followed independent variables but preceded the dependent variables in a causal sequence, whose mediating effects may have distorted the relational outcome of independent and dependent variables of this study (Frankfort-Nachmias & Leon-Guerrero, 2006). Included in this category were the competence and skills of site managers and supervisors which may have impacted work organization, preparation and implementation of work charter, work organization, effective communication, teamwork, task scheduling, risk management, work ethics, worker training and participation in SRW decision making, and work ethics; Project buildability and constructability on adopted building technology, tools and equipment required including worker skill and competence requirements (Adams, S.,1989); dissemination of design information and construction details on SRW work planning and scheduling; Terms and conditions of employment and regular payment of workers on attractiveness and retention of skilled workers; conflicting socio/cultural practices on workplace ethical practices including site organization and set up, workstations and work environment on site movement, material handling, noise, vibration control.

2.6.3 Conceptual Model

Figure 2.1 Indicates the conceptual framework model for the study showing considered variables and relationships among them.

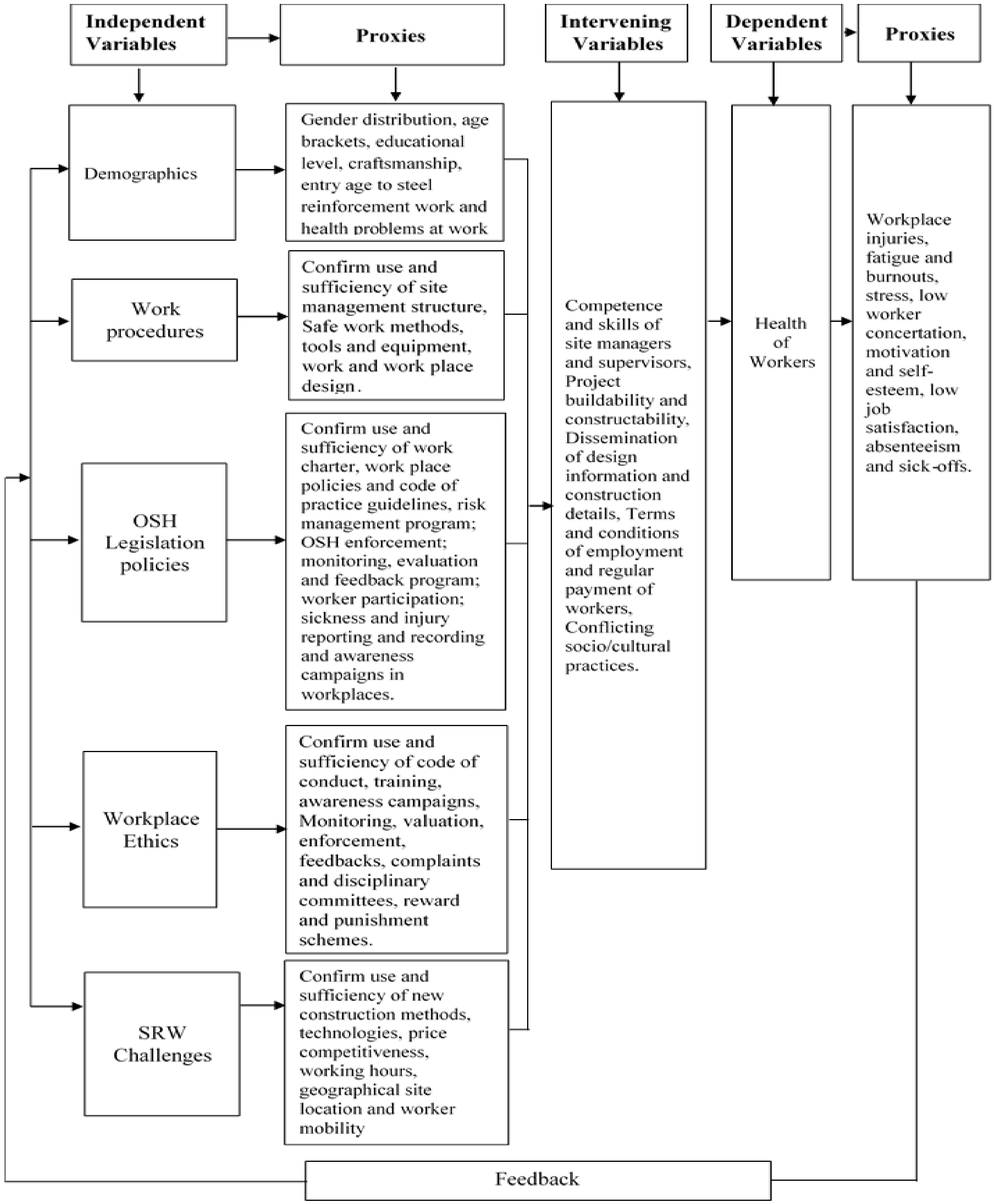

Figure 2. 1 Figure 2. 2 Conceptual framework model.

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

CHAPTER THREE

RESEARCH METHODS

3.1 Introduction

This chapter comprises detailed discussion of research design, geographical area or location of the study, data sources, sampling design, research tools and data collection techniques, data analysis and presentation and logical and ethical considerations.

3.2 Research design

A research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions (Mugenda & Mugenda, 2012). Research design available for social science studies include case study, experimental, survey, histories and analysis of archival information (Rukwaro, 2016).This study was based on a multiple-case study plan and structure which is an empirical research inquiry on a contemporary phenomenon, within the real-life context which the researcher has no control over (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).

3.3 Geographical area or location of the study

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.

3.4 Data sources

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).

3.5 Sampling design

This included unit of analysis, target population, sample size and sampling techniques.

3.5.1 Unit of analysis

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).

3.5.2 Population and Target Population

The population for the study was the total number of steel reinforcement workers in building construction sites in Kenya.

Target population was the study population listed in specific sites in Nairobi County.

3.5.3 Sample size and sampling technique.

Sampling is a process of selection of parts of a population for study, the basis of which judgment or inference about the population is made. The process includes obtaining information about the entire population by examining only a part of it (Kothari, 2011). Sampling is used in inferential statistics to make predictions on the behavior of the population under study (Mugenda & Mugenda, 2012). Using sampling techniques, a researcher is guaranteed that the characteristics of the population are accurately reproduced in the sample.

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. Stratified random sampling involves 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 was a challenge. To overcome this, 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 was 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.

Using the above formulae, the number of registered and licensed building construction firms to be sampled were 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 3.1

Table 3. 1Sample 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: Author, 2019

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 study (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. 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 3.2

Table 3. 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: Author, 2019

The sample numbers required for each stratum were rounded off to whole numbers as shown in table 3.2 above since it is not feasible to work with fractions of sample sizes in this regard.

From the 20 multiple case study 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

The adjusted respondents' sizes per stratum was as shown in Table 3.3

Table 3. 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: Author, 2019

3.6 Research tools and data collection techniques

Interviews, questionnaires, observations and BCS documentary analysis were used to collect primary data while secondary data was obtained from reviewed literature. Training and preparation of the research field team was carried out prior to start of data collection to ensure strict adherence to protocol, research budget and accuracy, verifiability and timeliness of the information gathered.

3.6.1 Interviews

Semi-structured interviews were adopted as one of the data collection tools because they allowed for face -to - face in-depth information extraction to be achieved by enabling the interviewer to probe and expand the interviewee's responses (Rubin & Rubin, 2005; Dörnyei, 2007 & Berg, 2007). Semi-structured interviews were based on prepared interview guide, which is a schematic presentation of questions or topics covering all research objectives to be explored by the interviewer (Berg, 2007). The data sort was from site management personnel as shown in appendix 3 of this study. Recording of the interview was done to make it easier for the researcher to focus on the interview content and verbal prompts thus enabling the transcriptionist to generate verbatim transcript of the interview. The interviews were guided by the study purpose and objective and were non- intrusive into the respondent's personal matters. Each interview took approximately 30 minutes as scheduled.

3.6.2 Questionnaires

The questionnaires are cheap and easy means of data collection and are free of evaluator bias. The tools used for this purpose were structured questionnaires adopted from the standard Nordic questionnaire for the analysis of management of steel reinforcement work on the health of workers. They were personally or electronically administered on and collected from steel reinforcement workers within the geographical area of study. Questions were kept short and clear as detailed in appendix 2 and were tested before circulation. The respondents were briefed on the purpose and importance of personally completing and returning the questionnaire in time.

3.6.3 Observations

Casual and scheduled semi-structured form of observations were to collect at source data for the study. Information about occasions, events, behaviors, and artifacts was collected and recorded at source in field note books, data tables, semi-structured questions and cameras. (Marshall & Rossman, 1989). A collection of site photographs was as shown in appendix 11. The purpose of the exercise was communicated to the observed to avoid the effect of the observer on the observed. Observer bias was minimized by sticking to the study purpose and objectives.

Collection of secondary data was carried out by reviewing existing literature and accessing internet which is an inexpensive and time saving means of obtaining information, new insights and discoveries to help address the objectives and purpose of this study. Every reasonable endeavor was made to avoid using stale, inappropriate or low-quality information often available from the internet for this study.

3.7 Pilot study

A pilot study was carried out to pre-test and review the effectiveness of the research plan, structure and strategy including identifying logistical problems which could occur during the field study and determining what resources (finance, staff and time) would be needed for the main study (Mugenda & Mugenda, 2003). Cronbach's Coefficient Alpha was computed using statistical package for social sciences (SPSS version 2.1) so as to determine and make necessary adjustments on the validity and level of reliability of the data collection tools for the study (Bolarinwa, 2015)

3.7.1 Validity

Validity is the extent to which an instrument measures what it is supposed to measure and performs as it is designed to perform as ascertained by use of test-retest techniques (Coolican, 1994). A pilot study (test–retest reliability) was conducted to determine the reliability of the instruments and identify the sensitive and ambiguous items (Mugenda & Mugenda, 2003).

3.7.2 Reliability

Internal consistency of reliability for scaled items was tested using Cronbach's alpha (α) where an alpha score of 0.6 or higher was considered satisfactory (Joppe & Golafshsni, 2003). The reliability test was conducted within the test range of between 0 and 1, implying that, the closer the coefficient was to 1.0, the greater the internal consistency. The reliability of the consistency of the latent variables in the consistency test is good if = > 0.5 < = 0.6, acceptable if > 0.6 <= 0.7, very good if > 0.7 <= 0.8 and excellent if > = 0.8. The Cronbach alpha (α) was calculated in a bid to measure the reliability and validity of the research instrument. This was achieved by testing the reliability of all the questions in the questionnaire that were addressing a particular variable. Results of the test were as shown in Table 3.4

Table 3. 4 Overall Cronbach's Alpha reliability test

Category	Variable	Number of items	Coefficient
Supervisors	Steel reinforcement work procedures	8	0.9738
	OSH legislation and policies	4	0.9600
	work ethics	5	0.7500
Workers	Steel reinforcement work procedures	12	0.8803
	Challenges	6	0.7305

Source: Author, 2019

Results in Table 3.4 show that in the supervisors' category, the Cronbach alpha (α) value for Steel reinforcement work procedures was 0.9738, legislation and policies 0.9600, and work ethics 0.750. The average Cronbach alpha (α) for all three variables was 0.8946, implying that items for all the variables were reliable. On the workers' category, there were only two major variables, work procedures and challenges. Steel reinforcement had a Cronbach alpha (α) value of 0.8803 while challenges had a Cronbach alpha (α) value of 0.7305. The results indicate that all the variables were reliable since their Cronbach alpha (α) was above 0.7 which was used as a cut-off of reliability for the study.

3.8 Data analysis and Presentation

Data in research study are facts and statistics on an issue collected for reference or analysis. Qualitative data analysis is the conversion of research data into results (Patton, 2002). The researcher organized the data in accordance with the research objectives, strategy and study variables (Best & Khan, 2006). The research data from multiple sources was identified, defined, assembled, transcribed, checked for completeness, accuracy, relevance and thereafter cleaned up, processed and arranged for use in the study. The study variables were grouped and measured using the Likert scale rating to aid in finding more coherent descriptions and explanations in their relationships. The participants' responses were summarized by computing the data for measuring the central tendency (mean, median and mode) and variability (range, variance and standard deviation) and presented in tables, charts, and graphs together with short discussions so as to give meaning to the data being analyzed (Hall, 2008).

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. Multiple regression analysis was used for examining relationships between variables in the study including determining the influence of independent variables on each other and on the dependent variable together with the level of significance of the relationships (Bryman & Cramer, 1990; Tranmer & Elliot, 2008). Regression statistical method of analysis was preferred because it enabled the study to identify which of the independent variables impacted on the dependent variable, by how much and how the independent variables influenced each other. Besides giving p values, this method has an error adjustment term and also shows residual figures indicating how far away the actual data points are from the predicted data points.

One-way Analysis of Variance (ANOVA) was used to measure equality of means across the population by determining whether there were any statistically significant differences between them (Turner & Thayer, 2001). The method was also used to test the equality of means hypothesis. Chi square statistical test was used to measure the dependence of variables in the null hypothesis of the study (Bewick, Cheek & Ball., 2004). 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.

3.9 Logical and ethical considerations

Permission to carry out the study was obtained from University of Nairobi and authorization from the National Commission for Science, Technology and Innovation; Ministry of Education and County Commissioner, Nairobi County to carry out and complete the study within the specified geographical area of the study and period as shown in appendices 7, 8, 9, and 10 respectively. The researcher also applied to management of various construction sites to be allowed to collect data for the study (appendix 1 – letter of transmittal). All respondents in the study were assured of the confidentiality over the information provided as it was to be used for academic work only.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter contains presentation, analysis and interpretation of data obtained from multiple sources such as interviews, questionnaires, observations and documents. The work was arranged in various thematic groups including response rate, demographics and specific study objectives. It was then presented in form of graphs, charts and tables. Descriptive and inferential statistical methods were used to interpret and give meaning to the results.

4.2 Response rate

The target population of 200 comprised of 175 steel reinforcement workers and 25 supervisors comprising of site managers, clerk of works and steel reinforcement trade supervisors working in selected construction sites in Nairobi County. The response obtained was as shown in Table 4.1

Table 4. 1 Response rate

Category of respondents	Number of respondents	Response rate	% Response
Steel reinforcement workers	175	125	62.5
Site managers, clerk of works and trade supervisors	25	18	9
Total	200	143	71.5

Source: Author, 2019.

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.

4.3 Demographic profile of respondents

4.3.1 Gender distribution.

Response rate on gender distribution was as shown in Table 4.2

Table 4. 2 Gender distribution.

	Frequency Workers	Percent	Frequency Supervisors	Percent
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.

4.3.2 Age bracket

Results of respondents' age distribution was as shown in Table 4.3.

Table 4. 3 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.

4.3.3 Education level

Results of workers' literacy level distribution were as shown in Table 4.4

Table 4. 4 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.

4.3.4 Craftsmanship

Results on the respondents' level of craftsmanship training was as shown on Table 4.5

Table 4. 5 Craftsmanship

	Frequency	Percent	Frequency	Percent
	Supervisors		Workers	
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).

4.3.5 Age steel reinforcement workers started working

The study purposed to find out the age at which respondents started steel reinforcement work in BCS and the results were as shown in Figure 4.1

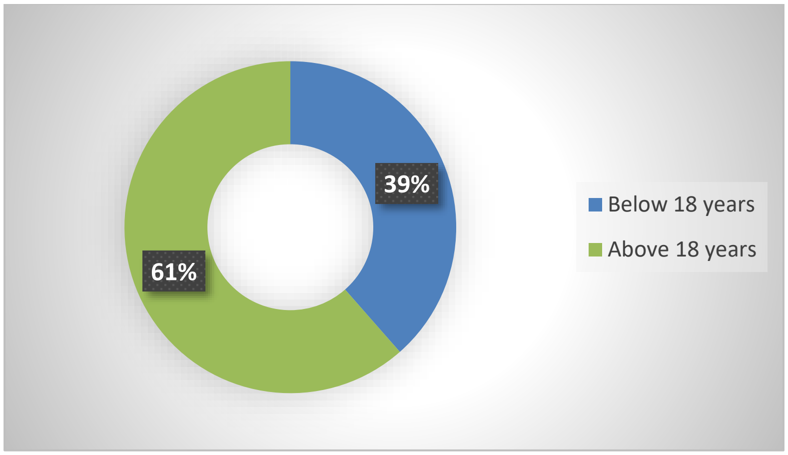

Figure 4. 1 Age steel fixers started working

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

4.3.6 Health problems

The results on whether steel reinforcement workers experienced health problems with any part of their body within the first six months of employment in BCS were as shown in Figure 4.2

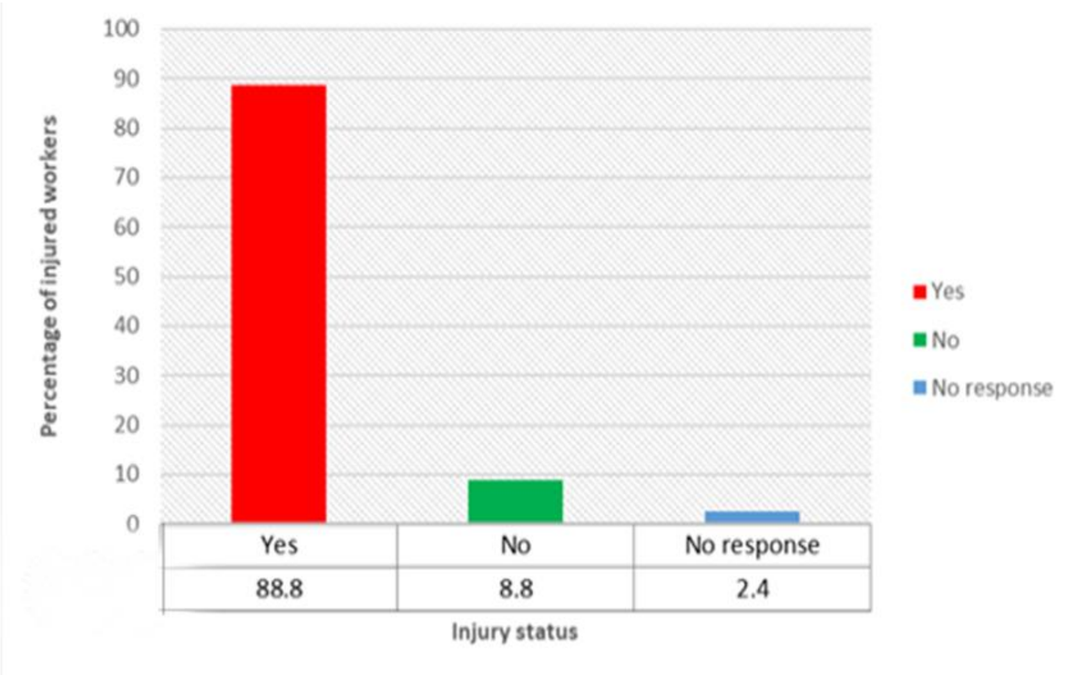

Figure 4. 2 Health problems at work.

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).

4.4 Steel reinforcement work procedures

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

4.4.1 Descriptive analysis

The study used the Likert scale analysis technique to establish the effects of SRW procedures on the management of steel reinforcement workers' health in BCS based on ranked respondents' opinion on each item in the study questionnaire. The opinions or respondent anchors were expressed in form of "strongly agree", "agree", "not sure", "disagree" and "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). To obtain the required percentage entries for use in the analysis, the number of responses to each item of questionnaire was entered against the desired respondent anchor column in the Likert scale table. The percentage response against the total for each respondent anchor was then calculated and entered for analysis as shown in table 4.6

Table 4. 6 Respondents' opinion on steel reinforcement work procedures.

Respondents' opinion		Strongly disagree **5**	Disagree **4**	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 was 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 were 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 provides 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 was 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 fulfilment 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.

4.4.2 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.

To facilitate application of this statistical method the respondent anchors in table 4.6 were assigned numerical values of 1 for "strongly agree", 2 for "agree", 3 for "not sure", 4 for "disagree" and 5 for "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). The assignment of values to the ranked opinions of respondents was to give them meaning for inferential analysis purposes. These values together with the corresponding number of respondents obtained in respect of each questionnaire item were then used to compute Pearson correlation coefficient and p value using statistical package for social sciences (SPSS version 2.1) with results as shown in Table 4.7

Table 4. 7 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.

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.

4.5 Occupational safety and health legislation and policies

4.5.1 Descriptive analysis

Likert scale analysis technique was used to evaluate effects of occupational safety and health legislations and policies on the management of steel reinforcement workers' health in BCS. Likert scale was based on ranked respondents' opinion on each items in the study questionnaire. The opinions or respondent anchors were expressed in form of "strongly agree", "agree", "not sure", "disagree" and "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). To obtain the required percentage entries for use in the analysis, the number of responses to each item of questionnaire was entered against the desired respondent anchor column in the Likert scale table. The percentage response against the total for each respondent anchor was then calculated and entered for analysis as shown in table 4.8

Table 4. 8 Occupational safety and health legislation and policies.

Respondents' opinion		Strongly disagree-5	Disagree -4	Not sure-3	Agree	Strongly Agree	No Response
There is a published work charter in your building construction site.	N	0	0	0	7	7	4
	%	0	0	0	38.9	38.9	22.2
There is a building and construction industry-wide code of practice and guidelines	N	0	2	0	10	5	1
	%	0	11.1	0	55.5	27.8	5.6
There is regular monitoring, evaluation and enforcement of steel reinforcement work safe method guidelines	N	0	0	1	11	5	1
	%	0	0	5.6	61	27.8	5.6
The management provides for workers' participation in important decision making regarding steel reinforcement work.	N	0	2	2	10	3	1
	%	0	11.1	11.1	55.5	16.7	5.6
There is are designated risk assessment and prevention personnel	N	0	1	0	14	2	1
	%	0	5.6	0	77.8	11.1	5.5
There is safety and health emergency response and first aid teams in your building construction site	N	0	0	0	12	5	1
	%	0	0	0	66.7	27.8	5.5
	N	0	0	0	13	4	1

Workers report to the management all incidents and potential hazards in steel reinforcement work	%	0	0	0	72.2	22.2	5.6
The management allows workers to decline execution of steel reinforcement work under hazardous conditions	N	0	2	0	7	6	3
	%	0	11.1	0	38.9	33.3	16.7
Sickness or injury cases of steel reinforcement workers are reported and recorded.	N	0	0	0	7	10	1
	%	0	0	0	38.9	55.5	5.6
There are adequate welfare facilities for workers in your building construction site.	N	0	0	1	13	3	1
	%	0	0	5.6	72.2	16.6	5.6
There are regular local Occupational health and Safety officials visiting your building construction site,	N	0	4	1	9	3	1
	%	0	22.2	5.6	50.0	16.6	5.6

Source: Author, 2019

The respondents' opinion on whether there was a published work charter in BCS clearly indicating workers and management roles, operational budget and performance goals including SRW methods and daily work schedules, 77.8% of them agreed or strongly agreed. On whether there was a building and construction industry-wide code of practice and guidelines for management of OSH matters in steel reinforcement work in BCS, 11.1% respondents disagreed and 83.3% agreed or strongly agreed. On whether there was regular monitoring, evaluation and enforcement of steel reinforcement work safe method guidelines in BCS, 88.8% agreed or strongly agreed.

On whether the management provided for workers' participation in important decision making regarding steel reinforcement work in BCS, 11.1% respondents disagreed and 72.3% agreed or strongly agreed. On whether there was a designated risk assessment and prevention personnel, 5.6% of the respondent disagreed, 88.9 % agreed or strongly agreed. On whether there existed safety and health emergency response and first aid teams in BCS, 94.5% of the respondents agreed or strongly agreed. On whether workers report to the management all incidents and potential hazards in steel reinforcement work, 94.4% of the respondents agreed or strongly agreed. On whether management allowed workers to decline execution of steel reinforcement work under hazardous conditions, 11.1% respondents disagreed while72.2% agreed or strongly agreed. On whether cases of sickness or injury were reported and recorded, 94.4% of the respondents agreed or strongly agreed. On whether there were adequate welfare facilities for workers use in BCS, 88.9% agreed or strongly agreed. On whether there were regular local occupational health and Safety officials visiting to BCS, 22.2% respondents disagreed and 66.6% agreed or strongly agreed.

Whereas the results indicated that over 83% of the respondents agreed that OSH laws and regulations on the management of steel reinforcement work in BCS were being complied with, earlier results of this study on the demographics of the respondents and steel reinforcement work procedures do not support this outcome. For instance, 88% of respondents reported to have suffered injuries within six months of employment in BCS yet, the study indicated that there was regular monitoring, evaluation and enforcement of safe work method guidelines 88.9%, worker participation in management decisions 72.3% and risk assessment and prevention personnel 88.9% in BCS.

Results from interviews carried out indicated that most of construction sites visited, 65% lacked clear policies on management of steel reinforcement works, performance standards, targets and assessment procedures, mechanism for monitoring and evaluation of health and safety standards. For instance, on publication of workplace policy setting out duties and responsibilities of both management and workers on safety and health matters,70% of the correspondents indicated that policy matters are handled by their head office and not on site, a clear misunderstanding of the purpose and objective of workplace the instrument. A casual observation confirmed that indeed only 30% of respondents had such policy displayed on site as required by OSH regulations. (Kirobo, 2013) observes that construction sites in Kenya require adoption of a good health and safety management system to include a sustainable health and safety policy clearly setting out company objectives, duties and responsibilities of workers and management on safety and health management matters in construction sites and how they can be achieved.

On implementation of safety and health performance standards, targets and procedures, 60% of the respondents indicated that they were no other established safety and health standards and procedure guidelines for implementation except as contained in OSH regulations to which they are committed to comply with. As to whether management and workers undergo regular training on health and safety matters, 72% of the respondents indicated that there were no established training programs to follow but prior to engagement, all new workers were appropriately inducted by their safety and health officers. These results demonstrated lack of serious endeavor on majority of respondents in commitment towards effective planning, implementation, regular monitoring and review of safety and health matters in BCS.

The results are supported by Kemei, Kaluli, & Kabubo (2013) who observed that reluctance to invest in safety and health matters; lack of training and enforcement of safety and health regulations, enterprise organizational commitment, adherence to strict operational procedures and competence in machine and equipment handling contribute to poor BCS safety and health management in Kenya. Kirobo (2013) concurs with this outcome and adds that the building and construction industry in Kenya lacks an effective safety and health management system. The above results confirm concerns raised by Kariuki (2012) and Kirombo (2012) stated that existing OSH workplace administrative and enforcement instruments are apparently not sufficient and effective tools for protective management and control of the workplace health in Kenya. Goldie (2001) alluded to similar challenges and adds that the Australian Standard 4801-2000 approach had given the construction industry a common template on which to build an OHS management system incorporating planning, management, monitoring, review and feedback on safety and health matters. In Great Britain, OSH regulations have been revised to include duties and responsibilities of developers, designers, contractors and workers in planning, management, monitoring, regular review and feedback on safety and health matters in the building and construction industry.

4.5.2 Inferential analysis

Pearson correlation analysis technique was used to determine the relationship between **OSH** legislation and policies, and health of the workers' in BCS**.** To facilitate application of this analysis method, the respondent anchors in table 4.8 were assigned numerical values of 1 for "strongly agree", 2 for "agree", 3 for "not sure", 4 for "disagree" and 5 for "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). The assignment of values to the ranked opinions of respondents was to give them meaning for inferential analysis purposes. These values together with the corresponding number of respondents obtained in respect of each questionnaire item were then used to compute Pearson correlation coefficient and p value using statistical package for social sciences (SPSS version 2.1) with results as shown as shown in Table 4.9

Table 4. 9 Correlation between OSH legislation and policies and workers' health.

		Workers health	OSH legislation
Workers health	Pearson correlation	1	.285**
	Sig.(2-tailed)		.001
	N	18	18
Occupational safety and health legislation and policies	Pearson correlation	.285**	1
	Sig.(2-tailed)	.001	
	N	18	18
** Correlation is significant at the 0.01 level (2-tailed).			

Source: Author, 2019.

The computation yielded a Pearson correlation coefficient (r) value of 0.29 which is greater than 0.2 but not more than 0.4, implying a moderate positive linear correlation between OSH legislation and policies and workers' health. The Sig. (2-tailed) or p value obtained was 0.001 which is less than 0.05 and very close to 0, implying that there was a statistically significant correlation between OSH legislation and policies and workers' health. This implies that increases or decreases in effectiveness of OSH legislation and policies directly relates to increases or decreases in workers' health in BCS.

4.6 Workplace ethics

4.6.1 Descriptive analysis

The analysis was to evaluate effects of workplace ethics on management of steel reinforcement workers' health in BCS. Likert scale was based on ranked respondents' opinion on each items in the study questionnaire. The opinions or respondent anchors were expressed in form of "strongly agree", "agree", "not sure", "disagree" and "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). To obtain the required percentage entries for use in the analysis, the number of responses to each item of questionnaire was entered against the desired respondent anchor column in the Likert scale table. The percentage response against the total for each respondent anchor was then calculated and entered for analysis as shown in Table 4.10.

Table 4. 10 Workplace ethics

Respondents' opinion		Strongly disagree-- -5	Disagree- 4	Not sure- 3	Agree - 2	Strongly Agree- 1	No Response
There are rules and regulations on Ethics and Code of conduct signed between the employer and employee.	N	0	1	0	12	4	1
	%	0	5.6	0	66.6	22.2	5.6
There are regular training programs, awareness campaigns by the management on good ethical practices	N	0	2	0	12	3	1
	%	0	11.1	0	66.7	16.6	5.6
The management treats all workers fairly and impartially.	N	0	0	1	12	4	1
	%	0	0	5.6	66.6	22.2	5.6
There is no discrimination, bullying or ethical injustices amongst workers in steel reinforcement work	N	0	0	3	11	3	1
	%	0	0	16.6	61.1	16.7	5.6
The management rewards unethical conduct whistle blowers	N	0	0	3	10	4	1
	%	0	0	16.6	55.6	22.2	5.6
The management punishes unethical conduct in your building construction site	N	0	1	2	9	4	2
	%	0	5.6	11.1	50.0	22.2	11.1
There is a complaints and disciplinary committee to attend to workers matters on this site	N	0	1	0	9	5	3
	%	-	5.6	-	50	27.8	16.6

Source: Author, 2019.

Regarding the respondents' opinion on whether there were rules and regulations on ethics and code of conduct signed between the employer and employee, 5.6 % disagreed while 88.8% agreed or strongly agreed. On whether there were regular training programs and awareness campaigns by the management on good ethical practices, 11.1% respondents disagreed and 83.3 % agreed or strongly agreed. On whether the management treated all workers fairly and impartially, 88.8% agreed or strongly agreed. On whether there was no discrimination, bullying or ethical injustices amongst workers, 77.8% agreed or strongly agreed. On whether the management rewards unethical conduct whistle blowers, 77.8% agreed or strongly agreed. On whether the management punishes unethical conduct in BCS, 5.6% respondent disagreed and 72.2% agreed or strongly agreed. On whether there was a complaints and disciplinary committee to attend to workers matters, 5.6% respondents disagreed while 77.8% agreed or strongly agreed. However, earlier results of this study indicated that 39% of workers were employed before attaining the legal age of 18 years which was unethical and against OSH laws.

Workers interviewed on workplace ethics revealed supervisors' biasness in task assignment. For instance, 40% were of the opinion that the hard tasks of steel reinforcement cutting, bending and tying were always assigned to workers perceived not to be friendly to supervisors resulting in inter-worker strained relationships. On expected daily output, 35% of the respondents reported that daily target assignments were difficult to achieve besides being disproportionate to daily wage earnings. In as much as results from the questionnaire indicated 80% compliance rate, responses from workers interviewed indicated that there were perceived unethical practices in building construction sites in the study. Magley et al. (1999) supports this finding and adds that for an unethical act to impact on the victims' well-being, that person must perceive it as unethical and determine the act to be of sufficient magnitude to have an impact on them. The magnitude of the impact is influenced by the duration of the act, number of times it occurred, extent of the injury and disruption it is perceived to have caused (Shrubsole, 1999 and Bolin, 1985).

Agervold & Mikkelsen (2004) concurs and further observes that unethical actions and other workplace injustices impact negatively on the workers well-being. Evans et al., (2007) note that workplace unethical behavior towards workers affects victims, perpetrators themselves, witnesses to the act, and others indirectly involved, such as coworkers, family and friends. Vega & Comer (2005) supports this adding that victims of unethical acts suffer from depression, low self-esteem, anxiety, job-induced stress and insomnia effects which may persist for long. Mathenge (2012) agrees with the study results and affirms that lack of effective enforcement of professional code of practice and ethical conduct has encouraged unethical practices in the building and construction industry in Kenya.

4.6.2 Inferential analysis

Pearson correlation analysis technique was used to determine the relationship between **workplace ethics** and health of the workers' in BCS**.** To facilitate application of this method, the respondent anchors in table 4.10 were assigned numerical values of 1 for "strongly agree", 2 for "agree", 3 for "not sure", 4 for "disagree" and 5 for "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). The assignment of values to the ranked opinions of respondents was to give them meaning for inferential analysis purposes. These values together with the corresponding number of respondents obtained in respect of each questionnaire item were then used to compute Pearson correlation coefficient and p value using statistical package for social sciences (SPSS version 2.1) with results as shown in Table 4.11

Table 4. 11 Correlation between work ethics and workers' health and

		Workers' health	Workplace ethics
Workers health	Pearson correlation	1	- 0.059
	Sig.(2-tailed)		0.523
	N	18	18
Works ethics	Pearson correlation	- 0.059	1
	Sig. (2-tailed)	.523	
	N	18	18

Source: Author, 2019.

This yielded a Pearson correlation coefficient (r) value of -0.059 which was less 0, indicative of a small negative correlation between workplace ethics and workers' health. The sig. (2-tailed) or p value obtained was 0.523 which was more than 0.05, implying that there was no statistically significant correlation between workplace ethics and workers' health. This implied that increases or decreases in effectiveness of workplace ethics would not directly increases or decreases effects on workers' health in BCS.

4.7 Workplace challenges

4.7.1 Descriptive analysis.

The analysis was used the Likert scale analysis technique to evaluate the impact of workplace challenges in management of SRW on workers' health in BCS. The scale was based on ranked respondents' opinion on each items in the study questionnaire. The opinions or respondent anchors were expressed in form of "strongly agree", "agree", "not sure", "disagree" and "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). To obtain the required percentage entries for use in the analysis, the number of responses to each item of questionnaire was entered against the desired respondent anchor column in the Likert scale table. The percentage response against the total for each respondent anchor was then calculated and entered for analysis as shown in Table 4.12.

Table 4. 12 workplace challenges

Respondents' opinion		Strongly disagree-5	Disagree-4	Not sure-3	Agree 2	Strongly Agree 1	No response
New construction methods and technologies	*N*	10	8	6	76	20	5
	%	8.0	6.4	4.8	60.8	16.0	4.0
Price competitiveness	N	8	10	15	54	20	18
	%	6.4	12.0	13.6	43.2	19.2	5.6
Geographical location of your building construction site	N	9	9	10	64	25	8
	%	7.2	7.2	8.0	51.2	20.0	6.4
Workers mobility	N	6	7	16	68	23	5
	%	4.8	5.6	12.8	54.4	18.4	4.0
Working hours	N	8	5	6	78	23	5
	%	6.4	4.0	4.8	62.4	18.4	4.0

Source: Author, 2019

On the respondents' opinion whether there were SRW challenges in management of SRW on workers' health, due to new construction methods and technologies in BCS, 14.4% strongly disagreed or disagreed while 76.8% agreed or strongly agreed. On whether there were SRW challenges due to price competitiveness, 17.6% of the respondents strongly disagreed, 56.8% agreed or strongly agreed. On whether there were SRW challenges in geographical location of BCS, 14.2% of the respondents strongly disagreed or disagreed while 71.2% agreed or strongly agreed. On whether there were SRW challenges in workers' mobility, 10.4% of the respondents strongly disagreed or disagreed and 72.8% agreed or strongly agreed. On whether there were SRW challenges in working hours, 10.4% of the respondents strongly disagreed or disagreed, 80.8% agreed or strongly agreed. The results show that the majority 72.8%respondents agreed that there were SRW challenges in management of SRW on workers' health in BCS.

Workers interviewed on SRW challenges indicated discomfort with use of existing construction methods and technologies in BCS. For instance, 60% of respondents reported that management was reluctant to provide them with appropriate tools, equipment and working platforms necessary for effective task execution. SRW materials site handling was largely manual without training on safe handling techniques. Cutting was by hack saws requiring repetitive motions which exposed workers to risk of injuries. 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 without appropriate work- breaks thus exposing the workers to risks of muscle strain and 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 was also observed. Most of the workers were executing work without appropriate protective clothing such as gloves. On the other hand, a majority (70%) of the site managers interviewed indicated that equipment provided for execution of various SRW tasks were adequate but added that investment in new construction methods and technologies was expensive without guarantee of return on investment besides incurring additional budget on worker retraining.

On Price competitiveness, 35% of the respondents reported that daily target assignments were disproportionate to daily wage earnings. Besides, there were no attractive employment incentives to augment the low wage earnings. Delayed payment for work done exerted additional pressure on workers in meeting their financial commitments such as payment for food, shelter and commuter costs. On geographical location of building construction sites, 40% of workers interviewed indicated that daily commuting to workplaces without offer of free transport by employer impacted on their overall earnings and free or rest time. On worker mobility, 45% of the respondents indicated their willingness to move to other sites with better employment terms and conditions including management on safety and health workplace matters. On working hours, 60% of respondents indicated unwillingness to work overtime due to work monotony, exhaustion, poor pay and commuter inconveniences.

Results of the study on new building methods and technology are supported by Mahbub (2012) who observes that none involvement of builders at project planning and design stages hampers incorporation of innovative construction methods, technologies and programs for effective management of steel reinforcement workers' health in BCS. Gassel (2008) concurs and adds that innovative construction methods and technologies assists in improving working conditions by circumventing dangerous work, and permitting work to be performed that people cannot do without endangering their safety and health in BCS. Ikediashi et al., (2012); Wong, Ng, & Chan (2010) add that even where such incorporation is desired, resources for worker training in handling, operating and maintenance of such methods and technologies are scarce. Results on price competitiveness are supported by Kirobo (2012) who observes that none inclusion of safety and health matters in project bids impacts on planning and management of such matters during project construction phase. Hickson & Ellis (2014); Moselhi, Assem & El-Rayes (2005); Jarkas & Radosavljevic (2013) adds that unscheduled project delays affect price competitiveness in continued financing of safety and health matters in BCS.

Results on project geographical location and worker mobility as SRW challenge are supported by various studies which observe that attractiveness of skilled workers and supervisors to such sites including the frequency of OSH officers' visits is influenced by existing market demands, safety and health management structure, employment emoluments, local socio/cultural practices and language barriers (Adamu et al., 2011; Funso, Sammy, & Gerryshom, 2016; Doloi et al., 2012). Results on working overtime as a challenge are supported by (Dembe et al., 2005) who concluded that extended working hours impacted on workers' health. Kazaz, Manisali & Ulubeyli (2008) supports the results by summing up factors of low-skilled workers' performance on management of safety and health in workplaces under four categories, namely; organizational factors, economic factors, physical factors and socio-psychological factors, based on the theory of motivation.

4.7.2: Inferential analysis

Pearson correlation analysis technique was used to determine the relationship between **workplace** challenges in management of SRW and health of the workers' in BCS**.** To facilitate application of this method, the respondent anchors in table 4.12 were assigned numerical values of 1 for "strongly agree", 2 for "agree", 3 for "not sure", 4 for "disagree" and 5 for "strongly disagree." (Bowling, 1997; Burns, & Grove, 1997). The assignment of values to the ranked opinions of respondents was to give them meaning for inferential analysis purposes. These values together with the corresponding number of respondents obtained in respect of each questionnaire item were then used to compute Pearson correlation coefficient and p value using statistical package for social sciences (SPSS version 2.1) with results as shown in Table 4.13

Table 4. 13 Correlation between challenges in BCS and workers' health.

		Workers health	Workplace challenges
Workers health	Pearson correlation	1	0.177
	Sig.(2-tailed)		0.052
	N	125	125
Workplace challenges	Pearson correlation	0.177	1
	Sig.(2-tailed)	0.052	
	N	125	125

Source: Author, 2019.

The results yielded a Pearson correlation coefficient (r) value of 0. 177 which is greater than 0.0 but not more than 0.2, indicative of a very low positive linear correlation between BCS challenges and workers' health. This means that changes in BCS challenges are weakly were weakly related to changes in workers' health. The sig. (2-tailed) value obtained was 0.052 which is more than 0.05, implying that there was a statistically insignificant correlation between SRW challenges and workers' health implying that increases or decreases in SRW challenges does not significantly relate to increases or decreases in workers' health in BCS.

4.8 Regression analysis

Multiple linear regression method was used to establish which and by how much the independent or predictor variables, that is to say; work procedures, OSH legislation and policies, workplace ethics and SRW challenges impacted on the health workers' as a dependent variable including showing how the independent variables influenced each other. It was also used to demonstrate how the combined influences of independent variables impacted on the dependent variable by running a multiple linear regression model on SPSS program. Besides giving p values for each predictor variable, this method had the advantage of an inbuilt error adjustment term and residual figures indicating how the far actual data points were from the predicted. The study used multivariate statistical model to determine effects of independent variables on the dependent variable by applying the following formulae:

$WHI = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta4X4 + \varepsilon$

Where:

WHI- Workers health index

$\beta0$- Constant

$\beta1$, $\beta2$, $\beta3$, and $\beta4$ - Coefficients of variables

X1- Work procedures

X2- OSH legislations and policies

X3- Workplace ethic

X4- Workplace challenges

ε - Error term

Results of the test were as shown in Table 4.14

Table 4. 14 Regression model and coefficients summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.731[a]	.635	.619	.7720

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	0.231	0.186	--	1.241	0.017
Work procedures	0.028	0.069	.031	0.404	0.020
OSH legislation and policies	0.349	0.067	.377	5.173	0.000
Workplace ethics	0.126	0.082	.119	1.536	0.027
Workplace challenges	0.414	0.083	.393	5.012	0.000

Source: Author,2019

The value of R in the model indicates how close the data is to the fitted regression line. for instance, a value of R =100% indicates that the model explains all variability of the response data around its mean. The value of R square shows up to what percentage changes in workers' health as a dependent variable is explained by the combined changes in independent variables in the model. The sig. or p values of the model indicates the degree of influence by each predictor variable on the independent variable when the test is performed at 95% confidence interval, that is to say; only 5% is given to chance of error thus setting the significance threshold mark of 0.05. P values above 0.05, are therefore rendered insignificant, meaning that they do not influence workers' health statistically. The regression coefficients (B) indicates how predictor variables in the study relate to each other and their individual contributions to changes on the dependent variable.

The analysis showed that R=0.731, implying that there is a moderate correlation between workers' health and work procedures, OSH legislation and policies, workplace ethics and workplace challenges. The analysis yielded an R-square values of 0.635, implying that changes in workers' health as a dependent variable were influenced by combined changes in independent variables in the model up to 63.5%. The balance, 36.5% could be accounted for by other factors (intervening variables) outside the scope of this study.

The p-values of each of the independent variables of the study were as follows: work procedures had a p value of 0.020 implying that the influence of work procedures on workers' health was statistically significant. OSH legislation and policies and Workplace challenges had a p value of 0.000 each, implying that their influence on workers' health was statistically significant. Workplace ethics yielded a p value of 0.027, meaning it had a statistically significant influence on workers' health. The regression coefficients (B) indicated that the health of workers, work procedures, OSH legislation and policies, workplace ethics and workplace challenges were all positively and significantly related to each other. Work procedures, OSH legislation, workplace ethics and workplace challenges influenced health of the worker by 0.028 (2.8%), 0.349 (34.8%), 0.126 (12.6%) and 0.414 (41.4%) respectively.

Figure 4.3 Scatter plot of regression model variables showing residual figures and indicating how far the actual data points are from the predicted.

Figure 4. 3 Scatter plot of regression model variables

Source: Author, 2019.

4.9: Analysis of variance (ANOVA)

One - way analysis of variance (ANOVA) test was carried out to establish the equality of means across the independent variables of the study with results as shown in Table 4.15

Table 4. 15 ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	78.769	4	19.692	33.045	.000[b]
	Residual	68.531	115	.596		
	Total	147.300	119			

Source: Author, 2019

The null hypothesis (Ho) for ANOVA test states that there is no statistically significant difference in the population means when the p-value associated with F is smaller than 0.05. The alternative hypothesis assumes that there is at least one statistically significant difference among the population means. The test yielded an ANOVA F value of 33.045 and the associated p value of 0.000 implying that means across the independent variables were not equal. Consequently, the null hypothesis (H_o) that there was no statistically significant difference in the population means was rejected and the alternative hypothesis (H_a) that at least one statistically significant difference among the population means is accepted**.**

From the ANOVAs results, the probability value of 0.000 was obtained implying that the regression model was significant in predicting the relationship workers' health and role of work procedures, OSH legislation and policies, workplace ethics, and workplace challenges on steel fixers' health. The independent variables were used to explain this relationship.

4.10 Hypothesis Testing

The null hypothesis of the Chi-Square test is that no statistically significant relationship between dependent and independent variables. At 95% confidence level, the *p*-value of the Chi-Square statistic is considered statistically significant when less than 0.05 implying that the variables are not independent of each other and that there is a statistically significant relationship between the study variables. The following hypotheses were tested.

$Ho_{1.}$ - There was no statistically significant relationship between management of SRW procedures and the health of steel reinforcement workers in BCS. The alternative hypothesis (Ha_1) was that there was a statistically significant relationship between management of SRW procedures and the health of steel reinforcement workers in BCS

$Ho_{2.}$ - There was no significant relationship between management of OSH legislations and policies and the health of steel reinforcement workers in BCS. The alternative hypothesis (Ha_2) was that there was a statistically significant relationship between management of OSH legislations and policies and the health of steel reinforcement workers in BCS.

$Ho_{3.}$ - There was no statistically significant relationship between management of workplace ethics and the health of steel reinforcement workers in BCS. The alternative hypothesis (Ha_3) was that there was a statistically significant relationship between management of workplace ethics and the health of steel reinforcement workers in BCS.

$Ho_{4.}$-There was no statistically significant relationship between the management of workplace challenges and the health of workers in BCS. The alternative hypothesis (Ha_4) was that there was a statistically significant relationship between management of workplace challenges and the health of steel reinforcement workers in BCS. Chi square test results were as shown in Table 4.16

Table 4. 16 Chi Square test results.

	Chi square value	P value	Decision rule	Dependent/Independent
Ho_1	246.818	0.00	Reject H_{o1}	Dependent
Ho_2	156.120	0.02	Reject H_{o2}	Dependent
Ho_3	39.168	0.01	Reject H_{o3}	Dependent
Ho_4	29.286	0.02	Reject H_{o4}	Dependent

Source: Author, 2019

On the first hypothesis (H_{O1}), the test yielded a p value of 0.00 which is less than 0.05. implying that the relationship between the variables under consideration was statistically significant. The null hypothesis (H_{O1}) that there was no statistically significant relationship between management of SRW procedures and the health of steel reinforcement workers in BCS was rejected and the alternative hypothesis (H_{a1}) that there was a statistically significant relationship between management of SRW procedures and the health of workers in BCS accepted implying that management of SRW procedures and the health of steel reinforcement workers in BCS were dependent.

On the second hypothesis (Ho_2), the test yielded a p value of 0.02 which is less than 0.05 implying that there was a statistically significant relationship between the variables under consideration. The null hypothesis (Ho_2) that there was no statistically significant relationship between management of OSH legislations and policies and the health of steel reinforcement workers in BCS was therefore rejected and the alternative hypothesis (H_{a2}) that there was a significant relationship between management of OSH legislation and policies and the health of steel reinforcement workers in BCS accepted implying that management of OSH legislations and policies and the health of steel reinforcement workers in BCS were dependent.

On the third hypothesis (Ho_3), the test yielded a p value of 0.01 $_{\text{which}}$ is less than 0.05 implying a statistically significant relationship between the variables under consideration. The null hypothesis (Ho_3) that there no statistically significant relationship between management of workplace ethics and the health of steel reinforcement workers in BCS was therefore rejected and the alternative hypothesis (H_{a3}) that there was a statistically significant relationship between management of workplace ethics and the health of steel reinforcement workers in BCS accepted. This means that management of workplace ethics and the health of steel reinforcement workers in BCS were dependent.

On the fourth hypothesis (H_{O4}), the test yielded a p value of 0.02 which is less than 0.05 implying that there was a statistically significant relationship between the variables under consideration. The null hypothesis (H_{O4}), that there was no statistically significant relationship between SRW challenges and workers' health in BCS was therefore rejected and the alternative hypothesis (H_{a4}) that there was a statistically significant relationship between SRW challenges and workers' health in BCS accepted. This means that management of workplace challenges and the health of steel reinforcement workers in BCS were dependent.

CHAPTER FIVE

DISCUSSION OF RESULTS, CONCLUSION, RECOMMENDATION AND AREAS FOR FURTHER STUDY.

5.0 Introduction

This chapter focuses on the discussion of results, conclusion, recommendation and the areas for further study. It summarized the study results upon which conclusions and recommendations were drawn based on the study objectives. Suggestions for further areas of study were also captured as a way of filling knowledge gaps identified in the study.

5.1 Discussion of results

The discussion sought to outline a summary outlook of the management of steel reinforcement work and its impact on workers' health in BCS under each study objective, describing the significance of the results in relation to reviewed literature including interpreting and explaining the understanding of the study problem in light of the results and reviewed literature. The impact of demographics has also been discussed under each of the following study objectives.

5.1.1. Objective (i) Establish how management of SRW procedures impact the health of steel reinforcement workers in BCS

Work procedures identified for study included site management structures, safe work methods and their use, appropriate tools and equipment, regular training on new working skills, approved alternative work methods, task variety, teamwork, work-breaks and management of noise pollution and excess vibration in BCS. Identification of steel reinforcement work activities in BCS was conducted using a self-administered survey questionnaire and site observations. The work entailed preparation, fabrication and installation of steel reinforcement bars and meshes in BCS in accordance with detailed drawings provided and oral or written instructions issued.

The steel reinforcement worker was to receive steel reinforcement materials on site, sort them in accordance with required sizes, measure, cut, bend, fabricate and install in accordance with production drawings, bar bending schedules details and supervisor's instructions. The workers were under direct supervision of steel reinforcement trade supervisors operating under the overall supervision of the COW at the technical level and site manager at management level. Although 77.8% of responses from site managers and COW indicated that there were published work charter in BCS clearly indicating workers and management roles, operational budget and performance goals including SRW methods and daily work schedules, 76% (average) of responses from workers indicated that the existing SRW management structures were not clear or effective in protecting their health against work related risks.

There were, for instance, no adequate SWM guidelines, appropriate tools and equipment for use, training on new skills and hazard protection and prevention measures, alternative work methods, work variety, teamwork, work- breaks and protection against noise pollution and excess vibration energy. This resulted in use of excessive force, assuming awkward posture, performing repetitive motion for a considerable period of time without rest and exposure to excessive noise and vibration during execution of SRW in BCS. Appendix 11 shows site pictorial observations and highlights in respect of some of the issues or concerns raised by workers on work procedures that would impact on their personal safety and health. The demographic results of the study indicated that 50% and 66.4% of SRW supervisors and workers respectively had attained certificate level of craftsmanship and below. Further, 39% of respondents had started working when below the age of 18 years. This implies that the supervisors and workers had no sufficient skilled training and experience to effectively undertake or participate in decision making in the management of SRW.

Pearson correlation analysis for the study established a positive linear correlation of r = 0.24 between work procedures and steel reinforcement workers' health in BCS with a statistically significant p value of 0.2. Regression analysis of the study yielded a P value of 0.02 indicating that when the combined influence of all independent variables against the dependent variable of the study are considered, work procedures still yielded a statistically significant relationship with the workers' health. The results also yielded a B (Unstandardized Coefficients Value-B) value of 0.028, implying that work procedure impacted on SRW workers' health in BCS by 2.8% out of the total effects of independent variables on the independent variable in this study.

The chi square test on the relationship between work procedures and management of steel reinforcement workers' health gave a p value of 0.00, implying existence of a strong correlation between these variables. This finding did not therefore support the null hypothesis (H_{o1}) of the study that, management of SRW procedures had no significant effect on steel reinforcement workers' health in BCS. Consequently, the null hypothesis was rejected and the alternative hypothesis (H_{a1}) that SRW procedures had a statistically significant relationship with SRW workers' health in BCS was accepted.

The above empirical results established that there was indeed a relationship between steel reinforcement work tasks requiring use of excessive force, assuming awkward posture, repetitive work and exposure to excessive vibration and workers' health in workplaces. However, the nature and severities of the impact depended upon the risk type, part of the body involved, duration, frequency and intensity of exposure. Further, 78.8% of the respondents indicated lack of incorporation of new or appropriate construction methods and technologies into SRW execution process for purposes of improving work output and reducing workplace health risk exposures to workers. For instance, mechanization of steel reinforcement bar and mesh site handling, cutting, bending and tying will substantially reduce work related risks to workers' health in BCS.

The outcome of the study confirmed how management of SRW procedures impacted on the workers' health in BCS. That is to say; workers' exposure to these risks was a consequence of lack of effective management structure, poor application of ergonomics principles and practices in work and workplace design, use of inappropriate tools and equipment and worker training. This would have been occasioned by either lack of clarity or misunderstanding of purpose of a management structure for carrying out SRW in BCS. A management structure sets out how task allocation, coordination, and supervision are intended to be carried out so as to achieve the desired objectives of an enterprise.

The literature reviewed for the study revealed that work and workplace designs integrating motivational, social and work context characteristics influenced workers' job satisfaction, stress and turn- over among other imperial indicators of the level of workers' health in workplaces. The study results revealed no evidence of sufficient management efforts in matching workstations, tools machinery, equipment and work systems designs with workers physical, physiological, biometrical and psychological capacities within the context of "fit tasks to worker and not worker to tasks" ergonomics mantra would achieve workers' safety, health and wellbeing in workplaces. The literature reviewed also indicated that excessive exposure to adverse work environment conditions such as excessive noise and vibrations demotivated the workers thus affecting their emotions and behaviors hence workplace health.77.6% of the respondents were of the opinion that there were no control measures to manage excessive noise and vibration in BCS. The reported high outcome of workers' health problems at work in the past 6 months would be attributed to

5.1.2. Objective (ii): Evaluate how management of SRW OSH legislation and policies impact the health of steel reinforcement workers in BCS.

The OSH legislation and policies issues considered in the study included work charter, industry – wise code of practice and guidelines, regular monitoring, evaluation and enforcement of SRW save work methods, worker participation in important decision making in SRW, risk management personnel, emergency response and first aid kits, incident and potential hazard reporting, workers freedom to decline executing SRW under hazardous conditions, sickness and injury reporting and recording, workers 'welfare facilities and visitation of local OSH officials.

Whereas 83.8% (average) of respondents indicated substantive compliance with workplace OSH legislation and policies in BCS, responses from the demographics, work procedure and reviewed literature of the study did not fully support these results. For instance, the level of craftsmanship training for supervisors and workers was considerably inadequate for the standard of information processing, dissemination and use required for effective management and execution of SRW in BCS. There was evidence of workers below 18 years of age engaged in SRW contrary to OSH requirements. Whereas 66.6% and 88.8% of the respondents agreed that there were regular local occupational health and safety official visiting and there was regular monitoring, evaluation and enforcement of SRW methods in BCS respectively, results of the study on work procedure indicated low performance on establishment of SRW management structure, use of SWM, regular worker training, work rotation and variety which are lead indicators of low compliance with OSH requirements in executing SRW in BCS.

Results of Pearson correlation analysis yielded a value of (r) = 0.29 and P value of 0.001 indicating a moderate positive linear but statistically significant relationship between OSH relationship and policies and workers' health in BCS. Regression analysis of the study yielded a P value of 0.00 indicating that when the combined influence of all independent variables against the dependent variable of the study are considered, OSH legislation and policies still yielded a statistically significant relationship with the workers' health. The results also yielded a B (Unstandardized Coefficients Value-B) value of 0.349, implying that OSH legislation and policies impacted on SRW workers' health in BCS by 34.9% out of the total effects of independent variables on the independent variable in this study.

The chi square test on the relationship between OSH legislation and policies and management of steel reinforcement workers' health gave a p value of 0.01, implying existence of a strong correlation between these variables. This finding did not therefore support the null hypothesis (H_{o2}) of the study that, the management of OSH legislation and policies had no significant effect on steel reinforcement workers' health in BCS. Consequently, the null hypothesis was rejected and the alternative hypothesis (H_{a2}) that the management of OSH legislation and policies had a statistically significant relationship with SRW workers' health in BCS was therefore accepted.

The empirical results of the study indicated that lack of publication, clarity, purpose and use of work chatter, site managers and supervisors not being sufficiently competent, inadequate training of workers and laxity of OSH officials in effective monitoring, evaluation and compliance enforcement of OSH regulations and policies on SRW in BCS was the main cause of failure in implementing OSH regulations and policies intended to improve SRW workers' health in BCS. A work charter is a management document establishing roles, operational budget, desired goals, delivery methods and daily work schedules. The charter includes a work policy statement, signed, dated and posted in a prominent building construction's notice board sets out aims, objectives and targets in management of health and safety matters in work place, clearly indicating how monitoring of safety and health performance in workplaces will be achieved by regularly evaluating performance of established work tasks, workstations and workplace design lead indicators; frequency and quality of training of management and workers, structure and quality of supervision, instructions and guidance to workers; supply and maintenance of appropriate tools, machinery and equipment including personal protection equipment; construction methods, technologies and systems; Worker participation in decision making, establishment of health and safety committees, risk management; accidents, incidents and sickness recording and reporting; project audit, OSH compliance notices and feedback against established national standards.

The literature reviewed for the study indicated that employment of underage workers, lack or inadequate site record keeping, prompt notification of BCS related injuries and sickness, non-reliance on centralized advisory information centers on workplace health performance indicators and standards as some of the OSH legislation and policy structural weaknesses in the implementation of a robust safety and health management system in BCS in Kenya. The literature also noted that OSH management process failures in workplaces was attributable to lack of incorporation of workplace safety and health issues at the project design stage, limited developers' involvement in design and implementation of work environment plan during construction stage, lack of ergonomics specialists' inputs, and regular training of workers, supervisors and manages including publishing guidelines and procedures in management of OSH matters in workplaces.

The results of this study were supported by various literature reviewed for the study which indicated that existing OSH workplace administrative and enforcement instruments are apparently not sufficient and effective tools for protective management and control of the workplace health in Kenya. It was also noted that majority of workers were not conforming to the basic requirement and only a few of the management personnel had the knowledge, skill and ability in carrying out OSH regulation within their respective organizations.

5.1.3. Objective (iii): Evaluate how management SRW work ethics impacts the health of steel reinforcement workers in BCS.

Workplace ethics matters considered for study included rules, regulations and code of conduct on ethics, training and awareness campaign by management on good workplace ethics, fair and impartial treatment of workers by management, Unethical practices amongst workers, reward of whistle blowers on unethical practices, punishment for unethical practices and complaints and disciplinary committees to attend to workers' matters in BCS.

In spite of 80% of questionnaire respondents agreeing that good ethical practices were being followed in execution of SRW in BCS, 40 % of respondents interviewed indicated that there was biasness in task assignments and daily output target allocations. Biasness was reported against the backdrop of 77.8% of respondents been of the opinion that there was a complaints and disciplinary committee in place to attend to workers matters in BCS. This finding was collaborated by early results of the study which indicated that there, no teamwork (48.8%), task variety (72.5%) and alternative approved methods of executing SRW in BCS (82.4%). There was employment of workers below the age of 18 years (36%) as noted in the earlier results of this study. These results implied that there was no sufficient cooperation amongst workers or between workers and management, task monotony and limited chances for creativity and career advancement including child labour exploitation in BCS.

Pearson correlation analysis for the study established a small negative linear correlation of r = -0.059 between workplace ethics and steel reinforcement workers' health in BCS with no statistically significant p value of 0.52. Regression analysis of the study yielded a P value of 0.027 indicating that when the combined influence of all independent variables against the dependent variable of the study are considered, workplace ethics still yielded a statistically significant relationship with the workers' health. The results also yielded a B (Unstandardized Coefficients Value-B) value of 0.126, implying that work procedure impacted on SRW workers' health in BCS by 12.6% out of the total effects of independent variables on the independent variable in this study.

The chi square test on the relationship between workplace ethics and management of steel reinforcement workers' health gave a p value of 0.02, implying existence of a strong correlation between these variables. This finding did not therefore support the null hypothesis (H_{o3}) of the study that, the management of workplace ethics had no significant effect on steel reinforcement workers' health in BCS. Consequently, the null hypothesis was rejected and the alternative hypothesis (H_{a3}) that the management of workplace ethics had a statistically significant relationship with SRW workers' health in BCS was therefore accepted.

The study found imbalances in employment distribution of primary and secondary education certificate holders against college and university levels of education, apprentice and certificate holders against diploma craftsmanship holders. Biasness in task allocation and daily target output overload on some workers, limited task variety and alternative methods of task execution was also noted. The study found out that lack of effective enforcement of professional code of practice and ethical conduct has encouraged unethical practices which impacted negatively on the workers well-being in spite of existence of complaints and disciplinary committees of deal with workers matters in BCS.

Literature reviewed for the study indicated that effective communication, integrity, honesty, fairness, reliability, objectivity and accountability are some of the attributes of good ethical cultures within an organization. Workers benefit from good ethical culture in an organization including improved health, training and promotion, job satisfaction and self-efficacy. The study outcome indicated that where worker's personal characteristics such as physical and mental capacities, experience and skills, education and training, age, needs and aspirations are not balanced against Job and equipment design, work environment and work organization, workers' health in workplaces is affected. However, some literature for this study indicated that there were perceived or subtle unethical practices in workplaces which are difficult to detect. A person must perceive an act as unethical and determine it to be of sufficient magnitude for it to have an impact on him.

5.1.4. Objective (iv): Establish how management of SRW challenges impacts the health of steel reinforcement workers in BCS.

Identified challenges in management of SRW identified for study included new construction methods and technologies, price competitiveness, geographical location of sites, workers' mobility and working hours.

Results of the study indicated that 72.8% of respondents agreed that there were challenges in executing SRW in construction sites that impacted their health. Top on the list of the respondents' concerns was working hours (80.8%) followed by new construction methods (76.8%), worker mobility (72.8%), geographical site location (71.2%) and price competitiveness (56.8%). Pearson correlation analysis for the study established a positive linear correlation of r = 0.177 between workplace challenges and steel reinforcement workers' health in BCS with no statistically significant p value of 0.052. Regression analysis of the study yielded a P value of 0.000 indicating that when the combined influence of all independent variables against the dependent variable of the study are considered, workplace challenges still yielded a statistically significant relationship with the workers' health. The results also yielded a B (Unstandardized Coefficients Value-B) value of 0.414, implying that work procedure impacted on SRW workers' health in BCS by 41.4% out of the total effects of independent variables on the independent variable in this study.

The chi square test on the relationship between work procedures and management of steel reinforcement workers' health gave a p value of 0.02, implying existence of a strong correlation between these variables. This finding did not therefore support the null hypothesis (H_{o4}) of the study that, workplace challenges had no significant effect on steel reinforcement workers' health in BCS. Consequently, the null hypothesis was rejected and the alternative hypothesis (H_{a4}) that workplace challenges had a statistically significant relationship with SRW workers' health in BCS was accepted.

The major contentions on working hours and worker mobility were due to unfavorable terms of engagement, work overload and working beyond the official hours. The study found the cause of this impediment being insufficient project documentations, variations, delay in payments and late approvals among other factors resulting to project delay thus necessitating working beyond hours to recover lost time. This affected workers' health with the majority reporting to have had little or no time to rest or engage in personal activities outside the construction site. The results of gender distribution of workers indicate that we had more male than female workers in BCS. This had an unintended effect of more male suffering from work related health problems than female, an outcome likely to impact on their social economic contribution to the society.

Literature reviewed for the study indicated that effective pre-contract project definition, technical assessment, planning and documentation together with cross functional collaboration and cooperation amongst all stake holders minimizes or eliminates project cost and time overruns. The study indicated that available new technologies for use in construction sites include; Prefabrication to reduce on site activities, mechanization to ease human workload, automation for complete takeover of tasks performed by the labour using machinery and robotics which are machinery to perform diversified tasks by themselves. Use of these technologies improve working conditions by avoiding dangerous work, and permitting work to be performed that people cannot do thus reducing workplace health and safety risks and improving productivity. However, results of this study indicated that availability and use of new building methods and technologies in executing SRW in BCS was a challenge. These challenges include the fragmented nature of the traditional construction industry where the builder had no opportunity to lobby for incorporation of such methods and technologies in the design for better workers' safety and health management in BCS; incompatibility of the new methods and technologies with existing health and safety management system practices and construction operations; low technology literacy of project participants; High competition in job market and over preference for lowest bidder, unpredictable workflow in the construction industry which does not guarantee return on the required heavy investment in procurement and personnel training in this area. Other notable impediments included low standardization, modulation and pre-fabrication of building components and methods, multiple project stake holders with singular emphasis on final product rather than the process, complexity of construction contracts and dispute resolution mechanisms, conservative company culture due to increased risk transfer to contractors, unfavorable government policies and investment programs and lack of sufficient information on these technologies and new construction methods in Kenya.

The foregoing impediments have consequently encouraged retention of traditional building technologies prone to shortage or poorly maintained tools, plant and equipment to the detriment of workers' health and safety in BCS. This tendency was mostly noted in BCS under the management of medium and small building construction enterprises who are often reluctant to buy new plant and equipment on the pretext of poor return on investment because regular building construction workflow is not guaranteed. The study also noted that project price competitiveness was due to market forces, project funding reliability and contract documentation. Geographical location influenced availability of skilled workers, supervisors, OSH enforcement agencies frequency of visitation, workers travel time and cost.

5.1.5 Combined effect of work procedure, OSH legislation and policies, workplace ethics and challenges on the Health of workers in BCS.

A total 88.8% respondents reported to have experienced health problems within the first six months of employment in BCS. This implies that a majority of the steel reinforcement workers often encounter health problems as a result of working in construction sites. Workers health was the expected output (dependent) variable which was influenced by work procedure, OSH legislation and policies, workplace ethics and challenges all of which were inputs (independent) variables of the study.

Results of regression analysis showed that R=0.731, implying that there was a moderate correlation between the combined independent variables and the dependent variable of the study. The value of R square obtained was 0.635, implying that changes on the dependable variable was influenced by independent variables of the study up to 63.5%. The balance, 35.5% was due to intervening variables such as competence and skills of site managers and supervisors, project buildability and constructability, dissemination of design information and construction details, terms and conditions of employment and regular payment of workers, type of contract, project size and complexity, workers engaged in other tasks in BCS, site and environment design which are outside the purview of this study.

The B value for each of the independent variables were as follows. Work procedure 0.028(2.8%), OSH legislation and policies 0.349 (34.9%), workplace ethics 0.126 (12.6%) and workplace challenges 0.414 (41.4%). This implies that any desired action to improve SRW workers' health in BCS must start with resolving issues relating to workplace challenges followed by OSH legislation and policies, work ethics and work procedure.

The null hypothesis for ANOVA (H_{04}) was that there was no significant difference in the population mean when the P value associated with F was less than 0.05. The alternative hypothesis assumed that there was at least one significant difference among the population means. The study results yielded an ANOVA F value of 33.045 and a p value of 0.00 implying that the means across the independent variables were not equal. Consequently, the null hypothesis for ANOVA (H_{o4}) that there was no significant difference in the population means was rejected and the alternative hypothesis (H_{a4}) that there was a significant difference in the population means was accepted.

5.2 Summary of results

The inquiry was in four thematic areas, steel reinforcement work procedures, OSH legislation and policies, workplace ethics and challenges, key results of which were as summarized below.

5.2.1 Steel reinforcement work procedures

Results from the study indicated that management of steel reinforcement work procedures in BCS impacted on workers' health in workplaces by a coefficient of 0.028 as established in the study. That is to say, for every unit increase or decrease in work procedure, there was a corresponding increase or decrease of 2.8% on workers' health index in BCS. The study attributed this outcome to:

i) Weakness of the builder in establishing a clear management structure for steel reinforcement work in BCS.

ii) Weakness of builders in preparation and enforcement of appropriate and adequate task design for steel reinforcement work in BCS.

iii) Weakness of builders in engagement and maintenance of adequate and appropriately trained, induct and regularly refresh personnel for execution of steel reinforcement works in BCS.

iv) Weakness of builders in procurement and maintenance of appropriate and adequate plant, tools and equipment.

v) Lack of effective engagement of workers in steel reinforcement work management decision making.

vi) Weakness of the builder in preparation and enforcement of work and environment safety and health plan.

vii) Lack of standards and code of practice for performance evaluation of steel reinforcement work procedure in BCS.

viii) Lack of application of Ergonomics' principles and practices in work and work place design in BCS.

5.2.2 Occupation safety and health legislation and policies.

Results from the study indicated that management of steel reinforcement work, Occupation safety and health legislation and policies in BCS impacted on workers' health in workplaces by a coefficient of 0.349 as established in the study. That is to say, for every unit increase or decrease in work procedure, there was a corresponding increase or decrease of 34.9% on workers' health index in BCS. The study attributed this outcome to:

i) Weakness of builders in engagement and maintenance of adequate and appropriately trained, inducted and regularly refreshed personnel for implementation of work and environment safety and health plans.

ii) Weakness of builders in keeping records and reporting on safety and health matters including keeping of a health files in BCS.

iii) Weakness in existing OSHA management systems in terms of structure and process.

iv) Lack of standards and code of practice for performance evaluation of work and environment safety and health matters.

5.2.3 Workplace ethics.

Outcome of the study revealed that management of SRW workplace ethics impacted on workers' health in workplaces by a coefficient of 0.126 as established in the study. That is to say, for every unit increase or decrease in work procedure, there was a corresponding increase or decrease of 12.6% on workers' health index in BCS. The study attributed this outcome to:

i) Weaknesses of builders in upholding good ethical practices in workplace relating to steel reinforcement work.

ii) Weaknesses of builders in engagement of workers without due regard to education and skill level balance.

iii) Lack of standards and code of practice for performance evaluation of workplace ethics.

5.2.4 Steel reinforcement work challenges

The results revealed that steel reinforcement work challenges impacted on workers' health in workplaces by a coefficient of 0.414 as established in the study. That is to say, for every unit increase or decrease in work procedure, there was a corresponding increase or decrease of 0.0.414 on workers' health index in BCS. The study attributed this outcome to:

i) The project design team giving little attention to constructability matters on workers' safety and health at design stage. This includes incorporation of appropriate construction technologies such as prefabrication, mechanization and automated aids in project design plans, safety and health plans in bid documents.

ii) Weakness in existing Occupational safety and health legislation and policies which do not provide for involvement of all project team members in objective setting, planning, evaluation and monitoring of performance standards of health and safety matters.

iii) Weakness of builder in conducting regular audit for effective management of safety and health matters on steel reinforcement works.

iv) Lack of regular monitoring, evaluation and enforcement of OSH regulations by health and safety officers.

v) Lack of the developers and design team involvement in preparation and implementation of work and environment safety and health plan.

vi) Weakness of developer and designers requesting for project design changes requiring overtime engagement of workers

vii) Weakness of builders in adopting new construction methods and technologies on account of investment and additional skill training cost, unpredictable market workflow and incompatibility with existing traditional building construction practices.

viii) Builders weakness in maintaining skilled staff on site due to changing site conditions, market demands and delay in payments.

ix) Lack of standards and code of practice for performance evaluation of workplace ethics.

5.3 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, OSH legislation and policies, workplace ethics and SRW challenges all impacted on and hence were significant predictor indicators of steel reinforcement workers' health in BCS.

Regression analysis of variables enabled the study to identify which of the independent variables impacted on the dependent variable, by how much and how the independent variables influenced each other. The results indicated that steel reinforcement challenges (41.4%) had the biggest impact on the health of the worker in BCS followed by OSH legislations and policies (34.9%), work ethics (12.6%) and work procedures (2.8%). If performance standards of these independent variables are established, then a national index for measurement of steel reinforcement workers' health in BCS for effective monitoring evaluation and feedback management purposes may be achieved. It is hoped that results of this study will make modest contributions to government on policy, academia and future research to expand knowledge on some aspects investigated.

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.

5.4 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.

i) Government or policy formulators.

The study recommends the government in consultation with other stake holders in the building and construction industry to consider:

Reviewing of existing OSH policies, laws and regulations to include or enhance the roles, duties and obligations of developers, principal designers and principal contractors in the planning, management and monitoring of steel reinforcement workers' safety and health matters throughout the building construction project life circle. Principal contractor's duties to include consulting and engaging with steel reinforcement workers. Encouraging and supporting builders and workers to adopt appropriate and user friendly construction methods and technologies.

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.

Enhancing recruitment of adequate number of safety and health officers for regular monitoring, enforcement and evaluation of safety and health matters in BCS including obtaining performance feedbacks on national data banking and effective stake holders' information exchange. Including other government enforcement agencies with capacity and widespread presence to collect data on safety and health from building construction sites and also strengthen surveillance to curb violation of workers' employment rights and recruitment of under-age workers in BCS.

ii) Academia.

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.

5.5 The areas for further study.

The study will be useful to other researchers wishing to expand knowledge on this study by carrying out further investigations to establish.

i) The performance indicators for each objective of the study for purposes calculating steel reinforcement workers' health index in BCS.

ii) Impact of designers' pre-construction inputs, project team training, and consultation and engagement of principal contractor with workers on safety and health matters, on workers' health in BCS.

iii) Effect of safety and health officers' monitoring, evaluation and enforcement of safety and health requirements on workers' health in BCS.

iv) Organization and structure of a multiple case study as a guide to similar studies.

v) Conclusions and recommendations of other scholars on similar studies

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Zsuzsanna Jakab WHO Regional Director for Europe 14th European Health Forum Gastein, 7 October 2011, Bad Hofgastein, Austria.

APPENDICES

Appendix 1: Letter of Transmittal

Japheth Rasugu Nyamboki
BOX 5475 – 00200,
NAIROBI.
Mail: nyaraconsults@yahoo.com

THE CONSTRUCTION CONTRACTOR, Date………………..

BOX -------------,

NAIROBI.

Dear Sir/Madam,

RE: IMPACT OF STEEL REINFORCEMENT WORK MANAGEMENT ON WORKERS' HEALTH IN BUILDING CONSTRUCTION SITES: CASE STUDY, NAIROBI COUNTY, KENYA.

I am a masters' student in construction management at the University of Nairobi Main campus carrying out a research on the steel reinforcement work management on the workers' health disorders in construction sites in Nairobi county, Kenya as a partial fulfillment for the requirement for an award of degree in masters of construction management in the school of the built environment department of real estate and construction management.

This is a request for participation of the management staff and staff of your company in responding to the attached questionnaire. Their truthful response will help facilitate this study.

The results of this study will be purely used for academic purposes. Any information given will be confidential and only for the purpose of this study.

Thank you in advance for your participation.

Yours Faithfully,

Japheth Rasugu Nyamboki.

Appendix 2: Questionnaire for Workers

RESEARCH ON THE IMPACT OF STEEL REINFORCEMENT WORK MANAGEMENT ON WORKERS' HEALTH IN BUILDING CONSTRUCTION SITES: CASE STUDY IN NAIROBI COUNTY, KENYA.

A. Demographics

Please tick in the box provided as appropriate

1. Gender: Male ☐ Female ☐

2. Age (years)

- i. 18-28 ☐
- ii. 29-40 ☐
- iii. 41-60 ☐
- iv. 60 and above ☐

3. Educational level

- i. Primary ☐
- ii. Secondary ☐
- iii. tertiary/College ☐
- iv. University ☐

4. Level of Craftsmanship training

- i. Apprentice ☐
- ii. Certificate ☐
- iii. Diploma ☐
- iv. Others (specify)……………………………………………………….

5. At what age did you start steel reinforcement work?

- i. Below 18 years 18 years ☐ ii. Above 18yearsand above ☐

6. Have you experienced health problems with any part of your body within the first six months of youry employment as a steel reinforcement worker in this building construction site?

- i. Yes ☐ ii. No ☐

Please rank the following statements in each area on Steel Reinforcement Work on the following scale: Strongly disagree (1) Disagree (2); Not sure (3); Agree (4) strongly agree (5).

B. Steel reinforcement work procedures	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
7. There is a clear management structure for executing steel reinforcement work in your building construction site					
8. There are safe work methods (SWM) guidelines for use in steel reinforcement work in building construction site					
9. Use of some save work methods in steel reinforcement work in your building construction site do not affects your health.					
10. There are equipment and tools for use in all steel reinforcement work in your building construction site					
11. Use of equipment and tools for steel reinforcement work in your building construction site affects your health.					
12. There is adequate personal protection gear for use in steel reinforcement work in your building construction site.					
13. The management adopts work station to fit the steel reinforcement workers' physical attributes including protection against mental stress					
14. Workers are regularly trained on new working skills, hazard protective and preventive measures in your building construction site.					
15. There are various approved alternative methods of executing your steel reinforcement work in your building construction site.					

16. There are a wide range of steel reinforcement task variety to choose from in your building construction site					
17. There are scheduled work-breaks allowed in steel reinforcement repetitive work in your building construction site.					
18. There is team work amongst workers in executing steel reinforcement work in your building construction site.					
19. There are control measures to manage noise pollution, excess vibration energy and hot or cold whether that may be harmful to steel reinforcement workers on this site					

20. Is your employment in steel reinforcement .

i. Part time ☐ ii. Regular ☐

Please rank the following statements in each area on Steel Reinforcement Work on the following scale: Strongly disagree (1) Disagree (2); Not sure (3); Agree (4) strongly agree (5).

C. Occupational Safety and Health Legislation and policies	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
21. The management provides for worker's participation in important decision making regarding steel reinforcement work in your building construction site.					
22. Workers to report to the management all incidents and potential hazards in steel reinforcement work in your building construction site					
23. The management allows you to refuse to execute steel reinforcement work under					

hazardous conditions in your building construction site.					
D. Work Ethics					
24. There are rules and regulations on Ethics and Code of conduct signed between the Employer and the workers in steel reinforcement work in your building construction site					
25. There management treats all workers fairly and impartially in steel reinforcement work in your building construction site.					
26. There is regular training on benefits of good upholding good ethical practices on your performance of steel reinforcement work in your building construction site.					
27. The management rewards unethical conduct whistle blowers					
28. The management punishes unethical conduct in your building construction site					
E. Challenges The following factors materially impacts on your health in the course of executing steel reinforcement work in your building construction site					
29. New construction technologies					
30. Price competitiveness					
31. Geographical location of your building construction site					
32. Worker's mobility					
33. Working hours					

Thank you

Appendix 3: Interview schedule for site management (clerk of works, site managers)

Introduction

My name is Japheth Rasugu Nyamboki, a student at the University of Nairobi pursuing a master's degree in project management**.** It is the University requirement that I conduct and submit a research thesis on a selected and approved topic in partial fulfilment of the requirement for the award of the degree of master of construction management, school of the built environment. My research topic is on the impact of steel reinforcement work management on workers' health in building construction sites: multiple - case study in Nairobi County, Kenya.

I would like to ask you some questions about your background, your education, some experiences you have had, OSH legislation and policies, ethics and challenges in relation to your workplace. This is to assist learn more about you and gain insights on the management system under which steel reinforcement works is executed in building constructions sites. I kindly request for a maximum of 30 minutes of your indulgency on this exercise.

Kindly give me your response to the following

A. Demographics

Gender: Male ☐ Female ☐

Age (years)

v. 18-28 ☐
vi. 29-40 ☐
vii. 41-60 ☐

Educational level

i. Primary ☐
ii. Secondary ☐
iii. tertiary/College ☐

vi. University

Level of Craftsmanship training

v. Apprentice ☐

vi. Certificate ☐

vii. Diploma ☐

viii. Others (specify) ………………………………………………………….

Legislation and policies	**Interviewees response**
There is a published work charter in your building construction site.	
There is a building construction industry - wide code of practice and guidelines for the management of Occupation Safety and Health matters in steel reinforcement work in your construction site.	
There is are regular campaigns by local Occupational health and Safety officials for promoting OSH awareness by visiting your building construction site conducting seminars, workshops, road-shows, and publishing articles in the local mass media.	
There is a regular monitoring evaluation and enforcement of steel reinforcement work Safe Work Methods (SWM) guidelines requirements in your building construction site	
There is are designated risk assessment and prevention personnel in your building construction site	
There is safety and health emergency response and first aid team in your building construction site	
Sickness or injury cases of steel reinforcement workers on this building construction site are promptly reported and recorded.	

There are adequate welfare facilities for workers in your building construction site.	
Occupation Safety and Health supervisors visits your building construction site regularly to monitor, audit and enforce steel reinforcement work safety and health OSHA requirements	
Work ethic	
There is no discrimination, bullying or ethical injustices in steel reinforcement work your building construction site	
There are regular training programs, awareness campaign by the management on the value of upholding good ethical practices in steel reinforcement work your building construction site	
There is complaints and disciplinary committee to attend to workers matters on this site	
Challenges	
The pricing of Occupational safety and health requirements in bid documents determines the management's impacts on implementation of ethical strategies in your building construction site	
There is institutional involvement of the design team in the approval and enforcement of occupational safety and health strategies for steel reinforcement work in your building construction site	
The existing Occupational safety and health laws are sufficiently responsive to the dynamic market demands especially on new	

technologies in steel reinforcement work in your building construction site	
The existence of other laws regulating OSH activities in workplaces do not impact on the enforcement of OSHA, 2007 requirements in your building construction site.	
There exist unethical practices in your building construction sites that take place behind closed doors, couched in calming terms or are sufficiently ambiguous as to cause workers to Condon and maintain a sense of personal control	

I appreciate the time you have given for this interview

Thank you.

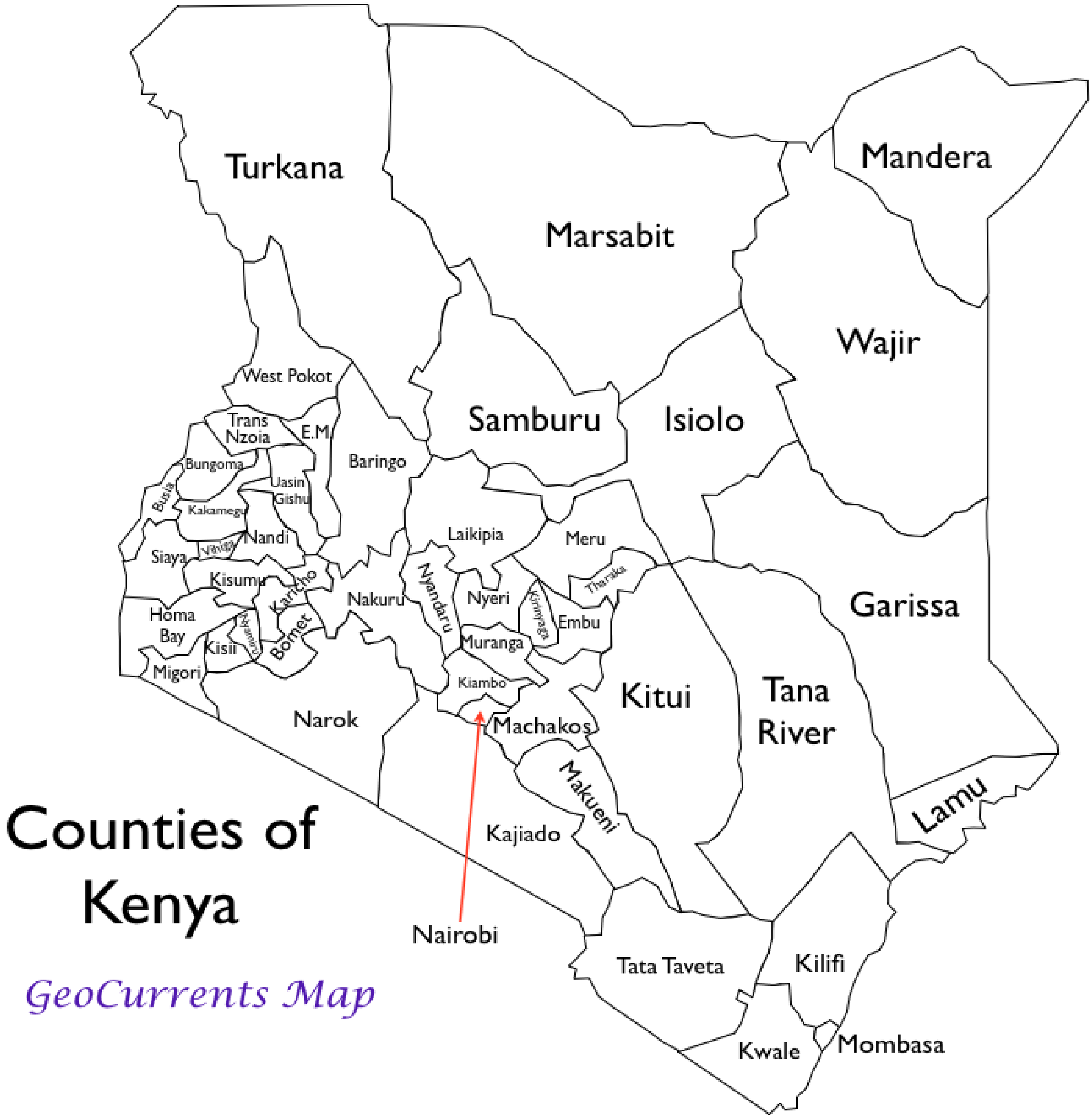
Appendix 4: Observation Schedule

Problems looked for when making an assessment	**YES**	**NO**
The tasks, do they involve:		
Holding loads away from the body?		
Twisting, stooping or reaching upwards?		
Large vertical movement?		
Long carrying distances?		
Strenuous pushing or pulling?		
Repetitive handling?		
Insufficient rest or recovery time?		
A work rate imposed by a process?		
The loads, are they:		
Heavy or bulky?		
Difficult to grasp?		
Unstable or likely to move unpredictably (like animals)?		
Harmful, e.g. sharp or hot?		
Awkwardly stacked?		

Too large for the handler to see over?		
The working environment, are there:		
Restrictions on posture?		
Bumpy, obstructed or slippery floors?		
Variations in floor levels?		
Hot/cold/humid conditions?		
Gusts of wind or other strong air movements?		
Poor lighting conditions?		
Restrictions on movements from clothes or personal protective equipment (PPE)?		
Individual capacity, does the job:		
Require unusual capability, e.g. above average strength or agility?		
Endanger those with a health problem or learning/physical disability?		
Endanger pregnant women?		
Call for special information or training?		
Handling aids and equipment:		
Is the device the correct type for the job?		
Is it well maintained?		
Are the wheels on the device suited to the floor surface?		
Do the wheels run freely?		
Is the handle height between the waist and shoulders?		
Are the handle grips in good condition and comfortable?		
Are there any brakes? If so, do they work?		
Work organization factors:		
Is the work repetitive or boring?		
Is work machine or system-paced?		
Do workers feel the demands of the work are excessive?		
Have workers little control of the work and working methods?		
Is there poor communication between managers and employees?		

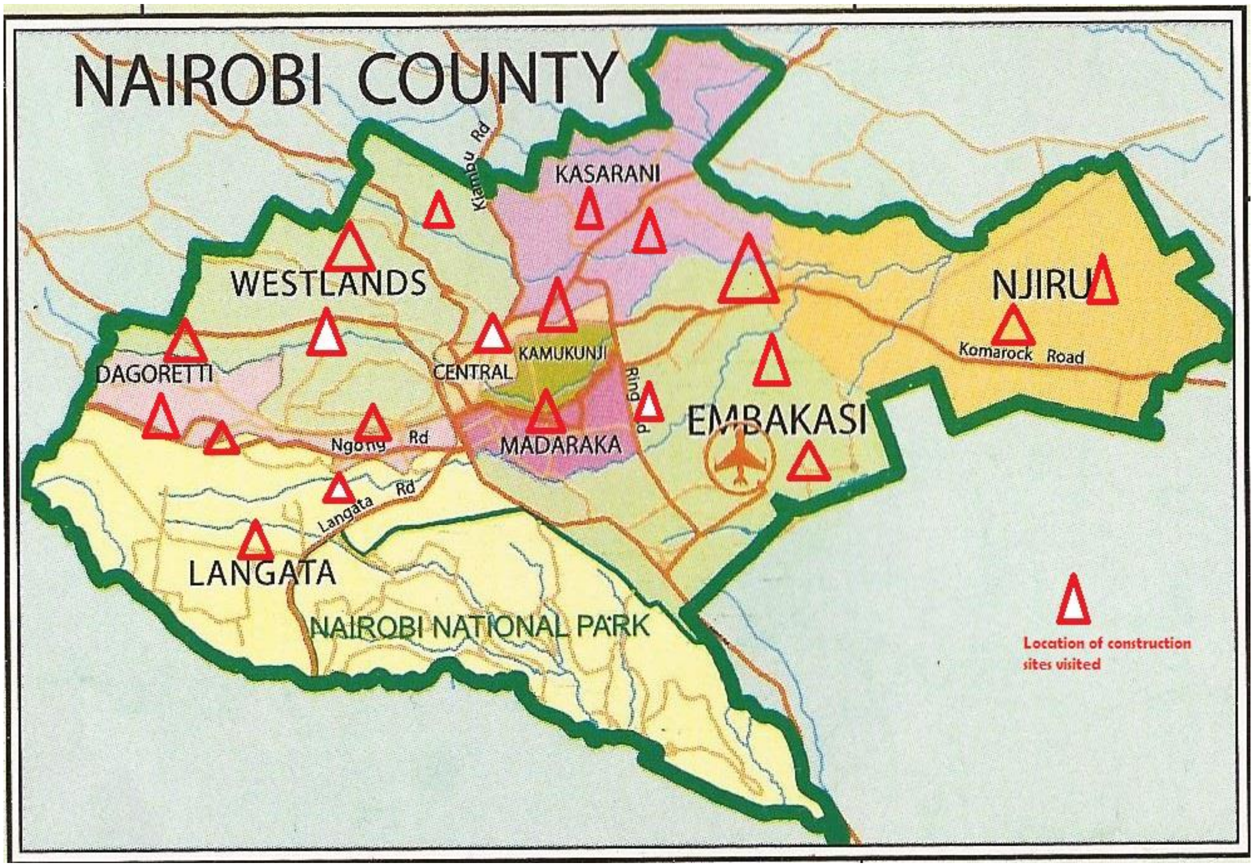
Source: Author, 2019

Appendix 5: Map of Counties of Kenya



Source: GeoCurrents, 2019

Appendix 6: Map of Nairobi County indicating sites visited



Source: Geomaps/Author, 2019

Appendix 7: Letter of Authorization from the University of Nairobi

UNIVERSITY OF NAIROBI

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION MANAGEMENT

P.O. Box 30197, 00100 Nairobi, KENYA, ***Tel: No. +254-020-491 3531***
E-mail: *dept-recm@uonbi.ac.ke*

Ref: B50/64/812/2010 **Date:** 27th August, 2018

To Whom It May Concern

Dear Sir/Madam,

<u>SUBJECT: NYAMBOKI RASUGU JAPHETH</u>

This is to certify that the above named is a student in the Department of Real Estate and Construction Management, pursuing a Master of Arts degree in Construction Management.

He is carrying out a research entitled "***Management of Steel Reinforcement Works on Worker's Health in Building Construction Sites: Case study in Nairobi***" in partial fulfillment of the requirements for the degree programme.

The purpose of this letter is to request you to allow him access to any kind of material he may require to complete his research. The information will be used for research purposes only.

CHAIRMAN
DEPARTMENT OF REAL ESTATE
AND CONSTRUCTION MANAGEMENT
UNIVERSITY OF NAIROBI

<u>Isabella N. Wachira – Towey, (Phd)</u>
Chair & Senior Lecturer
Dept. of Real Estate & Construction Management

Appendix 8: Research Authorization – NACOSTI and NCC.

NACOSTI

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/32716/25166**

Date: **21st September, 2018**

Japheth Rasugu Nyamboki
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Management of steel reinforcement work on workers' health in building construction sites: Case study in Nairobi County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **20th September, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

DR. MOSES RUGUTT, PHD, OGW
DIRECTOR GENERAL/CEO

Copy to:

FOR The County Commissioner
Nairobi County.

ACC

COUNTY COMMISSIONER
NAIROBI COUNTY
P. O. Box 30124-00100, NBI
TEL: 341666

The County Director of Education
Nairobi County.

Appendix 9: Research Permit – NACOSTI

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 20729

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MR. JAPHETH RASUGU NYAMBOKI
of UNIVERSITY OF NAIROBI, 5475-200 NAIROBI,has been permitted to conduct research in *Nairobi County*

on the topic: *MANAGEMENT OF STEEL REINFORCEMENT WORK ON WORKERS' HEALTH IN BUILDING CONSTRUCTION SITES: CASE STUDY IN NAIROBI COUNTY, KENYA.*

for the period ending:
20th September,2019

Permit No : NACOSTI/P/18/32716/25166
Date Of Issue : 21st September,2018
Fee Recieved :Ksh 1000

....
Applicant's Signature

....
Director General
National Commission for Science, Technology & Innovation

Appendix 10: Letter of Authorization from Ministry of Education

Republic of Kenya
MINISTRY OF EDUCATION
STATE DEPARTMENT FOR EARLY LEARNING & BASIC EDUCATION

Telegrams: "SCHOOLING", Nairobi
Telephone; Nairobi 020 2453699
Email: rcenairobi@gmail.com
cdenairobi@gmail.com

When replying please quote

REGIONAL COORDINATOR OF EDUCATION
NAIROBI REGION
NYAYO HOUSE
P.O. Box 74629 – 00200
NAIROBI

Ref: RCE/NRB/GEN/1 VOL. I

DATE: 25th September, 2018

Japheth Rasugu nyamboki
University of Nairobi
P.O. 30197-00100
NAIROBI

RE: RESEARCH AUTHORIZATION

We are in receipt of a letter from the National Commission for Science, Technology and Innovation regarding research authorization in Nairobi County on "***Management of steel reinforcement work on workers' health in building construction sites: study in Nairobi County, Kenya***".

This office has no objection and authority is hereby granted for a period ending **20th September, 2019** as indicated in the request letter.

Kindly inform the Sub County Director of Education of the Sub County you intend to visit.

REGIONAL COORDINATOR OF EDUCATION
NAIROBI
25 SEP 2018
MINISTRY OF EDUCATION NAIROBI

KINOTI KOGORA
FOR: REGIONAL COORDINATOR OF EDUCATION
NAIROBI

C.C

Director General/CEO
Nation Commission for Science, Technology and Innovation
NAIROBI

Appendix 11: Site photo Recordings

Steel worker carrying steel bar without PPE

Steel worker tying reinforcement bars

Steel worker tying reinforcement bars

Steel worker carrying steel bar without PPE

Steel worker tying reinforcement bars

Steel worker tying reinforcement bars

Source: Author 2019.