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Review Article

Prevalence of Work-Related Musculoskeletal Disorders among Nurses: A Meta-Analysis

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Abstract

Background: Work-related musculoskeletal diseases (WMSDs) have a greater negative impact on nurses' physical and mental health. However, the epidemiologic characteristics of nurse WMSDs are unclear, and the reported prevalence of WMSDs varies widely. The aim of this meta-analysis was to provide a quantitative synthesis of WMSDs' prevalence in nurses and estimate the pooled prevalence of its.

Methods: The PubMed, ScienceDirect, Web of Science, Cochrane Library, EMBASE, CINAHL, Ovid, WANFANG, VIP, China Knowledge Integrated, and CBM databases were searched for relevant studies. The retrieval period extended from database initiation to Mar 2022. After data extraction and quality assessment, a meta-analysis was performed using the Stata 16.0 software package.

Results: Overall, 42 articles were included, yielding a total sample size of 36,934. The annual prevalence of WMSDs among nurses was found to be 77.2% (95% confidence interval: 0.725-0.819). The three anatomical areas with the highest prevalence of WMSDs among nurses were the lower back (at 59.5%), neck (at 53.0%) and shoulder (at 46.8%). Nurses in developed countries have a higher prevalence of WMSDs than those in developing countries.

Conclusion: There was currently moderate evidence to suggest a high prevalence of WMSDs in nurses. National policies should aim to reduce their prevalence in this population.

Keywords: Nurse; Work; Musculoskeletal disorders; Prevalence

Introduction

Evidence published in the Lancet in 2018 suggested that of the many occupational diseases, work-related musculoskeletal disorders (WMSDs) have considerable impact on health and cause harm; they are also important causes for sick leaves and disability (1). WMSDs refer to muscle, nerve, or other soft tissue injuries or diseases caused by exposure to workplace-related risk factors (2). As they seriously affect quality of life, leading to varying degrees of long-term illnesses, work restrictions, high treatment costs, and absenteeism (3), the social and economic burden they create cannot be underestimated.

Nurses have a higher prevalence of WMSDs and are exposed to more serious occupational hazards than those in other occupations. A previous study has found the prevalence of WMSDs in nurses to be higher than that of other occupations, such as

manufacturing workers and physicians (4, 5). The large numbers of patients and various diseases and treatment techniques encountered in the nursing workplace create an environment with unique biological, physical, and chemical factors that contribute to a high prevalence of WMSDs. The prevalence of WMSDs in nurses ranges from 60–98% (6, 7), the reported prevalence varies widely among the numerous studies in this field. Notably, workers' compensation, diagnostic tests, and physician services can cost between $50,000 and $100,000 per musculoskeletal injury in this population (8). Nurses with musculoskeletal diseases have a higher turnover tendency (9), a higher risk of depression (10), and a lower quality of life (11). WMSDs are also an important cause of sick leaves, patient safety issues, and decreased quality of care (12, 13). In the long term, the current prevalence of WMSDs is not expected to be conducive to the stability and development of the nursing team, and is likely to endanger patient safety.

Previous meta-analyses on WMSD prevalence among nurses have been performed for specific sites (such as the upper extremity) and on specific groups (such as those working in the operating room) (14, 15). However, to the best of our knowledge, no meta-analyses have been performed on the prevalence of WMSDs in all nurses and various anatomical sites. The lack of a clear understanding on the underlying epidemiology of WMSDs in nurses has various implications for the design of diagnostic criteria, establishment of specialized services, and recruitment in intervention trials. We therefore aimed to perform a quantitative synthesis of the prevalence of WMSDs among nurses worldwide and estimate its pooled prevalence. This study was performed in order to provide a reliable evidence-based basis for the formulation of precise interventions and health policies for WMSD prevention in this population.

Methods

Data sources and searches

This study was a meta-analysis, performed based on the PRISMA guidelines. Eleven Chinese and English databases were searched; these included the PubMed, ScienceDirect, Web of Science, Cochrane Library, EMBASE, CINAHL, Ovid, WANFANG, VIP, China Knowledge Integrated, and CBM databases. The retrieval period extended from the date of database establishment to Mar 2022. The key search terms included "nurse/nurses/nursing*/nursing personnel/registered nurses" AND "musculoskeletal disorders/musculoskeletal injury/back musculoskeletal/neck musculoskeletal /shoulder musculoskeletal" NOT "randomized controlled*/*controlled/meta/review."

Studies were retrieved using computer and manual retrieval methods, and the search languages were Chinese and English. This study is registered on the PROSPERO website (registration number: CRD42021248807).

Inclusion and exclusion criteria

The inclusion criteria were as follows: (i) cross-sectional study design, (ii) study subjects were registered nurses, (iii) in case of duplication of data in multiple studies, the study with the largest sample size or the last to be published had been selected, and (iv) WMSDs were diagnosed based on the following criteria: 1) nurses experienced any one of the four symptoms of soreness, numbness, pain, and activity limitation in any one part of the body for more than 24 h (without relief during breaks) within the past 1 year, and 2) the study used the Nordic Musculoskeletal Disorders Questionnaire or an adapted version of this tool for evaluation.

The exclusion criteria were as follows: (i) data or the full text for the study were not available, and (ii) the study was performed at a rural center.

Study selection and data extraction

Two researchers (WG Sun and TQ Zhang) independently screened the literature based on the inclusion and exclusion criteria, extracted the data, and evaluated study quality. Disagreements were resolved via further discussion with a third reviewer (HX Zhang) to achieve consensus. The extracted data included the name of the first author, publication date, country, sample size, and outcome

measurement. All data were extracted and cross-checked by the two researchers.

Quality assessment

Two investigators (WG Sun and TQ Zhang) from the research group independently assessed the risk of bias of the included studies (using the cross-sectional study quality assessment tool recommended by the American Agency for Healthcare Research and Quality)(16) and cross-checked the results. Scores of 0–3, 4–7, and 8–11 were considered to be of low, medium, and high quality, respectively. Disagreements were resolved via discussion or consultation with a third party.

Data analysis

The Stata 16 (Stata Statistical Software, Release 16, College Station, TX, USA) software package was used for the present meta-analysis. The overall prevalence of WMSDs and that of WMSDs in various anatomical sites were calculated (with 95% CI) and the I^2 value was used to quantitatively assess heterogeneity among the included studies. In cases with I^2 <50% and P ≥0.1, a fixed-effect model was used for meta-analysis; however, in cases with I^2 >50% and P<0.1, the pooled data were considered heterogeneous and subgroup analysis was performed based on country and publication year to identify the sources of the heterogeneity; if the source of heterogeneity cannot be found, a random-effect model was used for meta-analysis. The test level of the meta-analysis was set to α=0.05; the publication bias of the included studies was evaluated using a funnel plot and the stability and reliability of the meta-analysis results were evaluated using the sensitivity analysis method. Based on this method, studies were excluded one by one and changes to the results and total prevalence of WMSDs were observed.

Results

Included studies

Overall, 4,296 studies were screened. After checking for duplication, primary screening, re-screening, and quality assessment, 42 studies were ultimately included. All studies had a cross-sectional design and included 36,934 participants (Fig. 1). The quality assessment results showed that 41 and 1 papers had scores of 4 to 7 and 8, respectively. The articles originated from 15 countries and regions (Table 1).

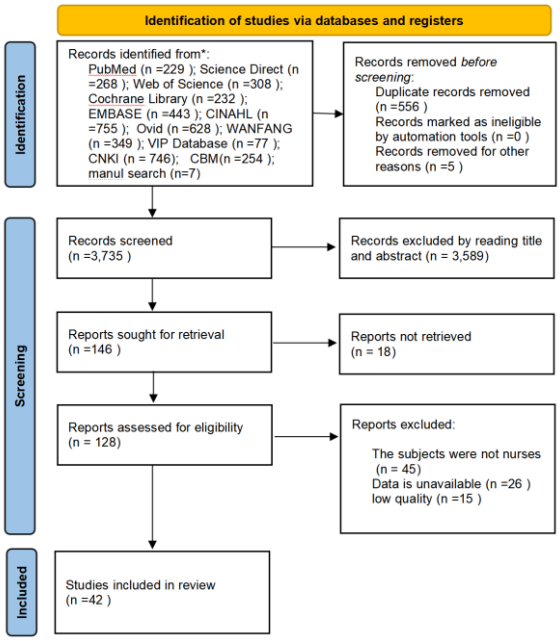

Fig. 1: Literature selection process and results

Table 1: Basic characteristics of the included studies

Author (yr) (Ref)	*Country*	*Age (Mean±SD)*	*Gender*		*Sample size*	*Quality assessment*	*Inclusion part of WMSDs*
			Male	Female			
Ping Yan,2017 (17)	China	31.83±7.18	214	6,460	6,674	4	① ② ⑤ ⑥ ⑩
Khader A.Almhdawi,2020 (18)	Jordan	32.1±5.7	282	315	597	5	⑥ ⑦ ⑧ ⑨
EvangelosC,2003 (19)	Greek	37±7.2	67	284	351	6	① ② ⑥
Jui-Yeh,2006 (20)	China	25-34	0	3,950	3,950	5	① ② ⑥ ⑩
ShuaiYang,2020 (21)	China	29.26±4.71	91	893	984	6	① ② ⑥ ⑩
Tiina Freimann,2016 (22)	Estonia	40	7	401	404	5	① ② ⑥ ⑦ ⑩
MireyaZamora Macorra,2018 (23)	Mexico	41.1±8.4	17	312	329	5	① ② ④ ⑥
Thanh Hai Nguyen,2020 (6)	Vietnam	32.3±9.9	221	958	1,179	6	① ④ ⑤ ⑥ ⑧ ⑨ ⑩
Jun Wang,2020 (24)	China	-	-	-	663	4	⑩
Christina Passali,2018 (7)	Greek	37.85±7.48	76	318	394	6	① ⑤ ⑥ ⑩
Mohammad Heidari,2018 (25)	Iran	30.6±4.45	89	211	300	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑨
Florentino Serranheira,2015 (26)	Portugal	36±9.16	338	1,058	1,396	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Nur Azma Amin,2014 (27)	Malaysia	30.61±5.29	0	376	376	5	① ② ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Manel Ouni,2020 (28)	Tunisian	41.42±5.7	142	168	310	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Jing Li,2020 (29)	USA	36.4	-	-	502	4	⑦ ⑧ ⑨
Asmare Yitayeh,2015 (30)	Ethiopia	30±5.8	-	-	268	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Alison M trinkoff,2002 (31)	USA	45	70	1,093	1,163	5	① ② ⑥
Alireza CHOOBINEH,2010 (32)	Iran	31.54±8.46	126	249	375	6	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Lipscomb,2004 (33)	USA	45	72	1,091	1,163	5	① ② ⑥
Changchun Cheng,2017 (34)	China	33.22±8.21	4	402	406	7	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Meili Wu,2015 (35)	China	28.2±6.1	15	385	400	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨
Yingyu Liu,2015 (36)	China	31.4±6.5	0	784	784	6	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Haiou Tong,2017 (37)	China	29.48±6.3	0	582	582	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Shaojin Huo,2019 (38)	China	31.2±6.6	0	304	304	8	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Lei Lei,2019 (39)	China	-	-	-	536	7	① ② ⑤ ⑥ ⑩
Fengmei Jiang,2019 (40)	China	31±3.4	0	388	388	6	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Lu Gan,2021 (41)	China	31.39±6.62	0	483	483	6	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑩
Huanqiong Cai,2012 (42)	China	26．4±7．5	11	360	371	6	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Jianhe Du,2016 (43)	China	22-53	0	800	800	5	① ② ⑥ ⑦
Lei Chen,2020(44)	China	39.1±6.4	0	302	302	6	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Xi Xue,2021 (45)	China	31.9±5.6	2	348	350	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Xue Zhang,2021 (46)	China	31.1±6.19	18	696	714	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩
Dongpan Li,2018 (47)	China	-	0	315	315	5	① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Yueqin Wang,2020 (48)	China	-	-	-	1,284	6	①②③④⑤⑥⑦⑧⑨⑩
Xi Zhang,2020 (49)	China	31.83±6.97	0	1,578	1,578	5	①②③④⑥⑦⑧⑨⑩
Soo-Jeong Lee,2010 (50)	USA	47.3±8.8	28	333	361	5	①②⑥⑩
SheilaJ.Cameron,2008 (51)	Canada	51.55±3.95	12	291	303	5	①②⑤⑥⑧
Philip J Schluter,2014 (52)	Australia	45	-	-	3,664	6	①
K.Saraswathi Krishnan,2021 (53)	Malaysia	-	0	300	300	6	①②③④⑤⑥⑦⑧⑨⑩
Weige Sun,2021 (54)	China	-	18	660	678	6	①②③④⑤⑥⑦⑧⑨⑩
D.Sezgin,2015 (55)	Turkey	27.9±5.1	67	256	323	5	①②④⑤⑥⑧⑩
DerekR.Smith,2005 (56)	Korea	-	-	-	330	5	①②③④⑤⑥⑦⑧⑨⑩

Note: ① :neck； ② :shoulder； ③ :elbow； ④ :wrist； ⑤ :upper back； ⑥ :lower back； ⑦ :knee； ⑧ :foot； ⑨ :leg /buttock； ⑩ :any body； -:not reported in the literature

Meta-analysis results

Annual prevalence of WMSDs among nurses

The annual prevalence of WMSDs among nurses was 77.2% (95% CI: 72.5–81.9, $P<0.001$); the I^2 value was 99.1%. Sensitivity analysis showed the annual prevalence to be between 75.9% and 77.9%. The absence of any conclusive difference suggested that the results of the study were relatively robust (Fig. 2).

Annual prevalence of WMSDs in different anatomical sites

The top three locations for WMSDs among nurses were the lower back (in 59.5%), neck (in 53.0%), and shoulder (in 46.8%). The included studies showed high heterogeneity and the sensitivity analysis showed no conclusive differences in the results (Table 2).

Subgroup analysis results

The studies were divided into three subgroups according to the year of publication (2000-2014, 2015-2018, and 2019-2021) and the number of studies on each site. The results showed an initial increase in the prevalence of WMSDs of the neck, upper back, and other anatomical sites, followed by a decrease over time; however, the prevalence of WMSDs of the shoulder and knee showed an increasing trend (Table 3).

The included studies were divided into two subgroups based on the degree of regional development. After adjustment by time and department, the prevalence of WMSDs of the feet and entire body was higher in developed areas than in developing areas. Conversely, WMSDs in other anatomical sites were higher in developing areas than in developed areas (Table 4).

Publication bias

The funnel plot method was used to test the publication bias of the included studies. The literature included in this study demonstrated potential publication bias; this may be attributed to publication in different languages and flaws in the research design of some articles (that led to a higher incidence of positive results).

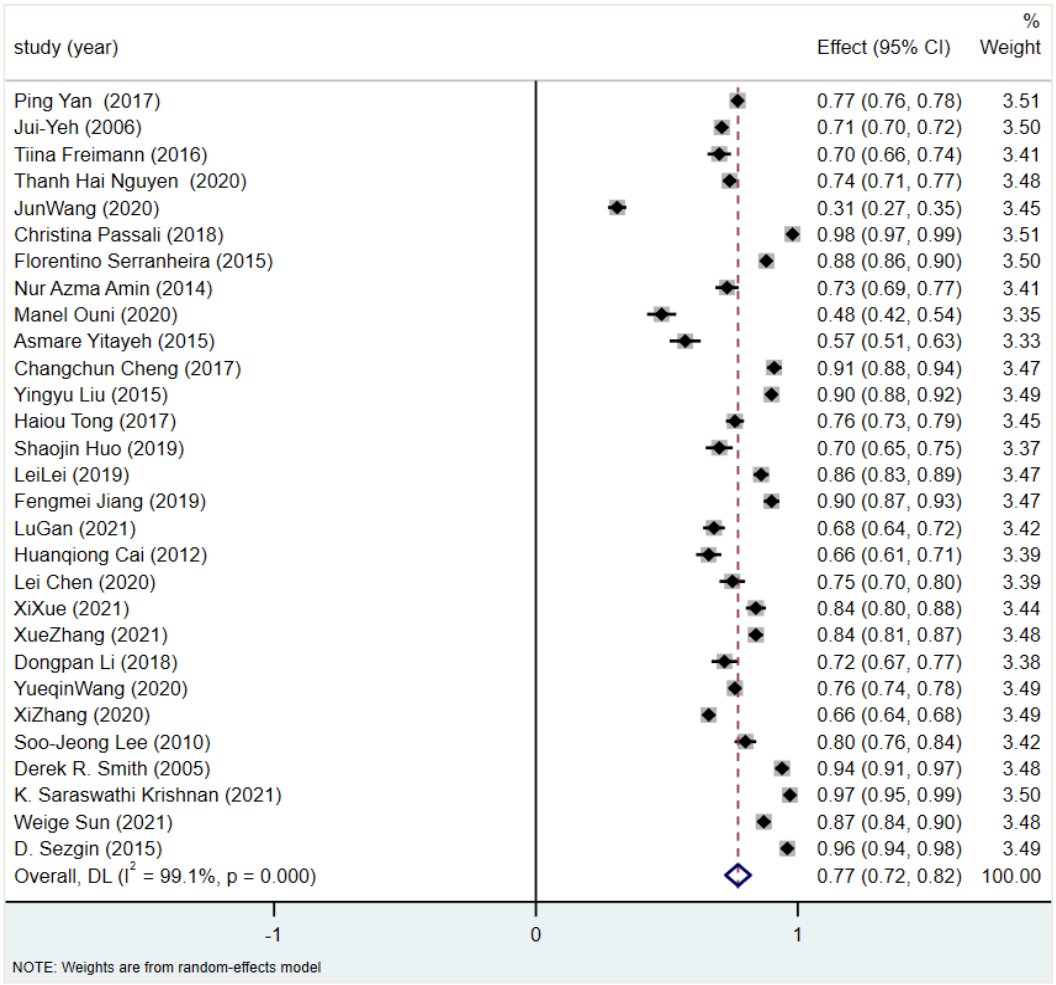

Fig. 2: Forest plot of the annual prevalence of WMSDs in nurses

Table 2: Annual prevalence of WMSDs in different anatomical sites

Anatomical site	*Effect size (%)*	*95%CI (%)*	*I²%*	*N*	*Sample size*
WMSDs	77.2	72.5-81.9	99.1	29	26,987
Lower back	59.5	53.6-65.4	99.2	38	32,105
Neck	53.0	45.8-60.3	99.5	38	35,172
Shoulder	46.8	40.3-53.3	99.3	35	29,935
Upper back	43.3	38.6-48.1	97.9	28	20,425
Knee	35.9	29.5-42.3	98.8	27	14,897
Feet	33.0	26.4-39.6	99.0	27	15,198
Wrist	30.8	25.4-36.3	98.5	27	14,829
Leg/Buttock	28.9	22.9-34.8	98.8	24	14,389
Elbow	18.3	13.6-22.9	98.7	23	12,622

Note: N: number of studies. Effect sizes were all combined using a random effect model; *P*-values of all results were less than 0.001

Table 3: Meta-analysis results of the annual prevalence of WMSDs in different anatomical sites during different time periods

Anatomical site	***2000-2014***				***2015-2018***				***2019-2021***			
	N	Sample size	I^2	Effect size (95%CI) (%)	N	Sample size	I^2	Effect size (95%CI) (%)	N	Sample size	I^2	Effect size (95%CI) (%)
Neck	11	12,407	99.6	45.4 (31.5-59.3)	14	13,375	99.1	56.7 (47.3-66.2)	13	8,406	98.6	55.5 (46.9-64.1)
Shoulder	10	8,743	99.3	42.1 (30.3-53.9)	13	12,981	99.3	46.7 (36.4-57.0)	12	7,227	98.9	50.8 (40.4-61.2)
Upper back	5	1,755	91.9	41.0 (33.0-49.0)	11	11,842	98.1	47.4 (40.0-54.9)	12	6,828	98.4	40.5 (31.7-49.3)
Lower back	10	8,743	99.2	54.7 (42.8-66.7)	14	13,375	97.9	67.3 (61.3-73.4)	14	9,003	99.3	55.1 (43.9-66.4)
Knee	4	1,452	96.9	37.7 (24.1-51.4)	10	5,655	99.2	35.3 (22.9-47.7)	13	7,790	98.4	35.7 (27.6-43.9)
Leg/Buttock	4	1,452	91.4	22.2 (15.0-29.3)	8	4,451	99.0	30.8 (18.9-42.8)	12	8,486	99.1	29.8 (20.6-39.0)
WMSDs	5	5,388	98.5	76.9 (66.1-87.6)	10	11,546	99.0	81.8 (75.0-88.5)	14	9,069	99.1	74.1 (65.6-82.5)

Note: N: number of studies. Effect sizes were all combined using a random effect model; *P*-values of all results were less than 0.001

Table 4: Meta-analysis results of the prevalence of WMSDs in various anatomical sites in developed vs. developing countries

Anatomical site	***Developing country***				***Developed country***			
	N	Sample size	I^2	Effect size (95%CI) (%)	N	Sample size	I^2	Effect size (95%CI) (%)
Neck	7	2,780	98.5	60.3 (44.7-76.0)	8	8,822	99.1	51.5 (40.2-62.8)
Shoulder	4	1,775	98.5	57.0 (38.9-75.2)	6	4,764	99.3	44.6 (28.7-60.4)
Upper back	4	1,752	98.7	50.3 (30.6-69.9)	3	2,120	98.7	49.0 (29.1-69.0)
Lower back	6	2,404	97.7	71.5 (60.3-82.8)	7	5,158	99.4	64.4 (48.3-80.5)
Knee	8	5,523	96.1	36.6 (30.1-43.1)	3	2,228	98.3	34.9 (18.2-51.7)
Feet	9	6,702	98.8	27.9 (18.9-36.8)	3	2,228	99.0	41.0 (19.3-62.7)
WMSDs	3	1,375	98.5	79.1 (66.5-91.7)	4	2,481	97.5	90.2 (83.5-96.9)

Note: N: the number of studies. Effect sizes were combined using a random effect model, and the *P*-values of all results were less than 0.001

Discussion

To the best of our knowledge, the present meta-analysis is the first to integrate the prevalence of WMSDs among nurses from various countries and that of WMSDs at various anatomical sites. Our study provides more accurate data pertaining to WMSD incidence in nurses and demonstrates the epidemiological trends of WMSDs at various anatomical sites from different regions. This may provide a reliable reference for the formulation of targeted interventions in different regions.

The results of this meta-analysis showed the annual prevalence of WMSDs among nurses to be 77.2%; this was lower than other studies (6, 26). Nurses are at a high-risk of WMSDs owing to their occupational characteristics. From a physiologic point of view, as most nurses are female, their musculoskeletal system is not as developed as that of males. Their vertebral bodies and intervertebral discs are smaller than those of males, and they are more prone to osteoporosis and other conditions that can lead to an increased risk of WMSDs (57). From an occupational perspective, the nursing shift system often involves three shifts. Nurses have minimal control over their working time owing to the large number of patient-related emergencies. They often have long working hours and considerably high overtime hours, which make nursing work even more difficult. It is difficult for the body to obtain adequate rest; this increases the risk of WMSDs (58). From the perspective of the working environment, the Movimientazione e Assistenza Pazienti Ospedalizzati index of the nursing work environment is high; there are also many unfavorable ergonomic factors such as extra hospital beds, insufficient auxiliary equipment, and insufficient bed spacing (59). These factors increase the likelihood of adopting poor postures during nursing operations and in turn increase the risk of developing WMSDs. From a psychological point of view, most nurses need to work night shifts for many years; they manage many emergencies, which generate considerable psychological pressure. This is associated with lower psychological resilience and job satisfaction in these roles. Notably, psychological factors also aggravate the prevalence of WMSDs in nurses (60).

The top three injured parts of the body by annual prevalence among nurses are the lower back, neck and shoulder; these results are similar to those reported already (23), but differ from another one (61). There may be two reasons for this finding. First, continuous muscle contraction produces fatigue. The "ergonomic load-muscle response-fatigue-injury" model is of importance in the development of WMSDs (62). Nursing tasks such as patient transportation and intravenous therapy are very commonly performed. Nursing tasks such as transporting patients and venous therapy are in great demand. With innovations in venous therapy technology the frequency of venous indwelling needles, infusion ports and PICC punctures have increased. The common issue with these nursing operations is that the neck, shoulder, and lower back remain in the same posture for a long time; this necessitates sustained muscle contraction in these areas, resulting in fatigue and potential injury. Second, an increase in the number of critically ill patients and the demands of an aging population have increased the number of procedures performed daily; these include dressing changes, venipunctures, and daily care. During these procedures, nurses frequently need to adopt bending, twisting, and head bowing postures (54). In this context, studies have demonstrated an increased risk of WMSDs in cases where vertebral bodies are subjected to shear stress (63). Nurses should therefore try to avoid maintaining the same posture for a long time; they should also try to perform stretching and ankle pump exercises after a long operation on a daily basis to relieve muscle fatigue (64).

Owing to the limited number of included studies, only a temporal subgroup analysis was performed on the annual prevalence of WMSDs in the neck, shoulder, upper back, lower back, knee,

thigh/hip, and entire body. The results indicated an increase in the prevalence of WMSDs in the shoulder and knee over time. The overall prevalence of WMSDs in these sites was also higher during the past three years despite a downward trend in other sites. This may be explained by the fact that the increase in prevalence of WMSDs among nurses has gained increasing attention worldwide; this may have increased the implementation of preventive measures against WMSDs of the neck, shoulder, back, and entire body (65, 66). The finding indicates the efficacy of global efforts made to reduce the prevalence of WMSDs among nurses in recent years. However, the prevalence of WMSDs in the shoulder and knee have increased despite this success. This may be attributed to the increased use of electronic devices such as mobile phones and tablets and the increased need for procedures such as administration of infusions, dressing changes, and disease monitoring, increased the time that nurses spend with their neck in flexion. A study found that on an average, nurses spent at least 4 h a day with their neck flexed (67); in addition, 63% kept their neck flexed for a prolonged period (54). Notably, the work circumstances of nurses who need to maintain a standing position or walk for long periods have not significantly improved. This may lead to the excessive use of the knee joint and muscles, resulting in injury. As there are few studies on knee WMSDs, it is expected that future research from various countries will focus on interventions directed towards minimizing nursing knee WMSDs.

Owing to the limited number of included studies, a regional subgroup analysis was performed on the annual prevalence of WMSDs in the neck, shoulders, upper back, lower back, knees, feet, and entire body. WMSDs of the feet and entire body were found to be more common in developed regions, while those of other sites were more common in developing regions. This was an interesting finding of this study, and may be related to developments in technology. Hospitals in developing regions may not equipped with sufficient nursing aids and the bed-to-care ratio is lower than that of developed regions. For example, while the bed-to-care ratio in a certain region of China was found to be 1:0.8 (68), that of an operating room in South Korea was found to be approximately 1:3 (69). The lack of adequate auxiliary equipment and human resources constraints may lead to frequent overuse of muscles in nurses, increasing the prevalence of WMSDs. This study found the annual prevalence of foot and entire body WMSDs in developed countries to be higher than that in developing countries. The reported body mass index was higher among nurses from developed countries than in those from developing countries (27.4 m^2/kg vs. 23.56 m^2/kg); notably, being overweight is an important predisposing factor for WMSDs in nurses (53). Developing countries should therefore focus on the prevention and management of WMSDs in nurses. These efforts need to start from national policies, regulations, and macrocontrol. Nurses should also be provided comprehensive protection and support for WMSDs according to their national conditions; this may reduce the prevalence of WMSDs by eliminating the root cause.

The results of this study may provide a reference for the early prevention and treatment of WMSDs in nurses and the formulation of relevant health policies.

Conclusion

This meta-analysis found the prevalence of WMSDs in nurses to be 77.2%. Except for the shoulders and knees, most anatomical sites demonstrated a downward trend in the prevalence of WMSDs. Many areas in developing countries showed a higher prevalence of WMSDs than developed countries. Therefore, both national policies and the hospital environment in these areas should promote the prevention of WMSDs and the rehabilitation of affected nurses.

Journalism Ethics considerations

Ethical issues (including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy, among others) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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