The prevalence and associated occupational risk factors of lower back pain among registered nurses at Tygerberg Hospital, South Africa:

a cross-sectional study.

by

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Declaration

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Abstract

Background

Low back pain (LBP) complaints are the most frequently reported work-related musculoskeletal disorders among nurses worldwide. However, few epidemiological studies on occupational LBP among nurses have been carried out in Africa. The purpose of this study was to assess the prevalence of work-related low back pain and associated risk factors among nursing professionals at a tertiary hospital in South Africa.

Methods

A cross-sectional study design with an analytic component was implemented at Tygerberg Academic Hospital. Data were collected using a self-administered questionnaire. The questionnaire, based on the internationally validated Standardized Nordic Questionnaire, was modified for local use. Descriptive (mean, standard deviation and percentages) and inferential (including logistic regression analysis) statistics were used to analyze data. Alpha level was set at $p< 0,05$.

Results

A total of 280 completed questionnaires were analyzed (response rate 70,0%). The median age of the participants was 47 years (IQR 38,0 - 52,3) and the majority were female (97%). The 12-month period-prevalence of LBP was 73,2% and the lifetime prevalence was 80,7%. Significant risk factors for reported LBP included manual handling (carrying, lifting, or moving) of heavy inanimate materials and medical equipment (aOR: 3,70 95%CI: 1,85 - 7,41). Both working in the adult ICU (aOR: 0,21 95% CI: 0,06 - 0,66) and working night shifts (aOR: 0,31 95%CI: 0,14 - 0,73) were found to be protective. However, according to the nurses' perceptions, working in the same awkward position for prolonged periods and continuing to work while injured or hurt were strong contributory factors to low back pain.

Conclusions

Musculoskeletal disorders affect more than 80% of nursing professionals in Tygerberg Hospital, the lower back being the most commonly affected body region. Although several studies have implicated direct manual handling of patients and work-related psychosocial risk factors as predictors of LBP among nurses, this study showed that manual handling of inanimate materials and medical equipment (e.g., laden trolleys, beds, oxygen cylinders etc.) are strongly associated with low back pain among nurses.

Further research focusing on the ergonomics of manual material handling of inanimate objects and equipment on the prevalence of low back pain among the nurses is recommended.

Key words: low back pain, nurses, occupational, prevalence, risk factors

Opsomming

Agtergrond

Lae rugpyn klagtes is die algemeenste werkverwante muskuloskeletale afwyking onder verpleegpersoneel wêreldwyd. Daar is egter min epidemiologiese studies oor beroeps-lae-rugpyn onder verpleegsters in Afrika. Die doel van hierdie studie was om die voorkoms van werksverwante lae rugpyn en gepaardgaande risikofaktore by verpleegpersoneel in 'n tersiêre hospitaal in Suid-Afrika te ondersoek.

Metodes

'n Deursnitstudie met 'n analitiese komponent is in die Tygerberg Akademiese Hospitaal uitgevoer. Die data is versamel deur middel van 'n selfgeadministreerde vraeboog. Die vraeboog, gebaseer op die internasionaal-gevalideerde en gestandaardiseerde Nordiese vraelys, was aangepas vir plaaslike gebruik. Beskrywende (gemiddelde, standaardafwyking en persentasies) en inferensiële (insluitend logistieke regressie analise) statistieke is gebruik om data te ontleed. Alfa -vlak is op p <0,05 gestel.

Resultate

'n Totaal van 280 voltooide vraelyste is ontleed (reaksiekoers 70,0%). Die mediaanouderdom van die deelnemers was 47 jaar (IKR 38,0 - 52,3) en die meerderheid was vroulik (97%). Die 12-maande-voorkoms van lae rugpyn was 73,2% en die lewenslange voorkoms was 80,7%. Beduidende risikofaktore vir gerapporteerde lae rugpyn sluit handmatige hantering (dra, optel of beweeg) van swaar lewelose items en mediese toerusting in (aWV: 3,70 95%VI: 1,85 - 7,41). Werk in die volwasse intensiewe sorgeenheid (aWV: 0,21 95%VI: 0,06 - 0,66) en nagskof werk (aWV: 0,31 95%VI: 0,14 - 0,73) was beskermend. Volgens die persepsies van die verpleegsters was werk vir lang periodes in dieselfde ongemaklike posisie en om aan te hou werk na hulle beseer of seergemaak is, sterk bydraende faktore tot lae rugpyn.

Gevolgtrekkings

Muskuloskeletale afwykings affekteer meer as 80% van die verpleegpersoneel in die Tygerberg hospitaal, en die lae rug word die meeste geraak. Alhoewel verskeie

studies direkte handmatige hantering van pasiënte en werkverwante psigososiale risikofaktore as voorspellers van lae rugpyn onder verpleegsters impliseer het, het hierdie studie getoon dat handmatige hantering van lewelose materiaal en mediese toerusting (bv. belaaide trollies, beddens, suurstofsilinders, ens.) sterk geassosieer is met lae rugpyn onder verpleegsters. Verdere navorsing wat fokus op die ergonomie en hantering van lewelose items en toerusting met die voorkoms van lae rugpyn onder die verpleegsters word aanbeveel.

Sleutelwoorde: lae rugpyn, verpleegsters, beroep, voorkoms, risikofaktore

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"What shall I render to the LORD? For he has done so very much for me." - Travis Greene

List of figures and tables

List of abbreviations

LBP	Low Back Pain
WMSKDS	Work-related Musculoskeletal Disorders
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immunodeficiency Syndrome
HRH	Human Resources for Health
ICF	International Classification of Function
WHO	World Health Organization
NIOSH	National Institute for Occupational Safety and Health
HCW	Health Care Worker
SU	Stellenbosch University
HREC	Human Research Ethics Committee
WCG	Western Cape Government
DOH	Department of Health
TBH	Tygerberg Hospital
BMI	Body Mass Index
A&E	Accident and Emergency
ICU	Intensive Care Unit
OPD	Outpatients Department
OR	Odds Ratio
aOR	Adjusted Odds Ratio
CI	Confidence Interval
HWSE	Healthy Worker Survival Effect
MSKDs	Musculoskeletal disorders

Definitions

1. Registered Nurse – for the purpose of this study means a trained and licensed healthcare personnel employed on a contract to provide care for the sick in hospital. This included the following nursing categories:
    - Enrolled Nurse Assistant
    - Enrolled (Staff) Nurse
    - Professional General Nurse (non- managerial)
    - Professional Specialty Nurse (non- managerial)
    - Nurse Manager

2. Lower Back Pain – for the purpose of this study defined as any ache, pain, discomfort or numbness lasting for longer than a day in the area between the twelfth ribs and the gluteal folds during the last 12 months.

3. Healthy Worker Survivor Effect (HWSE) – is a bias that occurs in occupational studies when less healthy workers are more likely to reduce their workplace exposures. The HWSE occurs when workers reduce their workplace exposures for health-related reasons, whether or not the exposure affects health.

4. Manual material handling – for the purpose of this study is defined as the transporting or supporting of a load (other than the patient) by hand or another part of the body. It can include lifting, lowering, pushing, pulling, carrying and intentional throwing of a load. Manual handling is an integral part of nursing care.

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1. INTRODUCTION AND LITERATURE REVIEW

Lower back pain (LBP) is a musculoskeletal disorder thought to result from a combination of chronic overuse and acute injury to the muscles, ligaments, tendons, intervertebral discs, nerves, or vertebrae of the lumbar spine(1). LBP predominantly affects the working population in both developed and developing nations, leaving a significant number of individuals disabled(2).

Although lower back pain represents a common occupational problem, few epidemiological studies have investigated LBP prevalence and risk factors among nurses in Africa, particularly those in South Africa. Lower back complaints are the most frequently reported musculoskeletal complaints in nurses, with a past year prevalence of 30 – 60% in developed countries(3)(4). Recent studies conducted in Zambia, Nigeria, South Africa and Zimbabwe showed a past year LBP prevalence in nurses of 68.9%, 70.9%, 59% and 82.1% respectively(5)(6)(7)(8).

Musculoskeletal disorders, such as LBP are one of the main causes of sickness absence among hospital nurses and nursing aides, although underreporting is common(9). In order to come up with effective preventive measures for lower back pain in their workplace, the current status (prevalence and associated risk factors) should first be investigated amongst the nursing cadre. For these reasons, the goal of this study is to investigate the prevalence of work-related musculoskeletal disorders, to investigate perceptions of risk factors in the workplace, lost working days due to work-related lower back pain, and the current coping mechanisms among nurses who work in the public sector in Cape Town, South Africa.

1.1. Background and Rationale

South Africa has a quadruple burden of disease consisting of HIV and AIDS; communicable diseases; non-communicable diseases; violence and injuries with consequent high levels of morbidity and mortality which exacerbates the shortage of human resources for health(HRH)(10). The high prevalence of HIV which impacts on human resources in the healthcare sector, poor health outcomes for the budget spend on health and shortages of healthcare professionals are among the challenges highlighted in the HRH strategy for the Health Sector: 2012/13 – 2016/17. Given that nurses make up the largest single group of healthcare providers in any country,

including South Africa, the HRH crisis can also be characterized as a nursing crisis(10). LBP significantly contributes to lost working days among nurses, which aggravates shortage of the already scarce but critically skilled cadre.

The Global Burden of Disease study of 2010 reported that LBP is one of the most common causes of disability and sixth in overall burden among all health conditions. LBP in nurses is also associated with reduced efficiency at work and early retirement (11). Lost working days are a major public health and economic problem and in nurses leads to shortage of staff at work which can jeopardize optimal care(12). Lost working days have been shown to be associated with trunk bending and rotation, lifting activities at work, low job satisfaction and high levels of work load(13). A study by Roelen et al., in the Netherlands showed that mental and physical fatigue has also been associated with lost working days among nurses, and psychological support and supervision for the new nurses at work can reduce the number of lost working days(14). Several organizations have attempted to characterize occupational risk factors associated with musculoskeletal injuries such as LBP(2)(15), resulting in the adoption of validated tools e.g., the Standardized Nordic Questionnaires for analysis of musculoskeletal symptoms(16). The World Health Organization(WHO) adopted the International Classification of Functioning, Disability and Health (ICF) in 2001 as a framework for organizing and documenting information on functioning and disability(17), which was used as the guiding framework for this study.

Despite several research studies having identified psychosocial risk factors associated with lost working days among the nurses in general, there remains a great deal that is not known about the LBP-related factors that contribute to work absence in our population(18)(19). Information regarding risk factors of LBP most closely associated with lost working days is needed to develop more effective interventions that could determine both: (i) who might benefit most from interventions designed to reduce the impact of LBP on work dysfunction and, (ii) the factors that should be targeted for successful interventions.

1.2. Literature Review

Mechanical low back pain (LBP) exists in every culture and country. Worldwide, more disability is caused by LBP than any other condition. Estimates by numerous investigators indicate that at some point in time in their lives, 80% of all human beings

experience low back pain(20). LBP is one of the internationally recognized work-related musculoskeletal disorders (WMSKDS), a group of disorders to which the work environment and performance of work contribute significantly, or that are made worse or longer lasting by working conditions. The relationship between occupational factors and low back pain is difficult to determine, as objective evidence is often lacking, and exact exposure is usually difficult and sometimes impossible to quantify.

Occupational risk factors for LBP include rapid pace and repetitive nature of work tasks, heavy lifting, bending and twisting, strained postures, and inadequate recovery time between exposures(21). The greatest burden for work-related LBP was noted as being aged between 35 and 65 years, being in the agricultural sector of the economy, and living in regions with high populations, including Asia, Africa and the Middle East(21). This study showed that LBP arising from occupationally related ergonomic exposures is an important cause of disability in working persons. LBP results in significant levels of disability, producing restrictions on usual activity and participation, such as an inability to work(22).

An epidemiological study that was carried out in the Republic of China, which analyzed the risk factors for LBP in nursing personnel in a 5,000-bed medical centre had the following findings: “Of the 3,212 eligible nursing personnel, 3,159(98.3%) responded to the mail survey. Risk factors for low back pain were age, stature and body weight, duration of work, work habits, and sitting posture. The lifetime prevalence of lower back pain was 77, 9%. The primary cause of low back pain was lifting of heavy objects. Muscle strain was the most common diagnosis. For low back pain treatment, the nurses’ first choice was physical therapy and rehabilitation”(1).

Smith *et al.* in a study among nurses in rural Japan reported that nurses who were regularly involved in manual handling of patients had an increased risk of musculoskeletal disorders (MSKDS) of 16.7% compared to those who did not. Furthermore, transferring or moving patients were also predictors of MSKDSs (23).

A summary of eight systematic review reports that examined evidence supporting causal relationships between bending/twisting, awkward postures, sitting, standing/walking, carrying, pushing/pulling, lifting and manual handling/assisting patients and LBP found no strong evidence supporting a causal relationship according to the Bradford Hill framework(15). Despite reviewing 99 studies that examined various types of occupational physical activities and LBP, few strong conclusions could be made regarding causation. Conflicting evidence for association was identified

for assisting patients, manual handling, carrying, awkward postures, sitting, standing, and walking. However, the magnitude of the problem of LBP clearly mandates the need for further investigation of this topic, as it is vitally important to formulate a return-to-work plan and preventative recommendations.

Another systematic review identified that nurses are vulnerable to WMSKDS, especially lower back pain and injury(24). The predisposing risk factors of lower back pain and injury are poor patient transfer technique, high physical demand of the nursing profession, poor health and fitness conditioning status of the nurses, and obesity. Risk factors were divided into extrinsic and intrinsic factors. The extrinsic factors included the following:

(i) Physical job demands of the nursing profession to include bending and twisting(25)(26).

(ii) Physical demands of nurse-patient interaction include turning, bathing, dressing, seating the patient in bed and/or chair and transferring the patient. There were different tasks: stretcher to bed, bed to chair, and bed to toilet (27)(28).

Anap et al. postulated that the above mentioned physical tasks do contribute to the prevalence of WMSKDS(26). Many of the above tasks require the nurse to alter her body position from the anatomical ideal posture to ensure that the task is completed successfully. In addition, many tasks require the nurse to maintain these deviated postural alignments for prolonged periods of time, which increases the risk of WMSKDS (29)(25)(30). Transferring of patients requires the nurse to flex their vertebral column for prolonged duration, exerting isometric muscle contraction to maintain their static posture or to slowly lower a heavier patient to the chair (eccentric muscle contractions)(31).

According to the National Institute for Occupational Safety and Health (NIOSH) Research Report of 2006: “Healthcare workers face a number of risk factors for MSKDSs in the workplace, such as back and shoulder injuries. These disorders are associated with excessive back and shoulder loading due to lifting heavy loads during manual patient handling, applying excessive forces during pushing and/or pulling of objects, required use of awkward postures during patient care, and working long hours and/or doing shift work.” The research program included studies aimed at the prevention of MSKDSs due to patient handling, prevention of injuries due to slips, trips

and falls, and prevention of injury and illness due to long hours of work. This effort is increasingly important because of the current nursing shortage, the aging nursing workforce (average age of 46.8 years), and the obesity epidemic in the US that is resulting in increased weight of patients to be handled. It is likely that the implementation of the results of such programmes research will significantly help reduce injuries and illnesses for healthcare workers, as well as promote nurse recruitment and retention(32).

The most frequently mentioned work-related factors for lower back pain include manual lifting, pushing and pulling of loads, heavy physical work, static work posture, frequent bending and twisting, and whole body vibration(33). Anecdotally, there has been a general assumption that low back pain prevalence in Health Care Workers (HCWs) is comparatively lower than in the heavy-duty industrial labourers, and as such not many epidemiological studies have focused on health care professionals as a high-risk group.

Mechanical hazards inherent in the hospital include manual handling and/or lifting (lifting of patients in particular) which makes nursing one of the occupations most affected by musculoskeletal disorders. Nurses are required to lift and transport patients or medical equipment, often in difficult environments, particularly in developing countries, where lifting aides may not always be available (6). A focus on formulating interventions to reduce exposure to the associated work-related risk factors and research to improve the available exposure and risk information, especially in the health care setting is thus necessary. A closer investigation into the working conditions of nurses in South Africa, including any relevant work-related morbidity is thus an imperative.

In an epidemiological study done in South Africa, Olivier et al. looked at the presence of stress and its association with LBP among the staff members employed at a district hospital in Gauteng. The point prevalence of LBP among employees was 47.4%. Psychological stress experienced at work was found to be associated with the presence of LBP. As a result, their clinical recommendations included that healthcare providers need to incorporate the provision of education, support and appropriate referral systems for patients who perceive themselves to have high levels of stress. LBP prevention and management programmes should incorporate stress management and relaxation techniques(19).

These researchers concluded that educational programmes on prevention and workplace interventions are required in order to reduce occupational injuries, and more research needs to be done to explore the risk factors for lower back pain among nurses in the healthcare working environment.

To address these knowledge gaps, this study aims to assess the prevalence of LBP, associated risk factors, and number of lost working days in the past year (attributed to LBP) in a sample of nurses working in a tertiary public hospital in Cape Town, South Africa.

1.3. Aims and Objectives

The aim of this study is to assess the prevalence of lower back pain amongst registered nurses at Tygerberg Hospital, and to identify the associated occupational risk factors.

1.3.1 Primary Objective

- To determine the prevalence of lower back pain amongst nurses over a one-year period

1.3.2 Secondary Objectives

- To identify associated occupational risk factors for lower back pain among nurses in the hospital
- To determine the nurses' perceptions of work-related risk factors for lower back pain
- To assess the frequency and level of interventions received for lower back pain and other actions taken.

2. METHODOLOGY

2.1. Ethical and Regulatory Compliance

2.1.1 Approval for the study

Ethics approval was obtained from Stellenbosch University Human Research Ethics Committee (SU-HREC), Reference number: S18/10/202 and thereafter Tygerberg Hospital Management and Western Cape Government Department of Health (WCG-DOH) for permission to involve the nurse participants at work.

2.1.2 Informed Consent and confidentiality

Informed consent was individually sought from all potential participants before they could partake in the study. Both the consent forms and self-administered questionnaires were availed in the English language only, since our target population included only registered nurses with post-matriculation level of education. Each participant was allocated a uniquely coded study number. The master study Excel spreadsheet only contained the unique study number with no identifiable patient details. Strict confidentiality was maintained at all times as hard copy data was kept securely under lock and key, and all electronic datasets were secured in a password protected Laptop, only accessible to the primary investigator and study supervisor.

2.1.3 Standard of care and the right to decline participation

This study did not impact on the standard of clinical care as the self-administered questionnaires were issued to the nurse participants at their regular work stations. Their right to decline participation without any subsequent prejudice was expressly emphasized at the time of seeking informed consent. Overall, this study was conducted in accordance with the Declaration of Helsinki and the DOH Guidelines for Good Clinical Practice.

2.2. Study Design

We used a combined descriptive and analytical cross-sectional study design to realise the aim and objectives of this study by means of self-administered questionnaires. A cross-sectional descriptive component was used to determine the prevalence of low back pain, while the analytical cross-sectional design was used to:

(i) Identify associated risk factors for low back pain among nurses in the hospital setting using multiple variable logistic regression, and

(ii) Compare lost working days between participants with and those without low back pain.

The self-reporting questionnaire, based on the internationally validated Standardized Nordic Questionnaire(16) was modified for local use.

2.3. Setting

This study was performed at Tygerberg Hospital, a 1 384 bed-capacity tertiary referral hospital located in Parow, Cape Town. It is the largest hospital in the Western Cape Province and the second largest hospital in South Africa. It acts as a teaching hospital for the Faculty of Medicine and Health Sciences of Stellenbosch University, the University of the Western Cape, and the Cape Peninsula University of Technology. The current number of nursing personnel stands at 2 017 registered nurses working to support the full range of general specialist and subspecialist services provided.

2.4. Participants

2.4.1. Study Population and Selection criteria

The study population included all nurses currently employed by Tygerberg Academic Hospital.

Inclusion criteria

Nursing personnel who fulfil all of the following criteria were eligible for inclusion:

- Must be employed by Tygerberg Hospital
- Must provide written informed consent
- Must have worked at Tygerberg Hospital for a period of not less than one year

Exclusion criteria

Nursing personnel who fulfil any one of the following criteria were not eligible for inclusion in the study:

- Nurses who work in the hospital, but who were not employed by the hospital, such as Agency staff
- Nursing students who do their practical training in the hospital, but have not yet qualified as nurses
- Unable (or unwilling) to provide written informed consent

2.4.2. Sampling Frame and Strategy

The sampling frame of this study was obtained from the Human Resources (HR) departmental database. All current employees (who have been in the employ of the hospital for at least one year) formed part of the sampling frame. A random sample was taken from the sampling frame, using a computerised random digit generator.

2.4.3. Sampling and study size

The sample size was estimated using the Epi Info™ Version 7 software with the following assumptions: a study population size of 2 017 (the number of nurses employed at Tygerberg Hospital based on the HR department database), an expected 12-month prevalence of LBP of 70% as guided by previous studies, a precision of +/- 5 at 95% confidence limit (5)(6). This dictated having a minimum sample size of 278 participants. In order to account for unusable questionnaires and other reasons for non-inclusion in the study, a total random sample of 400 nurses was taken.

2.5. Data Sources and Collection

The investigator individually approached each study participant who had been randomly selected by the random digit generator from the sampling frame (the HR-database) at their respective work stations to obtain their informed consent and thereafter give them the self-administered questionnaire. Completed questionnaires were collected before the end of that working shift to minimize chances of loss to follow up.

All the variables described under subsection 2.6 below were gathered directly from the study participants by means of a study questionnaire (Appendix B.1.). Only contact details and the division in which the employee was working was obtained from HR.

2.6. Variables

The following variables were included in the survey:

2.6.1. Independent Variables

(i) Demographic factors: age in years, gender, with height and weight used to calculate Body Mass Index (BMI)

(ii) Work-related factors: nursing category, main current work, working hours per shift , work rotations and frequency of performing specific nursing tasks

(iii) Perceived risk factors for musculoskeletal disorders: treating excessive number of patients, not having enough rest breaks, working in the same position (posture) for prolonged periods, continuing to work while injured or hurting, unanticipated sudden movement or fall by patient and work scheduling (overtime or irregular shifts).

(iv) Consequence or outcome variables: hospitalization; change of jobs or duties; reduction in activity (both at work and at home); lost time at work and frequency of consultation with a medical practitioner due to low back pain in the past 12 months. The highest level of treatment intervention and other coping mechanisms for low back pain were also explored.

2.6.2. Dependent Variables

Low back pain defined as any ache, pain, discomfort or numbness lasting for longer than a day in the area between the twelfth ribs and the gluteal folds during the last 12 months.

2.7. Addressing Potential Bias

Simple random sampling was used to mitigate selection bias and a sample size calculation was performed to minimize the risk of a Type 2 error.

In order to mitigate against the Healthy Worker effect, multiple attempts were made to find staff members who were not at work (booked off sick) at the first attempt to locate the individual. Likewise, Night Shift nurses were included by specifically setting aside some days where they were approached after 19h00, when they were on duty.

2.8. Statistical Analysis

Statistical procedures were performed using STATA Software version 15 (Statacorp).

2.8.1. Descriptive Analysis

We calculated the descriptive statistics for all of the variables, which included continuous variables (presented as a mean and standard deviation) and categorical variables (presented as frequencies and percentages). Prevalence of self-reported musculoskeletal disorders was calculated by dividing the number of employees who reported musculoskeletal symptoms by the total number of participants in the study during the one-year period.

2.8.2. Analytical component

The association between potential risk factors (demographic or work-related) and LBP was first assessed using a univariate analysis. Chi-square tests were used for categorical data (with Fisher's exact tests where necessary) and the Student's t-test was applied for quantitative data. A p-value of less than 0.05 was considered statistically significant.

The results were also reported as Odds Ratios (ORs) with their corresponding 95% Confidence Intervals (CIs).

3. RESULTS

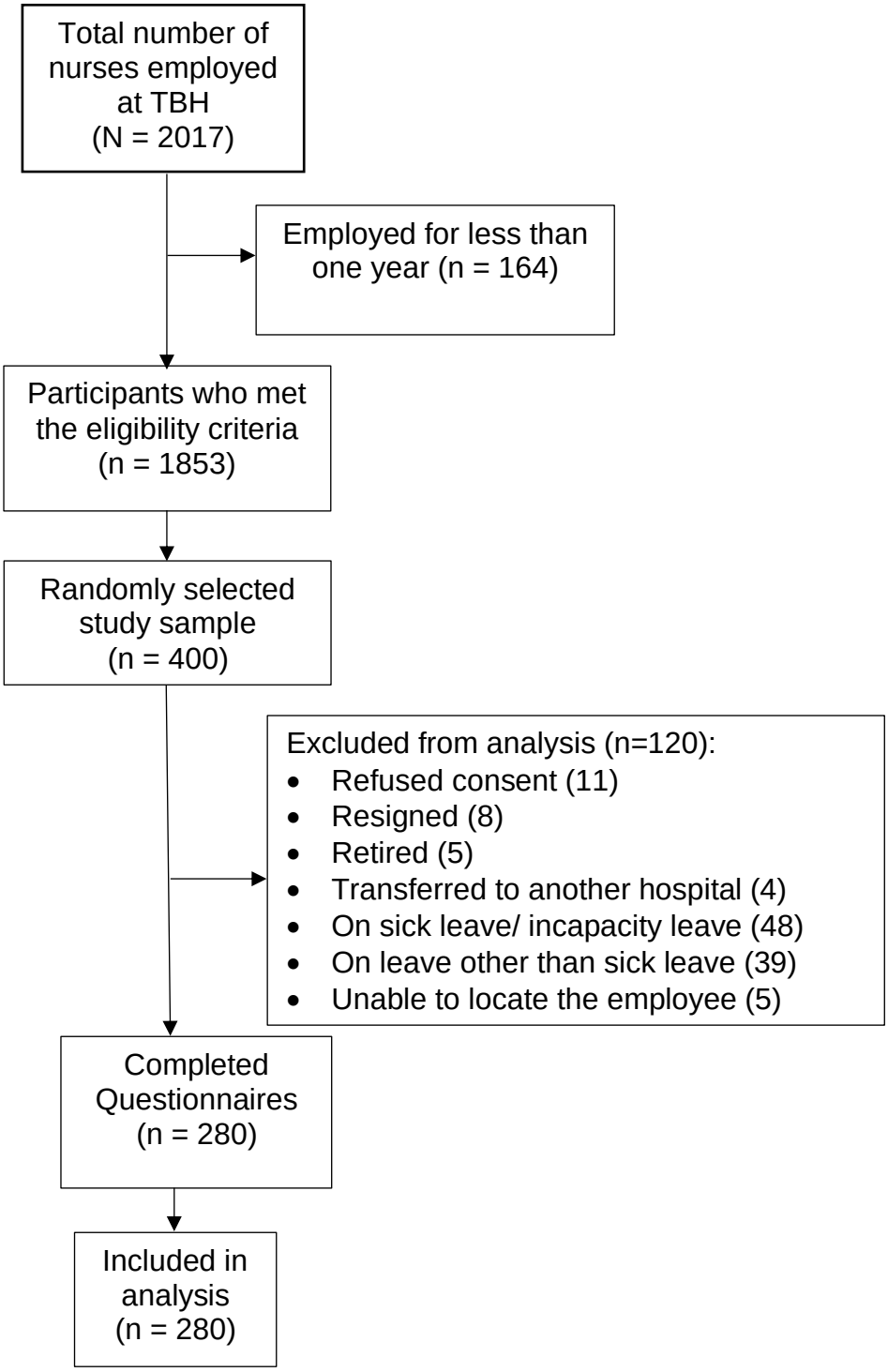
3.1. Study participants

A total of 2017 nurses were employed at TBH during the time of this study, of which 164 were employed for a period of less than 12 months, leaving 1853 eligible participants (the sampling frame). A computer-generated random sequence was used to sample employees for participation in the study.

A sequence of 400 individuals was generated and sampling was performed in accordance with the sequence, with replacement of the individual if the other inclusion/ exclusion criteria were violated. Sequential sampling continued until the required minimum sample size was reached. A total of 400 questionnaires were distributed, of which 280 completed the questionnaire correctly, yielding a response rate of 70%. The questionnaires were issued to these employees during the period from September to December 2019.

A total of 280 individuals were included in the study and completed their questionnaires as shown in the flow diagram below. The reasons for non-participation were as captured in the flow diagram (Figure 1), below. However, some of the nurses could not be located because of changing shifts while others were not willing to give their informed consent to participate.

Figure 1: Flow diagram illustrating selection of the study sample



3.2. Socio-demographic characteristics of the participants

Personal socio-professional characteristics

In this study, only 3% (n = 8) of the 280 study participants were male, a reflection of the prevailing gender imbalance in the nursing fraternity in South Africa.

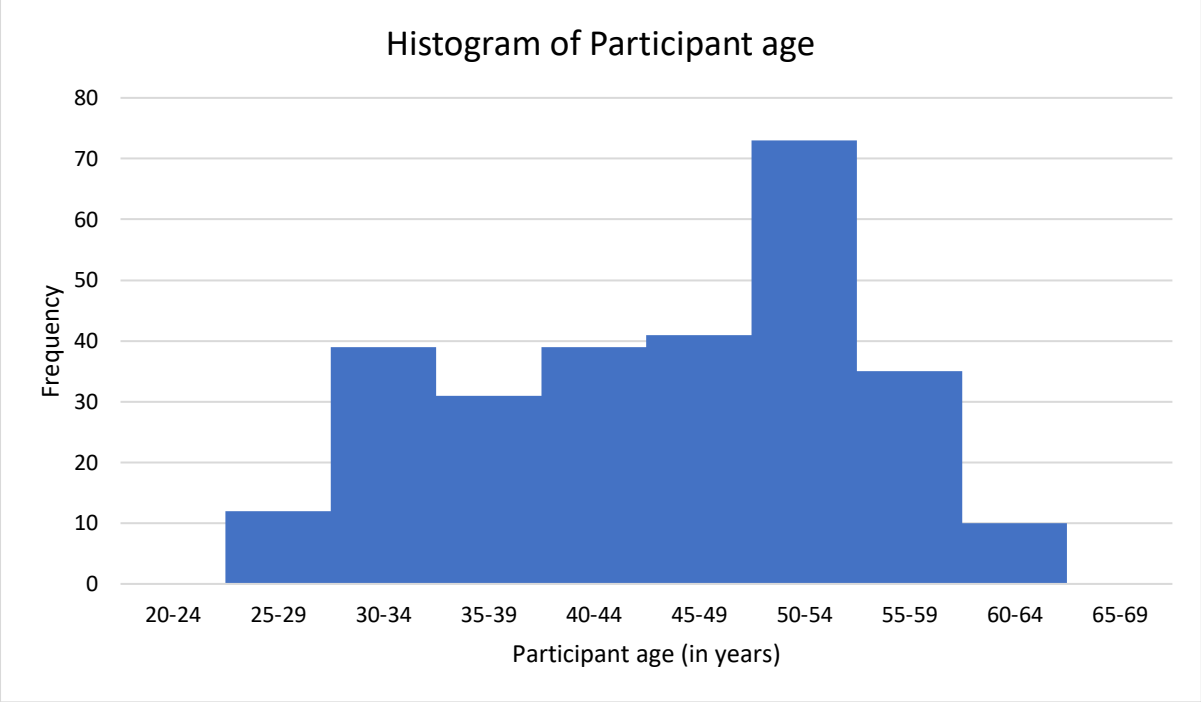
The other baseline characteristics of the study participants were as shown in Table 1 below:

Table 1: Baseline characteristics of the study participants

	Age (Years)	Weight (Kg)	Height (CM)	BMI (Kg/m^2)	Employment Duration (Years)
Range	26 - 64	45 - 138	130 - 190	16.9 - 58.6	2 - 45
Mean (SD)	Skewed	84 (17.6)	159.3 (9.2)	33.3 (7.3)	17.6 (11.9)
Median [IQR]	47 [38 -52.3]	83 [70.9 - 95.8]	159 [154 - 164]	32.8 [27.8 - 37.8]	12 [7 - 30]

Age data was not normally distributed (Shapiro-Wilk test, $p < 0.0001$). The histogram of the participants' age (Figure 2) provides the age distribution of the study population, illustrating that the age group with the highest frequency 26.1% (73/280) were those in the 50 to 54 - years age range.

Figure 2: Histogram showing the age distribution of the study participants.



Almost two-thirds 63.9% (179/280) of the study participants were noted to be obese (BMI ≥ 30), with 24.3% (68/280) overweight (BMI 25.0-29.9) and only 11.8% (33/280) having a normal BMI (18.5 – 24.9). The proportional distribution by BMI between those with and without low back pain are shown in Table 7.

The duration of participant's career ranged from 2 years to 45 years with a mean duration of 17.6 years (SD 11.9).

3.3. Job profile of the study participants

Table 2: Distribution of study participants by nursing category

Working category	Count	Percentage
Enrolled Nursing Assistant (ENA)	112	40.0%
Staff Nurse	53	18.9%
General Nurse	44	15.7%
Specialty Nurse	49	17.5%
Nurse Manager	22	7.9%
Grand Total	280	100.0%

Table 2 above shows the distribution of study participants by nursing category.

Enrolled Nursing Assistants (ENAs) constituted the majority of our study participants 40% (112/280), being the ones tasked with carrying out most of the physically demanding nursing tasks and Nurse Managers, who mostly perform administrative duties and operational planning (more sedentary roles), were in the minority at 7.9% (22/280).

Participants in the sample (N= 280) were from various sections of the hospital, which included medical wards (8.57%), surgical wards (23.93%), Intensive Care Units (ICU) – Paediatric (4.29%), Adult Intensive Care Units (ICU) (12.14%), Theatres (8.21%), Accident and Emergency (6.07%), general Paediatric wards (14.29%), Obstetrics and Gynaecology wards (12.14%) and Outpatient Departments (OPD) (10.36%).

In terms of working shifts, 71.8% (201/280) of the study participants worked day shifts, with 11.8% (33/280) working exclusively night shifts and the other 15.7% (44/280) worked both day and night shifts. Only 0.7% (2/280) of the participants worked permanent part-time shifts during the day, mostly in specialized Outpatient Clinics.

Figure 3. Pie chart showing the percentage distribution of study participants by clinical rotations.

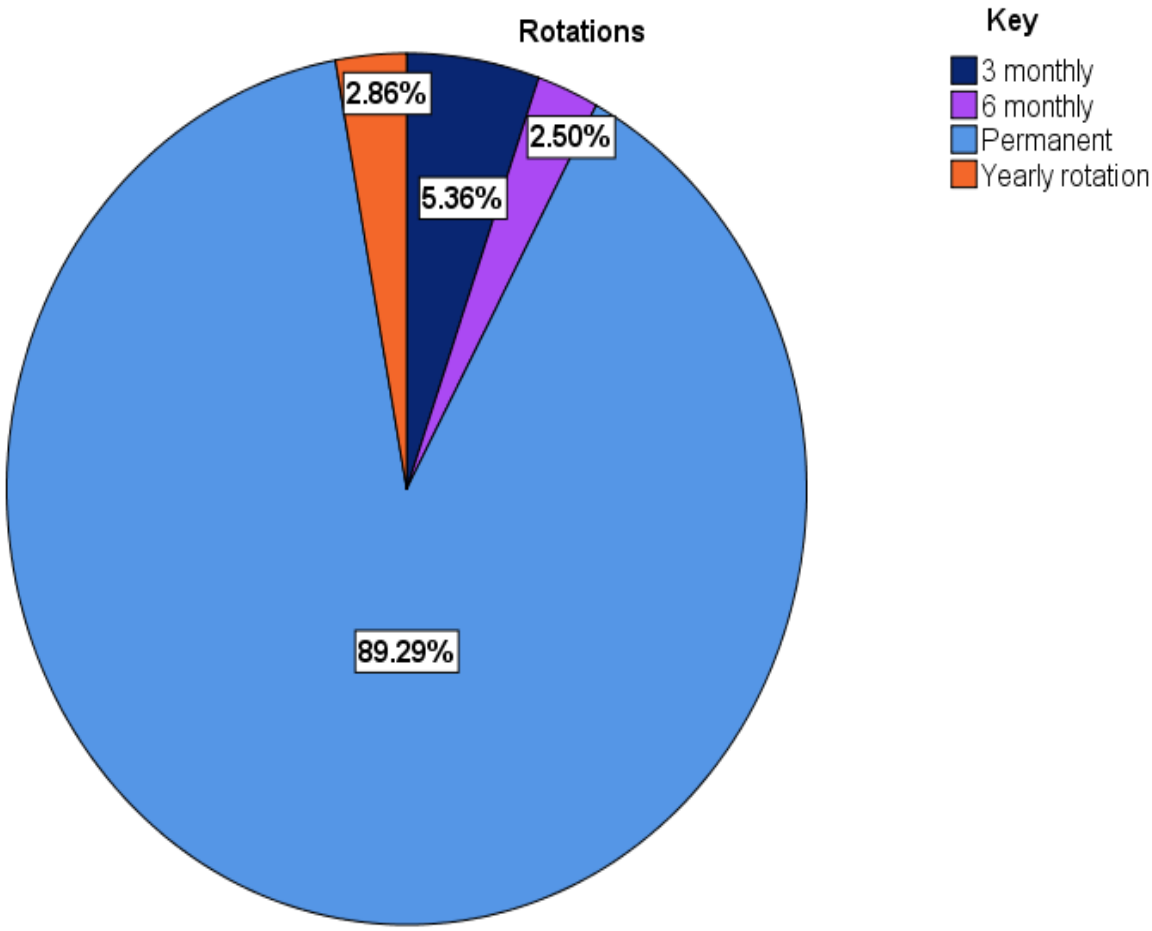


Figure 3 shows the distribution of study participants by clinical rotations.

3.4. Prevalence and consequences of low back pain

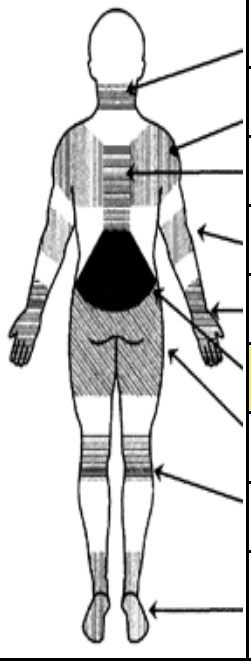
Table 3 shows the frequency of MSKDs in the study sample. The overall 12-month prevalence of self-reported MSKDs was 89.3% (250/280), with symptoms in at least one body region. Only 10.7% (30/280) of participants did not have any MSKD symptoms in the past 12 months and 75% (210/280) of participants had MSKD symptoms in more than one body region.

Table 3: Self-reported frequency of MSKDs and number of body regions affected

Number of body regions	Count	Percentage
0	30	10,7
1	40	14,3
2	44	15,7
3	40	14,3
4	35	12,5
5	35	12,5
6	20	7,1
7	17	6,1
8	8	2,9
9	11	3,9
Grand Total	280	100,0

The musculoskeletal disorders survey revealed that 73.2% (n=205) of the study participants have had LBP in the past 12 months, 46.4% (n=130) had experienced shoulder symptoms, while 43.6% (n=122) experienced ankles or feet symptoms and the least affected body region 16.1% (n=45) was the elbows as shown in Table 4, below. During the past 12 months, low back trouble was the most frequently cited reason (35.4%) that prevented participants from carrying out their normal activities (e.g., job, housework, hobbies). In the past year, 36.4% of the study participants had consulted a physician for low back symptoms. The lower back was the most frequently reported (42.9%) region for musculoskeletal symptoms during the last 7-day period preceding our survey.

Table 4: Percentage of study participants who indicated that they have had musculoskeletal symptoms per body region.

Body region affected		Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g., job, housework, hobbies) because of trouble in:	During the last 12 months have you seen a physician for this condition	During the last 7 days have you had trouble in:
	NECK	40.3%	13.6%	13.2%	15.4%
	SHOULDERS	46.4%	18.9%	15.0%	22.9%
	UPPER BACK	33.2%	13.9%	13.9%	19.3%
	ELBOWS	16.1%	7.5%	6.4%	7.1%
	WRISTS/HANDS	34.3%	19.3%	15.0%	15.4%
	LOWER BACK	73.2%	35.4%	36.4%	42.9%
	HIPS/THIGHS	23.6%	11.4%	10.0%	11.8%
	KNEES	33.9%	12.5%	12.1%	19.6%
	ANKLES/FEET	43.6%	17.1%	13.2%	25.0%

The 12-month prevalence of LBP was 73.2% (205/280) among the study participants. When focusing on the lower back in isolation, 80.7% (226/280) of the study participants indicated that they have ever had lower back trouble. Only 8.4% (19/280) of these individuals have been hospitalized as a result of low back trouble and 9.7% (22/280) indicated that they had to change their jobs or duties as a result. The number of days that these employees suffered low back trouble in the preceding 12 months is shown in Table 5 below.

Table 5: Number of days that these employees suffered low back trouble in the last 12 months

Total length of time that employee had low back pain	number (percentage)
Never had backache	61(21.7%)
0 days	17(6.1%)
1-7 Days	96(34.3%)
8-30 days	27(9.6%)
>30 days	25(8.9%)
Every day	54(19.3%)
Grand Total	280(100%)

Only 71 did not have any reduced activity during the last 12 months (see question 5.5). Of the 209 employees who had back trouble, 49.8% (n=104) had reduced their work activity and 39.7% (n=83) had reduced their leisure activities. The number of days that low back trouble prevented them from doing their normal work (at home or away from home) during the past 12 months in shown in Table 6.

Table 6: Number of days that low back trouble prevented study participants from doing their normal work during the past 12 months

Lost working time	number (percentage)
0 days	62 (29.7%)
1-7 days	100 (47.8%)
8-30 days	26 (12.4%)
>30 days	21 (10.1%)
Grand Total	**209 (100%)**

A total of 118 of these employees (56.5%) consulted a doctor, physiotherapist, or chiropractor because of their LBP during the past 12 months and 115 (55.0%) indicated that they have experienced back trouble during the past 7 days.

To compare the levels of agreement within the participants' responses, the question of low back trouble during the past 7 days was deliberately repeated. A comparison of responses for low back trouble in past 7 days (see questions 5.8 and Q4) showed:

- Percentage agreement: 80.38%
- Cohen's k: 0.60

Substantial agreement was demonstrated in the participants' responses.

3.5. Perceptions of contributory risk factors for low back pain

When it comes to the nurses' perceptions of risk factors for low back pain (see results breakdown in Table 9), this study showed that working in the same position for prolonged periods and treating an excessive number of patients per day were regarded as the most significant contributors.

Finally, our study has shown that almost 59% (166/280) of the participants held the perception that continuing work while hurt or injured was a risk factor for low back pain.

3.6. Interventions and other actions taken for low back pain

Other outcome variables such as consultation frequency, treatment or intervention and action taken were also studied. The study found that around 42% (117/280) consulted for low back pain on a yearly basis and only one participant (0.36%) consulted on a weekly basis. Thirty eighty percent (107/280) have never consulted for low back pain within the last twelve months.

Furthermore, almost 39% (108/280) saw a general practitioner regarding low back pain and 22.5% (63/280) depended on self-medication. In addition, almost 1.8% (5/280) received an operation within the last twelve months. Among the registered nurses in our study, only 6.8% (19/280) saw a specialist for assistance and 7.5% (21/280) were referred to a general practitioner. Only 0.36% (1/280) each had quarterly consultations, multiple operations with interventions and never saw a GP for treatment.

None of the participants attended a back safety training programme or changed their profession as a result of LBP.

3.7. Comparison of frequency of distribution: low back pain versus the potential risk factors

Table 7: Association between low back pain and the demographic variables

Variables	**Low back pain**			
	No [n (%)]	**Yes [n (%)]**	**Total [n (%)]**	**p-value**
	75(26.79)	205(73.21)	280	
Gender				
Male	3(4.00)	5(2.44)	8(2.86)	0.487
Female	72(96.00)	200(97.56)	272(97.14)	
Age group				
20-29	1(1.33)	9(4.43)	10(3.60)	0.183
30-39	22(29.33)	48(23.65)	70(25.18)	
40-49	23(30.67)	57(28.08)	80(28.78)	
50-59	24(32.00)	84(41.38)	108(38.85)	
60-69	5(6.67)	5(2.46)	10(3.60)	
Body Mass Index				
Normal (18.5-24.9)	8(10.67)	25(12.20)	33(11.79)	0.931
Overweight (25.0-29.9)	18(24.00)	50(24.39)	68(24.29)	
Obese (≥ 30)	49(65.33)	130(63.41)	179(63.93)	
Current work category				
Enrolled nursing assistant	29 (38.27)	83(40.49)	112 (40.00)	0.643
General nurse	15(20.00)	29(14.15)	44(15.71)	
Nurse manager	7(9.33)	15(7.32)	22(7.86)	
Specialty nurse	13(17.33)	36(17.56)	49(17.50)	
Staff nurse	11(14.67)	42(20.49)	53(18.93)	

Main current working location				
Accident and Emergency	5(6.67)	12(5.85)	17(6.07)	0.286
Adult ICU	15(20.00)	19(9.27)	34(12.14)	
Paediatric ICU	1(1.33)	11(5.37)	12(4.29)	
Medical wards	7(9.33)	17(8.29)	24(8.57)	
Outpatients department	5(6.67)	24(11.71)	29(10.36)	
Obstetrics and Gynaecology	10(13.33)	24(11.71)	34(12.14)	
Paediatric wards	9(12.00)	31(15.12)	40(14.29)	
Surgical wards	16(21.33)	51(24.88)	67(23.93)	
Theatre	7(9.33)	16(7.80)	23(8.21)	
Work rotations				
3-monthly	1(1.33)	14(6.83)	15(5.36)	0.238
6-monthly	2(2.67)	5(2.44)	7(2.50)	
Permanent placement	71(94.67)	179(87.32)	250(89.29)	
Yearly rotation	1(1.33)	7(3.41)	8(2.86)	

None of the demographic variables had statistically significant associations with LBP in this study.

Table 8: Association between low back pain and frequency of performing specific nursing tasks

Variables	**Low back pain**			
	No (n(%))	**Yes (n(%))**	**Total**	**p-value**
	75(26.79)	205(73.21)	280	
Carrying, lifting, or moving heavy materials or equipment				
Rarely	26 (34.67)	37(18.05)	63(22.50)	0.003
Frequently	49 (65.33)	168(81.05)	217(77.50)	
Patient transfer or lifting dependent patient				
Rarely	13(17.33)	37(18.05)	50 (17.86)	0.890
Frequently	62(82.67)	168(81.95)	230(82.14)	
Eating help / tube feeding				
Rarely	22(29.33)	66(32.20)	88(31.43)	0.648
Frequently	53(70.67)	139(67.80)	192 (68.57)	
Body position change				
Rarely	14(18.67)	61(81.33)	53(18.93)	0.946
Frequently	39(19.02)	166(80.98)	227(81.07)	

Drips and intravenous infusions				
Rarely	22(29.33)	73(35.78)	95(34.05)	0.313
Frequently	53(70.67)	131(64.22)	184(65.95)	
Blood sampling / injecting medicine				
Rarely	37(49.33)	111(54.15)	148(52.86)	0.475
Frequently	38(50.67)	94(45.85)	132(47.14)	
Medicine preparation				
Rarely	32(42.67)	101(49.27)	133(47.50)	0.327
Frequently	43(57.33)	104(50.73)	147(52.50)	
Record keeping and documentation				
Rarely	1(1.33)	11(5.39)	12(4.30)	0.191
Frequently	74(98.67)	193(94.61)	267(95.70)	
Helping patients to dress				
Rarely	19(25.33)	68(33.17)	87(31.07)	0.210
Frequently	56(74.67)	137(66.83)	193(68.93)	
Bed Making				
Rarely	14(18.67)	31(15.12)	45(16.07)	0.474
Frequently	61(81.33)	174(84.88)	235(83.93)	

There was a statistically significant association (p-value 0.003) between carrying, lifting or moving of inanimate heavy materials or equipment and LBP among the nurses.

Table 9: Work-related activities and job factors that were perceived by study participants as risk factors contributing to the development of low back pain

Variables	**Low back pain**			
	No (n(%))	**Yes (n(%))**	**Total**	**P-value**
	75(26.79)	205(73.21)	280	
Treating an excessive number of patients	69(24-95)	75(47-90)	73.5(44-92)	0.485
not having enough rest breaks	35(10-79)	49(20-80)	48(15-80)	0.111
Working in the same position for prolonged periods	52(15-90)	82(48--95)	76(41.5-94)	<0.001
Continuing to work while injured or hurt	36(2-92)	68(20-92)	58(10-92)	0.004
Unanticipated sudden movement or fall by patient	26(2-80)	44(12-75)	40(8.5-76)	0.121
Work scheduling (overtime, irregular shifts etc.)	49(6-82)	56(22-85)	54(18-84.5)	0.168

Nursing personnel perceived working in the same awkward position for prolonged periods and continuing to work while injured or hurt as contributing factors to LBP.

3.8. Univariate analysis

Table 10: Summary table of Univariate analysis for the different variables

Variables	OR (95% CI)	p-value
Gender		
Female	1.667(0.387-7.170)	0.493
Male	ref	
Age group		
20-29	2.571(0.309-21.402)	0.382
30-39	0.623(0.316-1.230)	0.173
40-49	0.708(0.364-1.376)	0.309
50-59	ref	
60-69	0.286(0.076-1.072)	0.063
Current work category		
Enrolled nursing assistant	1.336(0.495-3.607)	0.568
General nurse	0.902(0.302-2.695)	0.854
Nurse manager	ref	-
Specialty nurse	1.292(0.430-3.88)	0.648
Staff nurse	1.782(0.583-5.450)	0.311
Body mass index		
Normal	ref	
Overweight	0.889(0.339-2.329)	0.811
Obese	0.836(0.353-1.982)	0.684
Main current working location		
Accident and Emergency	0.697(0.193-2.513)	0.581
Adult ICU	0.368(0.134-1.006)	0.051
Paediatric ICU	3.194(0.361-28.290)	0.297
Medical wards	0.705(0.223-2.234)	0.553
Outpatients department	1.393(0.412-4.712)	0.593
Obstetrics and Gynaecology	0.697(0.244-1.988)	0.499
Paediatric wards	ref	-
Surgical wards	0.925(0.364-2.351)	0.871
Theatre	0.664(0.208-2.116)	0.488

Working shifts		
Day shift	ref	-
Night shift	0.397(0.186-0.848)	0.017
Both (Day & Night)	1.288(0.578-2.867)	0.536
Permanent part-time shifts	0.331 (0.020-5.419)	0.438
Work rotations		
3-monthly	1.008(0.191-5.333)	0.992
6-monthly	5.560(0.410-76.403)	0.196
Permanent placement	ref	
Yearly rotation	2.8(0.195-40.248)	0.449
Nursing experience (years)	1.014(0.991-1.039)	0.230
Work related activities		
Carrying and Lifting materials: Frequently	2.409(1.329-4.368)	0.004
Patient Transfer: Frequently	0.952(0.474-1.911)	0.890
Eating Help: Frequently	0.874(0.490-1.558)	0.649
Body Change: Frequently	0.977(0.496-1.926)	0.946
Drips IV: Frequently	0.745(0.419-1.323)	0.315
Taking Bloods: Frequently	0.825(0.485-1.402)	0.476
Med preparation: Frequently	0.766(0.449-1.307)	0.329
Record Keeping: Frequently	0.237(0.300-1.876)	0.173
Dressing Help: Frequently	0.684(0.376-1.242)	0.212
Bed Making: Frequently	1.288(0.642-2.585)	0.476

In nurses experiencing LBP, the odds of having frequently participated in carrying, lifting, or moving heavy materials or equipment was 2.409(95%CI 1.329-4.368) times higher than in nurses who did not experience LBP. This was statistically significant, with a p-value of 0.004. However, the odds of working exclusively on night shifts was 60% lower in nurses with LBP than in nurses who did not have LBP, with the odds ratio being 0.397(95%CI 0.186-0.848).

3.9. Multivariate logistic regression analysis

Table 11: Multivariate logistic regression analysis of possible risk factors for low back pain amongst registered nurses in Tygerberg hospital

Variables	aOR (95% CI)	p-value
Gender: Female	0.827(0.141-4.862)	0.834
Current work category		
Enrolled nursing assistant	1.730(0.548-5.468)	0.350
General nurse	0.953(0.272-3.336)	0.940
Nurse manager	ref	
Specialty nurse	2.011(0.565-7.161)	0.281
Staff nurse	2.402(0.647-8.922)	0.190
Body mass index		
Normal	ref	
Overweight	0.710(0.248-2.036)	0.524
Obese	0.673(0.286-1.585)	0.365
Main current working location		
Accident and Emergency	0.513(0.123-2.145)	0.361
Adult ICU	0.206(0.064-0.663)	0.008
Paediatric ICU	5.537(0.320-95.927)	0.240
Medical wards	0.649(0.184-2.282)	0.500
Outpatients department	1.839(0.528-6.408)	0.339
Obstetrics and Gynaecology	0.600(0.195-1.842)	0.372
Paediatric wards	ref	
Surgical wards	0.737(0.263-2.064)	0.561
Theatre	0.621(0.185-2.086)	0.441
Working shifts		
Day shift	ref	
Night shift	0.314(0.135-0.734)	0.007
Both (Day & Night)	1.502(0.616-3.661)	0.371
Permanent Part time	0.196(0.019-2.032)	0.172
Nursing experience (years)	1.016(0.990-1.043)	0.237
Carrying/Lifting: Frequently	3.704(1.852-7.407)	<0.001

Table 11 outlines a summary of factors associated with LBP in this study sample. Overall, on multivariate logistic regression analysis, both working in the adult ICU (aOR: 0.206; 95% CI: 0.064-0.663) and working night shifts (aOR: 0.314; 95% CI: 0.135-0.734) were found to be protective factors. However, carrying, lifting, or moving heavy materials and equipment (aOR: 3.704; 95% CI: 1.852-7.407) was a risk factor strongly associated with LBP.

4. DISCUSSION

4.1. Prevalence of low back pain

Low back pain among registered nurses is a multifactorial and debilitating disorder with high prevalence, exerting a huge socioeconomic burden on individuals and healthcare systems.

This study showed that almost three quarters of registered nurses at Tygerberg hospital suffered low back pain in the preceding 12 months. A review of numerous epidemiological studies assessing the prevalence of low back pain among nurses in different hospital settings showed the LBP 12-month prevalence ranging from 44.1% in Nigeria, 59% in South Africa, 68.6% in Botswana, 68.9% in Zambia, 61,3% in Saudi Arabia and a highest of 82,6% in Japan (5)(6)(7)(34)(35)(36). Our results were comparable with those of Smith et al of Korea, Karahan et al of Turkey and Mwilila et al of Tanzania who respectively found a 12-month period prevalence of LBP of 72.4%, 77.1% and 73.7% among nurses(29)(37)(38), but higher than that in the two studies recently conducted in South Africa, which showed 12-month period prevalences of LBP of 58% and 59% respectively (7)(39). The absence of objective criteria to define low back pain could be the source of such great inter-study variability.

Other possible explanations for the variation between studies could include an element of recall bias, since respondents were asked to report events occurring over a span of one year. Additionally, the estimation of prevalence could be biased by the healthy worker survivor effect (HWSE) (40), when healthy workers continue to work and unhealthy workers leave employment prematurely or are reassigned to less hazardous work because of their poor health. If this effect is present in our workforce, the actual prevalence may be even higher. The healthy worker effect may also be applied in cases where the least healthy employees transfer from higher to lower exposed jobs within the same workplace, when the exposure is recognized as a contributor to impaired health. Methods for mitigating HWSE vary and may require complex computations beyond the scope of this study. Control of these effects in longitudinal studies tend to involve one or more factors, including: age at hire, employment duration, employment status, time since hire, and age at risk (41). Methods have typically involved confounding control by restriction, by matching (stratifying), or by covariate adjustment. HWSE was not adequately addressed in this cross-sectional study, since the focus was limited to the current work status only. Another important consideration is to determine whether the high prevalence seen in

our study could be explained by the specific work setting (a tertiary hospital) and whether it is associated with specific risk factors that results in a higher prevalence than in other settings. This aspect in particular should be examined in future studies.

4.2. Demographic factors associated with low back pain

A systematic discussion of the descriptive analysis of the demographic variables from our study is explored below with appropriate comparators.

Age

Although the median age in our study sample was high and reflects an aging nursing workforce, our study did not show any significant association between age group and the presence of LBP (Table 5). Other studies in similar low resource settings(5)(8) also showed no significant association between age and LBP. However, it is generally acknowledged that increased age may infer increased duration of exposure and older workers are even more likely to develop other age-related (degenerative) risk factors. Such an association was indeed found in other studies, which showed a significant association between age group and LBP(6)(7)(42).

Gender

Most of the participants were female nurses, which was in keeping with the male to female ratios in similar studies worldwide(43)(44). The fact that most participants were females was expected and reflects the historical gender imbalance within the nursing fraternity countrywide (7)(19)(24) . Gender was not found to be a factor associated with LBP in our study . However, this result should be interpreted with caution, due to the low number of males participating in our study.

Body Mass Index (BMI)

Several studies in nursing populations found obesity to be associated with LBP (7)(8)(24). Surprisingly, in this study BMI had no direct association with the prevalence of LBP as an independent variable, even though we retained it as a potential confounder in the multivariate logistic regression.

4.3. Workplace factors associated with low back pain

4.3.1 Job profile of study participants

In our study, there were no statistically significant differences between the prevalence of low back pain by nursing category, current work area, length of service and participation in clinical rotations. This was at variance with the two studies done in

Nigeria and South Africa previously(7)(45). Dlungwane et al. in a study conducted in KwaZulu Natal (South Africa) reported a higher prevalence among enrolled nurses (54%), respondents aged 30 – 39 years (46%), overweight respondents (58%), and those working in Obstetrics and Gynaecology (49%). Bending, sustained postures and transferring patients were strongly associated with LBP. Nurses with more than 20 years in the profession reported a high prevalence of LBP. The prevalence of LBP was higher among the participants who were on six-monthly rotations (76%) compared to those on yearly rotation (16%) (7).

In a study conducted at another tertiary hospital in South Africa, Madiba et al. reported that nurses working 12-hour shifts had an increased risk of MSKDSs when compared to those working 8-hour shifts(39).

In our current study, working in adult Intensive Care Units (ICU) had a protective effect for LBP and there was no statistically significant difference between those nurses working 12-hour shifts when compared with those working 8-hour shifts. These disparities in study findings may potentially present selection bias due to the healthy worker survival effect as mentioned above. Thus, risk assessors must evaluate the likelihood of survivor effects on the basis of spatial and temporal relationships between employment, exposure, and outcome. This could help explain the higher proportions of low back pain in work areas like the Outpatients Department, which are generally perceived to have less physically demanding lifting and carrying of loads. Over the years, there could have been an unintended pooling of nurses with low back problems that were alternatively placed to work in OPD as a result of recommendations from the Occupational Health Specialist Clinic for reasonable accommodation while recuperating from a low back morbidity. In this study there is a clear potential for the outcome (LBP) to influence work status. This may have resulted in underestimating disease prevalence in those exposed and subsequently overestimating prevalence among the unexposed persons at the time of the occupational cross-sectional health survey.

4.3.2 Prevalence and consequences of low back pain

In this study a high number of the respondents reported having experienced musculoskeletal symptoms in any one region of their bodies in the 12 months prior to the survey, giving a self-reported 12-month period prevalence of 89.3% for MSKD at any body region. This was in keeping with other studies carried out in tertiary institutions in similarly resource-limited settings in Africa. The 12-month period prevalence of MSKD in any body region in Nigeria, Uganda, Zambia and Zimbabwe

were 78.0%, 80.8%, 68.9%, and 82.1% respectively (5)(8)(43)(45). Very few participants in our study denied having any MSKD symptoms in the preceding 12 months, suggesting a very high prevalence of MSKDs among the registered nurses.
The lower back was the most commonly affected body region in our study. This was in keeping with some studies in similar low resource settings(8)(24)(46). Although LBP was the most commonly affected body region in our study, other studies had different findings. A study conducted on Japanese nurses showed that MSKDS was most commonly reported at the shoulders (71.9%), followed by the lower back (71.3%) and the neck (54.7%)(35). In contrast, a study conducted among nurses at a tertiary centre in Zambia found that MSKDS were most commonly reported at the ankles/feet (54.9 %), followed by the lower back (53.3%) and shoulders (29.9%)(5). These variations in the distribution of MSKDSs per body region may be attributed to an overlap of multiple factors which include personal demographic characteristics, physical job demands and availability of mechanical lifting aides in the different healthcare work environments.

4.3.3 Night Duty

In our study, working night shift had a protective effect for LBP (Table 7). Nurses with LBP were more likely to have worked on day shifts compared to those without LBP. This was in keeping with a number of studies that reported that working on a day shift was a risk factor for low back problems (39)(44)(47)(48). Lagerström et al. suggested that day shifts were a risk factor for LBP because during day shifts, nurses perform more patient handling activities and have higher physical demands than nurses on night shifts (49). In our case, this could also be explained by the fact that due to the limited number of nursing staff on duty overnight certain activities like wound dressing, receiving and handling of material stocks and supplies to the ward were not carried out during night shifts. The core activities of the evening shift are to give medications, carry out observations and monitor the condition of admitted patients overnight. Except for new admissions and emergency cases, most elective procedures are deferred until dayshift when all the other departments in the hospital are open and fully functional. Nurses who exclusively work night shift are thus exposed to relatively less physical job demands compared to those working day shifts. However, this was at variance with Choobineh et al., who found that nurses working on rotating shifts had

a 2 to 3 times increased risk of developing MSKDSs compared to the non-shift workers(28).

These findings may suggest that, regardless of the time of the shift, shift work itself maybe a risk factor for LBP. Therefore, for future research, nurses' work schedules (e.g. working hours, overtime, on-call) need to be examined as a factor influencing back pain(4). Our study did not evaluate the effect of additional work being done by nursing personnel ("moonlighting"). Such additional work may be associated with increased exposure risk and is worthy of further study.

4.3.4 Carrying, lifting or moving of heavy materials and equipment

Several studies have implicated manual handling of patients as predictors of MSKDSs, specifically LBP among nurses(35)(43)(50)(51). However, in our current study there was no significant association between LBP and the actual manual handling of patients. This could be explained by the increased awareness from their training curriculum focused on back protection and better lifting techniques as regards direct patient handling e.g., turning patients in bed and transferring patient from bed to chair etc. These concepts are further emphasized during the induction training programme for newly recruited nurses.

Surprisingly, our study found a strong association between LBP and the carrying, lifting, or moving of heavy materials and medical equipment (e.g., laden trolleys) by the nurses. Similar findings were previously reported from a study in Uganda conducted at a tertiary hospital in a similarly resource limited setting. This could be explained by the prevailing chronic staff shortages where multi-tasking is the order of the day. The presence and use of old trolleys in the wards that are made of heavy base metal frames that are already heavy before being laden with any materials to be moved could also be contributory.

Schlossmacher et al. in a systematic review study focusing on low back injuries related to nursing professionals' working conditions showed that the prevalence of low back pain symptoms was approximately between 15% and 72% and the main risk factor was the transfer of the patient from bed to chair (52). Retsas et al. reported that about two thirds (67.6%) of all manual handling injuries were associated with direct patient care activities and another third (32.4%) with non-direct patient care activities(51)

Many nurses accept that low back pain is "part of the job", and they learn to live with the problem(53). These authors remarked that nurses also take substantially (about

40%) less sick leave than the general population. However, sick leave due to LBP is much higher in the nursing profession (about 30% more), than the general population. Videman et al. concluded that nurses with better patient handling skills are at a lower risk of sustaining a low back injury, compared to those with poor patient handling skills(54).

Harber et al. reported that not only general nursing tasks contributed to the incidence of LBP(55). Other risky occupational activities included moving (carrying and pushing) furniture, equipment and beds, particularly in smaller, cramped wards, standing, walking, stooping and job frustration(55).

Most of the beds in the hospitals are not height adjustable, therefore ordinary routine nursing tasks are mostly performed in static, fixed and awkward postures e.g., taking a blood sample or passing a urinary catheter. These postures adopted by nurses during daily routine tasks cause unnecessary postural stress(56). Fixed height beds place severe anthropometric constraints on nursing staff as far as fixed and stooped postures are concerned. In the United Kingdom the design of hospital beds is subject to the British Standards publication, BS4886. It requires the height of a fixed height bed to be 610+/-13mm. According to BS5223, spring mattresses should be 160mm thick and foam mattresses between 100 and 150mm, depending on the circumstance (57). According to Pheasant et al, bed height is selected for patient comfort, rather than for nurse safety. The fixed height beds measured in the Western Cape hospitals were 905mm (compared to the effective working height of around 710mm in the UK). This working height is only acceptable for the 5th percentile nurses to perform a lifting or transfer manoeuvre. The delicate tasks could be performed by the taller nurses in the seated position, but it is impossible to get close enough to the patient as it is impossible to get the knees under the bed when the cot-sides are dropped, there is no space for knees under the bed.

Nurses were observed to generally empty urine bags on the floor, which cumulatively entails prolonged stooped static posture. It would be less strenuous to place the urine bag holder on a bedside stool before emptying. Generally, a nurse goes on a ward round emptying the urine bags, this means that she adopts this static, stooped posture several times in a relatively short period of time.

Botha et al. found that forty percent of their sample participants reported that “portable” equipment is too heavy to carry or move around(56). The main pieces of equipment in question were hospital beds, intravenous drip stands (these were also difficult to push, due to “sticking” wheels over some floor surfaces), drug trolleys, oxygen

cylinders and Continuous Passive Motion (CPM) machines. All of the above were also deemed to be uncomfortable shapes to manoeuvre. Most of the time these pieces of equipment are moved or carried by a single nurse on her own.

Twenty-four percent of the sample reported that controls and/or equipment to be too low. The situation of wall plugs under the beds at floor level was a problem in both Leeuwendal as well as Vincent Palotti hospitals. These were both older buildings and those issues have never been addressed by the management. Measuring urine-output when the bag is on the floor, was also noted to be a big problem, as only one nurse normally performs this task, and it is almost impossible to clamp the tube from the patient and measure the output at the same time. Low level storage areas and the lower levels of the trolleys were also considered too low (56). Similar ergonomic concerns were observed among nurses working at Tygerberg hospital as regards poor workstation design, challenges related to bending, lifting and pushing laden trolleys and medical equipment during our study visits to the various work areas. Further research is recommended to clarify the impact of poor workstation design, manual material handling of inanimate objects and medical equipment on the current burden of low back pain among the nurses.

4.4. Other risk factors (i.e. not part of this study)

Several factors including anthropometric characteristics, the nature and severity of physical work, work postures, and methods of manual lifting/handling have been linked to the development of LBP(58). In addition, other aspects such as lifestyle conditions, individual levels of physical exercise, genetics (e.g. in ankylosing spondylitis), socioeconomic status and psychosocial work-related stress factors may also be considered as independent risk factors for the development of low back pain(19)(35)(59)(60). Although psychosocial factors have been identified as more significant predictors of long term disability, our current study seems to suggest that poor ergonomic work stations and work lay-out designs are significant risk factors contributing to the burden of low back pain among the nurses. Further research into the impacts of heavy lifting of inanimate objects e.g. furniture, laden trolleys and medical equipment in the healthcare work environment deserves more focused exploration.

4.5. Strengths and limitations

This is the first study describing the prevalence of low back pain and potential contributory factors at this hospital, hence its findings may shape the focus for further research in our healthcare environment. A strength in this study lies in the fact that in order to avoid selection bias a robust sampling methodology was implemented (simple random sampling) and conducted through a computerized random digit generator to select a random sample of participants from the Human Resources database. Deliberate efforts were made to ensure that the minimal target sample size was recruited, which ensured our study was adequately powered for validity of statistical analyses. With our response rate at 70%, we managed to achieve an adequate sample size from the randomly selected participants. Previously identified confounders from the literature review such as pre-existing back injury, shift work and pregnancy were deliberately included in the questionnaire to verify their degree of association (if any) to LBP among our study participants.

The use of a pre-validated self-administered standardised questionnaire (the modified Nordic Questionnaire (16)) as our investigation tool ensured good reliability and validity. This also allows comparison with other studies using the same tool.

All our study participants were registered nurses with post-matriculation qualifications, hence there was no language barrier limitations when using English language for communication to obtain informed consent and during the completion of the self-administered questionnaires. Only the English version of the questionnaires were used, therefore there was no risk of loss of details in translation. Having presented a short talk on the overview and purpose of this study to our hospital nursing management, there was a good buy-in and support for the project from most line managers. This means that nurses were officially allowed time-slots during their mostly busy working shifts to go through and complete their study survey questionnaires.

However, this study does have a number of potential shortcomings, which requires careful consideration when applying our results in other settings.

First, participants were recruited from a single tertiary hospital which might limit the generarizability of our results.

Second, due to the cross-sectional design, causality cannot be inferred without caution. Although this study has found statistically significant relationships with some variables analyzed, it should be borne in mind that LBP is multifactorial, including

psychosocial and other predictors (19)(35)(59) and this study did not evaluate an exhaustive list of potential causes.

Third, a reasonable proportion of potential study participants were away from duty on sick leave or incapacity leave on the day questionnaires were brought to their work station. As discussed above, the healthy worker effect is a well-documented type of selection bias that occurs in occupational studies and it is foreseeable that (given the high prevalence of LBP in this population) a number of personnel may have been absent as a result of the outcome of interest in this study. Our study may therefore underestimate the true prevalence. Further research, beyond the scope of this study, is required to explore the real proportion of absenteeism attributable to low back pain.

Finally, even though some confounding variables were deliberately included (in Section F) and adjusted for in multivariate analysis, our results might still be affected by some potential confounding factors such as psychosocial work-related stress, other lifestyle habits e.g. individual levels of physical exercises (hobbies, sports etc.) or socioeconomic status that were not considered in this study.

5. CONCLUSION AND RECOMMENDATIONS

This study indicates a very high 12-month period prevalence of LBP among nurses at our tertiary hospital. Although several studies have implicated direct manual handling of patients' physical loads and work-related psychosocial risk factors as predictors of MSKDSs and LBP among nurses, our current study findings suggest that heavy lifting, carrying or moving of inanimate materials and medical equipment (e.g. laden trolleys, beds, oxygen cylinders etc.) are strongly associated with LBP. Further research focusing on the impacts of poor workstation design, challenges related to frequent bending, working in awkward postures, manual material handling of inanimate objects and medical equipment on the prevalence of LBP among the nurses is recommended. Back safety training education programs with a broader focus beyond just lifting techniques and manual patient handling may increase the nurses' ergonomics risk awareness.

Implications for practice and/or policy recommendations

- Preventive measures should be implemented to reduce the risk of LBP, such as educational programmes to teach the proper use of body mechanics, lifting technique together with an increased awareness of safety hazards as regards manual handling and lifting of inanimate objects and medical equipment for nurses.
- Ergonomic assessment of work place risk factors and the greater use of back care interventions are recommended.
- Further studies should be conducted to evaluate the possible benefits of work-based exercise programmes and the value of psychosocial support for those with LBP.

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7. ADDENDA

Addendum A - Ethics Approvals

A.1. – Ethics Approval (HREC)

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

Approval Notice

New Application

10/04/2019

Project ID :8406

HREC Reference # S18/10/202

Title: The prevalence and associated risk factors of lower back pain among registered nurses at Tygerberg Hospital, South Africa: A cross-sectional Study.

Dear Dr Geoffrey Tafaune,

Your response to stipulations on your **New Application** received on 03/04/2019 00:27 were reviewed by members of **Health Research Ethics Committee** via **expedited** review procedures on 10/04/2019 and approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: 04 February 2019 to 03 February 2020

Please remember to use your project ID (8406) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review

Translation of the informed consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC.

Please note you can submit your progress report through the online ethics application process, available at: Links Application Form Direct Link and the application should be submitted to the HREC before the year has expired. Please see *Forms and Instructions* on our HREC website (www.sun.ac.za/healthresearchethics) for guidance on how to submit a progress report.

The HREC will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website https://applyethics.sun.ac.za/ProjectView/Index/8406

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

Yours sincerely,

Mrs. Melody Shana ,

Coordinator,

HREC1

National Health Research Ethics Council (NHREC) Registration Number:

REC-130408-012 (HREC1)•REC-230208-010 (HREC2)

Federal Wide Assurance Number: 00001372
Office of Human Research Protections (OHRP) Institutional Review Board (IRB) Number:
IRB0005240 (HREC1)•IRB0005239 (HREC2)

The Health Research Ethics Committee (HREC) complies with the SA National Health Act No. 61 of 2003 as it pertains to health research. The HREC abides by the ethical norms and principles for research, established by the World Medical Association (2013). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects;the South African Department of Health (2006). Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa (2nd edition); as well as the Department of Health (2015). Ethics in Health Research: Principles, Processes and Structures (2nd edition).

The Health Research Ethics Committee reviews research involving human subjects conducted or supported by the Department of Health and Human Services, or other federal departments or agencies that apply the Federal Policy for the Protection of Human Subjects to such research (United States Code of Federal Regulations Title 45 Part 46); and/or clinical investigations regulated by the Food and Drug Administration (FDA) of the Department of Health and Human Services.

A.2. – WCG - DOH Permission to conduct research at Tygerberg Hospital

Western Cape Government
Health

TYGERBERG HOSPITAL
REFERENCE:
Research Projects
ENQUIRIES: **Dr GG Marinus**
TELEPHONE:**021 938 5752**

Project ID: 8406

Ethics Reference: S18/10/202

TITLE: **The prevalence and associated risk factors of lower back pain among registered nurses at Tygerberg Hospital, South Africa: A cross-sectional Study.**

Dear Dr Geoffrey Tafaune

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL.

1. In accordance with the Provincial Research Policy and Tygerberg Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Tygerberg Hospital.

2. Researchers, in accessing Provincial health facilities, are expressing consent to provide the Department with an electronic copy of the final feedback within six months of completion of research. This can be submitted to the Provincial Research Co-Ordinator (Health.Research@westerncape.gov.za).

DR GG MARINUS
MANAGER: MEDICAL SERVICES

DR D ERASMUS
CHIEF EXECUTIVE OFFICER
Date: 5 April 2019

Administration Building, Francie van Zijl Avenue, Parow, 7500 Private Bag X3, Tygerberg, 7505
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Project ID: 8406

Ethics Reference: S18/10/202

TITLE: **The prevalence and associated risk factors of lower back pain among registered nurses at Tygerberg Hospital, South Africa: A cross-sectional Study.**

BY _____

An authorized representative of Tygerberg Hospital

NAME Dr DS Erasmus

TITLE CEO

DATE 5 April 2019.

Addendum B - Research Tools

B.1. – The Questionnaire

MUSCULOSKELETAL DISORDERS IN HEALTHCARE WORKERS QUESTIONNAIRE

Number of questionnaire:

1	2	3

All information herewith provided will be treated confidentially. It is not necessary to indicate your name in this questionnaire.

INSTRUCTIONS

1 Please answer all questions by providing an "X" in the box corresponding to the chosen alternative or by making a numerical entry in the space provided(e.g. for age, weight and height) as specified.
2 Please answer all questions as honestly, frankly and objectively as possible.
3 Answer according to your own personal opinion and experience.
4 Hand in the questionnaire to the researcher immediately after completion.

SECTION A: DEMOGRAPHIC DATA

1 What is your current age in years? ☐ Years.

2 What is your sex?

Gender		Answer
2.1	Male	☐
2.2	Female	☐

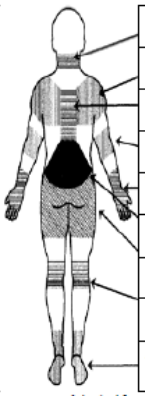
3 What is your Body Weight and Height?

Self-measured parameter		Answer
3.1	Weight (in Kilograms)	
3.2	Height (in centimetres)	

SECTION B. MODIFIED NORDIC QUESTIONNAIRE ON MSKDS

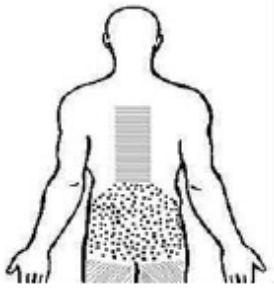
4. MUSCULOSKELETAL DISORDERS SURVEY

Please answer by putting a cross in the appropriate –one cross for each question. Please answer every question even if you have never had trouble in any parts of your body. This picture shows how the body has been divided.
You should decide for yourself which part (if any) is or has been affected.



	Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of trouble in:	During the last 12 months have you seen a physician for this condition	During the last 7 days have you had trouble in:
NECK	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
SHOULDERS	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
UPPER BACK	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
ELBOWS	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
WRISTS/HANDS	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
LOWER BACK	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
HIPS/THIGHS	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
KNEES	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes
ANKLES/FEET	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes	☐No ☐Yes

Adapted from: Kuorinka, Ilkka, et al. "Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms." Applied ergonomics 18.3 (1987): 233-237.



5. LOW BACK SURVEY

How to answer the questionnaire: In this picture you can see the approximate position of the part of the body that is being referred to in the questionnaire. By low back trouble is meant ache, pain or discomfort in the dotted area whether or not it extends from there to one or both legs (sciatica).
Please answer by putting a cross in the appropriate box – one cross for each question. You may be in doubt as to how to answer, but please do your best anyway.

1. Have you ever had low back trouble (ache/ pain/ discomfort)?

No | Yes

If "No" to question 1, please go to Section C

2. Have you ever been hospitalized because of low back trouble?

No | Yes

3. Have you ever had to change jobs or duties because of low back trouble?

No | Yes

4. What is the total length of time that you have had low back trouble during the last 12 months?

0 days | or | 8 – 30 days | 1 – 7 days | >30 days, but not every day | Every day

If "0 days" to question 4, please go to Section C

5. Has low back trouble caused you to reduce your activity during the last 12 months:

a. Work activity (at home or away from home)?

No | Yes

b. Leisure activity?

No | Yes

6. What is the total length of time that low back trouble has prevented you from doing your normal work (at home or away from home) during the last 12 months?

0 days | 8 – 30 days | 1 – 7 days | >30 days

7. Have you been seen by a doctor, physiotherapist, chiropractor or other such person because of low back trouble during the last 12 months?

No | Yes

8. Have you had low back trouble at any time during the last 7 days?

No | Yes

4. What is the total length of time that you have had low back trouble during the last 12 months?

Adapted from: Kuorinka, Ilkka, et al. "Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms." Applied ergonomics 18.3 (1987): 233-237.

SECTION C: OCCUPATIONAL EXPOSURE ASPECTS

6. What is your current working designation?

Indicate the working category of nursing that you currently fall under?	Answer
6.1 Enrolled Nurse Assistant	☐
6.2 Staff Nurse	☐
6.3 Professional General Nurse (Non-managerial)	☐
6.4 Professional Specialty Nurse (Non-managerial)	☐
6.5 Nurse Manager	☐

7. How long have you actively worked in the nursing profession?
_____ Years

8. Main current working environment (choose one only):

In which hospital unit or section are you **mainly** working?	Answer
8.1 Medical wards	☐
8.2 Surgical wards	☐
8.3 Intensive Care Units(ICU)- Paeds	☐
8.4 Intensive Care Unit (ICU)- Adults	☐
8.5 Theatre	☐
8.6 Accident and Emergency	☐
8.7 Paediatrics	☐
8.8 Obstetrics and Gynaecology	☐
8.9 Out Patients Department(OPD)	☐

9. Working hours per shift.

Which of the following closely describes your current working shifts?	Answer
9.1 8 Hours per day, e.g.(07:00 – 16:00hrs)	☐
9.2 12 Hours per day, e.g.(07:00 – 19:00hrs)	☐
9.3 Night Shift, e.g.(19:00 – 07:00hrs)	☐
9.4 Works both Day and Night Duty (4 – 6 months/Year)	☐
9.5 Permanent Part-time Shifts (07:00 – 13:00hrs)	☐

10. Which of the following would best describe your clinical rotations?

10.1. three-monthly rotation	☐
10.2. six-monthly rotation	☐
10.3. yearly rotation	☐
10.4. permanently work in this clinical area	☐

11. How often do you perform the following nursing tasks which entail working in awkward posture? Please indicate the frequency of each activity by putting an "x" in the most appropriate box.

Work-related activity / Job factor	Typical posture	Answer					
		Never	Very Rarely	Rarely	Occasionally	Very Often	Always
11.1 Bed making		☐	☐	☐	☐	☐	☐
11.2 Dressing help		☐	☐	☐	☐	☐	☐
11.3 Record keeping and documentation		☐	☐	☐	☐	☐	☐
11.4 Medicine preparation		☐	☐	☐	☐	☐	☐
11.5 Blood sampling / injecting medicine		☐	☐	☐	☐	☐	☐
11.6 Drips and intravenous infusions		☐	☐	☐	☐	☐	☐
11.7 Body position change		☐	☐	☐	☐	☐	☐
11.8 Eating help / tube feeding		☐	☐	☐	☐	☐	☐
11.9 Patient transfer or lifting dependent patient		☐	☐	☐	☐	☐	☐
11.10 Carrying, lifting, or moving heavy materials or equipment (e.g. Laden trolleys).		☐	☐	☐	☐	☐	☐

SECTION D: PERCEPTION OF RISK FACTORS FOR MUSCULOSKELETAL DISORDERS AMONG THE NURSES

12. This list describes things at work that could contribute to job-related lower back pain and injury. Please mark with an "X" on the line (see example), how much of a problem (if any) each item contributes to employees with back pain in your working environment? Where 0 is no contribution and 10 is major contribution.

Work-related activity / Job factor	Problem severity score Example: —X—
12.1 Treating an excessive number of patients in 1 day	No contribution 0 —— 10 Major contribution
12.2 Not enough rest breaks or pauses during the work shift	No contribution 0 —— 10 Major contribution
12.3 Working in the same positions for long periods (e.g. standing, bend over, sitting)	No contribution 0 —— 10 Major contribution
12.4 Continuing to work while injured or hurt	No contribution 0 —— 10 Major contribution
12.5 Unanticipated sudden movement or fall by patient	No contribution 0 —— 10 Major contribution
12.6 Work scheduling (overtime, irregular shifts, length of workday)	No contribution 0 —— 10 Major contribution

SECTION E: OUTCOME VARIABLES

13. How often do you consult a healthcare practitioner for a lower back pain problem?

☐ Never ☐ Yearly ☐ Monthly ☐ Weekly ☐ Daily

14. What was the highest level of intervention that you have had for a back problem? (pick only one)

Treatment/ intervention	Answer
14.1 I have never required treatment/ intervention	☐
14.2 Self-medicated	☐
14.3 Seen a GP/ physio with no further referral	☐
14.4 Referred to another GP/ physio for treatment	☐
14.5 Referred to (one or more) specialist(s)	☐
14.6 Had an operation	☐
14.7 Had multiple operations and interventions	☐

15. Which of the following applies to you (mark all that apply)?

Other actions taken	Answer
15.1 I continue working with lower back pain	☐
15.2 I regularly take sick leave for lower back pain	☐
15.3 I submitted a claim to the Workmen's Compensation for lower back injury on duty	☐
15.4 I have changed my area of practice within the profession as a result of a lower back injury	☐
15.5 Modified my patient lifting / transfer technique as a result of lower back injury	☐
15.6 Attended a "Back Safety Training Program"	☐
15.7None of the above applies to me	☐

SECTION F: CONFOUNDING VARIABLES

16. Please indicate whether any of the following may apply to you:

	No	Yes	If, yes: describe
16.1. Did you have any pre-existing back condition (scoliosis/ slipped disc/ etc.) BEFORE you started your nursing career?			
16.2. Have you suffered any back injury (e.g. car accident/ sports injury/ etc.) BEFORE you started your nursing career?			
16.3. Have you ever suffered a back injury DURING your nursing career, which was NOT related to your nursing work (e.g. sports injury/ car accident/ etc.)			
16.4. Are you currently pregnant?			
16.5. Other (please specify)			

THANK YOU FOR YOUR PARTICIPATION

B.2. – Participant Information Leaflet and Informed Consent Form

PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT: THE PREVALENCE AND ASSOCIATED OCCUPATIONAL RISK FACTORS OF LOWER BACK PAIN AMONG REGISTERED NURSES AT TYGERBERG HOSPITAL, SOUTH AFRICA: A CROSS-SECTIONAL STUDY.

REFERENCE NUMBER: S18/10/202

PRINCIPAL INVESTIGATOR: GEOFFREY TAFAUNE

ADDRESS: Occupational Health Clinic, 8th Floor C8CW
Tygerberg Hospital,
Private Bag X3, Tygerberg
Western Cape, 7505.

CONTACT NUMBER: Tel: 0219386282. Cell: 0723220436

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the study staff or doctor any questions about any part of this project that you do not fully understand. It is essential that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary**, and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

- This study aims to see how big the problem of lower back pain in nurses at Tygerberg Hospital is and to identify work-related risk factors.
- Using the HR database, we aim to randomly select 360 nurses who are employed in various departments in Tygerberg Hospital. Each person will complete a questionnaire, which takes approximately 10 minutes. The questionnaire contains questions about back problems, as well as work activities that may cause back problems.

Why have you been invited to participate?

- Nurses who are working at Tygerberg Hospital may be part of this study. You are one of the nurses who was randomly selected (by a computer programme) to participate in this study.

What will your responsibilities be?

- You only need to complete the self-administered questionnaire honestly and truthfully to the best of your ability.

How long will you take part in this research?

- It will take approximately 10 - 15 minutes to complete the questionnaire.

Will you benefit from taking part in this research?

- You will not be paid to take part in this research project. However, we hope that we can identify work-related risk factors that could be addressed to make sure that fewer nurses struggle with their backs at work.

Are there any risks involved in your taking part in this research?

- There are no risks or discomforts anticipated in this research.

If you do not agree to take part, what alternatives do you have?

- This survey is, and you can decide to not participate in this study.

Who will have access to your medical records?

- We will not access any of your medical records. The only records for this study will be the questionnaire that is completed. All the information collected will be treated as confidential and protected.

Will you be paid to take part in this study and are there any costs involved?

- No, you will not be paid to take part in the study survey. There will be no costs involved for you if you do take part.

Is there anything else that you should know or do?

- You can contact Dr. Geoffrey Tafaune at **Telephone: 021-938 5171** if you have any further queries or encounter any problems.
- You can contact the Health Research Ethics Committee at **021-938 9207** if you have any concerns or complaints that have not been adequately addressed by your study investigator.
- You will receive a copy of this information and consent form for your records.

Declaration by participant

By signing below, I ……..…….. agree to take part in a research study entitled *(The prevalence and associated occupational risk factors of lower back pain among registered nurses at Tygerberg Hospital, South Africa: a cross-sectional study).*

I declare that:

- I have read or had read to me this information and consent form, and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions, and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
- I may be asked to leave the study before it has finished if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) ……..…….. on (*date*) ……..…….. 2019.

…….. ……..

Signature of Participant **Signature of witness**

Declaration by investigator

I *(name)* ……..…….. declare that:

- I explained the information in this document to……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) ……..…….. on (*date*) ……..…….. 2019.

Declaration by interpreter

I *(name)* ..... declare that:

- I assisted the investigator (*name*) ..... to explain the information in this document to (*name of participant*) ..... using the language medium of Afrikaans/Xhosa.

- We encouraged him/her to ask questions and took adequate time to answer them.
- I conveyed a factually correct version of what was related to me.
- I am satisfied that the participant fully understands the content of this informed consent document and has had all his/her question satisfactorily answered.

Signed at (*place*) ..... on (*date*) .....

....

Signature of interpreter **Signature of witness**