Determining the Factors Affecting the Work-Related Musculoskeletal Disorder of Nurses Amidst COVID-19 in the National Capital Region

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Abstract

The work-related musculoskeletal disorders have always been a significant health problem for nurses, especially during the COVID-19 pandemic. They were expected to fight on the frontlines for an extensive time and sometimes without rest. The president of FNU, Maristela Abenojar, stated that the working conditions of the nurses were no longer humane. Several nurses worked more than 12-hours shifts while taking care of as many as 20 patients, refraining from having their meals and going to the bathrooms to save PPEs. In line with this, the current study utilized regression analysis to determine the risk factors that significantly affect the WMSDs of the nurses. The survey results gathered 103 nurse respondents from different hospitals around the National Capital Region. The findings have shown that several significant risk factors were identified to influence the WMSDs substantially. Some of the risk factors mentioned and the body region that they affected were the following: Working near physical limits and working while injured affected the hip/buttocks; safety or ergonomic training experience and work duration affected the lower back; an excessive number of patients affected the neck. The study also displayed a comprehensive and detailed proposed corrective action to confront the work-related risk factors present among the nurses. Organizational intervention must be done to help the nurses reduce their WMSDs and have a healthy work environment. Finally, a deeper analysis of each task can help further improve the study results.

Keywords: Work-related Musculoskeletal Disorders, Risk Factors, Nurses, COVID-19, Proposed Corrective Actions

1. Introduction

The fight against the coronavirus has been occurring for over two years now since it started to terrorize every country in 2020. According to the World Health Organization (WHO), the COVID-19 is an infectious disease that originated in Wuhan, China. The virus could spread through the mouth or nose of an infected person when they sneeze, cough, speak or breathe.

WHO (2021) mentioned that as of September 6, 2021, there were over 224 million confirmed cases of COVID-19 on a Global scale. In the report made by the Department of Health (DOH 2021), the national case data showed that there was a total of over 2 million confirmed positive cases of coronavirus in the Philippines. It also showed that the NCR was the top region with the most cases, with 697,033 cases as of September 7, 2021. Based on the COVID-19 tracker provided by the DOH (2021), 7,100 (68.4%) was the bed occupancy out of the total 10,380 for the early part of September. The data showed a higher percentage compared to the bed occupancy of 40.8% for June 2021. Out of 156 medical facilities in NCR, 33 facilities have a high risk (70% to < 85%) occupancy rate level, and 47 facilities have a critical (≥ 85%) occupancy rate level.

According to Haddad et al. (2020), nurses made up the most significant part of the health profession and were a critical component of healthcare. They have contributed to various world's primary health care achievements. They participate during major crises such as natural and man-made disasters, epidemics, and pandemics. Nurses play a significant role as key players in the recovery of the patients from being hospitalized and isolated due to the coronavirus and the COVID-19 outbreak planning and management.

In the study of Fawaz et al. (2020), the researchers stated that the nurses were continuously in the front line to take care of the patients and were actively involved with monitoring and evaluation in the community. They also engage in anticipated COVID-19-related outbreak planning. Therefore, this increases the demand for nurses and healthcare services. The nurses also have a role in maintaining the successful usage and supply of personal protective equipment and sanitation materials. They were also tasked to offer confinement guidelines, screening information, and triage protocols. In a global pandemic for public safety, awareness and knowledge exchange, and clinical management, a robust nursing workforce engagement was needed.

Anzalone (2020) also mentioned that nurses were also considered to have a critical role in mitigating the spread of infectious disease to reduce the death rate of the patients and slow down the spread of disease, which would contribute to the less burden in managing patients. The nurses serve as a vital link between patients and the health care team because they accompany the patients throughout their shift. Therefore, they noticed subtle changes in their patients by applying a nurse's assessment with critical thinking. The findings from the evaluation performed by the nurse would lead to decision-making done by the health care team to give an appropriate response to the patient's condition.

Maristela Abenojar, the national president of Filipino Nurses United (FNU), in the article by Santos (2021), mentioned that several nurses work 12-hours shifts while taking care of as many as 20 patients. She also noted that the nurses were refraining from having their meals and going to the bathrooms to save Personal Protective Equipment (PPE). She added that the working conditions were no longer humane. Furthermore, Abenojar mentioned that chronic understaffing of nurses has always been present, but the COVID-19 pandemic has made it more severe. She added that the FNU was given reports of numerous having a nurse shortage of 100 or more.

There were still many unanswered problems and concerns, particularly in high-risk environments and therapeutic settings. One issue was overcrowding in the emergency department, which has been noted as a critical source of worry. Adams & Walls (2020) mentioned that even though many health care workers recognized that heightened infection risk was an unavoidable aspect of the job, they frequently express concern about familial transmission, mainly when it involves elderly, immunocompromised, or chronically ill family members. It was also mentioned that because many of the nurses have medical conditions that increase their risk of severe infection or death if they become infected with COVID-19, organizations would need to decide whether or not to redeploy health care workers, including physicians, away from high-risk areas they become infected with the virus.

According to Nurs (2020), death could have been a source of stress and distress for nurses, mainly when the emphasis was on life preservation, such as in critical care units and emergency departments. They find themselves in a position where nurses worldwide were bracing themselves for what was genuinely a tsunami of death on their watch. Furthermore, the inability of the nurses on the front lines to save lives would harm their physical and emotional well-being.

Gotinga (2021) stated that doctors and nurses were bracing themselves as they encountered an overwhelming number of patients with critical conditions every day. Many hospitals were reaching their maximum capacity, resulting in patients who needed urgent treatment being sent home. Many people also have lost their lives waiting for hospitals to return a call to them. Some hospitals were reportedly forced to choose between patients who needed more attention.

Another article by Morales & Lema (2021) mentioned that overwhelmed hospitals faced several resignations caused by the surge of patients amidst the pandemic. Thousands of medical workers had mentioned common reasons for their resignation, such as psychological exhaustion from the workload, emotional torture, low pay, and poor working conditions.

Amidst the battle against the COVID-19 outbreak, frontline nurses have experienced various mental health challenges. According to Hu et al. (2020), out of 2014 frontline nurses, 60.5% had reported moderate and high burnout due to emotional exhaustion. The study also showed that 10.7%, 14.4%, and 91.2% of the participants revealed that they experience moderate to high levels of depression, anxiety, and fear, respectively.

Working as a nurse on the frontline affected a person's psychological and bodily condition, especially in a specific place where nurses were overworked. According to the SRM Institute of Medical Services (SIMS, 2020), several tasks involving a significant muscle response lead to a force load on the body. Awkward postures could have also been

damaging due to the excessive force on the joints, which were prone to overloading muscles and tendons. In addition, poor health habits such as lack of hydration, improper nutrition, and poor fitness could put a person at risk of chronic health issues and Musculoskeletal Disorder (MSD). MSDs could also develop when fatigue outpaces the rest and recovery needed by the body.

Boakye et al. (2018) stated that WMSDs or Work-related Musculoskeletal Disorders were single or multiple disorders in the tendons, muscles, joints, ligaments, spinal disc, or cartilage indicated by discomfort, or disability, impairment, or persistent pain. WMSDs could be caused or worsen mainly by the work performance and immediate environment effect where the work was being done. Most of the time, the disorders were present in the lower back, hand/wrist, shoulder, and neck regardless of the type of physical job. MSDs could usually cause temporary or permanent occupational disabilities.

In another study by Salik & Ozcan (2004), the researchers stated that WMSDs among the physical therapists in Izmir-Turkey were high due to their profession. 85% of the respondents had experienced one or more WMSDs in their career life. The researchers also mentioned that among the human body parts, most of the WMSDs that the respondents experienced were present in the lower back, which has the highest frequency of 26%, followed by hand-wrist (18%), shoulders (14%), and neck (12%). The researchers also mentioned a tendency for younger therapists to experience more WMSDs due to the lack of knowledge, skill level, and professional experience.

Anderson & Oakman (2016) stated that Allied Health Professionals (AHP) and nurses were involved with demanding physical work and psychosocial hazard exposure, including heavy or extreme workloads, limited job control, and time pressure. In addition, WMSDs prevention strategies focus on diminishing the physical hazards and risks. The lack of compatibility between risk management strategies and potential WMSDs causal factors by some means accounts for the health care sector's high number of reported WMSDs, despite the considerable efforts to minimize their prevalence.

The following were work-related musculoskeletal disorders studies associated with the nurses. In Boakye et al.'s (2018) study, the researchers conducted a survey of WMSDs among nurses and midwives. The study showed 79% and 53.8% WMSDs among registered general nurses (RGN) and registered community health nurses (RCHN). The study also showed that 52.1% of the respondents reported that lifting and transferring of dependent patients contributed most to the prevalence of WMSDs. 46.5% and 39.6% said that inadequate injury prevention training and working in awkward or cramped positions were also the most recognized factor for WMSDs.

In another study made by Trinkoff et al. (2006), the researchers determined that the work schedule of the nurses had increased the risk of developing MSDs. Nurses working instead of having a break, on a day off, and while sick were reported to have increased MSD. Working with less than 10 hours out was also reported to increase MSD among nurses because they do not have enough time to heal or recover to normal. In addition, over time, have a significant relationship with reported injury. The researchers explained that hours of a shift were positively correlated with injury risk.

Nguyen et al. (2020) stated that the most persistent health problem among nurses was musculoskeletal disorders. The 12-months prevalence of Musculoskeletal Symptoms (MS) for male nurses was 60.6%, while 77.6% for female nurses. Furthermore, the usual body parts affected were the neck, upper back, shoulders/upper arm, and lower back. The prevalence of Multisite Musculoskeletal Symptoms for 12 months for males and females was 37.6% and 57.1%, respectively. The MMS prevalence tended to worsen with age, seniority, a history of MSDs, and working in an urban a district hospital.

Another study by Anap et al. (2013) mentioned that one of the highest MSDs belongs to the nurse occupation. The study showed that 89.1% of the nurses had WMSDs or discomforts at some part of their life practicing their profession. It was reported that 48.2% of the respondents experienced WMSDs in the low back, 34.6% in the shoulders, 33.1% in the neck, and 29% in the neck. Other body parts like thoracic, foot and ankle, elbow, and hip had less prevalence among the nurses. More than half of the respondents (52.4%) had reported that lifting or transferring dependent patients was one of the most recognized WMSD risk factors throughout their duty, followed by working in the same positions for extended periods (47.6), lifting, carrying, or moving heavy equipment or materials (42.4%) and treating excessive quantity of patients in a single day (41.0%).

Previous studies showed a significant WMSD prevalence among the nurses that affect different body parts. Despite the abundance of studies about work-related musculoskeletal disorders among nurses worldwide amidst the COVID-19 pandemic, there is (limited to) no current published study about its prevalence in the Philippines amidst the COVID-19 pandemic.

The objective of this study was to determine the risk factors and the work-related musculoskeletal disorder (WMSD) that nurses had experienced. The second objective was to assess the relationship between risk factors and WMSDs. The third objective was to design a detailed proposed corrective action to reduce nurses' work-related risk associated with MSDs.

The study would help better understand the condition of the nurses amidst the pandemic. The study's findings would help design a detailed proposed corrective action to reduce nurses' work-related risk associated with MSDs. Furthermore, the study's outcomes could be used in future research related to work-related musculoskeletal disorders among nurses.

The study would only focus on determining the work-related factors that affect the MSDs among nurses belonging to the Intensive Care Unit (ICU) and Emergency Room (ER) department in the National Capital Region of the Philippines amidst the COVID-19 pandemic.

2. Methodology

2.1. Conceptual Framework

The researcher designed the proposed conceptual framework as presented in Figure 1. The proposed framework was created by integrating the models made by Dempsey et al. (2000) & Yusof et al. (2020). The conceptual framework has consisted of indicators of work-related risk factors, which include age, gender, BMI, work posture, time exposure, amount of load, worker capability with the sub-indicators experience and health status, and work demand with the sub-indicators task, machine/equipment, environment, and organization. The focal point of this study was the predictive model of work-related musculoskeletal disorder among nurses.

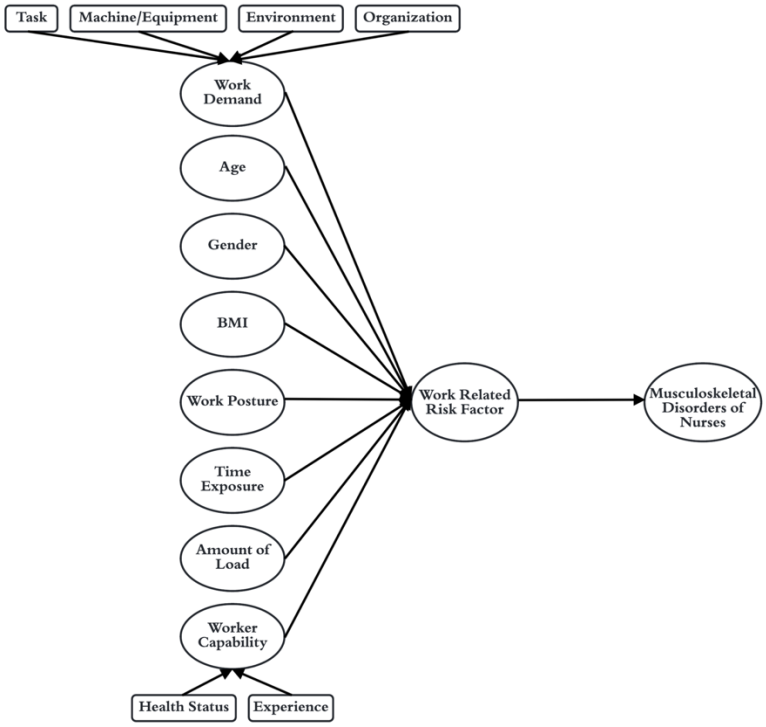

Figure 1. Conceptual Framework

2.2. Data Gathering

Objective 1: Determine the risk factors and the work-related musculoskeletal disorders (WMSD) that nurses have experienced.

Figure 2. IPO for determining the risk factors and WMSDs

The researcher would target 100 nurse respondents in the National Capital Region of the Philippines as a subject for the study. The respondents would be asked about their health and work-related information relevant to the study.

Due to the current COVID-19 pandemic, the researcher chose google forms as an online survey platform to collect the data necessary for the study. In addition, the link for the online survey would be distributed by the researcher to the respondents. The questionnaire for the online survey would contain two (2) parts. The first part of the survey would consist of the indicators of the work-related risk factor, which includes the age, gender, BMI, work posture, time exposure, amount of load, worker capability with the sub-indicators experience and health status, and work demand with the sub-indicators task, machine/equipment, environment, and organization. The second part of the survey would assess the WMSDs using the Cornell Musculoskeletal Disorder Questionnaire (CMDQ).

2.3. Cornell Musculoskeletal Disorder Questionnaire

In this study, Cornell Musculoskeletal Disorder Questionnaire (CMDQ) will be utilized to quantify and assess the degree of discomfort in the specific body parts of the nurses. This tool was designed for both men's and women's data collection, showing the frequency, intensity, and impact of discomfort on an individual for the last seven (7) days. Twenty (20) body parts would be assessed: the neck, shoulders, upper back, upper arms, lower back, forearms, wrists, hip/buttocks, thighs, knees, lower legs, and feet. In addition, the CMDQ utilizes the Likert scale in determining the level of frequency, intensity, and impact of discomfort for each body part.

2.4. Statistical Analysis

Objective 2: Assess the relationship between risk factors and work-related musculoskeletal disorder.

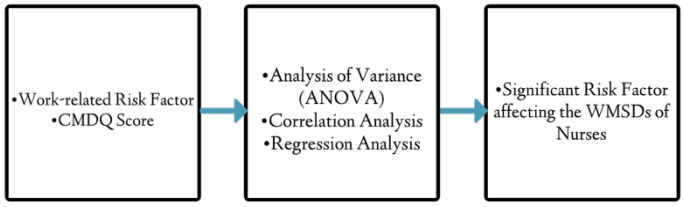

Figure 3. IPO for assessing the relationship between risk factors and work-related musculoskeletal disorder of nurses

2.5. Regression Analysis

This study would use regression analysis, a statistical tool, to examine the relationship of the variables and their significance to the study. It was used to determine the impact of the independent variables on the dependent variable. In addition, Angelini (2019) mentioned that regression analysis intends to provide an adequate and interpretable estimate of the mathematical relation f() in explaining Y in terms of X. The variable Y is the variable being predicted, and the X variable is the predictor variable. Moreover, X variables are added with subscripts to distinguish the different predictor variables. The equation model for simple regression analysis is $Y = a + bx$. The analysis results would provide p-values that would later be compared to a specific significance level (α). The p-value with a less than or

equal value to α would be considered significant, while a p-value with a greater value than α would be regarded as not significant.

Multiple regression analysis would be used to evaluate the significance of the relationship between work-related risk factor indicators and CMDQ scores. In addition, utilizing multiple regression analysis would generate an equation that determines the specific relationship between the predictor and outcome variables. This would also help determine which indicator significantly affects the WMSDs among the nurses. Furthermore, the results from the regression analysis would be used to develop a predictive model, which would then be used to design a proposed corrective action for each task.

2.6. Proposed Corrective Action

Objective 3: Design a detailed corrective action for each task to reduce the work-related risk associated with the musculoskeletal disorders experienced by the nurses.

Figure 4. IPO for designing the proposed corrective action

The results generated from the different statistical analyses would determine the statistically significant factors that cause or affect musculoskeletal disorders among the nurses. The significant factors would then be used to develop a detailed proposed corrective that would provide recommendations for improving or modifying the activities of the nurses to minimize or eliminate the possible risk of developing or worsening existing WMSDs.

3. Results and Discussion

3.1. Results of the Survey

In this study, the researcher conducted an online survey that acquired 103 respondents from nurses in the emergency and intensive care unit (ICU) department in the National Capital Region. The survey was divided into the risk factor indicators and the Cornell Musculoskeletal Disorder Questionnaire (CMDQ). Each respondent was able to answer the questions in the survey. The survey results would be further analyzed using different statistical tools to determine the relationships between the risk factor indicators and the CMDQ scores of the nurses.

The survey results showed that most of the respondents, 27 (26.21%), were 26 – 30 years old. Among the respondents, 53 (51.5%) females and 50 (48.5%) males. It was also shown that most of the respondents, 58 (57.28%), have a normal weight, followed by 28 (27.18%) respondents classified as overweight. Among the respondents classified as having a normal healthy weight, 32 (31.07%) were male, and 27 (26.21%) were female. The respondent distribution based on the nursing department was 52 (50.5%) for the intensive care unit; and 51 (49.5%) for the emergency department. 28 out of 52 nurses from the ICU were male, while 29 out of 51 nurses from the emergency department were female.

Based on the experience-related work capability, the respondents' common answer in years of professional experience was above four years. Most of the respondents, 50.49%, disagreed with having safety or ergonomic training experience, while 44.66% responded strongly disagree. Regarding health status-related worker capability, about 94 respondents reported they do not have excellent general health, and 97 responded that they do not engage in regular exercise. Ninety-nine respondents declared they have inadequate rest per day. Out of the 103 respondents. Seventy-four reportedly engaged in work while they were near their physical limits, and 41 responded that they engage in work while hurt or injured.

The results of the work posture of the respondents, there were 73, 65, and 62, that sat, walked, and stood, respectively, in an awkward or improper posture. The amount of load has shown that most respondents, 69, engage in lifting patients, and 65 out of 103 responses said they lift or carry machines or equipment. Seventy-eight of the respondents

answered that they lift or transfer patients that weigh more than they do, and 95 of the respondents said they do not lift or carry machines or equipment that more than they do.

Based on the task-related work demand, all of the respondents treat more than three patients per day, and out of 103 respondents, 102 reported that they treat an excessive number of patients per day. 98, 99, and 102 respondents engage with lifting or transferring dependent patients, engage with confused or agitated patients, and assist patients with gait activity. One hundred two respondents spend time working in the same position for a long time. One hundred respondents reach away from their bodies to do their required work. Moreover, 101 of the 103 respondents engage in repetitive movements to do their work. Based on the machine/equipment work demand, 99 respondents use machine/equipment that has a convenient design, and most of the respondents, 57, do not handle machines or equipment above their shoulders. According to the environment work demand, 100 respondents do not have an ergonomic workstation layout and adjustable chair. Respondents perceived their workstations as comfortable, with sufficient lighting, no loud noise exposure, and satisfied with the temperature. Most respondents have a day shift work schedule based on the organization-related work demand. About 53 of the respondents work 8 to 12 hours per day, and 50 work more than 12 hours per day. Ninety-nine of the respondents engaged in overtime duty, and 98 reported not having enough break time or rest breaks. One hundred respondents reported that they were exposed to the risk factors mentioned.

According to the results of the CMDQ, the frequency of experienced ache, pain, or discomfort varies. Respondents reported that most of them had experienced discomfort in their hip/buttocks (60.19%) 1 to 2 times last work week, followed by upper back (57.28%). The lower back has the most response when it comes to 3 to 4 times experienced discomfort last work week, followed by the right shoulder. The lower back and hip/buttocks have the most response to once every day experienced discomfort in the last workweek. Some also answered that they experience discomfort in the lower back several times every day. The body part affected the most with slight ache, pain, or discomfort was the right thigh, while the upper back was the most affected with moderate severity. Most of the responses in very uncomfortable severity point towards the lower back. The body part was perceived to have slight interference in the upper back, followed by the hip/buttocks. The lower back was the body part that was perceived to have a substantial work interference, followed by the right shoulder.

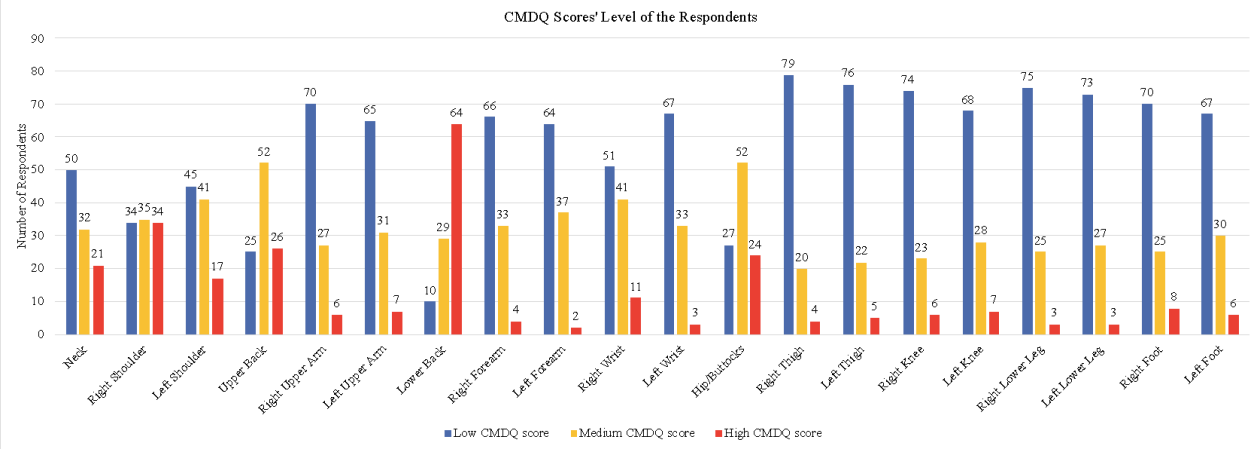

Figure 5. CMDQ Scores' Level of the Respondents

The CMDQ scores' levels of the nurse respondents for each body part are shown in Figure 5. The possible CMDQ scores are the following: 0, 1.5, 3, 3.5, 4.5, 5, 6, 7, 9, 10.5, 13.5, 14, 21, 31.5, 45, 90. The researcher then set the parameters to determine the level of the CMDQ scores. The parameters were as follows: less than 5 (Low CMDQ score); 5-10.5 (Medium CMDQ scores; more than 10.5 (High CMDQ scores). As presented in Figure 5, the Right Thigh has the most respondents, 79, that were classified to have Low CMDQ scores level followed by Left Thigh, 76, and Right Lower Leg, 75 respondents. Furthermore, the body region of the respondents with Medium of CMDQ scores level was mostly in the Upper Back and Hip/Buttocks, with 52 respondents, followed by the Left Shoulder and Right Wrist, with 41 respondents. Lastly, it was also shown that the majority of the respondents, 64, with CMDQ scores in

the Lower Back, were classified to have a High CMDQ score level followed by Right Shoulder, 34, and upper back, 26.

3.2. Regression Analysis

The regression analysis for all the 20 body regions and their relationship with the risk factor indicators produced P-values that would indicate which factors were the significant predictor of the discomfort of the nurses. The factors that yielded a significant P-value were the following: age, gender, BMI, ergonomic training experience, engagement with regular exercise, working near physical limits, working while injured or hurt, sitting and walking posture, lifting patients, lifting machines/equipment that weighs more than the respondents, creating an excessive number of patients, working with confused or agitated patients, assisting patients with gait activities, reaching away from the body, convenient design of the machine/equipment, comfortable work environment, comfortable due to the temperature, work schedule, work duration, overtime duty engagement, and the adequacy of break time or rest breaks. Lastly, the factors that did not produce significant P-value throughout the 20 body regions were the following: nursing department, years of professional experience, general health, rest adequacy, standing posture, lifting patients that weigh more than the respondents, lifting a machine/equipment, lifting or transferring dependent patients, same position for an extended period, repetitive movements, handling machine/equipment above the shoulders, ergonomic workstation layout, adjustable chair, workstation lighting, loud noise exposure, and exposure to the risk factors.

Table 1. Risk Factor that affects the Work-related Musculoskeletal Disorders of the Nurses

Risk Factor Indicators	
Age	Treating an excessive number of patients
Gender	Working with confused or agitated patient
BMI	Assisting patients with gait activities
Ergonomic training experience	Reaching away from the body to do work
Engagement with regular exercise	Convenient design of the machine/equipment
Working near physical limit	Comfortable work environment
Working while injured or hurt	Comfortable due to the temperature
Sitting posture	Work schedule
Walking posture	Work duration
Lifting patients	Overtime duty engagement
Lifting machines/equipment that weigh more than the respondents	The adequacy of break time or rest breaks

3.3. Proposed Corrective Actions

The researcher would develop a proposed corrective action using the risk factor indicators that significantly contribute to the discomfort experienced by the nurse respondents, see Table 14, to support the practice of safer workplaces and a healthier workforce. Tartal (2014) defined corrective actions as actions by a worker or an organization to eliminate the identified or detected the cause of non-conformity or further undesirable situations. The study of Scafa et al. (2019) suggested that corrective actions were categorized based on the following: (1) Equipment – physical solutions that were designed to assist the workers in doing their tasks; (2) Design – (re)design solutions that help the workers to modify their layout, workstations, and other accessories that could prevent unnecessary efforts and wrong postures; (3) Workplace – environmental comfort solutions that improve the overall work environment, not necessarily specific task-related; (4) Management – organizational solutions that make a more stimulating work environment, which helps in avoiding stress-related diseases and reducing the mental workload of the workers; and (5) Training – risk awareness and skills improvement to reduce the cognitive effort of the workers when executing their tasks. Previous studies were used as references to develop recommendations and possible improvements to the significant factors. The researcher has no exposure to the actual work-set up understudy. Below is the summary of the proposed corrective actions made by the researcher.

Table 2. Summary of Proposed Corrective Actions for Emergency and ICU Nurses

Summary of Proposed Corrective Actions for Emergency and ICU Nurses	
Age	● Modify work and activity to be better (particularly for older workers). ● Older workers must have a lighter and less physically demanding task.
Gender	● Modify work and activity to be better (particularly for women).
BMI	● Nurses must have a healthy balanced diet. ● Improve physical activity.
Ergonomic training experience	● Acquire ergonomic training experience.
Engagement with regular exercise	● Engage in regular exercise (particularly stretching or dynamic stretching).
Working near the physical limit	● Improve work system (lessen workload and give adequate time to rest and recuperate).
Working while injured or hurt	● Take time to rest and recuperate. ● Immediately communicate with the superiors to. convey the presence of injury. ● Immediately file an injury report.
Sitting posture	● Follow ergonomic guidelines for sitting posture. ● Maintain a neutral posture. ● Avoid bending the neck for an extended period. ● Avoid staying in a static position for long durations.
Walking posture	● Follow ergonomic guidelines for walking posture. ● Maintain a neutral posture. ● Avoid bending the neck for an extended period. ● Avoid staying in a static position for long durations.
Lifting patients	● Implement a zero-lift program by using battery-operated portable lifts and other patient transfer assisting devices. ● Follow proper body mechanics. ● Do not bend the waist when lifting patients. ● Bend the knees to make them absorb the shock when lifting.
Lifting machines/equipment that weighs more than the respondents	● Follow proper body mechanics. ● Do not bend the waist when lifting patients. ● Bend the knees to make them absorb the shock when lifting. ● Reduce the weight of the load. ● Use lifting equipment.
Treating an excessive number of patients	● Learn to manage the stress by managing the schedule. ● The work schedule must have adequate break time and rest. ● Maintain a balanced healthy lifestyle (balanced diet and regular exercise). ● Their organization should have shown more support to improve the mental and emotional well-being of the nurses. ● Their organization should hire more healthcare workers if possible.
Working with a confused or agitated patient	● Stay calm in handling agitated patients. ● Use verbal de-escalation as much as possible. ● Use physical intervention (if necessary). ● Undergo (more) training in manual handling (particularly in physical intervention).
Assisting patients with gait activities	● Undergo (more) training in manual handling.
Reaching away from the body	● Avoid unnecessary action of reaching away from the body as much as possible. ● If unavoidable, nurses should minimize the reaching distance with the target subject.
The convenient design of the machine/equipment	● Use equipment that has convenient or ergonomic designs. ● Do not use machines or equipment with poor or awkward designs.

Comfortable work environment	● Implement a (better) safe and comfortable work environment.
Comfortable due to the temperature	● Organizations should provide air temperature management where nurses get constant ventilation. ● Perform head cooling to increase their tolerance with heat stress and prevent PPE users from overheating. ● Do not wear the PPE for longer than necessary.
Work schedule	● Proper scheduling should be implemented ● Consecutive night shifts should be kept to a minimum. ● The nurses should have a regular and predictable work schedule.
Work duration	● The working hours of the nurses should be regulated.
Overtime duty engagement	● Overtime duty should be alternating with the typical work duration weeks.
The adequacy of break time or rest breaks	● Implement a schedule with adequate break time or rest breaks and utilize it to decrease their fatigue, stress, and the probability of having MSDs ● The organization, management, or work colleagues should promote breaktime and rest breaks. ● Nurses should have a rest break after every 2 hours during the work shifts because it would help to lower the likelihood of injuries.

4. Conclusion

There were a significant amount of studies about Work-related Musculoskeletal Disorders among nurses throughout the world. Despite its abundance, there is (limited to) no current published study about the WMSD prevalence among the nurses in the Philippines setting, especially during the COVID-19 pandemic. In addition, the identified risk factors from the related studies may or may not have been applicable to this study's setting. The absence of relevant studies motivated the researcher to examine the working conditions of the nurses amidst the COVID-19 pandemic and determine the work-related risk factors affecting their musculoskeletal disorder. One hundred and three nurses were able to answer the online survey questionnaire. The survey results were utilized in conducting statistical analysis to determine the significant risk factors that affect the WMSDs of the nurses. Several significant risk factors were identified to influence the WMSDs substantially.

Furthermore, the significant risk factors were used to develop a predictive model and detailed proposed corrective actions. In the present study, several respondents had reported that they were treating an excessive number of patients (99.03%), having inadequate rest breaks (95.15%), and working near their physical limits (71.84%). Organizational intervention must help the nurses reduce their WMSDs and have a healthy work environment.

The researcher recommends a deeper analysis for each task to improve the study further. Measuring the amount of time for each task, showing the specific tasks, activities, job descriptions, the specific training programs, duration and date of training, mental specific factors, and the comorbidity of musculoskeletal disorders could be an additional component study. Although proposed corrective actions were included in the study, details of the proposed actions, which will be covered in a Risk Mitigation Plan, are recommended for future studies.

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Biography

Vernin Felix is currently a Graduating Industrial Engineering student in Mapua University. He is also working as a Global Supply Chain Intern at Schneider Electric, with roles such as: collaboration with various international suppliers for container forecast and commitment follow-up; raising PPVs for suppliers' material escalation to rebalance the stocks; monitor supplier shipments; operated PO-related tasks; constructed GPS for rebalancing analysis and eBoard escalation. Supply Chain Management, Project Management, Quality Assurance, and Operations in manufacturing and technology has always been the interest of Vernin. He is always looking to improve his skills and qualifications to work to the highest standards possible in his role by reading books, viewing work challenges as a great opportunity to learn, and paying attention to the instructions of my mentors. Being certified as a Lean Six Sigma Yellow Belt has helped him widen his skill sets, highlighting critical thinking, data analysis and visualization, and root cause analysis. Vernin plans to widen his knowledge through taking a master's degree in the future.

Alma Rose Chan-Villapando has over 20 years of relevant working experience in various fields of Industrial Engineering including Methods and Systems Engineering, Work Measurement and Improvement, Compensation Administration, Operations Management, Productivity & Quality Management, and Value Engineering and Analysis. A Professor in the School of Industrial Engineering - Engineering Management of Mapua University, Alma obtained her Bachelor's degree in Industrial Engineering (Rank 1) and Master in Engineering Management (Magna Cum Laude) both from Mapua Institute of Technology. On the side, Alma is involved in a no. of consultancy works with various companies including construction, undergarments, logistics with engagement dealing with Process Review and Improvement, Compensation and Benefits, Productivity and Quality Improvement, to name a few. She is a certified Professional Industrial Engineer as conferred by the Philippine Institute of Industrial Engineers (PIIE)