WORKERS' PERCEPTIONS OF THE SAFETY CLIMATE IN THE CONSTRUCTION INDUSTRY

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree:

Master of Science in Nursing
by

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DECLARATION

I, Raksha Vryjlall Bhimjee, declare that this research is my own work. It is being submitted for the Master of Science (Nursing) Degree at the University of the Witwatersrand, Johannesburg. It has not been submitted previously for any other examination at this university or any other university.

Signature:

Date:

DEDICATION

To the Higher power that gave me the opportunity and courage to embark on this journey and reach my destination;

To all the construction workers building our homes, roads, bridges, buildings, hospitals, and our infrastructures – your safety and health matters;

To all the lives lost while undertaking construction work;

And to my mom – this is for you.

ACKNOWLEDGEMENTS

I would like to extend my heartfelt gratitude to the construction site staff for affording me the opportunity to access your construction site. Your constant co-operation and input was invaluable.

Thank you to the willing and enthusiastic respondents of this study for your honest input which made this research possible.

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I am grateful to all those very special people: colleagues, fellow students, my dear friends and extended family, who supported me in so many ways along this journey and helped me to remain on track – God bless you.

My dearest family – Kugin, Mishka & Mihir – thank you for your understanding of my intermittent presence and for your loving cups of tea –you helped make this a reality – none of this would have been possible without your support.

ABSTRACT

Background

The high rate of fatalities and injuries in the construction industry globally, requires that we focus away from the lagging indicators towards the leading indicators of safety and health. By giving attention to human factors, organisations can identify and isolate potential hazards or causes of risky behaviour before they lead to accidents or illness. One method of doing this would be to measure 'leading' indicators of safety such as the safety climate.

Purpose

This study describes the site workers' perceptions of the safety climate at the Nelson Mandela Children's Hospital construction site in the Gauteng Province, South Africa.

Research method

A quantitative, descriptive, cross-sectional survey design using the Nordic Occupational Safety Climate Questionnaire was used to elicit the workers' perceptions of the safety climate. The questionnaire is organised into 7 safety climate dimensions. The number of respondents totalled 108 (51.7% response rate). Data obtained from each of the 7 dimensions, was analysed using the statistical package STATA version 14.

Results

The results revealed that 72.2% of the workers rated managements' safety priority and ability as low. 57.4% of the workers rated peer safety communication, learning and trust in co-workers as low. 39.8% of the respondents had a positive perception regarding the site's safety systems. Overall, the workers perception of the safety climate at the Nelson Mandela Children's hospital construction site was fairly low with need for improvement.

Conclusion

The results and outcome of the study can be used to guide management to establish a positive safety climate and afford the opportunity to the workers to have a platform to reflect on their workplace safety motivations and choices.

Key concepts: Safety climate, Perceptions, Construction industry, Site workers

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CHAPTER ONE – INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

Construction workers are responsible for the construction and upkeep of roads, houses, workplaces and a nations' physical infrastructure. Throughout the growth of a construction project, several organisations, professionals, trades and labourers from diverse cultures and experiences are expected to work simultaneously in a constantly shifting work organisation with a transitory labour force and structure (Lin, 2010).

The International Labour Organisation (ILO) believes globalisation and the scramble for capital has resulted in technological change and competitive pressures. This often induces employers to regard occupational safety and health as though it is an afterthought (ILO, 2008). Globally there has been a positive enhancement in the occupational health and safety status in the construction industry, mostly motivated by international standards in the field: the Guidelines on occupational safety and health management systems (ILO-OSH 2001), published by the ILO (2001, updated 2009), and the Occupational Health and Safety Assessment Series (OHSAS) 18001 published by the OHSAS Project Group (2007), together with increased research, publications and stringent regulations.

This chapter presents background information into health and safety statistics in the construction industry as well as an introduction to the concept of safety climate. The paradigm perspectives as well as an overview of the research methodology are also presented.

1.2 BACKGROUND INTO SAFETY AND HEALTH STATISTICS IN THE CONSTRUCTION INDUSTRY

The construction industry comprises of numerous trades, each with their own risks for injuries, illnesses and fatalities. Occupational injuries, illness and fatalities affect more than just the worker; they negatively affect entire families and companies and are therefore an even bigger loss to the national economy (WHO, 2010).

1.2.1 Global Health and Safety Statistics in Construction

The construction industry consists of approximately 7–10% of the workforce worldwide and accounts for 30–40% of occupational fatal accidents (Zalk, Spee, Gillen et al. 2011). The World Health Organization (WHO, 2010) estimated that globally, 2 million people pass away yearly, as a result of occupational injuries and diseases including a further 268 million non-fatal workplace accidents.

A brief search for global health and safety statistics was conducted. The results showed that in the United States, 937 (21.4%) of the 4836 worker fatalities in the private sector were in the construction industry (United States Department of Labour, 2016). This figure, according to the US Department of Labour (2016) translates to one in five worker deaths. The primary cause of deaths on construction sites were falls, electrocution, being struck by an object and being caught in-between objects. This accounted for 64.2% of the construction worker deaths in 2015 (United States Department of Labour, 2016).

Statistics from the United Kingdom (Labour Force Survey, 2013–2016) showed that around 79 000 construction workers had an illness associated with their work (Health and Safety Executive 2016). Of these 79 000 cases, 64% were musculoskeletal disorders (MSD), 18% were cases of stress, depression or anxiety, while 18% involved other illnesses such as skin or respiratory conditions (Health and Safety Executive, 2016).

In Hong Kong, statistics for occupational injuries in 2014 stood at 37 523, while the high-risk construction industry had 3 467 industrial accidents in 2014, a 7.3% increase when compared to 3 232 accidents in 2013 (Hong Kong Labour Department, 2015). The construction industry had recorded the highest number of fatalities and accident rate amongst all industry sectors (Hong Kong Labour Department, 2015).

1.2.2 The South African context

The South African construction industry setting is similar to other countries in the sense that is it considered a high risk sector with huge compensation fund claims. For example, more than two billion Rand was claimed for the period April 2013 to March 2014 (DOL, 2014).

More than 1.18 million people are working in the construction industry on either a contract or permanent basis (Temkin, 2014). The Federated Employers Mutual Assurance Company (FEM) insures employers for their legal responsibilities under the Compensation for Occupational Injuries and Diseases Act (COIDA) No 130 of 1993. The FEM released statistics in December 2014, showed a total of 3163 accidents, 30 fatal accidents and 155 permanent disabilities. There were a total of 8069 documented lost work days, at an average cost of R24 556.00 per accident (Federated Employer's Mutual Assurance Company Accident stats, 2014).

As discussed by Kolver (2014), at the Construction Regulation No 37305 inauguration in 2014, the Minister of Public Works, Mr Nxesi, emphasised that the safety of employees must be a priority and it is unacceptable that on average two South African construction workers die on site every week.

In response to improving the safety of employees, leading construction companies, the government and trade unions in South Africa have all shown increased concern in terms of occupational health and safety (PriceWaterHouseCoopers, 2013). This is of paramount importance if the industry is to remain sustainable. The Occupational Health and Safety Act (OHSA) No.85 of 1993 was instituted to ensure a safe and healthy workplace environment for all employees and other persons associated with the workplace (RSA, 1993a).

Section 14 of the OHSA Act No.85 of 1993 prescribes the duties and responsibilities of employees in that they have to ensure a healthy and safe work environment. Section 8(d) of the OHSA Act No.85 of 1993 prescribes the responsibilities of the employer in terms of hazard identification and risk assessments (Republic of South Africa, 1993a). The OHSA Act No.85 of 1993 is supported by legislation, regulations and codes of practice that provide practical guidelines on workplace health and safety issues relating to workplace processes, with the aim of reducing rates of illness and injuries. An example of a regulation supporting the OHS Act No.85 would be the Noise Induced Hearing Loss Regulation No. R. 307 of 2003, which addresses various aspects of hearing conservation, information and training around noise, and the use of personal protective equipment (Republic of South Africa, 2003).

The growing concern in the construction industry regarding health and safety was further evidenced by the emphasis that was placed on initiatives such as the Construction Health and Safety Accord (DOL, 2012). The accord is a contract between the South African government, industry, and companies to improve the level of health and safety in the construction industry (PriceWaterhouseCoopers report, 2013).

Despite the endorsement and effects of the Construction Regulations, the traditional job factors in terms of cost, quality, and time still seem to be considerably more important than health and safety performance (Smallwood & Haupt, 2007). Health and safety should be appreciated as a core value and need not purely be determined by the legal structures (Agumba & Haupt, 2009).

The Department of Labour (DOL, 2012) highlighted, by means of an initiative to liaise with construction industry leaders, that the building and construction sector is acknowledged as one of the high-risk industries, along with the agriculture, chemical, and iron and steel trades. These industries were compensated more than R287 million for occupational injuries in the year 2013 (DOL, 2013). In the building and construction sector, during 2007–2010, there were 171 mortalities and 755 injuries (DOL, 2013).

Table.1.1 shows the South African construction industry's accident and fatality statistics between the year 2008 and 2012 (FEMA Report, 2014).

Table 1.1: The South African construction industry's accident and fatality rate between the year 2008 and 2012

	Number of Employees	Number of Accidents	Fatal Accidents
2008	282 743	10 925	65
2009	288 736	10 380	73
2010	277 764	9 174	95
2011	282 285	7 991	51
2012	311 815	8 277	71

Source: FEMA Report (2014)

Table 1.1 shows that while accident rates had decreased over the five year period, there was no significant change in the number of fatal accidents during this period.

The construction industry has a level of compliance to health and safety regulations of lower than 50% (DOL, 2015). Incidents that have highlighted poor compliance to health and safety regulations include: the collapse of the Tongaat Mall that resulted in two fatalities and twenty nine injuries, the breakdown of a house in Meyersdal that resulted in seven fatalities and the hospitalisation of seven employees (DOL, 2015). The continued alarming statistics in work-related injuries, illnesses and fatalities suggest that their prevalence in the construction industry requires continued safety research, attention and redress.

In an excerpt from the Integrated Annual Report for Group Five Construction Group (2016), a large South African company, it was noted that the company "sadly" and "disappointingly" had four fatalities in their sub-contractor and supplier base. The primary causes of these fatalities were falls from a height and vehicle accidents on site. An in-depth investigation was subsequently conducted, and, it was found that although the company had leading systems and processes in place, Group Five were not consistently changing the safety behaviour at grass roots level – from each individual worker through to management level (Group Five, 2016).

Furthermore, it was noted in the report that Group Five had re-launched a fresh code of conduct, anchored in their values, where safety was key, with a zero-tolerance approach to non-compliance. This provided clarity that Group Five would not employ people who refused to work safely, failed to follow documented processes and did not care for their colleagues (Group Five, 2016).

Reducing the accident and injury statistics and implementing more effective safety management strategies, continue to challenge academics, policy makers, practitioners and researchers (Pillay, 2013). The responsibility for effecting change on the present rates of occupational injuries, illnesses and fatalities lies both with management who create situations involving risks and employees who work with the risks directly.

Investigations into major workplace disasters in the process industry: Piper Alpha, nuclear power industry: Chernobyl 1986, marine transportation industry: Zeebrugge Ferry 1987 and passenger rail transportation industry: Ladbroke Grove and Clapham Junction, established that, despite the existence of complex engineering and technical safeguards, systems broke down catastrophically (Hoyos, 1995).

1.3 SIGNIFICANCE OF THE STUDY

Review of multiple literature articles relating to the nature of workplace accidents or illness revealed that by giving attention to human factors, organisations could identify and isolate potential hazards or reasons for risk behaviour before they manifest as accidents (Flin, Mearns, O'Connor et al. 2000; ACSNI, 1994; Chiaburu &Harrison, 2008). One method to do this would be to measure the 'leading' indicators like the safety culture and safety climate rather than focusing on the 'lagging' indicators of safety, for example accidents, injuries and illnesses.

The concept of "safety culture" was presented by the International Nuclear Safety Group in a report released post the Chernobyl disaster in 1986 (Bergh, 2011). This disaster brought to the fore the awareness of workplace safety culture. Organisations with a positive safety culture are characterised by communications founded on mutual trust based on shared perceptions of the importance of safety and by confidence in the efficiency of preventative measures (Health and Safety executive Research report, 2005).

There are numerous definitions of "safety culture" that exist today. The Advisory Committee on the Safety of Nuclear Installations (ACSNI, 1993), defined safety culture as the product of individual and group values, attitudes and perceptions, competencies and patterns of behaviour that influence commitment to an organisation's health and safety management programme.

"Safety Culture" however, does not reflect the workers' perceptions of the state of safety. In the 1980s, Zohar developed a concept of safety climate that was presented as a measurable component of safety culture, defining safety climate as the workers' perceptions of their work environment (Zohar, 1980). "Safety climate" therefore alludes to the outward features of safety culture, i.e. the perceptions and attitudes of an

individual or worker at a specific point in time, thus serving as a measure of the safety culture of a workplace (Singer & Vogus, 2013).

Deliberation continues within literature concerning whether the terms “culture” and “climate” represent the same or different concepts. The collective agreement is that “culture” signifies the more established and long-term characteristics of the organisation, and has been likened to its traits (O’Connor, O’Dea, Kennedy & Buttry, 2011). “Climate” is understood to embody shared perceptions employees have about how safety is valued and prioritised in an organisation (Zohar, 2010).

“Safety climate” is closely associated with operations and is characterised by perceptions towards the work milieu and work practices (Yule, 2003). Zohar (2000) concluded that these perceptions provided an indication of the “true priority of safety” of an organisation in terms of other priorities such as production or quality. Emergent research evidence suggests that safety climate could have a substantial bearing on injury prevention if organisations were to measure existing safety climate perceptions and develop workplace programmes to enhance the measured safety climate (Institute for Work and Health, 2007). Safety climate has incredible potential to improve health and safety and lower work-related illness and injury statistics (Institute for Work and Health, 2007). The leading indicators are therefore useful and critical for predicting or forecasting safety and health outcomes (O’Connor, O’Dea, Kennedy & Buttrey, 2011).

It is in this context that the researcher intended to determine the workers’ perceptions of the safety climate at the Nelson Mandela Children’s Hospital construction site in the Gauteng Province, South Africa.

1.4 PROBLEM STATEMENT AND MOTIVATION FOR THE STUDY

Despite legal frameworks and the commitments entered into by the signing of the Construction Health and Safety Accord (2012), traditional job factors of cost, quality, and time still bear more importance than the workers’ health and safety (Smallwood as quoted by Greve 2015). In the building and construction sector during 2007 – 2010, there were 171 fatalities and 755 injuries (DoL, 2013)

The Occupational Health and Safety Act 85 of 1993, as amended (Republic of South

Africa, 1993) states the employer should ensure a work environment that is safe and of minimal risk to the workers, within reason. One of the strategies in ensuring a safe work environment is involvement of the workers in safe work practices, as workers mostly use observation of their work environment as well as actions and work practices of colleagues and superiors as a guide for their own actions and work place safety choices (Varonen & Mattila, 2000).

Very limited safety climate studies have been conducted in the construction industry in the South African context. Therefore, describing the construction worker's perception of the safety climate can give management the chance to identify gaps and take steps toward ensuring a safer and healthier work environment as well as give the site workers a chance at introspection regarding safety issues in their workplace.

1.5 RESEARCH QUESTION

The study would attempt to address the following question:

What are the perceptions of the construction workers regarding safety issues at the Nelson Mandela Children's Hospital construction site in Gauteng Province, South Africa?

1.6 AIM OF STUDY

The aim of this research was to describe the site workers' perceptions of the safety climate at the Nelson Mandela Children's Hospital construction site in the Gauteng Province, South Africa.

1.7 RESEARCH OBJECTIVES

The key objectives of the study were to:

1. Describe workers' perceptions regarding management prioritisation, commitment and competencies regarding safety practices in the Nelson Mandela Children's Hospital construction site.
2. Describe perceptions regarding co-workers' attitude towards safety in the Nelson Mandela Children's Hospital construction site.
3. Describe workers' trust in the efficacy of safety systems in the Nelson Mandela Children's hospital construction site.

1.8 PARADIGMATIC PERSPECTIVE

To design a research study, the process begins by selecting a topic and a paradigm. The term paradigm denotes a perspective held by a community of researchers that is based on a set of shared assumptions, concepts, values and practices (Johnson & Christensen, 2010).

In the context of research, a paradigm is described as the fundamental model or frame of reference used to guide the research process in terms of the observations to be made and the enquiry process. This study uses a positivist paradigm. A positivist paradigm is associated with quantitative research and places emphasis on observing reality to obtain an objective truth (Rubin & Babbie, 2010), which is what this study intends to accomplish by determining the snap shot of the safety climate at the construction site.

The researcher's investigation of workers' perceptions of the safety climate in the construction industry is rooted in the following assumptions:

1.8.1 Meta-theoretical assumptions

The researcher's views of the four central concepts that influence safety climate and safe work practices are person, environment, health and nursing.

Person: A person is defined as an entity that has a moral right of self-determination (Anderson, 2000). In this study, a person is described as the construction site workers including site management staff located on the research site. The construction site workers refer to all of the main contractor's employees as well as all sub-contractors on the site where the study was conducted. The site workers and contractors are part of a vulnerable group. They are exposed to daily safety and health risks and hazards. The leading accident/ safety risks include falls from heights, being caught in or between machinery and electrocution by contact with power tools or power lines (Vitharana, de Silva & de Silva, 2015). The leading occupational illnesses include back injuries, air-bourne fibres and materials causing respiratory disease, hearing losses from long term noise exposure as well as skin diseases (Vitharana, de Silva & de Silva, 2015). As discussed, focus being placed on cost, quality and meeting deadlines instead of employee safety also places an extra risk to the employees' safety and health status.

Environment: Environment is defined as the complete surroundings of a living organism, which provides conditions for development and growth as well as danger and damage (Business Dictionary, 2017). In the context of this study the environment is the space wherein the construction workers carry out their daily work practices. There are various hazards and risks that these workers are exposed to, from chemicals that can contaminate the body to physical hazards that include noise pollution, extreme temperatures, vibration and radiation (Acutt & Hattingh, 2011). Also included are ergonomic hazards that particularly entail manual handling of loads, repetitive movements and prolonged use of vibration equipment. It is therefore critical that these environmental hazards be considered as a major safety priority. Workplace health and safety policies and practices are guided by the OHS Act 83 of 1993 (Republic of South Africa (a) 1993).The aim of the Act is to promote a positive occupational health and safety culture.

Health: Health is defined as a holistic as a state of physical, mental and social wellbeing, as opposed to simply the absence of disease (WHO 2001). In the present research, health is considered in the realm of safety. There is a clear need to focus on safety climate to prevent adverse events and reduce the negative statistics in this industry.

Nursing: As defined by the International Council of Nurses (2002), nursing encompasses autonomous and collaborative care of individuals of all ages, families, groups and communities, sick or well and in all settings. The primary roles of an occupational health nurse practitioner involve the following:

- preventing occupational injury and disease
- promoting health via a workplace strategy that focuses on non-occupational preventable conditions that can affect employees' ability to perform their work responsibilities and duties,
- environmental health management based on reduction and mitigation of risk to the working population and the extended community, which ultimately contributes to the wider public health agenda (WHO, 2001).

The occupational health nurse practitioner helps educate supervisors and workers on the effect of environmental, occupational and lifestyle influences on their health and social wellbeing.

1.8.2 Theoretical assumptions

Theoretical assumptions refer to declarations about the researcher in relation to that being researched (Polit & Beck, 2012). The element of analysis in this study is; construction site workers at the Nelson Mandela Children's Hospital construction site in relation to their perceptions with regards to the safety climate. The following operational definitions were used in the report:

Safety climate is the accrual of beliefs, values, and perceptions about safety that are common within a group at any given time (Zohar, 1980).

Perception refers to the way in which something is regarded, understood, or interpreted (Oxford Dictionary, 2015).

Site workers, refers to all employees that are part of the construction site team on area of ground on which a town, building, or monument is constructed (Oxford Dictionary, 2015).

Construction is the process of creating and building infrastructure or a facility (Oxford Dictionary, 2015).

1.8.3 Methodological assumptions

Methodological assumptions denote in what way the researcher envisions the entire process of evidence gathering unfolding (De Vos, Strydom, Fouche et al. 2011). For this research project a quantitative approach was adopted as site workers are working in accordance to deadlines and deliverables to complete the building of the hospital by 2017.

1.9 OUTLINE OF RESEARCH REPORT

Chapter one of the research report provides an overview of the study and an insight into global and South African occupational injury and illness statistics. The concepts of "safety culture" and "safety climate" have been introduced.

In chapter two, the literature review is presented, which also explores the concept of

safety climate. Chapter three outlines the research design and methodology used in the study and describes the method used to determine workers' perceptions of the safety climate on the construction site. The chapter further describes and motivates the research methodology and provides an overview of the problem, research questions and ethical issues of the study. The development of the questionnaire, method of data collection and sampling process are explained.

The analysis and presentation of the results are included in chapter four. The statistical procedures and methods used to analyse the data are discussed together with the validity and reliability of the study. The research questionnaire is also discussed. In chapter five, the conclusions, limitations and recommendations of the study are discussed.

CHAPTER TWO – LITERATURE REVIEW

2.1 INTRODUCTION

Chapter two provides an in-depth discussion on the concepts of organisational culture, safety culture and safety climate which is supported by the various literature reviewed. Literature review was undertaken to obtain a deeper understanding of the founding concepts specific to safety climate as well as to obtain an overview and insight on safety climate studies in the construction industry globally and in South Africa. The following databases were accessed to search for publications, articles, journals pertaining to safety climate and safety culture: ECU World Search, CINAHL, Emrald Insight, ScienceDirect, Scopus, Psychinfo and ProQuest. The websites of the South African OHS regulators, national and international Occupational Health and Safety organisation research centres, including the World Health Organisation, were also searched.

2.2 THE CONCEPTS OF ORGANISATIONAL CULTURE, SAFETY CULTURE AND SAFETY CLIMATE

The concept of safety culture has not been consistently defined in published literature (Gadd & Collins 2002; Guldenmund, 2000). Researchers in different academic disciplines have studied safety culture and have established diverse meanings of this concept (Vu & De Cieri, 2014). Weaver, Lubomski, Wilson et al. (2013) stated that the terms “culture” and “climate” are often used interchangeably in literature and in practice.

2.2.1 Organisational culture

A brief understanding of the concept of organisational culture, can guide us to the better understanding of safety culture and ultimately safety climate, as safety culture can be seen to have its foundation in organisational culture (Nordén-Hägg, 2010). Schein (2004, p.17) defines organisational culture as “a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think and feel in relation to those problems”. Needle (2004) defined organisational culture as the collective values, beliefs and practices of the employees which are a product of factors such as history, the size

of the organisation, strategy, management style, national cultures and including other factors. In their attempt to simplify the concept of organisational culture, Robbins, Judge, Odendaal and Roodt (2009) defined organisational culture as an acknowledgment of having shared norms and values, and permitting these norms and values to direct the behaviour of the collective group.

Greenberg and Baron (2003) stated employees who believe in the organisation and its values, are better able to deal with the pressures that they are faced with. Effects of social, cultural, economic including political changes in South Africa and globally, has a profound effect on South African companies and organisations (Werner, 2007). These changes, within which organisations are expected to compete globally, have a direct effect on organisational culture which is critically responsible for optimal organisational performance (Manetje & Martins, 2009). This specifically can be linked to safety performance parameters. It follows then from the definitions stated above that organisational culture is 'something' that an organisation has, and it therefore can be possible to change, improve and manage.

2.2.2 Safety culture

The concept of safety culture was presented following the Chernobyl accident (Macchi, Pietikainen, Liinasuo et al. 2013). This shift of focus to safety culture was motivated by the awareness and realisation that organisational, managerial and human factors are primary influential causes of accidents in these high-risk industries and not just technical failures (Weick, Sutclife & Obstfeld, 1999).

In 1993, the Advisory Committee on the Safety of Nuclear Installations (ACSNI) defined safety culture as a combination of individual and group values, attitudes, perceptions, abilities, and behaviours. Organisations with a positive safety culture have their foundation in mutual trust and shared perception of the worth of safety (ACSNI, 1993).

Fang and Wu (2013) went further to contextualise the concept of safety culture in construction projects. Construction project safety culture can be defined as a combination of attitudes, beliefs, values, behaviours and norms adopted by individuals and groups from different stakeholders in a construction job. This culture is

progressively shaped and evolves in the construction project setting (Fang & Wu, 2013). Safety culture therefore consists of the values, attitudes, perceptions and the behaviour of both the employees and employers. Safety culture, at any specific point in time, can be measured by another concept termed “safety climate” (Bergh 2011).

2.2.3 Safety climate

As with organisational and safety culture, a consistent definition of safety climate does not exist (Bergh, 2011). Mearns, Flin, Fleming & Gordon (1998), defined safety climate as the attitude and perception of the workforce at any given time and place implying that safety climate serves as a ‘snap shot’ of an organisation’s safety culture. Wiegmann, Zhang, von Thaden et al. (2002 p.10) formulated a definition, which states “Safety climate is the temporal state measure of safety culture, subject to commonalities among individual perceptions of the organisation”. Safety climate is therefore closely linked to operations categorised by daily perceptions of the work environment and work practices (Yule, 2003). Moving further down the years, Sinclair, Martin, and Sears (2010, p.1478) define safety climate as “workers’ shared perceptions about their organisation’s value for safety as expressed through the organisation’s safety polices, practices, and procedures”.

The safety climate field was pioneered by Zohar (1980) who studied the effect of the safety climate in industrial organisations in Israel. Zohar concluded that perceptions provided an indication of the “true priority of safety” of an organisation in terms of other priorities such as production or quality (Zohar, 2000). Organisations have multiple goals related to their performance, which is where policies, practices, and procedures find their origin and the comparative importance of those goals within an organisation informs managers on their application of the policy and procedure (Zohar, 2010). To explain further, it has been cited widely that production and safety priorities are two competing entities in terms of safety outcomes (McFadden, 2015). An organisation may place high importance on safety as a goal, but higher management may place an even higher priority and focus on the challenging demands of production (for example, “do whatever it takes to meet construction timeline goals”). This attitude and the relative importance of safety will substantially influence supervisors’ – and ultimately ground level workers’ – enactment of safety priorities relative to production. It was further noted by Zohar (2010) that perceptions form the frame of reference for employees around the

behaviour that is anticipated, supported, and rewarded. This definition therefore aligns employee behaviour and perceived expectations.

Other studies have provided support for safety climate as a multi-level concept encompassing two levels:

1. The organisation-level which encompasses employees' perceptions of the company's pledge to and ranking of safety and
2. The group-level which encompasses employees' perceptions of their supervisors' commitment to and prioritisation of safety (McFadden 2015; Vu & Cieri 2014; Wu, Lin, Shiau 2010).

It was documented that effective injury control programs are founded on managements' pledge to safety, inclusive of the standing of safety officers within the organisation, worker training programmes, consistent communication between management and workers, general housekeeping, and an established workforce (Zohar, 1980).

Nahrgang, Morgeson and Hofmann (2011) conducted a meta-analysis across four industries which indicated that safety climate is positively linked to adherence to safety measures. Presently, safety supervisory bodies, such as the Norwegian Petroleum Safety Authority and the State of Montana in the United States, have endorsed codes of practice necessitating employers to institute a positive safety culture (Vu & Cieri, 2014).

Unquestionably, an in-depth appreciation of the unique dimensions of safety climate can be attained when based on a safety climate questionnaire. An established safety culture and a positive safety climate are of utmost importance in attaining a safe workplace (Bergh, Shahriari & Kines, 2013).

2.3 WORKERS' PERCEPTION OF SAFETY IN THE CONSTRUCTION INDUSTRY

A study was conducted by Torner & Pousette (2009), which aimed to describe, from the viewpoint of construction workers and line managers, the constituents of positive safety standards. Four main categories of work safety pre-conditions and constituents were identified:

(1) Project features including the nature of the work
(2) Organisation and structures, with the sub-categories scheduling, work roles, processes, and resources
(3) Shared values, norms, and behaviours, including climate and culture
(4) Individual capability and attitudes, with the sub-categories knowledge, ability and experience, and individual attitudes (Torner and Pousette, 2009).

The outcome of the study showed that management attitudes, prescribed conditions, collective values and individual attitudes, network and strengthen each other in their impact on safety performance (Torner and Pousette, 2009).

In an earlier study conducted by O'Toole (2002), a worker safety perception survey was conducted together with collection of injury data over a 45-month period from a concrete producer in the United States. The results suggested that declines in injuries at the company sites were influenced by the positive employee perceptions of fundamental factors, one of them being management's commitment to safety. These perceptions act to impact employee resolutions that relate to risky behaviours and judgements in the workplace (O'Toole, 2002).

Interestingly, a study conducted by Huang et al. (2014) in the trucking industry provided an indication that supervisor perceptions of safety climate do not correspond with employee perceptions of safety climate, with supervisors presenting a higher rating. Furthermore, employee safety climate perceptions, and not supervisor perceptions of safety climate, pointedly projected safety behaviour (Huang et al. 2014). The results from this study supports the traditional safety climate literature and proposes that when endeavouring to measure and assess an industry's or organisation's safety climate, employee perceptions are more suggestive of safety behaviours and outcomes than supervisor input (Huang et al. 2014). The above studies give evidence to and indicate that safety climate is of immense importance for safety performance and thus, this area deserves further exploration.

2.4 THE BENEFITS OF SAFETY CLIMATE STUDIES

A positive safety climate has a ripple effect on safety benefits. As depicted in Figure 2.1, a positive safety climate enhances employee safety knowledge and motivation for safe work choices and practices by the adoption of safety as a core work value (Gershon, Karkashian, Grosch, *et al*, 2000). This adoption of safety creates an environment and culture where safety is a conscious part of daily wok activities. This value placed on safety leads to an increased perception of a safe workplace environment with valuable support from management. Ultimately, this positive safety climate results in increased production and profit because of positive worker safety morale, reduction in compensation funds and insurance costs (Gershon *et al,* 2000).

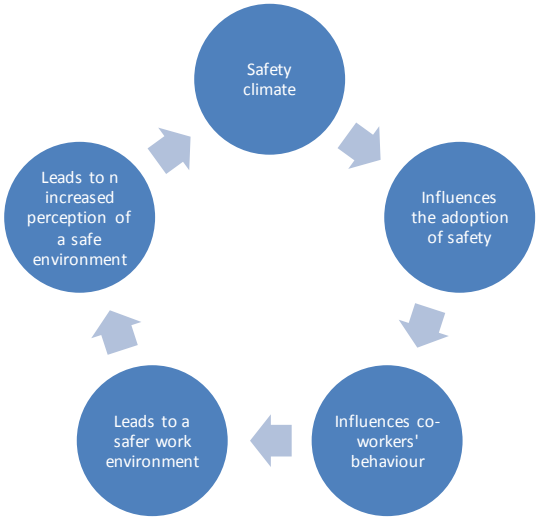

Figure 2.1 Benefits of safety climate (Source: Gershon et al. 2000)

Studies in the literature reviewed, researched the prognostic worth of safety climate studies for safety outcomes (Bergh 2011; Adutwum 2010; Fang et al. 2013; Huang et al. 2007). Christian, Bradley & Wallace et al. (2009) established that group and organisational safety climates were meaningfully associated with safety enactment (safety behaviours) and safety consequences.

2.4.1 Occupational health nursing practice

There is a moral, legal and ethical responsibility for managing safety and health in the construction industry. Workplace accidents and work related diseases and illnesses cause pain, suffering and often negative financial consequences to the employee which extends to their families. Prevention is of paramount importance to mitigate any ill-

effects of workplace hazards and risks. By giving importance to prevention and good health of the employees, organisations can create a culture that is employee-centred and provide supportive environments where safety is ensured. Health can also be positively affected by providing opportunities for employers to engage in workplace health programs (CDC 2016).

Occupational health nurse practitioners work as part of a multidisciplinary team, with other members being occupational health medical practitioners, SHE practitioners, industrial hygienists, safety engineers and academic researchers, to name a few.

The World Health Organisation defined the role of the occupational health nurse practitioner (OHNP) as encompassing the following aspects of workplace health:

a) The prevention of occupational injury and disease through a comprehensive pro-active occupational health and safety strategy;

b) The promotion of health and work ability, by focusing on non-occupational, workplace preventable conditions that, whilst not caused directly by work, may affect the employee's ability to maintain attendance or performance at work, through a comprehensive workplace health promotion strategy;

c) Improving environmental health management, by reducing risk to the working population and the wider community, this contributes to the wider public health agenda (WHO, 2001).

It follows that the benefits of measuring the present "snap shot" of the safety culture via the safety climate assessment tool can guide the OHNP in addressing the safety and health shortfalls on site.

2.5 MEASURING SAFETY CLIMATE

To determine the workers' perceptions of the safety climate, the safety climate must first be measured. For many years, high risk industries such as aviation, nuclear energy and petro-chemical industries have been measuring safety climate in view of assessing their worker's safety perceptions (National Health services, 2010).

In Zohar's first published safety climate study in 1980, a model of safety climate using a 40-item questionnaire was developed and tested on factory workers in different industries in Israel. The study established a way to measure safety climate: a questionnaire comprising items that measure a set of factors or paradigms that divulge shared perceptions of the organisation's safety climate. Zohar's (1980) original set of factors were:

1. Significance of safety training
2. Impact of the value placed on safety
3. Status of the safety committee
4. Status of the safety officer
5. Impact of safe conduct on promotion
6. Level of risk at work place
7. Management approaches toward safety
8. Effect of safe behaviour on social standing

Safety climate assessment is an easily manageable process as this can be achieved through using quantitative measures, such as, a self-report questionnaire. On the other hand, safety culture uses both qualitative and quantitative measures (Bergh, 2011).

Several tools exist to measure safety climate (Bergh, 2011). Fu, Zhang, Xie et al. (2006) explains that although the factors included in the safety climate survey questionnaires might not be the same, they are nonetheless interrelated. Fu et al. (2006) further described safety climate surveys as an accepted and effective approach towards encompassing workers in building an informed safety culture. Workers hereby have an opportunity to reflect on management's safety attitude and behaviour, and express their perceptions about threats involved in their jobs. Fu et al. (2006) reviewed various safety climate surveys from the year 2000 – and isolated nine safety climate dimensions which were amongst the most shared. These include:

1. Beliefs and values
2. Management commitment
3. Risk level and hazards identification
4. Management's efficiency
5. Workers' involvement and commitment

6. Safety institutes and specialists
7. Safety education and training
8. Site management
9. Standardisation

In consideration of the above literature review, for this study, a Nordic Occupational Safety Climate Questionnaire (NOSACQ-50) was adopted to guide the literature search and data collection. The nine safety climate dimensions as isolated by Fu et al. (2006) in their review, are encompassed in the NOSACQ-50. The NOSACQ-50 was established by a group of Nordic occupational safety researchers based on organisational and safety climate theory, psychological theory, empirical research, assimilated from international studies, and a constant development process of the questionnaire (Kines et al. 2011; NOSACQ-50 2010). The NOSACQ 50 consists of 50 items across seven dimensions with each of the seven dimensions consisting of 6–9 items, altogether 50 items, hence the name NOSACQ-50. The seven dimensions noted below have been further grouped under three broader aspects, in line with the studies' objectives (i) managements prioritisation, commitment and competencies regarding safety practices, (ii) co-worker attitudes towards safety and (iii) workers' trust in the efficacy of the safety systems. The seven dimensions are discussed below.

2.5.1 Dimension 1: Management's safety priority and commitment

Dimension 1 deals with workers' perceptions of how management prioritises and promotes safety. Aspects related to how management reacts to accidents or unsafe behaviour as well as how safety issues are communicated in the organisation from top (management) to bottom (on site workers) are highlighted.

A study conducted in central Taiwan explored the predictive factors in safety culture (Wu, Lin & Shiau, 2010). The researchers found that safety governance can be concentrated in a few areas: safety advising (monitoring, participation in committees); safety collaboration (being a figurehead, leading and communication); and safety decision-making (scheduling, resource provision, development). Furthermore, if process managers can convey superior safety leadership in the above-mentioned capacities, then workers will contribute more enthusiastically in safety actions, perceived risks will be reduced, and emergency response competencies improved (Wu et al. 2010). The

study had established that specific role performances from employers, operating managers, and safety professionals are meaningfully associated with safety culture. These conducts can consequently be effective in cultivating a positive safety culture and safety climate.

Kvalheim and Dahl (2016) stated that companies seeking to enhance safety compliance should focus on leadership practices that show a clear commitment to safety concerns, on improved accessibility and clarity of safety procedures, and on training that emphasises increased knowledge of safety issues and safety procedures.

In a study led by Fernández-Muñiz, Montes-Peon & Vazquez-Ordas (2007), it was found that an employee's conduct and participation in safety actions was positively influenced by the manager's commitment as well as by safety management systems effected by an organisation. It follows that managers can have a significant impact by their positive approach to safety and through their performances, as well as indirect effect through their backing and subsidy for the execution and expansion of the safety management systems (Fernández-Muñiz et al. 2007).

2.5.2 Dimension 2: Management's safety empowerment

This dimension reveals perceptions of the workers on how management empowers its workforce and supports their participation in safety related issues. This extends to how workers are empowered to influence aspects of their own safety at work. Cognizance of risks, sufficient training, and awareness of the value attached by the company or employer to risk avoidance, a preventative organisation and management controls that contribute to safety systems, and, simultaneously illustrate management's commitment to safety and safety empowerment (Reason, 1997). In a study aimed at examining how empowerment is perceived by workers employed on construction projects, it was found that there is a gap between employee's experiences and management's commitment and input into empowerment (Greasley, Bryman & Dainty et al. 2005). Health and safety were mentioned by the employees as a key obstacle to empowerment (Greasley et al. 2005).

2.5.3 Dimension 3: Management's safety justice

This dimension evaluates workers' perceptions of how management would treat and react to workers that were involved in an accident or incident. A reporting culture is based on workers' trusting the organisation sufficiently to report safety linked issues with no fear of blame, believing that reporting is encouraged and rewarded. Workers will not report faults and near-misses if they suspect that they will be negatively judged for them (Bergh, 2011).

As discussed above, Reason (1997) stated in his study that employees cannot be accused for affecting mishaps, since human error is a result rather than a cause. In the research conducted by Fernandez-Muniz et al. (2007) it was concluded that if workers perceive a high level of managerial commitment which is reinforced by the application of a suitable safety management system, the workers will have a tendency to be confident in their attitudes toward safety. They will be less disposed to unsafe workplace practices, and more likely to make recommendations and observations on refining work conditions (Fernández-Muñiz et al. 2007). Salamon and Robinson (2008) established that perceptions of trust from management, positively influenced employee's performance and workplace safety choices. Salamon and Robinson (2008) go on to suggest that those workers who perceive that they are trusted, identify that the trust invested in them binds their actions resulting in accountability standards that ultimately support the organisations' safety goals (Salamon & Robinson, 2008).

2.5.4 Dimension 4: Workers safety commitment

This dimension deals with how workers show commitment to safety, actively promote safety and are considerate of each other's safety. A study conducted in the trucking industry concluded that opportunities for drivers to contribute toward safety concerns should be considered by organisations as a subject that has a valued positive effect on its members' perception of safety culture (Arboleda, Morrow & Crum et al. 2003). In the trucking industry, drivers' contribution is imperative to envisage the overall perception of safety culture because these are the employees who deal recurrently with driving-related risks (Arboleda et al. 2003). In a study conducted by Yee (2002) in the Hong Kong construction industry, the main obstacles of safe work behaviour (safety commitment) were that certain health and safety procedures, instructions and rules did

not correlate and were not contextualised in the reality of how the construction work was done.

2.5.5 Dimension 5: Workers safety priority and risk non-acceptance

This dimension covers how workers prioritise safety before production and thus do not accept risk-taking or work in hazardous conditions. Shannon, Mayr and Haines (1997), investigated the association between workplace and organisational factors and injury rates and established that empowering workers and assigning safety activities were constantly linked to lower injury rates. Management's attitudes, shared values and individual attitudes intermingle and are reinforced in their effect on safety enactment (Torner & Pousette, 2009).

Results from the study by Kvalheim & Dahl (2016), demonstrated that work pressure was the most important contributor to safety compliance. They suggested that the organisation should focus on the enacted priorities when faced with safety issues that might conflict with production targets. There is little use in stating that safety is a top priority if workers are implicitly or explicitly pressured into prioritising production over safety in practical situations (Zohar 2010 in Kvalheim & Dahl, 2016).

When Yee (2002) explored the extent to which workers in the Hong Kong construction industry take risks at work or behave unsafely, it was found that the employees' behaviour are influenced by co-workers who take risks in the workplace. Overconfidence, heightened optimism and over familiarity influence the worker's appraisal rating of a hazard as significant (Yee, 2002).

2.5.6 Dimension 6: Peer safety communication learning and trust in safety ability

In this dimension, workers' perceptions of how peers discuss safety issues, learn from experiences, help each other to work safely and trust in each other's ability, is measured. In a study conducted by Williams, Ochsner, Marshall et al. (2010), participatory, peer-led teaching personalised to the requirements of construction day labourers was seen to have a beneficial effect on Latino immigrant workers' attitudes, safe-work choices, and self-reported injury rates. The results of the study suggested that

the day labourers have a strong concern with regards to health and safety information. Extensive application of training, particularly if reinforced with support from contractors, may culminate in reduced rates of traumatic injury in the industry (Williams et al. 2010). The study also revealed that 66% of workers had recounted sharing the information from their safety workbook with friends and co-workers after the safety training (Williams et al. 2010).

2.5.7 Dimension 7: Workers' trust in efficiency of safety systems

This final dimension measures how effective workers consider the formal safety systems for example, safety rounds and meetings, setting of safety goals and objectives. Results from a study conducted by Kvalheim and Dahl (2016) indicate that procedures and guidelines are basic constituents of a safety system, and are to be used by workers before and during the execution of work tasks in all high-hazard industries. The researchers found that a well-organised safety system where procedures are easy to access, and where the relevant procedures are readily available, facilitates safety compliance (Kvalheim and Dahl, 2016).

Other research studies have sought to determine if attitudes and perceptions of the safety climate differ amongst diverse groups of workers within the organisation, for example, to establish if there is a difference in expressed attitudes toward safety between management and workers. Cox & Flin (1998) found variances amongst safety attitudes of workers, supervisors and managers in the UK manufacturing area where permanent workers had a more positive attitude on selected concerns than did other groups. Gillen, Baltz and Gallen et al. (2002) found different perceptions of safety climate between unionised and non-unionised workers.

2.6 CONCLUSION

Although the construction industry is a massive sector for employment for many people, contractors and businesses, it poses an inherent threat to the health and safety of employees and sub-contractors due to the nature of work in this high-risk industry. A danger or risk to employees can negatively influence employee confidence, and consequences are loss in productivity and reputational risk (Mathenge, 2014). It is clear

from the statistics emerging from the construction industry worldwide that better measures for preventing illness, injury and death in the workplace are of paramount importance. This includes the protection of resources and the environment in which the industry operates. According to Olsen (2009), an assumption is that research on safety climate and safety culture in the long run may produce knowledge that will potentially improve the safety performance of organisations and, ultimately, the safety of societies.

CHAPTER THREE – RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

This chapter outlines the research design and the method adopted to achieve the research objectives. This includes a discussion on the study context, sample criteria, sampling process, data collection procedure and data analysis. In addition, the research instrument chosen for data collection including reliability and validity issues will be discussed. Ethical considerations and measures taken to protect the rights of the respondents are presented in this chapter.

3.2 RESEARCH SETTING

A research setting is the actual place and conditions or circumstances where and within which the research study takes place (Polit & Beck, 2012). The research setting for this study is the Nelson Mandela Children's Hospital (NMCH) construction site. The NMCH is a project initiated by the Nelson Mandela Children's fund, which was established by Nelson Mandela in 1995. NMCH is a 200-bed tertiary care paediatric hospital that provides specialised tertiary care. NMCH is an academic hospital engaged in training as well as research. The hospital is located in Johannesburg. The projected date for the beginning of graded clinical operations is scheduled for the second quarter of 2017.

Construction of the NMCH commenced on the 22 April 2014. The main contractor for the building of the hospital operates in the infrastructure, energy, resources and real estate sectors. The company are involved in project development, investment, construction, operations and maintenance and the manufacturing and supply of construction products. The headquarters are in South Africa, but the company have great focus in sub-Saharan Africa. They also operate in countries in Europe, employ over 9000 people and have operating experience in 28 countries.

3.3 RESEARCH DESIGN

Grove, Burns & Gray (2013) describe research designs as "a blueprint for conducting the study that maximises control over factors that could interfere with the validity of the findings". Research design assists the researcher to plan and implement the study in such a way as to obtain the desired results (Grove, Burns & Gray, 2013). De Vos,

Strydom, Fouche and Delport (2011) state that a research design forms an integrated statement and justification of more technical decisions involved in the planning of a research project.

A quantitative, descriptive and cross-sectional survey was used for this study. This design was used to describe the perceptions of workers regarding the safety climate in the construction industry. The benefit of using a survey for this research study, as indicated by Brink, van Rensburg & van der Walt (2011) is that a survey has the capacity to broach numerous questions about a specific subject thus giving extensive flexibility of data analysis.

The concepts that underpin this research are:

3.3.1 Quantitative design

Grove, Burns & Gray (2013) describe quantitative research as a systematic process of obtaining formal objective data, for the purpose of describing the variables, as well as testing and examining the relationships between variables. The main characteristic of quantitative research is that it is a formal measuring instrument, used to provide numeric information that is statistically analysed (Polit & Beck, 2012).

According to Cooper and Schindler (2006), quantitative research design uses structured questionnaires with larger sample sizes than qualitative research designs. Therefore, by using specific methodologies and techniques, quantitative research quantifies relationships between different variables (Khalid, Hilman & Kumar, 2012). Neuman (2006) explained that quantitative research is useful when opinions, attitudes and behaviours are to be examined.

In this study, a quantitative survey design was adopted as the researcher used a structured survey questionnaire to collect data from the study respondents. This method allowed the researcher to pose the same questions to all respondents in the study. The response choices facilitated the collection of objective data which was analysed to then describe the perceptions of the workers on the safety climate at the NMCH construction site.

3.3.2. Descriptive design

A descriptive study design is used to obtain a picture of the situation, preferences, practices, opinions, concerns or interests of the phenomenon of interest (Grove, Burns & Gray, 2013). The primary purpose of using a descriptive research design in this study was to describe the site workers' perceptions of the safety climate at the Nelson Mandela Children's Hospital construction site in the Gauteng Province, South Africa. Through this descriptive design, the researcher could identify aspects that workers were in agreement with or disagreed, with regards to the safety climate.

3.3.3 Cross-sectional survey research design

LoBiondo-Wood and Harber (2006) describe a cross-sectional study as a design wherein observations are conducted at a single point in time. This design is different from the longitudinal design where data is collected at different points of the study. In this study, data was collected on one occasion, at the time that the questionnaires were administered. A survey is defined as the collection of information from a large or representative section of the population (Malhotra & Grover, 1998). It entails obtaining information from people through mail, face to face or telephone interviews, a quantitative research method that uses structured or standardized format and uses a sample. This design enables the researcher to obtain facts and responses from a large sample of respondents thereby increasing the validity and generalisability of findings (Malhotra & Grover, 1998). The cross-sectional survey design was therefore the chosen design to fulfil the aim of the study which is to describe the site workers' perceptions of the safety climate at the Nelson Mandela Children's' Hospital construction site. By relying on cross sectional survey data, worthwhile data on the respondents perceptions and the relationship between the dimensions of safety climate were obtained however it has the limitation of not revealing more about the actual safety processes at the site. It serves as a snapshot and therefore gives no indication of the sequence of events that may impact at the given time of the administration of the questionnaire (Bland, 2001). A questionnaire serves as a practical research tool whereby large amounts of information can be collected from a large group of participants in a study within a fairly short period of time, in a cost effective way (Popper, 2004). The results of the questionnaire can be easily quantified by the researcher or statistical software packages. However, it is argued that questionnaires can be inadequate to understand certain forms of information

such as changes of emotions, behaviours and feelings. There is also no certain way to tell if the participant is responding truthfully to the questions posed nor how much thought has been put into the response (Popper, 2004).

3.4 RESEARCH METHODS

3.4.1 Population and sample

3.4.1.1 Population

Grove, Burns & Gray (2013) describe the population as all the elements that meet the criteria for inclusion in a study. The target population for this study was all the permanent and contract construction workers at the Nelson Mandela Children's Hospital construction site. The total population size at the construction site was 1061 as at 9th July 2015. The basis for focusing on these workers is that they are the operational teams faced with safety and health issues daily in their work, and would therefore give the greatest insight into the safety climate of the construction site. The demographic population information was obtained from the onsite construction junior project manager records as at July 2015.

3.4.1.2 Sample and sampling

Sampling involves the selection of a portion of the population to represent the total population, so that the results from the sample represent the rest of the group (LoBiondo-Wood & Haber 2006). The selected sample should therefore have similar characteristics to the population in the study to allow generalisation of the results to represent the population (Grove, Burns & Gray, 2013).

The total population size at the Nelson Mandela Children's Hospital construction site was 1061. This population comprises 60 permanent employees and 1001 contract workers as at 9th July 2015. A representative sample of 283 respondents was calculated based on a confidence level of 95%, allowing for a marginal error of 5% (Raosoft, 2009). A preliminary audit of the workers on site was conducted a year later shortly before the data collection phase. However, the total population size had decreased to (N=456). What was observed at the NMCH construction site is admittedly not an unusual situation. In most construction sites, the project begins with a large number of construction workers and as the project develops and approaches the completion

phase, the numbers of workers decrease as many of the contract workers have completed their tasks and have left the site. Following this discovery, the sample size was recalculated. The same process of calculating the sample size on a confidence level of 95%, allowing for a marginal error of 5% was used (Raosoft, 2009). A new sample size of 209 (n=209) plus an additional ten percent was adopted for this study to accommodate for questionnaires not returned or incorrectly filled in.

With regards to the sampling strategy, the researcher opted for an approach that can be easily applied on readily accessible persons. A non-probability convenience sampling strategy was found to be an appropriate strategy for this study (LoBiondo-Wood & Haber, 2006). Convenience sampling in literature is also known or described as haphazard or accidental sampling as it does not use any method of random selection (Grove, Burns & Gray, 2013). Lack of use of random measures of selecting respondents could lead to less representation and the results not generalisable (Brink, van de Walt & van Rensburg, 2011).

Nonetheless, in this study, the advice of LoBiondo-Wood and Haber (2006) on how to ensure representativeness and boost confidence in the research result was applied. The inclusion and exclusion criterion was careful considered and applied. The criterion that was used for recruiting prospective respondents for the study includes subjects that were above the 18 years of age that can read and write English. However, the researcher was available to assist workers who had a problem in completing the questionnaires. Respondents must have been working for the construction company for more than 3 months.

3.4.2 Data collection

3.4.2.1 Data collection instrument

The chosen data collection tool for the study was a self-administered Nordic Occupational Safety Climate Questionnaire NOSACQ-50 (Kines et al. 2011). The NOSACQ-50 was established by a group of Nordic Occupational Safety researchers constructed on organisational and safety climate theory, psychological theory, previous empirical research, empirical outcomes learned through international studies and a constant development process (Kines et al. 2011).

The NOSACQ-50 was chosen among the others because the instrument is a diagnostic and intervention tool which can be used to evaluate the status and progress of safety climate in an organisation (Kines et al. 2011). Secondly, it has been translated and validated into various languages. Thirdly, the tool is based on contemporary research and formulated on a 4 point Likert scale and does not include the "I don't know" or neutral statement that could have a negative impact with regards to formulating the conclusion of the results to formulate the recommendations. Finally, the authors of the NOSACQ-50 questionnaire invited the researcher to submit their results for benchmarking against the global database of safety climate in the construction industry.

The first part of the data collection tool consists of questions that relate to the respondents namely: age; gender; education level; duration working for the company; and job description. The NOSACQ-50 consists of 50 items across seven dimensions. The seven dimensions are formulated to address 3 pertinent aspects of safety climate: (i) managements' prioritisation, commitment and competencies regarding safety practices (ii) co-worker attitudes toward safety (iii) workers trust in the efficacy of the safety systems.

The questionnaire contains positively and negatively (reversed) formulated items using a four-point Likert scale. The scale challenges respondents to take a stand as to what degree they agree or do not agree with each item wherein 1= "strongly disagree"; 2="disagree"; 3= "agree" and 4= "strongly agree". The seven dimensions of the scales are, shared perceptions of 1: "management safety priority, commitment and competence"; 2: "management safety empowerment"; 3: "management safety justice"; 4: "workers' safety commitment"; 5: "workers' safety priority and risk non-acceptance"; 6: "Safety communication, learning, and trust in co-workers' safety competence"; 7: "workers' trust in the efficiency of safety systems" (Kines et al. 2011).

The seven dimensions were further grouped in line with the study's objectives:

Aspect 1: Management's prioritisation, commitment and competencies regarding safety practices = dimensions 1, 2 and 3

Aspect 2: Co-worker attitudes toward safety = dimensions 4, 5 and 6

Aspect 3: Employees' trust in the effectiveness of the safety system = dimension 7.

Table 3.1 NOSACQ-50 Safety climate dimensions and item examples

Dimension	Aspects	Example of item
1. Management safety priority and ability (9 items)	Workers' perceptions of how management: - rank safety - dynamically endorse safety and respond to unsafe behaviour - show capability in handling safety - communicate safety issues	Item 1: Management encourages employees here to work in accordance with safety rules - even when the work schedule is tight
2. Management safety empowerment (7 items)	Workers' perceptions of how management: - empower workers - supports participation	Item 13: Management never considers employees' suggestions regarding safety
3. Management safety justice (6 items)	Workers' perceptions of how management: treat workers involved in accidents justly	Item 20: Management looks for causes, not guilty persons, when an accident occurs
4. Workers' safety commitment (6 items)	Workers' perceptions of how they: - display commitment to safety - keenly promote safety - care for each other's' safety	Item 23: We who work here try hard together to achieve a high level of safety
5. Workers' safety priority and risk non-acceptance (7 items)	Workers' perceptions of how they: - rank safety before production - do not accept risk-taking or hazardous conditions	Item 33: We who work here never accept risk-taking even if the work schedule is tight
6. Peer safety communication learning and trust in safety ability (8 items)	Workers' perceptions of how they: - deliberate on safety issues whenever such emerge - absorb from experience - aid each other to work safely - treat safety suggestions from each other - trust each others' ability to guarantee safety	Item 38: We who work here have great trust in each other's ability to ensure safety
7. Workers' trust in efficiency of safety systems (7 items)	Workers' perceptions of how they: - consider proper safety systems effective, e.g. safety representatives and safety rounds - experience value from early planning - experience value from safety training -experience value from clear safety goals and objectives	Item 46: We who work here consider that safety training is good for preventing accidents"

3.4.2.2 Reliability and validity of the instrument

Validity of an instrument is the extent to which the tool accurately measures the concept being examined (Grove, Burns & Gray, 2013). Reliability of an instrument refers to the degree to which the results obtained by a measurement and procedure can be replicated (Rothman, Greenland & Lash, 2008).The 50 items across the seven dimensions have proven reliability and validity in various sectors and countries. The

NOSACQ-50 has been used in over 100 international studies, where results have been submitted to an international database thus allowing for benchmarking (Bergh et al. 2013). The NOSACQ- 50 was tested for validity and reliability in four independent Nordic studies by means of native language versions in each Nordic country (Kines et al. 2011). NOSACQ-50 was established as a reliable instrument for determining the safety climate, and valid for forecasting safety motivation, perceived safety level, and self-rated safety behaviour (Kines et al. 2011). The validity of NOSACQ-50 was additionally established by its capacity to differentiate between organisational components through identifying significant differences in safety climate. The significance to industry is that the NOSACQ-50 will support comparative studies of safety climate amongst and within companies, industries and countries (Kines et al. 2011).

In this study, an instrument pre-test exercise was done prior to the main study in another setting similar to the NMCH construction site. The NOSACQ-50 instrument was pre-tested on 10 construction workers. The purpose was to determine the ability of the construction workers to comprehend and answer questions as well as to establish how long it takes to fill in the questionnaire. In addition, the Cronbach's alpha coefficient test was conducted to test for internal consistency of the 7 dimensions (Table 4.3). The results were then compared with the international database by the instrument developers. The data was submitted for in-corporation into the international data base as per developer's request. Submission also facilitates comparison of the results from different studies and with official statistics or registers. The results from the pre-test compared well with the international database however a few items (questions) were problematic. The developer explained these questions as being difficult to understand and was a general problem in many studies due to the poorly worded items. The pre-test results were not included as part of the final results presented. No problems or concerns were noted in respect of completion of the questionnaire by the respondents.

3.4.2.3 Data collection process

The pre-test study and main study data collection process commenced after obtaining permission from the University of the Witwatersrand Human Research Ethics Committee (Appendix A) and the Post Graduate Committee (Appendix B). Permission was also obtained from the senior safety manager at the NMCH construction site (Appendix C).

A meeting was then held with the researcher and the NMCH construction site safety and health manager to discuss the aims and needs of the researcher. The researcher then attended a site safety and health meeting where the study was briefly explained to the site workers. Where clarity was required, the safety and health officer translated the researcher's response and explanation into other languages other than English. At this meeting, the researcher emphasised that the participation in the study was voluntary. The questionnaires (Appendix E) together with the information letter (Appendix F) and consent forms (Appendix G) were handed out by the health and safety site officer to each worker with a pen. These were provided by the researcher. The telephone numbers of the researcher's supervisor were supplied on the covering letter (Appendix F), should any of the respondents have enquiries.

To facilitate the return of questionnaires, three sealed slotted boxes were placed at strategic places on the site. The respondents were advised to drop their questionnaires into the slot of the sealed boxes. These boxes were kept at the end of the day in the safe-keeping of the site safety and health manager. They were collected three times within a two month period by the researcher. Although data collection was intended to continue until the sample was realised, due to the nature of the work setting, some workers were moved to another site and only 108 completed questionnaires out of 117 were returned.

3.5 DATA ANALYSIS PROCESS

The data for the study was collected manually using the Nordic Occupational Safety Climate questionnaire (Kines et al. 2011) (Appendix E). The results from the questionnaire were entered into an Excel spread-sheet. The data processing procedure entailed a data management process of cleaning the data through checking for errors in recording, duplicates within the data and missing values. To verify accuracy the manual questionnaires were used to verify that the data was recorded correctly.

A statistician from the University of the Witwatersrand assisted with the data analysis process. Data were analysed using the statistical package 'STATA' version 14. The level of statistical significance was set at $p < 0.05$.

In preparation for data analysis, the study variables were grouped and coded to meet the study objectives. With regards to the demographic data, the age of the respondents was calculated from subtracting the date of birth given by the participant from the date the questionnaire was filled in. The age of the respondents was recorded as a continuous variable and was then recoded as a categorical variable (1=20–29 years, 2=30–39 years, 3=40–49 years, 4=50–59 years). The genders of the respondents, the highest level of education, duration working in the company as well as the job role variables were coded as a binary variable. An example is the gender variable which was coded as (1=male; 2=female). The dimensions for the questionnaire were created from an in-built calculation on an excel spreadsheet provided with the Nordic Occupational Safety Climate questionnaire (Kines et al. 2011) to create the following dimensions "Management safety and ability", "management safety empowerment", "management safety justice", "worker safety priority and risk non-acceptance", "peer safety communication, learning and trust in safety ability" and "workers trust in efficacy of safety systems".

To organise the results of the 50 questions into seven dimensions as prescribed by the NOSACQ-50 questionnaire developers (Kines at al 2011), the reverse formulation items were scored dependant on the formulation of the question. This entailed taking the results from the questions asked in a negated manner and reversing the order of the scoring on the Likert scale i.e. score 1 became score 4, score 2 became score 3.

The first stage of the data analysis process was the descriptive analysis of the study participant's demographic data. A table and bar graphs with the frequency percentages of respondents in each demographic group were computed. The age of the respondents was also treated as a continuous variable and the distribution of participant ages was checked by computing the Shapiro Wilk test for normality. Factor analysis was used to determine the distribution of responses based on the gender of respondents. The dimension quintiles were reduced into two responses. The first response was 'disagree' which was computed through grouping the 'strongly disagree' and 'disagree' scores. The second response was 'agree' which was computed through grouping the 'strongly agree' and 'agree' scores. A chi-squared test of comparison was used to compare the proportions of responses.

A Cronbach's alpha statistic test was computed to assess the internal consistency of the variables for each dimension. This is an indication of how closely related the items in each dimension are (Tavakol & Dennick, 2011). As per instruction by the Nordic Occupational Safety Climate questionnaire developers, a Cronbach alpha coefficient of <0.7 is poor, showing the items in the dimension are not closely related, while the coefficient between 0.7 – 0.8 is considered acceptable indicating that the items are closely related (Table 4.3).

A proportionality frequency test table was computed to determine the frequency of respondents per response for each dimension. Histograms of participant responses were computed and the Shapiro Wilk test for normality was computed to indicate the distribution of participant responses and assess the statistical significance of the distribution. The mean/ median responses of the respondents per domain were outlined. In cases where a median±IQR was outlined instead of a mean±SD, the data on the responses were found to not be normally distributed.

3.6 ETHICAL CONSIDERATIONS

The ethical considerations in this research were observed by the following principles:

3.6.1 Permission to conduct the study

Ethical clearance to conduct the research was sought and obtained from the Human Research Ethics Committee of the University of Witwatersrand (Appendix A). The proposal for this study was also submitted to the Faculty of Health Sciences Postgraduate committee for permission to conduct the study and approval was given (Appendix B). Permission to conduct the study had been requested and granted by the main construction company (Appendix C). Approval for use of the instrument (Appendix E) was sought from the authors and given (Appendix D).

3.6.2 Beneficence

Beneficence refers to the principle of doing 'good' and protection of respondents from physical, emotional, social and psychological harm (Polit & Beck 2012). Participation in the study was voluntary with respondents being allowed to withdraw from the study at any time. The respondents in this study could discontinue participation in the study if they felt uneasy with the questions or chose not to continue with the questionnaire

completion, without any penalty. The respondents were provided with the researcher's and supervisor's contact details in case the respondents had any questions (Appendix G).

3.6.3 The right to informed consent

Informed consent means that participant have a right to be informed of what will happen. A letter explaining the nature and objective of the study were given to the prospective respondents (Annexure F). Respondents consenting to participating in the study were requested to sign a consent form (Appendix G). The participant's signature thereon was considered informed consent. Respondents were furthermore, informed about their right to refuse to participate or to withdraw at any time of the study without penalty.

3.6.4 Privacy, anonymity and confidentiality

In this study privacy, confidentiality and anonymity of the respondents were enhanced through ensuring that no personal identifiable information was recorded on both the demographic data information sheet and the questionnaire. Each questionnaire was allocated a numeric code thus maintaining the respondents right to privacy. The researcher ensured that no unauthorised person(s) had access to the data in this research. No identities of the respondents were revealed during the reporting of the research results. The questionnaires will be held in safe keeping by the researcher in a sealed box, for two years and thereafter will be destroyed.

3.7 CONCLUSION

This chapter provided an overview of the research methodology adopted in this research. The research design, setting, context, inclusion and exclusion criteria, population and sample, and data collection method was described briefly. The next chapter provides an analysis of the data collected and the presentation of the research results and discussion.

CHAPTER FOUR – PRESENTATION AND DISCUSSION OF RESULTS

4.1 INTRODUCTION

In chapter three, the research design together with the research methodology was discussed. This chapter presents the results of the data collected in order to determine the site workers' perception of the safety climate at the Nelson Mandela Children's hospital construction site. The discussion emanating from these results is presented.

4.2 PRESENTATION OF THE RESULTS

4.2.1 Response rate

At the time of conceptualising the study in July 2015, the total size of the construction workers at the NMCH site was 1061 (N=1061). The population consisted of sixty (N=60) permanent employees and hundred and one (N=101) contract workers. A representative sample size of 283 (n=283) was calculated using the Raosoft (2009) calculator in consultation with a statistician. However, at the time of data collection a year later, the population of construction workers at NMCH totalled N=456. This is indeed being due to the fact that most of the construction companies make use of contract employees. At the end of the building project cycle they move on to the next project or their services are terminated.

A new sample size of 209 (n=209) was calculated based on a confidence level of 95%, allowing for a marginal error of 5% (Raosoft 2009). An additional ten percent was added on to accommodate for questionnaires not returned or incorrectly filled in. So, a total of 219 (n=219) questionnaires were distributed and hundred and eight (n=108) were considered for data analysis, yielding a response rate of 51.7% (Table 4.1). The rest of the questionnaires were disqualified for the study due to insufficient information, or no information filled in and some were too dirty to be used as information was illegible.

Table 4.1 Respondents' questionnaire response rate

Total distributed	219
Total returned	116
Total completed	108
Total usable questionnaires	108
% of respondents	51.7%

4.2.2 Section A: Demographic data

This section presents the demographic data results and the analysis thereof. There are five items pertaining to the demographic data. These items include age, gender, highest level of education, length of employment at the company and the employee's work role description for the specific site (NMCH).

4.2.2.1 Age

Of the total sample of respondents, n=108, 41.7% (n=45) were aged between 20 and 29 years, 37% (n=40) were aged between 30 and 39 years, while 16.6% (n=18) were aged between 40–49 years and 4.6% (n=5) were aged between 50 and 60 years. Figure 4.1 below illustrates the age range of the respondents.

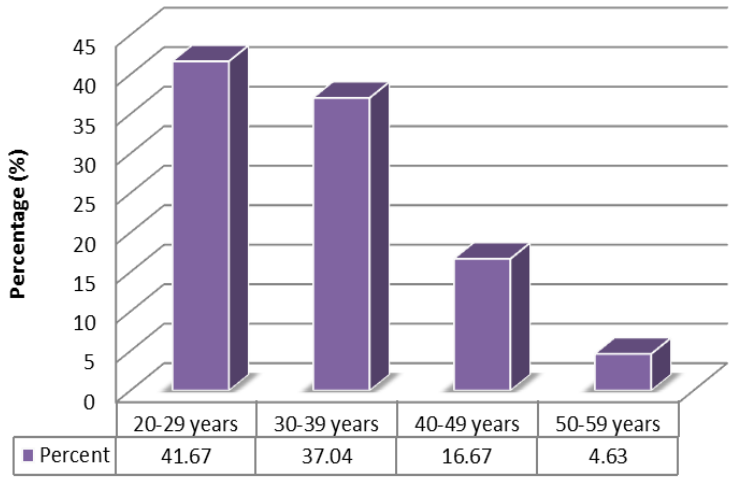

Figure 4.1 Age range of the respondents

The left skewed histogram below (Figure 4.2) was used to check the continuous variable: 'age' for normality. The results from the Shapiro Wilk test for normality indicates that age was not normally distributed (p=0.0002) hence the central tendency

measure to report was median±IQR. The median age of the respondents was 31±12 years.

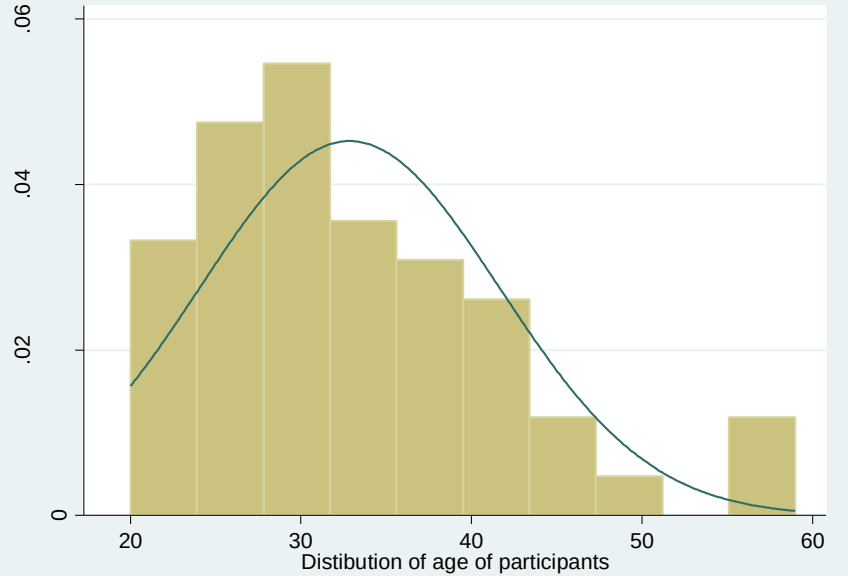

Figure 4.2: Distribution of participant's by age (p=0.0002)

4.2.2.2 Gender

Figure 4.3 below shows that among the respondents recruited for the study, male respondents accounted for 83.3% (n=90) and female respondents accounted for 16.7% (n=18). This indicates that males dominate the construction industry as per the 2015 CIDB statistical report where 89% of the 1.4 million people employed are male and 11% female (CIDB 2015).

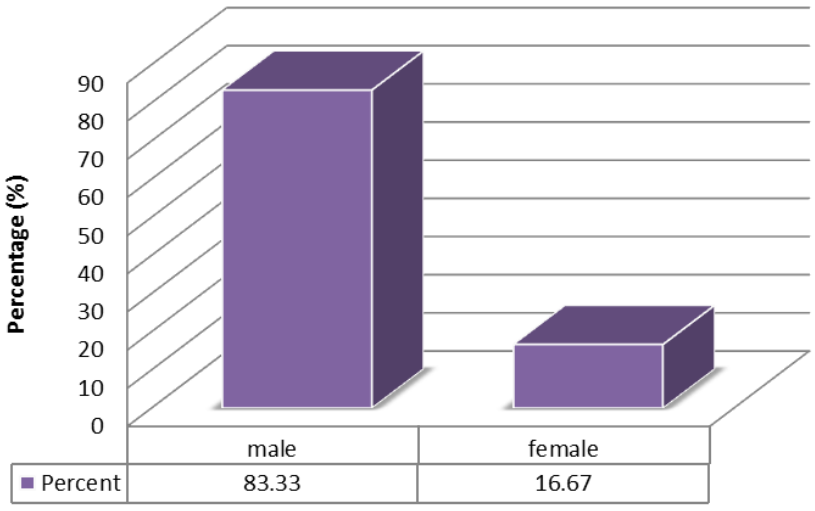

Figure 4.3 Distribution of respondents by gender

4.2.2.3 Level of education

Most of the respondents 50% (n=54) had attended Grade 5 to Grade 8. Only 1.9% (n=2) of site personnel were in possession of a degree qualification. This suggests that qualified engineers and managers, including top management, are not based on site. It is interesting to note the perceptions of site workers regarding policies, protocols and off-site management input regarding the safety climate of the construction site. The level of respondents' education is shown in Figure 4.4.

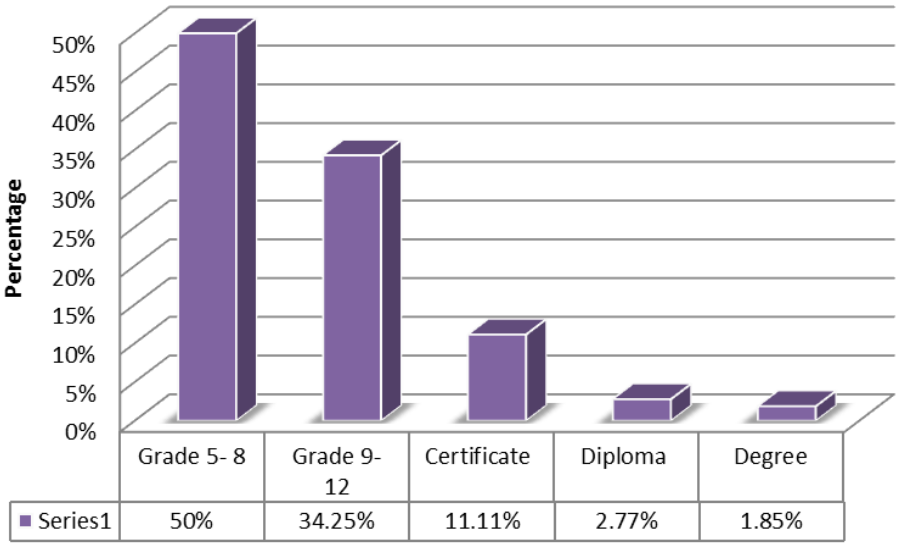

Figure 4.4: Level of education of respondents

4.2.2.4 Duration of employment

The study found that 39% (n=42) of respondents were employed for 1–2 years whereas a small percentage 8.3% (n=17) were employed for 3–6 months (Figure 4.5). The variation in the duration of employment is reflective of the transitory nature of site workers. Many contractors come onto site, execute their function in the construction process and thereafter leave the site. The permanent employees of construction company would be the site engineers and managers who would fall in the 17.59% category of 5 years or more of employment.

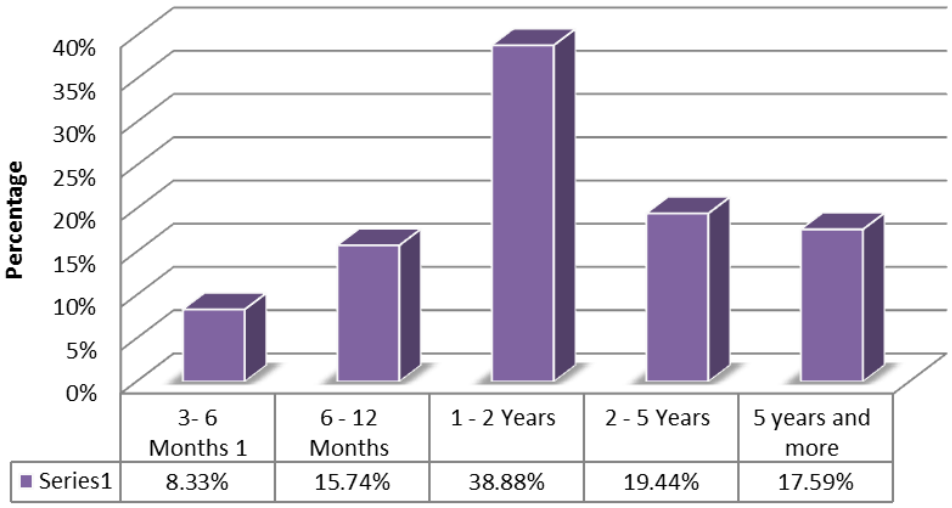

Figure 4.5: Duration of employment of respondents

4.2.2.5 Job role on the construction site

Figure 4.6 indicates that 77.7% (n=84) of the workers on site classify themselves as site workers.

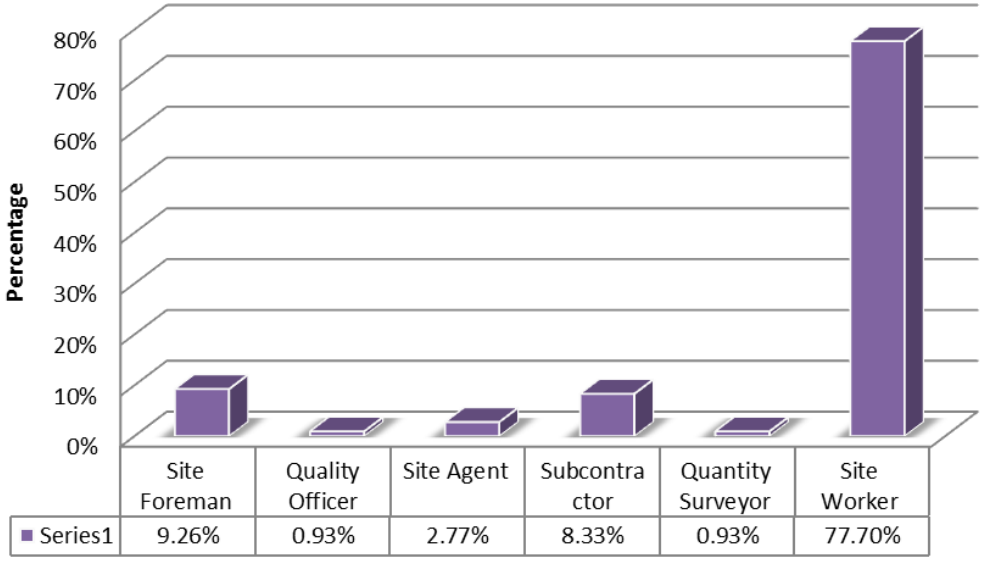

Figure 4.6: Distribution of respondents by job profile

4.2.3 Section B: Safety climate

In this section, the distribution of responses per dimension, the reliability of the dimension scores, the average scores per dimension and the benchmarking of these studies scores against the international database are presented.

4.2.3.1 Distribution of responses per dimension to assess perceptions of the safety climate

The results presented in the Table 4.2 below, indicate the different proportions of participant responses for each dimension. A proportionality test was computed to compare the frequencies per response following the questionnaire reliability assessment. The results show that for dimension 1: "*Management safety priority and ability*" less than 50% (n=49) of respondents responded in agreement to management's prioritisation and promotion of safety and therefore managements input to a positive safety climate. The same trend can be seen in the dimension 2 and 3: "*Management safety empowerment*" where again 45.4% (n=49) and "*Management safety justice*" where 27.7 % (n=30) of the respondents agreed to a management priority of safety issues, ability, empowerment and safety justice as contributors toward the safety climate. These results indicate a negative perception of workers on managements'

prioritisation, commitment and competencies regarding safety practices and ultimately their impact on a positive safety climate.

The respondents of the study also had negative perceptions regarding co-workers attitude towards safety as evidenced by most respondents having a high percentage of negative responses/perceptions in the following dimensions: Dimension 4: "Workers safety commitment": 68.5% (n=74), dimension 6: "peer safety communication learning and trust in safety ability": 57.4% (n=62) and dimension 7: "workers trust in efficacy of safety systems": 60.2% (n=65).

There was interestingly an equal distribution of responses among respondents who agreed: 50% (n=54) and those that disagreed 50% (n=54) to perceptions of how co-workers prioritise safety and practice risk non-acceptance (Dimension 5).

Table 4.2: Distribution of responses per dimension to assess occupational safety climate

Dimension	Strongly disagree n (%)	Disagree n (%)	Subtotal	Agree n (%)	Strongly agree n (%)	Subtotal
1. Management safety priority and ability	28 (25.93)	31 (28.70)	59 (54.63)	22 (20.37)	27 (25.00)	49 (45.37)
2. Management safety empowerment	30 (27.78)	29 (26.85)	59 (54.63)	24 (22.22)	25 (23.15)	49 (45.37)
3. Management safety justice	27 (25)	51 (47.22)	78 (72.22)	4 (3.70)	26 (24.07)	30 (27.77)
4. Workers safety commitment	34 (31.45)	40 (37.04)	74 (68.49)	7 (6.48)	27 (25.00)	34 (31.48)
5. **Workers safety priority and risk non-acceptance**	**27 (25.00)**	**27 (25.00)**	**54 (50)**	**28 (25.93)**	**26 (24.07)**	**54 (50)**
6. Peer safety communication learning, and trust in safety ability	48 (44.44)	14 (12.96)	62 (57.40)	19 (17.59)	27 (25.00)	46 (42.59)
7. Workers trust in efficacy of safety systems	32 (29.63)	33 (30.56)	65 (60.19)	16 (14.81)	27 (25.00)	43 (39.81)

4.2.3.2 Reliability of Dimensions of the Safety Climate Scale

The Cronbach's alpha statistic test was computed to assess the internal consistency of the variables for each dimension. This gives an indication of how closely related the items in each dimension were and provides a measure of the internal consistency of a test or scale and it is expressed as a number between 0–1 (Cronbach 1949). As per instruction by the Nordic Occupational Safety Climate questionnaire developers, a Cronbach's alpha of less than 0.7 is poor, showing that the items of the dimensions are not closely related, while the Cronbach's alpha between 0.7–0.8 is considered acceptable indicating that the items are closely inter-related.

Table 4.3 below presents the items that make up each dimension of the safety climate questionnaire and the Cronbach's alpha coefficient to assess how closely related the items in each dimension are. The items in all dimensions except for two dimensions were found to be closely related and to have adequate reliability (Cronbach's alpha >0.7) The two dimensions which were found to not have adequate reliability and whose items were found to be poorly related were dimension 6: "peer safety communication, learning, and trust in safety ability" (Cronbach's alpha=0.68) and dimension 4: "Workers safety commitment" (Cronbach's alpha=0.49). The low Cronbach value could be as a result of the wording of the items in the specific dimension aiming at measuring the same underlying concept.

Table 4.3: Reliability of Dimensions of the Safety Climate Scale

Dimension	Items	Cronbach's alpha
1. Management safety priority and ability	A1, A2, A3, A4, A5, A6, A7, A8, A9	0.75
2. Management safety empowerment	A10, A11, A12, A13, A14, A15, A16	0.74
3. Management safety justice	A17, A18, A19, A20, A21, A22	0.70
4. Workers safety commitment	**A23, A24, A25, A26, A27, A28**	**0.49**
5. Workers safety priority and risk non-acceptance	A29, A30, A31, A32, A33, A34, A35	0.71
6. Peer safety communication, learning, and trust in safety ability	A36, A37, A38, A39, A40, A41, A42, A43	0.68
7. Workers trust in efficacy of safety systems	A44, A45, A 46, A 47, A48, A49, A50	0.71

4.2.3.3 Average scores per dimension to assess occupational safety climate

Table 4.4 below shows the mean and median scores of the respondents' responses per dimension. In cases where a median±IQR was outlined instead of a mean±SD, the data on the responses were found to not be normally distributed. As per the instructions of the Nordic Occupational Safety Climate questionnaire developers (2011), the safety climate dimension mean scores can be graded as follows: a score more than 3.30 indicates a good/high/rich level or rating of safety climate, a score of 3.00–3.30 refers to a fairly good level of safety climate with a slight need for improvement, a score of 2.70–2.99 shows a fairly low level of safety climate with need for improvement and a score of below 2.7 indicates a low level with great need for improvement.

From the table 4.4 it can be seen that for 5 dimensions, the respondents of the study reported a fairly low level of safety climate that indicates need for improvement. Dimension 5: "Workers safety priority and risk non-acceptance" has a mean score of 2.25, indicating a low level of safety climate with great need for improvement.

Table 4.4: Average scores per dimension to assess occupational climate safety

	Dimension	**Mean**	**SD**
D1	Management safety priority and ability	2.58	0.2
D2	Management safety empowerment	2.86	0.31
D4	Workers safety commitment	2.73	0.23
D5	**Workers safety priority and risk non-acceptance**	**2.25**	**0.43**
D7	workers trust in efficacy of safety systems	2.7	0.21
		Median	**IQR**
D3	Management safety justice	2.83	0.17
D6	Peer safety communication, learning & trust in safety ability	2.88	0.31

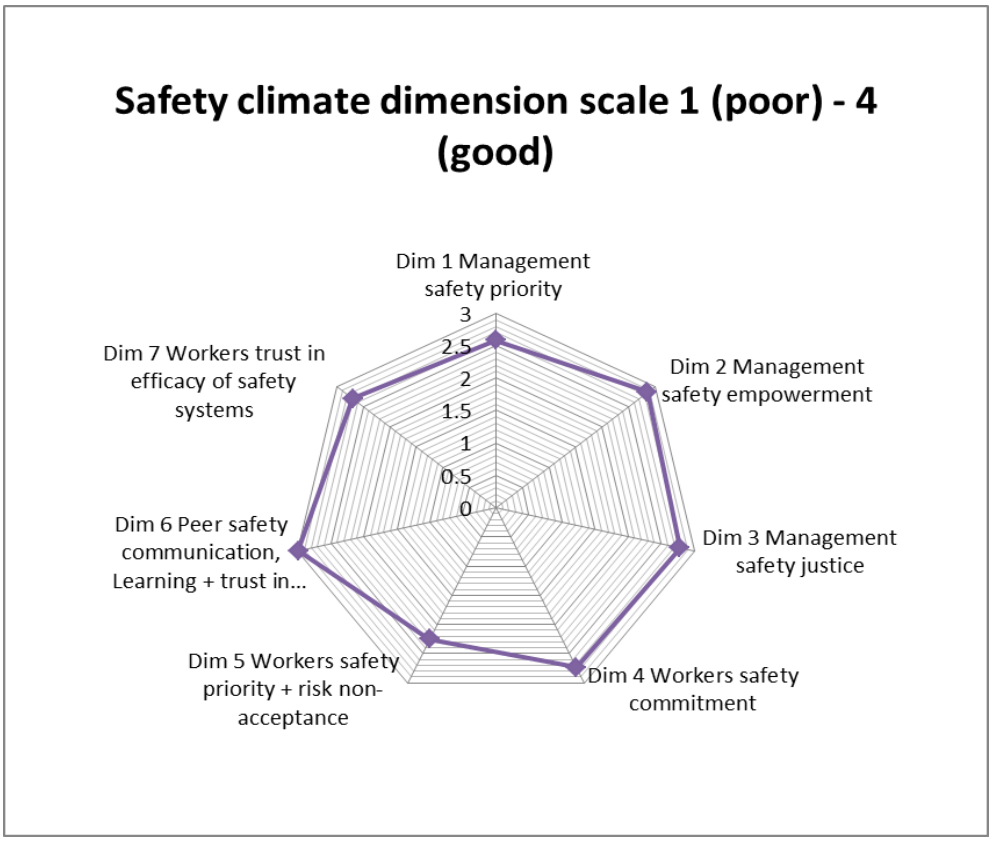

Figure 4.7: Safety climate dimension scale

The evaluation of the safety climate of the Nelson Mandela Children's Hospital construction site indicates an overall poor / low perception of safety climate by the site workers.

4.2.3.4 Distribution of responses per dimension by gender to assess occupational Safety climate

The Table 4.5 below shows the distribution of the number of respondents that agreed to each of the dimensions as opposed to those that disagreed by gender. The results show that there was no statistically significant association between the respondents' gender and whether their perceptions of an occupational safe climate varied ($p>0.05$).

Table 4.5: Distribution of responses per dimension by gender to assess occupational climate safety

Dimension	Gender	Disagree n (%)	Agree n (%)	p-value
Management's safety priority and ability	male	50 (55.56)	40 (44.44)	0.666
	female	9 (50)	9 (50)	
Management's safety empowerment	male	49 (54.44)	41 (45.56)	0.931
	female	10 (55.56)	8 (44.44)	
Workers' safety priority and risk non-acceptance	male	64 (71.11)	26 (28.89)	0.564
	female	14 (77.78)	4 (22.22)	
Peer safety communication learning, and trust in safety ability	male	61 (67.78)	29 (32.22)	0.711
	female	13 (72.22)	5 (27.78)	
Workers' trust in efficacy of safety systems	male	43 (47.78)	47 (52.22)	0.32
	female	11 (61.11)	7 (38.89)	
Management's safety justice	male	52 (57.78)	38 (42.22)	0.862
	female	10 (55.56)	8 (44.44)	
Workers' safety commitment	male	53 (58.89)	37 (41.11)	0.538
	female	12 (66.67)	6 (33.33)	

4.2.3.5 Comparison of dimension scores in the current study versus dimension scores from the NOSACQ-50 database revised in February 2015

Users of the NOSACQ- 50 questionnaire were encouraged to submit their data to the NOSACQ questionnaire co-ordinator for incorporation into the international database and furthermore to benchmark against the database (Kines et al. 2011). Table 4.6 below shows that in dimensions 1,3,4,5,6,7 there was a significant difference in the mean scores of respondents in the current study compared to the dimensions from the NOSACQ-50 database ($p<0.05$). There was no significant difference in the mean score in dimension 2: management safety empowerment between the current study and NOSACQ-50 database ($p>0.05$). These results however were considered with caution, as the comparison is between different settings as well as the fact the NOSACQ-50 database contains more study respondents from different companies who are most likely from varying industries as compared to this study.

Table 4.6: Comparison of dimension scores in the current study versus dimension scores from the NOSACQ-50 database revised in February 2015

Dimension	NOSACQ-50 Dimensions N=23 369	Current study N=108	p-value
1. "Management safety priority and ability"	2.94 ± 0.49	2.58 ± 0.20	0.0000
2. "Management safety empowerment"	**2.88 ± 0.47**	**2.86 ± 0.31**	**0.6587**
3. "Management safety justice"	2.95 ± 0.50	2.78 ± 0.32	0.0004
4. "Workers safety commitment"	3.14 ± 0.46	2.73 ± 0.23	0.0000
5. "Workers safety priority and risk non-acceptance"	2.92 ± 0.50	2.25 ± 0.43	0.0000
6. "Peer safety communication learning, and trust in safety ability"	3.09 ± 0.41	2.99 ± 0.31	0.0114
7. "Workers trust in efficacy of safety" systems"	3.17 ± 0.44	2.70 ± 0.21	0.0000

4.3 DISCUSSION OF RESULTS

4.3.1 Response Rate

A total of 219 (n = 219) questionnaires were distributed and 108 (n=108) were considered for data analysis. The response rate was 51.7%. The rest of the questionnaires were disqualified due to insufficient information being filled in. In some cases the questionnaire was too dirty to be used as information was illegible.

4.3.2 Gender

In the present study, male respondents accounted for 83.3% and female respondents accounted for 16.7%. This agrees with the 2015 CIDB report indicating that males dominate the 1.4 million people employed in the construction industry with 89% being male and 11% female (CIDB, 2015).

There was no statistically significant association between the respondents' gender and whether this difference resulted in variation in the perceptions of the safety climate in the construction industry ($p>0.05$).

4.3.3 Distribution of responses per dimension to assess perceptions of climate safety

The discussion of the results will be conducted under the 3 broader aspects in line with the research objectives i.e.: (i) managements' prioritisation, commitment and competencies regarding safety practices, (ii) co-worker attitudes toward safety, and (iii) "workers' trust in the efficacy of the safety systems".

These three aspects encompass the seven dimensions of the NOSACQ-50 questionnaire. The first aspect presented in this section is managements' safety priority, commitment, and competencies regarding safety practices. This aspect comprises dimensions 1 to 3: "management's safety priority and ability", "managements' safety empowerment" and "managements' safety justice". The second aspect is co-worker attitude towards safety at the construction site, comprising dimensions 4 to 6: "workers' safety commitment", "workers' safety priority and risk non-acceptance" and "peer safety communication learning and trust in safety ability". The last aspect discussed is dimension 7: "workers' trust in efficiency of safety systems".

4.3.3.1 Aspect 1: Management's prioritisation, commitment and competencies regarding safety practices

Throughout the larger percentage of historical safety climate research, there has been a persistent suggestion that "leaders create climate" (Zohar, 2010). In the literature reviewed, this concept and acknowledgment of leadership as a safety climate precursor has barely altered (Zohar, 2010). The association between leadership and safety climate has been principally described as an extension of the leader's concern for employees' well-being and this encompasses the physical well-being in high risk work environments (Hofmann et al. 2003; Zohar 2002; Zohar & Luria 2004; Zohar & Tenne-Gazit 2008).

In a study conducted by Langford, Rowlinson & Sawacha (2000), it was found that when employees perceive that management values and cares about the employee's personal safety, the workers are more willing to co-operate to improve safety performance. This in effect has a positive influence on the safety climate of that organisation. Therefore, one can conclude that both commitment to safety issues and safety communication

(Dimension 1) are fundamental to producing and supporting a positive safety climate in construction site environments (Mohamed 2002).

In a study conducted by Pearce (2012) it was found that if management is perceived as placing great value and importance on employee safety via policies, procedures and rewards, employees then behave in a manner that enhances safety and therefore contributes to a positive safety climate.

In the present study, 72.22% of the respondents rated “management’s safety priority and ability” as poor. Perceptions of this dimension are based on how much management prioritises safety, actively promotes safety practices and reacts to unsafe behaviour. It also encompasses how management handles and communicates safety issues. The low mean score of 2.58 showed great need for improvement (NOSACQ-50 Guidelines, 2010). There was no significant association between the respondents’ genders and their perceptions of this dimension (p value=0.666). The Cronbach’s alpha for dimension 1 is 0.75 and therefore indicates that the items in this dimension were closely related.

Niskanen (1994) suggested that it is not solely managements’ involvement in safety activities that is considered significant (and therefore backing a positive safety climate), but the degree to which management supports the participation of the workforce in safety related issues (Dimension 2). Social support has a consistently positive effect on participation in safety across varied industries. This social support can originate from management, supervisors, co-workers or the organisation as a whole (Alderman 2015). This pertains to workers’ perceptions regarding management empowering workers and supporting their safety. The present study revealed a mean score of 2.86, which is positive (>2.5) but still falls into the category of ‘need for improvement’ (mean between 2.7 and 2.99). Almost half (45.4%) of the respondents agreed that management empowers workers and supports participation specific to safety.

Edmondson (1996) noted that management of human errors in a negative way prompted a negative climate which in turn negatively influenced the inclination of both management and employees to communicate spontaneously and discuss errors and difficulties (dimension 3). It is therefore plausible, that high safety climate scores,

together with support from co-workers and positive management safety justice, will encourage workers to report all accidents and injuries. Workers' perceptions of how management investigates and deals with workplace accidents and negative events were scored as poor. Therefore, management did not deal in a proper, accurate, fair manner with regards to workplace accidents and the following investigations. This perception was evidenced by the dimension being scored the lowest of all 7 dimensions with 72.2% of workers disagreeing to proper, accurate, fair management and investigations into workplace accidents or negative events. The median score of 2.83 was noted – this being scored into the category of fairly low with the need for improvement.

4.3.3.2 Aspect 2: Co-worker attitude towards safety at the construction site

When working as part of a team, as construction workers do, it is critical to understand the influence that co-workers have on employees especially in terms of safe work practices and choices. Adutwum (2010) studied the safety climate in a Ghanian Industry and found that co-worker value for safety was the safety climate dimension most pivotal for safety compliance (dimension 3). In the present study, there were 68.5% of respondents who disagreed to co-workers having a positive safety commitment. This expands to perceptions regarding how co-workers work together to maintain a high level of safety in the workplace, whether joint responsibility is taken to ensure the workplace is safe, as well as true concern over co-worker's safety. The mean score for this dimension of workers' safety priority was 2.73 falling into the low category with need for improvement.

Safety participation entails discretionary behaviours performed by an individual when he/she may not be rewarded for that behaviour or when the specific behaviour may not contribute directly to the safety of that individual (Neal, Griffin & Hart, 2000). This is displayed when, for example, an employee joins a safety committee and attends non-compulsory safety meetings, thereby prioritising safety; this employee is participating and in effect, prioritising safety (dimension 5). A study by Mohamed (2010) concluded that work pressure has an adverse effect on the safety climate due to its bearing on workers' inclination, under pressure, to take time-saving shortcuts. Interestingly, in this study, there was an equal scoring for this dimension specific to avoidance of risk taking and therefore jeopardising of worker safety. Of the respondents surveyed, 50% both

agreed and disagreed to risk behaviour in safety critical work tasks. The mean score was 2.25 which can be categorised as a low safety climate level with great need for improvement.

Adutwum (2010) found that two safety climate dimensions – supervisor monitoring and safety communication (dimension 6), contributed considerably to forecasting employees' inclination to take safety related initiatives thus facilitating a positive safety climate. A supportive environment denotes the grade of trust and backing within a group of workers, confidence that workers have in work associations with co-workers, and general morale (Mohamed, 2002). Chiaburu and Harrison (2008) defined co-worker support as co-workers providing wanted resources to another employee (helping with tasks, mentoring, and being kind). The current study found that only 42.6% of the respondents perceived that peer safety communication, learning, and trust in safety ability of co-workers were present onsite and therefore this dimension had a low safety climate score. The mean for this dimension was 2.88.

4.3.3.3 Aspect 3: "Workers' trust in efficacy of safety systems"

Trust can be defined as positive expectations employees have regarding the behaviour and intent of various organisational members based on experiences, relationships, and roles (Kath, Magley & Marmet, 2010). Organisational trust according to Kath et al. (2010) plays a pivotal role in safety climate and safety motivation and therefore highlights that trust would not exist if there were no positive relationships and inputs from co-workers, their supervisors, and management (dimension 7).

An example of the impact of the safety culture and climate was seen in Total's oil refinery in Antwerp, Belgium. The petrol chemical company had enlisted contractors to help maintain pipework and machinery. There was discord between the safety cultures of the two companies that required repositioning if mishap and illness rates were to be condensed. After pronounced effort, the companies resolved vital organisational inconsistencies and subsequently intensified focus on employee behaviour. Employees were encouraged to work conscientiously and autonomously by training them to execute risk assessments prior to commencement a new job. The empowerment of the workers and alignment of the cultures gave rise to a zero-accident rate as soon as the

two companies had established best practices. The alignment of the safety cultures in both the companies was primarily a consequence of open communication, good leadership, the dynamic involvement of the employees and the inventive attitudes of the prevention services. The involvement of senior management confirmed to employees the significance placed on health and safety issues within the company (European Agency for Safety and Health at Work, 2012).

In this study, respondents rated "workers' trust in the efficacy of safety systems" as poor with a mere 39.81% of the respondents having a positive perception regarding the company's safety systems and that these very systems that are in place were of value to their safety. The mean score was 2.7 which falls in the category of low with need for improvement (NOSACQ-50, 2010). Interestingly, this was the sole dimension where there was significant difference between gender perceptions of the safety climate with regards to trust of these existing safety systems. Female respondents felt less safe (with 38.9% positive scores) compared to male respondents with 52.2% positive scores.

Safety climate can be considered in terms of its degree of favourability within the organisation (high/low or positive/negative) and its strength or variability (how much consensus exists among employees; strong/weak (Zohar, 2010). Overall the results rate the safety climate at the Nelson Mandela Children's Hospital construction site as fairly low with a need for improvement. The scores and ratings were generally low for each dimension. Only dimension 5: "workers safety priority and risk non-acceptance", had a neutral scoring with 50% of the respondents agreeing to aspects of this dimension and 50% disagreeing.

4.4 CONCLUSION

In this chapter, data analysis, study results and a discussion of the results have been presented. Results from the study reveal a fairly low level of safety climate at the Nelson Mandela Children's Hospital based on the seven safety climate dimension ratings. Data results were described and presented as tabulations. In the next chapter, the implications of the results for nursing practice, nursing education and nursing research will be discussed. The limitations to this study will also be presented.

CHAPTER FIVE – SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

5.1 INTRODUCTION

In Chapter four the data was presented and data analysis outcomes were discussed. This chapter presents a summary of this safety climate research process, the main results and the limitations of the study. The recommendations for ongoing improvement of the safety climate in the construction industry were formulated and presented based on the main study results and gaps identified in literature. The conclusion is also presented.

5.2 SUMMARY OF THE MAIN RESULTS

More than three quarters (79%) of the construction workers recruited for the study were aged 20–39 years, while 5% were aged 50–59 years. Male respondents accounted for 83.3% and female respondents accounted for 16.67% of the total respondents. This supports the CIDB finding that male employees dominate the construction industry (CIDB report, 2015).

Results of the study revealed that “workers’ perceptions of managements’ safety priority and ability” which are based on aspects of how much priority is given to safety, on active promotion of safety practices, reactions to unsafe behaviour as well as how management show competence in handling and communicating safety issues, was scored relatively low. Management’s safety priority and ability was rated as poor by approximately 72.2% of the respondents. This dimension had a mean score of 2.58 which is categorised as low with a great need for improvement.

This study also found that only 42.6% of the respondents perceived that “peer safety communication, learning, and trust in safety ability” of co-workers were present onsite and therefore this dimension had a low safety climate score. The mean for this dimension was 2.88. A small percentage (39.81%) of the respondents had a positive perception regarding the company’s’ safety systems and that these very systems in place were of value to their safety. The mean score was 2.7 which fell in the category of

low with need for improvement (NOSACQ-50, 2010). Interestingly, this was the sole dimension where there was significant difference between gender based perceptions of the safety climate with regards to trust of these existing safety systems. This dimension was scored positive by 38.9% of female respondents, whereas 52.2% of the male respondents scored trust in the efficiency of safety systems as positive. This result supports Barke, Jenkins-Smith & Slovic (1997) note in their study that one of the most consistent findings to emanate from research on people's perception of risk is that women express far more concern, with regards to various environmental and health hazards, than men do.

In conclusion, the overall the workers' perception of the safety climate at the Nelson Mandela Children's Hospital construction site is fairly low with the need for improvement. There was strong consensus between the workers' perception as evidenced by the distribution of responses. The scores and ratings were generally low for each dimension with only 1 dimension: "workers safety priority and risk non-acceptance", having a neutral scoring, with 50% of the respondents agreeing to aspects of this dimension and 50% disagreeing.

5.3 LIMITATIONS OF THE STUDY

The limitations identified were that the results of the study could not be generalised to all of the company's construction sites in view of the fact that the study was conducted at a single site as well as the criteria for inclusion in the study as limited to only English speaking respondents. The NOSACQ-50 questionnaire is possibly too difficult and complex for the respondents with a lower educational level, especially in the South African context. It was apparent from analysis of the responses that certain questions were difficult for respondents to understand. Another limitation noted in the study was that it is difficult to determine the extent to which employees are motivated to be safe and to what extent the feedback received in the questionnaire are in line with universal social expectations.

5.4 RECOMMENDATIONS

Based on these results the researcher has formulated the following recommendations:

5.4.1 Occupational health nursing practice

The contracting company did not have an occupational health nurse practitioner (OHNP) or an occupational health medical practitioner (OMP) at the time of the study and therefore the benefits of having an OHNP employed by the company will follow in the discussion. The measurement of the safety climate can guide the OHNP in addressing the safety and health shortfalls on site. Multi-level programs can be initiated. With proper resource allocation, these programs can be designed based on the perceptions or view point of the workers themselves. This will encourage participation in these health and safety programs as well as ensure sustainability. General recommendations include the appointment of an occupational health nurse practitioner or advisor to guide occupational health and safety programs for the construction company, safety climate and culture assessments be conducted periodically, increased focus be placed on risk based occupational health and safety programmes, to advocate for occupational health and safety commitment to Acts and Regulations by both management and workers themselves. WHO (2001) noted roles that the OHNP fulfils. These roles include being a clinician, specialist, manager, co-ordinator, advisor, health educator, counsellor and researcher.

In the first aspect of the safety climate questionnaire – Management's prioritisation, commitment and competencies regarding safety practices, the respondents reported a low level of safety climate in the dimensions compromising this aspect. It follows that in the consulting and advisory role, the OHNP can therefore advise management on the following practice inputs:

- Management needs to define and incorporate safety culture and safety climate as a core value and they need to define what level of safety climate is desired. This must be filtered down to all employees;
- Attendance of management to forums on site (perhaps at SHE meetings) where workers can voice site safety concerns with management directly. Goals can be set specifically toward safety climate improvements. These goals must be inclusive and require input from all the organisation's workers and relevant stakeholders;

- Management must display and commit to leadership integrity, by accurately profiling their workplace risks and having a detailed profile of the workforce. This involvement will cement occupational health and safety as a core value of the organisation;
- Management should recognise, promote, and reward safe work practices and positive health and safety participation;
- Management must ensure that the roles and responsibilities of the stakeholders in preventing and managing health and safety risks and concerns must be clearly defined, monitored and these employees must be empowered to fulfil their critical roles;
- Encouragement of accident and illness notification and positive worker involvement in investigations with no negative associations to this.
- Management should consider the employment of an Occupational Health Medical Practitioner (OMP) and Nurse practitioner (OHNP) at the construction company for establishment of a formal Occupational Health medical program to promote and protect worker health and safety.

In the second aspect of the safety climate questionnaire: Co-worker attitude towards safety at the construction site, the respondents again reported a low level of safety climate in the dimensions compromising this aspect. It follows then, to instil safety as a priority and actively promote safe work practices, the OHNP, in the educator and specialist role, can:

- Initiate monthly safety newsletters to be disseminated to all staff, including and especially workers onsite with no access to emails;
- Provide health and safety education classes on a group level as well as on an individual one-on-one level in the form of information sessions during clinic visits specific related to health and safety;
- Provide monthly toolbox safety talks on occupational health and safety issues thus empowering the workers regarding present hazards and risks;
- Provide health and safety awareness talks or meetings on risks of the workplace specific to construction where a forum is created for workers to voice their concerns and verbalise safety and health challenges on-site, such as the difficulties experienced there by female workers.

The third and final aspect of the safety climate questionnaire: Workers' trust in the efficiency of safety system was scores as low. To enhance and infuse a positive focus on this aspect, in the OHNP's clinical role, she/he can implement:

- Monthly on-site visits by an occupational health practitioner to review employees with chronic conditions. This will display to the workers, that management do have concerns regarding the complete wellbeing of the employee and not merely complying with obligatory legal safety requirement adherence thus positively promoting a trust relationship.
- Extensive training and empowerment on use of personal protective equipment
- Health and safety awareness talks or meetings on risks of the workplace specific to construction where a forum is created for workers to voice their concerns and verbalise safety and health challenges on-site for example – the difficulties experienced by female workers on-site.

In the OHNP's role as researcher, she/he can ensure:

- Frequent re-assessment of workers safety climate perceptions as a monitoring tool to ascertain if implemented strategies are in fact promoting a more positive safety climate in the organisation and to isolate which dimensions of the safety climate need further attention.

In the OHNP's roles as the co-ordinator, she / he can:

- Encourage much more worker participation, thus promoting a culture of dialogue and approachability of the OHNP. Workers and the site safety representatives can be motivated and encouraged to partake in health and safety decision-making;
- Facilitate forums like working groups that are tasked to investigate and discuss specific health and safety workplace concerns and issues. These in turn can be presented to management for consideration in the policy and protocol reviews.

5.4.2 Education and training of occupational health practitioners

It is critical that there is great focus placed on the importance of construction workers health and safety in Occupational Health educational program inclusive of the Acts and regulations pertaining to the construction industry. There is the need to understand, in depth, what factors impact and influence safety and health outcomes in the workplace

and not just focus on risks and hazards in the workplace. This will improve health and safety performance and decrease accident and injury rates. Training on various modes of assessing the group's safety culture and safety climate should be incorporated in Occupational Health educational programs.

Further training and education of occupational health practitioners on varied aspects of behavioural influences on safety is valuable in order to design effective programs to promote maximum and sustainable positive change in how workers perceive and behave in relation to health and safety choices.

5.4.3 Further research

Recommended further research and study would include:

- Review of the safety climate at the other construction sites in the construction company, which will enable a comparative study between sites;
- Further research the relationship between safety climate and safety and health incidents as well as non-compliance;
- Increase safety climate studies in the construction industry in South Africa in order to have a database for benchmarking specific to South Africa's demographic profile;
- Further research into how the safety climate and behaviour pathways are perceived and enacted by workers and what motivations there are for safe work choices and practices.

5.5 CONCLUSION

As the literature review indicated, there is undeniable value in determining the safety climate in the workplace. Management and co-worker input toward a safety conducive workplace is critical to safe work choices and ultimately impacts on occupational injury and illness rates. The European Agency for Safety and Health at Work (EASHW) goes further and recommends that an integrated approach to safety and health in construction involve all stages of the project life cycle being the design execution and operations (EASHW, 2004).

Results from the present study revealed a mean score across the seven dimensions as ranging between 2.25 and 2.88. As per the guidelines from the developer of the measure tool, this mean score indicates a low level of safety climate at the Nelson

Mandela Children's Hospital site, with need for improvement. The dimension with the lowest mean score (2.25) was workers' safety priority and risk non-acceptance. The direct implication of this low score is increased risk taking workplace behaviour leading to increased injury and illness rates. Individuals are more committed to groups that they work within than to the greater organisation. It follows that a workgroup serves as a powerful socialisation means to new members and for re-enforcing of existing member's behaviour. A pro-active approach to safety and not just traditional methods to address safety and health must come to the forefront as a core value that all industries hold strong to. Safety and health of the workers is our collective responsibility. Health and safety cannot be underestimated in any construction company as it forms the basis of construction.

REFERENCES

ACSNI [Advisory Committee on the Safety of Nuclear Installations] (1993). A study group on human factors Third report: organising for safety. United Kingdom: Health and Safety Executive. [Online; accessed 19 August 2015] Available at: https://inis.iaea.org/search/searchsinglerecord.aspx?recordsFor=SingleRecord&RN=29011023

Acutt J & Hattingh S. (2011). Occupational Health: Management and practice for health practitioners. Juta and Company Ltd.

Adutwum K. (2010). *Safety Climate in Ghanaian Industry: Its Measurement and Relative Influence on Employee Safety-Oriented Behaviour* (Master's thesis, Norges teknisk-naturvitenskapelige universitet, Fakultet for samfunnsvitenskap og teknologiledelse). [Online; accessed 15 August 2016] Available at: http://hdl.handle.net/11250/265079

Agumba J & Haupt T. (2009). *Construction health and safety culture in South African Small and Medium Enterprises*. [Online; accessed 19 November 2016] Available at: http://digitalknowledge.cput.ac.za/xmlui/handle/11189/3354 .

AIChE (American Institute of Chemical Engineers). (2012). *Safety Culture: What is at stake*. [Online; accessed 19 August 2015]. Available at: www.aiche.org/ccps/topics/elements-process-safety/commitment-process-safety/process-safetyculture/building-safety-culture-tool-kit/what-is-at-stake

Alderman E. (2015). *Construction Safety Climate in Ontario: A Longitudinal Study* (Doctoral dissertation). [Online; accessed 3 February 2017] Available at: https://tspace.library.utoronto.ca/bitstream/1807/70224/1/Alderman_Emilie_201511_MAS_thesis.pdf

Anderson, D. (2000). What is a person? Consortium on Cognitive Science Instruction. The Mind Project. [Online] Available at: http://www.mind.ilstu.edu/curriculum/what_is_a_person/what_is_a_person.php

Arboleda, A, Morrow PC, Crum MR & Shelley MC. (2003). Management practices as antecedents of safety culture within the trucking industry: similarities and differences by hierarchical level. *Journal of Safety Research*, 34(2), 189–197. [Online; accessed 23 November 2014] Available at: https://www.ncbi.nlm.nih.gov/pubmed/12737958

Barke, R., Jenkins-Smith, H., & Slovic, P. (1997). Risk Perceptions of Men and Women Scientists. *Social Science Quarterly, 78*(1), 167-176. Available at : http://www.jstor.org/stable/42863683

Bergh M. (2011). Thesis Report*:* Safety Climate An evaluation of the safety climate at AkzoNobel Site Stenungsund. Chalmers University of Technology, Sweden. [Online; accessed 12 August 2014] Available at: http://publications.lib.chalmers.se/records/fulltext/142447.pdf

Bergh M, Shahriari M & Kines P. (2013). Occupational safety climate and shift work. *Chemical Engineering Transactions*, 31: 403–408. [Online; accessed 1 February 2015] Available at: http://publications.lib.chalmers.se/publication/200125-occupational-safety-climate-and-shift-work

Bland M. An Introduction to Medical Statistics. 3rd Edn. Oxford: Oxford University Press; 2001.

Brink, H, van Rensburg, G, van Der Walt, C (2011). *Fundamentals of Research Methodology for Health Care Professionals*. Juta and Co.

BusinessDictionary.com. Definition: Environment. Accessed 1 October 2017. Website: http://www.businessdictionary.com/definition/environment.html

CDC. (2016). Center for Chronic Disease Prevention and Health Promotion – Workplace Health Model. [Online; accessed 20 September 2016] Available at: https://www.cdc.gov/workplacehealthpromotion/model/

Chen Q & Jin R. (2015). A comparison of subgroup construction workers' perceptions of a safety program. *Safety science*, *74*, 15–26. [Online; accessed 17 December 2016] Available at: http://dx.doi.org/10.1016/j.ssci.2014.11.021

Chiaburu DS & Harrison DA. (2008). Do peers make the place? Conceptual synthesis and meta-analysis of coworker effects on perceptions, attitudes, OCBs, and performance. *J Appl Psychol. 93*(5):1082-103. [Online; accessed 23 April 2015] doi: 10.1037/0021-9010.93.5.1082. Available at: https://www.ncbi.nlm.nih.gov/pubmed/18808227

Christian MS, Bradley JC, Wallace JC & Burke MJ. (2009). Workplace safety: A meta-analysis of the roles of person and situation factors. *Journal of Applied Psychology, 94,* 1103–1127. [Online; accessed 14 September 2014] Available at: https://www.ncbi.nlm.nih.gov/pubmed/19702360

CIDB. (2015). *Construction Monitor Report Q3 2015.* [Online; accessed 6 April 2016] Available at: http://www.cidb.org.za/publications/Documents/Construction%20Monitor%20-%20October%202015.pdf

CIDB. (2009). *Report on Construction Health and Safety in South Africa 2009.* [Online; accessed 8 May 2015] Available at: http://www.cidb.org.za/documents/kc/cidb_publications/ind_reps_other/ind_reps_construction_h_s_in_sa_status_recommendations.pdf

Clarke, S (2006). Contrasting perceptual, attitudinal and dispositional approaches to accident involvement in the workplace. *Safety Science* 44 (6), 537 - 550.

Cooper DR & Schindler PS. (2006). Business research methods:Empirical investigation. *Journal of Service Research*, *1*(2), 108–28.

Cooper MD. (2000). Towards a model of safety culture. *Safety Science,* 111–136. [Online; accessed 18 December 2014] Available at: http://www.behavioral-safety.com/articles/Towards_a_model_of_safety_culture.pdf

Cox S & Flin R. (1998). Safety culture: Philosopher's stone or man of straw? *Work and Stress, 12*(3), 189–201. [Online; accessed 27 July 2015] Available at: https://www.researchgate.net/publication/247510886_Safety_culture_Philospher's_stone_or_man_of_straw

Cronbach LJ. (1949). *Essentials of psychological testing*. Oxford, England: Harper.

De Vos AS, Delport CSL, Fouché CB & Strydom H. (2011). Research at grass roots: A primer for the social science and human professions. Van Schaik Publishers.

DOL (2012) *Construction Health and Safety Accord.* Available at: http://www.ecmba.org.za/PDF/Safety/Other/New%20Construction%20Health%20and%20Safety%20Accord%20(unsigned).pdf

DOL. (2012). Media desk: "DoL to sign a Construction Health and Safety Accord to help stem casualty list." [Online; accessed 8 November 2015] Available at: http://www.labour.gov.za/DOL/media-desk/media-alerts/dol-to-sign-a-construction-health-and-safety-accord-to-help-stem-casualty-list/

DOL. (2013). Media desk: "Department of Labour meets chiefs of construction industry to improve the status of occupational health and safety in the industry." [Online; accessed 8 November 2015] Available at: http://www.labour.gov.za/DOL/media-desk/media-alerts/department-of-labour-meets-chiefs-of-construction-industry-to-improve-the-status-ofoccupational-health-and-safety-in-the-industry

DOL. (2014) *Compensation Fund Report*. [Online; accessed on 25 March 2016] Available at: http://www.labour.gov.za/DOL/downloads/documents/annual-reports/compensation-for-occupational-injuries-and-diseases/2014/cfannualreport2014.pdf

DOL. (2015). *Labour on health and safety compliance by construction industry*. [Accessed 12 June 2016] Available at: http://www.gov.za/speeches/department-labour-implores-construction-industry-partnership-reverse-escalating-loss-life-9

Edmondson AC. (1996). Learning from mistakes is easier said than done: Group and organizational influences on the detection and correction of human error. *The Journal of Applied Behavioral Science*, *32*(1), 5–28. Accessed 16 March 2014. Available at: DOI: 10.1177/0021886396321001

European Agency for Safety and Health at Work. (2012). Management Leadership in Occupational Safety and Health: a practical guide. [Online; accessed 20 September 2015] Available at: https://osha.europa.eu/en/tools-and-publications/publications/reports/management-leadership-in-OSH_guide

Fang D & Wu H. (2013). Development of a safety culture interaction (SCI) model for construction projects. *Safety Science, 57*: 138–149. [Online; accessed 21 October 2014] Available at: http://nilp.vn/Portals/0/VT_Articles/2014/Safety%20Science,%20Vol_%2057,%20A_%2017.pdf

FEM. (2014). *Federated Employer's Mutual Assurance Company stats report.* [Online; accessed 12 March 2015] Available at: http://www.fem.co.za/Layer_SL/FEM_Home/FEM_Accident_Stats/FEM_Accident_Stats.htm

Fernández-Muñiz B, Montes-Peón JM & Vázquez-Ordás CJ. (2007). Safety culture: Analysis of the causal relationships between its key dimensions. *Journal of Safety Research*, *38*(6), 627–641. [Online; accessed 23 September 2015.] Available at: https://www.ncbi.nlm.nih.gov/pubmed/18054594

Flin, R, Mearns, K, O'Connor, P & Bryden R. (2000). Measuring safety climate: identifying the common features. *Safety Science, 34*(1), 177–192.

Fu, G, Zhang, J, Xie, X & Zhang Z. (2006). *Design for Safety Climate Questionnaire Framework*. National Science Foundation of China.

Gadd S & Collins A. (2002). Safety Culture: A review of the literature. Sheffield: Health and Safety Laboratory. [Online; accessed 17 December 2014.] Available at: http://www.hse.gov.uk/research/hsl_pdf/2002/hsl02-25.pdf

Gershon RR, Karkashian CD, Grosch JW, Murphy LR, Escamilla-Cejudo, A, Flanagan PA,& Martin L. (2000). Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *American Journal of Infection Control*, *28*(3), 211–221. [Online; accessed 15 March 2015] Available at: https://www.ncbi.nlm.nih.gov/pubmed/10840340

Gillen, M, Baltz, D, Gassel, M, Kirsch, L & Vaccaro D. (2002). Perceived safety climate, job demands, and coworker support among union and nonunion injured construction workers. *Journal of safety research*, *33*(1), 33–51. [Online; accessed 8 October 2015] Available at: https://www.ncbi.nlm.nih.gov/pubmed/11979636

Guldenmund FW. 2000. The nature of safety culture: a review of theory and research. Safety Science, 34(1–3): 215–257. [Online; accessed 6 January 2015] Available at: http://aml-safety.com.au/AMLstores/_images/pdf-files/safetyscience2000.pdf

Guldenmund FW. (2010). Understanding and exploring safety culture (Doctoral dissertation, TU Delft, Delft University of Technology). [Online; accessed 6 September 2015] Available at: http://resolver.tudelft.nl/uuid:30fb9f1c-7daf-41dd-8a5c-b6e3acfe0023

Greasley K, Bryman, A, Dainty, A, Price, A, Soetanto, R, King N. (2005). Employee perceptions of empowerment, Employee Relations. 27(4), 354–368. [Online; accessed 12 May 2015] Available at: http://www.emeraldinsight.com/doi/abs/10.1108/01425450510605697

Greenberg, J., & Baron, R.A. (2003) Behaviour in organisations: Understanding and managing the human side of work (8th ed.). Upper Saddle River: Pearson Education, Inc.

Greve N. (2015). Less than 50% of construction industry complies with health, safety regulations – DoL. Engineering news. [Online, accessed 12 June 2015] Available at: http://www.engineeringnews.co.za/article/less-than-50-of-construction-industry-complies-with-health-safety-regulations-dol-2015-07-09

Griffin MA & Neal A. (2000). Perceptions of safety at work: a framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of occupational health psychology*, *5*(3), 347. [Online; accessed 24 August 2015] Available at: https://www.researchgate.net/profile/Andrew_Neal3/publication/43488437_Perceptions_of_safety_at_work_A_framework_for_linking_safety_climate_to_safety_performance_knowledge_and_motivation/links/00b495248b81699a26000000.pdf

Group Five – Integrated annual report (2016). [Online; accessed 12 January 2017] Available at: http://www.g5.co.za/reports/ar-2016/pdf/integrated-report-2016.pdf

Grove SK, Burns N & Gray JR. (2013). Qualitative research methodology. *The Practice of Nursing Research, 7th ed. St Louis, MO: Elsevier Health Sciences*, 264–293.

Health and Safety Commission (HSC). (1993). ACSNI Humans Factors Study Group. *Third report: Organising for safety.* London: Health and Safety Commission [Online; accessed 10 March 2015] Available at: http://www.hse.gov.uk/research/rrpdf/rr367.pdf

Health and Safety Executive (2016) *Health and safety statistics: United Kingdom*. [Online; accessed 12 January 2017] Available at: http://www.hse.gov.uk/statistics/industry/construction/

Hofmann DA, Morgeson FP & Gerras SJ. (2003). Climate as a moderator of the relationship between leader–member exchange and content specific citizenship: safety climate as an exemplar. Journal of Applied Psychology, 88(1), 170. [Online; accessed 17 May 2015] Available at: https://msu.edu/~morgeson/hofmann_morgeson_gerras_2003.pdf

Hong Kong Labour Department. (2015). *Occupational Safety and Health Statistics Bulletin Issue No 15.* (August 2015). Hong Kong. [Online; accessed 6 December 2015] Available at: http://www.labour.gov.hk/eng/osh/pdf/Bulletin2014.pdf.

Hoyos,C.G. (1995). Occupational Safety :Progress in understanding the basic concepts of safe and unsafe behaviour. *Applied Psychology : An International Review.* 44 (3), 235 – 250.

Huang YH, Robertson MM, Lee, J, Rineer J, Murphy LA, Garabet, A & Dainoff MJ. (2014). Supervisory interpretation of safety climate versus employee safety climate perception: Association with safety behaviour and outcomes for lone workers. *Transportation Research Part F: Traffic psychology and behaviour*, *26(*B), 348–360. [Online; accessed 2 December 2016] Available at: http://www.sciencedirect.com/science/article/pii/S1369847814000448

International Council of Nurses (2002) Definition: Nursing. [Online] Available at: http://www.icn.ch/who-we-are/icn-definition-of-nursing/

International Labour Office (ILO). 2008. World of Work Magazine. 2008. Issue 63. Available at: http://www.ilo.org/wow/Articles/lang--en/WCMS_099050/index.htm

ILO: International Labour Organisation. (2009). *Guidelines on occupational safety and health management systems / ILO-OSH 2001.* Geneva: ILO.

Institute for Work and Health. (2007). *Safety climate has great potential in reducing workplace injury rates.* [Online; accessed 23 July 2014] Available at: http://www.iwh.on.ca/at-work/49/safety-climate

Johnson,B & Christensen, L (2010). Educational Research (4th Ed) Quantitative, Qualitative, and Mixed Approaches. SAGE Publications.

Kath LM, Magley VJ & Marmet M. (2010). The role of organizational trust in safety climate's influence on organizational outcomes. *Accident Analysis & Prevention*, *42*(5), 1488–1497. [Online; accessed 21 May 2016] Available at:

https://www.researchgate.net/publication/44663594_The_role_of_organizational_trust_in_safety_climate's_influence_on_organizational_outcomes

Khalid K, Hilman H & Kumar D. (2012). Get along with quantitative research process. *International Journal of Research in Management*, *2*(2): 15–29. [Online; accessed 5 May 2015] Available at: http://repo.uum.edu.my/7187/

Kines P, Lappalainen J, Mikkelsen L, Olsen E, Pousette A, Tharaldsen J, Tómasson K & Törner M. (2011). Nordic Safety Climate Questionnaire (NOSACQ-50): A new tool for diagnosing occupational safety climate. *International Journal of Industrial Ergonomics* (41), 634–646. [Online; accessed 6 November 2014] Available at: https://www.av.se/globalassets/filer/arbetsmiljoarbete-och-inspektioner/sakerhetskultur-nosacq-artikel-eng.pdf

Kolver L. (2014). Construction Regulations 2014 provide legislative platform to address health and safety. [Online; accessed 12 February 2015] Available at: http://www.engineeringnews.co.za/article/construction-regulations-2014-provide-legislative-platform-to-address-health-and-safety-2014-02-10

Kuhn TS. (1977). Objectivity, value judgment, and theory choice. *The Essential Tension: Selected Studies in Scientific Tradition and Change*. P.74 – 86.University of Chicago Press: Chicago.

Kvalheim SA & Dahl Ø. (2016). Safety compliance and safety climate: a repeated cross-sectional study in the oil and gas industry. *Journal of Safety Research*, *59*, 33–41. Norwegian University of Science and Technology (NTNU). [Online; accessed 16 January 2017] Available at: https://www.ncbi.nlm.nih.gov/pubmed/27846997

Langford D, Rowlinson S & Sawacha E. (2000). Safety behaviour and safety management: its influence on the attitudes of workers in the UK construction industry. *Engineering, Construction and Architectural Management*, *7*(2), 133–140. [Online; accessed 12 February 2015] Available at: http://onlinelibrary.wiley.com/doi/10.1046/j.1365-232x.2000.00137.x/abstract

Lardner R. (2003). PRISM Safety culture Application Guide. [Online; accessed 3 March 2014] Available at: www.epsc.org/data/files/PRISM/FG1Safety_Culture_Guide.doc

Lin M-L. (2010). Preventing injuries among construction workers. *Journal of Safety Research, 41*(3): 189. [Online; accessed 20 December 2016] Available at: http://dx.doi.org/10.1016/j.jsr.2010.04.003

LoBiondo-Wood G & Haber J. (2006). *Nursing research: Methods and critical appraisal for evidence-based practice*. St. Louis, MO: Mosby.

Macchi L, Pietikäinen E, Liinasuo M, Savioja P, Reiman T, Wahlström M, Kahlbom U & Rollenhagen C. (2013). *Safety culture in design*. Final report. Nordisk Kernesikkerhedsforskning, Roskilde, Denmark. [Online; accessed 22 April 2015] Available at: http://www.iaea.org/inis/collection/NCLCollectionStore/_Public/44/054/44054114.pdf

Malhotra, M. K., & Grover, V. (1998). An assessment of survey research in POM: from construct to theory. *Journal of Operations Management*, 16, 407-425. Available at : http://www.ln.edu.hk/mkt/staff/gcui/Survey%20research%20in%20POM.pdf

Manetje, O., & Martins, N. (2009). The relationship between organisational culture and organisational commitment. Southern African Business Review, 13(1), 87-111.

Mathenge NK. (2014). *Designers' perspectives on early contractor involvement as a means to improve the safety performance on construction sites* (Doctoral dissertation). [Online; accessed 1 April 2017] Available at: http://hdl.handle.net/10539/20119

McFadden A. (2015). *The impact of co-workers on safety outcomes: comparing models of mediation, moderation, and incremental effects*. Clemson University. [Online; accessed 12 December 2016] Available at: http://tigerprints.clemson.edu/all_dissertations/1576

Mearns K, Flin R, Gordon R & Fleming M. (1998). Measuring safety climate on offshore installations. *Work & Stress, 12*(3), 238–254. [Online; accessed 6 July 2015] Available at: http://dx.doi.org/10.1080/02678379808256864

Mearns K & Flin R. (1999). Assessing the state of organizational safety – culture or climate. *Current Psychology, 18*(1), 5–17. [Online; accessed 12 August 2015] Available at: https://link.springer.com/article/10.1007/s12144-999-1013-3

Merriam-Webster Dictionary. Definition: paradigm. [Online; accessed 16 June 2015] Available at: https://www.merriam-webster.com/dictionary/paradigm

Mohamed S. (2002). Safety climate in construction site environments. *Journal of construction engineering and management*, *128*(5), 375–384. [Online; accessed 13 July 2015] Available at: https://www.researchgate.net/publication/245283616_Safety_Climate_in_Construction_Site_Environments

Nahrgang JD, Morgeson FP & Hofmann DA. (2011). Safety at work: a meta-analytic investigation of the link between job demands, job resources, burnout, engagement, and safety outcomes. *Journal of Applied Psychology, 96*(1):71–94. [Online; accessed 16 October 2015]. DOI: 10.1037/a0021484. Available at: https://www.ncbi.nlm.nih.gov/pubmed/21171732

National Health Services. (2010). *An introduction to safety climate*. [Online; accessed 30 May 2015] Available at: http://www.nes.scot.nhs.uk/media/6364/SC%20overview%20for%20practices%20MASTERCOPY.pdf

Neal A, Griffin MA & Hart PM. (2000). The impact of organizational climate on safety climate and individual behavior. *Safety science*, *34*(1), 99–109. [Online; accessed 19 May 2015] Available at: http://158.132.155.107/posh97/private/behavioral-safety/organizational-climate-Neal.pdf

Needle, D. (2004) Business in context: an introduction to business and its environment. 4th *ed*n. London: Thomson Learning.

Nelson Mandela Children's Hospital website: http://www.nelsonmandelachildrenshospital.org

Neuman WL. (2006). *Social Research Methods: Qualitative and Quantitative Approaches*. Toronto: Pearson.

Niskanen T. (1994). Safety climate in the road administration. *Safety Science*, *17*(4), 237–255. [Online; accessed 15 June 2016] Available at: https://www.researchgate.net/publication/222734626_Safety_climate_in_the_road_administration

Nordén-Hägg A. (2010). *Failure-Free Pharmacies? An Exploration of Dispensing Errors and Safety Culture in Swedish Community Pharmacies* (Doctoral dissertation, Acta Universitatis Upsaliensis). [Online; accessed 8 July 2015] Available at: http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A345620&dswid=-6702

NOSACQ-50 Developers. (2010). From *Det Nationale Forskningscenter for Arbejdsmiljø*. [Online; accessed 9 August 2014] Available at: http://www.arbejdsmiljoforskning.dk/da/publikationer/spoergeskemaer/nosacq-50/nosacq-50-developers

O'Connor P, O'Dea A, Kennedy Q & Buttrey S. (2011). Measuring safety climate in the aviation industry: A review and recommendations for the future. *Safety Science, 49*, 128–138. [Online; accessed 12 January 2015] Available at: https://aran.library.nuigalway.ie/bitstream/handle/10379/3122/O'Connor_et_al 2011),_safety_climate_lit.pdf?sequence=1&isAllowed=y

OHSAS Project Group. (2007). *Occupational Health and Safety Assessment Series 18001 / OHSAS 18001*.

Olsen ME, Lodwick DG & Dunlop RE. (1992). *Viewing the world ecologically.* Boulder, CO: Westview Press.

Olsen E. (2009). Safety climate and safety culture in health care and the petroleum industry: psychometric quality, longitudinal change, and structural models. [Online; accessed 21 October 2015] Available at: https://brage.bibsys.no/xmlui//bitstream/handle/11250/184958/PhD,%20Espen%20Olsen%20Main%20part.pdf?sequence=1.

O'Toole M. (2002). The relationship between employees' perceptions of safety and organizational culture. *Journal of Safety Research, 33*(2), 231–243. [Online; accessed 15 April 2015] Available at: http://158.132.155.107/posh97/private/culture/relationship-Toole.pdf

Oxford Dictionary. (2015). Definitions: [Online; accessed 12.1.2015] Available at: https://en.oxforddictionaries.com/definition/

Pearce MN. (2012). *Safety Climate, Safety Behaviours and Control: An Application of the Job Demand-Control model to Occupational Safety*. A thesis submitted in partial fulfilment of the requirements for the Degree of Masters of Science in Applied Psychology at the University of Canterbury. [Online; accessed 5 January 2017] Available at: https://ir.canterbury.ac.nz/handle/10092/7010

Peterson M. (2015). FSP Business: *Prof John Smallwood believes SA's safety culture must change!* [Online; accessed 21 February 2016] Available at: http://fspbusiness.co.za/articles/workplace-safety/prof-john-smallwood-believes-sas-safety-culture-must-change-7179.html

Pera SS & Van Tonder S. (2002). *Ethics in Healthcare*. Juta and Co Ltd.

Pillay M. (2013). Ethics of empirical qualitative research in construction health and safety: reflections from a PhD project part 1. *American Journal of Sociological Research, 3*(2): 7–16. [Online; accessed 5 May 2016] Available at: http://article.sapub.org/10.5923.j.sociology.20130302.01.html

Polit DF & Beck CT. (2012). *Resource manual for nursing research*. Wolters Kluwer Health/Lippincott Williams & Wilkins.

Popper,K (1959), *The logic of Scientific Discovery.* Re-printed (2004) by Routledge, Taylor and Francis. Available at: http://strangebeautiful.com/other-texts/popper-logic-scientific-discovery.pdf

PricewaterhouseCoopers report. (2013). *Highlighting trends in the South African construction industry*. [Online; accessed 12 August 2015] Available at: https://www.pwc.co.za/en/assets/pdf/sa-construction-december-2013.pdf

Raosoft Inc. (2009). Online sample size calculator. Available at: http://www.raosoft.com/samplesize.html

Reason J. (1997). *Managing the risks of organizational accidents*. Aldershot, Hampshire, England: Ashgate.

Reason J. (1991). *Human Error*. Cambridge University Press: Cambridge.

Republic of South Africa. (1993a). *Occupational Health and Safety Act No. 85 of 1993*.

Republic of South Africa. (1993b). *Compensation for Occupational Injuries and Disease Act No 130 of 1993.*

Republic of South Africa. (2003). Government Gazette No. R.307. *Noise Induced Hearing Loss Regulation*.

Robbins, S.P., Judge, T.A., Odendaal, A., & Roodt, G. (2009). Organisational behaviour: Global and Southern African perspectives (2nd ed.). Pinelands, Cape Town: Pearson Education.

Rothman KJ, Greenland S, Lash TL. Modern Epidemiology. Philadelphia, USA: Lippincott William and Wilkins; 2008. p. 128-47.

Rubin A & Babbie E. (2010). *Essential research methods for social work*. New York: Brooks/Cole Cengage Learning.

Salamon SD & Robinson SL. (2008). Trust that binds: the impact of collective felt trust on organisational performance. *Journal of Applied Psychology, 93*(3): 593–601. [Online; accessed 28 November 2014] Available at: https://www.ncbi.nlm.nih.gov/pubmed/18457488

Schein EH. (2010). *Organizational culture and leadership*. (Vol. 2). John Wiley & Sons.

Shannon H, Mayr J & Haines T. (1997). Overview of the relationship between organizational and workplace factors and injury rates. *Safety Science 26*(3), 201–217.

Sinclair RR, Martin JE & Sears LE. (2010). Labor unions and safety climate: Perceived union safety values and retail employee safety outcomes. *Accident Analysis and Prevention*, *42*(5), 1477–1487. [Online; accessed 4 September 2015] Available https://www.ncbi.nlm.nih.gov/pubmed/20538104

Singer SJ & Vogus TJ. (2013). Safety climate research: taking stock and looking forward. *BMJ Qual Saf*. 22(1):1–4. [Online; accessed 17 December 2016] Available at: http://qualitysafety.bmj.com/content/22/1/1

Smallwood JJ. (2014). In Greve N. (2015). *Less than 50% of construction industry complies with health, safety regulations – DoL. Engineering news*. [Online; accessed 12 June 2015] Available at: http://www.engineeringnews.co.za/article/less-than-50-of-construction-industry-complies-with-health-safety-regulations-dol-2015-07-09

Smallwood JJ & Haupt TC. (2007). Impact of the South African Construction Regulations on construction health and safety: Architects' perceptions. *Journal of Engineering, Design and Technology*, *5*(1), 23–34.

Tavakol M & Dennick R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2,* 53. [Online; accessed 22 February 2016] Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4205511/

Temkin S. (2014). *South Africa's construction industry poised for future growth despite recent setbacks in the economy and labour unrest: PwC report*. [Online; accessed 7 September 2015] Available at: http://www.pwc.co.za/en/press-room/construction-sa.jhtml

Törner M & Pousette A. (2009). Safety in construction – a comprehensive description of the characteristics of high safety standards in construction work, from the combined perspective of supervisors and experienced workers. *Journal of Safety Research*, *40*(6): 399–409. [Online; accessed 10 January 2017] Available at: https://www.ncbi.nlm.nih.gov/pubmed/19945552

United States Department of Labour. (2010). Bureau of Labour Statistics Economic News Release August 19, 2010: Census of Fatal Occupational Injuries Summary, 2009. [Online; accessed 15 November 2015] Available at: http://www.bls.gov/news.release/cfoi.nr0.htm

United States Department of Labour. (2016). Occupational Safety and Health Administration: Commonly Used Statistics. [Online; accessed 6 December 2016] Available at: https://www.osha.gov/oshstats/commonstats.html

Varonen U & Mattila M. (2000). The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accident Analysis and Prevention. 32*(6), 761–769. [Online; accessed 16 June 2015] Available at: http://dx.doi.org/10.1016/S0001-4575(99)00129-3

Vitharana, V.H.P., De Silva, G.H.M.J.S. & De Silva, S., (2015). Health hazards, risk and safety practices in construction sites – a review study. *Engineer: Journal of the Institution of Engineers*, Sri Lanka. 48(3), pp.35–44. https://engineer.sljol.info/articles/abstract/10.4038/engineer.v48i3.6840/

Vu T & De Cieri H. (2014). *Safety culture and safety climate definitions suitable for a regulator: A systematic literature review.* Research report 0414-060-R2C. Monash University. [Online; accessed 26 April 2015] Available at: http://www.iscrr.com.au/__data/assets/pdf_file/0005/292316/Safety-Culture-and-climate-Definitions-for-regulator-systematic-literature-review.pdf

Weaver SJ, Lubomksi LH, Wilson RF, Pfoh ER, Martinez KA & Dy SM. (2013). Promoting a culture of safety as a patient safety strategy: a systematic review. *Annals of Internal Medicine*, *158*(2), 369–374. [Online; accessed 25 June 2015] Available http://doi.org/10.7326/0003-4819-158-5-201303051-00002

Weick K, Sutclife K & Obstfeld D. (1999). Organizing for reliability: processes of collective mindfulness. *Research in Organizational Behaviour* 21, 81–123. [Online; accessed 23 March 2014] Available at: http://drillscience.com/DPS/Organizing%20for%20High%20Reliability.pdf

Werner, A. (2007). Organisational behaviour: A contemporary South African perspective. Pretoria: Van Schaick.

WHO. (2001). *Role of the occupational health nurse*. World Health Organisation [Online; accessed 20 November 2015] Available at: http://www.who.int/occupational_health/regions/en/oeheurnursing.pdf

WHO. (2010). *Healthy workplaces: a model for action.* World Health Organization, Switzerland [Online; accessed 19 September 2015] Available at: http://www.who.int/occupational_health/publications/healthy_workplaces_model_action.pdf

WHO. (2014). *Mental health: a state of well-being*. World Health Organisation, Switzerland. [Online; accessed 12 August 2015] Available at: http://www.who.int/features/factfiles/mental_health/en/

Wiegmann DA, Zhang, H, von Thaden, T, Sharma, G & Mitchell A. (2002). A synthesis of safety culture and safety climate research. Savoy, Illinois: University of Illinois at

Urbana-Champaign. [Online; accessed 12 August 2015] Available at: https://www.nrc.gov/docs/ML1025/ML102500649.pdf

Williams Q, Ochsner M, Marshall E, Kimmel L & Martino C. (2010). The impact of a peer-led participatory health and safety training program for Latino day laborers in construction. *Journal of Safety Research, 41*(3), 253–261. [Online; accessed 18 February 2015] Available at: https://www.ncbi.nlm.nih.gov/pubmed/20630277

Wu T-C, Lin C-H & Shiau S-Y. (2010). Predicting safety culture: The roles of employer, operations manager and safety professional. *Journal of Safety Research, 41*(5): 423–431. Available at: https://doi.org/10.1016/j.jsr.2010.06.006

Yee SK. (2002). Study of Application of Positive Safety Performance Indicators in Hong Kong Construction Industry. Research report. [Online; accessed 15 December 2016] Available at: http://158.132.155.107/posh97/private/research/thesis/SO%20Ka%20Yee.pdf

Yule S. (2003). Senior management influence on safety performance in the UK and US energy sectors. Doctoral thesis, University of Aberdeen, Scotland. [Online; accessed 23 August 2014] Available at: http://homepages.abdn.ac.uk/s.j.yule/pages/dept/Yule_safety%20climate%20and%20culture%20review.htm

Zalk DM, Spee T, Gillen M, Lentz TJ, Garrod A, Evans P & Swuste P. (2011). Review of Qualitative Approaches for the Construction Industry: Designing a Risk Management Toolbox. *Safe Health Work 2011*; 2:105–21. [Online; accessed 3 March 2015] Available at: http://www.ncbi.nlm.nih.gov/pubmed/22953194

Zhang H, Wiegmann DA, Von Thaden TL, Sharma G & Mitchell AA. (2002). Safety culture: A concept in chaos? In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *46*(15): 1404–1408. SAGE Publications. [Online; accessed 2 January 2017] Available at: http://journals.sagepub.com/doi/abs/10.1177/154193120204601520

Zohar D. (2000). A group-level model of safety climate: Testing the effect of group climate on micro accidents in manufacturing jobs. *Journal of Applied Psychology,* 85(4), 587–596.

Zohar D & Luria G. (2004). Climate as a social-cognitive construction of supervisory safety practices: scripts as proxy of behaviour patterns. *Journal of Applied Psychology 89*(2), 322–333.

Zohar D & Tenne-Gazit O. (2008). Transformational leadership and group interaction as climate antecedents: A social network *65*analysis. *Journal of Applied Psychology*, *93*(4), 744–757. [Online; accessed 19 May 2015] Available at: http://dx.doi.org/10.1037/0021-9010.93.4.744

Zohar D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology*, (1), 96–102. [Online; accessed 19 May 2015] Available at: http://dx.doi.org/10.1037/0021- 9010.65.1.96

Zohar D. (2010). Thirty years of safety climate research: reflections and future directions. *Accident Analysis and Prevention*, *42*(5), 1517–1522. [Online; accessed 29 August 2015] Available at: http://www.sciencedirect.com/science/article/pii/S0001457509003339

Zohar D. (2002). The effects of leadership dimensions, safety climate, and assigned priorities on minor injuries in work groups. *Journal of Organizational Behaviour* 23, 75–92.

APPENDIX A – ETHICS APPROVAL

R14/49 Ms Raksha Bhimjee

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M150428

NAME: (Principal Investigator)	Ms Raksha Bhimjee
DEPARTMENT:	Nursing Group Five Construction Group
PROJECT TITLE:	Workers Perceptions of Safety Climate in the Construction Industry
DATE CONSIDERED:	24/04/2015
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Ms AM Tshabalala
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	20/07/2015

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX B – POSTGRADUATE COMMITTEE APPROVAL

UNIVERSITY OF THE
WITWATERSRAND,
JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

19 August 2016
Person No: 0200678Y
PAG

Miss RV Bhimjee
22 Athlone Avenue
Sandringham
2192
South Africa

Dear Miss Bhimjee

Master of Science in Nursing: Approval of Title

We have pleasure in advising that your proposal entitled *Workers perceptions of the safety climate in a construction industry* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

APPENDIX C – INSTITUTION APPROVAL

[redacted]

[redacted]

Dear Raksha Bhimjee

I hereby grant you permission to be onsite at the [redacted] construction site to conduct your research study titled: **SAFETY CLIMATE IN THE CONSTRUCTION INDUSTRY.**

If you have any questions regarding this letter of approval, please do not hesitate to give me a call on [redacted]

Sincerely.

Ernest Moropana
Safety Officer.
Signature: ___

APPENDIX D – APPROVAL FOR INSTRUMENT USE

From: Pete Kines (PKI) [**mailto:pki@arbejdsmiljoforskning.dk**]
Sent: 04 October 2016 03:58 PM
To: Bhimjee,Raksha
Subject: VS: Request for usage of NOSACQ-50
Dear Raksha,
Thank you for your interest in NOSACQ-50 ☺ Your study in construction sounds very interesting – what language versions will you need? Do you expect any literacy issues?

1) Please feel free to download and use the NOSACQ-50 questionnaire, and any of the 30+ language versions you need from:
http://www.arbejdsmiljoforskning.dk/en/publikationer/spoergeskemaer/nosacq-50/nosacq-50-translations

2) Please familiarize yourself with the guidelines at: www.nrcwe.dk/nosacq

3) Let me know if you would like benchmark data from the international database (currently 49,000+ respondents from 280+ sites on 6 continents)

4) Keep in touch and please arrange to send any results you have for inclusion in the international database.

Let me know if I can be of any further assistance.
Sincerely
Pete

Pete Kines (PKI)
Senior Researcher, psychologist, PhD-civil engineer
Division of Safety Research
Direct Phone: +45 39 16 53 60
e-mail: pki@nrcwe.dk
https://www.researchgate.net/profile/Pete_Kines

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www.nrcwe.dk

APPENDIX E – DATA COLLECTION INSTRUMENT

SAFETY CLIMATE QUESTIONNAIRE

Section A : Demographic Data **Questionnaire Number : _____**

Instructions: Answer or Tick the relevant answer

Age _____

Gender : Male _____ Female_____

Highest level of education

Grade 5–8	**1**
Grade 9–12	**2**
Certificate	**3**
Diploma	**4**
Degree	**5**

For how long have you been employed in this company

3–6 months	**1**
6–12 months	**2**
1–2 years	**3**
2 – 5 years	**4**
5 years and more	**5**

Which of the following best describes your role on site (please tick your choice)

Site Foreman	**1**
Quality Officer	**2**
Site Agent	**3**
Subcontractor	**4**
Quantity Surveyor	**5**
Site worker	**6**

Section B

In the following section, please describe how you perceive that the managers/ supervisors at this workplace handle safety. *Please mark a cross (X) in the block of your choice.*

	Strongly Disagree	Disagree	Agree	Strongly Agree
Management encourages employees here to work in accordance with safety rules – even when the work schedule is tight				
Management ensures that everyone receives the necessary information on safety				
Management looks the other way when someone is careless with safety				

	Strongly Disagree	Disagree	Agree	Strongly Agree
Management place safety before production				
Management accept employees here takings risks when the work schedule is tight				
We who work here have confidence in the management's ability to handle safety				
Management ensures that safety problems discovered during safety rounds / evaluations are corrected immediately				
When a risk is detected, management ignores it without action.				
Management lacks the ability to handle safety properly				
Management strives to design safety routines that are meaningful and actually work				
Management makes sure that each and everyone can influence safety in their work				
Management encourages employees here to participate in decisions which affect their safety				
Management never considers employees suggestions regarding safety				
Management strives for everybody at the worksite to have high competence concerning safety and risks				
Management never asks employees for their opinions before making decisions regarding safety				
Management involves employees in decisions regarding safety				
Management collects accurate information in accident investigations				
Fear of sanctions (negative consequences) from management discourages employees here from reporting near-miss accidents				
Management listens carefully to all who have been involved in an accident event				
Management looks for causes, not guilty persons, when an accidents occurs				

	Strongly Disagree	Disagree	Agree	Strongly Agree
Management always blames employees for accidents				
Management treats employees involved in an accident fairly				

In the following section, please describe how you perceive employees at this workplace handle safety

	Strongly Disagree	Disagree	Agree	Strongly Agree
We who work here try hard together to achieve a high level of safety				
We who work here take joint responsibility to ensure that the workplace is always kept tidy				
We who work here do not care about each other's safety				
We who work here avoid tackling risks that are discovered				
We who work here help each other to work safely				
We who work here take no responsibility for each other's safety				
We who work here regard risks as unavoidable				
We who work here consider minor accidents as a normal part of our daily work				
We who work here accept dangerous behaviour as long as there are no accidents				
We who work here break safety rules in order to complete work on time				
We who work here never accept risk taking even if the work schedule is tight				
We who work here consider that our work is unsuitable for cowards				
We who work here accept risk taking at work				
We who work here try to find a solution if someone points out a safety problem				
We who work here feel safe when working together				
We who work here have great trust in each other's ability to ensure safety				

	Strongly Disagree	Disagree	Agree	Strongly Agree
We who work here learn from our experiences to prevent accidents				
We who work here take each other's' opinions and suggestions concerning safety seriously				
We who work here seldom talk about safety				
We who work here always discuss safety issues when such issues come up				
We who work here can talk freely and openly about safety				
We who work here consider that a good safety representative plays an important role in preventing accidents				
We who work here consider that safety rounds / evaluations have no effect on safety				
We who work here consider that safety training is good for preventing accidents				
We who work here consider early planning for safety as meaningless				
We who work here consider that safety rounds /evaluations help find serious hazards				
We who work here consider safety training useless				
We who work here consider that it is important that there are clear-cut goals for safety				

51	Is there anything else that you wish to add?

APPENDIX F – PARTICIPANT INFORMATION LETTER

WORKERS PERCEPTIONS OF SAFETY CLIMATE IN THE CONSTRUCTION INDUSTRY

Subject Information letter

Dear Sir / Madam

My name is Raksha Bhimjee and I am a student at University of Witwatersrand. I am currently studying for a Master's Degree in Occupational Health Nursing at the Faculty of Health sciences of the University of the Witwatersrand. As part of the Degree, I am required to complete a study under the guidance of a research supervisor.

My study is about the Safety Climate in your company and I would greatly appreciate your input in this regard. I would like to explore how you perceive your company approaches safety concerns in on site. Please note that participation is voluntary and there is no risks involved to you or your job.

Your name or any other identifying information will not be requested. Refusal to participate or withdrawal from the study at any time is assured. Your responses will be kept confidential. Should you agree to take part in the study, I kindly ask that you sign the attached consent form. A summary of the outcomes of the study will be presented to management of your company and to the rest of the workers through the workers representative committees.

The study will involve completing a questionnaire. This will take approximately 30 minutes to complete. Data collected will remain strictly confidential. Anonymity is guaranteed as neither names nor identifying data will be recorded. Should you feel uncomfortable you may decline to answer any question presented to you.

Please feel free to contact me should you need more information

Thank you for taking the time to read this letter.

Yours sincerely,

Raksha Bhimjee

Phone: 011 234 0800 / 083 298 9637

APPENDIX G – CONSENT FORM FOR RESPONDENTS

TITLE: WORKERS PERCEPTIONS OF SAFETY CLIMATE IN THE CONSTRUCTION INDUSTRY

Participant Consent

INVESTIGATOR: Raksha Bhimjee

I hereby invite you to consider participating in a study to explore the *WORKERS PERCEPTIONS OF SAFETY CLIMATE IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY* Participation is entirely voluntary and there are no risks involved. Refusal to participate or withdrawal from the study at any time is assured. Your responses will be kept confidential. Should you agree to take part in the study you will be asked to please sign the attached form.

A quantitative study involving a structured questionnaire will be used. The researcher will administer the questionnaire clarify matters of concern. This will take approximately 30 minutes. Data collected will remain strictly confidential. Anonymity is guaranteed as neither names nor identifying data will be recorded. Should you feel uncomfortable you may decline to answer any question presented to you.

Results of the study will be made available to the senior management of the facility. Please feel free to contact me at these numbers should you need more information 011 234 0800 / 083 298 9637 or my supervisor Ms. M Tshabalala at 011 488 4267.

The above points were discussed with the respondents and in my opinion; the participant understands the risks, benefits and obligations involved in participating in this study.

……..... ……

Investigator Date

I understand that my participation is voluntary and that I may refuse to participate, or withdraw my consent and stop taking part at any time without penalty. I hereby freely consent to take part in this study project.

……..... ……..

Signature of participant Date