Nursing Section

Work-related Musculoskeletal Disorders, Workability and its Predictors among Nurses Working in Delhi Hospitals: A Multicentric Survey

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ABSTRACT

Introduction: Nurses are considered to be the frontline healthcare professionals with prolonged hours of caring for ailing as well as critically ill patients. This highly demanding work pattern can lead them to experience Work-related Musculoskeletal Disorders (WRMSD) and thus makes it important to study its prevalence and its impact on workability and to develop appropriate supportive strategies to improve their health and work efficiency.

Aim: To explore the prevalence of WRMSDs among hospital nurses in Delhi, including the risk factors and coping strategies adopted by them to avoid the risk of WRMSDs.

Materials and Methods: This multicentric survey, cross-sectional study was conducted in different hospitals in Delhi, India, from October 2020 till March 2021 among 260 nurses. Data were collected using the Nordic Musculoskeletal Questionnaire (NMQ), Perceived Stress Scale (PSS) and Workability Index (WAI). Pearson's product moment correlation was used to develop correlations for continuous variables and Biserial correlation test was used for dichotomous variables. The level of significance was 95% (p-value <0.05).

Results: The mean age and mean work duration were 35.62±7.12 years, and 8.60 hours per day, respectively. Out of total, 230 (88.5%) were females and 30 (11.5%) were males. The prevalence of WRMSD was 80% during the last 12 months with low back pain, the most commonly reported problem. The majority of nurses communicated moderate workability (47.7%) and moderate level of stress (73.5%). The result of linear multiple regression analysis showed that the independent variables of (age, work hours, type of job, back and shoulder pain) explained 46.4% of the workability index (R^2=0.444, adjusted R^2=0.395), and the model significant (F-value=14.76, p-value <0.001).

Conclusion: Nurses are at high-risk for WRMSD as well as observing prolonged stress and reduced workability. Special measures should be taken to ensure that they work in an ergonomically acceptable workplace and that proper body mechanics and stress management practices are adopted. Lifestyle intervention would help in preventing and reducing impact of WRMSDs.

INTRODUCTION

Musculoskeletal disorders refer to a group of inflammatory and degenerative ailments that affect the muscles, ligaments, tendons, joints, peripheral nerves, and blood vessels that support them, resulting in soreness, pain, and discomfort [1]. When such disorders arise out of work-related events, they are called Work Related Musculoskeletal Disorders (WRMSD) [2]. Some common conditions include tenosynovitis, epicondylitis, bursitis, nerve compression, sciatica, myalgia, osteoarthritis, low back pain, regional pain syndrome. Some common symptoms include pain, weakness, stiffness and decreased Range of Motion (ROM). Inflammation may cause warmth, tenderness, impaired function, erythema. WRMSDs are thought to be caused by a combination of intrinsic and extrinsic variables [2]. Repetitive movements, uncomfortable posture, and high force levels were identified as three key risk factors by Silverstein BA et al., [3].

Musculoskeletal illnesses have a significant influence in the workplace and are emerging as a rapidly rising concern in our modern society; they are the second leading cause of short-term or temporary work impairment, after the common cold [4]. WRMSDs is a severe workplace issue that leads to higher compensation and healthcare costs, lower productivity, and a lower quality of life [4,5].

Hospital workers are under constant pressure to work more efficiently with fewer resources and management. Although healthcare professionals (especially nurses) are known to be at a high-risk for WRMSDs, it is one of the least studied occupation. Nurses were found to be at the highest risk among all the healthcare professionals

with prevalence of it being 56% amongst them in India [6]. Because of their high job demands, nurses are also known to have a high prevalence of emotional discomfort, such as depression, anxiety, and stress [7,8]. Literature reports that that nurses who present with anxiety symptoms are more likely to have WRMSDs, notably in their neck and shoulders, than those who did not [9].

Workability is described as a worker's ability to accomplish a task while taking into account varied work demands (including working conditions), health, and mental resources [10]. Workability is the total of all elements that enable employees to properly manage their work demand in a given situation [11]. The Workability Index (WAI) is a 7-part self-assessment tool that measures an individual's workability. It includes current ability, workability in relation to physical and mental demands of the job, reported diagnosed diseases, estimated impairments due to health status, sick leave over the previous 12 months, self-prognosis of workability in the next two years, and mental resources [12]. There has been an increasing interest in conducting workability studies in healthcare settings in recent years. Nurses frequently engage in strenuous physical activities such as lifting and transferring patients, working in poor postures, and standing for long periods of time, all of which can result in a variety of disabling injuries, such as Musculoskeletal Disorders (MSDs), which limit their ability to work [13].

The WRMSDs among nurses in several areas of the world and in some parts of India have been studied, as well as workability among nurses in various parts of the world [14-19]. A study conducted in

Maharashtra reported a high prevalence of 89.1% of work related musculoskeletal discomfort with lower back and shoulder the most commonly affected areas [15]. A similar study done on nurses working in Indian army found a one year prevalence of work related musculoskeletal disorders in lower back followed by shoulder and ankle regions. Middle age nurses suffered the most [20]. A cross-sectional study that assessed prevalence of WRMSDs among healthcare professionals in Chennai found nurses to be at highest risk [6]. However, in New Delhi, India there is a scarcity of data on WRMSDs and workability and associated factors. The major goal of this study was to determine the prevalence of WRMSDs among hospital nurses in Delhi, including the risk factors and coping strategies adopted by them to avoid the risk of WRMSDs.

MATERIALS AND METHODS

This cross-sectional study (multicentric survey) was conducted in different hospitals in Delhi, India, from October 2020 till March 2021 among 260 nurses. The study was approved by the Research Committee of School of Physiotherapy, Delhi Pharmaceutical Sciences and Research University, Delhi (Reference no. 10/876/Acad/DPSRU/2018/11466). The letter of invitation, informed consent and verbal communication stressed the voluntary and anonymous nature of participation. A sample size of 260 was calculated using Cochrane formula assuming 26% prevalence of WRMSD [4].

Inclusion criteria: Nurses within the age group of 25-55 years, both male and female, with work experience of atleast one year in a hospital set-up of minimum 200 beds.

Exclusion criteria: Subjects with history of physical trauma, diagnosed case of degenerative disorder, inflammatory disease or congenital anomalies, pre-existing psychiatric anomalies, pregnant subjects were excluded from the study.

Study Procedure

All the registered nurses from eight different hospitals (two government and six private) in New Delhi, India participated in the study. Convenience sampling method was used for the selection of hospitals that had atleast 200 beds. An electronic questionnaire was sent to 320 full-time registered nurses out of which 260 nurses completed the survey. Consent was obtained from all the nurses who participated in the study. Over a six-week period, the nurses received two survey reminders.

A cross-sectional questionnaire design was used in this investigation. Respondents provided personal information as well as the type of shift they worked on a data sheet. Age, gender, marital status, educational level, years of work experience, hours of work, job context {Coronavirus Disease 2019 (COVID-19), non COVID-19 ward}, and shift work were all questions that respondents were asked to answer.

Questionnaire

Other data collecting instruments used in the study were Nordic Musculoskeletal Questionnaire (NMQ), Workability Index (WAI) and Perceived Stress Scale (PSS).

Nordic Musculoskeletal Questionnaire (NMQ): The NMQ is a reliable and valid assessment tool [21]. The NMQ is divided into two sections: the first is a general questionnaire that identifies the body areas that cause musculoskeletal problems; the second section is a body map that shows nine symptom sites (neck, shoulder, upper back, elbows, low back, wrist/hands, hips/thighs, knees, and ankles/feet). If the participant has had any musculoskeletal problems in the previous 12 months, he or she must respond (yes or no). The questionnaire next asked if the symptoms had hindered the responder from doing his or her typical work at home or away from home in the previous 12 months, and if he or she had pain in any of the nine body sites. Items on perception of job risk factors and coping mechanisms were also included in the questionnaire.

Workability Index (WAI): The WAI is a tool for assessing an individual's workability [22]. It is made up of seven parts: current ability, workability in relation to physical and mental demands of the job, reported diagnosed diseases, estimated impairments due to health status, sick leave in the previous 12 months, self-prognosis of workability in the next two years, and mental resources of the individual. WAI scores vary from 7-49, with four categories proposed to define them:

- Poor (7-27),
- Moderate (28-36),
- Good (37-43), and
- Exceptional (44-49).

The Workability Score (WAS) is a self-assessment of a worker's present ability in comparison to his or her lifetime best. It goes from 0-10,

- Poor (0-5) being the lowest,
- Intermediate (6,7), and
- Good (8 being the highest).

Perceived stress scale: The PSS was created as a 14-item scale to assess the respondent's impression of stressful experiences by asking them to score the frequency of their feelings and thoughts in relation to events and circumstances that occurred in the preceding month. PSS-14 has a total score range of 0-56 (from 0-40 and from 0-16, for PSS-10 and PSS-4, respectively). A higher score suggests that you are under more stress [23,24].

STATISTICAL ANALYSIS

Data was entered into a Microsoft Excel sheet-2013. The Statistical Package for Social Sciences (SPSS) software version 24.0 was used. Descriptive statistics has been represented through tables and graphs. Parametric tests are used for continuous data and non parametric tests for categorical data. Pearson's product moment correlation was used to check develop correlations for continuous variables and Biserial correlation test was used for dichotomous variables. The level of significance was 95% (p-value <0.05).

RESULTS

The majority of the participants were females 230 (88.5%).The mean age of the nurses was 35.62±7.124 years. All of the participants were full time employees. Mean work duration of 260 nurses was 8.60 hours per day [Table/Fig-1].

Nordic musculoskeletal pain questionnaire: [Table/Fig-2] shows participants responses on the NMQ. The prevalence of WRMSD among Indian nurses was 80%. The majority of them (~52%) said they had lower back pain in the previous 12 months. The majority of nurses reported having musculoskeletal symptoms in the previous seven days (~60%). Lower back, ankle and foot, cervical, and shoulders were the most common areas of discomfort. Total 84 (40%) of the nurses have reported pain as the cause having prevented them from doing normal work in the past 12 months. 50% nurses had experienced pain on regular basis.

Risk factors: Majority of the nurses (63.8%) had chosen "not enough rest/breaks during the day" as the major risk factor leading to development of WRMSD. Working in same position for long time followed by treating many patients each day and not getting sufficient rests during the day were other risk factors [Table/Fig-3].

Coping strategies adopted by nurses: Overall, 42.3% of nurses almost always modified their nursing procedure in order to avoid stressing an injury and 34.6% sometimes used this strategy to avoid the risk of WRMSD [Table/Fig-4].

Workability Index (WAI): Mean WAI score of 260 nurses was 30.96±6.93 (moderate workability). Majority of nurses i.e. 47.7% had moderate workability,11.5% nurses had poor workability, 102 (39.23) nurses had good workability and 4 (1.53) nurses reported

Characteristics of the participants	N (%)
Age category (years)	
25-35	144 (55.4)
36-45	90 (34.6)
>45	26 (10)
Gender	
Female	230 (88.5)
Male	30 (11.5)
Marital status	
Single	64 (24.6)
Married	196 (75.4)
Degree	
Bachelor's degree	118 (45.4)
Master's degree	142 (54.6)
Working experience	
Less than 5 years	140 (53.84)
5-10 years	57 (21.92)
More than 10 years	63 (24.23)
Work Setting	
COVID-19 ward	208 (80)
Non COVID-19 ward	52 (20)
Type of job	
8 hours fixed shift	80 (30.8)
8 hours rotating shift	180 (69.2)

[Table/Fig-1]: Demographic data.

Response on NMQ	n,%
Presence of musculoskeletal disorder in last 12 months	208 (80%)
Body region	
Neck	75 (36%)
Shoulder	67 (32%)
Elbow	10 (5%)
Wrist and Hand	21 (10%)
Back	108(52%)
Hip	52 (25%)
Knee	58 (28%)
Ankle and foot	95 (46%)
Symptoms hindered from doing normal work in last 12 months	84 (40%)
Symptoms hindered from doing normal work in last 7 days	125 (60%)
Frequency of pain	
Regular	104 (50%)
Sometimes	52 (25%)
Never	52 (25%)

[Table/Fig-2]: Participant responses on NMQ.

Risk factors	n,%
Repeatedly performing nursing tasks	132 (50.76%)
Treating many patients each day	134 (51.53%)
Not enough rest/breaks during the day	166 (63.84%)
Performing manual nursing techniques	102 (39.23%)
Working in awkward or cramped positions	114 (43.84%)
Working in the same position for long periods	158 (60.76%)
Bending or twisting your back in an awkward way	116 (44.61%)
Reaching or working away from your body	68 (26.15%)
Unanticipated sudden movements or falls by patients	60 (23.07%)
Assisting patients during gait activities	96 (36.92%)
Lifting or transferring dependent patients	128 (49.23%)

Risk factors (continued)	n,%
Carrying, lifting or moving heavy materials	76 (29.23%)
Working at or near your physical limits	64 (24.61%)
Overtime, irregular shift, length of workday	100 (38.46%)
Inadequate training in injury prevention	46 (17.69%)
Lack of assistive devices and equipment	54 (20.76%)
Malfunction of equipment e.g. beds that cannot be adjusted	84 (32.30%)

[Table/Fig-3]: Risk factors for development of WRMSDs.

S. No.	Strategies	Almost Always	Sometimes	Almost Never
1	I get someone else to help me handle a heavy patient	106	126	28
2	I modify patient's position/my position	104	118	38
3	I use a different part of my body in administering my nursing procedure	92	112	56
4	I warm up and stretch before performing my nursing duties	56	106	98
5	I modify my nursing procedure in order to avoid stressing an injury	110	90	60
6	I pause regularly so I can stretch and change posture	64	134	62
7	I adjust plinth/bed height so I can stretch and change posture	70	110	80
8	I select techniques/procedures that will not aggravate or provoke my discomfort	88	112	60
9	I stop a treatment if it causes or aggravate my discomfort	64	80	116

[Table/Fig-4]: Coping strategies adopted by nurses.

excellent workability [Table/Fig-5]. According to participants' answers on the PSS, Mean stress score of 260 nurses was 18.96 (moderate stress). Majority of the nurses (73.5%) had moderate stress.

Workability Index	n,%
Poor	30 (11.5)
Moderate	124 (47.7)
Good	102 (39.23)
Excellent	4 (1.53)
Perceived stress score	
Low	46 (17.7%)
Moderate	191 (73.5%)
High	23 (8.8%)

[Table/Fig-5]: Workability Index (WAI) and Perceived Stress Score (PSS).

Relationship of WAI with demographic factors and WRMSDs: Pearson's product moment correlation was used to check develop correlations for continuous variables and Biserial correlation test was used for dichotomous variables. A negative and significant correlation was seen for continuous variables i.e. age, number of hours of work, perceived stress. A significant negative correlation was seen for dichotomous variables i.e., neck pain, shoulder pain and back pain. [Table/Fig-6] shows correlation matrix.

Predictors of WAI: A standard linear multiple regression analysis was performed to find significant predictors of workability of nurses [Table/Fig-7]. Outliers, multicollinearity, normality, linearity, and residual independence were all evaluated. When the significant variables (age, perceived stress score, hours of work, type of job, work setting, neck, shoulder and back pain) were used in the regression analysis of WAI scores, the results showed that the independent variables explained 46.4 percent of the workability index (R^2=0.444, adjusted R^2=0.395), and the model was significant (F=14.76, p-value <0.001). Neck pain, work setting and level of education did not demonstrate significant connection with workability of nurses.

Workability	R value	p-value
Age	-0.265**	0.008*
Hours	-0.201	0.001*
Gender	0.104	0.095
Marital status	-0.071	0.253
Level of education	0.229	0.038*
Type of job (shift/fixed)	-0.152	0.014*
Work Setting (COVID-19/Non COVID-19 ward)	0.144	0.021*
Total stress core	-0.622**	0.001*
Neck pain	-0.169	0.056*
Shoulder pain	-0.220	0.053*
Elbow pain	-0.028	0.651
Wrist pain	0.112	0.072
Back pain	-0.358	0.054*
Hip pain	0.108	0.083
Knee pain	-0.015	0.811
Ankle pain	-0.104	0.094

[Table/Fig-6]: Correlation of WAI with demographic variables and WRMSDs.

Model		Unstandardised Coefficients		Standardised Coefficients	T	Significance
		B	Std. Error	Beta		
1.	(Constant)	36.078	3.417	-	10.557	0.001*
	Neck pain	-1.373	1.085	0.088	1.265	0.207
	Shoulder pain	-0.372	0.999	0.024	0.373	0.01*
	Back pain	-1.615	0.984	-0.102	-1.641	0.002*
	Perceived stress score	-8.077	0.896	-0.525	-9.015	0.001*
	Type of job	-2.436	1.090	0.145	2.234	0.026*
	Hours at work	-2.101	0.836	0.125	-2.512	0.01*
	Work Setting	-1.880	1.075	-0.080	-1.453	0.081
	Age	-0.006	0.069	-0.006	-.094	0.025
	Level of education	-1.221	0.949	-0.078	-1.286	0.200

[Table/Fig-7]: Predictors of WAI.

DISCUSSION

The aim of this research was to explore the prevalence of WRMSDs and its perceived stress and to determine the workability of nurses and influencing factors. This study included a total of 260 nurses working in different government and private hospitals in Delhi, India. The prevalence of WRMSD was found to be 80% during the last 12 months with low back pain, the most commonly reported problem followed by ankle and foot, shoulder, neck, knee, hip/thigh, wrist/hand, elbow. The majority of nurses communicated moderate workability (47.7%) and moderate level of stress (73.5%).The result

of linear multiple regression analysis showed that the independent variables of (age, work hours, type of job, back and shoulder pain) explained 46.4% of the workability index.

As reported in the result section the prevalence of WRMSD is similar to or higher than most of national and international studies. [Table/Fig-8] shows a comparative analysis of WRMSD. Results show higher prevalence in present study compared to studies by Raithatha C et al., Lipscomb J et al., Yan P et al., and Yasobant J et al., Low back pain was the most commonly area affected in most of studies similar to present study [6,14,25-29]. Low back was found to be the most common affected area. This is quiet similar to findings of other studies [14,15,28]. According to the authors, LBP is the most common musculoskeletal illness in adults, with 60-80% of people experiencing it at some point in their lives. LBP has also been identified as one of the most prevalent WMSDs among nursing professionals, with a point prevalence of around 17%, an annual prevalence of 40-50%, and a lifetime prevalence of 35-80% [16]. According to some studies, more than half of all nurses (56%) have recurring back problems [17].

Excessive work load and non standard work posture were revealed to be risk factors for WRMSDs in a prior study, which was similar to this one [19]. Injuries among nurses have been linked to low back bending, carrying and lifting factors, and patient transfers, according to other studies. The Royal Nursing School and the American Nurses Association (ANA) have issued patient transfer principles in recent decades to prevent potential injuries to nurses during patient transfers, as well as to reduce the incidence of low back pain and the development and/or recurrence of WMSDs [30]. There have been no such guidelines made or adopted by the government or local authorities in India. There is a dire need to review the working condition of nurses.

Result of this study show that the most common coping strategies adopted by nurses to alleviate pain are; "take rest, pause regularly, change posture, stretch" and "modify nursing procedure to avoid stressing an injury". Similar results were obtained from multivariate analysis, adequate hours of work was a protective factor for the WRMSDs. According to a research a 15-minute rest period ensures that the erector muscle of the spine and heart rate return to normal [31]. As a result, proper rest hours are recommended for nurses in the nursing profession [32], in order to reduce tension and relax muscle tissues, as well as to eradicate muscle tiredness. More study based on ergonomics techniques and procedures is required to give a complete analysis of types of body postures and stretches, as well as modifications to nursing processes, in order to avoid WRMSDs.

Mean stress score of nurses in this study was 18.96±5.07, which falls under the category of moderate stress. Majority of the nurses (73.5%) had moderate stress, 17.7% nurses have low stress and 8.8% nurses have high stress. These findings are similar to study by Alharbi H et al., in which majority of nurses experienced

Study	Place of study	Sample size	Mean age (years)	Gender	Tool used	Prevalence of WRMSD
Munabi RJ et al., [25]	Uganda	741	35.4	Female (85.7%) Male (14.3%)	NMQ	80.8%
Raithatha AS and Mishra DG, [26]	India	296	30.4	Female	Self-structured questionnaire	60.5%
Lipscomb J et al., [27]	USA	1163	45	Female (95.4%) Male (4.6%)	NMQ	72.5%
Yan et al., [29]	China	6674	31.83	Female (96.8%) Male (3.2%)	The Chinese version of musculoskeletal questionnaire	77.4%
Smith DR et al., [14]	Japan	221	38.7	Females only	Estonian translation of the survey instrument developed for the CUPID study	84%
Yasobant S et al., [6]	India	965	32.5	Male (41.4%) Female (58.6%)	NMQ	26.4%
Majumdar D et al., [28]	India	627	34	Females only	NMQ	Lower back pain (67%) Neck pain (47.4%) Ankle/feet pain (36%)

[Table/Fig-8]: Comparative analysis of WRMSD in various countries [6,14,25-29].

moderate level of stress [33]. Another study by Mozhdeh S et al., also showed that majority of participants (55%) had moderate level of stress [34].

Most of the available literature reports about factors affecting WRMSDs but there is a paucity of literature assessing workability of nurses and associated factors. Another goal of the study was to add to our understanding of the elements that contribute to optimal workability of the nurses and its predictors. The study reported mean WAI to be 30.96±6.93 which falls in the category of moderate workability. Majority of nurses (124, 47.7%) had moderate workability, 11.5% nurses reported poor workability, 39.23% nurses had good workability and only 1.5% nurses had excellent workability. In a similar study performed in Xinjiang nurses demonstrated moderate workability [29]. The scores in present study are lesser compared to study by Akodu AK and Ashalejo ZO, that reported good workability among nurses and also no association with WRMSDs [19] whereas present study found a significant negative correlation with neck, shoulder and back pain. Age, type of job (fixed/shift), number of hours of work, perceived stress, back and shoulder pain were found to be the predictors of WAI. In several studies, older nurses had a lower workability index, and there was a strong inverse relationship between WAI, age, and work experience. It is propounded that 'Individuals' physical capabilities can influence their job ability in high-demand occupations'. Nursing is a physically demanding career, and as people get older, their physical capacity decreases. According to Abbasi M et al., Work capacity and ability were reduced as a result of increased work hours, experience and imposed physical and mental restrictions [20].

Few studies have looked at the relationship between shift work and workability and how one influences the other. Shift occupations are linked to extended working hours, non ergonomic work schedule planning, and health and well-being issues. In addition workers' physiological, psychological, and physical concerns have been reported as a result of biorhythm disturbances. Based on these findings it can be attributed that nurses who worked a permanent shift had considerably higher WAI ratings than nurses who worked rotational or shift basis [35]. Another study on the other hand found no link between the number of shifts worked and workability [36]. However time and type of shift job were not included in present study.

Limitation(s)

Considering the COVID-19 situation, face to face interaction with nurses was not possible. Therefore, online forms were circulated. So, limited number of subjects were involved in the study and limited responses were obtained. Physical examination of nurses to rule out the exact problem was not possible in COVID-19 era.

CONCLUSION(S)

In the nursing profession, the physical and emotional stresses of work-related musculoskeletal disorders and the resultant low workability can have a significant impact on the long-term recruitment and retention of nurses who are expected to work more efficiently and with less resource in populations which are otherwise ageing. As a result the current work has practical, policy, and research consequences. Work-place policies that will improve workability and as a result better efficiency should be designed. WRMDs among nurses should be addressed and handled by the administration at each institution to avoid negative repercussions such as diminished work efficiency. Nurses should be made aware of the severity of WRMDs and good body mechanics according to policymakers. Experts and therapists should evaluate the working environment of the nurses and related ergonomic hazards on a regular basis and suggest proper environmental and biomechanical modifications. To prevent the symptoms of WMSDs and improve their overall health and job abilities they should be enrolled in lifestyle health promotion programmes such as regular exercise, lifestyle modification, food,

physical activity and weight management. There is also a need to boost psychological interventions for nurses by giving them with simple and quick strategies to deal with negative emotions when treating patients and to improve their ability to self-adjust as soon as possible. The study also has implications for the continuing education of nurses. A systematic evidence-based curriculum should be established to educate them about probable risk factors for work related disorders, their prevention and management.

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