

UNIVERSITY OF SÃO PAULO
RIBEIRÃO PRETO COLLEGE OF NURSING

NOELHI HERMES PUNCH

**WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG NURSES AT THE
GEORGETOWN PUBLIC HOSPITAL CORPORATION IN GUYANA.**

RIBEIRÃO PRETO

2020

NOELHI HERMES PUNCH

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THE GEORGETOWN PUBLIC HOSPITAL CORPORATION IN GUYANA.**

Dissertation presented to the University of de São Paulo
at Ribeirão Preto College of Nursing to obtain the title
of Master of Science, Postgraduate Program in
Fundamental Nursing.

Line of Research: Occupational Health Nursing

Supervisor: Prof. Dr. Fernanda Ludmilla Rossi Rocha

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2020

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DEDICATION

I dedicate this research to my wonderful family, who has been there for me throughout my academic journey and has showered me with their love, support, and continual prayers. Also, to my friends and best friend 'King Elijah' who has inspired and motivated me to pursue my dreams, stay focus, and work hard towards my goals because winners never quit and quitters never win. These principles I apply to my life daily, and I am truly grateful for all of these spectacular people who have contributed to my success. I love you all, and I thank God for blessing me with all of you!

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“Change is the end result of all true learning.”

(Leonardo Leo Buscaglia)

ABSTRACT

Punch, N.H. **Work-related musculoskeletal disorders among nurses at the Georgetown Public Hospital Corporation in Guyana.** 2020. 136p. Master (Dissertation) - University of São Paulo, Ribeirão Preto College of Nursing, Ribeirão Preto, 2020.

Nurses are affected by work-related musculoskeletal disorders (WMSD), which are related to the work activities performed during nursing practice. Therefore, the purpose of this quantitative, descriptive, cross-sectional study was to investigate the occurrence of work-related musculoskeletal disorders among Registered Nurses (RN) and Nursing Assistants (NA) working at the Georgetown Public Hospital Corporation (GPHC), Guyana. A total of 271 nurses (185 RN and 86 NA) participated in the study, and data collection was performed using an instrument to the characterization of the nurses and the Nordic Musculoskeletal Questionnaire (NMQ). The Integrated Model of WMSD was used as the theoretical framework of this research. The study findings revealed that female nurses were more affected by WMSD than male nurses, and the younger nurses with shorter years of experience were the most affected by WMSD. Also, most of the nurses were of African descent, single, had children, and had a diploma in nursing as their highest level of education. The prevalence of WMSD over the last 12 months was 91.5% among the RN and NA, most of the RN (63.1%) and NA (28.4%) reported WMSD, and 28.0% of the nurses reported sick or absent from work, but only 25.1% of the nurses visited a physician because of the problem. More so, 55.0% of the study participants reported body mechanics ergonomics (BME) training, and 82.3% of the nurses accepted that they need BME training. The most commonly affected body region in the last 12 months was the lower back (72.0%), followed by the neck (49.1%), shoulders (37.7%), legs (37.6%), wrist/hands (33.9%), knees (33.2%), upper back (32.5%), hips/buttocks (18.5%), and elbows (4.8%). Also, the most commonly affected site in the last week was the lower back (50.2%), followed by the neck (27.3%), legs (26.2%), upper back (23.2%), shoulders (20.3%), knees (19.2%), wrist/hands (18.8%), hips/buttocks (11.1%), and elbows (3.7%), and there was a significant decrease in the prevalence of WMSD among the nurses in the last week compared to the last 12 months. Most of the nurses were unable to carry out relaxation activities in the last 12 months because of musculoskeletal pain in all nine regions of their bodies. Lower back pain was most prevalent among the nurses working in the Medical/Surgical Units (35.1%), Emergency and Intensive Care Units (22.9%), and Pediatric Units (10.7%). Statistically significant associations (at the 0.05 significant level) were found between sex and WMSD in the last 12 months for the upper back and one/both legs, sex and job demands and social support in the last 12 months and last week. Also, significant associations were found between age and WMSD in the last 12 months for the hips/buttocks region of the body, and between nursing category and WMSD in the last 12 months for the neck region. More so, statistically significant associations were found between ward and WMSD in the last 12 months and last week for the neck, lower back, and shoulders, between education level and WMSD in the last 12 months in the neck, in one/both knees, and one/both legs, and between years of employment and WMSD in the last 12 months and last week in one/both legs. Therefore, we concluded that there was a high prevalence of WMSD among the nurses at the GPHC, and lower back pain was the most common type of WMSD. Therefore, more research is needed to develop health promotion programs at work in the GPHC.

Keywords: Occupational Health; Nursing; Cumulative Trauma Disorders; Work-related Musculoskeletal Disorders.

RESUMO

Punch, N.H. **Distúrbios osteomusculares relacionados ao trabalho entre enfermeiras do Georgetown Public Hospital Corporation na Guiana**. 2020. 136p. Mestrado (Dissertação) - Universidade de São Paulo, Escola de Enfermagem de Ribeirão Preto, Ribeirão Preto, 2020.

Profissionais da enfermagem são afetados por distúrbios osteomusculares relacionados ao trabalho (DORT), os quais estão relacionados às atividades laborais realizadas durante a prática de enfermagem. Portanto, o objetivo deste estudo quantitativo, descritivo e transversal foi investigar a ocorrência de distúrbios osteomusculares relacionados ao trabalho (DORT) entre enfermeiros registrados (RN) e assistentes de enfermagem (NA) que trabalhavam no Georgetown Public Hospital Corporation, Guiana (GPHC). Participaram do estudo 271 enfermeiros (185 RN e 86 NA) e a coleta de dados foi realizada utilizando-se um instrumento de caracterização dos enfermeiros e o Nordic Musculoskeletal Questionnaire (NMQ). O Modelo Integrado de DORT foi utilizado como referencial teórico nesta investigação. Os resultados revelaram que as mulheres foram mais afetadas por DORT do que enfermeiros do sexo masculino; enfermeiros mais jovens e com menor tempo de experiência foram os mais afetados por DORT. Além disso, a maioria dos enfermeiros eram afrodescendentes, solteiros, tinham filhos e possuíam diploma em enfermagem como nível de escolaridade mais elevado. A prevalência de DORT nos últimos 12 meses foi de 91.5% entre os enfermeiros do GPHC, a maioria dos RN (63.1%) e NA (28.4%) relataram DORT e 28.0% relataram doença ou ausência do trabalho; porém, apenas 25.1% dos enfermeiros consultaram o médico devido ao problema. Além disso, 55,0% dos participantes relataram possuir treinamento em ergonomia de mecânica corporal (BME) e 82.3% referiram que necessitavam deste treinamento. A região corporal mais afetada nos últimos 12 meses foi a região lombar (72.0%), seguida do pescoço (49.1%), ombros (37.7%), pernas (37.6%), punho/mãos (33.9%), joelhos (33.2%), parte superior das costas (32.5%), quadris/nádegas (18,5%) e cotovelos (4,8%). Além disso, o local mais comumente afetado na última semana foi a parte inferior das costas (50.2%), seguido pelo pescoço (27.3%), pernas (26.2%), parte superior das costas (23.2%), ombros (20.3%), joelhos (19.2%), punho/mãos (18.8%), quadris/nádegas (11.1%) e cotovelos (3.7%), e houve uma diminuição significativa na prevalência de DORT entre os enfermeiros na última semana em comparação com os últimos 12 meses. A maioria dos enfermeiros não conseguiu realizar atividades de relaxamento nos últimos 12 meses devido a dores osteomusculares em todas as nove regiões do corpo. A dor lombar foi mais prevalente entre os enfermeiros que atuam em Unidades Médicas/Cirúrgicas (35.1%), Unidades de Emergência e Terapia Intensiva (22.9%) e Unidades Pediátricas (10.7%). Associações estatisticamente significativas (nível de significância de 0.05) foram encontradas entre sexo e DORT nos últimos 12 meses para a parte superior das costas e uma/ambas as pernas e entre sexo e demandas de trabalho e suporte social nos últimos 12 meses e na última semana. Também foram encontradas associações entre idade e DORT nos últimos 12 meses para a região do quadril/nádegas do corpo e entre categoria profissional e DORT nos últimos 12 meses para a região do pescoço. Além disso, associações estatisticamente significativas foram encontradas entre local de trabalho e DORT nos últimos 12 meses e na última semana para o pescoço, parte inferior das costas e ombros, entre nível de escolaridade e DORT nos últimos 12 meses no pescoço, em um/ambos os joelhos e uma/ambas as pernas e entre tempo de emprego e DORT nos últimos 12 meses e na última semana em uma/ambas as pernas. Portanto, conclui-se que houve alta prevalência de DORT entre os enfermeiros do GPHC, sendo a lombalgia o tipo mais comum de DORT. Deste modo, considera-se que outras

investigações são necessárias para o desenvolvimento de programas de promoção da saúde no trabalho no GPHC.

Palavras-chave: Saúde do Trabalhador; Enfermagem; Transtornos Traumáticos Cumulativos; Distúrbios Osteomusculares Relacionados ao Trabalho.

RESUMEN

Punch, N.H. **Trastornos musculoesqueléticos relacionados con el trabajo entre enfermeras de la Corporación de Hospitales Públicos de Georgetown en Guyana.** 2020. 136p. Maestría (Disertación) - Universidad de São Paulo, Facultad de Enfermería de Ribeirão Preto, Ribeirão Preto, 2020.

Las enfermeras se ven afectadas por trastornos musculoesqueléticos relacionados con el trabajo (WMSD), que están relacionados con las actividades laborales realizadas durante la práctica de enfermería. Por lo tanto, el propósito de este estudio cuantitativo, descriptivo y transversal fue investigar la ocurrencia de trastornos musculoesqueléticos relacionados con el trabajo entre enfermeras registradas (RN) y asistentes de enfermería (NA) que trabajan en la Corporación de Hospitales Públicos de Georgetown (GPHC), Guyana. En el estudio participaron un total de 271 enfermeras (185 enfermeras y 86 NA), y la recolección de datos se realizó mediante un instrumento de caracterización de las enfermeras y el cuestionario nórdico musculoesquelético (NMQ). El Modelo Integrado de WMSD se utilizó como marco teórico de esta investigación. Los hallazgos del estudio revelaron que las enfermeras se vieron más afectadas por la WMSD que los enfermeros, y las enfermeras más jóvenes con menos años de experiencia fueron las más afectadas por la WMSD. Además, la mayoría de las enfermeras eran afrodescendientes, solteras, tenían hijos y tenían un diploma en enfermería como su nivel más alto de educación. La prevalencia de WMSD en los últimos 12 meses fue del 91,5% entre los RN y NA, la mayoría de los RN (63,1%) y NA (28,4%) reportaron WMSD, y el 28,0% de las enfermeras reportaron estar enfermos o ausentes del trabajo, pero solo el 25,1% de las enfermeras visitó a un médico por el problema. Más aún, el 55,0% de los participantes del estudio informaron haber recibido formación en ergonomía mecánica corporal (BME) y el 82,3% de las enfermeras aceptaron que necesitan formación en BME. La región del cuerpo más afectada en los últimos 12 meses fue la zona lumbar (72,0%), seguida del cuello (49,1%), hombros (37,7%), piernas (37,6%), muñecas / manos (33,9%), rodillas (33,2%), espalda alta (32,5%), caderas / glúteos (18,5%) y codos (4,8%). Asimismo, el sitio más afectado en la última semana fue la zona lumbar (50,2%), seguida del cuello (27,3%), piernas (26,2%), parte superior de la espalda (23,2%), hombros (20,3%), rodillas (19,2%), muñeca / manos (18,8%), cadera / nalgas (11,1%) y codos (3,7%), y hubo una disminución significativa en la prevalencia de WMSD entre las enfermeras en la última semana en comparación con las últimas 12 meses. La mayoría de las enfermeras no pudieron realizar actividades de relajación en los últimos 12 meses debido al dolor musculoesquelético en las nueve regiones del cuerpo. El dolor lumbar fue más prevalente entre las enfermeras que trabajaban en las Unidades Médico Quirúrgicas (35,1%), Unidades de Urgencias y Cuidados Intensivos (22,9%) y Unidades Pediátricas (10,7%). Se encontraron asociaciones estadísticamente significativas (al nivel de 0.05 significativo) entre sexo y WMSD en los últimos 12 meses para la parte superior de la espalda y una / ambas piernas, sexo y demandas laborales y apoyo social en los últimos 12 meses y la semana pasada. Además, se encontraron asociaciones significativas entre la edad y WMSD en los últimos 12 meses para la región de caderas / glúteos del cuerpo, y entre la categoría de enfermería y WMSD en los últimos 12

meses para la región del cuello. Más aún, se encontraron asociaciones estadísticamente significativas entre la sala y WMSD en los últimos 12 meses y la última semana para el cuello, la espalda baja y los hombros, entre el nivel de educación y WMSD en los últimos 12 meses en el cuello, en una / ambas rodillas, y una / ambas piernas, y entre años de empleo y WMSD en los últimos 12 meses y la semana pasada en una / ambas piernas. Por lo tanto, llegamos a la conclusión de que había una alta prevalencia de WMSD entre las enfermeras del GPHC y que el dolor lumbar era el tipo más común de WMSD. Por lo tanto, se necesita más investigación para desarrollar programas de promoción de la salud en funcionamiento en el GPHC.

Keywords: Salud Laboral; Enfermería; Trastornos de Traumas Acumulados; Trastornos Musculoesqueléticos Relacionados con el Trabajo.

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LIST OF ABBREVIATIONS

A&E- Accident & Emergency
BCU- Burns Care Unit
CICU- Cardiac Intensive Care Unit
CSR- Caesarian Section Room
FHDU- Female High Dependency Unit
FMW- Female Medical Ward
FSW- Female Surgical Ward
GPHC- Georgetown Public Hospital Corporation
HCW- Health Care Worker
ICU- Intensive Care Unit
IDW- Infectious Disease Ward
IRB- International Review Board
LBP- Lower Back Pain
MHDU- Male High Dependency Unit
MHDW- Maternity High Dependency Ward
MMW- Male Medical Ward
MOPH- Ministry of Public Health
MS1W- Male Surgical 1Ward
MS2W- Male Surgical 2Ward
MSD- Musculoskeletal disorder
NA- Nursing Assistant
NICU- Neonatal Intensive Care Unit
NMQ- Nordic Musculoskeletal Questionnaire
OR- Operating Room
OU- Ophthalmology Unit
OWAS- Ovako Working Posture Analysis System
PACU- Post Anesthetic Care Unit
PCA- Patient Care Assistant
PDS- Personal Data Sheet
PHC- Primary Health Care
PHDU- Pediatric High Dependency Unit
PMW- Pediatric Medical Ward

PNU- Post Natal Unit

PSW- Pediatric Surgical Ward

PU- Psychiatric Unit

REBA- Rapid Entire Body Assessment

RN- Registered Nurse

RULA- Rapid Upper Limb Assessment

SPH- Safe Patient Handling

SPHM- Safe Patient Handling and Mobility

WE- Ward E

WMSD- Work-related musculoskeletal disorders

DEFINITION OF KEY TERMS

Alignment: referring to posture, the relationship of body parts to one another.

Ambulate: walking; able to walk.

Body mechanics: movement of the body in a coordinated and efficient way so that proper balance, alignment, and conservation of energy is maintained.

Disorder: a problem or illness which affects someone's mind or body.

Ergonomics: physical stressors involving excessive force; i.e., lifting heavy objects or working in an awkward position.

Lift: to raise from a lower to a higher position

Mobility: state or quality of being mobile; facility of movement.

Musculoskeletal: pertaining to the muscles and bones.

Posture: attitude or position of body

Skeletal system: system of separate bones (206) bound together by ligaments and responsible for supporting, moving, and giving shape to the body.

Sprain: injury caused by wrenching or twisting of a joint that result in tearing or stretching of the associated ligaments.

Strain: injury caused by excessive force or stretching of muscles or tendons around the joint.

Work-related: connected with your work or job.

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1. Individual Presentation

My name is Noelhi Punch, I am 30 years old, and I am a Registered Nurse from Guyana, South America. I have graduated as a Registered Nurse from the Georgetown School of Nursing in 2014 and have also graduated with a Bachelor of Science in Nursing (BSN) degree from the University of Guyana in 2016. Also, I have worked as a Registered Nurse at the Georgetown Public Hospital Corporation (GPHC) for over six years to present and have gained experience in the area of Medical/Surgical nursing, Critical-Care nursing, Infectious Diseases, Palliative care, and Pediatric nursing practice.

The nursing skills that I have developed over time include the formulation of nursing care plans to manage patient with various conditions, monitoring and evaluation of patient's condition committed to my care, preparation of different trays for clean and sterile procedures, administering individualized treatment to patients among other nursing skills too numerous to mention. Also, I am knowledgeable in areas of patient and family education, medication administration, training and supervision of subordinate nursing staff, and student nurses (to help to mold and shape these individuals into someone who love the nursing profession and who would also make it their duty to give their best always to enhance the quality of life of the patients committed to their care).

More so, I am an accountable, polite, reliable, ethical, and confidential health care provider with a prestigious ability to stay calm, and focus in the event of emergencies, think critically, as well as participate in collaborative multidisciplinary teamwork. Moreover, advocate on behalf of my colleagues, patients, and their relatives, and build a positive work relationship with patients, family members, physicians, and other medical professionals through means of effective therapeutic nurse communication with an emphasis on active listening.

I am also a hardworking, dedicated Registered Nurse with a great passion for nursing, and I am very much enrolled in the Masters of Fundamental Nursing Program at the University of São Paulo Ribeirão Preto College of Nursing. I believe that this Master Program represented an opportunity to increase my knowledge about the working condition, work environment, and safety of the nurses at the GPHC as well as to enhance the nursing profession in Guyana and the world at large in the most extraordinary way by being an effective and efficient change agent who will make meaningful contributions to the noble nursing profession.

2. Introduction

Musculoskeletal disorders (MSD) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs.¹ The term MSD also represents a wide range of inflammatory and degenerative conditions affecting the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels. However, on the other hand, work-related musculoskeletal disorders (WMSD) are deemed as any MSD that may be related to an exposure at work or exacerbated by exposure to work that inhibits a worker's capability in performing their duties of employment.^{2, 3} Also, WMSD encompasses several different names, such as repetitive stress injuries (RSIs), cumulative trauma disorders (CTDs), repetitive motion disorders, and overexertion injuries. These 'common names' are widely used in many parts of the world, but despite this fact, there is a general shift among scientists and practitioners to use the more general term musculoskeletal disorders.³

Furthermore, WMSD constitutes a significant proportion of occupational morbidity, which results in loss of workdays and costs.⁴ According to the US Bureau of Labor Statistics, there were 388 060 MSD cases in 2012, accounting for 34% of all injury and illness cases. Both the incidence rate and case count remained statistically unchanged in 2012 from the previous year; however, the median days away from work increased by one day to a median of twelve days. Laborer and freight, stock, and material movers had the highest number of MSD cases with an incidence rate of 164 per 10 000 full-time workers, which is a significant increase from 140 in 2011.⁵

Ranking high among the effects of WMSD is low back pain, with a prevalence of over 70%. Other known pathologies include the collapse of the intervertebral discs; herniation of herniated discs, while others were observed to be asymptomatic. Although effective primary and secondary prevention treatments are available, the high prevalence and lack of a specific pathology have made treating and preventing low back pain difficult.³

Additionally, WMSD is divided into major groups such as those of the upper extremities, which includes the hand, wrist, elbow, arm, shoulder, and neck. Also, those affecting the neck and shoulder, and finally, those affecting the hand, wrist, and arm. The disorders of these groups of WMSD include many musculoskeletal ailments, such as tendonitis (pain and inflammation of tendons) and generalized muscle pain. Tendonitis affects several parts of the upper extremity and usually has a specific name based on its location. Muscle pain also affects different parts of the extremity, mainly the shoulder trapezius muscles, the wrist, and finger extensor muscles-located in the forearm. Other upper extremity disorders of WMSD include nerve entrapments. The most common nerve

entrapment is carpal tunnel syndrome, which is the entrapment of the median nerve at the wrist as it passes through the small tunnel formed by the carpal bones of the wrist and the transverse ligament.³

More so, WMSD is one of the most common health problems among healthcare workers (HCWs). Studies have indicated that HCWs, whose responsibilities include carrying, transferring, or relocating patients, and who were involved in regular forward bending of the whole body and prolonged standing, were exposed to a high risk of WMSD in the neck, lower back, and knee regions.^{6,7}

Yasobant and Rajkumar (2014) conducted a cross-sectional study in India among five different HCWs (dentists, laboratory technicians, nurses, physicians, and physiotherapists) working in various clinical departments in a tertiary care hospital in Chennai, India.⁸ The study findings revealed that a high proportion of healthcare professionals reported WMSD at one or more body regions and that the lower back was the most commonly affected area. The study also showed the 'job risk factors' which contributed to HCWs developing WMSD include working in the same position for long periods, working in an awkward or cramped position, and handling an excessive number of patients or samples in one day and nurses were at the highest risk, while physicians had the lowest risk of developing WMSD.⁸

Further, a group of researchers carried out a literature review in the PubMed, Science Direct, Google Scholar, and E-Thesis databases and selected 23 papers (11 were on the prevalence and risk factors of WMSD among healthcare workers, and 12 were about the interventions used to prevent WMSD among HCWs). The study findings revealed that nurses were the most affected group of HCWs who had the highest prevalence of WMSD, compared to other healthcare professionals and hospital workers. In the review, interventions were used to prevent WMSD risk factors, but some were unsuccessful in the prevention of WMSD in healthcare tasks. Therefore, the researchers suggested that future research should focus on the duties of HCWs that are WMSD risk factors to be more innovative and redesign ergonomic workstations to prevent risk factors.⁹

To add to the research studies on WMSD in the work setting, data from the Bureau of Labor Statistics (BLS) showed that in 2014, the rate of overexertion injuries averaged across all industries was 33 per 10,000 full-time workers. By comparison, the overexertion injury rate for hospital workers was twice the average (68 per 10,000), the rate for nursing home workers was over three times the average (107 per 10,000), and the rate for ambulance workers was over five times the average (174 per 10,000). Also, the single greatest risk factor

for overexertion injuries in healthcare workers was identified as the manual lifting, moving, and repositioning of patients, and this resulted in workers taking days away from work.¹⁰

Further, WMSD has become of great concern to public health, especially those associated with back conditions-a complex problem for certain occupational groups, particularly nursing personnel.¹¹ Studies have also shown that WMSD is a common cause of morbidity affecting occupational groups such as health care professionals, and it has been reported that nurses are mostly affected by WMSD worldwide than any other healthcare professionals since they stand in the same position for long periods, and lifting or transferring of patients.¹²

A critical analysis of relevant studies has indicated that the overall prevalence of lower back pain in hospital staff was 65%, and the highest rate was reported among nurses. Also, the nursing profession is typically listed as one of the top 10 occupations with the highest annual incidence rates for sprain and strain injuries with a sudden onset of WMSD occurring as a result of the cumulative effect of long-term overexertion during the course of a working lifetime.¹³

Moreover, no recent studies (within the last five years) were found concerning WMSD in the Latin America and Caribbean region. Therefore, conducting this study in Guyana will help to shed some light on the current situation with regards to the prevalence of WMSD among nurses in Latin America and the Caribbean region. The Guyana Health Sector is made up of five levels of healthcare (such as health posts, health centers, district hospitals, regional hospitals, and referral hospitals). The healthcare system in Guyana is made up of both the public and private sectors, and the Ministry of Health controls the public sector.

The Georgetown Public Hospital Corporation (GPHC) is the only national referral hospital in Guyana. The health facility has more than 50% of the health workforce in Guyana, of which Nurses are considered as the “backbone of the healthcare system.” At the GPHC, the nurses usually work three different rotating shift systems (7:00am-3:00pm, 1:00pm-9:00pm, and the 8:30pm-7:30am) shifts. The various shifts present their various job demands, workloads, and staffing patterns, which can have a significant impact on WMSD and the overall health of nurses working in resourced-strapped settings.

In Guyana, no known research study has been published about WMSD, yet anecdotal evidence suggests that this is a primary concern. Hence, there is an urgent need to implement this research on the proposed topic "The prevalence of WMSD among nurses at the GPHC in Guyana" to highlight the characteristics of this phenomenon among nurses and make

recommendations that will help to reduce absenteeism that resulted from WMSD, which is also a great benefit of this research.

The objective of this research, therefore, seeks to investigate the prevalence of WMSD and to identify the most common type of musculoskeletal disorder among nurses at the GPHC. The research also seeks to answer the following research questions: What is the prevalence of WMSD among nurses at the GPHC? Which type of WMSD is most prevalent among nurses working at the GPHC? Are the WMSD associated with demographic characteristics of the nurses?

3. JUSTIFICATION

There is a substantial amount of statistical evidence that indicates a high risk of WMSD among hospital nurses. However, there are still numerous amounts of challenges when understanding the association between WMSD and the occupational risk factors, which possess a constant threat to nurses performing their duty of employment in the workplace. Nurses move patients multiple times each day, incurring cumulative stress and trauma, resulting in chronic pain and potential injury.¹⁴

As a registered nurse working on various units at the GPHC for over a period of six years to date, the researcher has observed that nurses often complain of experiencing work-related pain and or discomfort in their bodies. For some of the nursing units, nurses were refusing to lift, turn, and position patients in bed even in emergencies because of fear of developing musculoskeletal injuries such as spinal injuries, abdominal pain, and lower back pain. The latter of which are among the chief complaints of nurses when compared to other occupational groups (when lifting, turning and safely positioning patients).¹³ Anecdotal evidence also suggests to the researcher that nurses reported more sick days off than any other health professionals often as a result of WMSD, hence the need to explore this growing phenomenon.

The findings of this study will assist in gathering pertinent information on WMSD among nurses at the GPHC. It will also increase awareness among nurses about WMSD, the occupational risk factors they are seldom exposed to, and the actions they can take to avoid these risk factors, which can lead to severe morbidity and mortality. Moreover, nurses will see the need to take WMSD seriously to prevent and promptly report when these injuries occur to ensure systems are in place to decrease their occurrences.

Further benefits of the research findings can help in reducing the number of days nurses report sick or absent from work due to WMSD, thus, making more healthy nurses available to deliver quality, holistic, and optimum nursing care to patients at the GPHC. The availability of more nursing staff will reduce the amount of workload on the already “strained” worker and prevent stress, fatigue, overexertion, and burnout among the nursing staff at the GPHC. Nurses will be able to conserve more energy, stay focus and alert, make fewer mistakes in the provision of care, and provide safe, efficient, and quality nursing care to patients thus, upholding the mission and vision of the GPHC.

4. OBJECTIVES

4.1. General Objective

To analyze the occurrence of work-related musculoskeletal disorders among nurses at the Georgetown Public Hospital Corporation in Guyana.

4.2. Specific Objectives

- To identify the different types of work-related musculoskeletal disorders that affect nurses at the Georgetown Public Hospital Corporation;
- To determine the prevalence of work-related musculoskeletal disorders among the nurses;
- To investigate the associations between demographic characteristics of the nurses and the occurrence of work-related musculoskeletal disorders among the nurses.

5. Literature Review

It is important to note, however, that WMSD is a major safety concern in today's health care environment due to the manual lifting of patients with higher acuity levels and obesity. Much occupational health research has shown that certain workers and job characteristics are risk factors for workplace injuries. Workers who engage in physically demanding jobs, especially those jobs that involve repetitive motion, are at greater risk for WMSD. These risks are particularly prevalent in the health care sector, and it is often reported that nurses are at higher risk of workplace musculoskeletal injury than other health care workers due to frequent lifting and transferring of patients. Conversely, many analyses of the physical requirements of jobs do not consider the modifying effect of time spent on a physical task and the risk of WMSD among nurses.¹⁵

Bearing this in mind, the topic the researcher seeks to explore is "The prevalence of work-related musculoskeletal disorders (WMSD) among nurses." The main reason for researching this topic is to find out how the nurses at the GPHC are being affected by WMSD. Before exploring this phenomenon, it is eminent to note that the articles for this literature review were taken from the CINAHL-Plus, and Medline combined search database, Scopus, Google Scholar, and PubMed databases, and only scholarly peer-reviewed, and full-text online journal articles, published within the last five years were used. Notably, only articles similar to the researchers' topic of interest were selected to obtain recent findings of the topic. The relevant articles were also analyzed and synthesized to identify gaps, strengths, and weaknesses as well as areas where there is a need for further research on the topic of interest.

The first article selected was a cross-sectional study done by Yao et al. (2019) to investigate the prevalence of work-related musculoskeletal disorders (WMSD) among municipal hospital nursing staff to explore the association of work style and physical exercise with WMSD. A total of 692 nurses in 5 municipal hospitals completed a questionnaire survey. The survey items include personal information, lifestyle, physical exercise, and symptoms of WMSD. The study findings indicate that the prevalence of WMSD was 84% among the nurses, and the effects were noted in all parts of the nurse's body. The highest prevalence was found in the neck (68.2%), followed by the waist (67.6%) and shoulder (54.6%). The researchers concluded that there was a high prevalence of musculoskeletal disorders among the municipal hospital nursing staff, and an elevated risk of WMSD was observed in nurses who do not exercise, work shift, and stay up late at night. The study

utilized both univariate and multivariate analyses to prove that physical exercise, working night shift, and staying up late were associated with WMSD among nurses.¹⁶

At the same time, Naushad et al. (2019) conducted a study to explore the risk factors and prevalence of work-related musculoskeletal disorders (MSD) among nurses in Dubai at two famous hospitals, namely the Iranian Hospital and Burjeel Hospital for Advanced Surgery. A total of 100 nurses were included in the study, and the study results showed that female nurses were more affected than male nurses. Most of the nurses were (between 28 and 35 years of age) with a few years of work experience. Positive responses to having developed MSD were predominantly from the nurses working in the surgical ward. The body sites most affected was the back (44%), feet (18%), neck and shoulder (18%), and the majority of nurses reported physical, ergonomic factors as the prominent cause for their MSD as opposed to the previous study done by Yao et al. (2019).^{16, 17}

Another cross-sectional study was done by Yang et al. (2018) to investigate the prevalence and risk factors of work-related musculoskeletal disorders among intensive care nurses in the Hunan Province of China. The nurses working in mixed intensive care units of 20 tertiary hospitals completed an online survey regarding work-related musculoskeletal injuries, and approximately 97% of the respondents reported experiencing at least one work-related musculoskeletal disorder within the previous year. However, low back pain was the most commonly reported musculoskeletal disorder (80.1%), followed by neck pain (78.6%) and shoulder pain (70.4%). The study findings also indicate the need for nurses and managers to reinforce risk awareness, improve physical and psychosocial working conditions, and promote a safer work environment.¹⁸

Chiwaridzo et al. (2018) conducted another cross-sectional study in Zimbabwe to investigate work-related musculoskeletal disorders among 208 registered nurses at Parirenyatwa Group of Hospitals (PGH). The prevalence of WMSD among the nurses was 95.7%. The first episode experienced in the first five years of working was 52.7%. However, 82.1% of the nurses experienced WMSD in the last 12 months. Low back pain was the most common WMSD reported, which accounted for 67.9%. Also, WMSD were significantly associated with qualification attained, postgraduate ergonomic training, and working experience. The researchers, therefore, concluded that there is a need for prompt hospital education programs aimed at raising awareness among nurses, as highlighted in the previous study on the existence of WMSD and the consequences at PGH.^{12, 18}

Nevertheless, another study was conducted in Xinjiang by Yang et al. (2018) among 1873 nurses in the Departments of Internal Medicine, Surgery, Emergency, ICU, Operating Room, and Supply Room of 6 Grade 3 General Hospitals in Xinjiang Beijing. The researchers used a revised Nordic National Musculoskeletal Disorders Standard Questionnaire and Work Ability Index Scale to evaluate the status of nurses with WMSD. The study findings revealed that WMSD among the nursing staff in the past year was 77.42%. The highest symptom incidence in all parts of the body was in the waist, neck, shoulder, and back, and the symptom incidence was 63.59%, 59.80%, 47.78%, and 37.32%, respectively. The researchers did multiple linear regression analysis, which proved that past medical history, WMSD disease, length of service, and night shift frequency were the factors influencing the working ability of nursing staff, also revealed in the study done by Yao et al. (2019).^{16, 19}

Further, Abdul Rahman, Abdul-Mumin, and Naing (2017) conducted a cross-sectional study amongst emergency (ER) and critical care (CC) nurses in Brunei to compare the prevalence of WMSD among ER nurses and CC nurses. A total of 201 ER and CC nurses participated in the study. The study findings revealed that the work demands of CC nurses were significantly higher than ER nurses and the nurses also experienced workplace stress and burnout. The highest prevalence of musculoskeletal pain was in the neck, shoulder, upper and lower back, and foot region.²⁰

More so, another cross-sectional study was carried out by Yan et al. (2017) to investigate the status of WMSD in nurses working in the hospitals in Xinjiang Uygur Autonomous Region, and 6674 nurses took part in the study. The nurses completed a modified musculoskeletal North European questionnaire. The study findings revealed that the most commonly affected regions by WMSD were the lower back, neck, shoulder, and upper back, with an annual prevalence of 62.71%, 59.77%, 49.66%, and 39.50%, respectively. There was a statistical difference in the yearly prevalence of WMSD in those with different ages and working durations. Therefore, nurses' shift, work, and rest duration were closely related to WMSD in this study.²¹ Also, like this study, lower back pain was the most prevalent WMSD among nurses in the research done by Chiwaridzo et al. (2018) and Yang et al. (2018).^{12, 18}

Besides, Yan et al. (2016) conducted another study to investigate the prevalence of WMSD in nurses in Xinjiang, China, to analyze the influencing factors for the development of WMSD, and to provide a reference for the prevention and treatment of WMSD among

nurses. The study was carried out among 2851 nurses working in the departments of internal medicine, surgery, gynecology, pediatrics, emergency, intensive care, and operating rooms. The study findings revealed there was a high prevalence of WMSD (78.58%) among the nurses. The prevalence of WMSD was 63.36% in the waist, 61.79% in the neck, 52.52% in the shoulder, 41.83% in the back, 35.56% in the knees, 33.35% in the ankles, 26.02% in the wrists, 23.41% in the hip, and 17.62% in the elbows.²² Similar findings were also revealed in the study done by Yang et al. (2018).¹⁹

Undoubtedly, there is a high prevalence of WMSD in various hospitals, and nurses are considered the health care professional group most affected. So, to understand the effects of nursing tasks on WMSD, symptoms a group of researchers, namely Serranheira, Sousa-Uva, and Sousa-Uva (2015), conducted a study among Portuguese nurses who completed a modified Nordic Musculoskeletal Questionnaire. The study results indicated that most of the nurses were females (75.8%), and most of them reported more than one symptom of WMSD (88%). However, low-back pain was the most prevalent complaint, which accounted for 60.9% of the cases as a result of the tasks performed more than ten times a day, such as invasive procedures, care of hygiene, and patient comfort in bed.²³

In contrast, studies have shown that WMSD constitutes a pressing occupational health problem among registered nurses (RN) all around the world, and its prevalence is mainly associated with the high physical demands of nurses that remain poorly studied in primary health care (PHC). Hence, Ribeiro, Serranheira, and Loureiro (2017) conducted a cross-sectional study in Portugal to describe nurses' self-reported symptoms of WMSD (mainly discomfort and pain) in PHC. A total of 409 nurses completed an online Portuguese version of the Nordic Musculoskeletal Questionnaire (NMQ) using the survey monkey platform. The study findings revealed that mostly female (84.0%) showed a high prevalence of WMSD symptoms in the last 12 months, also found in the previous study carried out by Serranheira, Sousa-Uva, and Sousa-Uva (2015) as well as the study done by Naushad et al. (2019) in Dubai.^{17, 23, 24}

The study findings also revealed that the lower back was the most affected body region (63.1%), followed by cervical, dorsal, shoulders, and the wrist or hand. More so, in the same period, absenteeism related to these complaints was high (51.4%) and was strongly connected with standing work (48.8%), bending the trunk (42.3%), rotating the trunk (40.6%), applying force with hands or fingers (37.3%), sitting work (36.6%) and repetitive arm movement (34.3%). The study also showed associations between the prevalence of

WMSD symptoms in different body regions and some individual characteristics such as gender, age, BMI, presence of other pathologies, and regular physical exercise. The study findings also indicated that, in other areas of nursing practice, PHC nurses are also exposed to risk factors, which contributes to a high prevalence of WMSD symptoms due to inadequate and extreme postures sustained for prolonged periods and repetitiveness. The researchers concluded that it is, therefore, essential to develop occupational prevention programs to address this occupational health issue among PHC nurses.²⁴

A multi-hospital cross-sectional survey was carried out by Younan et al. (2019) to identify the prevalence of work-related musculoskeletal disorders, levels of chronic occupational fatigue, and how individuals are affected by work organization factors. Nurses from 39 hospitals participated in the study, which revealed that 71.3% of the participants reported a work-related musculoskeletal disorder in the previous 12 months, mainly back pain. However, this was also linked to the nurse's years of experience, nurse to patient ratios, and chronic occupational fatigue. Severe occupational fatigue levels were also associated with education, age, years of experience, nurse to patient ratio, and model of care. Therefore, healthcare organizations need to develop strategies to ensure a healthier occupational environment for nurses, also indicated by the study done by Yang et al. (2018).^{18, 25}

Speaking of work, conditions the emergency department is a highly demanding work environment, considered by high workload and stress, and Bazazan et al. (2019) carried out a study among 380 emergency nurses in five hospitals. The study was conducted to investigate the association of MSD and workload with work schedule (permanent day and night work) and job satisfaction among the nurses who also completed a Standardized Nordic Questionnaire. The study findings revealed that work schedule and job satisfaction level was significantly associated with the MSD in different body regions. There was a high prevalence of musculoskeletal problems, particularly in the knees, upper back, lower back, neck, and shoulders. In conclusion, the researcher's findings can help to better understand the working conditions and emphasize the need for ergonomic interventions in order to reduce MSD and workload among emergency nurses and the importance of mental aspects of workload in this occupational group.²⁶

Additionally, nursing shortages are also related to the increased risk of musculoskeletal disorders among nursing professionals during work, and the complexity of patient care places nurses at high-risk for injury, also listed as an occupational risk for WMSD. Hence a cross-sectional study was done by Passali et al. (2018) to evaluate the

association of personal, professional, and health factors with the development of WMSD in the nursing staff working in hospitals in the capital of Greece. The study was conducted online with 394 nurses using the Nordic Musculoskeletal Questionnaire, and the study findings revealed the prevalence of musculoskeletal disorders, in general, was 98.0%, with symptoms reported for the waist (85.3%), neck (71.2%), and back (70.7%).²⁷

The study also showed that the risk for WMSD was higher for specific Registered Nurses (RN) groups. Also, female nurses had a higher risk than males, RN with (11-20) years of work experience had a higher risk than their younger colleagues, and RN who strain their waist, and lift loads, faced higher risks. Shift work, age, and body mass index also lead to increased risk of WMSD indicated in the previous study done by Ribeiro, Serranheira, and Loureiro (2017) in Portugal.²⁵ The researchers, therefore, concluded that Greek nurses suffer more frequently from WMSD in comparison to their colleagues internationally and hospital managers need to be aware of these things along with the Greek National Health System to develop a prevention policy for WMSD in Greek hospitals.²⁷

A systematic review and meta-analysis were carried out by Bernal et al. (2015) to estimate the association between psychosocial risk factors in the workplace and musculoskeletal disorders (MSD) in nurses and aides. An electronic search was performed using MEDLINE (Pubmed), Psychinfo, Web of Science, Trip database, Cochrane Central Controlled Trials, NIOSHTIC and Joanna Briggs Institute of Systematic Reviews on Nursing and Midwifery, to identify observational studies assessing the role of psychosocial risk factors on MSD in hospital nurses and nursing aides. Twenty-four articles were included in the review, and seventeen were selected for the meta-analysis. The researchers concluded there was an association between high psychosocial demands on low job control with prevalence and incidence of lower back pain and a high prevalence of shoulder and knee pain among nurses and nursing aides.²⁸

Further, a comprehensive review was carried out by Davis and Kotowski (2015) to determine the prevalence of musculoskeletal pain and reported injuries for nurses and nursing aides. A total of 132 articles on the prevalence of MSD pain and injuries were included in the review. All the papers were published in peer-reviewed English-speaking journals and subjected to a quality review. The study results indicated that the prevalence of MSD pain for nurses and nursing aides was highest in the lower back, followed by the shoulders and neck. However, the majority of the studies focused on low back pain within 12 months. The

researchers concluded from the review that MSD pain in the nursing profession was widely investigated worldwide, with a chief focus on low-back pain.²⁹

Nevertheless, there is a substantial amount of statistical evidence, which indicates a high risk of WMSD among hospital nurses. However, there are still numerous amounts of challenges in understanding the association between musculoskeletal symptoms and various individual and occupational risk factors. Therefore, a cross-sectional study was carried out by Mehralizadeh, Dehdashti, and Kashani (2017) in Iran to examine the direct and indirect interactions of various risk factors with musculoskeletal complaints in hospital nurses. The study findings showed there was a personal effect of psychological, role-related, and work posture stressors on musculoskeletal complaints.³⁰

On the other hand, WMSD is a significant concern for public health, leading to temporary and permanent disability, and health care workers, including nurses, are at high risk for these disorders. Heidari, Borujeni, and Khosravizad (2018) conducted another cross-sectional study among 300 nurses working in the teaching hospitals affiliated with Shiraz University of Medical Sciences (SUMS) to assess the health-promoting lifestyles of nurses and their association with musculoskeletal disorders and symptoms. Data was obtained from the study participants using the Health-promoting Lifestyle Profile (HPLP) and the Nordic Musculoskeletal Questionnaire (NMQ). The study revealed that 47% of the study participants had a moderate level of lifestyle. In terms of musculoskeletal symptoms, the most prevalent were reported in the back (88.33%), knees (83.33%), and thighs (71%). The researchers, therefore, concluded that lifestyle variables are a good predictor for nurses' musculoskeletal symptoms, knowledge of health-promoting lifestyle behaviors, and practice of these behaviors are necessary to reduce musculoskeletal disorders among nurses.³¹

Further, Ping et al. (2015) did a correlation analysis to determine the correlated influential factors between WMSD, nursing practice environment, quality of life, and social support. A cluster sampling was performed on the nurses from 12 hospitals in the six areas in Xinjiang, and the researchers used the modified Nordic Musculoskeletal Questionnaire, Practice Environment Scale (PES), the 36-item Short-Form Health Survey, and Social Support Rating Scale to obtain data for the study. The study revealed that the total prevalence of WMSD was 79.52% among the nurses, which mainly involved the waist (64.83%), neck (61.83%), and shoulder (52.36%). Also, the prevalence of WMSD in the nurses in Xinjiang Autonomous Region was high, and the researcher concluded that bodily pain, total healthy

condition, having adequate staff and support resources to provide quality patient care, and social support were the protective factors of WMSD in the nurses.³²

Furthermore, WMSD all over the world are a frequent cause of illness affecting people working, especially in the health sector and in the medical professions, and nursing staff experience the negative impact of work on the motor system to the highest degree. Filipaska et al. (2018), therefore, conducted a self-assessment to assess the extent of disability of nursing staff exposed to excessive strain on the spine as measured by the Oswestry Disability Index (ODI). A total of 50 nurses employed in surgical (32%) and conservative (68%) departments were involved in the study. The researcher used a diagnostic survey and the ODI to collect data for the study. The results of the study showed that the occurrence of pain in the spine adversely affects functional performance when it comes to social life and lifting. The average disability score on the ODI scale was 25.9%, which indicates a moderate disability of the respondents, and the researchers concluded that pain in the spine significantly affects the functional capacity of the nurses adversely affected by WMSD.³³

More so, Carneiro, Martins, and Torres (2015) carried out a study on musculoskeletal disorder risk assessment in-home care nurses. Two methods were used to quantify the risk of WMSD associated with nursing activities, such as Rapid Entire Body Assessment (REBA) and Manual Handling Assessment Charts (MAC). REBA and MAC methods were applied to patient handling activities and tasks involving manual material handling, respectively. The study results indicated that the presence of multiple risk factors influences the adoption of risk behaviors by the nurses.³⁴

Besides, nursing is a professionally demanding job, and nurses are prone to develop musculoskeletal disorders. However, no data was available regarding the prevalence of musculoskeletal disorders among Pakistani nurses. A group of researchers, namely Rathore, Attique, and Asmaa (2017), therefore, conducted a cross-sectional study to document the pattern of WMSD in Pakistani nurses and their perceptions about contributing factors and management of WMSD in six hospitals in Lahore and Rawalpindi among 117 nurses. The study revealed the prevalence of musculoskeletal disorders over 12 months was 31.6%, with the most common site being the lower back (32%) followed by the shoulder (20%), upper back, and knees (10%) among the nurses and 60.6% sought professional help, and married nurses were more prone to WMSD. Also, working in the same positions for long periods, attending to an excessive number of patients in one day, and working in awkward and cramped locations were the most commonly perceived risk factors for WMSD. The

researchers, therefore, concluded that there is a need to increase awareness regarding ergonomics and posture maintenance to reduce WMSD and improve patient care, and this can be achieved by workshops and seminars on ergonomics and WMSD.³⁵

Choi and Brings (2016) performed a literature review on work-related musculoskeletal hazards and risks associated with handling overweight and obese patients and summarize the recommended interventions to mitigate musculoskeletal concerns among nurses and nursing assistants. Approximately 350 publications were initially screened, and 22 refereed articles were used to synthesize for this study based on inclusion or exclusion relevance and strength of evidence on overweight or obese patient handling. Evidence suggested that the work-related musculoskeletal risks among nurses and nursing assistants included sprains or strains, low back pain, wrist, knee, and shoulder injuries. The findings indicated that the WMSD risks increased when nurses and nursing assistants were manually moving or lifting patients who are overweight or obese. The recommended solutions included lifting or transfer equipment and devices, ergonomic assessments and controls, no-lift policies, training and education, also suggested in the previous study done by Chiwaridzo et al. (2018) and the research done by Rathore, Attique, and Asmaa (2017).^{12, 35, 36}

Another comprehensive narrative review was carried out by Weiner et al. (2015) to present current research about the risk factors, prevention strategies, and assistive devices that could reduce WMSD caused by repositioning patients in bed. Repositioning is a high-risk activity, frequently causing occupational injuries. These occupational injuries are attributed to excessive physical demands on nurses due to patients' weight and awkward nurse postures. During repositioning, the risk of injury can be minimized by reducing friction between the patient and the bed. Hence, friction-reducing devices have been developed to reduce the manual force required to move patients, but further research is needed to evaluate the potential effectiveness of the devices.³⁷

Further, Rodarte-Cuevas et al. (2016) also conducted a cross-sectional study in Mexico to characterize the conditions of quality of work-life, the presence of musculoskeletal disorders, and the association between these variables in nursing staff of a public hospital in Zacatecas, Mexico. A total of 107 nurses were recruited for the study, and the Professional Quality of Life questionnaire was applied as well as the Standardized Nordic Questionnaire for musculoskeletal pain and work-related risk factors. The study findings indicated that the quality of working life gained an average of 55.62; the intrinsic motivation was the best-rated component, contrary to managerial support that got the lowest scores. The presence of risk

factors in the development work of musculoskeletal problems obtained a mean of 50.10 (SD=26.69). The musculoskeletal disorders occurred in the neck region, lumbar spine, and knees with 42.1% for each one. The quality of work-life decreased in the presence of musculoskeletal problems in the lumbar region, dorsal, neck, and knees. Therefore, it was necessary to improve the working conditions of nurses to reduce the presence of musculoskeletal problems and improve their quality of working life.³⁸

Conversely, Ratzon, Bar-Niv, and Froom (2016) conducted a randomized controlled trial among 31 nurses to examine the effects of a structured, personalized ergonomic intervention program for hospital nurses with musculoskeletal pain. A multi-stage study that included the Nordic Musculoskeletal Questionnaire, Karasek's questionnaire, the Rapid Entire Body Assessment, and an intervention program was completed with 14 nurses, while the remaining 17 were assigned to a control group. The intervention program was facilitated by one physiotherapist and included four meetings over three months. The control group received only instruction sheets. Data on body posture and frequency and intensity of pain were collected before and at three months after the termination of the intervention program. The study results indicated that when comparisons were made with the control group, the intervention group showed an improvement in REBA scores and posture that is considered a risk factor for work-related musculoskeletal disorders. However, there were no significant differences in the number of body parts in pain or the level of musculoskeletal pain.³⁹

Moreover, musculoskeletal disorders are one of the most common and costly occupational injuries because they account for one-third of work-related injuries per year. In the descriptive cross-sectional study carried out by Farahabadi et al. (2016) the factors affecting musculoskeletal disorders were investigated among hospital emergency nurses of Qom University of Medical Sciences. A total of 127 emergency nurses participated in the study and completed the Nordic musculoskeletal disorders questionnaire. Data analysis was carried out using Mann-Whitney and the Chi-square Statistical tests. The significance level was considered to be 0.05, and the study findings revealed that 46 (36.2%) of the study participants were men, and the remaining were women. The overall prevalence of musculoskeletal disorder was 82.7%, and the group of researchers concluded that there was a high prevalence of musculoskeletal disorders among the nurses who participated in the study. There is also the need for change in job performance, adjustment of working hours, holding ergonomics workshops, and the implementation of preventative measures.⁴⁰

On the contrary, nurses in developed countries have access to technical aids during manual patient handling, unlike the nurses in India and other developing countries who frequently experience awkward postures during work. Hence, Goswami, Ghosh, and Sahu (2017) carried out a study among 220 nurses to investigate the prevalence of WMSD among nurses in West Bengal, India. The study findings revealed that 89.5% of the nurses were troubled by WMSD. The most affected body parts were legs (72.5%), lower back (67.5%), neck (57.5%), knee and ankle (52.5% each), and shoulder (35.5%). Posture analyses using REBA indicated that most of the postures were unsafe. In particular, patient transfer was considered very high-risk. Work-related factors and MSD were interrelated, and awkward postures were the main causative factor, which demanded immediate ergonomic interventions to improve the nurses' health status through redesigning of the work-rest cycle, also recommended in the previous study done by Farahabadi et al. (2016).^{40, 41}

Furthermore, Mahmoudifar and Seyedamini (2017) carried out a descriptive-analytical cohort study among 100 nurses to determine ergonomic relationship during work in the nursing staff of the Intensive Care Unit (ICU) and operating room. The Nordic questionnaire and Rapid Entire Body Assessment (REBA) standards in terms of body posture ergonomics were used to obtain data for the research. The study findings indicated that most complaints were from the operating room group (68%) and ICU staff (60%) for the lumbar musculoskeletal system. There was a significant relationship between the total REBA scores of body, legs, neck, arm, force status, load fitting with hands, and static or dynamic activities in the operating room and ICU staff groups. In the operating room and ICU groups, most subjects obtained score (11-15) and very high-risk level. The researchers concluded that nurses working in the operating room and ICU ward are subjected to high-risk occupational injuries, which are dramatically resulted from inappropriate body posture or particular conditions of their works. Hence the need for taking corrective actions along with planning and identifying ways to prohibit the prevalence of disorders in the future.⁴²

The prevalence of WMSD among Operating Room (OR) nurses is generally higher compared to that of non-specialized nurses because OR nurses are actively involved in creating and maintaining the surgical field and passing of equipment to surgeons making these nurses more prone to WMSD. Therefore, Clari et al. (2019) conducted a cross-sectional study in Italy among 148 OR nurses working in eight representative hospitals in northwest Italy. The study was done to evaluate the association between personal and job characteristics and the risk of upper limb WMSD among the OR nurses. The study findings revealed that the

prevalence of upper limb WMSD was 45.9%, and multivariate analysis showed that female nurses and monthly hours spent working as a scrub nurse are directly associated with a higher DASH score. The researchers recommended the urgent implementation of ergonomic interventions on surgical equipment alongside job rotation and medical surveillance programs, also recommended in the previous study done by Farahabadi et al. (2016) and Goswami, Ghosh, and Sahu (2017).^{40, 41, 43}

Abedini et al. (2015) carried out another study in Iran and used the NMQ to detect MSD in nurses as a consequence of handling patients.⁴⁴ These authors proposed the mechanization of the tasks to reduce MSD among nurses.⁴⁵ More so, Pugh et al. (2015) in Australia adapted the NMQ to a virtual (online) platform and found reliable results concerning MSD in a group of nurses.⁴⁶ An ergonomic intervention in hospital nurses with MSD was undertaken by Chanchai et al. (2016) in Thailand, using the NMQ with nursing personnel, and the study was effective in reducing risk factors of MSD among nursing personnel.⁴⁷

Also, Ouni et al. (2020) carried out a descriptive study to evaluate the prevalence and risk factors of musculoskeletal disorders (MSD) among Tunisian nurses, and the study findings revealed that the prevalence of MSD was 48.1%. The lower back was most affected, followed by the upper back and knees with 68.5%, 36.9%, and 34.5%, respectively. The researchers did a chi-square test, which also indicated that MSD is associated with female gender ($p=0.001$), being single ($p=0.013$), high BMI ($p<0.001$), seniority ($p=0.001$), repetitive work ($p=0.004$), prolonged standing ($p=0.007$), intense physical effort ($p<0.001$), lifting heavy loads ($p=0.002$), uncomfortable position ($p=0.008$) and low social support ($p<0.001$). Logistic regression showed intense physical exertion (OR=7.72, 95% CI 2.98-19.97). Therefore, the researchers concluded that a high number of Tunisian nurses complained of musculoskeletal issues, and the lower back was mostly affected. Also, found in the previous studies done by Chiwaridzo et al. (2018), Yang et al. (2018), and Naushad et al. (2019). However, education courses on prevention and coping approaches for MSD will help to minimize the rate of work risks among nurses and promote nursing performance in inpatient care.^{12, 17, 18, 48}

Moreover, MSD at multiple sites was more prevalent than at single sites, and Nguyen et al. (2020) carried out a cross-sectional study to describe the prevalence and characteristics of Multisite Musculoskeletal Symptoms (MMS) among nurses in Haiphong, Vietnam. A total of 1179 nurses working in 15 district hospitals participated in the study, and the researchers

used the modified version of the Nordic Musculoskeletal Questionnaire (NMQ) to obtain data for the research. The study findings showed that the prevalence of MSD during the past 12 months was 60.6%. The most common affected site was the lower back, also found in the previous study done by Ouni et al. (2020), followed by the neck, upper back, and shoulder/upper arm. The researchers concluded that the study showed a high prevalence of MMS and work-related musculoskeletal symptoms among the nursing staff, and extensive research is needed to improve our understanding of MMS to develop preventative measures for nurses.⁴⁹

Kolcz et al. (2020) conducted a Preliminary Prospective Monocentric and observational study in Poland to evaluate selected body composition parameters and ergonomic safety of professionally active nurses and work-related risks during nursing activities. A total of 37 nurses participated in the study, and the findings revealed, the nurse's body composition parameters were within the normal range, and the body water level was 97.3%. A statistically significant correlation was found between the knowledge of workplace ergonomic principles and body mass index, and the researchers concluded that musculoskeletal pain and poor implementation of ergonomic behaviors are significant problems among the nurses due to overweight or obesity.⁵⁰

More so, a cross-sectional study was carried out by Kim and Lee (2019) on the work-related perceptions, injuries, and musculoskeletal symptoms between US-educated and Foreign-educated nurses. A total number of 419 California RN were included in the study, and the Foreign-educated nurses reported a positive safety climate ($p=0.017$) and perceived their jobs as less demanding ($p=0.008$) than US-educated nurses. The prevalence of work-related musculoskeletal symptoms was significantly lower in foreign-educated nurses than in US-educated nurses ($p=0.044$), but the difference was not statistically significant in the multivariate analysis. The researchers, therefore, concluded that immigrant nurses have a different perception about safety climate and job demands, which may have modified their occupational health risks.⁵¹

Yang, Wang, and Zeng (2020) carried out a cross-sectional study among ICU nurses from 28 tertiary hospitals in Hunan and Guangdong provinces in China to determine the risk factors for WMSD among the nurses. A total of 984 ICU nurses completed a self-reported online questionnaire, and the prevalence of WMSD was 96.8%.⁵² However, working in an ICU is considered a risk factor for developing musculoskeletal complaints since the healthcare demands are high in the ICU, and nurses are required to meet these demands.

Thus, Coskun, Dilek, and Demiral (2020) conducted a study between January 2017 and June 2019 as a pre and post-test assessment to determine the effects of the multifaceted ergonomics intervention program in reducing musculoskeletal complaints among ICU nurses.⁵³

A total of 50 ICU nurses participated in the study, and the control group consisted of 23 nurses, and the intervention group had 27 nurses. The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was used to assess musculoskeletal complaints in both groups, and the study findings were similar in both groups concerning the number of visits to doctors due to musculoskeletal complaints of sick days and total CMDQ scores ($p>0.05$) for all. Therefore, the researchers concluded that work-related musculoskeletal complaint is a common occupational health problem among nurses, and intervention without administrative measures might have limited success.⁵³

Additionally, it is essential and most necessary for healthcare professionals to have thorough evidence-based knowledge of body mechanics and its proper use in their daily practices. Thus, Dash and Das (2019) carried out a study to assess the knowledge and understanding of staff nurses regarding good body mechanics in the prevention of low back pain. A purposive and convenience sampling technique was used to select 60 nurses from the medicine, surgery, and orthopedic ward at Pradyumna Bal Memorial Hospital in Bhubaneswar Odisha. The nurses completed a pre-test self-instructional module on correct body mechanics in preventing low back pain and then completed the post-test seven days after.⁵⁴

The study findings highlighted that in the orthopedic ward, 45% of the staff nurses had good knowledge, 5% had average knowledge, and 15% of the staff nurses had poor knowledge of prevention of low back pain. In the surgery ward, 60% of the nurses had good knowledge, 25% had average knowledge, and 15% had poor knowledge. In the medicine ward, 70% of the nurses had good knowledge, 30% had average knowledge, and none of the staff nurses had poor knowledge on the prevention of low back pain. The researchers then concluded that the self-instructional module was effective in improving the knowledge of staff nurses on how to prevent low back pain by using proper body mechanics.⁵⁴

Further, Abdollahi et al. (2020) conducted a Quasi-randomized controlled clinical trial among 74 nursing staff working in the operating rooms of two teaching hospitals to determine the effect of an ergonomics educational program on MSD in nursing staff in the operating room. The nurses were also placed into a control and intervention group and were

assessed for prevalence and risk of MSD using the NMQ and REBA checklist. The study findings showed that there was a statistically significant difference between the groups. The overall risk of MSD decreased in the intervention group after the education program ($P=0.03$). Therefore, educating nursing staff about ergonomics can influence the prevalence and risk of MSD among nurses.⁵⁵

More so, WMSD is a top concern for nurses worldwide, and Bhimani (2016) carried out a cross-sectional study to understand work-related musculoskeletal injuries in rehabilitation from a nursing perspective. A total number of 58 rehabilitation nurses participated in the study, and the nurses completed an anonymous paper survey. The study findings showed that lack of time, patient acuity, ergonomics, body movement issues, knowledge deficit, and communication were risk factors of WMSD. Therefore, nursing input is critical in understanding and reducing content specific WMSD.⁵⁶

Further exploration of the literature revealed that WMSD has also lead to health-related absenteeism among healthcare professionals, and its consequences are reflected in the cost of benefits, substitutes, and reduced productivity. Therefore, Hafner, Milek, and Fikfak (2018) carried out a cross-sectional study to analyze absenteeism among medical center employees. The study findings revealed that sick leave at the medical Centre is higher than 5%, exceeding the Slovenian healthcare sector average. Also, MSD, as the main reason for absence, is significantly more frequent in women, non-medical staff. Among the MSD, low back pain predominates as a reason for absence and is most frequent among nurses, midwives, and employees of (20 to 45) years old.⁵⁷

More so, Ching et al. (2018) carried out a study among nursing assistants since little is known about how nursing assistants (NA) perceive the nature of their work and how their work contributes to WMSD. Twenty-four NA with WMSD working in four nursing homes participated in semi-structured focus group interviews. Their WMSD was not limited to the lower back but involved several body parts. The risk factors for WMSD included physical, psychosocial, organizational, and personal circumstances as well as coworkers and clients. However, it is the synergistic effects of long working hours without sufficient rest, working even with musculoskeletal pain because of staff shortages, ineffective management with insufficient prework training, and inadequate equipment maintenance. Also, an aging workforce with a strong commitment to resident care played a crucial role in WMSD among NAs working in nursing homes. The study also found that multidimensional intervention

strategies using engineering, administrative, and personal controls should be developed to reduce WMSD among NAs working in nursing homes.⁵⁸

Moreover, Cheung et al. (2018) conducted a cross-sectional study to determine WMSD in nursing assistants (NA) and the factors associated with them. A total of 440 NA from 52 nursing homes were recruited by convenience sampling. The study results showed that 88.4% of NA reported WMSD in one body part and the shoulders and lower back was the body part mostly affected as a result of physical and psychological work demands. The researchers concluded that efforts should be directed at integrating work style intervention into lifestyle physical activity training for NA, also indicated in the previous study carried out by Ching et al. (2018).^{58, 59}

Additionally, a cross-sectional study was carried out by Nourollahi, Afshari, and Dianat (2018) among 80 nurses. The research was done to continuously assess trunk postures for an entire shift in various hospital wards and examine the relationship between the duration of exposure to awkward trunk postures and the occurrence of low back pain (LBP) among nurses. The prevalence of LBP was determined using the revised Nordic Musculoskeletal Questionnaire. Full-shift work trunk posture exposure was measured using an inclinometer, and the study results showed, the prevalence of LBP among hospital nurses was 72%. The nurse's working in the general and orthopedic wards were most affected. The researcher's performed a logistic regression analysis, which showed that the duration of exposure to awkward trunk postures had a significant relationship with LBP. The researchers, therefore, concluded that the potential risks of nursing job in terms of frequent and extreme trunk awkward postures leads to the development of LBP.⁶⁰

Also, Gaowgzeh (2019) conducted a study to evaluate the prevalence, risk factors, and associations of personal characteristics, general health status, and physical load with complaints of LBP among nursing professionals in Jeddah, Saudi Arabia. A total of 60 nurses were randomly selected to answer self-administered questionnaires, and the study findings revealed a prevalence rate of 61.7% for LBP, and 20% of the nurses with LBP were working in the obstetrics and gynecology units. The study demonstrated that the prevalence of LBP was high among nurses working in Jeddah, and the physical therapist's role is vital because nurses need to practice relaxation and stretching exercises in between work schedules to reduce the risk of WMSD.⁶¹

More so, research in occupational medicine has identified several physical and psychological risk factors for the development of WMSD. Also, previous studies have shown

that MSD was due to physically demanding and strenuous work conditions such as lifting or carrying heavy loads, awkward posture, and repetitive movement.⁶² Hence, Hammig (2020) carried out a cross-sectional study on work and stress-related musculoskeletal and sleep disorders among 1232 health professionals in a hospital in Switzerland. The study findings revealed that health care professionals reported severe or very severe MSD as well as severe sleep disorders. The prevalence rates were significantly slightly higher among nurses than among physicians and other health care workers. Also, general stress, work stress, a physical effort at work, and painful or tiring posture at work were found to be risk factors for MSD, while general and work-related stress were significantly associated with sleep disorders.⁶³

Schroder and Nienhous (2020) conducted a systematic review and meta-analysis to examine the occurrence of Work-related intervertebral disc disease of the lumbar spine (LDD) among health personnel. Five studies reported a high prevalence of LDD among nurses and geriatric nurses (11.3% - 96.3%) compared to all controls (3.8% - 76.5%). The researchers, therefore, concluded that nurses have a higher probability of developing disc herniation than office workers.⁶⁴

Nevertheless, Vinstrup, Jakobsen, and Andersen (2020) carried out a cohort study to investigate perceived stress and low back pain among 1144 healthcare workers from 389 departments at 19 hospitals. The nurses responded to questionnaires with items on lifestyle, health, and working environment, and the study findings indicated that moderate and high stress at baseline increased the odds of LBP at one year follow up with odds ratios (OR) of 1.39 (95% CI 1.13-1.71) and 1.99 (95% CI 1.49-2.66) respectively. The researchers concluded that psychological stress increases the odds of LBP among healthcare workers, and similar findings were found in the cross-sectional study done by Hammig (2020).^{63, 65}

Al-Hadidi et al. (2020) carried out a cross-sectional study on the prevalence of LBP among female Jordanian Hospital staff at childbearing age since low back pain is considered the most common WMSD among female healthcare workers. A total of 209 nurses participated in the study, and the study findings revealed that nurses have a significantly higher frequency of LBP (82.5%, $p=0.03$) in comparison to office workers (67.5%) and patients transporters (68.6%) also seen in the previous study done by Schroder and Nienhous (2020).⁶⁴ The pain score visual analog scale after treatment varied significantly ($p=0.003$) since it was 28.2 (± 35.4) for office workers compared to 22.8 (± 26.5) for nurses and 6.5 (± 33.7) for patient transporters. A higher proportion of nurses also reported lower back pain affected their job performance (64.9%, $p=0.013$), and 43.3% of them reported having

previous sick leaves due to LBP ($p=0.008$). The researchers concluded that LBP is common among female hospital workers with a significantly higher prevalence among female nurses when compared to other female hospital staff.⁶⁶

The repetitiveness of priming and dismantling disposables for hemodialysis treatment were contributory factors for dialysis nurses developing MSD. Therefore, Westergren, Ludvigsen, and Lindberg (2019) conducted a cross-sectional study to compare the prevalence of musculoskeletal complaints among hemodialysis nurses working at a dialysis center in Denmark ($n=194$) and Sweden ($n=351$). The NMQ was used to obtain data for the study, and the research findings revealed that 90.2% of Danish nurses reported musculoskeletal complaints in one part of their body, while 88.9% of Swedish nurses reported the same. The anatomical locations with the most complaints were the neck, lower back, and hands. Absenteeism from work was mostly due to complaints regarding the hands, and the researchers concluded that the prevalence of musculoskeletal complaints seems to be higher among hemodialysis nurses than among nurses in general.⁶⁷

More so, since nurses are the first contacts within the healthcare organization and provide direct care to clients, this creates a highly demanding work environment, which can even affect the mental health of nurses. Therefore, Amin et al. (2018) carried out a cross-sectional study in Malaysia to determine the prevalence of self-perceived emotional distress and how it relates to WMSD among 660 female nurses. The NMQ was used to identify the annual prevalence of WMSD, and the Malay short version depression, anxiety, and stress (M-DASS) instrument were used to perceive emotional distress among the nurses. The study findings revealed that only 376 nurses completed the survey and the response rate was 83.3%. Also, 73.1% of the nurses experienced WMSD in at least one anatomical site in the last 12 months, and 75% expressed emotional distress. More than half of the nurses reported anxiety and stress, and multiple logistic regressions also showed that stress and anxiety significantly increased WMSD by two-fold among the nurses, and the researchers concluded that there is a significant association between emotional distress and WMSD.⁶⁸

Ricco, Pezzetti, and Signorelli (2017) carried out a case-control study among home healthcare workers in northern Italy to investigate back and neck pain disability and upper limb symptoms. Four groups participated in the research, which includes 100 female Healthcare workers (HCW), 100 Home Health workers (HHW), 100 HCW with low exposure to patient handling, and 100 HCW exposed to high patient handling. There were also a control group of 200 visual display unit workers. Overall, the prevalence of MSD was

17% in the reference group, and 28.3% for HCW, HHW, and HCW had similar prevalence of neck pain with 9% and 11%, respectively. However, lumbosacral pain prevalence was higher in the HHW group (31%), and the HCW and HHW prevalence was 20% and 10% respectively for upper limb complaints, and the researchers concluded that the prevalence of MSD was relatively high with HHW being a high-risk group for lumbosacral back pain.⁶⁹

Further, Fernandes et al. (2018) carried out a descriptive and exploratory study to determine the prevalence of self-reported WMSD among healthcare professionals at a hospital in Northern Portugal, and 435 healthcare professionals participated in the study by completing an electronic questionnaire. The study findings revealed that 105 professionals were mainly nurses and nursing assistants who reported a high frequency of symptoms in several body areas, especially the spine. The researchers concluded that WMSD involving health professionals should be considered a problem for health institutions beyond training programs to address the situation.⁷⁰

Furthermore, El- Sallamy et al. (2018) did a cross-sectional study among nurses at Tanta University Hospital to determine the pattern, risk factors, and coping strategies of WMSD among the nurses. The study results showed that 92.3% of the nurses had WMSD in the past 12 months, and the most frequent site reported was low back pain (56.6%), followed by neck pain (51.5%) and knee pain (50.4%). The most frequent job risk reported was working in the same positions for extended periods (90.8%), continuing to work while injured (90.7%) and bending or twisting the back in an awkward way (85.2%). Also, asking for assistance when handling heavy patients (91.0%), modifying patients and the nurse position (79.6%), and inadequate formal training on injury prevention (80.6%) were the top coping strategies. Thus, the researchers concluded that most of Tanta University Hospital nurses reported WMSD at different body sites, and the lower back was mostly affected. Also, training programs on injury prevention are recommended to lower the rate of WMSD to encourage efficient inpatient care also seen in the previous study done by Cheung et al. (2018).^{59, 71}

According to the Occupational Safety and Health Administration (OSHA), nurses are at high risk for WMSD because of their occupation, which is highly demanding. Hence, Elsherbeny et al. (2018) carried out a cross-sectional study to estimate the prevalence of musculoskeletal complaints and its associating factors among nurses working in Mansoura Children University Hospital. The NMQ was used to determine the prevalence of WMSD among the study participants, and the study findings revealed that the prevalence of

musculoskeletal complaints among the nurses was 85.9%. The most common site was the elbow (85.2%), followed by the pelvis/thigh (74.9%) and wrist (64.6%). However, the least affected site for pain was the lower back (37%), which differs from the previous study done by El-Sallamy et al. (2018) and Cheung et al. (2018).^{88, 89} The prevalence was also lower among the 30 to 40 age group when compared to younger age groups (80% and 91.2%), respectively, and the researchers concluded that 86% of pediatric nurses reported a one-year prevalence of musculoskeletal complaints.⁷²

Further, Amer (2018) carried out another cross-sectional study to assess the prevalence of WMSD among nurses at Suez Canal University Hospital and Ismaila General Hospital in Egypt. A total of 135 female nurses participated in the study, and the modified version of the standardized NMQ and the medical checklist for symptoms of WMSD was used to collect data. The study findings showed that 83.7% of the nurses reported symptoms of MSD and 91.4% of the nurses were working in inpatient and ICU, and 77.9% in the outpatient unit. The lower back was the most prevalent site (79.3%), and the researchers concluded that there is a high frequency of WMSD among Egyptian nurses, and the lower back is mostly affected.⁷³

Pinar and Ali (2018) also conducted a systematic review in the PubMed database to evaluate the prevalence of musculoskeletal disorders in nurses, and a total number of 34 articles were included in the analysis, and it was reported that MSD in nurses was limited in the last 12 months. The prevalence of MSD varied from 33% to 88%, and the most affected body region was the lower back, shoulder, neck, knees, wrist/hands. The study findings also indicated that WMSD was due to trauma and repetitive tasks including, lifting, transferring, or repositioning patients, prolonged standing, and awkward postures such as bending, stooping, and reaching. Operating room and intensive care nurses were mostly affected by WMSD, which was significantly associated with age, gender, BMI, Ward, shift, and working in a hospital.⁷⁴

Musculoskeletal pain (MSP) is also the most common cause of incapacitation among nurses. Therefore, Freiman, Paasuke, and Merisalu (2016) conducted a cross-sectional study on work-related psychosocial factors and mental health problems associated with musculoskeletal pain in nurses at Tartu University Hospital. A total of 404 nurses were included in the study.⁷⁵

The overall prevalence of MSP was 70% in the past years and 64% in the past month. Lower back pain (57%) and neck pain (56%) were mostly present in the past years. Also,

mental health problems and stress were associated with MSP.⁷⁵ More so, Lin et al. (2020) carried out a cross-sectional study among 1803 nurses to explore the prevalence of MSD in various body parts and the risk factors of MSD. The nurses completed a demographic questionnaire, and the NMQ and the study findings revealed that the highest prevalence of MSD symptoms was in the right shoulder (85.8%) followed by the left shoulder (80.9%), neck (62.4%), right wrist (62.2%) and lower back (60.4%). Risk factors include the type of department the nurses are working, exercise habits, age, and the number of days worked per week ($p < 0.05$).⁷⁶

Further, Saberipour et al. (2019) carried out a systematic review and meta-analysis to determine the prevalence of musculoskeletal disorders among Iranian nurses. A total of 33 eligible articles were analyzed, and the study results showed that the prevalence of MSD was high among the nurses, the lower back was most affected, and similar findings were also found in the study done by El- Sallamy et al. (2018) and Cheung et al. (2018).^{59,71,77}

Since most of the studies showed that nurses are at high risk of developing musculoskeletal symptoms when compared to other occupational groups. D' Agostin and Negro (2017) carried out another cross-sectional study to gain more insight into the prevalence rates of MSD among nurses. A total of 177 hospital nurses were included in the study, and 185 university employees were used as a reference group. The study results showed that lower back pain (61.0% VS 42.2%) was the most prevalent symptom, followed by neck pain (48.6% VS 25.9%). The prevalence was slightly higher among nurses and increases significantly with age, also seen in the study done by Lin et al. (2020).^{76,78}

Also, Raithatha and Mishra (2016) conducted a cross-sectional study to determine the MSD and perceived work demands of female nurses at a Tertiary Care Hospital in India. A total number of 296 nurses with a mean age of 30.4 participated in the study, and the prevalence of MSD in the last seven days was 60.5%, with low back pain being the most common and elbow pain the least common. Also, physical demand was perceived to be the most contributory factor of back pain and knee pain.⁷⁹ Moreover, Salama et al. (2018) carried out another study among nurses working in the outpatient department, intensive care units of a university hospital, and nursing school faculty of nursing, Alexandria, Egypt. The study findings showed that a high proportion of nurses reported MSD (99%) during the last year, and the shoulder (97%) was mostly affected, followed by the neck (95%). Also, nurses who were of childbearing age and had two pregnancies in the last two years, as well as used computers, were at high risk of MSD. The coping strategies statistically significant were

nurses using different parts of their bodies during nursing procedures (34%) and change of posture (30%).⁸⁰

Several reports have shown that MSD is one of the most occupational health problems seen in society among healthcare workers, particularly nurses, with a frequency of 40% to 90%, which is even three or four times the general population.⁸¹ Hence, Kalkim, Midilli, and Dogru (2019) carried out a cross-sectional study to determine the MSD and etiology factors most present in nurses. A total of 498 nurses participated in the study, and 87.3% of the nurse's reported musculoskeletal symptoms in their bodies in the last 12 months. The lower back (78.5%), upper back (74.9%), knees (63.1%), neck (61.2%), and shoulders (59.6%) were the affected areas reported. Also, nurses over 40 years were most affected due to little sleep and working for more than 8 hours ($p < 0.05$).⁸²

Further, Nur et al. (2016) carried out a study to investigate the prevalence and impact of WMSD among nurses in public hospitals in the Klang Valley in Malaysia. A total number of 376 nurses with a response rate of 77.4% participated in the study, and 88.6% of the nurses experienced symptoms of WMSD in the last 12 months, which was also similar in the previous study. The neck (48.9%) was the most prevalent site, followed by the feet (47.2%), upper back (40.7%), and shoulders (36.1%). The nurses also reported that their WMSD affected their QOL.⁸³

Nevertheless, Tsekoura (2017) carried out a cross-sectional study among 278 nurses across 15 hospitals in Greece. The study was conducted to explore the prevalence rate of WMSD in nursing personnel and the perceived risk factors for WMSD. The prevalence of WMSD was 84%, and the lower back was most affected with a lifetime prevalence of 59.15%, an annual prevalence of 39.6%, and a weekly prevalence of 34.2%, respectively. The perceived risk factors present were lack of ergonomics knowledge and training and shortage of nursing staff in Greek hospitals.⁸⁴

Moreover, Semachew et al. (2020) conducted a systematic review and meta-analysis on low back pain among nurses working in clinical settings of Africa. The researchers analyzed 19 studies from different regions in Africa. The highest prevalence of LBP was from the West Africa region (67.95%). The researchers concluded that even though the prevalence for the African region is lower compared to the western and Asian, studies the prevalence of low back pain among the nurses is still substantial.⁸⁵

Furthermore, Azizpour, Delpisheh, and Maahsoodi (2015) carried out a descriptive-sectional Cohort study among 45 nursing personnel and 45 operating room personnel of a

teaching hospital in Ilam City in 2012. The study participants completed the NMQ and REBA survey to assess posture, and the study findings showed that the waist was the most prevalent MSD found among the operating room personnel and the nursing personnel with 46.7% and 56.7%, respectively. There was a significant relationship between operating room personnel and nurses with regards to the upper body, feet, neck, arms, and forearms, and the total point of REBA ($p < 0.05$). There was also a significant relationship between gender, education level, and total REBA points in the nursing group ($p < 0.05$). However, there was no significant relationship between demographic factors and total points between the two groups of personnel ($p > 0.05$). Also, the risk level was 11 to 15 in the operating room group and (8 to 10) in the nursing group. Therefore, the high prevalence of waist MSD as a result of improper body posture.⁸⁶

Nevertheless, Nutzi et al. (2015) did a correlation questionnaire study to examine the prevalence of musculoskeletal complaints in Swiss operating room (OR) nurses and how work-family conflict, work interruption, and influence at work relates to lumbar and cervical back pain. A total of 116 OR nurses from eight different hospitals in Switzerland participated in the study, and the findings showed that 66% of the OR nurses had musculoskeletal problems. The most prevalent musculoskeletal complaints were lumbar (52.7%), cervical pain (38.4%), 20.5% in the knees and legs, and 9.8% in the hands and feet. Multiple regression analyses showed that work-family conflict and interruptions significantly predicted lumbar and cervical pain in OR nurses, while influence at work only predicted lumbar pain ($p < 0.05$). Therefore, reducing the work-family conflict and interruptions at work as well as improving the work environment helps to promote the health of OR nurses.⁸⁷

Besides, Taghinejad et al. (2016) carried out a descriptive-correlational study among 240 hospital nurses with BSc nursing degrees and working at three public hospitals of Ilam province in Iran. The study revealed that 71.9% of the nurses experienced MSD in at least one anatomical site within the last year. Low back pain was most prevalent (40%), followed by hip pain and pain in the thigh (11.1%). Most of the affected nurses worked at the surgery wards (17.8%), emergency (15.6%), and intensive care units (12.6%). Pain (48.1%) and cramps (31.9%) were the most frequent symptoms of MSD. Also, bending or twisting the waist for performing procedures, patients transfer to beds, working with the hands higher than the shoulder height, and changing the position of patients in bed were the most frequent occupational risk factors of MSD. However, increased age, weight, height, body mass index, and gender had no significant association with MSD, which differs in the study done by D'

Agostin and Negro (2017) and Lin et al. (2020) and the researchers concluded that there was a high prevalence of WMSD among Iranian hospital nurses.^{76, 78, 88}

Moreover, Homaïd et al. (2016) carried out a cross-sectional study to determine the prevalence and risk factors of low back pain among OR staff at a tertiary care center, Makkah, Saudi Arabia. The study results showed that the prevalence of LBP was 74.2%. There was no statistically significant association between LBP and any of the general risk factors ($p>0.05$).⁸⁹

Almer (2020) carried out another systematic review and meta-analysis on the prevalence of low back pain and risk factors among health workers in Saudi Arabia, and 22 studies were included in the final analysis. The study results showed that the pool prevalence rate was 40.8% for seven studies, 65% for thirteen studies, and 81.4% for two studies for seven days, 12 months, and concerning career, respectively, for the professional groups. Also, nurses and physical therapists were more susceptible to LBP, and the risk factors include bending and twisting the back, lifting and pulling objects, and manual patient handling, also found in the previous study done by Taghinejad et al. (2016) in Iran. The researchers concluded that LBP is highly prevalent among health workers in Saudi Arabia when compared with international rates.^{88, 90}

Further, Alnaami et al. (2019) carried out a cross-sectional study on the prevalence and risk factors associated with low back pain among 740 health care workers in southwestern Saudi Arabia. The study results indicated that the prevalence of LBP in the past 12 months was 73.9%. The risk factors found were working in secondary and tertiary hospitals, increased BMI, and a positive history of overexertion back trauma. So, LBP is a common problem among healthcare workers.⁹¹

Also, Jradi, Alanazi, and Mohammad (2020) carried out another cross-sectional study on the psychosocial and occupational factors associated with LBP among nurses in Saudi Arabia, and 427 nurses were included in the study. The study findings revealed that the prevalence of LBP was 80%, and the associated factors were frequent lifting, work-related stress, lack of job satisfaction, work-related problems, and financial problem, among others.⁹² More so, LBP is a common occupational hazard affecting 35 % to 90% of all professionals, and the prevalence has reached 40% to 90% among nurses worldwide. Hence, Abolfotouh et al. (2015) conducted a cross-sectional study on the prevalence, consequences, and predictors of LBP among 254 nurses in a tertiary care setting. The study participants completed the NMQ, and the study findings showed that there was a high level of back pain in nurses with a

one-year prevalence of 54.3%, for chronic LBP 26.8%, for sick leave due to LBP 18.1%, and 34.3% for medical treatment.⁹³

Furthermore, Tavakkol et al. (2020) carried out a multidisciplinary focus review of musculoskeletal disorders among operating room personnel, and 30 articles were included in the study. The study findings showed that MSD was present in various parts of the body, and the lumbar region was most affected, also seen in the previous study. The risk factors were physical, psychological, age, gender, work experience, and smoking. Therefore, operating room personnel need to focus on programs that will help to reduce MSD and increase awareness.⁹⁴

Finally, Fekadu Mijena et al. (2020) carried out a cross-sectional study on low back pain among nurses working at public hospitals in Eastern Ethiopia, and 404 nurses participated in the study. The prevalence of low back pain was 38.1% over the last 12 months, and working in an awkward posture, manual lifting, and having more than five years of working experience were the factors associated with low back pain among the nurses.⁹⁵

So, in a nutshell, most of the studies obtained were cross-sectional studies, and the studies also revealed the most common type of WMSD among nurses was lower back pain, and the lumbar region was mostly affected. Also, amongst the reviewed studies, nurses working in the OR, ICU, ER, Surgical ward, Pediatrics ward, medical inpatient and outpatient departments, and dialysis center were mostly affected by WMSD. There was a high prevalence of WMSD amongst the nurses working in Arabia, Beijing, China, Dubai, Egypt, Greece, India, Iran, Malaysia, Portugal, Saudi Arabia, South Africa, Switzerland, Vietnam, Zambia, and Zimbabwe. The prevalence was relatively high among nurses working in healthcare facilities in Denmark, Italy, and Tunisia, but low among the nurses in Mexico and Pakistan, and female healthcare workers (nurses) were mostly affected by WMSD.

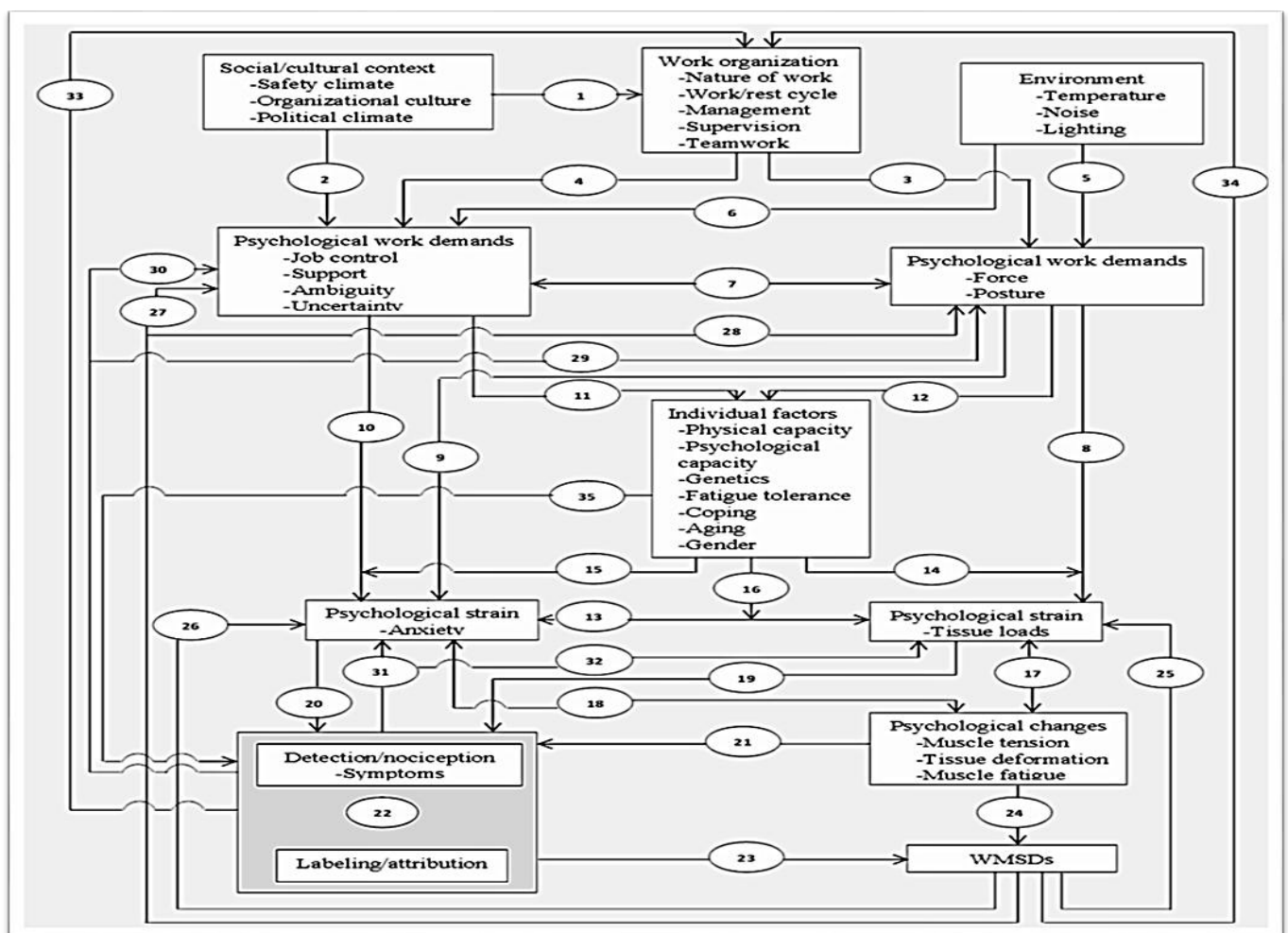
The risk factors which contributed to nurses developing WMSD includes patient transfer, turning or positioning patients, frequent lifting, work-related stress, lack of job satisfaction, knowledge deficit, lack of communication, working shifts, lack of time, patient acuity, awkward posture, repetitive movement, work-related problems, financial problems, physical and psychological problems, age, gender, BMI, and work experience. Most of these risk factors can be avoided by implementing protective factors such as avoid working long hours and staying up late at night, daily exercises, adequate staff and support, and training and educational programs on WMSD to protect nurses and improve the quality of their work life.

Also, several studies have indicated that knowledge of body mechanics, good health promotion lifestyle practices, and ergonomics training are necessary to reduce WMSD among nurses. However, no recent studies (published within the last five years) were found on the prevalence of WMSD among nurses in Latin America and the Caribbean in the reviewed databases, which clearly shows that there is a great need for this research on the prevalence of WMSD among nurses at the GPHC in Guyana.

6. Theoretical Framework

Many theories and models of WMSD have been proposed over the years by different researchers, such as the work-style model of WMSD, multi-variate interaction theory of musculoskeletal injury precipitation, differential fatigue theory, cumulative load theory, and the over-exertion theory.^{96, 97} These theories, although used for different population groups, provide in-depth theoretical mechanisms for the relationship between physical factors at work and WMSD.⁹⁸ Therefore, this research utilizes a combination of the theories and models (proposed over the years by various researchers) known as the Integrated Model of WMSD. The integrated model of WMSD is complex and is comprised of 35 different pathways. At the top of the model are the workplace factors, which determine exposures such as social or cultural context, work organization, and environment (see Figure 1). Figure 1 shows the Integrated Model of WMSD.

Figure 1- Integrated Model of WMSD



Source: Karsh, B.T. Theories of work-related musculoskeletal disorders: Implications for ergonomic interventions. *Theoretical Issues in Ergonomics Science*. 2006; 7(1): 71–88.

Pathway ‘1’ indicates that the social and cultural contexts of the organization will influence the way that work is organized.⁹⁹ Pathway ‘2’ shows that the social and cultural context in the organization can also have a direct impact on psychological work demands because of the nature of the safety climate, politics, or organizational culture. The ‘3’ and ‘4’ pathways show a direct impact of the organization on physical work demands and psychological work demands and how the social or cultural context on physical and psychological work demands is mediated by the work organization.¹⁰⁰

Pathways ‘5’ and ‘6’ show that the environment at work (e.g. noise, lighting, and temperature) can also directly influence physical and psychological work demands. The reciprocal pathway ‘7’ between physical and psychological work demands indicates that the two types of demands can influence each other, while pathway ‘8’ shows the direct impact of physical work demands on the physical strain. Also, the mechanism by which the physical demands impact physical strain and subsequent physiological changes and the development of WMSD may be as a result of overexertion, cumulative loading, and differential fatigue or work-style changes.⁹⁶ Physical demands can lead to physical strain such as tissue loads, but can also lead to psychological strain in pathway ‘9’ to the extent that the physical demands are psychologically stressful.

The ‘10’ pathway shows that psychological work demands can influence psychological strain. Also, psychological demands can have a direct impact on psychological strain if the demands cause stress or anxiety. The direct effect of psychological demands on the psychological strain and subsequent responses may be through work-style changes, increased muscle tension, or psychological stress.^{100, 101, 102}

The ‘11’ and ‘12’ pathways show that physical and psychological work demands may directly impact the individual through adaptation mechanisms such as improving physical or psychological capacity.¹⁰³ The reciprocal pathway ‘13’ shows that physical and psychological strain can affect each other whereby psychological strain may impact physical strain by increasing muscle tension, and physical strain can also influence psychological strain if the physical strain causes psychological stress.

More so, individual characteristics, such as capacity, tolerance, and coping can moderate many of the relationships such as physical capacity can moderate the relationship between physical work demands and physical strain in pathway ‘14’ and coping mechanisms may moderate the relationship between psychological work demands and psychological strain in pathway ‘15’. However, capacity and internal tolerances may also impact the extent to

which physical and psychological strain affect each other in pathway '16' which may lead to a physiological response, which in turn can act as new doses for other physical and psychological responses in pathway '17' and '18'.

Also, the individual, work organization, physical and psychological strain, and associated physiological responses can all impact the detection of symptoms or labeling and attribution in pathways '19', '20', '21', and '35' through mechanisms related to heightened sensitivity or negative affectivity.¹⁰⁰ Once symptoms are perceived, an individual must label the symptom and attribute the symptom to something indicated by pathway '22' and, eventually, the symptoms may lead to a diagnosis of a WMSD in pathway '23'. However, even without symptoms, a WMSD may be present, which is indicated by pathway '24'.

Pathways '25', '26', '27' and '28' show that the existence of a WMSD may give feedback to impact physical and psychological strain or demands because a WMSD may cause a person to modify how they work and manage their physical demands or strain or increase psychological stress as a result of their psychological demands. Therefore, the mere presence of symptoms may also lead a person to modify how they perform a task and may even contribute to stress in pathways '29', '30', '31', and '32'. Finally, the detection of symptoms, in pathway '33', or the presence of a WMSD, in pathway '34', may lead to the redesign of work, thus impacting work organization.⁹⁸

Even though the integrated model may be complex, the researcher has selected this model for the study on the prevalence of WMSD among the nurses at the GPHC since it is made up of a combination of WMSD theories or concepts and shows various pathways in which an individual can be exposed to WMSD regardless of their occupation. The model can also be used to assess for WMSD, implement solutions, evaluate outcomes, and follow up on WMSD among nurses at the GPHC.

7. Methods

7.1. Study setting characteristics

The study was developed at the GPHC, which is the only National Referral Hospital in Guyana. The GPHC is a 600 beds health care institution with approximately 500 nurses who works according to a shift system.

7.2. Study design and population

This is a quantitative, descriptive, cross-sectional study developed to investigate the prevalence of WMSD among nurses at the GPHC. A descriptive study is characterized as the attempt to determine, describe, or identify what is, and not why it is that way. More so, a descriptive study is aimed at casting light on current issues or problems through a process of data collection to describe various aspects of a phenomenon or situation more completely.¹⁰⁴ The study population consisted of two categories of nurses, namely Registered Nurses (RN) and Nursing Assistants (NA), who are currently working at the GPHC and comprise a total of 271 workers.

7.3. Procedures

7.3.1. Data collection

The data were collected over six months, from March 2020 to August 2020. The researcher ensured that each participant completed a consent form before they took part in the study. Data was collected using a self-administer questionnaire, which requested information related to the nurses' demographics, personal, and occupational information, and by utilizing the Nordic Musculoskeletal Questionnaire (NMQ). The instruments were completed within a stipulated time frame convenient for the nurses. Each questionnaire was coded to maintain strict confidentiality and prevent selection and information biases from entering the study.

7.3.2. Study participants

All the available RN and NA from the GPHC were invited to participate in the study.

The inclusion criteria for this research study were:

1. Registered Nurses and Nursing Assistants who work full-time at the GPHC or part-time at another hospital;
2. Registered Nurses and Nursing Assistants working the 7-3 shift, 1-9 shift, and night shift (or day and night shift) at the GPHC.

The exclusion criteria for this research study were:

1. Nurses working part-time at the GPHC and working in another occupation;
2. Nurse's working at the GPHC, but not in practice settings.
3. Nurse managers and supervisors.

7.3.3. Research instruments

An instrument with nurses' demographics, personal and occupational information and the Nordic Musculoskeletal Questionnaire (NMQ) was used to collect the data. The nurses' characterization instrument is divided into section A, with six questions on personal history, and section B, with ten questions on workers' occupational history (Appendix C). The Nordic Musculoskeletal Questionnaire was developed by Kuorinka et al. (1987) with the support of the Nordic Council of Ministers to investigate musculoskeletal symptoms of different individuals in various parts of the world and to make a comparison between different studies. The NMQ was developed from previous medical questionnaires and is a simple, general questionnaire that is internationally recognized, validated, and used to detect symptoms in the neck, back, shoulders, and extremities. The tool was not developed for clinical diagnosis and can be used as a structured interview.^{105, 106}

In this study, a modified version of the standardized NMQ was used. The current instrument is made up of 50 items. Items 1 to 18 are based on musculoskeletal trouble/problems in the nine (9) regions of the body (such as the neck, shoulders, elbows, wrist/hands, upper back, hip/buttocks, knees, and legs) experienced during the last 12 months and last seven (7) days. Items 19 to 27 are based on whether musculoskeletal troubles have prevented the individual from carrying out relaxation activities (such as physical activities, housework, hobbies, and swimming) in the nine regions of the body during the last 12

months. Items 28 to 38 are based on body postures, and 39 to 50 on job demands and social support (Attachment 1).¹⁰⁷

Some advantages of using the NMQ are standardization of the questions, worldwide recognition, can be used free of charge, the possibility of self-evaluation, relatively quick identification of the symptoms, applicable to large populations, can be used together with other evaluation methods. Also, several countries had translated, validated, and adapted the NMQ with satisfactory results, including Brazil, China, France, Greece, Iran, Italy, Japan, Poland, South Korea, Taiwan, and Turkey.¹⁰⁸

Further, a literature review was conducted by Lopez-Aragon et al. (2017) on the application of the standardized NMQ on a worldwide level.¹⁰⁸ This study showed that the NMQ was used in many types of research involving nurses over the years, and the first study that applied the NMQ to nurses was carried out by Lusted et al. (1996) in Australia, in which MSD was evaluated among 30 nurses working in two similar units in a residential center. Symptoms were found in the lumbar, neck, and upper limbs.¹⁰⁹

Also, for eight years, Maul et al. (2003) carried out a study in Switzerland with male nurses in a Swiss hospital using a modified version of the NMQ, among other methods. The results indicated that lumbar discomfort is a persistent problem among nurses, indicating a recurrent, not progressive trend.¹¹⁰ In China, Smith et al. (2004) used the NMQ and identified MSD in hospital nurses, with lumbalgia being the most reported problem. Also, a relation was found with psychosocial factors.¹¹¹

Yeung et al. (2005) conducted a study in the United States and applied the NMQ to 97 hospital nurses to analyze the psychosocial work environment. By a factorial analysis, these authors revealed a relation between the body regions affected and certain psychosocial factors (workload).¹¹² Also, Hartvigsen et al. (2005) conducted another study in Denmark to evaluate the effectiveness of the NMQ in Danish nurses and assistant nurses in two plans of ergonomic training. One was intensive three hours of training, while the other was weekly. The results pointed to the same effect for lumbar injuries.¹¹³

Using both the NMQ and the Job Content Questionnaire, Choobineh et al. (2006) carried out a study in Iran to analyze the relationship between musculoskeletal disorders and the demands of nursing work in a university hospital. MSD was found to be related to the demands of physical labor but not to psychological demands.¹¹⁴ Further, Smith et al. (2006) conducted a study in Japan and used a modified version of the NMQ in Japanese for nurses in a hospital to detect MSD. The study revealed symptoms in the shoulders, followed by the

lumbar region, the neck, and the dorsal region. Furthermore, risk factors associated with psychosocial parameters were identified.¹¹⁵

Schenk et al. (2007) researched in Switzerland and used the NMQ in administrative workers and nurses together with scales of measuring pain by pressure.¹¹⁶ On the other hand, Kee and Seo (2007) did another research, and the NMQ was adopted in South Korea to detect MSD among nursing personnel. The shoulders were shown to be the most vulnerable area, associated with the type of work unit in the hospital.¹¹⁷

In Taiwan, Feng et al. (2007) conducted a study in Thailand and analyzed assistant nurses by the NMQ and other methods. The results revealed that the transfer of patients and the psychological demands of the work were the main causes of lumbar pain.¹¹⁸ Also, Valecillo et al. (2009) carried out a study in Venezuela and found a high incidence of MSD in the neck and upper as well as lower back regions of the nursing staff of a military hospital, and the researchers correlated the work stress with these symptoms.¹¹⁹

Again using the NMQ, Choobineh et al. (2010) carried out research in Iran among 375 nurses from surgery and related MSD to psychosocial risks.¹²⁰ Also, the study by Kim et al. (2010) in the United States with more than 1000 home care workers with the NMQ showed that the physical demands of this profession trigger MSD, especially in the neck, shoulders, and back.¹²¹ Mehrdad et al. (2010) carried out another study in Iran, using the NMQ and the General Nordic Questionnaire of psychological and social factors in the workplace (QPSNordic), and the study findings showed that there was a high prevalence of musculoskeletal symptoms associated with psychosocial factors, especially stress.¹²² On the other hand, Aرسالani et al. (2011) conducted another study in Iran and evaluated a representative sample of nurses by three questionnaires, one being the NMQ, and concluded that this questionnaire was reliable.¹²³

In Brazil, Costa-Schmidt and Spadoti-Dantas (2012) used the analogical Visual Scale (EVA) and the NMQ to study professionals in nursing that worked in surgery. The study results revealed a statistically significant association between the MSD of the lumbar region and those of the shoulders in the last 12 months.¹²⁴ Carneiro et al. (2012) also carried out a study in Portugal, using the NMQ in nurses working in the home and others working at a health center, and found that the former were three-fold more exposed to MSD in the lumbar region than were the latter.¹²⁵ Similarly, Serranheira et al. (2013, 2015) conducted two studies in Portugal and detected that MSD in the lumbar region was associated with psychosocial factors in the nursing staff of Portuguese hospitals.^{126, 127}

Further, Darby et al. (2013) also carried out a study in the United States using the NMQ on hospital nurses in the endoscopic unit and found MSD in the neck, shoulders, and back. In turn, the researchers related these symptoms to the characteristics of the individuals studied.¹²⁸ Similarly, Raeisi et al. (2014) conducted another study in Iran using the NMQ and found an association between physical demands and work shifts with lumbar troubles among the nursing staff.¹²⁹ Barzideh et al. (2014) also carried out a study in Iran using the Job Content Questionnaire and the NMQ among Iranian nurses and identified a direct relation between (MSD and work) stress.¹³⁰ In the same year, Mynarski et al. (2014) conducted a study in Polonia using the NMQ and made a preliminary evaluation on the possible link between sports and the reduction in MSD among nurses.¹³¹

Reed et al. (2014) conducted another study using the NMQ with nurses in a pediatric hospital in Australia. However, the musculoskeletal affliction occurred in the ankle and foot, sometimes limiting physical activity.¹³² Moreira et al. (2014) carried out another study in Brazil and applied the NMQ to nursing staff warned of MSD due to numerous external factors, proposing the implementation of new prevention measures.¹³³ Abedini et al. (2015) carried out another study in Iran and used the NMQ to detect MSD in nurses as a consequence of handling patients.⁴⁴ More so, Pugh et al. (2015) in Australia adapted the NMQ to a virtual (online) platform and found reliable results for MSD in a group of nurses.⁴⁶ An ergonomic intervention in hospital nurses with MSD was undertaken by Ratzon et al. (2016) in Israel, and Chanchai et al. (2016) in Thailand, using the NMQ with nursing personnel, and the studies were effective in reducing risk factors.^{39, 47} Finally, Rodarte-Cuevas et al. (2016) sought to characterize the quality of work-life in the nursing staff of a hospital in Mexico by applying the NMQ and its relation to the individuals.³⁸

A cross-sectional study was done by Ribeiro, Serranheira, and Laureiro (2017) in Portugal to identify self-reported WMSD symptoms by nurses that worked in Primary Health Care, whereby the nurses completed the online Portuguese version of the NMQ via the survey monkey platform. Also, in this study, the lower back was the most affected body region.²⁴ Other study was carried out by Nourollahi, Afshari, and Dianat (2018) in Iran to determine the prevalence of lower back pain (LBP) among 80 hospital nurses using the NMQ, and it was found that 72% of the nurses had LBP.⁶⁰

A most recent study was conducted by Akodu and Ashalejo (2019) in South-West Nigeria with 135 nurses (126 females and 9 males) in tertiary, secondary, and private hospitals in Lagos to investigate the association between WMSD and the nurse's ability to

work. The study findings also indicated that LBP was the most common WMSD, which is similar to the previous study done in Portugal and Iran using the NMQ.¹³⁴

7.3.4. Data Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25.0 as well as the Stata version 13.0 statistical software. The research findings were also displayed and organized in the form of tables.

7.4. Ethical Consideration

This research was approved by the Ethical Review Panel of the University of Sao Paulo, Brazil, the International Review Board (IRB) of the Ministry of Public Health (MOPH), and the board of Directors of the GPHC had approved for the study to be conducted among the nurses at the GPHC. All participants were informed of the study objectives and their right to withdraw from the study at any time. A consent form (Appendix B) was signed before the completion of the questionnaires. All information gathered from the study participants was treated with strict confidentiality. The study participants were not exposed to any known risk during the research.

8. Results

The demographic characteristics of the study participants showed that a total of 271 nurses participated in the study. These data are presented in the Table 1.

Table 1- Demographic characteristics of the study participants. 2020 (n=271).

Variables	N	%
Age		
<30	162	59.9
30-49	107	39.5
>49	2	0.8
Sex		
Male	21	7.7
Female	250	92.3
Ethnicity		
African	172	63.5
East Indian	24	8.9
Amerindian	8	3.0
Others	67	24.7
Marital Status		
Single	192	70.8
Married	74	27.3
Divorced	5	1.8
Children		
No	133	49.1
Yes	138	50.9
Level of Education		
Certificate	80	29.5
Diploma	133	49.1
Bachelors	58	21.4
Category of Nurses		
Registered Nurses (RN)	185	68.3
Nursing Assistants (NA)	86	31.7
Work Place (GPHC) only		
No	19	7.0
Yes	252	93.0
Musculoskeletal disorders		
No	23	8.5
Yes	248	91.5
Physician Visit		
No	203	74.9
Yes	68	25.1
Report Sick/Absent		
No	195	72.0
Yes	76	28.0
Total	271	100.0

It was verified that a large proportion of the nurses were in the 20-29 age group (59.9%), and most of the nurses were females (92.3%) and 63.5% of the nurses were of African descent, followed by mixed-race individuals (24.7%). Most of the nurses were single (70.8%) and had children (50.9%). About the educational level, 49.1% of the nurses acquired a diploma in nursing, and only 21.4% of the nurses had a bachelor's degree in nursing. Also, 68.3% were Registered Nurses (RN), 31.7% were Nursing Assistants (NA), and 93.0% of the nurses worked full-time at the GPHC.

Related to the occurrence of WMSD, it was observed that 91.5% of the nurses reported musculoskeletal problems, and 28.0% reported sick or absent from work, but only 25.1% of the nurses visited a physician because of the problem. More so, 55.0% of the study participants reported body mechanics ergonomics (BME) training, and 82.3% of the nurses accepted that they need BME training. Besides, the Table 2 showed that 63.1% of the RN and 28.4% of the NA reported WMSD.

Table 2 - Prevalence of work-related musculoskeletal disorders in terms of nurses' professional category. 2020 (n=271).

Nursing category	WMSD					
	Yes		No		Total	
	N	%	n	%	N	%
Registered Nurses	171	63.1	14	5.2	185	68.3
Nursing Assistants	77	28.4	9	3.3	86	31.7
Total	248	91.5	23	8.5	271	100.0

WMSD: work-related musculoskeletal disorders

The Table 3 demonstrates the prevalence of nurses affected by WMSD and the time of employment at the Georgetown Public Hospital Corporation (GPHC).

Table 3 - Prevalence of work-related musculoskeletal disorders of nurses according to years of employment at the Georgetown Public Hospital Corporation. 2020 (n=271).

Years of Employment	N	%	WMSD				Total	
			Yes		No		N	%
			N	%	N	%		
<1	22	8.1	21	7.7	1	0.4	22	8.1
1-5	168	62.0	154	56.8	14	5.2	168	62.0
6-10	50	18.5	44	16.2	6	2.2	50	18.5
11-15	19	7.0	18	6.6	1	0.4	19	7.0
16-20	8	3.0	7	2.6	1	0.4	8	3.0
21-25	1	0.4	1	0.4	0	0.0	1	0.4
26-30	1	0.4	1	0.4	0	0.0	1	0.4
>30	2	0.7	2	0.7	0	0.0	2	0.7
Total	271	100	248	91.5	23	8.5	271	100.0

WMSD: work-related musculoskeletal disorders

It was observed that out of the 271 participants, 248 nurses were affected by WMSD (91.5%), most of the nurses were employed at the GPHC for five years (62.0%), and 56.8% of the nurses were affected by WMSD in the first five years. Hence, the younger nurses were more affected by WMSD than the older nurses at the GPHC.

The study participants working at the Accident and Emergency (A&E), Burns Care unit (BCU), Cardiac Intensive Care Unit (CICU), Caesarian Section Room (CSR), Female High Dependency Unit (FHCU), Female Medical Ward (FMW), Female Surgical Ward (FSW), Intensive Care Unit (ICU), Infectious Disease Ward (IDW), Male High Dependency Unit (MHCU), Maternity High Dependency Ward (MHDW), Male Medical Ward (MMW), Male Surgical 1Ward (MS1W), Male Surgical 2Ward (MS2W), Neonatal Intensive Care Unit (NICU), Ophthalmology Unit (OU), Post Anesthetic Care Unit (PACU), Pediatric High Dependency Unit (PHCU), Pediatric Medical Ward (PMW), Pediatric Surgical Ward (PSW), Post Natal Unit (PNU), Psychiatric Unit (PU), and Ward E or Gynecology Ward (WE).

In order to analyze these data, the healthcare settings were grouped into four categories: 1) Pediatric Units (PMW, PSW, PHCU); 2) Emergency and Intensive Care Units (A&E, BCU, CICU, ICU, NICU, PACU); 3) Gynecology and Maternity (WE, CSR, MHDW, PNU); 4) Medical/Surgical Units (FHCU, FMW, FSW, IDW, MHCU, MMW, MS1W, MS2W, OU, PU).

The Table 4 presents the nurses affected by WMSD according to the work settings of the GPHC.

Table 4 - Prevalence of work-related musculoskeletal disorders of nurses according to the healthcare settings of the Georgetown Public Hospital Corporation. 2020 (n=271).

Healthcare Settings	WMSD					
	Yes		No		Total	
	n	%	n	%	N	%
Pediatric Units	39	14.4	5	1.8	44	16.2
Emergency and Intensive Care Units	81	29.9	6	2.2	87	32.1
Gynecology and Maternity	13	4.8	2	0.7	15	5.5
Medical/Surgical Units	115	42.4	10	3.7	125	46.1
Total	248	91.5	23	8.5	271	100.0

WMSD: work-related musculoskeletal disorders

The findings revealed that 42.4% of the nurses working in the Medical/Surgical Units and 29.9% of the nurses working in the Emergency and Intensive Care Units at the GPHC were affected by WMSD in the last 12 months.

In order to identify the occurrence of musculoskeletal disorders, the Nordic Musculoskeletal Questionnaire (NMQ) was used. The prevalence of WMSD of nurses in different body regions at the GPHC in the last 12 months, last week, and the failed to perform relaxation activities in the last 12 months are presented in the Table 5.

Table 5 - Prevalence of musculoskeletal disorders of nurses in different body regions in the last 12 months, last week, and the failed to perform relaxation activities. 2020 (n=271).

Body Regions	WMSD in the last 12 months		WMSD in the last week		Failed to perform relaxation activities in the last 12 months	
	n	%	n	%	N	%
Neck						
No	138	50.9	197	72.7	234	86.3
Yes	133	49.1	74	27.3	37	13.7
Shoulders						
No	169	62.4	216	79.7	237	87.5
Yes	-	-	-	-	34	12.5
Right	27	10.0	19	7.0	-	-
Left	10	3.7	6	2.2	-	-
Both	65	24.0	30	11.1	-	-
Elbows						
No	258	95.2	261	96.3	259	95.6
Yes	-	-	-	-	12	4.4
Right	4	1.5	4	1.5	-	-
Left	2	0.7	1	0.4	-	-
Both	7	2.6	5	1.8	-	-
Wrist/hands						
No	179	66.1	220	81.2	222	81.9
Yes	-	-	-	-	49	18.1
Right	47	17.3	29	10.7	-	-
Left	15	5.5	7	2.6	-	-
Both	30	11.1	15	5.5	-	-
Upper Back						
No	183	67.5	208	76.8	230	84.9
Yes	88	32.5	63	23.2	41	15.1
Lower Back						
No	76	28.0	135	49.8	162	59.8
Yes	195	72.0	136	50.2	109	40.2
Hips/buttocks						
No	221	81.5	241	88.9	244	90.0
Yes	50	18.5	30	11.1	27	10.0
One/both Knees						
No	181	66.8	219	80.8	227	83.8
Yes	90	33.2	52	19.2	44	16.2
One/both Legs						
No	169	62.4	200	73.8	218	80.4
Yes	102	37.6	71	26.2	53	19.6
Total	271	100.0	271	100.0	271	100.0

The Table 5 shows that the prevalence of WMSD among the nurses at the GPHC in the last 12 months was high in the lower back (72.0%), followed by the neck (49.1%), shoulders (37.7%), legs (37.6%), wrist/hands (33.9%), knees (33.2%), upper back (32.5%). Also, the prevalence of WMSD among the nurses at the GPHC in the last week was high in the lower back (50.2%), followed by the neck (27.3%), legs (26.2%), upper back (23.2%), shoulders (20.3%), knees (19.2%), and wrist/hands (18.8%). Besides, most of the nurses at the GPHC were also unable to carry out relaxation activities in the last 12 months because of musculoskeletal pains in the lower back (40.2%), followed by the legs (19.6%), wrist/hands (18.1%), knees (16.2%), upper back (15.1%), and neck (13.7%).

The prevalence of WMSD of nurses in different body regions according to healthcare settings at the GPHC in the last 12 months are presented in the Table 6.

Table 6 - Prevalence of musculoskeletal disorders of nurses in different body regions in the last 12 months in terms of healthcare settings. 2020 (n=271).

Body Regions	Pediatric Units		Emergency and IC Units		Gyneco and Maternity		Medical/Surgical Units		Total	
	N	%	N	%	N	%	N	%	n	%
Neck	16	5.9	51	18.8	10	3.7	56	20.7	133	49.1
Shoulders	12	4.4	42	15.5	6	2.2	42	15.5	102	37.6
Elbows	1	0.4	4	1.5	1	0.4	7	2.5	13	4.8
Wrist/hands	13	4.7	29	10.7	3	1.2	47	17.3	92	33.9
Upper Back	11	4.0	34	12.5	8	3.0	35	13.0	88	32.5
Lower Back	29	10.7	62	22.9	9	3.3	95	35.1	195	72.0
Hips/buttocks	11	4.0	21	7.7	3	1.1	22	8.1	57	21.0
One/both Knees	11	4.0	33	12.2	3	1.1	43	15.9	90	33.2
One/both Legs	13	4.7	37	13.7	4	1.5	48	17.7	102	37.6

It was observed that lower back problems were reported by 35.1% of the nurses working in the Medical/Surgical Units in the last 12 months, 22.9% of the nurses working in the Emergency and IC Units and 10.7% of the nurses in the Pediatric Units. Neck problems were reported by 20.7% of the nurses working in the Medical/Surgical Units and 18.8% of the nurses working in the Emergency and IC Units.

The association between demographic variables (sex, age, category of nurses, education level, ward, years of employment) and the occurrence of WMSD in different body segments related to the participants (according to the NMQ) are presented in tables 7 to 19, below.

Table 7 - Association between sex and musculoskeletal disorders in neck, upper back, lower back, hips, one/both knees, one/both legs reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Male		Female		p value
	No n(%)	Yes n(%)	No n(%)	Yes n(%)	
WMSD in the last 12 months					
Neck	9(42.9)	12(57.1)	129(51.6)	121(48.4)	0.441**
Upper Back	10(47.6)	11(52.4)	173(69.2)	77(30.8)	0.043**
Lower Back	6(28.6)	15(71.4)	70(28.0)	180(72.0)	0.955**
Hips/buttocks	17(81.0)	4(19.0)	204(81.6)	46(18.4)	1.000*
One/both Knees	15(71.4)	6(28.6)	166(66.4)	84(33.6)	0.638**
One/both Legs	8(38.1)	13(61.9)	161(64.4)	89(35.6)	0.017**
WMSD in the last week					
Neck	16(76.2)	5(23.8)	181(72.4)	69(27.6)	0.708**
Upper Back	17(81.0)	4(19.0)	191(76.4)	59(23.6)	0.791*
Lower Back	12(57.1)	9(42.9)	123(49.2)	127(50.8)	0.484**
Hips/buttocks	18(85.7)	3(14.3)	223(89.2)	27(10.8)	0.714*
One/both Knees	17(81.0)	4(19.0)	202(80.8)	48(19.2)	1.000*
One/both Legs	13(61.9)	8(38.1)	187(74.8)	63(25.2)	0.197**

*Fisher's exact test; ** Pearson chi-square test

Table 8 - Association between sex and musculoskeletal disorders in shoulders, elbows, and wrist/hands reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Male				Female				p value
	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	
WMSD in the last 12 months									
Shoulders	11(52.4)	2(9.5)	2(9.5)	6(28.6)	158(63.2)	25(10.0)	8(3.2)	59(23.6)	0.339*
Elbows	19(90.5)	1(4.8)	0(0.0)	1(4.8)	239(95.6)	3(1.2)	2(0.8)	6(2.4)	0.326*
Wrist/hands	13(61.9)	5(23.8)	1(4.8)	2(9.5)	166(66.4)	42(16.8)	14(5.6)	28(11.2)	0.871*
WMSD in the last week									
Shoulders	15(71.4)	2(9.5)	2(9.5)	2(9.5)	201(80.4)	17(6.8)	4(1.6)	28(11.2)	0.120*
Elbows	20(95.2)	0(0.0)	0(0.0)	1(4.8)	241(96.4)	4(1.6)	1(0.4)	4(1.6)	0.560*
Wrist/hands	17(81.0)	3(14.3)	0(0.0)	1(4.8)	203(81.2)	26(10.4)	7(2.8)	14(5.6)	0.937*

*Fisher's exact test

The data presented in the Tables 7 and 8 present a significant association between sex and reported musculoskeletal problems in the upper back ($p=0.043$) and one/both legs ($p=0.017$). No association was found between sex and WMSD related by the nurses in the last week ($p>0.05$), neither between sex and problems in shoulders, elbows, and wrist/hands.

Table 9 - Association between sex, body posture and job demands and social support reported by the participants in the last 12 months and last week. 2020 (n=271).

Nordic Musculoskeletal Questionnaire Items	Male			Female			p value
	Always n(%)	Sometimes n(%)	Never n(%)	Always n(%)	Sometimes n(%)	Never n(%)	
Body posture							
28. During my work I keep a good work	2(9.5)	19(90.5)	0(0.0)	30(12.0)	218(87.2)	2(0.8)	1.000*
29. At work I sit for long hours in one position	0(0.0)	6(28.6)	15(71.4)	1(0.4)	79(31.6)	170(68.0)	1.000*
30. For more than two hours per day I sit with	1(4.8)	7(33.3)	13(61.9)	6(2.4)	99(39.6)	145(58.0)	0.571*
31. During my work I sit in awkward posture	0(0.0)	15(71.4)	6(28.6)	11(4.4)	186(74.4)	53(21.2)	0.606*
32. In work I perform repetitive tasks	11(52.4)	9(42.9)	1(4.8)	93(37.2)	146(58.4)	11(4.4)	0.321*
33. I find my job physically exhausting	4(19.0)	16(76.2)	1(4.8)	46(18.4)	192(76.8)	12(4.8)	1.000*
34. when I key my hand is placed in a straight line with my lower arm	1(4.8)	15(71.4)	5(23.8)	11(4.4)	144(57.6)	95(38.0)	0.384*
35. When I work my head is bended	1(4.8)	18(85.7)	2(9.5)	42(16.8)	181(72.4)	27(10.8)	0.412*
36. Head is twisted towards the left or right	0(0.0)	15(71.4)	5(23.8)	13(5.2)	157(70.0)	62(24.8)	1.000*
37. Truck is twisted towards the left or right	0(0.0)	15(71.4)	6(28.6)	9(3.6)	163(65.2)	78(31.2)	0.909*
38. My trunk is in asymmetrical position	2(9.5)	16(76.2)	3(14.3)	14(5.6)	195(78.0)	41(16.4)	0.694*
Job demands and social support							
39. I work under extensive work pressure	4(19.0)	17(81.1)	0(0.0)	52(20.8)	187(74.8)	11(4.4)	1.000*
40. I have not enough time to finish my job task	4(19.0)	11(52.4)	6(28.6)	32(12.8)	153(61.2)	65(26.0)	0.575*
41. At work I speed to finish my tasks on time	4(19.0)	15(71.4)	2(9.5)	42(16.8)	156(62.4)	52(20.8)	0.515*
42. I find my work tasks difficult	0(0.0)	14(66.7)	7(33.3)	6(2.4)	159(63.6)	85(34.0)	1.000*
43. I have too many job tasks	1(4.8)	13(61.9)	7(33.3)	23(9.2)	173(69.2)	54(21.6)	0.496*
44. The work flow goes smoothly	2(9.5)	17(81.1)	2(9.5)	18(7.2)	225(90.0)	7(2.8)	0.154*
45. I can ask and enquire in my work	8(38.1)	13(61.9)	0(0.0)	109(43.6)	140(56.0)	1(0.4)	0.681*
46. My work tasks depend on other colleagues	5(23.8)	14(66.7)	2(9.5)	48(19.2)	179(71.6)	23(9.2)	0.809*
47. My work atmosphere is comfortable	7(33.3)	14(66.7)	0(0.0)	31(12.4)	200(80.0)	19(7.6)	0.029*
48. If I made a mistake in work task I find support from my colleagues	9(42.9)	11(52.4)	1(4.8)	62(24.8)	173(69.2)	15(6.0)	0.183*
49. If I made a mistake in work task I find support from supervisors	6(28.6)	10(47.6)	5(23.8)	39(15.6)	172(68.8)	39(15.6)	0.131**
50. My colleagues are friendly	11(52.4)	10(47.6)	0(0.0)	69(27.6)	176(70.4)	5(2.0)	0.087*

*Fisher's exact test; ** Pearson chi-square test

The Table 9 shows no association between sex and body posture of the nurses. About job demands and social support, a significant association was found between sex and item 47 of NMQ – My work atmosphere is comfortable ($p=0.029$).

Table 10 - Association between age and musculoskeletal disorders in neck, upper back, lower back, hips, one/both knees, one/both legs reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Age						p value
	20-29		30-39		40-59		
	No n(%)	Yes n(%)	No n(%)	Yes n(%)	No n(%)	Yes n(%)	
WMSD in the last 12 months							
Neck	78(48.1)	84(51.9)	56(56.6)	43(43.4)	4(40.0)	6(60.0)	0.312*
Upper Back	107(66.0)	55(34.0)	68(68.7)	31(31.3)	8(80.0)	2(20.0)	0.680*
Lower Back	42(25.9)	120(74.1)	31(31.3)	68(68.7)	3(30.0)	7(70.0)	0.610*
Hips/buttocks	139(85.8)	23(14.2)	73(73.7)	26(26.3)	9(90.0)	1(10.0)	0.035*
One/both Knees	114(70.4)	48(29.6)	61(61.6)	38(38.4)	6(60.0)	4(40.0)	0.292*
One/both Legs	96(59.3)	66(40.7)	64(64.6)	35(35.4)	9(90.0)	1(10.0)	0.131*
WMSD in the last week							
Neck	117(72.2)	45(27.8)	72(72.7)	27(27.3)	8(80.0)	2(20.0)	0.970*
Upper Back	119(73.5)	43(26.5)	79(79.8)	20(20.2)	10(100.0)	0(0.0)	0.089*
Lower Back	74(45.7)	88(54.3)	56(56.6)	43(43.4)	5(50.0)	5(50.0)	0.233**
Hips/buttocks	146(90.1)	16(9.9)	85(85.9)	14(14.1)	10(100.0)	0(0.0)	0.318*
One/both Knees	134(82.7)	28(17.3)	77(77.8)	22(22.2)	8(80.0)	2(20.0)	0.567*
One/both Legs	114(70.4)	48(29.6)	77(77.8)	22(22.2)	9(90.0)	1(10.0)	0.265*

*Fisher's exact test; **Pearson chi-square test

The Table 10 demonstrates only a significant association with age and WMSD in hips/buttocks ($p=0.035$) of the participants in the last 12 months. No association was found between age and musculoskeletal problems in shoulders, elbows, and wrist/hands (Table 11).

Table 11 – Association between age and musculoskeletal disorders in shoulders, elbows, and wrist/hands reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Age												p value
	20-29				30-39				40-59				
	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	
WMSD in the last 12 months													
Shoulders	104(64.2)	17(10.5)	2(1.2)	39(24.1)	57(57.6)	9(9.1)	8(8.1)	25(25.3)	8(80.0)	1(10.0)	0(0.0)	1(10.0)	0.140*
Elbows	153(94.4)	3(1.9)	2(1.2)	4(2.5)	95(96.0)	1(1.0)	0(0.0)	3(3.0)	10(100.0)	0(0.0)	0(0.0)	0(0.0)	0.890*
Wrist/hands	106(65.4)	26(16.0)	10(6.2)	20(12.3)	67(67.7)	18(18.2)	5(5.1)	9(9.1)	6(60.0)	3(30.0)	0(0.0)	1(10.0)	0.888*
WMSD in the last week													
Shoulders	132(81.5)	11(6.3)	3(1.9)	16(9.9)	75(75.8)	7(7.1)	3(3.0)	14(14.1)	9(90.0)	1(10.0)	0(0.0)	0(0.0)	0.724*
Elbows	154(95.1)	3(1.9)	1(0.6)	4(2.5)	97(98.0)	1(1.0)	0(0.0)	1(1.0)	10(100.0)	0(0.0)	0(0.0)	0(0.0)	0.902*
Wrist/hands	131(80.9)	19(11.7)	4(2.5)	8(4.9)	83(83.8)	8(8.1)	3(3.0)	5(5.1)	6(60.0)	2(20.0)	0(0.0)	2(20.0)	0.324*

* Fisher's exact test

Related to the nurses' category, the Table 12 demonstrates only a significant association with WMSD in the neck ($p=0.016$) of the participants in the last 12 months. No association was found between nurses' category and musculoskeletal problems in the shoulders, elbows, and wrist/hands (Table 13).

Table 12 - Association between nurses' category and musculoskeletal disorders in neck, upper back, lower back, hips, one/both knees, one/both legs reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Registered Nurse		Nursing Assistant		p value
	No n(%)	Yes n(%)	No n(%)	Yes n(%)	
WMSD in the last 12 months					
Neck	85(45.90)	100(54.1)	53(61.6)	33(38.3)	0.016**
Upper Back	121(65.4)	64(34.6)	62(72.1)	24(27.9)	0.274**
Lower Back	58(31.4)	127(68.6)	18(20.9)	68(79.1)	0.075**
Hips/buttocks	151(81.6)	34(18.4)	70(81.4)	16(18.6)	0.964**
One/both Knees	117(63.2)	68(36.8)	64(74.4)	22(25.6)	0.069**
One/both Legs	117(63.2)	68(36.8)	52(60.5)	34(39.5)	0.660**
WMSD in the last week					
Neck	136(73.5)	49(26.5)	61(70.9)	25(29.1)	0.657**
Upper Back	142(76.8)	43(23.2)	66(76.7)	20(23.3)	0.998**
Lower Back	99(53.5)	86(46.5)	36(41.9)	50(58.1)	0.074**
Hips/buttocks	167(90.3)	18(9.7)	74(86.0)	12(14.0)	0.302**
One/both Knees	148(80.0)	37(20.0)	71(82.6)	15(17.4)	0.619**
One/both Legs	141(76.2)	44(23.8)	59(68.6)	27(31.4)	0.185**

**Pearson chi-square test

Table 13 - Association between nurses' category and musculoskeletal disorders in shoulders, elbows, and wrist/hands reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Registered Nurse				Nursing Assistant				p value
	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	
WMSD in the last 12 months									
Shoulders	115(62.2)	19(10.3)	7(3.8)	44(23.8)	54(62.8)	8(9.3)	3(3.5)	21(24.2)	1.000*
Elbows	176(95.1)	2(1.1)	2(1.1)	5(2.7)	82(95.3)	2(2.3)	0(0.0)	2(2.3)	0.794*
Wrist/hands	116(62.7)	38(20.5)	12(6.5)	19(10.3)	63(73.3)	9(10.5)	3(3.5)	11(12.8)	0.124*
WMSD in the last week									
Shoulders	154(83.2)	10(5.4)	4(2.2)	17(9.2)	62(72.1)	9(10.5)	2(2.3)	13(15.1)	0.156*
Elbows	178(96.2)	3(1.6)	1(0.5)	3(1.6)	83(96.5)	1(1.2)	0(0.0)	2(2.3)	0.904*
Wrist/hands	152(82.2)	21(11.4)	4(2.2)	8(4.3)	68(79.1)	8(9.3)	3(3.5)	7(8.1)	0.490*

*Fisher's exact test

Tables 14 and 15 show the association between the ward (Pediatric Units, Emergency/Intensive Care Units, Gyneco/Maternity and Medical/Surgical Units), and musculoskeletal disorders reported by the participants. It was observed a significant association between ward and neck ($p=0.032$) in the last 12 months and between the ward and lower back ($p=0.038$) in the last week (Table 14).

Table 14 - Association between the ward and musculoskeletal disorders in neck, upper back, lower back, hips, one/both knees, one/both legs reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Pediatric Units		Emergency/ICU		GO/Maternity		Medical/Surgical		p value
	No n(%)	Yes n(%)	No n(%)	Yes n(%)	No n(%)	Yes n(%)	No n(%)	Yes n(%)	
WMSD in the last 12 months									
Neck	28(63.6)	16(36.4)	36(41.4)	51(58.6)	5(33.3)	10(66.7)	69(55.2)	56(44.8)	0.032**
Upper Back	33(75.0)	11(25.0)	53(60.9)	34(39.1)	7(46.7)	8(53.3)	90(72.0)	35(28.0)	0.073**
Lower Back	15(34.1)	29(65.9)	25(28.7)	62(71.3)	6(40.0)	9(60.0)	30(24.0)	95(76.0)	0.408**
Hips/buttocks	36(81.1)	8(18.2)	66(75.9)	21(24.1)	15(100.0)	0(0.0)	104(83.2)	21(16.8)	0.125*
One/both Knees	33(75.0)	11(25.0)	54(62.1)	33(37.9)	12(80.0)	3(20.0)	82(65.6)	43(34.4)	0.348*
One/both Legs	31(70.5)	13(29.5)	50(57.5)	37(42.5)	11(73.3)	4(26.7)	77(61.6)	48(38.4)	0.421*
WMSD in the last week									
Neck	31(70.5)	13(29.5)	56(64.4)	31(35.6)	10(66.7)	5(33.3)	100(80.0)	25(20.0)	0.079**
Upper Back	39(88.6)	5(11.4)	62(71.3)	25(28.7)	11(73.3)	4(26.7)	96(76.8)	29(23.2)	0.147*
Lower Back	28(63.6)	16(36.4)	40(46.0)	47(54.0)	11(73.3)	4(26.7)	56(44.8)	69(55.2)	0.038*
Hips/buttocks	40(90.9)	4(9.1)	74(85.1)	13(14.9)	15(100.0)	0(0.0)	112(89.6)	13(10.4)	0.399*
One/both Knees	37(84.1)	7(15.9)	70(80.5)	17(19.5)	13(86.7)	2(13.3)	99(79.2)	26(20.8)	0.900*
One/both Legs	36(81.8)	8(18.2)	58(66.7)	29(33.3)	14(93.3)	1(6.7)	92(73.6)	33(26.4)	0.087*

*Fisher's exact test; ** Pearson chi-square test

Table 15 - Association between the ward and musculoskeletal disorders in shoulders, elbows, and wrist/hands reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Pediatric Units				Emergency/ICU				GO/Maternity				Medical/Surgical				p value
	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	
WMSD in the last 12 months																	
Shoulders	32(72.7)	4(9.1)	2(4.5)	6(13.6)	45(51.7)	10(11.5)	2(2.3)	30(34.5)	9(60.0)	4(26.7)	1(6.7)	1(6.7)	83(66.4)	9(7.2)	5(4.0)	28(22.4)	0.035*
Elbows	43(97.7)	0(0.0)	0(0.0)	1(2.3)	83(95.4)	0(0.0)	1(1.1)	3(3.4)	14(93.3)	0(0.0)	1(6.7)	0(0.0)	118(94.4)	4(3.2)	0(0.0)	3(2.4)	0.285*
Wrist/hands	31(70.5)	7(15.9)	2(4.5)	4(9.1)	58(66.7)	11(12.6)	4(4.6)	14(16.1)	12(80.0)	1(6.7)	1(6.7)	1(6.7)	78(62.4)	28(22.4)	8(6.4)	11(8.8)	0.552*
WMSD in the last week																	
Shoulders	38(86.4)	3(6.8)	0(0.0)	3(6.8)	61(70.1)	6(6.9)	4(4.6)	16(18.4)	13(86.7)	2(13.3)	0(0.0)	0(0.0)	104(83.2)	8(6.4)	2(1.6)	11(8.8)	0.183*
Elbows	43(97.7)	1(2.3)	0(0.0)	0(0.0)	82(94.3)	1(1.1)	0(0.0)	4(4.6)	15(100.0)	0(0.0)	0(0.0)	0(0.0)	121(96.8)	2(1.6)	1(0.8)	1(0.8)	0.607*
Wrist/hands	40(90.9)	3(6.8)	1(2.3)	0(0.0)	71(81.6)	5(5.7)	2(2.3)	9(10.3)	13(86.7)	1(6.7)	0(0.0)	1(6.7)	96(76.8)	20(16.0)	4(3.2)	5(4.0)	0.107*

*Fisher's exact test

The Table 15 show a significant association between the ward and musculoskeletal disorders of the participants in the shoulders (p=0.035) in the last 12 months, but no association was found in the last week for WMSD in the shoulders, elbows, and wrist/hands when the Fisher's exact test was computed.

Table 16 - Association between education level and musculoskeletal disorders in neck, upper back, lower back, hips, one/both knees, one/both legs reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Certificate		Diploma		Bachelor's		p value
	No n(%)	Yes n(%)	No n(%)	Yes n(%)	No n(%)	Yes n(%)	
WMSD in the last 12 months							
Neck	51(63.8)	29(36.3)	62(46.6)	71(53.4)	25(43.1)	33(56.9)	0.022**
Upper Back	58(72.5)	22(27.5)	85(63.9)	48(36.1)	40(69.0)	18(31.0)	0.417**
Lower Back	15(18.8)	65(81.3)	43(32.3)	90(67.7)	18(31.0)	40(69.0)	0.087**
Hips/buttocks	66(82.5)	14(17.5)	107(80.5)	26(19.5)	48(82.8)	10(17.2)	0.900**
One/both Knees	59(73.8)	21(26.3)	91(68.4)	42(31.6)	31(53.4)	27(46.6)	0.038**
One/both Legs	48(60.0)	32(40.0)	92(69.2)	41(30.8)	29(50.0)	29(50.0)	0.037**
WMSD in the last week							
Neck	58(72.5)	22(27.5)	92(69.2)	41(30.8)	47(81.0)	11(19.0)	0.239**
Upper Back	60(75.0)	20(25.0)	99(74.4)	34(25.6)	49(84.5)	9(15.5)	0.289**
Lower Back	32(40.0)	48(60.0)	70(52.6)	63(47.4)	33(56.9)	25(43.1)	0.097**
Hips/buttocks	68(85.0)	12(15.0)	121(91.0)	12(9.0)	52(89.7)	6(10.3)	0.396**
One/both Knees	67(83.8)	13(16.3)	106(79.7)	27(20.3)	46(79.3)	12(20.7)	0.728**
One/both Legs	54(67.5)	26(32.5)	103(77.4)	30(22.6)	43(74.1)	15(25.9)	0.278**

** Pearson chi-square test

The Table 16 shows a significant association between education level (Certificate, Diploma, Bachelor's) and WMSD in the neck (p=0.022), one/both knees (p=0.038), and one/both legs (p=0.037) of the participants in the last 12 months.

Table 17 - Association between educational level (Certificate, Diploma, Bachelor's) and musculoskeletal disorders in shoulders, elbows, and wrist/hands reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Certificate				Diploma				Bachelor's				p value
	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	No n(%)	Right n(%)	Left n(%)	Both n(%)	
WMSD in the last 12 months													
Shoulders	51(63.8)	6(7.5)	2(2.5)	21(26.3)	85(63.9)	17(12.8)	6(4.5)	25(18.8)	33(56.9)	4(6.9)	2(3.4)	19(32.8)	0.389*
Elbows	76(95.0)	2(2.5)	0(0.0)	2(2.5)	126(94.7)	2(1.5)	1(0.8)	4(3.0)	56(96.6)	0(0.0)	1(1.7)	1(1.7)	0.883*
Wrist/hands	60(75.0)	8(10.0)	2(2.5)	10(12.5)	83(62.4)	28(21.1)	7(5.3)	15(11.3)	36(62.1)	11(19.0)	6(10.3)	5(8.6)	0.160*
WMSD in the last week													
Shoulders	58(72.5)	8(10.0)	2(2.5)	12(15.0)	111(83.5)	8(6.0)	2(1.5)	12(9.0)	47(81.0)	3(5.2)	2(3.4)	6(10.3)	0.549*
Elbows	77(96.3)	1(1.3)	0(0.0)	2(2.5)	127(95.5)	3(2.3)	1(0.8)	2(1.5)	57(98.3)	0(0.0)	0(0.0)	1(1.7)	0.963*
Wrist/hands	64(80.0)	8(10.0)	1(1.3)	7(8.8)	111(83.5)	13(9.8)	5(3.8)	4(3.0)	45(77.6)	8(13.8)	1(1.7)	4(6.9)	0.477*

*Fisher's exact test

No association was found between nurses' educational level (Certificate, Diploma, Bachelor's) and musculoskeletal disorders in shoulders, elbows, and wrist/hands in the last 12 months and last week.

Table 18 - Association between years of employment and musculoskeletal disorders in neck, upper back, lower back, hips, one/both knees, one/both legs reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Years of Employment								p value
	<1		1 - 5		6 - 10		>10		
	No n(%)	Yes n(%)	No n(%)	Yes n(%)	No n(%)	Yes n(%)	No n(%)	Yes n(%)	
WMSD in the last 12 months									
Neck	13(59.1)	9(40.9)	80(47.6)	88(52.4)	29(58.0)	21(42.0)	16(51.6)	15(48.4)	0.507**
Upper Back	16(72.7)	6(27.3)	110(65.5)	58(34.5)	35(70.0)	15(30.0)	22(71.0)	9(29.0)	0.825**
Lower Back	2(9.1)	20(90.9)	51(30.4)	117(69.6)	16(32.0)	34(68.0)	7(22.6)	24(77.4)	0.145*
Hips/buttocks	14(63.6)	8(36.4)	144(85.7)	24(14.3)	39(78.0)	11(22.0)	24(77.4)	7(22.6)	0.060**
One/both Knees	14(63.6)	8(36.4)	118(70.2)	50(29.8)	32(64.0)	18(36.0)	7(54.8)	14(45.2)	0.366**
One/both Legs	9(40.9)	13(59.1)	103(61.3)	65(38.7)	30(60.0)	20(40.0)	27(87.1)	4(12.9)	0.005*
WMSD in the last week									
Neck	18(81.8)	4(18.2)	116(69.0)	52(31.0)	41(82.0)	9(18.0)	22(71.0)	9(29.0)	0.251*
Upper Back	15(68.2)	7(31.8)	127(75.6)	41(24.4)	40(80.0)	10(20.0)	26(83.9)	5(16.1)	0.530**
Lower Back	5(22.7)	17(77.3)	85(50.6)	83(49.4)	28(56.0)	22(44.0)	17(54.8)	14(45.2)	0.056**
Hips/buttocks	19(86.4)	3(13.6)	151(89.9)	17(10.1)	43(86.0)	7(14.0)	28(90.3)	3(9.7)	0.767*
One/both Knees	18(81.8)	4(18.2)	136(81.0)	32(19.0)	41(82.0)	9(18.0)	24(77.4)	7(22.6)	0.965*
One/both Legs	12(54.5)	10(5.5)	124(73.8)	44(26.2)	36(72.0)	14(28.0)	28(90.3)	3(9.7)	0.031*

*Fisher's exact test; **Pearson chi-square test

A Significant association was found between years of nurses' employment and WMSD in one/both legs (p=0.005) in the last 12 months and one/both legs (p=0.031) in the last week.

Table 19 - Association between years of employment and musculoskeletal disorders in shoulders, elbows and wrist/hands reported by the participants in the last 12 months and last week. 2020 (n=271).

Body Regions	Years of Employment															p value	
	<1				1 – 5				6 – 10				>10				
	No	Right	Left	Both	No	Right	Left	Both	No	Right	Left	Both	No	Right	Left		Both
n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	
WMSD in the last 12 months																	
Shoulders	14(63.6)	0(0.0)	1(4.5)	7(31.8)	106(63.1)	21(12.5)	3(1.8)	38(22.6)	28(56.0)	3(6.0)	4(8.0)	15(30.0)	21(67.7)	3(9.7)	2(6.5)	5(16.1)	0.172*
Elbows	20(90.9)	0(0.0)	0(0.0)	2(9.1)	161(95.8)	3(1.8)	1(0.6)	3(1.8)	47(94.0)	1(2.0)	1(2.0)	1(2.0)	30(96.8)	0(0.0)	0(0.0)	1(3.2)	0.524*
Wrist/hands	16(72.7)	3(13.6)	1(4.5)	2(9.1)	107(63.7)	27(16.1)	10(6.0)	24(14.3)	37(74.0)	9(18.0)	1(2.0)	3(6.0)	19(61.3)	8(25.8)	3(9.7)	1(3.2)	0.436*
WMSD in the last week																	
Shoulders	18(81.8)	2(9.1)	0(0.0)	2(9.1)	133(79.2)	14(8.3)	4(2.4)	17(10.1)	38(76.0)	1(2.0)	2(4.0)	9(18.0)	27(87.1)	2(6.5)	0(0.0)	2(6.5)	0.635*
Elbows	20(90.9)	0(0.0)	0(0.0)	2(9.1)	161(95.8)	4(2.4)	0(0.0)	3(1.8)	50(100.0)	0(0.0)	0(0.0)	0(0.0)	30(96.8)	0(0.0)	1(3.2)	0(0.0)	0.144*
Wrist/hands	19(86.4)	1(4.5)	0(0.0)	2(9.1)	134(79.8)	20(11.9)	5(3.0)	9(5.4)	43(86.0)	4(8.0)	1(2.0)	2(4.0)	24(77.4)	4(12.9)	1(3.2)	2(6.5)	0.960*

*Fisher's exact test

No association was found between years of nurses' employment and musculoskeletal disorders in shoulders, elbows, and wrist/hands in the last 12 months and last week.

9. Discussion

The demographic research findings revealed that 271 nurses (185 RN and 86 NA) participated in the study at the GPHC. Most of the nurses who participated in the study were in the (<30 years old) age group (162 nurses). Hence, more younger nurses participated in the research compared to older nurses at the GPHC. Also, the nurses who reported WMSD (with lower back pain being the most common type of WMSD) at the GPHC were females, which made up a large proportion (92.3%) of the study population compared to males, which made up the remaining (7.7%) of the study population. Similar findings were also seen in the study done by Naushad et al. (2019), whereby more female nurses participated in the research compared to male nurses.¹⁷

The main reason for this occurrence is because the nursing profession, on the whole, is predominantly made up of female nurses compared to male nurses. The study also revealed that female nurses were mostly affected by musculoskeletal disorder (MSD) than male nurses, and younger nurses (within the 28-35 age group) were more affected by WMSD than older nurses. These findings were also consistent with the present study findings.¹⁷ However, Kalkim, Midilli, and Dogru (2019) cross-sectional study differ from the current study findings, whereby nurses over 40 years were more affected by WMSD.⁸²

Further, Serranheira, Sousa-Uva, and Sousa-Uva (2015) study among Portuguese nurses were also consistent with the study findings at the GPHC, whereby most of the nurses who reported more than one symptom of WMSD were females (78.5%), and lower back pain was the most prevalent complaint among the nurses (60.9%).²³ Ribeiro, Serranheira, and Loureiro (2017) cross-sectional study among nurses in Portugal had similar findings to the present study conducted at the GPHC among RN and NA since the study revealed that mostly female (84.0%) showed a high prevalence of WMSD symptoms in the last 12 months and the lower back was the most affected body region.²⁴ Further evidence was found in Passali et al. (2018) study among nurses in Greek hospitals, which showed that female nurses had a higher risk of WMSD than male nurses.²⁷

Most of the nurses who participated in the study at the GPHC in Guyana were Africans (63.5%), and these nurses also represented a large proportion of the study population, followed by others, which represent nurses of mixed race (24.7%), East Indians (8.9%), and the least number of nurses who participated in the study were Amerindians (3.0%). A large proportion of the nurses were single (70.8%) and were of childbearing age, and 50.9% of the nurses had children. Similar findings were also found in Salama et al.

(2018) study among nurses in Egypt, which revealed that the nurses were of childbearing age and had two pregnancies in the last two years.⁸⁰

Further evidence was also found in Al-Hadidi et al. (2020) cross-sectional study developed among female nurses of childbearing age since lower back pain is considered the most common WMSD among female healthcare workers.⁶⁶ Also, most of the nurses who participated in the study at the GPHC had a diploma in nursing, and the highest level of education attained by the nurses was a Bachelor's degree in nursing. Taghinejad et al. (2016) descriptive-correlational study findings were also consistent with these findings since the nurses who participated in the study also had Bachelors of Science nursing degrees working in public hospitals in Iran and had symptoms of WMSD in the lower back.⁸⁸

Nevertheless, two categories of nurses participated in the study at the GPHC, namely the Registered Nurses (RN) and Nursing Assistants (NA). However, most of the nurses were RN (68.3%), while the least number of nurses were NA (31.7%). The study findings also revealed that 93.0% of the nurses work full-time at the GPHC, 91.5% of the nurses reported WMSD, and 63.1% of the affected nurses were RN, while 28.4% of the affected nurses were NA. The majority of the nurses were employed at the GPHC for five years (62.0%), and (56.9%) of the nurses were affected by WMSD in the first five years of working. These findings revealed that the prevalence of WMSD in the first five years of working in the present study was also higher than the prevalence of WMSD (52.7%) found in the first five years of working in the cross-sectional study done by Chiwaridzo et al. (2018) among nurses in Zimbabwe.¹²

On the other hand, the younger nurses with fewer years of employment and experience were significantly affected by WMSD compared to the older nurses with more years of service and working experience at the GPHC. These findings also emphasized the importance of the nursing administration at the GPHC to closely observe the younger nurses working in the different healthcare settings at the institution to determine why these nurses were more affected by WMSD than the older nurses and offer solutions to mitigate or reduce the prevalence of WMSD among nurses in the workplace. However, Passali et al. (2018) study among nurses in Greek hospitals varies from the present study findings since RN with (11-20) years of work experience had a higher risk of developing WMSD than their younger colleagues.²⁷

Further analysis of the study findings revealed that a large proportion of the nurses who were affected by WMSD at the GPHC did not report sick/absent from work (72.0%),

compared to the small proportion of nurses who reported sick/absent from work (28.0%) due to musculoskeletal pain in the lower back. Hafner, Milek, and Fikfak (2018) study findings were also similar to these findings, whereby more than 5% of the nurses with MSD had sick leave or absent from work frequently because of lower back pain.⁵⁷ Ribeiro, Serranheira, and Loureiro (2017) cross-sectional study also proved that absenteeism was high (51.4%) among the nurses affected by WMSD.²⁴

Even though the nurses were greatly affected by WMSD at the GPHC, the study findings also showed that the majority of the affected nurses did not visit a physician (74.9%) for their musculoskeletal problem at the GPHC, and only a small proportion of the affected nurses, sought medical treatment (25.1%) for their musculoskeletal pain. Hence, the nurses continued to work with their musculoskeletal pain at the GPHC. Evidence in support of these findings was also found in Abolfotouh et al. (2015) cross-sectional study, which showed that (34.3%) of the affected nurses sought medical treatment for their MSD.⁹³ The only difference was that more nurses seek medical treatment in this study compared to the nurses at the GPHC with musculoskeletal pain.

Additionally, 55.0% of the nurses at the GPHC had some form of Body Mechanics Ergonomics Training (BMET) before participating in the study, but despite this, there was a high prevalence of WMSD among the nurses at the GPHC. The fact that 82.3% of the nurses also accepted that they need BMET at the GPHC also indicates that the nurses are willing to participate in a BMET program at the GPHC, which is also essential in reducing the prevalence of WMSD reported by the RN and NA at the GPHC. Other scientific evidence found in the literature was seen in Choi and Brings (2016) study, which also recommended ergonomics assessments and educational training solutions, among others, to reduce WMSD among nurses.³⁶ Coskun, Dilek, and Demiral (2020) study also revealed that ergonomics intervention programs were effective in reducing musculoskeletal complaints among ICU nurses, but intervention without administrative measures would lead to minimum success.⁵³ Further, Dash and Das (2019) study also revealed that the self-instructional module was effective in improving the knowledge of staff nurses on how to prevent low back pain by using proper body mechanics.⁵⁴

More so, Clari et al. (2019) cross-sectional study also showed that urgent implementation of ergonomic interventions is essential in reducing WMSD.⁴³ More evidence to support the present study findings can also be found in Kolcz et al. (2020) study, which revealed that musculoskeletal pain and poor implementation of ergonomic behaviors are

significant problems among nurses.⁵⁰ Also, Bhimani (2016) cross-sectional study revealed that lack of time, patient acuity, ergonomics, body movement issues, knowledge deficit, and communication were risk factors of WMSD.⁵⁶ Abdollahi et al. (2020) Quasi-randomized controlled clinical trial supports this argument by showing how educating nursing staff about ergonomics can influence the prevalence and risk of MSD among nurses.⁵⁵ Therefore, the nursing administration at the GPHC needs to organize and implement an annual BMET program to educate and sensitize the nurses on how to protect themselves from developing WMSD to reduce the prevalence of WMSD among nurses at the GPHC. Fernandes et al. (2018) descriptive and exploratory study also showed that WMSD involving health professionals should be considered a primary problem, and healthcare institutions need to even go beyond training programs to address the situation.⁷⁰ Further solution found in Weiner et al. (2015) study was the use of friction-reducing devices to reduce MSD among nurses.³⁷

In-depth analysis of the study findings also revealed that nurses working in the Medical/Surgical Units (42.4%), Emergency and Intensive Care Units (29.9%), and Pediatrics Unit (14.4%) at the GPHC were affected by WMSD, which was mostly found in the lower back, followed by the neck region. It was, however, vice versa among the nurses working in the Gynecology and Maternity Units (4.8%) at the GPHC in the last 12 months, whereby most of the nurses were affected by WMSD in the neck, followed by the lower back. However, Yan et al. (2016) and Yang et al. (2018) study among nurses working in similar departments (internal medicine, surgery, gynecology, pediatrics, emergency, intensive care, and operating rooms) differs from the present study findings, whereby WMSD were mostly found in the waist, followed by the neck in the last 12 months.^{19, 22} Abdul Rahman, Abdul Mumin, and Naing (2017) study among emergency (ER) and critical care (CC) nurses, also differs from the present study findings, whereby there was a high prevalence of WMSD in the neck, followed by the shoulder region.²⁰ Also, Bazazan et al. (2019) study conducted among emergency nurses revealed that there was a high prevalence of musculoskeletal problems, particularly in the knees, upper back, lower back, neck, and shoulders.²⁶

A critical analysis of the research findings also revealed that the prevalence of WMSD among the nurses at the GPHC in the last 12 months was high in the lower back (72.0%), followed by the neck (49.1%), shoulders (37.7%), legs (37.6%), wrist/hands (33.9%), knees (33.2%), upper back (32.5%), hips/buttocks (18.5%), and elbows (4.8%). Also, similar findings were seen in the cross-sectional studies done by Yan et al. (2017) and Yang et al. (2018), whereby the nurses who participated in these studies were mostly affected

by WMSD in the lower back, neck, and shoulder region of their bodies.^{18, 21} Conversely, Elsherbeny et al. (2018) cross-sectional study findings varies from the present study findings, whereby the elbow region was most affected by WMSD and the lower back region was least affected by WMSD among nurses working in Mansoura Children University Hospital in Egypt.⁷²

Comparatively, the prevalence of MSD found among the nurses at the GPHC in the lower back (72.0%), neck (49.1%), and shoulders (37.7%) in the last 12 months was higher than Yan et al. (2017) study in the lower back (62.71%) but lower in the neck (59.77%), and shoulder (49.66%) regions.²¹ However, the prevalence of MSD at the GPHC was lower than the prevalence of MSD in the cross-sectional study done by Yang et al. (2018) among ICU nurses in China for the lower back (80.1%), neck (78.6%), and shoulders (70.4%) regions, respectively in the last 12 months.¹⁸ Bernal et al. (2015) systematic review and meta-analysis also differ from the present study findings since a high prevalence of shoulder and knee pain was found among nurses and nursing aides.²⁸ Conversely, Davis and Kotowski (2015) comprehensive review was similar to the study at the GPHC since the study results indicated that the prevalence of MSD pain for nurses and nursing aides was highest in the lower back, but differ in terms of the shoulder being the next affected body region, followed by the neck, and not the neck then shoulders as was found in the present study among the nurses at the GPHC.²⁹

Like the present study, WMSD was mostly present in the lower back among nurses in Heidari, Borujeni, and Khosravizad (2018) cross-sectional study.³¹ Also, Filipaska et al.'s (2018) study showed that the occurrence of pain in the spine adversely affects the functional performance of nurses.³³ Rathore, Attique, and Asmaa (2017) cross-sectional study were also consistent with the present study findings since the commonly affected site was the lower back among the nurses (32%). Further Rodarte-Cuevas et al. (2016) cross-sectional study, also supports the findings of the present study and showed that the presence of musculoskeletal problems was in the lumbar/back region, which subsequently decreased the quality of nurses' work-life.³⁸ More so, Mahmoudifar and Seyedamini (2017) cohort study findings were consistent with the present study findings among the nurses at the GPHC and revealed that most complaints from the operating room group (68%) and ICU staff (60%) were for the lumbar musculoskeletal system.⁴² The lower back was also the most affected body region in Abedini et al. (2015), Ching et al. (2018), Cheung et al. (2018), and Vinstrup, Jakobsen, and Andersen (2020) study.^{45, 58, 59, 65}

Further evidence of lower back pain among nurses, in support of the present study findings, was found in Chanchai et al. (2016) study among nurses in Thailand, whereby the lower back was the most affected body region among nurses.⁴⁷ Ouni et al. (2020) descriptive study also revealed that the lower back was the most affected body region among Tunisian nurses.⁴⁸ Also, Nguyen et al. (2020) cross-sectional study showed that the most commonly affected site was the lower back among nurses in Vietnam.⁴⁹ Al-Hadidi et al. (2020) study also revealed there was a high frequency of lower back pain among female nurses.⁶⁶ More so, Amer (2018) cross-sectional study revealed that there was a high frequency of WMSD among Egyptian nurses, and the lower back was mostly affected.⁷³

More evidence of lower back pain among nurses to convey the present study findings can also be found in the systematic review conducted by Pinar and Ali (2018).⁷⁴ The lower back was also the most affected body region in the systematic review and meta-analysis done by Saberipour et al. (2019) among Iranian nurses.⁷⁷ D' Agostin and Negro (2017) cross-sectional study also revealed that lower back pain was most prevalent among nurses.⁷⁸ More so, Tsekoura (2017) study showed that the lower back was mostly affected by MSD among nurses in Greece.⁸⁴ The systematic review conducted by Semachew et al. (2020) among nurses in Africa also revealed that the nurses were mostly affected by lower back pain.⁸⁵

Moreover, Nutzi et al. (2015) study and Tavakkol et al. (2020) multidisciplinary focus review of musculoskeletal disorders also found that the most prevalent musculoskeletal complaints were lumbar (52.7%) among operating room nurses.^{87, 94} Fekadu Mijena et al. (2020) cross-sectional study also revealed that lower back pain was most prevalent among nurses working at public hospitals in Eastern Ethiopia.⁹⁵ Further scientific evidence of lower back pain among nurses was also found in the cross-sectional studies done by Homaid et al. (2016), Alnaami et al. (2019), Jradi, Alanazi, and Mohammad (2020), and the systematic review and meta-analysis done by Almer (2020) among nurses in Saudi Arabia.^{89, 90, 91, 92}

The research findings also revealed that there was a significant decrease in the prevalence of MSD among the nurses at the GPHC in the lower back (50.2%), neck (27.3%), legs (26.2%), upper back (19.2%), shoulders (20.3%), knees (19.2%), wrist/hands (18.8%), hips/buttocks (11.1%), and elbows (3.7%) in the last week compared to the last 12 months. Noting the compelling nature of this new evidence, therefore, suggest that further research is needed in this area to determine what lead to the drastic decrease in the prevalence of WMSD among the nurses at the GPHC in the various body regions in the last week compared to the last 12 months. However, Raithatha and Mishra (2016) cross-sectional study findings were

also similar to the present study findings, whereby lower back pain was most common, and elbow pain was least common among the nurses in India in the last week.⁷⁹ The prevalence of musculoskeletal pain among the nurses at the GPHC in the lower back (50.2%) was also lower than the prevalence found among the nurses in India in the lower back (60.5%) in the last week.⁷⁹

Besides, the study also revealed that most of the nurses at the GPHC were unable to carry out relaxation activities in the last 12 months because of musculoskeletal pains in the lower back (40.2%), followed by the legs (19.6%), wrist/hands (18.1%), knees (16.2%), upper back (15.1%), neck (13.7%), shoulders (12.5%), hips/buttocks (10.0%), and elbows (4.4%). However, no other study has shown these additional findings among nurses. Hence, the present study findings have also filled this gap in the literature. In terms of the healthcare settings, it was also observed that the nurses at the GPHC were mostly affected by lower back pain followed by neck pain, and lower back problems were reported by 35.1% of the nurses working in the Medical/Surgical Units in the last 12 months, 22.9% of the nurses working in the Emergency and Intensive Care Units and 10.7% of the nurses in the Pediatric Units. Similar findings were also found in D'Agostin and Negro (2017) cross-sectional study, whereby lower back pain was the most prevalent symptom, followed by neck pain among the nurses.⁷⁸

Neck problems were, however, reported by 20.7% of the nurses working in the Medical/Surgical Units, 18.8% of the nurses working in the Emergency and Intensive Care Units, 5.9% of the nurses working in the Pediatric Units, and 3.7% of the nurses working in the Gynecology and Maternity Units. The study findings also showed that neck pain was most prevalent among the nurses working in the Gynecology and Maternity Units, while lower back pain was most prevalent among the nurses working in the other units at the GPHC. Westergren, Ludvigsen, and Lindberg (2019) study findings were also similar to the present study findings since neck pain was the most common complaint among nurses working in dialysis centers in Denmark and Sweden.⁶⁷ Further Nur et al. (2016) and Yao et al. (2019) cross-sectional study findings also showed that the neck was the most prevalent site with musculoskeletal pain among nurses.^{16, 83}

In the present study, statistically significant associations were found between sex and WMSD in the upper back ($p=0.043$) and one/both legs ($p=0.017$) in the last 12 months. These findings were similar to the results of the cohort study done by Azizpour, Delpisheh, and Maahsoodi (2015) among operating room personnel and nurses since there were associations

found in the upper body and neck.⁸⁶ However, no association was found among the nurses at the GPHC for MSD in the neck, upper back, lower back, hips/buttocks, one/both knees, and one/both legs in the last week. More so, no association was found between sex and WMSD in the last 12 months and last week ($p>0.05$) in the shoulders, elbows, and wrist/hands, when the Fisher's exact and Pearson's chi-square test was computed in SPSS. Ouni et al. (2020) study findings were also consistent with the present study findings, whereby an association was present between MSD and female gender ($p=0.001$) after conducting a Pearson's chi-square test.⁴⁸

No association was found between sex and body posture in the last 12 months and last week ($p>0.05$). Also, Ratzon, Bar-Niv, and Fromm (2016) study showed similar findings to the present study since there was no statistical difference between nurses and body posture and the number of body parts in pain or the level of musculoskeletal pain.³⁹ However, Mehralizadeh, Dehdashti, and Kashani (2017) study findings differ from the present study since the study showed that there was a personal effect on work posture stressors resulting in musculoskeletal complaints among nurses.³⁰

Moreover, a statistically significant association was found between sex and job demands and social support in the last 12 months and last week for NMQ Item 47-My work atmosphere is comfortable ($p=0.029$) among the nurses at the GPHC. However, these findings were not present in the literature among the studies that utilized the NMQ. More so, a statistically significant association was found between age and WMSD in the hips/buttocks ($p=0.035$) of the participants in the last 12 months. The evidence, which supports these findings, can also be seen in Pinar and Ali (2018) study among operating room and intensive care nurses, whereby a significant association was found between age and WMSD.⁷⁴ In contrast, no associations were found in the neck, shoulders, elbows, wrist/hands, upper back, lower back, hips/buttocks, one/both knees, and one/both legs in the last 12 months and last week among the nurses at the GPHC when the Fisher's exact test was computed based on the responses of the nurses at the GPHC.

Nevertheless, there was a statistically significant association found among the nurses at the GPHC in the neck ($p=0.016$) in the last 12 months for nursing category and WMSD, but no association was found in the last week for MSD in the neck, upper back, lower back, hips/buttocks, one/both knees, and one/both legs when the Pearson's chi-square test was computed. These findings were also supported by Pugh et al. (2015) study, which found reliable results concerning MSD in a group of nurses.⁴⁶ On the contrary, no associations were

found between nursing category and WMSD for the shoulders, elbows, and wrist/hands in the last 12 months and last week.

Moreover, a statistically significant association was found between the various wards (Pediatric Units, Emergency/Intensive Care Units, Gynecology/Maternity, and Medical/Surgical Units) and WMSD reported by the study participants in the last 12 months and last week. It was also observed that a significant association was present between ward and WMSD in the neck ($p=0.032$) in the last 12 months and the lower back ($p=0.038$) in the last week. At the same time, a significant association was found between ward and WMSD in the shoulders ($p=0.035$) in the last 12 months, but no association was found in the last week for MSD in the shoulders, elbows, and wrist/hands when the Fisher's exact test statistics were computed. In support of these findings, Pinar and Ali (2018) systematic review also found a significant association between ward and WMSD among operating room and intensive care nurses.⁷⁴

The present research findings also revealed that there was a statistically significant association between education level and WMSD in the neck ($p=0.022$), one/both knees ($p=0.038$), and one/both legs ($p=0.037$) of the participants in the last 12 months. These findings are in line with previous findings found in Azizpour, Delpisheh, and Maahsoodi (2015) cohort study, whereby a significant relationship was found between the nurse's education level and WMSD ($p<0.05$).⁸⁶ There was, however, no association found in the last week for MSD in the neck, upper back, lower back, hips/buttocks, one/both knees, and one/both legs when the Pearson's chi-square test was computed. Also, no association was found in the last 12 months and last week for musculoskeletal disorders in the shoulders, elbows, and wrist/hands when the Fisher's exact test statistic was computed in SPSS based on the responses obtained from the nurses at the GPHC.

Further, statistical analysis revealed that there was a statistically significant association between years of employment and WMSD in one/both legs ($p=0.005$) in the last 12 months and one/both legs ($p=0.031$) in the last week. Similar findings were also found among nurses in Younan et al.'s (2019) study, whereby there was also a statistical association found between years of employment and WMSD.²⁵ However, no associations were found between years of employment and WMSD in the shoulders, elbows, and wrist/hands reported by the study participants in the last 12 months and last week at the GPHC. Moreover, most of the present study findings correspond with the literature but also revealed some remarkable outcomes.

It is important to note that the overall (91.5%) prevalence of WMSD found among the RN and NA at the GPHC was higher than the prevalence of WMSD found in Ping et al. (2015) correlation analysis, which had a prevalence of (79.52%).³² Also, Farahabadi et al. (2016) study, which had an overall prevalence of 82.7%.⁴⁰ Goswami, Ghosh, and Sahu (2017) study among nurses in India had a prevalence of (89.5%).⁴¹ More so, Nourollahi, Afshari, and Dianat (2018) cross-sectional study prevalence was (72.0%).⁶⁰ Gaowgzeh (2019) study also found that the prevalence of LBP was (61.7%) among nurses, which was lower than the present study findings at the GPHC among RN and NA for LBP in the last 12 months.⁶¹ Further, Amin et al. (2018) study prevalence of WMSD was (73.1%) among female nurses.⁶⁸ Ricco, Pezzetti, and Signorelli (2017) case-control study prevalence was also lower than the present study since the overall prevalence of MSD was 17% in the reference group and 28.3% in the intervention group.⁶⁹ More so, Freiman, Paasuke, and Merisalu (2016) cross-sectional study prevalence of MSD among nurses was 70.0% in the past years and 64.0% in the past month.⁷⁶

Conversely, the research performed by Salama et al. (2018) showed the prevalence of MSD was 99.0% among the nurses in Egypt.⁸⁰ Also, the prevalence of WMSD was 92.3% in the cross-sectional study developed by El-Sallamy et al. (2018) among the nurses at the Tanta University Hospital in Egypt, and 96.8% in the cross-sectional study conducted by Yang, Wang, and Zeng (2020) among the Intensive Care Unit (ICU) nurses in China.^{52,71} However, even though a high prevalence of MSD was found in Schroder and Nienhous (2020) study, there was a variation among the nurses in the intervention group (11.3% - 96.3%) and control group (3.8% - 76.5%).⁶⁴

More evidence in support of this argument can also be found in Chiwaridzo et al. (2018) cross-sectional study, which had a 95.7% prevalence of MSD among the nurses in Zimbabwe, Passali et al. (2018) cross-sectional study had a 98.0% prevalence of WMSD among the nursing staff in Greece. The prevalence of WMSD was 97.0% in the study done by Yang et al. (2018) among the nurses in China.^{12, 18, 27} Given these points, the present study also vividly revealed that the RN and NA at the GPHC were significantly affected by WMSD in various regions of their bodies, like the nurses working in China, Egypt, Greece, and Zimbabwe since the prevalence of WMSD found among nurses in these countries were more than 90.0%.

One of the strengths of this study is that it was the first study in Guyana to investigate the prevalence of WMSD among nurses. It is also the most recent study done (within the last

five years) in Latin America and the Caribbean to investigate the prevalence of WMSD among nurses. The study also used the NMQ, a validated tool used in many countries worldwide to study MSD among different populations, including nurses. The sample size was adequate in obtaining pertinent data from the nurses who participated in the study. The study also played a significant role in understanding the working condition of the RN and NA at the GPHC and was able to answer the research questions and determine how the nurses are affected by WMSD and the type of WMSD most prevalent among the RN and NA working on the various wards at the GPHC.

It is, however, essential to note the limitations of this present study. These limitations are the unavailability of nurses to participate in the study; some of the nurses were unable to complete the questionnaires because of lack of time, and working different shifts. Hence, only two categories of nurses working in inpatient settings at the GPHC had participated in the study. The research wasn't able to determine why there was a significant decrease in the prevalence of WMSD at the GPHC among the nurses who completed the NMQ in the last week, which calls for further research in this area. Nevertheless, there is no implication that the present study results are substantially biased due to misclassification, selection, or misinformation, and there is no plausible reason to believe that the study findings would be significantly different if applied to other categories of nurses (such as staff-nurse midwives and midwives) working in the same or different healthcare settings at the GPHC.

10. Conclusion

Overall, there was a high prevalence of WMSD or musculoskeletal pain (91.5%) among the RN and NA at the GPHC over the last 12 months, but the prevalence had also decreased significantly in the various regions of the nurse's body in the last week compared to the last 12 months. Hence, further research is needed in this area to determine what led to a significant decrease in the prevalence of WMSD among the nurses at the GPHC in the last week compared to the last 12 months. The type of WMSD that was most prevalent among the RN and NA at the GPHC was lower back pain, which prevented the nurses from carrying out relaxation activities during the last 12 months. However, a small proportion of the nurses with musculoskeletal pain reported sick/absent from work at the GPHC and seek medical treatment for their musculoskeletal pain, while the majority of affected nurses continued to work with their musculoskeletal pain at the GPHC.

At the GPHC, younger nurses were most affected by WMSD than older nurses, and the RN was more affected by WMSD in various parts of their bodies than NA at the GPHC. However, in the study, more NA seeks medical treatment for their musculoskeletal pain compared to RN at the GPHC. Nurses working on the Medical/Surgical Units and Emergency/Intensive Care Units were mostly affected by musculoskeletal pain in the last 12 months at the GPHC. Hence, nurses working in these particular wards where the work demands are very high were at a greater risk of developing musculoskeletal pain in their bodies.

In the study, statistically significant associations were found between the variables sex and WMSD, sex and job demands and social support, age and WMSD, and nursing category and WMSD. Also, ward and WMSD, education level and WMSD, and years of employment and WMSD in the last 12 months and last week at the 0.05 significant level. Even though the majority of the nurses at the GPHC had some form of Body Mechanics Ergonomics Training (BMET), the study findings also indicated that more training programs are needed to reduce the prevalence of WMSD among the nurses at the GPHC, along with support from colleagues and supervisors, adequate work-rest cycles, a comfortable work environment, and always maintaining a good posture. On the whole, nurses also need to avoid awkward posture, repetitive tasks, physically exhausting jobs, difficult job tasks, and too many job tasks since these things can lead to WMSD among nurses.

11. Recommendations

1. The nursing administration at the GPHC should organize and implement a yearly BMET program for the nurses at the GPHC.
2. The nurses, nursing leaders and managers at the GPHC need to ensure that the nurses maintain a good body posture at all times at work.
3. The nursing leaders and managers at the GPHC should also ensure that the nurses rotate job tasks frequently to reduce repetitiveness and prevent musculoskeletal injuries.
4. The nurses at the GPHC should be given adequate job tasks that they can manage effectively in a timely manner to prevent strain and stress on their bodies.
5. The GPHC should implement the use of more advanced assistive devices such as mechanical lifts and turning sheets to assist the nurses in lifting, turning and transferring patients at the GPHC.
6. The GPHC should set up a mandatory system for the nurses to report any form of WMSD to ensure that the nurses seeks medical treatment and gets physiotherapy done.
7. The GPHC should assign one or two attendants to each ward to assist the nurses in using the assistive devices when lifting, turning, and transferring patients safely at the GPHC, aid with moving or adjusting patient's beds, bedside cupboards, and assist with heavy loads such as patient's personal belongings.

References

1. Center for Disease Control and Prevention. Work- Related Musculoskeletal Disorders & Ergonomics. Retrieved from <https://www.cdc.gov/workplacehealthpromotion/health-strategies/musculoskeletal-disorders/index.html>. 2018. [Accessed on 10/05/2020]
2. Punnett L and Wegman D. H. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate, *Journal of Electromyography and Kinesiology*. 2004; 14(1):13-23. doi:10.1016/j.jelekin.2003.09.015.
3. Dennerlein J. T. Ergonomics/Musculoskeletal Issues. *International Encyclopedia of Public Health*. 2008, 443–452. <https://doi.org/10.1016/b978-012373960-5.00288-4>
4. Silverstein B, Fan ZJ, Smith CK et al. Gender adjustment or stratification in discerning upper extremity musculoskeletal disorder risk? *Scand J work Environ Health*. 2009 Mar; 35(2):113-126. doi:10.5271/sjweh.1309.
5. Bureau of Labour Statistics. Nonfatal Occupational injuries and illnesses requiring days away from work, 2012, US. 2013. Department of Labour, Washington, DC.
6. Mirmohammadi S, Yazdani J, Etemadinejad S, Asgarinejad H. A cross-sectional study on work-related musculoskeletal disorders and associated risk factors among hospital health cares. *Procedia Manuf*. 2015; 3: 4528-4534. <https://doi.org/10.1016/j.promfg.2015.07.468>
7. Tinubu BM, Mbada CE, Oyeyemi AL, Fabunmi AA. Work-related musculoskeletal Disorders among nurses in Ibadan, South-West Nigeria: a cross-sectional survey. *BMC Musculoskeletal Disorder*. 2010 Jan; 11:12. doi:10.1186/1471-2474-11-12.
8. Yasobant S, Rajkumar P. Work-related musculoskeletal disorders among health care professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India. *Indian J Occup Environ Med* 2014; 18 (2):75-81. doi:10.4103/0019-5278.146896.
9. Sanpatchaya S, Sasitorn T, Chaweewon B, Poramet E. Interventions commonly used to prevent work-related musculoskeletal disorders among healthcare workers. *Journal of Health Research [Internet]*. 2018 Oct; 32 (5):371- 383.
10. Centers for Disease Control & Prevention [CDC]. Safe Patient Handling. Retrieved February 18, 2020 from: <http://www.cdc.gov/niosh/topics/safepatient/>
11. Karahan A, Kav S, Abbasoglu A, Dogan N. Low back pain: Prevalence and associated risk factors among hospital staff. *Journal of Advanced Nursing*. 2009, 65(3), 516-524. doi:10.1111/j.1365-2648.2008.04905.x.

12. Chiwaridzo M, Makotore V, Dambi J. M, Munambah N, Mhlanga M. Work-related musculoskeletal disorders among registered general nurses: a case of a large central hospital in Harare, Zimbabwe. *BMC research notes*. 2018; 11(1): 315.doi:10.1186/s13104-018-3412-8.
13. Blair, H. Practice Good Body Mechanics for a Safe Working Environment. *ONS Connect*. 2008; 23(2):24.
14. Noble NL, Sweeney NL. Barriers to the Use of Assistive Devices in Patient Handling. *Workplace Health & Safety*. 2018 Jan; 66(1):41–48.doi:10.1177/2165079917697216.
15. Oranye NO, Wallis B, Roer K, Archer-Heese G, Aguilar Z. Do Personal Factors or Types of Physical Tasks Predict Workplace Injury? *Workplace Health & Safety*. 2016 Apr; 64(4):141–151. <https://doi.org/10.1177/2165079916630552>
16. Yao Y, Zhao S, An Z, Wang S, Li H, Lu L, et al. The associations of work style and physical exercise with the risk of work-related musculoskeletal disorders in nurses. *International Journal of Occupational Medicine & Environmental Health*. 2019 Jan; 32(1):15–24. doi: <https://doi.org/10.13075/ijomeh.1896.01331>
17. Naushad A, Alsaraeji Z, Ruhumbika Y, Isong EU, Alfoteih Y. The Prevalence of Work-Related Musculoskeletal Disorders among the Nurses in Dubai: Occupational Health Study. *Medico-Legal Update*.2019 Jan; 19(1):156–160.doi:10.5958/0974-1283.2019.00032.X
18. Yang S, Lu J, Zeng J, Wang L, Li Y. Prevalence and Risk Factors of Work-Related Musculoskeletal Disorders among Intensive Care Unit Nurses in China. *Workplace Health & Safety*. 2019 Jun; 67(6):275-287.doi:10.1177/2165079918809107.
19. Yang Y, Huang AM, Wang YN, Zhang L, Li FY, Yao H, et al. [Study on the correlation between work-related musculoskeletal disorders and work ability among nurses at three level general hospital in Xinjiang]. *Chinese Journal of Industrial Hygiene and Occupational Diseases*. 2018 Sep; 36(9):669–673.doi:10.3760/cma.j.issn.1001-9391.2018.09.006
20. Abdul Rahman H, Abdul-Mumin K, Naing L. Psychosocial Work Stressors, Work Fatigue, and Musculoskeletal Disorders: Comparison between Emergency and Critical Care Nurses in Brunei Public Hospitals. *Asian Nursing Research*. 2017 Mar; 11(1):13–18. doi:1016/j.anr.2017.01.003.

21. Yan P, Li F, Zhang L, Yang Y, Huang A, Wang Y, et al. Prevalence of Work-Related Musculoskeletal Disorders in the Nurses Working in Hospitals of Xinjiang Uygur Autonomous Region. *Pain Research & Management*, vol. 2017, Article ID 5757108, 7 pages, 2017. <https://doi.org/10.1155/2017/5757108>
22. Yan P, Li FY, Yang Y, Wang YN, Huang AM, Yao H. [Current status of work-related musculoskeletal disorders in nurses in Xinjiang, China]. *Chinese Journal of Industrial Hygiene and Occupational Diseases*. 2016 Aug; 34(8):561-65. doi:10.3760/cma.j.issn.1001-9391.2016.08.001
23. Serranheira F, Sousa-Uva M, Sousa-Uva A. Hospital nurses tasks and work-related musculoskeletal disorders symptoms: A detailed analysis. *Work*. 2015 Aug; 51(3):401–409. doi:10.3233/WOR-141939.
24. Ribeiro T, Serranheira F, Loureiro H. Work related musculoskeletal disorders in primary health care nurses. *Applied Nursing Research*. 2017 Feb; 33:72-77. doi:10.1016/j.apnr.2016.09.003
25. Younan L, Clinton M, Fares S, Jardali FE, Samaha H. The relationship between work-related musculoskeletal disorders, chronic occupational fatigue, and work organization: A multi-hospital cross-sectional study. *Journal of Advanced Nursing*. 2019 Aug; 75(8):1667-1677. doi:10.1111/jan.13952.
26. Bazazan A, Dianat I, Bahrapour S, Talebian A, Zandi H, Sharafkhaneh A, et al. Association of musculoskeletal disorders and workload with work schedule and job satisfaction among emergency nurses. *International Emergency Nursing*. 2019 May; 44:8-13. doi:10.1016/j.ienj.2019.02.004.
27. Passali C, Maniopoulou D, Apostolakis I, Varlamis I. Work-related musculoskeletal disorders among Greek hospital nursing professionals: A cross-sectional observational study. *Work (Reading, Mass)*. 2018; 61(3):489–498. doi:10.3233/WOR-182812.
28. Bernal D, Campos-Serna J, Tobias A, Vargas-Prada S, Benavides FG, Serra C. Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides: A systematic review and meta-analysis. *International Journal of Nursing Studies*. 2015 Feb; 52(2): 635–648. doi:10.1016/j.ijnurstu.2014.11.003.
29. Davis KG, Kotowski SE. Prevalence of Musculoskeletal Disorders for Nurses in Hospitals, Long- Term Care Facilities, and Home Health Care: A Comprehensive Review. *Human Factors*. 2015 Aug; 57(5):754–92. doi:10.1177/0018720815581933.

30. Mehralizadeh S, Dehdashti A, Kashani MM. Structural equation model of interactions between risk factors and work-related musculoskeletal complaints among Iranian hospital nurses. *Work*. 2017 May; 57(1):137–146.doi:10.3233/wor-172534.
31. Heidari M, Borujeni MG, Khosravizad M. Health-promoting Lifestyles of Nurses and Its Association with Musculoskeletal Disorders: A Cross-Sectional Study. *Journal of Lifestyle Medicine*.2018 Jul; 8(2):72–78.doi:10.15280/jlm.2018.8.2.72
32. Ping Yan, Yi Yang, Li Zhang, Fuye Li, Amei Huang, Yanan Wang, et al. Correlation analysis between work-related musculoskeletal disorders and the nursing practice environment, quality of life, and social support in the nursing professionals. *Medicine*. 2018 Mar; 97(9): e0026.doi:10.1097/MD.00000000000010026
33. Filipaska K, Wolska D, Haor B, Antczak-Komoterska A. Self-assessment of the Musculoskeletal System Load of the Nurses Employed in Conservative and Surgical Departments. *Journal of Neurological & Neurosurgical Nursing*.2018 Dec; 7(4):155-159.
34. Carneiro P, Martins J, Torres M. Musculoskeletal disorder risk assessment in home care nurses.*Work*. 2015 Sep; 51(4):657–65.doi:10.3233/WOR-152024.
35. Rathore FA, Attique R, Asmaa Y. Prevalence and Perceptions of Musculoskeletal Disorders among Hospital Nurses in Pakistan: A Cross-sectional Survey. *Cureus*. 2017 Jan 26; 9(1): e1001.doi:10.7759/cureus.1001.
36. Choi SD, Brings K. Work-related musculoskeletal risks associated with nurses and nursing assistants handling overweight and obese patients: A literature review. *Work*. 2015 Feb; 53(2): 439-48.doi:10.3233/WOR-152222.
37. Weiner C, Alperovitch-Najenson D, Ribak J, Kalichman L. Prevention of Nurses' Work-Related Musculoskeletal Disorders Resulting From Repositioning Patients in Bed: Comprehensive Narrative Review. *Workplace Health & Safety*. 2015 May; 63(5):226-32.doi:10.1177/2165079915580037.
38. Rodarte-Cuevas L, Araujo-Espino R, Trejo-Ortiz PM, González-Tovar J. [Quality of professional life and musculoskeletal disorders in nurses]. *Enfermeria Clinica*. 2016 Oct; 26(6):336– 343.doi:10.1016/j.enfcli.2016.08.002.
39. Ratzon NZ, Bar-Niv NA, Froom P. The effect of a structured personalized ergonomic intervention program for hospital nurses with reported musculoskeletal pain: An assigned randomized control trial. *Work*. 2016 Jun; 54(2):367–77.doi:10.3233/WOR-162340.

40. Farahabadi M, Arani ZA, Chavoshizadeh SA, Barati A. Investigation of Factors Affecting Musculoskeletal Disorders among Hospital Emergency Nurses of Qom University of Medical Sciences, Iran. *Qom University of Medical Sciences Journal*. 2016 Oct; 10(8):54-61.
41. Goswami S, Ghosh S, Sahu S. Evaluation of ergonomic risk factors in manual patient handling tasks of Indian nurses. *Ergonomics SA*. 2017 Aug; 29(1):2-10.doi:10.4314/esa.v29i1.2
42. Mahmoudifar Y, Seyedamini B. Ergonomic Relationship during Work in Nursing Staff of Intensive Care Unit with Operating Room. *International Archives of Health Sciences*. 2017 Apr; 4(2):42–47.doi:10.4103/iahs.iahs_16_17
43. Clari M, Garzaro G, Di Maso M, Donato F, Godono A, Paleologo M, et al. Upper Limb Work- Related Musculoskeletal Disorders in Operating Room Nurses: A Multicenter Cross-sectional Study. *International journal of environmental research and public health*. 2019 Aug; 16(16):2844.doi:10.3390/ijerph16162844
44. Abedini R, Choobineh A R, Hasanzadeh J. Patient manual handling risk assessment among hospital nurse. *Work*. 2015; 50(4): 669–75.doi:10.3233/WOR-141826.
45. Abolfotouh, S. M., Mahmoud, K., Faraj, K., Moammer, G., ElSayed, A., & Abolfotouh, M.A.Prevalence, consequences and predictors of low back pain among nurses in a tertiary care setting. *International Orthopaedics*. 2015 Dec; 39(12):2439–2449.
<http://doi.org/10.1007/s00264-15-2900-x>
46. Pugh J D, Gelder L, Williams A M, Twigg D E, Wilkinson A M, Blazeovich A J. Validity and reliability of an online extended version of the Nordic Musculoskeletal Questionnaire (NMQ-E2) to measure nurses fitness. *J. Clin.Nurs*.2015 Dec; 24 (23-24), 3550–3563.doi: 10.1111/jocn.12971.
47. Chanchai W, Songkham W, Ketsomporn P, Sappakitchanchai P, Siriwong W, Robson M G. The impact of an ergonomics intervention on psychosocial factors and musculoskeletal symptoms among Thai Hospital orderlies. *Int. J. Environ. Res. Public Health*. 2016 May; 13(5), 464.doi:10.3390/ijerph13050464.
48. Ouni M, Elghali MA, Abid N, Aroui H, Dabebbi F. Prevalence and risk factors of musculoskeletal disorders among Tunisian nurses. *La Tunisie medicale*. 2020 Mar; 98(3):225-231.

49. Nguyen TH, Hoang DL, Hoang TG, Pham MK, Bodin J, Dewitte JD, et al. Prevalence and Characteristics of Multisite Musculoskeletal Symptoms among District Hospital Nurses in Haiphong, Vietnam. *BioMed Research International*, vol. 2020, Article ID 3254605, 11 pages, 2020. <https://doi.org/10.1155/2020/3254605>
50. Kołcz A, Baran M, Walewicz K, Paprocka-Borowicz M, Rosińczuk J. Analysis of Selected Body Composition Parameters and Ergonomic Safety among Professionally Active Nurses in Poland: A Preliminary Prospective Monocentric and Observational Study. *BioMed Research International*, vol. 2020, Article ID 9212587, 9 pages, 2020. <https://doi.org/10.1155/2020/9212587>
51. Kim KM, Lee S-J. Work-Related Perceptions, Injuries, and Musculoskeletal Symptoms: Comparison between U.S.-Educated and Foreign-Educated Nurses. *Workplace Health & Safety*. 2019 Jul; 67(7):326–337. doi:10.1177/2165079918821699.
52. Yang S, Li L, Wang L, Zeng J, Li Y. Risk factors for work-related musculoskeletal disorders among intensive care unit nurses in China: a structural equation model approach. *Asian nursing research*. 2020 Aug; 14(4):241-248. doi.org/10.1016/j.anr.2020.08.004
53. Coskun Beyan A, Dilek B, Demiral Y. The Effects of Multifaceted Ergonomic Interventions on Musculoskeletal Complaints in Intensive Care Units. *International journal of environmental research and public health* . 2020 May; 17(10): 3719. doi:10.3390/ijerph17103719
54. Dash K, Das M. A Study to Assess the Effectiveness of Self-Instructional Module Regarding Knowledge of Correct Body Mechanics in Prevention of Low Back Pain among Staff Nurses Working at Tertiary Care Hospital, Bhubaneswar, Odisha. *International Journal of Nursing Education*. 2019 Apr; 11(2):32–35. doi:10.5958/0974-9357.2019.00035.7
55. Abdollahi T, Pedram Razi S, Pahlevan D, Yekaninejad MS, Amaniyan S, Leibold Sieloff C, et al. Effect of an Ergonomics Educational Program on Musculoskeletal Disorders in Nursing Staff Working in the Operating Room: A Quasi-Randomized Controlled Clinical Trial. *International Journal of environmental research and public health*. 2020 Oct; 17(19): 7333. doi:10.3390/ijerph17197333.
56. Bhimani R. Understanding Work-related Musculoskeletal Injuries in Rehabilitation from a Nursing Perspective. *Rehabilitation nursing : the official journal of the Association of Rehabilitation Nurses*. 2016 Mar; 41(2):91–100. doi:10.1002/rnj.187.

57. Hafner ND, Milek DM, Fikfak MD. Hospital Staff's Risk of Developing Musculoskeletal Disorders, Especially Low Back Pain. *Zdravstveno Varstvo*. 2018 Jun; 57(3):133–139. doi:10.2478/sjph-2018-0017.
58. Ching SSY, Szeto G, Lai GKB, Lai XB, Chan YT, Cheung K. Exploring the Synergic Effects of Nursing Home Work on Work-Related Musculoskeletal Disorders among Nursing Assistants. *Workplace Health & Safety*. 2018 Mar; 66(3):129–135. doi:10.1177/2165079917717497.
59. Cheung K, Szeto G, Lai GKB, Ching SSY. Prevalence of and Factors Associated with Work- Related Musculoskeletal Symptoms in Nursing Assistants Working in Nursing Homes. *International journal of environmental research and public health*. 2018 Feb; 15(2):265. doi:10.3390/ijerph15020265
60. Nourollahi M, Afshari D, Dianat I. Awkward trunk postures and their relationship with low back pain in hospital nurses. *Work*. 2018; 59(3):317–323. doi:10.3233/WOR-182683.
61. Gaowgzeh RAM. Low back pain among nursing professionals in Jeddah, Saudi Arabia: Prevalence and risk factors. *Journal of Back & Musculoskeletal Rehabilitation*. 2019 Jul; 32(4):555–560. doi:10.3233/BMR-181218.
62. Ngan K, Drebit S, Siow S, Yu S, Keen D, Alamgir H. Risks and causes of musculoskeletal injuries among health care workers. *Occup Med (Lond)*. 2010 Aug; 60(5): 389- 394. <https://doi.org/10.1093/occmed/kqq052>
63. Hämmig O. Work- and stress-related musculoskeletal and sleep disorders among health professionals: a cross-sectional study in a hospital setting in Switzerland. *BMC musculoskeletal disorders*. 2020 May; 21(1):319. doi:10.1186/s12891-020-03327-w
64. Schröder C, Nienhaus A. Intervertebral Disc Disease of the Lumbar Spine in Health Personnel with Occupational Exposure to Patient Handling-A Systematic Literature Review and Meta-Analysis. *International journal of environmental research and public health*. 2020 Jul; 17(13):4832. doi:10.3390/ijerph17134832
65. Vinstrup J, Jakobsen MD, Andersen LL. Perceived Stress and Low-Back Pain Among Healthcare Workers: A Multi-Center Prospective Cohort Study. *Frontiers in public health*. 2020 Aug; 8:297. doi:10.3389/fpubh.2020.00297
66. Al-Hadidi F, Bsisu I, Haddad B, AlRyalat SA, Shaban M, Matani N, et al. The prevalence of low back pain among female hospital staff at childbearing age. *PeerJ*. 2020 May 15; 8:e9199. doi:10.7717/peerj.9199

67. Westergren E, Ludvigsen MS, Lindberg M. Prevalence of musculoskeletal complaints among haemodialysis nurses - a comparison between Danish and Swedish samples. *International Journal of Occupational Safety and Ergonomics : JOSE*. 2019 Dec; 1–6. doi:10.1080/10803548.2019.1688018.
68. Amin NA, Quek KF, Oxley JA, Noah R, Nordin R. Emotional Distress as a Predictor of Work-Related Musculoskeletal Disorders in Malaysian Nursing Professionals. *International Journal of Occupational and Environmental Medicine*. 2018 Apr; 9(2): 69-78. doi:10.15171/ijjem.2018.1158.
69. Riccò M, Pezzetti F, Signorelli C. Back and neck pain disability and upper limb symptoms of home healthcare workers: A case-control study from Northern Italy. . *International Journal of Occupational and Environmental Health*. 2017 Mar; 30(2):291-304. doi:10.13075/ijomeh.1896.00629.
70. Fernandes CS, Couto G, Carvalho R, Fernandes D, Ferreira P. Self-reported work-related musculoskeletal disorders among health professionals at a hospital in Portugal. *Revista brasileira de medicina do trabalho : publicacao oficial da Associacao Nacional de Medicina do Trabalho-ANAMT*. 2018 Sep; 16(3):353-359. doi:10.5327/Z1679443520180230.
71. El-Sallamy M., Rania, Zayed, Hanaa , Saied, Shimaa, Shehata, Walaa. Work-Related Musculoskeletal Disorders among nursing staff of Tanta University Hospitals: pattern, risk factors, and coping strategies. *Community Medicine*. 2019 Oct; 37(4):51-61.
72. Elsherbeny EE, Elhadidy SS, El-Masry R, and El-Bahnasawy AS: Prevalence and associated factors of musculoskeletal complaints among nurses of Mansoura University children hospital. *Egyptian Journal of Occupational Medicine*, 2018 May; 42 (2):151-166. doi:10.21608/ejom.2018.6800
73. Amer SA: Work-related musculoskeletal symptoms among nurse staff in Ismailia, Egypt. *Egyptian Journal of Occupational Medicine*, 2018 Jan; 42 (1):61-78. doi:10.21608/EJOM.2018.4939
74. Pinar S and Ali O: Evaluation of the prevalence of musculoskeletal disorders in nurses: A systematic review. *Med Science*, 2018; 7(3): 479-85. doi:10.5455/medscience.2017.06.8747

75. Freimann T, Pääsuke M, Merisalu E. Work-Related psychosocial factors and mental health problems associated with musculoskeletal pain in nurses: A cross-sectional study. *Pain Res Manag.* vol. 2016, Article ID 9361016, 7 pages, 2016. <https://doi.org/10.1155/2016/9361016>.
76. Lin SC, Lin LL, Liu CJ, Fang CK, Lin MH. Exploring the factors affecting musculoskeletal disorders risk among hospital nurses. *PLoS ONE.* 2020; 15(4): e0231319. <https://doi.org/10.1371/journal.pone.0231319>
77. Saberipour B, Ghanbar S I, Zarea K, Gheibizadeh M, Zahedian M. Investigating prevalence of musculoskeletal disorders among Iranian nurses: A systematic review and meta-analysis. 2019; 7(3): 513–518. doi:10.1016/j.cegh.2018.06.007
78. D'Agostin F, Negro C. Symptoms and musculoskeletal diseases in hospital nurses and in a group of university employees: A cross-sectional study. *Int J Occup Saf Ergon.* 2016; 23(2): 274– 284. doi:10.1080/10803548.2016.1198092.
79. Raithatha AS, Mishra DG. Musculoskeletal disorders and perceived work demands among female nurses at a tertiary care hospital in India. *Int J Chron Dis.* 2016. <https://doi.org/10.1155/2016/5038381>
80. Salama L A A, Eleshnamie HA M. Musculoskeletal disorder: Risk factors and coping strategies among nurses. *Journal of Nursing Education and Practice.* 2018; 8(11): 51–60. doi: <https://doi.org/10.5430/jnep.v8n11p50>
81. Arsalani N, Khoshknab MF, Josephson M, et al. Musculoskeletal disorders and working Conditions among Iranian nursing personnel. *Int J Occup Saf Ergon* 2014; 20(4):671-80. doi:10.1080/10803548.2014.11077073.
82. Kalkim A, Midilli TS, Dogru S. Musculoskeletal disorder symptoms in nurses a etiological factors: A cross-sectional research. *Ann Med Res.* 2019; 26(3): 374–381. doi: 10.5455/annalsmedres.2019.01.01
83. Nur A, Rusli BN, RM N, Oxley JA, Quek KF. Work related musculoskeletal disorders female nursing personnel: prevalence and impact. *IJCRIMPH.* 2016; 8(3): 294–315.
84. Tsekoura M, Koufogianni A, Evdokia B, Elias T. Work- related musculoskeletal Disorder among Female and Male nursing personnel in Greece. *WJRR.* 2017; 3(1):8-15.
85. Semachew, Ayele & Workineh, Yinager & Ayalew, Emiru & Animaw, Worku. Low back pain among nurses working in clinical settings of Africa: systematic review and meta-analysis of 19 years of studies. *BMC Musculoskeletal Disorders.* 2020 May; 21(1):310. doi:10.1186/s12891-020-03341-y.

86. Azizpour Y, Delpisheh A, Maghsoodi Moghadam R. Ergonomic Evaluation of Job Performance within the Staff of the Nursing and the Operating Room by REBA Technique. *Journal of Nursing and Midwifery of Urmia University of Medical Sciences*. 2015;13(1):75-83.
87. Nützi M, Koch P, Baur H, Elfering A. Work–Family conflict, task interruptions, and influence at work predict musculoskeletal pain in operating room nurses. *Safety and health at work*. 2015; 6(4):329-37.doi:10.1016/j.shaw.2015.07.011.
88. Taghinejad H, Azadi A, Suhrabi Z, Sayedinia M. Musculoskeletal disorders and their related risk factors among iranian nurses. *Biotechnology and Health Sciences*. 2016; 3(1):e34473.doi:10.17795/bhs-34473.
89. Homaid MB, Abdelmoety D, Alshareef W, Alghamdi A, Alhozali F, Alfahmi N, et al. Prevalence and risk factors of low back pain among operation room staff at a Tertiary Care Center, Makkah, Saudi Arabia: a cross-sectional study. *Annals of occupational and environmental medicine*. 2016;28:1.doi:10.1186/s40557-016-0089-0.
90. Al Amer, H. S. Low back pain prevalence and risk factors among health workers in Saudi Arabia: A systematic review and meta-analysis. *Journal of Occupational Health*. 2020. 62(1). e12155. <https://doi.org/10.1002/1348-9585.12155>
91. Alnaami, I., Awadalla, N. J., Alkhairy, M., Alburidy, S., Alqarni, A., Algarni, A., Mahfouz, A. A. Prevalence and factors associated with low back pain among health care workers in southwestern Saudi Arabia. *BMC Musculoskeletal Disorders*. 2019; 20(1): 56. doi:10.1186/s12891-019-2431-5.
92. Jradi, H., Alanazi, H., & Mohammad, Y. Psychosocial and occupational factors associated with low back pain among nurses in Saudi Arabia. *Journal of Occupational Health*. 2020; 62(1). e12126. <https://doi.org/10.1002/1348-9585.12126>
93. Abolfotouh, S. M., Mahmoud, K., Faraj, K., Moammer, G., ElSayed, A., & Abolfotouh, M.A. Prevalence, consequences and predictors of low back pain among nurses in a tertiary care setting. *International Orthopaedics*. 2015; 39(12): 2439–2449. <https://doi.org/10.1007/s00264-15-2900-x>
94. Tavakkol, R., Karimi, A., Hassanipour, S., Gharahzadeh, A., & Fayzi, R.A. Multidisciplinary Focus Review of Musculoskeletal Disorders Among Operating Room Personnel. *Journal of Multidisciplinary Healthcare*. 2020; 13: 735–741. <http://doi.org/10.2147/jmdh.s259245>

95. Fekadu Mijena, G., Geda, B., Dheresa, M., & Fage, S. G. Low Back Pain Among Nurses Working at Public Hospitals in Eastern Ethiopia. *Journal of Pain Research* 2020; 13: 1349–1357. <https://doi.org/10.2147/jpr.s255254>
96. Feuerstein M. Work style: definition, empirical support, and implications for prevention, evaluation, and rehabilitation of occupational upper-extremity disorders. In: *Beyond Biomechanics: Psychological Aspects of Musculoskeletal Disorders in Office Work*, S.D. 1996, Moon and S.L. Sauter (Eds), pp. 177–206.
97. Kumar S. Theories of musculoskeletal injury causation. *Ergonomics*.2001 Jan; 44(1):17-47.[doi:10.1080/00140130120716](https://doi.org/10.1080/00140130120716).
98. Karsh B, T. Theories of work-related musculoskeletal disorders: Implications for ergonomic interventions. *Theoretical Issues in Ergonomics Science*.2006; 7: 71– 88.
99. National Research Council and Institute of Medicine. *Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities*. Panel on Musculoskeletal Disorders and the Workplace. 2001, Commission on Behavioral and Social Sciences and Education (Washington, DC: National Academy Press). 510 pages. <https://doi.org/10.17226/10032>.
100. Westgaard R, H. Effects of psychological demand and stress on neuromuscular function. In: *Beyond Biomechanics: Psychological Aspects of Musculoskeletal Disorders in Office Work*, S.D. 1996, Moon and S.L. Sauter (Eds), pp. 75–90 (Bristol, PA:Taylor & Francis).
101. Carayon P, Smith M, J. Work organization and ergonomics. *Applied Ergonomics*. 2000 Dec, 31(6):649-662.[doi:10.1016/s0003-6870\(00\)00040-5](https://doi.org/10.1016/s0003-6870(00)00040-5).
102. Smith M J, Carayon P. Work organization, stress, and cumulative trauma disorders. In: *Beyond Biomechanics: Psychological Aspects of Musculoskeletal Disorders in Office Work*, S.D. 1996, Moon and S.L. Sauter (Eds), pp. 23–42
103. Armstrong T J, Buckle P, Fine L J, Hagberg M, Jonsson B, Kilbom A, Kuorinka I A, Silverstein B A, Sjøgaard G, Viikari-Juntura E A. A conceptual model of work-related neck and upper-limb musculoskeletal disorders. *Scandinavian Journal of Work Environment and Health*.1993; 19: 73–84.[doi:10.5271/sjweh.1494](https://doi.org/10.5271/sjweh.1494).
104. Dudovskiy. J. Methodology. Descriptive Research. Retrieved from <https://research-Methodology.net/descriptive-research/2019>. [Accessed on 20/08/2019]
105. Crawford, J. O. The Nordic Musculoskeletal Questionnaire. *Occupational Medicine*. 2007 June; 57:300-301. [http://doi.org/10.1093/occmed/kqmo36](https://doi.org/10.1093/occmed/kqmo36)

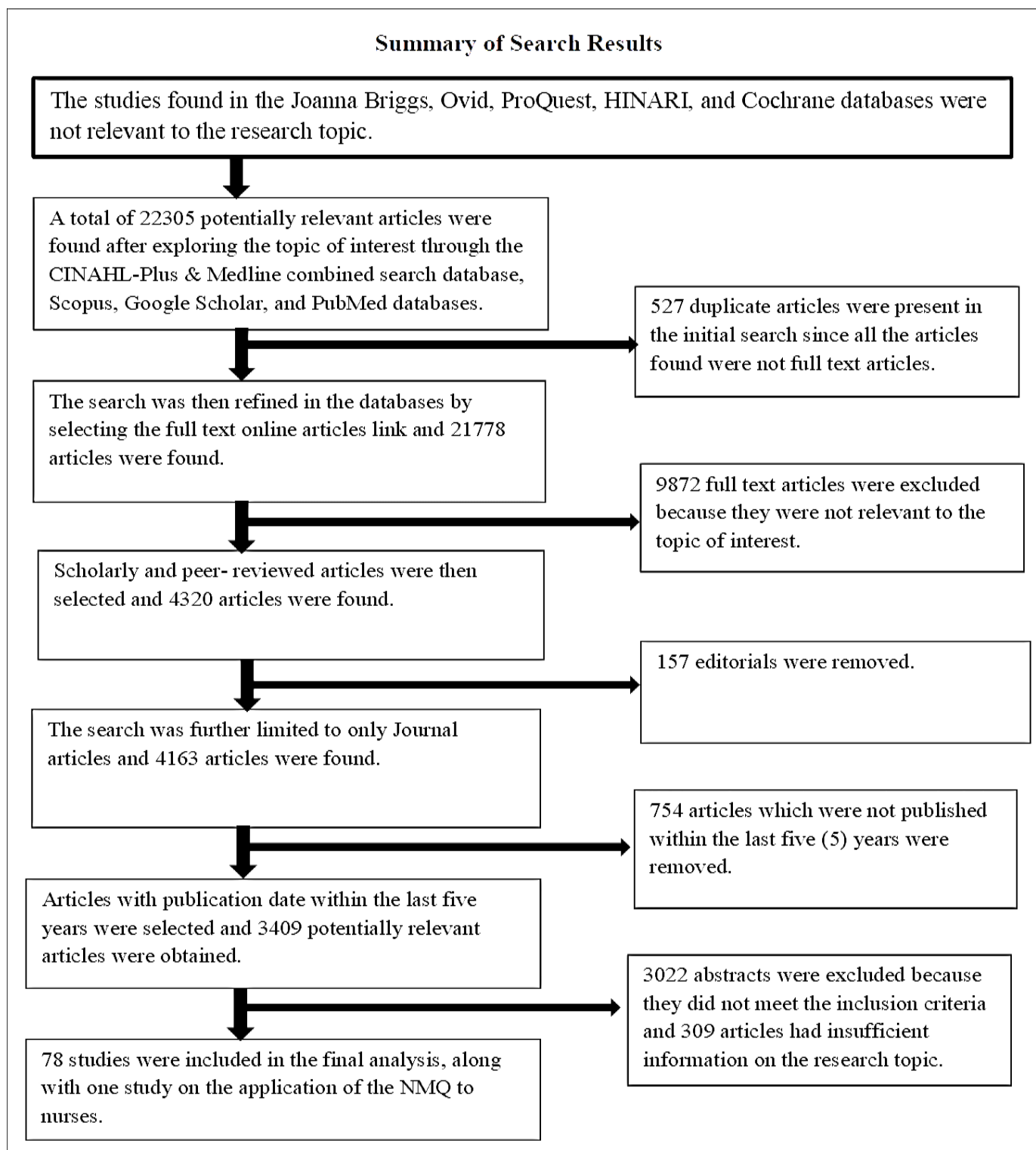
106. Kuorinka I, Jonsson B, Kilbom A et al. Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. *Appl Ergon* 1987 Sep;18(3):233–237.doi: 10.1016/0003-6870(87)90010-x.
107. Roja Z, Kalkis V, Roja I, Kalkis H. The effects of a medical hypnotherapy on clothing industry employees suffering from chronic pain. *Journal of Occupational Medicine and Toxicology*. 2013 Sep; 8: 25. <http://doi.org/10.1186/1745-6673-8-25>
108. Lopez- Aragon L, Lopez- Liria R, Callejon- Ferre A, Gomez- Galan. Applications of the Standardized Nordic Questionnaire: A review. *Sustainability*. 2017 Aug; 9(9):1514. <https://doi.org/103390/su9091514>
109. Lusted M J, Carrasco C L, Mandryk J A, Healey S. Self- reported symptoms in the neck and upper limbs in nurses. *Appl. Ergon.* 1996, 27, 381–387.
110. Maul I, Laubli T, Klipstein A, Krueger H. Course of low back pain among nurses: A longitudinal study across eight years. *Occup. Environ. Med.* 2003 Jul; 60(7), 497–503. doi:10.1136/oem.60.7.497.
111. Smith D R, Wei N, Zhao L, Wang R S. Musculoskeletal complaints and psychosocial risk factors among Chinese hospital nurses. *Occup. Med.* 2004 Dec; 54(8): 579–582.doi: 10.1093/Occmed/kqh117.
112. Yeung S S, Genaidy A, Deddens J, Sauter S. The relationship between protective and risk characteristics of acting and experienced workload, and musculoskeletal disorder cases among nurses. *J. Saf. Res.* 2005, 36(1): 85–95.doi:10.1016/j.jsr.2004.12.002.
113. Hartvigsen J, Lauritzen S, Lings S, Lauritzen T. Intensive education combined with low tech ergonomic intervention does not prevent low back pain in nurses. *Occup. Environ. Med.* 2005 Jan; 62(1): 13–17.doi:10.1136/oem.2003.010843.
114. Choobineh A, Rajaeefard A, Neghab M. Association between perceived demands and musculoskeletal disorders among hospital nurses of Shiraz University of Medical Sciences: A questionnaire survey. *Int. J. Occup. Saf. Ergon.*2006; 12(4): 409–416.doi: 10.1080/10803548.2006.11076699.
115. Smith D R, Mihashi M, Adachi Y, Koga H, Ishitake T. A detailed analysis of musculoskeletal disorder risk factors among Japanese nurses. *J. Saf. Res.* 2006 May; 37(2): 195–200.doi:10.1016/j.jsr.2006.01.004.
116. Schenk P, Laubli T, Klipstein A. Validity of pressure pain thresholds in female workers with and without recurrent low back pain. *Eur. Spine J.* 2007Feb; 16(2): 267–275.doi: 10.1007/s00586-006-0124-x

117. Kee D, Seo S R. Musculoskeletal disorders among nursing personnel in Korea. *Int. J. Ind. Ergon.* 2007Mar; 37(3): 207–212.doi:10.1016/j.ergon.2006.10.020
118. Feng C K, Chen M L, Mao I F. Prevalence of and risk factors for different measures of low back pain among female nursing aides in Taiwanese nursing homes. *BMC Musculoskelet. Dis.*2007 Jun; 8: 52. <https://doi.org/10.1186/1471-2474-8-52>
119. Valecillo M, Luisa-Quevedo A, Lubo-Palma A, Dos Santos A, Montiel M, Camejo M, Sanchez, M. Musculoskeletal symptoms and occupational stress among nurses in a military hospital. *Bol. Malar. Salud Ambi.*2009; 17(2): 85–95.
120. Choobineh A, Movahed M, Tabatabaie S H, Kumashiro M. Perceived demands and musculoskeletal disorders in operating room nurses of Shiraz City hospitals. *Ind. Health* 2010, 48(1), 74–84.doi:10.2486/indhealth.48.74.
121. Kim I H, Geiger-Brown J, Trinkoff A, Muntaner C. Physically demanding workloads and the risks of musculoskeletal disorders in homecare workers in the USA. *Health Soc. Care Community* 2010 Sep; 18(5): 445–455. <https://doi.org/10.1111/j.1365-2524.2010.00916.x>
122. Mehrdad R, Dennerlein J T, Haghghat M, Aminian O. Association between psychosocial factors and musculoskeletal symptoms among Iranian nurses. *Am. J. Ind. Med.* 2010 Oct; 53(10):1032–1039.doi:10.1002/ajim.20869.
123. Arsalani N, Fallahi-Khoshknab M, Ghaffari M, Josephson M, Lagerstrom M. Adaptation of questionnaire measuring working conditions and health problems among Iranian nursing personnel. *Asian Nurs. Res.* 2011Sep; 5(3): 177–182. doi:<https://doi.org/10.1016/j.anr.2011.09.004>
124. Costa-Schmidt D R, Spadoti-Dantas R A. Quality of work life and work-related musculoskeletal disorders among nursing professionals. *Acta Paul. Enferm.* 2012; 25(5): 701–707.
125. Carneiro P, Braga A C, Barroso M. Forecasting the risk of WRMSDs in home care nurses. In *Proceedings of the 8th International Symposium on Occupational Safety and Hygiene*, Guimaraes, Portugal. 2012 Feb; 104–110.<http://hdl.handle.net/1822/20449>
126. Serranheira F, Uva M, Uva A. Backache and work in hospital nurses. In *Proceedings of the 9th International Symposium on Occupational Safety and Hygiene (SHO)*, Guimaraes, Portugal, 14–15 February 2013; 469–471.

127. Serranheira F, Sousa-Uva M, Sousa-Uva A. Hospital nurses tasks and work-related musculoskeletal disorders symptoms: A detailed analysis. *Work* 2015; 51(3), 401–409. doi:10.3233/WOR-141939.
128. Darby B, Gallo A M, Fields W. Physical attributes of endoscopy nurses related to musculoskeletal problems. *Gastroenterol. Nurs.* 2013; 36(3): 202–208. doi: 10.1097/SGA.0b013e31829466eb
129. Raeisi S, Namvar M, Golabadi M, Attarchi M. Combined effects of physical demands and shift working on low back disorders among nursing personnel. *Int. J. Occup. Saf. Ergon.* 2014; 20(1): 159–166. doi:10.1080/10803548.2014.11077034.
130. Barzideh M, Choobineh A R, Tabatabaee H R. Job stress dimensions and their relationship to musculoskeletal disorders in Iranian nurses. *Work* 2014; 47(4): 423-429. doi:10.3233/WOR-121585.
131. Mynarski W, Grabara M, Nawrocka A, Niestroj-Jaworska M, Wolkowycka B, Cholewa J. Physical recreational activity and musculoskeletal disorders in nurses. *Med. Pracy* 2014 Jul; 65(2): 181–188. doi:10.13075/mp.5893.2014.018
132. Reed L F, Battistutta D, Young J, Newman B. Prevalence and risk factors for foot and ankle musculoskeletal disorders experienced by nurses. *BMC Musculoskelet. Dis.* 2014; 15: 196. doi:10.1186/1471-2474-15-196.
133. Moreira R F, Sato T O, Foltran F A, Silva L C, Coury H J. Prevalence of musculoskeletal symptoms in hospital nurse technicians and licensed practical nurses: Associations with demographic factors. *Braz. J. Phys. Ther.* 2014; 18(4): 323–333. doi: 10.1590/bjpt-rbf.2014.0026
134. Akodu AK, Ashalejo ZO. Work-related musculoskeletal disorders and work ability among hospital nurses. *Journal of Taibah University Medical Sciences.* 2019 Mar; 14(3):252–261. doi:10.1016/j.jtummed.2019.02.009

Appendices

Appendix A



Appendix B - Consent Form

Dear Research Participant,

I am a final year student currently pursuing my Master's Degree in Fundamental Nursing at the University of São Paulo in Brazil, and I am kindly seeking your permission to participate in my research study. My research topic is "The prevalence of work-related musculoskeletal disorders (WMSD) among nurses at the GPHC." This research aims to improve the nurse's working environment and prevent WMSD among nurses. Also, you will not be exposed to any risk if you participate in the research, and your assistance and cooperation will be greatly appreciated. Your participation is also voluntary, and about 15 minutes of your time will be required to complete the Personal Data Sheet and Nordic Musculoskeletal Questionnaire. Also, all information will be kept confidential, and if you are no longer interested in participating in the research, you are free to withdraw from the study at any time.

If you need further information, as it pertains to the research study, please feel free to contact me by email: - noelhi_punch2000@yahoo.com or by telephone number 592-689-9282.

Thank you in anticipation.

Signature of participant

.....

Date: -.....

Signature of researcher

.....

Date: -.....

Appendix C – Demographic Characteristics of the Participants

This instrument contains two sections. Section A - Personal History and Section B- Occupational History. Please place a tick (✓) in the appropriate circle provided and answer all questions to the best of your knowledge and ability.

(Section A) - Personal History

1. How old are you? (years) _____
2. Sex: 1Male 2Female
3. Ethnicity: 1African 2East Indian 3Amerindian 4Others
4. Marital Status: 1Single 2Married 3Divorced
5. Do you have any children? 1No 2Yes
6. What is your highest level of Nursing Education? 1Certificate 2Diploma
3Bachelor's Degree 4Master's Degree 5PhD

(Section B) - Occupational History

7. How long have you been working at the GPHC? _____
8. What is your employment status? 1Part-time 2Full- time
9. Do you work at the GPHC only? 1No 2Yes
10. Which department/ward do you presently work on at the GPHC? _____
11. Kindly select your category of nursing: 1RN 2NA
12. Have you ever developed any work-related musculoskeletal pain or discomfort since you started working at the GPHC? 1No 2Yes
13. If yes have you seen a physician for this condition? 1No 2Yes
14. If yes did you report sick or stay away from work? 1No 2Yes
15. Have you ever done any body mechanics or ergonomics training before? 1No 2Yes
16. Would you like to participate in a body mechanics or ergonomics training session?
1No 2Yes

Appendix D - Permission Letter for GPHC

Lot 28 Eldorado Village

West, Coast, Berbice

Date: - 14/06/2019

The Chief Executive Officer

Cc: Director of Medical, Nursing & Professional Services

Georgetown Public Hospital Corporation

New Market Street

Georgetown Guyana

Dear Mr. George Lewis,

I am a final year student currently pursuing my Master's Degree in Fundamental Nursing at the University of São Paulo in Brazil, and I am, therefore, kindly seeking your permission to conduct my research study on the prevalence of work-related musculoskeletal disorders (WMSD) among nurses at the GPHC. Also, I am currently seeking your approval to self-administer my questionnaires to the nurses working in the various departments at the GPHC to obtain information for my research study, which is a requirement for the Masters of Fundamental Nursing Programme at the University of São Paulo.

I would also like to assure you that the research findings would benefit the institution by helping the organization to put measures and systems in place to improve nurses working environment, prevent nurses from developing WMSD, as well as reduce the number of days nurses stay away from work as a result of developing WMSD at the GPHC. Thank you in anticipation.

Yours Sincerely,










Noelhi Punch

Attachments

Attachment 1 - The Nordic Musculoskeletal Questionnaire

Please answer if you have never had any trouble in any parts of your body
(One tick for each question using tick boxes)

Have you at any time during the last 12 months had trouble (ache, pain, discomfort, numbness) in:

1 Neck  No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	2 Shoulders  No 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> in the right shoulder 3 <input type="checkbox"/> in the left shoulder 4 <input type="checkbox"/> in both shoulders	3 Elbows  No 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> in the right elbow 3 <input type="checkbox"/> in the left elbow 4 <input type="checkbox"/> in both elbows	4 Wrist/hands  No 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> in the right wrist/hand 3 <input type="checkbox"/> in the left wrist/hand 4 <input type="checkbox"/> in both wrist/hand	5 Upper back  No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	6 Lower back  No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	7 Hips/ buttocks  No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	8 One/both knees  No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	9 One/both legs  No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
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Have you had trouble during the last week in:

10 Neck No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	11 Shoulders No 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> in the right shoulder 3 <input type="checkbox"/> in the left shoulder 4 <input type="checkbox"/> in both Shoulders	12 Elbows No 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> in the right elbow 3 <input type="checkbox"/> in the left elbow 4 <input type="checkbox"/> in both elbows	13 Wrist/hands No 1 <input type="checkbox"/> Yes 2 <input type="checkbox"/> in the right wrist/hand 3 <input type="checkbox"/> in the left wrist/hand 4 <input type="checkbox"/> in both wrist/hands	14 Upper back No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	15 Lower back No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	16 Hips/ buttocks No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	17 One/both knees No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	18 One/both legs No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
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During the last 12 months have you been prevented from carrying out relaxation activities (e.g. physical activities, housework, hobbies, swimming) because of this trouble?

19 Neck No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	20 Shoulders No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	21 Elbows No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	22 Wrist/hands No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	23 Upper back No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	24 Lower back No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	25 Hips/ buttocks No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	26 One/both knees No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>	27 One/both legs No Yes 1 <input type="checkbox"/> 2 <input type="checkbox"/>
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Body Posture

Job demand and social support

	Always	Sometimes	Never		Always	Sometimes	
28 During my work I keep a good work Posture.	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	Never	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
29 At work I sit for long hours in one position	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	39 I work under extensive work pressure	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
30 For more than two hours per day I sit with lifted shoulders	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	40 I have not enough time to finish my Job task	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
31 During my work I sit in awkward posture	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	41 At work I speed to finish my tasks on time	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
32 In work I perform repetitive tasks	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	42 I find my work tasks difficult	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
33 I find my job physically exhausting	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	43 I have too many job tasks	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

34 when I key my hand is placed in a straight line with my lower arm	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	44 The work flow goes smoothly	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
35 When I work my head is bended	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	45 I can ask and enquire in my work	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
36 Head is twisted towards the left or right	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	46 My work tasks depend on other colleagues	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
37 Truck is twisted towards the left or right	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	47 My work atmosphere is comfortable	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
38 My trunk is in asymmetrical position	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	48 If I made a mistake in work task I find support from my colleagues	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
				49 If I made a mistake in work task I find support from supervisors	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>
				50 My colleagues are friendly	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>

Source: Roja, Zenija & Kalkis, Valdis & Roja, Inara & Kalkis, Henrijs. The effects of a medical hypnotherapy on clothing industry employees suffering from chronic pain. *Journal of occupational medicine and toxicology* (London, England). 2013; 8: 25. doi:10.1186/1745-6673-8-25.

Attachment 2 - University of São Paulo Permission Letter for GPHC

		UNIVERSITY OF SÃO PAULO AT RIBEIRÃO PRETO COLLEGE OF NURSING
PAHO/WHO Collaborating Centre for Nursing Research Development		Avenida Bandeirantes, 3900 - Ribeirão Preto - São Paulo - Brasil - CEP 14040-902 Phone: 55 16 3315.3393 - Fax: 55 16 3315.0518 www.eerp.usp.br - eerp@usp.br

Permission Letter for GPHC

Lot 28 Eldorado Village
West, Coast, Berbice
Date: - 01/07/2019

The Chief Executive Officer
Cc: Director of Medical, Nursing & Professional Services
Georgetown Public Hospital Corporation
New Market Street
Georgetown Guyana

Dear Mr. George Lewis,

We hereby certify that Noelhi Hermes Punch is a student of the University of São Paulo at Ribeirão Preto College of Nursing - EERP/USP, currently enrolled in the Master's Program in Fundamental Nursing and the student will be conducting her final year research project at the GPHC to collect data for her research project.

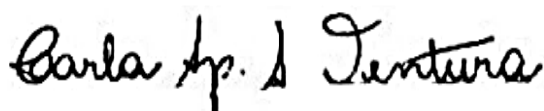
Therefore, the EERP/USP is kindly seeking your permission for Ms. Noelhi Punch to conduct her research project at the GPHC, which is a major requirement to complete the Masters of Fundamental program at the USP.

Please let me know if you need further information.

Sincerely,



Dr. Lucila Castanheira Nascimento
Full professor
Department of Maternal-Infant Nursing and Public Health



Dr. Carla A. Arena Ventura
Full professor
Department of Psychiatric Nursing and Social Sciences

Attachment 3 - IRB Form**International Review Board Application Form****Ministry of Public Health
Guyana****Project Proposal Form
Ethical Review Committee**

1. Title of Project: - The prevalence of work-related musculoskeletal disorders (WMSD) among nurses at the Georgetown Public Hospital Corporation (GPHC) in Guyana.

2. Investigators:

Primary investigator (PI): - Noelhi Punch

Tel No.: - 592 689-9282

Collaborators/Co investigators

Name: - Tel no: -

Sponsors/Agencies/Organization: - University of São Paulo, Ribeirão Preto College of Nursing

3. Expected dates of:

Sample collection field work: - March, 2020 to August, 2020

Lab analysis: -

Writing final results/thesis/publication: - December, 2020

4. Purpose and objective of project.

The purpose of this research study is to investigate the prevalence of WMSD among nurses at the GPHC as well as identify the most common type of musculoskeletal disorder among nurses.

5. How many subjects will be used?

Two hundred and seventy (270) subjects will be used in the research study.

6. Who are being recruited and what are the criteria for their selection?

Only the Registered Nurses and Nursing Assistants who are working full-time at the GPH and Part-time at another hospital and the nurses working the 7-3 shift, 1-9 shift or night shift will be recruited for the study.

7. How are subjects being recruited? If with written materials, attach a copy. If verbally state exactly what they will be told, by whom, and when and where this will occur.

The nurses working at the GPHC will be recruited for the study based on the inclusion criteria of the research, and the researcher will explain the significance of the study to the participants prior to the administration of a consent form which will also be voluntarily signed by the nurses who wish to take part in the study at the GPHC.

8. Describe the study methodology and procedures. Include details of all medical devices or tests, interviews, questionnaires, or use of medical records.

The research will be a quantitative descriptive study aimed at determining the prevalence of work-related musculoskeletal disorders (WMSD) among nurses at the GPHC. Also, the researcher will conduct the study for a period of seven months at the GPHC. During the seven months period the researcher will collect data from the nurses using a structured self-administered Personal Data Sheet, and the Nordic Musculoskeletal Questionnaire developed from a project funded by the Nordic Council of Ministers. The first five months will be used to collect the data and the last two months will be used to analyse the data, write up the final report, and the findings will be presented.

9. What is known about the risks and benefits of the proposed research? Do you have any additional opinions on this issue?

There are no known risks pertaining to this research, and the benefits of this research is to make suitable recommendations to sensitize persons who are in the capacity to put systems and programmes in place to create a better work environment for nurses at the GPHC to prevent nurses from developing WMSD, as well as reduce the among of days nurses report sick or stay away from work at the GPHC.

10. What discomfort or incapacity are subjects likely to endure as a result of their participation?

The subjects will not endure any form of discomfort or incapacity as a result of participating in the research.

11. What provisions are made to protect confidentiality? Who has access to coded and encoded data?

The researcher will be the only person administering the Personal Data Sheets, and the Nordic Musculoskeletal Questionnaire to the nurses at the GPHC, and all information obtained will be kept in a confidential manner, and only the researcher will have access to the coded and encoded data.

12. How much time will a subject have to dedicate to participating?

The subjects participating in the study will have to dedicate approximately 15 minutes of their time to the research.

13. What are plans for future use of data or samples, beyond what is already described?

The data or sample will be used as future references, as well as for making meaningful comparison with follow up studies on the same topic or similar topics of interest.

14. How will informed consent be obtained? If by written forms, please attach copies. If informed consent will be verbal, state who will be involved and provide a written statement of information that will be given to subjects, and to nurses or other intermediaries.

Informed consent will be obtained by a written consent form.

15. Do you agree to provide a statement of significant findings (not more than one page in laypersons terms) to the MOPH Committee when writing your paper/thesis, and to copy such information to participants who request it?

Yes, the researcher agrees to provide a statement of significant findings to the Ministry of Public Health (MOPH) committee as well as study participants when requested.

16. If the study is a part of your requirement for training, list the members of your supervisory committee and their affiliated institutions:

Prof. Dr. Fernanda Rocha - University of São Paulo.

Nurse Charnette Cornette - Georgetown Public Hospital Corporation.

17. I certify that this statement is true. I agree to submit any subsequent changes in study design that bear on living subjects to the IRB for review. I will report to the IRB any concerns brought to me by the study participants about their roles or treatment in the project.

Signed: *N. Hunch*
(Principle Investigator)

Date 07/02/2020

G. Cornette
(Research Supervisor)

Date 07-02-2020

Please submit completed forms along with seven (7) copies of the study Proposal and other relevant documents to:

Dr. Shamdeo Persaud, CMO
Chairman, IRB/Ethical Review Committee
Ministry of Public Health, Guyana
Lot 1 Brickdam, Stabroek
GEORGETOWN
Guyana
Tel: 592 226 1224
Fax 592 225 6271

E-mail: cmoguyana@gmail.com or cmo@health.gov.gy

Attachment 4 - IRB Approval Form

Institutional Review Board FWA00014641
Ministry of Public Health
Brickdam, Georgetown, GUYANA
Telephone: 592-22-61224
e-mail: cmoguyana@gmail.com/cmo@health.gov.gy

Memo

To: Noelhi Punch
From: The Chairman, IRB Ministry of Health
Date: 5/08/2019
Re: IRB Approval of New Protocol # 608/2019

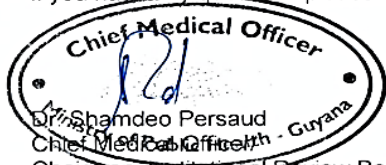
The Ministry of Public Health's IRB has reviewed the request for approval of protocol # **608/2019** entitled "*The prevalence of work-related musculoskeletal disorders (WMSD) among nurses at the GPHC in Guyana*", and has approved the protocol for the maximum allowable period of **one year**. This IRB approval expires **July, 2020**.

As a reminder, the IRB must review and approve all human subjects' research protocols at intervals appropriate to the degree of risk, but not less than once per year. There is no grace period beyond one year from the last IRB approval date. It is ultimately your responsibility to submit your research protocol for continuation review and approval by the IRB. Please keep this approval in your protocol files as proof of IRB approval and as a reminder of the expiration date. To avoid lapses in approval of your research and the possible suspension of subject enrollment and/or termination of the protocol please submit your continuance request at least six weeks before the protocol expiration date.

Upon completion of your research a Report ^{CP} **MUST** be submitted to the Board.

Any problems of a serious nature should be brought to the immediate attention of the IRB and any proposed changes to the protocol should be submitted as an amendment to the protocol for IRB approval before they are implemented.

If you have any questions please contact the **IRB Administrator** or the **IRB Chairman** on **226-1224**.


 Dr. Shamdeo Persaud
 Chief Medical Officer
 Chairman, Institutional Review Board

Ministry of Public Health
GUYANA

Regulation in accordance with the MOH Act

**ETHICAL PRINCIPLES & POLICIES GOVERNING RESEARCH INVOLVING
HUMAN SUBJECTS**

The Guyana Institutional Review Board, Ministry of Public Health requires that all research projects or studies involving human subjects comply with the principles and procedures for protecting human research subjects specified below.

1. ***Ethical Principles Governing Human Subjects Research***

The Guyana Institutional Review Board, Ministry of Public Health is guided by the ethical principles regarding research involving human subjects set forth in the Declaration of Helsinki. These ethical principles must guide individuals, groups and institutions in the conduct of all studies in which human subjects participate.


2. ***Policies Governing Human Subjects Research***


The policies below are to be compiled with by all Researchers.

- a) Researchers acknowledge and accept their responsibilities for protecting the rights and welfare of all human subjects involved in research which they sponsor or conduct.
- b) Researchers encourage and promote a research atmosphere that safeguards the rights and welfare of human subjects.
- c) Researchers agree that before human subjects are involved in research which they sponsor or conduct, proper consideration must be given to:
 - 1) Risks to the subjects
 - 2) Anticipated benefits to the subjects and others
 - 3) Importance of the knowledge that may reasonably be expected to result
 - 4) Informed consent process to be employed
- d) Researchers agree that, whenever appropriate, they will consider special safeguards for protecting research subjects who may be vulnerable to coercion or undue influence, such as children, prisoners, pregnant women, refugees, mentally disabled persons, rural populations and economically or educationally disadvantaged persons.

e) Researchers agree to provide appropriate administrative overview to ensure that these principles are applied effectively.

3. The Guyana IRB, Ministry of Public Health may implement appropriate mechanisms to ensure that these regulations are complied with.


.....
Chairman
Institutional Review Board


.....
Investigator(s)

Date: 5/8/19.....

Date: 05/08/19.....

Attachment 5 - Approval Letter from GPHC



Georgetown Public Hospital Corporation

Director of Medical & Professional Services

New Market Street, Georgetown, Guyana
Tel: 226-6712; Fax: 225-3346; Email: medicaldjefgphc@gmail.com



4th March, 2020

Dr. Fernanda Rocha
University of Sao Paulo,
Ribeirao Preto Collage of Nursing Brazil.

Dear. Dr. Rocha,

I hereby confirm that approval has been granted for Nurse Noelhi Punch to access records to carry out her research paper entitled:

"The prevalence of work — related musculoskeletal disorder (WMSD) among nurses at the Georgetown Public Hospital Corporation (GPHC) in Guyana"

Sister: Charnette Corvette, Junior Departmental Supervisor has been identified to supervise this research on behalf of the Georgetown Public Hospital Corporation.

Please be reminded of the following:

- that permission needs to be sought for any publication of information gathered using our data
- Copies of the **final** research papers **must** be submitted to the hospital through my office upon completion of the research.



 Dr. Fawcett Jeffrey
 Director, Medical & Professional Services
 GEORGETOWN PUBLIC HOSPITAL CORPORATION

Copy: Brigadier George Lewis, C.E.O
 Sister Celeste Gordon, Assistant Director, Nursing Services
 Brother Keith Alonzo, Assistant Director, Nursing Services
 Dr. Shamdeo Persaud, Chief Medical Officer, Ministry of Public Health
 Sister: Charnette Corvette, Junior Departmental Supervisor
 Researcher: Nurse, Noelhi Punch.

Supervisor: Bro: Owen John, Georgetown School of Nursing