

Work-Related Musculoskeletal Disorders and Mental Health among Nursing Personnel in the Context of COVID-19 Pandemic in West Bengal, India

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ABSTRACT

Introduction: COVID-19 outbreak created enormous turmoil all over the world. The health sectors were overburdened with critically ill COVID-19 patients. The load on the health sector burdened and fatigued the health care workers especially the nursing personnel as they were in direct contact with the symptomatic patients predominantly. In each wave, the patients' number surged and overwhelmed the health sectors. In this study, the prevalence of work-related musculoskeletal disorders (WMSDs) discomfort and mental exhaustion among the nursing personnel were assessed.

Methods: The duration of the study was from the end of September 2021 to March 2022. The factors that sourced the discomfort symptoms amidst and the interludes of the later waves of COVID-19 and their interrelations were also assessed here. The Modified Nordic Questionnaire and the COVID Stress Scales (CSS) were used in this study.

Results: 73.9% of subjects (N=88) reported the presence of WMSDs symptoms in at least one body region in the last one-year time period with the most prevalent discomfort in the lower back region (42%), followed by discomforts in the ankles, neck, and knee. The mean value of the total score of CSS was 33.74(±19.90) with high mean values in compulsive checking, danger, and contamination subscales. This study showed significant positive correlations between the presence of WMSD symptoms with BMI ($r_s=0.266$, $p=0.012$) and CSS total scores ($r_s=0.216$, $p=0.043$).

Conclusion: Large percentages of reports on musculoskeletal discomforts with reports on mental enervation related to COVID-19 indicated weariness of the nursing personnel. The physical exhaustion due to overloading work and the interplay between mental stress and WMSDs revealed pivotal issues of concern.

Keywords: COVID-19, COVID stress scales, Nordic questionnaire, Nursing personnel, Work-related musculoskeletal disorders (WMSDs)

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Introduction

The outbreak of COVID-19 or severe acute respiratory syndrome novel coronavirus (SARS-CoV-2) has horrified the world with innumerable

shocking and untimely deaths, and a much larger number of ailing people. It was primarily reported in the Hubei Province of China and within a very short time, it grasped the whole country and then

almost every country in the world. As this virus can be transmitted very quickly in several ways like direct transmission, contact transmission, aerosol transmission, etc., healthcare workers became the most susceptible ones to the infection. Despite the outbreak of COVID-19 from December 2019 to January 2020, in a few continents and countries such as India, a considerable number of COVID-19- positive scenarios started appearing in March 2020.¹ The second wave of COVID-19 started in the middle of March 2021, and 144,829 cases were detected in India on April 9th. The largely affected states were Maharashtra, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Uttar Pradesh, and West Bengal.² The case surge that started in mid-March 2021 and spiked quickly in April, there were more than 300,000 new infections found after 10 consecutive days of recording and on May 1, India reported just over 400,000 new COVID-19 cases in a single day.³ The 2nd wave showed some striking differences from the 1st wave. Though the scarcity of PPE, medicines, and beds declined, more younger people were affected and there were high positivity rates. Various new symptoms surfaced with an increased number of patients facing breathlessness and there was an increased need for mechanical ventilators and oxygen requirements for the patients.⁴ On 24th November 2021, the omicron variant of COVID-19 was reported to the World Health Organization (WHO) by South Africa. Along with various other countries, the Omicron variant was found in India also and caused a rapid rise in COVID cases in Mumbai, Delhi, and also in other states.⁵ According to the health bulletin issued by the Government of West Bengal, there were 16,93,744 total COVID cases in West Bengal up to 6th January 2022 with active cases of 41,101 on that day. 2,228 patients and 154 patients were admitted to hospitals and safe homes respectively. Up to 21st February 2022, there were 20,13,553 total cases and 4,443 active cases.⁶

Since 2020 with the increasing numbers of COVID-19 patients everywhere and with an increased load on hospitals and health sectors, health workers faced massive challenges. As the health workers too became infected, the shortage

of staff in health sectors imposed far greater hurdles on them. During the outbreaks, nursing staff needed to work in emergency units, intensive care units (ICUs), and COVID units for a long time wearing personal protective equipment (PPE). Increased workload and exhaustive work conditions made the situation more tiring. In a study performed by Nie et al (2020), among 263 nurses, 199 reported changes in duties due to the virus outbreak, 135 reported overtime work, and 66 were found to be with psychosocial distress. The stress symptoms related to COVID-19, concern for the family, being employed in an emergency department, treated differently as they were working in the health sector, were found to be associated with distress.⁷ In a study performed by Said and El-Shafei (2021), nurses were found to be with high-stress levels. Workload, personal fear, demands, stigma, tackling and adjusting to deaths of patients, and contact with infections were found to be as probable stressors.⁸ In another study performed in Bangladesh, 61.9% of nurses showed some degree of psychological distress during the outbreak. 50.5% and 51.8% of subjects among them reported depression and anxiety respectively.⁹ In India, 12.1% and 14.7% of subjects among 354 nurses showed severe anxiety and depression respectively in a study performed by Sharma et al. (2021).¹⁰ In a study performed by Jose et al, (2020) 86% of nurses feared the transmission of infections to family members even if they maintain the safety measures needed. Emergency department nurses showed moderate to high levels of burnout.¹¹

The occurrence of musculoskeletal disorders (MSDs) was found to be very high in health sectors, especially in nursing sectors. Work-related musculoskeletal disorders (WMSDs) is a collective term that encompasses damaging conditions of muscles, nerves, joints, bones, ligaments, tendons, and adjacent blood vessels and leads to various kinds of discomforts and strain injuries in the lower back, knee, shoulder, hands, joints and deters body movements. Nursing personnel is exposed to various factors in their work area which can lead to WMSDs. Older persons and persons with disability or critically ill patients depend on the nursing staff for their daily

activities and these patient-handling tasks were found to be highly associated with WMSD symptoms among the workers. Factors like manual handling of patients and instruments, changing clothes and assisting in their daily activities, patients' degree of dependency, and co-operations were found to be related to the onset and aggravation of WMSD symptoms among nursing personnel. WMSDs among workers can affect the quality of life, daily chores, and service life. Absenteeism due to discomfort indirectly increases the cost of health services and also decreases overall productivity.¹² As health sectors are the occupational sectors with an overloading burden, the outbreak of COVID-19 has made the situation more critical. Sharp increases in patients number along with more critically ill patients, created havoc in health sectors which resulted in fast arrangements to increase bed numbers, staff requirements, the need for more critical care instruments, medicines, PPE kits, and scarcity of workspaces in different wards. As there was an increased number of COVID patients in covid wards, a large amount of the nursing population of the health sector was ascertained to the COVID patients admitted. This caused increased task demand among the nursing personnel allotted to the other non-COVID wards of that health sector. Work hours increased not only for hours but sometimes for days. As nurses were the frontline warriors since the first scenarios of the outbreak, they became more prone to infections. Not only did the mental exhaustion, but they also faced the increased workload in deteriorated work conditions. As the nursing task is notably risk-prone and can lead to WMSDs, the alteration in occupation due to the COVID-19 outbreak caused far greater consequences. Since the 1st wave of COVID-19, the number of patients, the type of population infected, the symptoms, and the arrangements in the health sectors were changed. The ease of accessibility of the medicines and equipment and the availability of the vaccines made the situation a little bit easier. But as we are forced to live with the COVID virus and already endured three waves of this, it will never be insignificant to prepare for alarming situations in the future. The situations in this pandemic and the

changes in demand and work procedures in health sectors affected the physical and mental health of the health workers. In each wave, the patients' number surged and that overloaded the health sectors for several months durations. The nursing personnel was forced to task in these altered situations repeatedly. The effects on their mental state, the consequences of the unendurable workload, and the interplay between them along with their manifestation on the nurses' overall health have not been assessed properly yet. This needs to be addressed with utmost concern.

This present study, it is aimed to analyze the COVID-19-related stresses among nursing personnel and the prevalence of musculoskeletal discomfort among them.

The objectives of this study are,

- To find the prevalence of WMSDs among the nursing personnel employed in overburdened health sectors amidst, and the interludes of the later waves of COVID-19.
- To assess the COVID-19-related stress among the nursing personnel.
- To analyze the components that sourced the WMSDs among them since the COVID-19 outbreak.

Methods

The study was performed in 5 different hospitals and nursing homes in West Bengal. The study period was from 25th September 2021 to 23rd March 2022. Taking the confidence level of 95% with a 10% margin of error and 50% population proportion, using Cochran's formula¹³, the calculated sample size was 96.

$$n = \frac{z^2 pq}{e^2}$$

Where, *z* is the confidence level, *e* is the margin of error/level of precision, *p* is the population parameter and *q* is (1-*p*).

To meet the above sample number 120 nursing personnel were selected randomly and approached for the study. As 13 nursing personnel were engaged in major patient and ward-related activities and 6 nursing personnel were not available due to the culmination of duty hours, 101 nursing personnel participated in the study. Finally, 88 subjects were selected maintaining the

inclusion criteria of this study. The inclusion criteria of this study were female registered nurses employed in different wards of the hospitals and nursing homes of West Bengal during the COVID-19 pandemic. The exclusion criteria of this study were nurses with histories of major accidents and injuries in the past, chronic musculoskeletal diseases, clinically diagnosed psychological disorders, histories of recent major surgery, pregnancy, and availing sick leaves of 7 days or more within the previous one month from the day of the study. The ethical clearance for this study was obtained by the Institutional Human Ethical Committee, Department of Physiology, University of Calcutta.

At first, the hospital and nursing home authorities were approached with request letters mentioning the details of the study and after preliminary approval from the authority, the details of the study and study procedures were described to the nursing superintendents and/or subsequent officials. After the introduction with the nursing staff present there, the particulars of the study were described and willing subjects were taken for the study. Participants were given the consent forms mentioning the essentials of the study and then they were asked to come to the interview room one by one to avoid the hindrances of biased answering. They were asked not to discourse the questionnaires and details of the procedures with others.

At first, the body height and body weight of the subject was measured using an anthropometer (Martin's Anthropometer) and a weighing machine ("Crown" weighing Machine, Mfg. by Raymon Surgical Co.) and noted down along with the age of the subject. The questions "Have you tested positive for COVID-19?" and "Have your

relatives/close ones tested positive for COVID-19?" were asked to the subjects and the answers were noted down. The Modified Nordic Questionnaire^{14,15} and the COVID Stress Scales (CSS)¹⁶ were used in this study. In the Modified Nordic Questionnaire, various body parts like the neck, shoulder, elbow, hand, upper and lower back, thigh, knee, and feet were cited. There were questions about the presence of pain or uneasiness in the said areas within the last 12 months and also within the last 7 days. Subjects were asked to point out appropriate body parts with discomforts. In the CSS there were 36 items encompassing factors of 5 dimensions of stress and anxiety related to COVID-19. Fear related to danger and contamination, fear related to economic consequences, xenophobia, compulsive checking and seeking reassurances, and symptoms of traumatic stress were the 5 dimensions incorporated in this scale. All the items were rated 0 to 4 where 0 indicated the lowest response and 4 indicated the highest. Body mass index (BMI) was calculated from the data of body height and body weight.¹⁷

SPSS 23 version was used to analyze the data. Descriptive statistics were used to estimate the percentages of discomfort reports in different body areas of the subjects, along with the age, body height, weight, BMI, and CSS responses. Spearman correlation was used to evaluate the relationship between WMSD symptoms with BMI and total CSS response values.

Results

In this present study, the mean age of the subjects (N=88) was 33 years. The mean height and weight were 1.53 m and 59 kg respectively. The mean value of BMI was 25.12 kg/m² (Table 1).

Table 1. Demographics of the subjects

Variable	Minimum	Maximum	Mean (SD)
Age (Years)	20.00	59.00	32.8295 (±10.46)
Height (m)	1.30	1.68	1.5325 (±0.09)
Weight (kg)	31.00	85.00	59.0068 (±10.90)
BMI (kg/m ²)	16.22	44.77	25.1212 (±4.30)

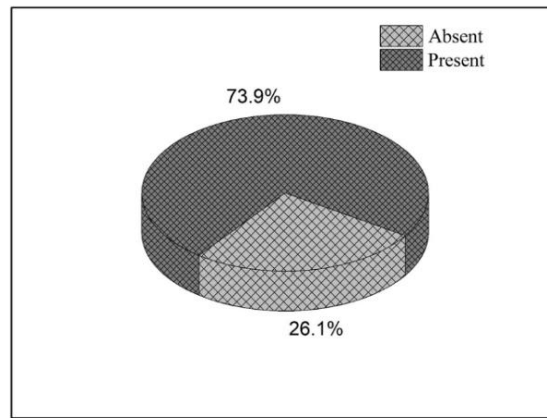
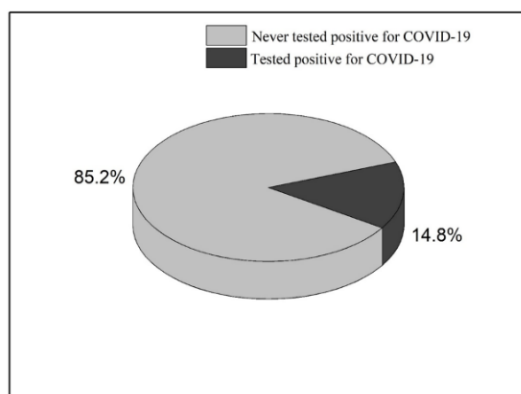


Figure 1. Percentages of the prevalence of WMSDs among the subjects

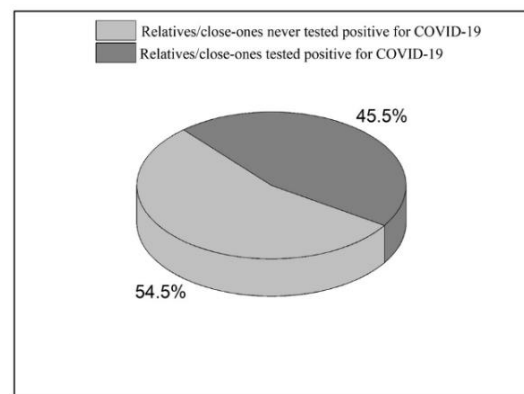
Here, 73.9% (n=65) of subjects reported the presence of WMSD symptoms in at least one body region in the last one-year time period (Figure 1). The most prevalent discomfort was pain in the lower back region. 42% of subjects reported discomfort in that area over the last year with 30.7% and 18.2% reports of hindrance in daily work and symptoms in the last 7 days respectively. Discomfort in the ankles was the next prevalent one with 26.1% of reports. Discomfort in the neck and knee constituted 22.7% and 20.5% of

complaints respectively. 9.1% and 8% reported pain in the shoulder and hip regions correspondingly. Prevalence of musculoskeletal discomfort and BMI showed a significant positive correlation ($r_s = 0.266$; $p = 0.012$).

In this study with the question “Have you tested positive for COVID-19?”, 14.8% of subjects answered “Yes” and with the question, “Have your relatives/close ones tested positive for COVID-19?”, 45.5% answered “Yes” (Figure 2).



(a)



(b)

Figure 2. Percentage of the prevalence of COVID-19 positivity among:

(a) the subjects, and (b) the subjects’ relatives/close-ones

Among all the subjects, the minimum score obtained from all 6 subscales in CSS encompassing 5 dimensions was 0. The maximum scores were 20, 18, 19, 21, 20, and 13 for Danger, Contamination, Socio-economic consequences, Xenophobia, Compulsive checking, and Traumatic stress subscales respectively. The mean (\pm standard deviation) values of the same were 6.91 (± 4.89), 5.78 (± 5.31), 4.55 (± 5.41), 3.44 (± 5.44), 10.85 (± 5.57), and 2.20 (± 3.12) respectively.

The five dimensions of COVID-related stress of CSS were represented in six subscales. The first

factor associated with danger and contamination-related stress were denoted as two separate subscale responses. Mean (SD) response values of the subjects with WMSDs (n=65) and without WMSDs (n=23) on the different subscales of CSS are reported below (Table 2). The mean response values in each CSS subscale were higher among the subjects with WMSDs rather than subjects without WMSDs except for the danger subscale where the dispersal of the responses was slightly higher among the subjects without WMSDs.

The mean (SD) values in the Compulsive checking

subscale were highest concerning the other subscales among both the subjects with and without WMSDs. The distribution of subjects'

responses on the Compulsive checking subscale is depicted below (Figure 3).

Table 2. Mean (SD) response values of the 6 subscales of CSS among the subjects with and without WMSDs

CSS Subscales	Mean (SD)	
	Subjects with WMSDs (n=65)	Subjects without WMSDs (n=23)
Danger subscale	6.91 (±4.89)	6.91 (±5.02)
Contamination subscale	6.46 (± 5.51)	3.87 (±4.20)
Socio-economic consequences subscale	4.82 (±5.33)	3.78 (±5.70)
Xenophobia subscale	3.66 (±5.44)	2.83 (±5.50)
Compulsive checking subscale	11.17 (±5.24)	9.96 (±6.46)
Traumatic Stress subscale	2.68 (±3.35)	0.87 (±1.77)

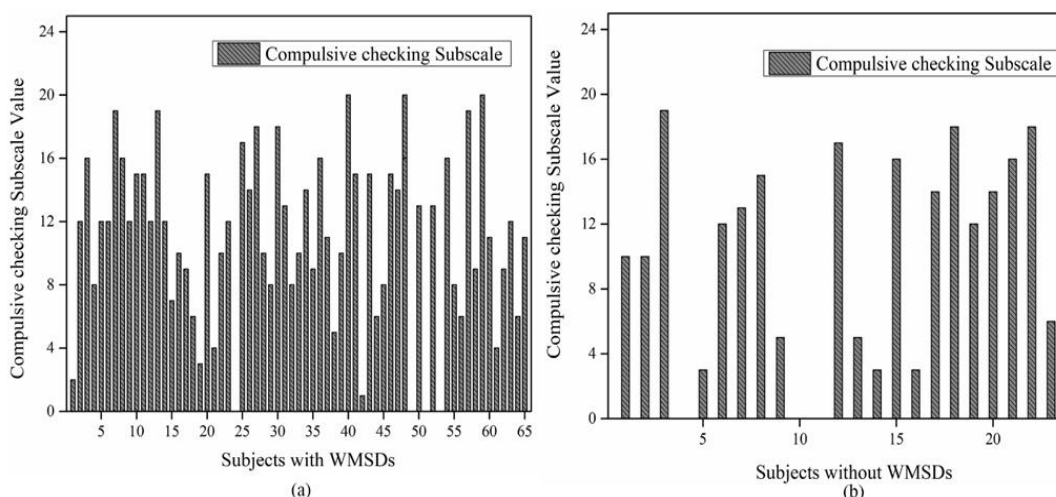


Figure 3: Distribution of the responses of the subjects (a) with WMSDs and (b) without WMSDs on the Compulsive checking subscale of CSS

In this study, the mean value of the total score of CSS was 33.74 (±19.90) with a minimum value of 0 to a maximum value of 86. The distribution of total scores of the subjects with and without WMSDs on

the CSS responses is depicted below (Figure 4). The prevalence of WMSDs showed a significant positive correlation with CSS total scores ($r_s = 0.216$; $p = 0.043$).

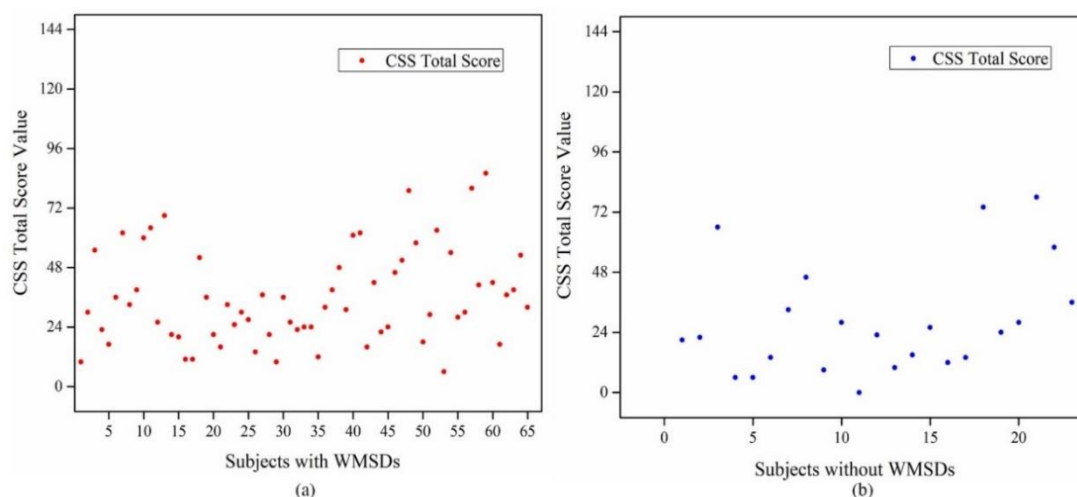


Figure 4. Distribution of the total scores of CSS among the subjects: (a) with WMSDs and (b) without WMSDs

Discussion

In this present study, the mean age of the subjects (N=88) was 33 years and they belonged to the young group of workers with a suitable amount of experience in this field. The mean height and weight were 1.53 m and 59 kg respectively. The mean value of BMI was 25.12 kg/m². A large number of subjects (73.9%) reported discomfort in at least one body region in the last 12 months. The most prevalent discomfort was a pain in the lower back region with a percentage of 42%. There were discomforts in the ankles, neck, and knees with percentages of 26.1%, 22.7%, and 20.5% respectively. This study corresponded with the work performed by Amin et al (2020), where 73.1% of the nurses reported WMSDs for the last 12 months. The most reported discomforts were in the neck, feet, upper back, and shoulder regions with percentages of 48.9%, 47.2%, 40.7%, and 36.9% respectively.¹⁸ Another study executed by Yang et al (2020) showed supporting evidence where 96.8% of ICU nurses complained 12 months of the prevalence of WMSDs. The highest rates of described WMSDs were in the low back area with a percentage of 80.5%, followed by the neck region and shoulder with percentages of 79% and 70.4% respectively.¹⁹

In this study prevalence of musculoskeletal discomfort and BMI showed a significant positive correlation with an r_s -value of 0.266 in $p=0.012$. In previous studies, BMI was associated with the onset and aggravation of WMSD symptoms among workers.²⁰ This study supported the findings that being overweight and obese were linked with an amplified risk of the lower limb and lower back pain and injuries.²¹

In this study with the question "Have you tested positive for COVID-19?", the answer of 14.8% of subjects was affirmative, and with the question, "Have your relatives/close ones tested positive for COVID-19?", there were 45.5% positive answers. As the health workers were the frontline warriors in this pandemic, they were the ones with the highest risk of exposure. Infections among them further burdened the remaining workforce to meet the work demand. Being in the risk-prone zone also troubled the healthcare workers who

were already struggling with chronic comorbidities. The infection rate was at least 11-fold higher in healthcare workers than in the general population. Though the nursing personnel and other health workers maintained wearing masks and PPE regularly which safeguarded them but with the high workload and long duty hours the stringency was relaxed. Shortage of PPEs led to reusing PPEs, constrained workspaces led to a lack of social distancing while resting or eating, high workloads led to inadequate handwashing, human errors in touching the outer surface of the mask, etc.²² All these factors led to more risk to the workers and increased infections. In a study performed by David et al (2021) in Brazil, the nursing personnel was found to be at the highest risk of infections and deaths.²³ A large number of subjects also reported incidents of COVID cases among their relatives or close ones. This could source fear and anxiety-related stress among the nursing personnel.

In this study, the mean value of the total score of CSS was 33.74(±19.90). The mean values for Danger, Contamination, Socio-economic consequences, Xenophobia, Compulsive checking, and Traumatic stress subscales were 6.91(±4.89), 5.78(±5.31), 4.55(±5.41), 3.44(±5.44), 10.85(±5.57), and 2.20(±3.12) respectively. This study showed high mean values in compulsive checking, danger, and contamination subscales. Subjects reported checking COVID -19 related news, blogs, and videos related to symptoms, scientific advancements, medicines, suggestions by researchers, new rules and regulations imposed, on mobile phones, and other relevant sources available. Asking the doctors for advice and checking the bodies for probable symptoms were also common. Concerns about infections, anxieties about safety measures not being enough to safeguard from the virus, worries about family members getting infected, and worries about touching and cough/sneeze-related contamination in public places, and in public transport were found to be important factors for concerns. In line with these results, Portuguese nurses showed a high level of stress with anxiety and depression

compared to the general population. The presence and/or absence of adequate protective equipment showed a relation to the level of stress, anxiety, and depression.²⁴ Another study performed in Saudi Arabia showed similar concerns. The core of the nursing profession was built on caring for the sick, and the nursing personnel put their very best to ensure that, but the load of COVID-19 on the health sectors, patients' increased needs, insufficient protective equipment, risk of infections, altered guidelines, physical and mental exhaustion challenged the professional quality of life of the workers.²⁵ The health workers showed alarming rates of insomnia symptoms along with anxiety and depression during the early phase of the pandemic.²⁶ As with the passing months, the level of stress and anxiety related to COVID-19 declined concerning the starting months of the pandemic. Though the number of patients spiked with each wave, the habituation to the situation, the learnings from the scenarios of the subsequent waves, acclimatization to the protocols, a better understanding of the safety rules, better management of the wards, beds, protective equipment and findings and availability of vaccines contributed to weakened fear and anxiety related to COVID. Though the health care workers were struggling with the fear of infections, the anxious situations, uncomfortable circumstances, and painful feelings wearing PPEs, their devotion to their duties and altruistic feeling toward the patients helped them to carry on the responsibilities they are assigned, and also helped them to fight through the high-stress level while working.²⁷ But after all of that, the present levels of stress and anxiety among them are still a matter of concern as it is directly affecting the physical and mental health of the workers.

As the nurses were already overburdened with a high workload previously from the pandemic, more upsurge in work hours in each wave heightened the stress level among nurses. Studies not related to COVID-19 had already connected long working hours to mental fatigue and other disorders like changed sleeping patterns and musculoskeletal discomforts. Increased number of working hours during the pandemic was found to be directly related to nurses' stress levels.²⁸

This study showed a significant positive correlation between the presence of WMSD symptoms and CSS total scores with $r_s=0.216$ and $p=0.043$, which indicated an increased rate of WMSDs with heightened COVID-related stress. It can be predicted from the outcomes that nursing personnel assigned with more duty hours in the emergency or COVID wards with a large number of critically ill patients, the heightened mental stress among them, and both the intensified physical demand and psychological distresses, catalyzed by functioning continuously in various wards with COVID-19 patients, collectively encumbered their physical health possibly leading to WMSDs symptoms among them.

It was informed previously in studies that stressors like job demand, responsibility at the workplace, and having control in the workplace were linked with MSDs symptoms.^{29,30} High demands with less control, low support in workplaces, and effort-reward disparity were also reported to be related to discomfort in various body areas.³¹ Discomfort and pain also can make workers less tolerant of the emotional demand of the workplace and on the other side, excessive physical and mental demands can again lead to WMSDs manifestation and intensification.³² The significant correlation between CSS total scores and discomfort reports showed analogous tendencies. Excessive mental load, stress, and anxiety can lead to physical manifestation, and tolerating discomforts while attaining the exhaustive demand can also lead to more mental fatigue. Increased demand due to the pandemic had also backed the discomforts.

This pandemic pointed out the need for changes in the healthcare sector all over the world. It can be stated from the learnings and struggles so far amidst the pandemic, that the virus is still present and continuously challenging the community, and preparations must be done to fight now and in the future. In both resource-limited and resource-rich settings, adequate and attainable changes should be done to avoid infections and ensure the overall well-being of the health workers. Changes in ICU designs, safer positioning of beds and intensive care equipment, staff recruitment and preparing expandable trained staff pool, ensuring the safety

and physical and mental well-being of the staff, confirming effective supply and proper utilization of PPEs needs to be done in the health sectors.^{33,34}

Conclusion

The outbreak of COVID-19 took a toll on society. The overburdened health sectors, severely ill patients, and deaths all over the world startled and frightened everyone. Despite the fear of the situation, the frontline workers are continuously serving the community with courage and responsibility. The healthcare workers were the ones who dealt with the overcrowded conditions of hospitals and nursing homes. Since 2020, in each wave, the situation changed and the nursing personnel needed to modify themselves physically and mentally according to the demands. Most of the time the nurses were the ones who were in direct contact with the patients. They had dealt with the exhaustive feelings of wearing PPEs for long often in adverse climatic conditions, excessive workload, a sharp increase in the patient-to-nurse ratio, increased duty hours along with the fear of getting infected and chances of transmitting the virus to the family members. These not only increased their mental stress and anxiety but also deteriorated their physical condition. Nurses' complaints of musculoskeletal discomforts along with high psychological distress surfaced a firm connection between the stress related to COVID-19 and the musculoskeletal discomforts. Alteration to the arrangements in the emergency, ICUs, and COVID units, increased number of staff, staff recruitment, staff turnover, proper rest breaks, training to the staff for proper use of protective equipment and safety protocols, arranging ample number of PPEs, addressing the physical discomfort and mental health of the workers needs to be done to ensure the safety of the workers and smooth operations in health systems.

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