Policies and Regulatory Frameworks Influencing Trends of Work-related Fatalities and Severe Injuries in the Construction Industry in Dar-es-Salaam Region, Tanzania:1980 to 2009

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BY

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DECLARATION

I hereby declare that this Master of Public Health dissertation is my own work, and where other primary and secondary sources have been used they have been appropriately acknowledged. The dissertation has not been submitted previously to any other Institution or University as part of an academic qualification.

This Dissertation is prepared in partial fulfillment of the requirement of the Master of Public Health degree at the School of Family and Public Health Medicine, Nelson R Mandela School of Medicine, University of KwaZulu-Natal, Durban South Africa.

I, **Joshua Mwita Matiko** declare that

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ACRONYMS AND ABBREVIATIONS

AAT	Architects Association of Tanzania
ACET	Association of Consulting Engineers of Tanzania
AQSRB	Architects and Quantity Surveyors Registration Board
BREC	Biomedical Research Ethics Committee
CRB	Contractors Registration Board
ERB	Engineers' Registration Board
GDP	Gross Domestic Product
IET	Institution of Engineers Tanzania
LFS	Labour force survey
NCC	National Construction Council
NIMR	National Institute for Medical Research
NIOSH	National Institute of Occupational Health
OHS	Occupational Health and Safety
OSHA	Occupational Health and Safety Authority
PGEC	Postgraduate Education Committee
SPSS	Statistical Package for Social Sciences
TASECA	Tanzania Civil Engineering Association
TIQS	Tanzania Institute of Quantity Surveyors
TZS	Tanzanian Shillings
USA	United States of America
US-OSHA	US Occupational Safety and Health Administration

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ABSTRACT / SUMMARY

Introduction

Despite the existence of data in the Labour Commissioner's Accident and Occupational Diseases Register of Tanzania, trends in the frequency of work-related fatalities and severe injuries in the construction industry, in relation to the development of policies and regulatory frameworks over the years and their effectiveness as interventions, have not been systematically evaluated.

Aim

The aim of this study was to investigate the relationship between the regulatory framework, trends in the frequency of work-related fatalities and severe injuries among construction workers in Dar-es-Salaam Region, Tanzania, from January 1980 to December 2009.

Methods

The Accident Notification and Register was accessed from the Tanzanian Labour Department. Data were extracted from the register, coded and analyzed using SPSS. Chi square was used to test if injuries and fatalities in the construction industry and non-construction industries are influenced by introduction of regulatory bodies, legislation and policies during the baseline period (1980 – 1981) and subsequent time periods. Dependent variables were cases of injuries and fatalities in the construction industry and in the non-construction industries, while independent variables included duration during which the regulatory bodies, legislation and policies have been operational, age, sex, education and duration of employment.

Results

The introduction of regulatory bodies, legislation and policies was statistically significant in the reduction of reported cases in the construction industry across all time periods as compared to the baseline period. The adjusted risk of fatalities and work related injuries frequency in the construction industry decreased (OR 0.5; 95% CI 0.4 – 0.6 during 1998 – 2001) in almost all time periods compared to the baseline period except for the period between 1982 and 1985 (OR 1.2; 95% CI 1.0 to 1.3).

Discussion

This study is the first to be conducted in Tanzania. The study has shown that new governing bodies and the introduction of new policies and legislations that were introduced in the construction sector were effective in terms of reduction of reported accidents. The results of this study are similar to other studies that have conducted elsewhere. The studies that were conducted in US in 2001and 2003 to evaluate regulatory intervention on vertical falls found evidence that introduction of regulations was effective in preventing non-fatal and fatal injuries in the construction industry. Our results could have been confounded by other factors such as improvement of economic status, construction technologies and work practices.

Recommendations

In addition to establishment of regulatory bodies, legislation and policies to reduce the accidents, the focus should be also to change technology and practices on construction sites. A safety culture should also be emphasized.

CHAPTER 1. INTRODUCTION

1.1 INTRODUCTION

The construction industry is one of the most hazardous occupational settings worldwide (1), (2). The industry includes activities such as construction, upkeep, repair and demolition of small, medium and large permanent or temporary buildings erected for a variety of purposes using a range of materials and techniques. Those activities may be done manually or assisted by machinery (3). As has happened in many countries, the construction industry in Tanzania has witnessed considerable changes over the last three decades. These include establishing new governing bodies, introducting new policies and legislation, a growth and expansion in terms of its activities, and employing an increasing number of workers (4). These have influenced the prevalence of occupational injuries and accidents in the industry in a variety of ways (5).

Reports on fatalities and injuries are collected and summarized in Accident Register which is maintained in the Labour Commissioner's office in the Ministry of Labour and Employment for compensation purposes since 1949 after enactment of Workmen's Compensation Ordinance Cap 263 (6). Four years later, notification of accidents and occupational diseases was required under the Notification of Accidents and Occupational Diseases Ordinance of 1953 Cap 330 (7). Despite the availability of the Accident Register and routine hospital records, trends in the frequency of fatalities and severe work related injuries in the construction industry, in relation to national policy and legislative interventions, have not yet been established.

They have not been analysed to determine what the trends are with regard to accident rates and common causes, such as falls from height, collapsing objects, contact with moving objects etc. . Nor has any analysed been done regarding whether and how factors such as macro-interventions (legislation, policy and statutory bodies) and economic conditions have influenced these trends, and whether they are the same as those reported internationally. This is particularly relevant in the Dar-es-Salaam Region of the country, in which the biggest business city is located (Dar-es-Salaam), where 2.6 million people live, and where most of the national government offices are located. It

also contains most of the national government offices and is the hub of the country's business sector.

1.2 BACKGROUND

In most developing countries, only fatalities and severe work-related injuries are notified (8). This is the case in Tanzania, and leads to an underestimation of the magnitude of occupational health and safety (OHS) problems, because in many cases, data on minor injuries are missing or not reported. Inadequate information on OHS hazards leads to difficulties in motivating for the implementation of relevant standards at construction sites and other places of work. It is therefore important to initiate efforts to implement changes to the OHS standards in the industry. However, before the implementation of new standards and strategies to mitigate the situation, the effectiveness of previously introduced policies, governing bodies and legislation should be assessed to evaluate their impact on fatalities and injuries frequency, and on the types and causes of fatalities and work-related injuries.

This study invetigated the effect of two main factors on the frequency of fatalities and injuries in the construction industry in Dar-es-Salaam Region, using data that was reported to the office of the Labour Commissioner over a thirty year period (1980-2009). These two factors were the establishment of new governing bodies and the introduction of new policies and legislation, their purpose being to improve working conditions and hence to reduce fatalities and work related injuries in the construction industry.

1.3 DEFINITIONS

"Contractor" - any person who for reward or other valuable consideration undertakes the construction, installation, erection or alteration or erection for any other person, of any structure situated below, on, or above the ground or other work connected therewith or the execution of any alteration or otherwise, or other work connected therewith (9).

"Local Contracting firm" - is a firm in which the majority shares are owned by citizens of the United Republic of Tanzania.

"Foreign Construction firm" – is a firm which the majority shares are not owned by citizens of the United Republic of Tanzania

"Construction worker" - a worker who works for a Construction Company

"Severe work-related injury" – an occupational injury which leads to admission of a worker in the hospital for more than three days

"Over three days off duty" - an occupational injury which results in a worker being off duty (not hospitalized) for more than three days

"Construction Case Ratio" - the ratio of cases in the construction industry to all cases

"Construction fatality ratio" – the ratio of fatal cases in the construction industry to all fatal cases

1.4 HYPOTHESIS

The hypothesis tested in this study were: Fatalities and work related injuries decreased in frequency in the construction industry upon the establishment of new governing bodies and the introduction of new policies and legislations at different periods between 1980 and 2009.

Do you not need to state the null hypothesis?

1.5 AIM

The aim of this study was to investigate the relationship between the regulatory framework and trends in the frequency of work-related fatalities and severe injuries among construction workers in Dar-es-Salaam Region, Tanzania from January 1980 to December 2009.

1.6 SPECIFIC OBJECTIVES

1. To describe the demographics of workers with severe injuries and work related fatalities between January 1980 and December 2009;
2. To describe the nature, types and causes of work-related fatalities and severe injuries among the construction workers;
3. To determine the frequency of work-related fatalities and severe injuries in construction industry and describe the frequency trends between 1980 and 2009; and

4. To examine the impact of the implementation of new occupational health and safety legislation and the establishment of regulatory bodies on work-related fatalities and severe injuries among construction workers.

1.7 SIGNIFICANCE OF THE STUDY

The results of this study will help to identify causes injuries, job categories and age groups at high risk of getting injured in the construction industry. This study is important as its results will add value to on-going review process of Occupational Safety and Health Rules in Construction Industry as part of establishment of policy strategies to reduce accidents and occupational illness as well as providing a model for the analysis and interpretation of routinely collected data to direct such strategies in the construction sector in Tanzania. The study will also recommend the strategies to improve accidents and occupational illness recording and notification system based on the findings.

CHAPTER 2. LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will provide a background to the construction industry in Tanzania, with specific reference to the Dar-es-Salaam Region, provide information on the Accident Register and factors impacting on construction accident trends. The chapter will also discuss nature of employment in construction industry.

2.2 BACKGROUND

The construction industry is often more hazardous than other sectors (manufacturing, electricity, transport, finance, etc), has relatively high rates of injuries and fatalities (8), (10), (11), (12), and accounts for 30 to 40% of the world's fatal injuries (3). This is because workers are exposed to a number of hazards such as dust, manual handling, falling objects, and both physical and psychosocial risk factors (13), (14). Fatalities and injuries in construction sites are attributed to several common causes the world over, the most common being falls from a high level, struck by a falling object, electric shock, caught in between equipment or fixed objects (15).

The construction industry has the highest rate of accidents among all industries (16), (17), (18). In the USA in 1996, construction industry fatalities accounted for 19% (fatality rate was 19.4 per 100,000 workers) and work-related accidents for 8% of all work-related accidents. In France in the same year, construction industry fatalities were 26% (fatality rate was 17.2 per 100,000 workers) and work-related accidents were 19% of all work-related deaths and accidents respectively (1). In Argentina in 1997, similar results were seen, with fatalities accounting for 16% (fatality rate was 48.5 per 100,000 workers) and work-related accidents 14% of all work-related accidents (1). In Japan in 1998, however, these results were much higher, their fatality rate being 40% and work-related accident being 28% of all work-related accidents (19). The percentage of fatality rate and work-related accident was high in Japan compared to other countries probably due to good reporting system. The above statistics show that the risk of construction workers involved in fatal occupational accident is higher in less developed countries

compared to developed countries. For instance, workers in Argentina are 2.8 time more likely to be involved in fatal accident than workers in France.

In a report on Registration, Regulation and Development of Contractors in Tanzania (Occupational Health and Safety), by Factories Inspectorate in 1999, it was noted that the formal construction industry in Tanzania was responsible for approximately 10% of all occupational accidents, 10% of fatalities, 12% of partial disabilities and 7% of temporary disability (2). The report does not clearly stated why the statistics show that the percentage of accidents in its construction industry were relatively low compared to other countries, and could be due to a high under reporting or due to lack of incentives to reporting or disincentives for those who do not report.
In the survey conducted in Moshi and Arusha Regions in Tanzania in 1998, falls of workers accounted for 51% and falls of material accounted for 24% of all accident types (20). The recent rates of fatalities and severe work related injuries in Tanzania are not available due to the data in the Accidents Register at the office of Labour Commission not having been evaluated for several years.

Tanzania has a population of 44 million people with 16 million people working in different economic sectors such as agriculture, hunting and forestry, fishing, mining and quarry, manufacturing, electricity, construction, etc (21). The integrated Labour Force Survey (LFS) conducted in 2006 showed that 178,681 (1.1% of all workers)worked in the construction industry, which is dominated by male workers (98.0%) (22), of whom 56,388 (32.0%) were employed in Dar-es-Salaam City. . Over a five year period (2001 – 2006), according to the LFS, there was a 57% increase of number of workers in this sector (23). This increase indicates that construction in Tanzania is an important sectors and one of the fast growing.

As with many developing countries, OHS standards are not properly followed. A survey of 63 construction sites in Tanzania in 2001 indicated that only 12 were using scaffolds according to standards set out in the Occupational Health and Safety (Building Operations and Works of Engineering Construction) Rules. In the same survey, out of 33 construction firm managers interviewed, only six had an OHS policy in place (9).

There are several reasons which lead to low compliance with OHS standards, including low awareness and enforcement the requirements under OHS legislation, and lack of adequate risk identification and communication (24). Another reason could be that owners have no OHS responsibility under the law, and therefore do not provide adequate fund to contractors to cover OHS compliance costs.

Studies on the impact of establishing regulatory bodies and OHS legislation have mainly been conducted in the manufacturing industry of the United States of America (USA). The promulgation of Occupational Safety and Health Act of 1970, which created National Institute for Occupational Safety and Health (NIOSH) and the US Occupational Safety and Health Administration (US-OSHA), contributed to the reduction of fatality rates from 8.9 per 100,000 workers in 1980 to 5.6 per 100,000 workers in 1989. (25). Since 1971, NIOSH has performed a number of activities, such as investigating hazardous work conditions, conducting research and training, and developing educational materials which contributed to worker protection (26). Since the establishment of the US-OSHA, a number of activities towards improving working conditions have been conducted. US-OSHA has laid down procedures for workplace inspection, and developed safety standards and regulations, mandatory workplace safety controls, and worker training programmes (25). A study showed that enforcement of OHS standards through inspections by US-OSHA officials in 1973 had no statistically significant impact in 1974, but had reduced injury rates by 1979 by approximately 16% (27). The study could not explain the reasons for the decline, but suggested that it might be as a result of underreporting of accidents due to fear (fear to report accidents) associated with disincentives imposed by US-OSHA after its establishment in 1973.

Cochrane researchers from the Finnish Institute of Occupational Health analysed the results of five studies on injuries. Three studies evaluated the effect of regulations, one evaluated a safety campaign, and one a drug-free workplace programme on fatal or non-fatal injuries compared to no drug-free workplace programme. The analysis found that regulatory interventions did not show either an initial or sustained effect on fatal or nonfatal injuries (Effect Size = 0.69) (28).

US and Cochrane studies suggest that the enforcement of OHS legislation alone have no significant effect in reducing accidents, which might also be the case in developing countries such as Tanzania.

2.3 ACCIDENTS REGISTER

The Tanzanian Accidents Register was established in 1949 after enactment of the Workmen's Compensation Ordinance Cap 263 (6). The main objective of the Ordinance was to provide for compensation for fatalities and injuries suffered by workmen arising out of and in the course of their employment (6). In 2008, the Workers' Compensation Act was enacted to replace the Workmen's Compensation Ordinance and to improve the compensation system. It was anticipated that once this Act was promulgated, it would significantly reduce the number of accidents as it would provide disincentives for employers with higher accident rates (they pay higher annual premium). Unfortunately, to date, the Act has not been gazetted, and compensation and reporting is therefore still done under the Workmen's Compensation Ordinance. When an accident causes the loss of life of a worker or disables them for at least three consecutive days from earning full wages, the employer or his/her representative is obliged to report that accident to the Labour Offices. There are 32 labour offices countrywide including two in Dar-es-Salaam. Since 1949, all accidents have been reported mainly for the purpose of compensation. The accident is reported to a Labour Office by the employer, after which the worker is supplied with a special form on which they record the relevant details of the accident, including the injury assessment by the medical officer (Appendix 1).

The number of occupational fatalities and injuries have fluctuated over the years. For instance, between 1999 and 2008 the number of reported cases in the whole country was 552 in 1999 and 2000, and 743 in 2007, an average of 568 accidents per year (29). However, the current reporting system does not show a complete picture as it only covers formal workplaces in which employees are covered by compulsory workmen's' insurance (30). Owing to the limitations with the official notification system, this study will focus only on formal construction sector.

2.4 NATURE OF EMPLOYMENT IN CONSTRUCTION INDUSTRY IN TANZANIA

Construction companies are required to register with Contractors' Registration Board and Occupational Safety and Health Authority, this processes enabling the government to monitor their compliance with the necessary regulation, including registration of their construction sites and equipment. The construction industry employs many categories of workers such as masons, plant operators, carpenters, painters, steel fixers, pipe fitters, electricians, and welders, tiles layers, fitter mechanics, general labour and many others. Workers are categorized according to different levels of skill and experience.

Construction company owners in Tanzania employ few permanent staff, the rest being employed for a specific duration, depending on the lifetime of the project, or to perform a specific task (31). Most of the workers have primary education level with three years or more work experience and few of them has OHS formal education (24). Contractors therefore have three types of employment categories: permanently employed workers , workers employed on annual contracts (normally 12 months), and contract terms (piece work) (32). All three categories of workers are covered by all OHS legislation. Once they are engaged, employers have full responsibility to protect them from health risk (33). A large number of workers do not have a permanent workplace due to the nature of the construction industry. Once they finish their contract or piece work, they move to another site where they may be employed by another contractor. Contractors are reluctant to employ many permanent workers not because they want avoid OHS responsibilities, but because they are not sure when they will get the next project, and want to avoid payment to workers who are not working all the time.

The informal construction sector also operates in Tanzania, and consists of small groups or individuals who are not registered with any Government institution (34) and therefore don't pay tax. This sector employs 3.0% of workers in construction industry (22) but as they are not registered in any of the official institutions, it is very difficult to regulate them in all aspects including OHS issues.

2.5 FACTORS IMPACTING ON CONSTRUCTION ACCIDENT TRENDS

Since 1975, a number of governing bodies have been established under Acts of Parliament that are responsible for improving the working conditions in the construction industry in Tanzania. The governing bodies are:

- Institution of Engineers Tanzania (IET) in 1975.
- National Construction Council (NCC) in 1981;
- Contractors Registration Board (CRB) in 1997;
- Engineers' Registration Board (ERB) in 1997;
- Architects and Quantity Surveyors Registration Board (AQSRB) in 1997;
- Occupational Health and Safety Authority (OSHA) in 2003;

Each of these will be reviewed below with respect to the role that they play on regulating the industry and promoting health and safety measures in place to reduce accidents in the construction industry.

2.5.1 OCCUPATIONAL HEALTH AND SAFETY AUTHORITY

The Occupational Health and Safety Authority (OSHA) was established in 2001 as part of Public Service Reform Programme Phase One (PSRP I) under the Executive Agencies Act No. 30 of 1997 (35). It was established to take over the functions of Factories Inspectorate Unit (FIU) under the Labour Department, and was a semi-autonomous status, its functions including the administration of OHS legislation including the Occupational Health and Safety (OHS) Act No.5 of 2003. This Act enabled its formalization as an official authority, although it had been functioning in that capacity since 2001. The OHS Act applies to all workplaces including the construction industry, its main aim being OSHA to promote occupational health and safety and to maintain work environments that are free from occupational hazards that may cause harm to employees and damage to property.

2.5.2 CONTRACTORS REGISTRATION BOARD

The Contractors Registration Board (CRB) was established by the Contractors Registration Act No. 17 of 1997 and was amended in 2008. The major functions of the Board are registration, regulation and promotion of contractors in Tanzania. In addition, the Board needs to ensure that all labour laws, and occupational health and safety

regulations in the construction industry are adhered to (36). The amendments to the Contractors Registration Act in 2008 did not add more responsibilities to CRB on occupational health and safety issues.

2.5.3 NATIONAL CONSTRUCTION COUNCIL

The National Construction Council (NCC) was established in 1981 under the Act of Parliament No. 20 of 1979. Its main goal was to promote the development of the local construction industry (37). However, while the NCC initially had no clear and direct approach on health and safety issues, in 2007, it assumed the OHS responsibilities after amendment of the Act.

2.5.4 ENGINEERS' REGISTRATION BOARD

The Engineers' Registration Board (ERB) was established under the Engineers' Registration Act, No. 15 of 1997, and was repealed in 2007. Its main goal is to monitor and regulate engineering activities and the conduct of the engineers and engineering consulting firms in Tanzania through the registration of engineers and engineering consulting firms. The engineers are regulated in a manner that will ensure safety to life, property and the environment and at the same time, enhance the quality of engineering works and services (38). The main function of the ERB is to maintain and keep a register of engineers, including consulting engineers or firms providing engineering services. ERB can also enter and inspect sites where any construction activities is being carried out to verify that standards, professional ethics and the relevant health and safety aspects are observed.

2.5.5 ARCHITECTS AND QUANTITY SURVEYORS' REGISTRATION BOARD

The Architects and Quantity Surveyors' Registration Board (AQSRB) was established by the Architects and Quantity Surveyors (Registration) Act No. 16 of 1997, and was repealed in 2010. One of the objectives of the board is regulate the conduct of architects, quantity surveyors and consulting firms, including regulating safety and health issues, particularly during the design stage (39). The main function of the AQSRB is to register and maintain registers of architects, quantity surveyors and their

firms, both local and foreign. It has also their function to entering building sites and construction works to inspect and verify and ensure that sites and works are complying with all government regulations and laws including requirement of safety and health.

2.5.6 INSTITUTION OF ENGINEERS TANZANIA

Institution of Engineers Tanzania (IET) was operationalised in 1977 after acquiring its registration in 1975 under the Society Application Ordinance of 1954, and is guided by a written constitution approved by its membership. The main goal of the institution is to promote engineers and to equip them with skills to perform their engineering tasks properly and promote the general advancement of the science and practice of Engineering. IET provides some training programmes for its members which includes trainings on OHS issues.

2.5.7 THE OCCUPATIONAL HEALTH AND SAFETY ACT 2003

The occupational health and safety act 2003 replaced the Factories Ordinance of 1950, which made provisions for the safety, health and welfare of persons working in factories and other places including construction sites. The Occupational Health and Safety Act No. 5 of 2003 covers the items provided for in the Ordinance, and includes the protection of persons, other than persons at work, against hazards to health and safety arising out of or in connection with activities of persons at work; and the provision for matters connected with occupational safety and health (40).

The Act provides for the designation and function of safety and health representatives in workplaces that have four employees or more also establish and give functions to Safety and Health Committees. It gives powers to inspectors for conducting inspection, investigation and formal inquiries, and deals with the protection of workers, mainly from mechanical and chemical hazards. It includes general safety requirements for prime-movers, transmission machinery, self acting machines, hoists and lifts, other lifting gear such as cranes, chains and ropes, pressure vessels such as boilers, steam and air receivers. Theoretically, it is assumed that there is no difference between accidents occurrence in construction and non-construction industries during which the Factories

Ordinance and OHS Act have been in operation, as both pieces of legislation affect all sectors, including the construction sector.

2.5.8 THE FACTORIES (BUILDING OPERATIONS AND WORKS OF ENGINEERING CONSTRUCTION) RULES OF 1985

The Factories Rules were established under the Factories Ordinance, but despite it being replaced by the OHS Act, the Rules are still in use to date. The Rules make provision for safety, health and welfare of persons engaged in building operations and works of engineering construction undertaken by way of trade or business, or for the purpose of any industrial or commercial undertaking; and to building operations and works of engineering construction undertaken by or on behalf of the Government, a local authority or a public body (41). The Rules include guidelines on safety in excavations, shafts and tunnels, cofferdams and caissons. They also make safety provisions for lifting appliances, scaffolds and other working places. Adequate lighting and ventilation, provisions of first aid equipment as well as sanitary facilities are also included, although in general terms.

2.5.9 CONSTRUCTION INDUSTRY POLICY

In 2003, the Government of Tanzania, through the National Construction Council, established a policy on the Construction Industry. The Policy emphasises the development of an efficient and self sustaining roads network and housing scheme that is capable of meeting the diverse needs for construction, rehabilitation and maintenance of civil works for trunk, regional, districts and feeder roads network and buildings, through the involvement of the private sector. One of the objectives of the policy is to promote and undertake research programmes that are geared towards applying technologies, products and practices that are not harmful to the environment, human health and safety (42).

The policy has mentioned some of the safety hazards which pose imminent danger to the health of workers, or damage to materials, equipment, or structures. The policy mentioned health hazards in construction sites which include heat, radiation, noise, dust, shock and vibrations, and toxic chemicals. The policy has stipulated the strategy to

prevent OHS hazards,this being to promote education and training programmes on environmental sustainability, sustainable construction practices and human health and safety issues.

2.5.10 THE MINING (SAFE WORKING AND OCCUPATIONAL HEALTH) REGULATIONS, 1999

The Mining Regulations make provisions for safety, health and welfare of persons engaged to all mines and quarries during exploration, evaluation, development, construction, production, closure, reclamation and abandonment (43). These regulations are enforced by the Chief inspector of Mines who reports to the Commissioner of Mines in the Ministry of Energy and Mineral Resources. These are the only regulations in the country which do not apply to the construction industry, except when the construction is undertaken in the mine.

2.5.11 ECONOMIC GROWTH IN THE CONSTRUCTION INDUSTRY

The construction industry plays a significant role in Tanzania's economic growth, with the average growth rate for the construction sector increasing from 1% in 1994 to 12% in 1998. The contribution of the construction sector to employment creation accounted for 9% in 2000. From 1999 and 2000, the growth of the construction sector averaged 9% per year, while its contribution to Gross Domestic Product (GDP) averaged 5%. The average contribution to total capital formation during the period 1988 to 1997 was 57%. In terms of government expenditure, an average of 14% of the development budget was spent on construction projects for the period 1988 to 1997, compared to an average of 30% for the period 1976 to 1985 (42).

The growth rate of the sector increased to 12% in 2005/06 from 11% in 2004/05 and the contribution of construction activity to the overall GDP rose to 6% in 2005/06, compared to a contribution of 5% in 2004/05. In 2005/06, the total government expenditure for construction affairs and services was TZS 53,425 million compared to the expenditures in 2004/05 estimated to be TZS 58,693 million, and in 2003/04 estimated to be TZS 29,740 million. Since 2000, Tanzania's real GDP has grown at an annual rate of approximately 6.3%, with the construction industry being a major

contributor to this growth. Construction contributes approximately TSh 740 billion (£300 million) or 6% to the GDP of TSh13,000 billion or £5.2 billion (44).

The change in the economic situation may have impacted on the frequency of fatalities and severe work related injuries in the construction industry, which may also be due to the fact that economic growth is normally accompanied with more occupational hazards. The assumption is that in the case of a change in the economic situation in the country, the effects will be across all industrial sectors. As there is not enough data on trends of economic growth to analyse the impact to the economic change on the occurrence of accidents, it is therefore assumed that the economic growth has had the same impact on the frequency of fatalities and severe work related injuries across all industries.

CHAPTER 3. METHODS

3.1 INTRODUCTION

This is a cross-sectional study based on records of occupational fatalities and severe work-related-injuries of workers in Dar-es-Salaam. This study analysed a set of data based on official reports to the Tanzanian Office of Labour Commissioner for the purpose of compensation, particularly in Dar-es-Salaam Region. In this study, the aim was to describe and analyse the trends in accidents and frequency of fatalities and severe injuries, and to determine the impact of policy and legislative interventions that have been introduced in the sector throughout the years.

This chapter details the study design, the target population and study sample, how the health outcome and legislative data was obtained and possible confounders in the study. The chapter also deals with how data were managed and how ethical issues were considered.

3.2 STUDY DESIGN

This was a cross sectional study. The reported cases of accidents were assessed over time in different time durations, and comparisons were made between construction and non-construction industries.

3.3 TARGET POPULATION AND STUDY SAMPLE

The section describes the target population for the study, indicates how the study population were selected, and details the sample Size Considerations.

3.3.1 TARGET POPULATION

The target population were all workers employed in Dar-es-Salaam Region who were eligible to have their work-related injuries or deaths recorded in the database in Labour Commissioners' office Dar-es-Salaam. This study could not include data of accidents reported in other regions due to financial constraints. These are mainly men, as the construction industry is physically very demanding and requires a level of strength.

3.3.2 SELECTION OF STUDY POPULATION

All workers with work-related fatalities and severe injuries recorded in the Accident register in Labour Commissioners' office Dar-es-Salaam were selected, including those in the non-construction industries. Then reported cases from the construction industry were compared to the non-construction industries in different time periods to evaluate the effectiveness of policies, regulatory bodies and legislation. The construction industry was chosen as a comparison group due to the fact that there numerous policies, regulatory bodies and legislative frameworks in the industry compared to all other industries.

3.3.3 SAMPLE SIZE CONSIDERATIONS

No sampling was done, as all work-related fatalities and severe injuries in the construction industry and all non-construction industries that were recorded in the Accident Notification and Register Book database in the office of Labour Commissioner, Dar-es-Salaam, between January 1980 and December 2009 were studied.

3.4 COLLECTION OF HEALTH OUTCOMES DATA

Data was collected from the Accident register in the Tanzanian Labour Commissioners' office in Dar-es-Salaam. The variables contained in the register are as shown in the accident report form (Appendix 1) and consist of the following categories:

- Socio-Demographic details such as age, sex, severity of injury and education level
- Nature of injury
- Outcome: recovery or death

The information in the register was extracted from accident notification forms that are submitted by employers and medical report from the attending medical doctor who treated a worker.

Four (4) field research assistants were employed and trained for one day by the principal researcher on how to extract information related to fatalities and injuries from the above mentioned dataset. Work-related fatalities and severe injuries of all non-construction

industries were recorded so as to compare the trends with construction industry. During data collection, the principal researcher supervised the process, and randomly verified the information filled in the accident report form with the accident register as part of the quality control.

3.5 COLLECTION OF LEGISLATIVE AND POLICY DATA

Ministries responsible for administering the construction industry and occupational health generally, such as the Ministries of Works and Infrastructure, Health and Social Welfare, Justice and Labour and Employment, were approached to determine whether there were any policies, legislation or institutions under their jurisdiction that regulated or promoted safety and health at work. All policies, legislation and institutions that were established from1980 up to 2009 were identified to be included in this study.

3.6 POSSIBLE CONFOUNDERS

Possible confounders could be the improvement of economic status, construction technologies and work practices that could contribute to a reduction of reported cases on accidents. In additional to established regulatory bodies, legislation and policies, awareness on OHS issues and more investment in accident prevention at enterprise level could have influenced accidents reduction. These confounders were not controlled due to unavailability of data. However, it has been assumed that other factors had the same impact in all the industries.

3.7 DATA MANAGEMENT AND ANALYSIS

This section describes how the data was managed, and the various types of analysis namely: descriptive as well as bivariate and multivariate. Data were coded and analyzed using the statistical software, Statistical Package for Social Sciences version 16.0 (SPSS ver16.0). The study considered the percentage of cases of fatal and non-fatal injuries in the construction industry and in non-construction industries, using the number of all workers who reported to the Labour Office for purposes compensation from 1980 to 2009 as the denominator. In both construction and non-construction industries, the study tested differences in the distribution of the reported cases of fatal

and non-fatal injuries in terms of age, sex, severity of injury and education level, using the chi-square..

3.7.1 DATA MANAGEMENT

A data extraction form was developed onto which the relevant information from the Accident register was transcribed. The data collection proves for the injuries took six months to collect, during which time, the data recorders were given access to a room at the Labour Commissioner's office, which was locked at night and in which the forms were stored until in the morning of the next day, when they were collected by the researcher and taken for entry into SPSS ver16.0 for analysis. Once the data had been captured from the forms, they were stored in a locked cupboard in the researcher where they will be stored for five years. Access to the digital data was only granted to the researcher, their supervisor and the statistician assisting with the analysis.

3.7.2 DESCRIPTIVE ANALYSIS

The frequency distribution of records in each categorical variable, such as sex, level of education, age group, sex, category of job, and work experience, were calculated and displayed in bar charts. The frequencies of work-related fatalities and severe injuries by: cause of injuries such as falls from a height, awkward or sudden movement, slip and falls on the level, etc; and agency of accident such as temporary construction or fabric (e.g. ladder, stairs, scaffold), materials (e.g. metal, timber, stone, sand, gravel), construction machinery (e.g. bulldozer, power-driven shovel, boring machine), etc were analysed per year. Construction Case Ratio (Ratio of construction cases to all cases) and construction fatality ratio (ratio of fatality cases in construction industry to all fatality cases) were calculated to compare cases of accident and fatalities between construction industry and non-construction industry in different categories.

3.7.3 BIVARIATE AND MULTIVARIATE ANALYSIS

Trends and frequency of work-related fatalities and severe injuries were investigated to determine any impacts upon the introduction of regulatory bodies, legislation and policies for the period under investigation. Time periods were used as a proxy marker for the legislation or policy framework introduced in those time periods.

Chi square analysis was done for each time periods in which different legislation and regulatory bodies were established to assess their effectiveness in the reduction of work-related injuries and fatalities comparing to baseline period (1980 – 1981). In this case, independent variables (exposure variables) were the time periods in which the regulatory bodies, legislation or policies were established, and the outcome variables (dependent variables) were whether work-related fatalities and severe injuries occurred in the construction industry or in non-construction industries. Logistic regression model was done to refine the Chi square analysis, taking into account the possible influence of other periods in which other regulatory bodies, legislation and policies had been introduced. In this case, dependent and independent variables are defined and coded as follows:

1. The outcome variables (dependent variables) were work-related fatalities and severe injuries in the construction industry or in non-construction industries in the particular time periods.
2. The independent variables were periods in which the regulatory bodies, legislation and policies were operational. For instance, the Factories Ordinance CAP 297 of 1950 was in operation, prior to the introduction of the Institution of Engineers Tanzania (IET), while the period (1980-1981) is considered as baseline exposure and is coded as 0. Other periods are defined and coded as shown in Table 3.1. All regulatory bodies and legislation, except the Factories Ordinance, are still in operation. In the subsequent period in which a regulatory body or legislation is introduced, the previous regulatory bodies and legislation are included into that period, and the final period includes all regulatory bodies and legislation. However, it is hypothesized that in every time period, new regulatory body or legislation should result in a reduction of accidents during the time that the regulatory body or legislation has been in existence. Therefore, this study has tried to determine and changes after the introduction of every regulatory body or legislation, using the period of introduction of the change as a proxy.

To compare fatalities and severe injuries while adjusting for various demographic factors and categories of workers, bivariate correlation and logistic regression analysis

was used. In each time period demographic factors such age group, education level, sex, and work experience were defined as independent variables, and fatalities and injuries are defined as outcome (dependent variables).

Table 3.1: Different time periods during which regulatory framework have been in operation

Time Periods	Legislation, Institutions or policy that have been in operation	Code
1980 - 1981	Period in which Institution of Engineer Tanzania and Factories Ordinance CAP 297 was in operation before establishment of other regulatory frameworks (this is baseline).	0
1982 - 1985	Period in which the above instrument and National Construction Council have been in operation.	1
1986 - 1997	Period in which the above and Factories (Building Operations and Works of Engineering Construction) Rules of 1985, have been in operation.	2
1998 - 2001	Period in which The above instrument Engineers Registration Board, Contractors Registration Board, Mining (safe working and occupational health) regulations and Architect and Quantity Surveyors Registration Board have been in operation.	3
2002 - 2003	Period in which the above instrument and Occupational Safety and Health Authority have been in operation.	4
2004 - 2009	Period in which all the above instrument and OHS Act 2003 and National Construction Policy have been in operation.	5

3.8 ETHICS

This study protocol was submitted to University of KwaZulu-Natal Biomedical Research Ethics Committee (BREC) (Reference number EXP003/06) (see Appendix 4) and Postgraduate Education Committee (PGEC) for review and approval (see Appendix 4). Clearance to conduct this study was obtained from the National Institute for Medical Research (NIMR) in Tanzania, Reference number NIMR/HQ/R.8a/Vol. IX/1105) (see Appendix 2). The Labour Commissioners' office was requested to allow their data sets to be used in the study (Reference number HC 250/232/02) (see Appendix 3). The nature and benefits of study were clearly explained.

Confidentiality, anonymity and protection of participants from physical, emotional, social or any other kind of risk or discrimination were ensured. Each fatality or injury was assigned a case number that was used to identify all information related to that participant. No individual identification data were extracted from dataset.

CHAPTER 4. RESULTS

4.1 INTRODUCTION

This chapter presents the results of both the descriptive as well as bivariate and multivariate analysis. As the data was qualitative, it is described and presented in tables and some comments for specific results have been given.

4.2 DESCRIPTIVE ANALYSIS

There were a total of 36 004 reported cases of fatal and non-fatal incidents in the Accident Notification and Register Book in the Labour Offices between January 1980 and December 2009 in all age groups (Table 2). Of the 36 004 reported cases, 3 815 (10.6%) were reported from the construction industry and the rest (32,189) were reported from other industries. Overall, the fatality cases were 1.4% (n = 497) of all reported cases, of which 96 (0.3 %) were from the construction industry.

There were more cases reported in the construction industry compared to other industries in the age groups of 26 to 30 and 31 to 35, where ratios of the construction industry cases were 2.9% and 2.6% respectively. Females constituted less than 1% in the construction industry, and 8.7% in the other sectors. For the purposes of this study, the results will therefore be taken to largely reflect the injuries of men, unless otherwise stated.

The results show that the ratio of reported cases in the construction industry to all industries was the highest among workers with primary education (0.07), followed by workers with a secondary education (0.3) (Table 4.1). The ratio of construction industry cases to all cases was also higher among workers with work experience between one year and two years (0.05), and for job categories, it was high among general labourers (0.05).

Table 4.1: Descriptive statistics of reported cases during the period of study (1980 – 2009)

Number of Cases	**Construction (%) (N=**3815)	**Non-construction (%) (N=**32189)	**Construction Case Ratio (Ratio of construction cases to all cases)**
Sex			
Male	3783 (99.2)	29374 (91.3)	0.11
Female	32 (0.8)	2815 (8.7)	0.001
Age Group			
18 -20	65 (1.7)	784 (2.4)	0.002
21-25	686 (18.0)	6024 (18.7)	0.02
26-30	1054 (27.6)	8232 (25.6)	0.03
31-35	944 (24.7)	7271 (22.6)	0.03
36-40	502 (13.2)	4240 (13.2)	0.01
41-45	233 (6.1)	1773 (5.5)	0.01
46-50	179 (4.7)	2287 (7.1)	0.01
Over 50 years	152 (4.0)	1578 (4.9)	0.004
Work Experience			
No data available	0 (0.0)	11 (0.03)	-
Less than one year	278 (7.3)	2029 (6.3)	0.01
1 -2 years	1611 (42.2)	13305 (41.3)	0.05
3-5 years	1346 (35.3)	11218 (34.9)	0.04
More than five years	580 (15.2)	5626 (17.5)	0.02
Education			
No data was given	57 (1.5)	1611 (5.0)	0.002
Never went to school	73 (1.9)	1202 (3.7)	0.002
Primary education	2514 (65.9)	19810 (61.5)	0.07
Secondary education	882 (23.1)	7307 (22.7)	0.03
College education	219 (5.7)	1741 (5.4)	0.01
University education	70 (1.8)	518 (1.6)	0.002
Job Category			
Masons/bricklayers/plasterers/tiles layers	315 (8.3)	10 (0.03)	0.01
Plant operators/drivers	930 (24.4)	1153 (3.6)	0.03
Carpenters	330 (8.7)	1428 (4.4)	0.01
Painters	62 (1.6)	1332 (4.1)	0.002
Welder/steel fixer	71 (1.9)	1604 (5.0)	0.002
Pipe fitter/plumber	33 (0.9)	992 (3.1)	0.002
Electricians	33 (0.9)	1080 (3.4)	0.002
Fitter mechanics	12 (0.3)	30 (0.1)	0.00
Concrete placers/finishers	31 (0.8)	0 (0.0)	0.002
General labourers	1880 (49.3)	22820 (70.9)	0.05
Scaffolders	9 (0.2)	11 (0.03)	0.00
Supervisors/site engineers	89 (2.3)	1706 (5.3)	0.002
Consultants	20 (0.5)	23 (0.1)	0.00

Fatality ratio (ratio of fatal cases:all cases) were calculated within the age groups and other demographic categories as shown in Table 4.2. The fatality ratio in the

construction industry was highest (0.03) among the 46 to 50 year age group and lowest (0.017) among the 41 to 45 years age group, while in other industries, the fatality ratio was higher (0.014) among the 21 to 25 year age group.

The results show that according to the cases that were reported for compensation, the fatality ratio (0.03) was higher among workers with work experience of 3 to 5 years, followed by those with 1 to 2 years work experience. For non-construction industries, almost all categories of work experience had the same fatality ratio (1.3%) except for those who had work experience of less than one year (0.8%).

The distribution of reported cases by category of workers in construction industry shows the highest fatality ratio was among electricians (9.1%) and the lowest was among general labourers (2.3%).

Table 4.2: Percentage of fatality and construction industry case fatality ratio for each category

Category	Fatality in construction industry N (%)	Fatality in non-construction industries N (%)	Construction case fatality ratio
Sex			
Male	96 (2.5)	372 (1.3)	0.003
Female	0 (0.0)	29 (1.0)	0.0
Age Group			
18 -20	2 (3.1)	8 (1.0)	0.002
21-25	18 (2.6)	71 (1.2)	0.003
26-30	31 (2.9)	114 (1.4)	0.003
31-35	21 (2.2)	92 (1.3)	0.003
36-40	11 (2.2)	50 (1.2)	0.002
41-45	4 (1.7)	23 (1.3)	0.002
46-50	6 (3.4)	23 (1.0)	0.002
Over 50 years	3 (2.0)	20 (1.3)	0.002
Work Experience			
Less than one year	5 (1.8)	17 (0.8)	0.002
1 -2 years	42 (2.6)	167 (1.3)	0.003
3-5 years	39 (2.9)	146 (1.3)	0.003
More than five years	10 (1.7)	71 (1.3)	0.002
Education			
No data was given	3 (5.3)	22 (1.4)	0.002
Never went to school	1 (1.4)	10 (0.8)	0.001
Primary education	59 (2.3)	218 (1.1)	0.003
Secondary education	29 (3.3)	113 (1.5)	0.004
College education	3 (1.4)	30 (1.7)	0.002
University education	1 (1.4)	8 (1.5)	0.002
Job Category			
Mason/bricklayer/plasters/tiles layer	9 (3.1)	0 (0.0)	0.028
Plant operator/driver	23 (2.5)	18 (1.6)	0.011
Carpenter	13 (3.9)	15 (1.1)	0.007
Painter	0 (0.0)	22 (1.7)	0.0
Welder/steel fixer	1 (6.7)	27 (1.7)	0.001
Pipe fitter/plumber	0 (0.0)	14 (1.4)	0.0
Electrician	3 (9.1)	15 (1.4)	0.003
General labourer	43 (2.3)	267 (1.2)	0.002
Scaffolders	0 (0.0)	1 (9.1)	0.0
Supervisors/site engineer	3 (3.4)	22 (1.3)	0.002
Consultant	1 (5.0)	0 (0.0)	0.023

Table 4.3 shows the distribution of reported cases of fatal and non-fatal by cause in the construction industry. A total of 3 815 cases were reported, but for 159 (4.2%) cases, the cause of injuries or death was not mentioned. Hit by a moving or flying object represented the most common causes of injuries (26.6%) among all causes, while falling

from a height was the main cause for construction workers. These two categories among the construction workers accounted for 63% of injuries.

Table 2.3: Reported cases by causes of injuries or fatalities in the Construction Industry (n=3 815)

Cause of injury or fatalities (n (% of all cases)	Fatality (n = 96)	Severe Injury (n = 3142)	Over 3 days off Duty (n = 577)
	N (%)	N (%)	N (%)
Data not available (n = 159; 4.2%)	4 (4.2)	131 (4.2)	24 (4.2)
Moving machinery or material being machined (n = 423;11.1%)	8 (8.3)	353 (11.2)	62 (10.7)
Exposed to or in contact with harmful substance (n = 153; 4.0%)	3 (3.1)	129 (4.1)	21 (3.6)
Exposed to fire (n = 4; 0.1%)	0 (0)	4 (0.1)	0 (0)
Electrical or an electrical discharge (n = 65; 1.7%)	2 (2.1)	48 (1.5)	15 (2.6)
Injured by animal (n = 398; 10.4%)	5 (5.2)	316 (10.1)	77 (13.3)
Physical assault by person (n = 171; 4.5%)	0 (0)	147 (4.7)	24 (4.2)
Hit by moving or flying object (n = 1019; 26.7%)	30 (31.2)	851 (27.1)	138 (23.9)
Hit by moving vehicle (n = 454; 11.9%)	13 (13.5)	373 (11.9)	68 (11.8)
Hit or struck by object or something fixed or stationery (n = 3; 0.1%)	0 (0)	3 (0.1)	0 (0)
Injured while handling (n = 128; 3.4%)	0 (0)	101 (3.2)	27 (4.7)
Slipped, tripped or fell on the same level (n = 484; 12.7%)	0 (0)	414 (13.2)	70 (12.1)
Fell from a height (n = 350; 9.2%)	31 (32.3)	268 (8.5)	51 (8.8)
Trapped by collapsing structure (n = 2; 0.1%)	0 (0)	2 (0.1)	0 (0)
Injured by sharp edges, pinch point, nail (n = 2; 0.1%)	0 (0)	2 (0.1)	0 (0)

4.3 BIVARIATE AND MULTIVARIATE ANALYSIS

The analysis consisted of four components, namely: Risk Ratio to compare cases in the construction industry to those in the non-construction sectors; Odds ratios derived from logistic regression model for all fatal cases; Odds Ratios comparing reported cases in the construction industry and non construction industries (all cases) from logistic regression models, and Odds Ratios comparing reported fatal cases in the construction industry and non construction industries from logistic regression models.

Table 4.4 presents the results of the bivariate analyses that assessed the relationship between the different time periods (as proxy markers for the introduction of new legislative and policy frameworks) and the occurrence of fatal and non-fatal cases compared to the baseline period (1980 – 1981) in the construction and non-construction sectors. Although there is no statistical significant relationship of occurrence of fatal accidents, except during 2004 – 2009 (p = 0.05), the risk ratio decreased in each time period. The RR >1 in the 1982-1985 time period implies an increased risk of non-fatal injuries in that period, compared to the baseline. All other time periods suggested a protective effect compared to the baseline time period.

Table 4.4: Risk Ratio to compare cases in the construction industry to those in the non-construction sectors

Time Period	Risk Ratios	
	Fatal Cases (p-value)	All Cases (p-value)
1980 – 1981	1(baseline)	1(baseline)
1982 – 1985	0.6 (0.11)	1.2 (< 0.05)
1986 - 1997	0.6 (0.07)	0.6 (< 0.05)
1998 – 2001	0.7 (0.40)	0.6 (< 0.05)
2002 – 2003	0.6 (0.23)	0.7 (< 0.05)
2004 - 2009	0.8 (0.05)	0.4 (< 0.05)

Table 4.5 represents the comparison of risk of all reported fatal and non-fatal case among the various variables. Increased risk was associated with the younger age categories, higher educational levels and increasing work experience in the construction sector. However, with exception of the latter two variables, for most categories among these variables, the findings could have been due to chance. The striking finding is that working in the construction sector resulted in twice the risk of fatal injuries compared to working in non-construction industries.

Table 4.5: Odds ratios derived from logistic regression model for all fatal cases (n= 36 004)

Classification	Fatal cases (N = 497) (%)	Odds Ratios (95% CI)
Age Group		
18 -20	10 (2.0)	(baseline)
21-25	89 (17.9)	0.8 (0.4 - 1.6)
26-30	145 (29.2)	0.8 (0.4 - 1.7)
31-35	113 (22.7)	0.7 (0.3 - 1.5)
36-40	61 (12.3)	0.6 (0.3 - 1.3)
41-45	27 (5.4)	0.6 (0.3 - 1.4)
46-50	29 (5.8)	0.6 (0.3 - 1.4)
Over 50 years	23 (4.9)	0.6 (0.3 - 1.5)
Work Experience		
Less than one year	22 (4.4)	(baseline)
1 -2 years	209 (42.1)	1.7 (1.0 - 2.9)
3-5 years	185(37.2)	1.9 (1.1 - 3.3)
More than five years	81(16.3)	1.7 (1.0 - 3.2)
Education level		
Never went to school	11 (2.2)	(baseline)
Primary education	277 (55.7)	1.4 (0.8 - 2.5)
Secondary education	142 (28.6)	2.0 (1.0 - 3.6)
College education	33 (6.6)	1.9 (0.9 - 3.7)
University education	9 (1.8)	1.7 (0.7 - 4.0)
Sex		
Female	29 (5.8)	(baseline)
Male	468 (94.2)	1.2 (0.8 - 1.8)
Employment Sector		
Non Construction Cases	401 (80.7)	(baseline)
Construction Cases	96 (19.3)	2 (1.6 - 2.5)

The odds ratios above were obtained from logistic regression models, adjusting for age categories, work experience, education categories, sex and sector of employment.

Table 4.6 presents the odds ratios comparing reported cases in the construction and non-construction industries. There was an elevated risk generally in age, sex, work experience, education and severity, although this was not statistically significant for the lower age groups. The age groups of 46 to 50 years and over 50 years showed a decreasing odds ratio, as did the various time periods, except for time period 1982 – 1985 (OR = 1.2).

Table 4.6: Odds Ratios comparing reported cases in the construction industry and non construction industries (all cases) from logistic regression models

Classification	Construction (%) N = 3815	Non construction (%) N = 32189	OR (95% CI)
Age Group			
18 -20	65 (1.7)	784 (2.4)	(baseline)
21-25	686 (18.0)	6024 (18.7)	1.0 (0.8 – 1.4)
26-30	1054 (27.6)	8232 (25.6)	1.1 (0.8 – 1.5)
31-35	944 (24.7)	7271 (22.6)	1.2 (0.9 – 1.6)
36-40	502 (13.2)	4240 (13.2)	1.1 (0.8 – 1.5)
41-45	233 (6.1)	1773 (5.5)	1.2 (0.8 – 1.6)
46-50	179 (4.7)	2287 (7.1)	0.7 (0.5 – 1.0)
Over 50 years	152 (4.0)	1578 (4.9)	0.6 (0.6 – 1.3)
Sex			
Female	32 (0.8)	2815 (8.7)	(baseline)
Male	3783 (99.2)	29374 (91.3)	11.9 (8.3 – 17.0)
Work Experience			
Less than one year	278 (7.3)	2029 (6.3)	(baseline)
1 -2 years	1611 (42.2)	13305 (41.3)	1.2 (1.0 - 1.4)
3-5 years	1346 (35.3)	11218 (34.9)	1.2 (1.0 – 1.5)
More than five years	580 (15.2)	5626 (17.5)	1.2 (1.0 – 1.4)
Education level			
Never went to school	73 (1.9)	1202 (3.7)	(baseline)
Primary education	2514 (65.9)	19810 (61.5)	2.1 (1.7 – 2.7)
Secondary education	882 (23.1)	7307 (22.7)	2.0 (1.5 – 2.5)
College education	219 (5.7)	1741 (5.4)	2.1 (1.6 – 2.8)
University education	70 (1.8)	518 (1.6)	2.2 (1.5 – 3.1)
Severity			
Non Fatal Cases			(baseline)
Fatal Cases			2.1 (1.7 – 2.6)
Period of accident			
1980 – 1981	519 (13.6)	3133 (9.6)	(baseline)
1982 – 1985	1293 (33.9)	6187 (19.2)	1.2 (1.0 – 1.3)
1986 – 1997	1378 (36.1)	3189 (9.9)	0.5 (0.4 – 0.5)
1998 – 2001	280 (7.3)	15297 (47.5)	0.5 (0.4 – 0.6)
2002 – 2003	195 (5.1)	1828 (5.7)	0.6 (0.5 – 0.7)
2004 – 2009	150 (3.9)	2555 (7.9)	0.3 (0.3 – 0.4)

The odds ratios above were obtained from logistic regression models, adjusting for age categories, sex, work experience, education categories, severity of injuries, and time period of accident.

Table 4.7 represents the comparison of odds ratios of reported fatal cases in the construction industry and non-construction industries from the logistic regression model. Most of the estimates of risk shown in this table could be findings by chance, however, of note are the estimates of risk for the period of accident, which suggests a decreasing odds ratio, except in the last time period.

Table 4.7: Odds Ratios comparing reported fatal cases in the construction industry and non construction industries from logistic regression models

Classification	Construction N = 96 (%)	Non construction N = 401 (%)	OR (95% CI)
Age Group			
18 -20 (N = 10)	2 (2.1)	8 (2.0)	(baseline)
21-25 (N = 89)	18 (18.8)	71(17.7)	1.8 (0.2 – 16.6)
26-30 (N = 145)	31 (32.3)	114 (28.4)	3.2 (0.3 – 34.1)
31-35 (N = 113)	21(21.9)	92 (22.9)	2.5 (0.2 – 27.6)
36-40 (N = 61)	11(11.5)	50 (12.5)	3.3 (0.3 – 38.3)
41-45 (N = 27)	4 (4.2)	23 (5.7)	2.7 (0.2 – 37.9)
46-50 (N = 29)	6 (6.2)	23 (5.7)	4.2 (0.3 – 55.0)
Over 50 years (N = 23)	3 (2.1)	20 (5.0)	2.6 (0.2 – 38.9)
Sex			
Female (N = 29)	0 (0.0)	29 (100)	(baseline)
Male (N = 468)	96(7.2)	372 (92.8)	-
Work Experience			
Less than one year (N = 22)	5 (5.2)	17 (4.2)	(baseline)
1 -2 years (N = 209)	42 (43.8)	167 (41.6)	0.6 (0.1 - 2.5)
3-5 years (N = 185)	39 (40.6)	146 (36.4)	0.5 (0.1 – 2.5)
More than five years (N = 81)	10 (10.4)	71 (17.7)	0.2 (0.0 – 1.5)
Education level			
Never went to school (N = 11)	1 (1.1)	10 (2.6)	(baseline)
Primary education (N = 277)	59 (63.4)	218 (57.5)	2.6 (0.3 – 21.7)
Secondary education (N = 142)	29 (31.2)	113 (29.8)	2.2 (0.3 – 18.5)
College education (N = 33)	3 (3.2)	30 (7.9)	0.8 (0.1 – 9.3)
University education (N = 9)	1 (1.1)	8 (2.1)	1.3 (0.1 – 26.0)
Period of accident			
1980 – 1981 (N = 44)	12 (12.5)	32 (8.0)	(baseline)
1982 – 1985 (N = 89)	14 (14.6)	75 (18.7)	0.4 (0.2 – 1.0)
1986 – 1997 (N = 251)	40 (41.7)	211 (52.6)	0.5 (0.2 – 1.1)
1998 – 2001 (N = 51)	10 (10.4)	41 (10.2)	0.5 (0.2 – 1.4)
2002 – 2003 (N = 32)	5 (5.2)	27 (6.7)	0.5 (0.2 – 1.6)
2004 – 2009 (N = 30)	15 (15.6)	15 (3.7)	2.8 (1.0 – 8.1)

The odds ratios above were obtained from logistic regression models, adjusting for age categories, sex, work experience, education categories, and time period of accident.

CHAPTER 5. DISCUSSION, CONCLUSSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter discussed the results presented in Chapter 4, details the study limitations, outlines some recommendations, and indicates the significance of these findings to the construction industry in particular, but to affected sectors in general. The results will be discussed with respect to the four Objectives identified in Chapter 1 namely:

1. To describe the demographics of workers with severe injuries and work related fatalities between January 1980 and December 2009;
2. To describe the nature, types and causes of work-related fatalities and severe injuries among the construction workers;
3. To determine the frequency of work-related fatalities and severe injuries in construction industry and describe the frequency trends between 1980 and 2009; and
4. To examine the impact of the implementation of new occupational health and safety legislation and the establishment of regulatory bodies on work-related fatalities and severe injuries among construction workers.

5.2 DISCUSSION

This study is the first in Tanzania to investigate the relationship between the regulatory framework (using the time period of introduction of the instrument as a proxy marker), and trends in the frequency of work-related fatalities and severe injuries among construction workers in the country. The study has shown that most of the new governing bodies, as well as the introduction of new policies and legislations in construction sector, have been effective in terms of a reduction of reported accidents. This study has also been able to identify some indicators, frequency, and trends on fatalities and work-related injuries for the duration of thirty years.

5.2.1 DESCRIPTIVE ANALYSIS

The analysis of construction workers indicates that labourers were the most at risk of severe injury for occupational injuries of all categories in both the construction (49.3%)

and non-construction sectors (70.9%). The age group 26 – 30 years had the highest reported cases, ,followed by the age group 31 – 35 years which may be due to those age groups being the most active in the labour force in Tanzania (22). This highlights the need for improved instruction and safety measures for these ages on site, and every effort needs to be made to reduce the number of serious injuries at this stage of their lives.

Despite the fact that many construction workers were manual labourers, education appeared to play a role in reducing the risk of injury, with those having at least a secondary education or higher level of schooling being less likely to suffer from serious injuries than those with lower levels. This indicates the need for appropriate supervision at all times, given that this situation is unlikely to change, and highlights the need for communication within the industry regarding risk reduction strategies.

This study has shown that 10.6% of all reported case happened in the construction sector. This is similar to the results of a study conducted in Dar-es-Salaam in 1990 which shown that 10% of accidents was contributed by construction sector (2). The results indicated that the common causes of injuries or fatalities in the construction industry were: hit by moving or flying object (26.7%); slipped, tripped or fell on the same level (12.7%); hit by moving vehicle (11.9%) and moving machinery or material being machined (11.1%). This is similar to studies elsewhere which had shown that the common causes of fatal injuries in the construction industry include falling (ranges from 7% to 52.7%), motor vehicle accidents (ranges from 8.2% to 23.4%), and electrocutions (ranges from 7% to 9.6%) (48), (49), (50), (51), (52). This highlights the lack of adequate safety measure with regard to manual handling, the movement of equipment, machinery, objects or vehicles on construction sites. While workers in the industry are a number of risk factors, a concerted effort needs to be made to identify those risk factors and safety measures should be improved.

5.2.2 BIVARIATE AND MULTIVARIATE ANALYSIS

The years used in the analysis were those in which the instruments, policies or agencies were brought into operation, and were taken as a proxy marker for that instrument,

policy or agency. Most instrument, policy or agency were established to regulated OHS in the construction industry, except for the Factories Ordinance, Mining (safe working and occupational health) regulations, OSHA and OHS Act 2003. Cases reported during these time periods were considered and are as illustrate.

Between 1986 and 2009,compared to baseline period (1980 – 1981), the occurrence of accident in the construction sector was reduced by approximately half compared to in the non-construction sectors. This suggests that the newly established regulatory bodies and legislation introduced during this period had a substantial impact in the protection of workers. The logistic regression models indicated that the introduction of new regulatory bodies and legislation decreased the risk of fatalities and work related injuries frequency in the construction industry between 1986 and 2009, except for the years between 1982 and 1985 (OR 1.2; 95% CI 1.0 to 1.3). This suggests that establishment of the National Construction Council in 1997 did not contribute to the reduction of fatalities and work related injuries frequency in the construction industry. However, the decrease of risk of reported cases in the construction industry between 2004 and 2009 (OR 0.32; 95% CI (0.3 to 0.4)) compared to baseline duration indicates that the enactment of the of the OHS Act 2003 and the National Construction Policy in combination with the previously established regulatory bodies and legislation had an impact in reduction the accidents.

The adjusted risk of getting injured (according to reported cases of fatal and non-fatal) n the construction sector increased from 1982 and 1985 compared to baseline period (OR 1.2; 95% CI 1.0 – 1.3). This may have two explanations. One is that the Factories Ordinance CAP 297 and Institution of Engineer Tanzania were inadequate, which resulted in an increase of the number of incidents of injuries or fatalities, and the other that there was no specific legislation for the construction sector, which led to increase of accidents. However, it was not possible to obtain information to conclude on any of the above explanations.

Generally, this study has shown that there is evidence to support the hypothesis that the establishment of regulatory frameworks and legislation in the construction sector has

reduced non-fatal and fatal injuries, this being similar to studies conducted elsewhere. The studies that were conducted in US in 2001and 2003 to evaluate regulatory intervention on vertical fall found that establishment of regulations to be effective in preventing non-fatal and fatal injuries in the construction industry (45), (46). The decline in cases of accidents seen in the latter studies was about twice the number compared to the period before establishment of intervention. Another study was conducted in 2002 to evaluate the establishment of trench and excavation standards, and showed an effectiveness in reducing the risk of fatal injuries due to falling into trenches (2-times decline) following the implementation of the intervention (47). We could not compare the results of this study among developing countries due to lack of published studies in the latter.

The analysis by Cochrane to assess the effects of interventions for preventing injuries among workers at construction sites that included the above studies was done in 2012. The analysis found that regulatory interventions did not show either an initial or sustained effect on fatal or nonfatal injuries (Effect Size 0.69) (28). The reason for such a result was mentioned to be low quality overall study methodology.

5.3 LIMITATIONS

This study had several limitations, one of which was the unavailability of the number of workers (denominator) in each sector in every year. For that reason, it was not possible to calculate rates of accidents in each year and by sector, nor was it possible to perform statistical analysis, such as a comparison of rates in different categories of workers. However, odds ratios of reported cases of fatal and non-fatal incidents from construction and non-construction sectors were calculated through logistic regression model, which provides an approximate value of relative risk.

Economic development fluctuation over time could have impacted on the frequency of fatalities and severe work related injuries, which could not be accounted for.It was not possible to consider economic factors, as there was no economic data to analyse the impact. The economic data could have been compared with reported cases to determine

whether there had been an increase or decrease in reported cases with an increase or decrease in economic activities and productivity. However, this data was not available.

Another limitation of the study was that the cases obtained from the Register were reported over several years, during the period 1980 – 2009. This presented the possibility that economic status, construction technologies and practices in Tanzania may have changed during that period, which could have influenced accident occurrence. This may be reflected in a general improvement since 1980 in the availability of fatality and injury data, and improved technology or economic conditions may therefore have confounded the relationship.

Data were collected from reported accidents in the Labour Office which is secondary data, resulting in unreported accidents not being captured. It was difficult to estimate the degree of misclassification of the causative factors. Data may also have been incomplete, particularly where any fault on the part of persons submitting the reports was concerned, hence this may have reduced the validity of the findings.

5.4 RECOMMENDATIONS

The findings of this study show that policies and regulatory frameworks have influence in the trends of work-related fatalities and severe injuries in the construction industry. It is therefore recommended that enforcement mechanism should be improved by harmonizing and coordination among regulatory bodies. There should be a mechanism for information sharing between regulatory bodies, which will help to further reduction of work-related fatalities and severe injuries in the industry.

The study found that young workers with low level of education were at high risk of getting injured. Training package for young workers entering the industry should be developed, their intention being to develop a safety culture and increase the awareness and knowledge among young workers about how to prevent getting injured. In addition, proper supervision of those young workers should be required as part of the industry standards, by competent persons who have a sound knowledge in OHS matters.

A comprehensive accidents and occupational diseases reporting and notification system should be established that would record not only severe injuries, but also near miss and property damage data. The system should include informal sector and self-employed persons, and could give incentives for reporting and disincentives for not reporting.

This study could not consider the influence of other factors, such as economic growth or change of work practices in the industry. Therefore, it recommended that more studies should be conducted to ascertain if such factors have any influence in the reduction of work-related injuries and fatalities.

The study has shown that laborers in both construction sector (49.3%) and non-construction sectors (70.9%) and electricians (fatality ratio 9.1) are the most vulnerable to all types of job category. Therefore intensive investment should be made in this area to find out what is the cause of the high reported cases and appropriated interventions should be put in place.

5.5 CONCLUSIONS

This study suggests that obligatory regulatory interventions introduced over thirty years (1980 – 2009) had a substantial impact in reduction of accidents in construction sector, this being similar to studies conducted elsewhere. However, the results could have been confounded by other factors such as improvement of economic status, construction technologies and work practices. In additional to established regulatory bodies, legislation and policies, the focus should also be on changing technologies and practices in performing different activities on construction sites. Data to control for those confounders were not available.

It has been shown that presence of legislation, policies and boards has reduced work-related injuries and fatalities in the construction industry compared to other industries. This could contribute to reduction of the occurrence of work-related injuries and fatalities in both the construction and non-construction industries.

This study is important as the findings will contribute to the on-going review process of occupational safety and health policy in the construction industry as part of establishing policy strategies to reduce accidents and occupational illness. The results will help to establish other intervention programmes that will be accompanied not only by legislation enforcement, but also by education, training, culture change and campaigns to reduce accidents.

In conclusion, while the introduction of regulatory bodies, legislation and policies in Tanzania may have impacted on the reduction of work-related injuries and fatalities, other factors, such as improved work practices, awareness and education and use of advanced technology in construction industry, may also have played a role. The results of this study should be used as a baseline for an on-going review process of Occupational Safety and Health Rules in the Construction Industry and to improve reporting in the Dar-es-Salaam Accidents Register. The results should also be used to establish policy strategies to reduce accidents and occupational illness, and provide a model for the analysis and interpretation of routinely collected data to direct such strategies in the construction sector in Tanzania.

REFERENCES

1. Lopez-Valcarzel A. Occupational Safety and Health in Construction Work. Afr Newslett on Occup Health and Safety. 2001;11(1):4–7.

2. Kitumbo HI, Kirenga AP. Construction industry in Tanzania. Afr Newslett on Occup Health and Safety. 2001;11(1):8–9.

3. Week JL. Health and safety hazards in the construction industry. 4th ed. Encyclopaedia of occupational health and safety. ILO; 1998.

4. Construction Sector Transparency. Tanzania Construction industry [Internet]. Construction Sector Transparency Initiatives. 2009 [cited 1BC Feb 10]. Available from: http://www.constructiontransparency.org/CountriesSupporters/Countries/Tanzania/.

5. Monyo RA. Situation analysis on occupational health and safety in Tanzania. Regional Symposium on Occupational Health and Safety, Marangu Tanzania. Marangu: Afr Newsletter, FIOH; 1998.

6. Government of Tanzania. Workmen's compensation ordinance Cap 263. Labour, editor. Dar-es-Salaam: Government Printer; 1949.

7. Government of Tanzania. Notification of Accidents and Occupational Diseases Ordinance. Dar-es-Salaam: Goverment Printer; 1953.

8. Snashall D. Safety and health in construction industry. Br Med J. 1990;301(6752):563–4.

9. Contractors Registration Board. List of Registered Contractors [Internet]. Directory of Registered Contractors. 2001 [cited 2009 Feb 10]. Available from: http://www.crbtz.org

10. Gwendolyn HC, Scott H, Ronald S. Fatal occupational falls in the U.S. construction industry, 1980–1989. Accid Anal Prev. 28(5):647–54.

11. Cameron I, Hare B, Davies R. Fatal and major construction accidents: a comparison between Scotland and the rest of Great Britain. Safety Sci. 2008;46:692–708.

12. Colak B, Etiler N, Bicer U. Fatal occupational injuries in the construction sector in Kocaeli, Turkey, 1990–2001. Ind Health. 2004;42:424–30.

13. Bell CA, Stout NS. Fatal injuries in construction. Excel. 1990;4(1):5–7.

14. NOSI. Online Statistics Interactive National Workers' Compensation Statistics Databases. [Internet]. The Safe Work Australia; 2010. Available from: http://nosi.ascc.gov.au/

15. Hinze J. Construction Safety. Upper Saddle River, New Jersey: Prentice-Hall, Inc.; 1997.

16. Sawacha E, Naoum S, Fong D. Factors affecting safety performance on construction sites. Int J Proj Manage. 1999;17(5):309–15.

17. Ahmed SM, Kwan JC, Weiming FY, Ho Pui DC. Site safety management in Hong Kong. J Managene Eng. 2000;16(6):34–42.

18. Koehn EE, Kothari RK, Pan CS. Safety in developing countries: professional and bureaucratic problems. J Construct Eng Manage. 1995;121(3):261–5.

19. JISHA (Japan Industrial Safety and Health Association). Occupational accident statistics in Japan [Internet]. Tokyo: JISHA; 1999. Available from: http://www.jisha.or.jp/english/final98e

20. Safari PF. Accident prevention in construction industry: scaffolding and scaffold erection. 1985.

21. National Bureau of Statistics. Population and Housing Censuses. Dar-es-Salaam: National Bureau of Statistics; 2012.

22. National Bureue of Statistics. Integrated Labour Force Survey - Analytical Report. Dar es Salaam: Tanzania Bureau of Statistics; 2006.

23. National Bureau of Statistics. Intergrated Labour Force Survey. Dar es Salaam, Tanzania: Tanzania Bureau of Statistics; 2001.

24. PHOYA S. HEALTH AND SAFETY RISK MANAGEMENT IN BUILDING CONSTRUCTION SITES IN TANZANIA: The Practice of Risk Assessment, Communication and Control [Internet]. CHALMERS UNIVERSITY OF TECHNOLOGY, Gothenburg, Sweden; 2012. p. 113. Available from: publications.lib.chalmers.se/records/fulltext/164071.pdf

25. Stout NA, Jenkins EL, Pizatella TJ. Occupational injury mortality rates in the United States: changes from 1980 to 1989. Am J Public Health. 1996;86:73–7.

26. US Dept of Health and Human Services. Improvement of Workplace safety, 1990 - 1999. Morbidity and Mortality Weekly Report. Centers for Disease Control and Prveantion, CDC; 1999;48(22):461–84.

27. Smith RS. The Impact of OSHA Inspections on Manufacturing Injury Rates. J Hum Resour. 1979;14:145–70.

28. Van der Molen HF, Lehtola MM, Lappalainen J, Hoonakker PLT, Hsiao H, Haslam R. Interventions for preventing injuries in the construction industry. Cochrane Database of Systematic Reviews; 2007.

29. ILO. ILO conventions - International Labour Standard [Internet]. 2007. Available from: http://www.ilo.org/ilolex/english/convdisp1.htm

30. Government of Tanzania. Workmen's Compensation Ordinance. Department of Labour, editor. Dar-es-Salaam: Government of Tanganyika; 1949.

31. Wells J. The Construction Industry in Developing Countries: Alternative Strategy for Development. Taylar and Francis; 1986.

32. National Construction Council. Baseline study of labour practices on large construction sites in the United Republic of Tanzania. Geneva: International Labour Office (ILO); 2005.

33. Government of Tanzania. The Occupational Health and Safety Act [Internet]. Occpational Safety and Health Authority T, editor. Dar-es-Salaam: Government of Tanzania; 2003. Available from: www.parliament.gov.tz

34. Jason A. INFORMAL CONSTRUCTION WORKERS IN DAR ES SALAAM, TANZANIA. Geneva; 2007.

35. Government of Tanzania. Executive Agencies Act. PO, editor. Government Printer; 1997.

36. Government of Tanzania. The Contractors Registration Act. Contractors Registration Board, editor. Dar-es-Salaam: Governement Printer; 1997.

37. Government of Tanzania. National Construction Council Act. National Construction Council, editor. Dar-es-Salaam: Government Printer; 1976.

38. Government of Tanzania. Engineers Registration Act. Engineers Registration Board, editor. Dar-es-Salaam: Government Printer; 1997.

39. Government of Tanzania. Architects and Quantity Surveyors (Registration) Act. Architects and Quantity Surveyors Board, editor. Dar-es-Salaam: Government Printer; 1997.

40. The Government of Tanzania. The Occupational Health and Safety Act No 5 of 2003. Dar es Salaam, Tanzania: Goverment Printer; 2003.

41. Department of Labour. The Factories (Occupational Health Services) Rules. Dar es Salaam; 1985.

42. Government of Tanzania. Construction Industry Policy. National Construction Council, editor. Dar-es-Salaam: Goverment Printer; 2003.

43. Government of Tanzania. The mining (safe working and occupational health) regulations. Minsitry of Energy and Mineral Resoures, editor. Dar-es-Salaam: Government Printer; 1999.

44. Tanzaniainvest. Tanzania Construction Sector Report [Internet]. Dar es Salaam; 2008. Available from: http://www.tanzaniainvest.com/tanzania-construction-sector

45. Derr J, Forst L, Chen HY, Conroy L. Fatal falls in the US construction industry, 1990 to 1999. J Occup Environ Med. 2001;43(10):853 – 60.

46. Lipscomb HJ, Li L, Dement J. Work-related falls among union carpenters in Washington State before and after the Vertical Fall Arrest Standard. Am J Ind Med. 2003;44:157 – 65.

47. Suruda A, Whitaker B, Bloswick D, Philips P, Sesek R. Impact of the OSHA trench and excavation standard on fatal injury in the construction industry. J Occup Environ Med. 2002;44(10):902–5.

48. Pratt SG, Kisner SM, Moore PH. Machinery-related fatalities in the construction industry. Am J Ind Med. 1997;23(42 - 50).

49. Collins J, Landen DD, Kisner SM, Johnston JJ, Chin SF, Kennedy RD. Fatal occupational injuries associated with forklifts, United States,1980 –1994. Am J Ind Med. 1999;36:504 – 12.

50. Bentley TA, Hide S, Tappin D, Moore D, Legg S, Ashby L. Investigating risk factors for slips, trips and falls in New Zealand residential construction using incident-centered and incident-independent methods. Ergonomics. 2006;49:62–77.

51. Bentley TA, Hide S, Tappin D, Moore D, Legg S, Ashby L. Investigating risk factors for slips, trips and falls in New Zealand residential construction using incident-centered and incident-independent methods. Ergonomics. 2006;49:62 – 77.

52. Ore T, Fosbroke DE. Motor vehicle fatalities in the United States construction industry. Accid Anal Prev. 1997;29:613 – 626.

Appendix 1: Accident/injury report form

Fatalities and severe work-related injuries in construction industry in Dar-es-Salaam region, Tanzania during January 1980 – December 2009

A: Personal Information of the injured/dead person

1. ID: (to be given by research assistant) _____
2. Age:
    a. ☐ 18 – 20,
    b. ☐ 21 – 25,
    c. ☐ 26 – 30,
    d. ☐ 31 – 35,
    e. ☐ 36 – 40,
    f. ☐ 41 – 45,
    g. ☐ 46 – 50,
    h. ☐ over 50 years
3. Work experience at the time of accident:
    a. ☐ less than 1 year,
    b. ☐ 1 – 2 years,
    c. ☐ 3 – 5 years,
    d. ☐ more than 5 years
4. Level of education of a victim worker:
    a. ☐ Never went to school;
    b. ☐ Primary education;
    c. ☐ Secondary education;
    d. ☐ Collage education;
    e. ☐ University education
5. Sex:
    a. ☐ female,
    b. ☐ male
6. Category of the victim worker:
    a. ☐ mason/bricklayer/Plasterers,

b. ☐ plant operator/driver,
c. ☐ carpenter,
d. ☐ painter,
e. ☐ Welders/steel fixer,
f. ☐ pipe fitter/plumber,
g. ☐ electrician,
h. ☐ tiles layer,
i. ☐ fitter mechanic,
j. ☐ concrete placer/finisher,
k. ☐ general labourer,
l. ☐ Scaffolders,
m. ☐ supervisors/site engineer/manager,
n. ☐ consultant
o. ☐ others, please mention _____

B: Particulars on the Company

7. Name Company:_____
8. Sector of the company:
    a. ☐ Construction industry
    b. ☐ Non-Construction industry

C: Information on Work-related injury/fatality

9. Date of the accident _____
10. The accident led to:
    a. ☐ fatality,
    b. ☐ severe injury,
    c. ☐ over three days off duty.
11. Cause of injury or fatalities:
    ☐ Moving machinery or material being machined
    ☐ Asphyxiated
    ☐ Exposed to, or in contact with, a harmful substance
    ☐ Exposed to fire

☐ Exposed to an explosion

☐ Electricity or an electrical discharge

☐ Injured by an animal

☐ Physically assaulted by a person

☐ Hit by a moving, flying or falling object

☐ Hit by a moving vehicle

☐ Hit or stack by object or something fixed or stationary

☐ Injured while handling, lifting or carrying

☐ Slipped, tripped or fell on the same level

☐ Fell from a height

☐ Trapped by collapsing structure

☐ injured by sharp edges, pinch point, nail etc

☐ Others, please explain _____

Appendix 2: permission letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF LABOUR, EMPLOYMENT AND YOUTH DEVELOPMENT

Telegrams: KAZIAJIRA
Tel. No.: 2125609
Fax No.: 2112054
e-mail: kazi@africaonline.co.tz

Labour Department
P. o. BOX 1422
Dar es Salaam
Tanzania

In reply please quote:
Ref. No. HC 250/232/02

14th December 2009

Joshua Matiko
Occupational Safety and Health Authority
P. O. Box 519
Dar es Salaam

RE: APPLICATION FOR PERMISSION TO USE COMPENSATION DATA FOR RESEARCH PURPOSE

Please refer to the above subject matter together with your letter dated 8th December 2009.

We have no objection on utilizing our data as regards your research topic. You are allowed to use the dataset in our office for the intended purpose and we will like to share with you the findings of your research.

We wish you all the best in your study and should you need any assistance please do not hesitate to call on us.

D.N. Kaali
For **Labour Commissioner**

Appendix 3: clearance certificate

THE UNITED REPUBLIC OF
TANZANIA

National Institute for Medical Research
P.O. Box 9653
Dar es Salaam
Tel: 255 22 2121400/390
Fax: 255 22 2121380/2121360
E-mail: headquarters@nimr.or.tz
NIMR/HQ/R.8a/Vol. IX/1105

Ministry of Health and Social Welfare
P.O. Box 9083
Dar es Salaam
Tel: 255 22 2120262-7
Fax: 255 22 2110986

31st March 2011

Joshua Matiko
Occupational Safety and Health Authority
P O Box 519
DAR ES SALAAM

CLEARANCE CERTIFICATE FOR CONDUCTING MEDICAL RESEARCH IN TANZANIA

This is to certify that the research entitled: Policies and regulatory framework influencing trend of work-related fatalities and severe injuries in construction industry in Dar es Salaam Region, (Matiko J *et al*), has been granted ethics clearance to be conducted in Tanzania.
The Principal Investigator of the study must ensure that the following conditions are fulfilled:

1. Progress report is submitted to the Ministry of Health and the National Institute for Medical Research, Regional and District Medical Officers after every six months.
2. Permission to publish the results is obtained from National Institute for Medical Research.
3. Copies of final publications are made available to the Ministry of Health & Social Welfare and the National Institute for Medical Research.
4. Any researcher, who contravenes or fails to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine. NIMR Act No. 23 of 1979, PART III Section 10(2).
5. Approval is for one year: 31st March 2011 to 30th March 2012.

Name: Dr Mwelecele N Malecela

Signature

CHAIRPERSON
MEDICAL RESEARCH
COORDINATING COMMITTEE

Name: Dr Deo M Mtasiwa

Signature

CHIEF MEDICAL OFFICER
MINISTRY OF HEALTH, SOCIAL WELFARE

CC: RMO
DMO

Appendix 4: Postgraduate Education Committee (PGEC) for review and approval

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

08 July 2011

Professor R Naidoo
Dept of Occupational & Environmental Health
Howard College Campus

Dear Professor Naidoo

PROTOCOL – "Policies and regulatory frameworks influencing trend of work-related fatalities and severe injuries in construction industry in Dar Es Salaam Region, Tanzania (1980-2009)
Matiko JM - 207524656 – Masters in Public Health

The Postgraduate Education Committee ratified the approval of the abovementioned study on 05 July 2011.

Please note:

- The Postgraduate Education Committee must review any changes made to this study.
- The study may not begin without the approval of the Biomedical Research Ethics Committee.

May I take this opportunity to wish the student every success with the study.

Yours sincerely

Professor SJ Botha
Chair: Postgraduate Education Committee

CC. Mr JM Matiko

Biomedical Research Ethics Committee
Westville Campus

Postgraduate Education Administration
Medical School Campus
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