Prevalence and influencing factors of low back pain among nurses in China: a systematic review and meta-analysis

Original article

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Abstract: **Background:** Low back pain (LBP) is one of the most common occupational injuries that nurses experience in their daily work, which ultimately causes disability or difficulty in performing heavy physical activity. There is scarce information that presents a direct figure about the prevalence of LBP in Chinese nurses.

Objective: To systematically review and analyze the prevalence and influencing factors of LBP among nurses in China.

Methods: Related literature extracted from PubMed, Web of Science, Scopus, China National Knowledge Infrastructure databases were selected and reviewed based on the PRISMA guideline. Random effects models were used for data analysis, where heterogeneity was tested through I^2 . Egger's test was used to analyze the literature publication bias.

Results: The combined data indicated that the prevalence of LBP among nurses in China was 78% [95% confidence interval (CI) = 0.72–0.83]. The prevalence of LBP among nurses in China has declined in the past decade. Nurses presented a high risk of LBP in terms of female (OR = 2.38, 95% CI = 1.23–3.44, $P < 0.0001$), married (OR = 2.79, 95% CI = 1.57–3.86, $P < 0.0001$), $24 \leq \text{BMI} < 28$ (OR = 2.03, 95% CI = 1.18–3.08, $P < 0.0001$), and working for more than ten >10 years (OR = 2.54, 95% CI = 2.03–3.32, $P < 0.0001$).

Conclusions: There is a high prevalence of LBP among nurses in China. Interventions that include healthy dietary habits and physical activity mainly focusing on female married nurses who are working for at least 10 years should be implemented. Furthermore, nurses ought to apply ergonomic principles for personal protection at the workplace.

Keywords: low back pain • nurse • meta-analysis • China • chronic disease

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1. Introduction

Low back pain (LBP) is defined as pain, discomfort, and functional limitation in the area from T12 rib below to hip fold above, excluding primary structural

pathological changes such as disc herniation and spinal stenosis.^{1,2} It mainly involves back pain, radicular pain, and involvement pain.³ At present, LBP is one of the

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most severe burdens of noncommunicable diseases in the world. It accounts for disability among 60.1 million people worldwide.⁴ Besides, up to \$87.6 billion in medical spending for LBP has also brought enormous economic pressure on governments and people, especially in the middle- and low-income countries.⁵

The worldwide prevalence of LBP in adults was about 40%, while the incidence is around 38% each year.⁶ Owing to occupational physical and emotional factors, the risk of LBP in healthcare workers is much higher than that of construction workers and other manufacturing and construction practitioners.⁷ Health workers are exposing to those LBP risk factors due to the involvement in repeated treatment and rehabilitation activities for patients, which includes heavy manual handling, relocation of patients, and working in extremely awkward positions.⁸

A study in Bangladesh is evident that nurses are more vulnerable to LBP among occupational populations in the healthcare services sector.⁹ It has been reported that the global prevalence of LBP among nurses around the world was 40–90% and developing countries with a shortage of health workforce are at higher risk.¹⁰ Turkish and Slovenian studies found the prevalence of LBP among nurses at 84.2% and 85.9%, respectively.^{11,12} Guan et al. stated the prevalence of LBP in Chinese nurses at 51.63%.¹³

Several studies have indicated that the prevalence and factors related to LBP among nurses are from different geographical locations in China. However, the comprehensive nationwide data about the prevalence rate of LBP and its influencing factors in Chinese nurses are limited. Similarly, to facilitate valid and productive efforts to interpret and replicate the prevalence and influencing factors of LBP, an understanding of the current state of the literature is necessary. Therefore, this article aimed to assess the prevalence and influencing factors of LBP among nurses in China.

2. Methods

2.1. Data sources and searches

The systematic review and meta-analysis of this study were performed based on the PRISMA guidelines. The literature was searched from January to February 2019 using the following databases: PubMed, Web of Science, Scopus, and China National Knowledge Infrastructure (CNKI). Original articles published from 2010 to 2019 were identified by using the keywords “low back pain,” “nurse,” “prevalence,” “incidence,” and “current status.” In addition, keywords with the medical subject headings (MeSh) using a conjunctions word, such as AND, NOT, OR, were used in the “Advanced Searches” of

the international database. Furthermore, researchers paid attention to conference papers included in related databases. The citations had been entered in the reference management software Mendeley, Version 1.19 (Elsevier, London, UK).

2.2. Study selection

Two authors searched the database based on titles and abstracts to exclude duplicate and unrelated literature. In contrast, the other authors reviewed the full text of literature based on the results of the first screening independently. If there were any discrepancies, the first author performed as the tiebreaker.

The literature selection process followed the literature’s inclusion and exclusion criteria of this study. The cross-sectional study that reported the prevalence and influencing factors of LBP among more than 50 nurses in mainland China was the inclusion criteria. However, the literature that includes study population other than in-service nurses, incomplete study results or errors, and languages other than English or Chinese was excluded.

2.3. Data extraction and quality assessments

Two independent researchers performed data extraction. Researchers encoded related variables in the literature based on variable characteristics. Extracted variables were author name, year of publication, study site, study population, sample size, type of standard questionnaire, gender, age, marital status, education background, BMI, year of working experience, and prevalence of LBP. Furthermore, the adjusted odds ratios (AOR) with confidence intervals (CIs) of variables, that is, gender, age, BMI, educational background, and work experience variables were also extracted.

The researchers conducted a preliminary evaluation of the selected literature following the Australian Joanna Briggs Institute (JBI) Reviewers Manual.¹⁴ The scope of the evaluation included the evaluation research framework, sampling techniques, sample size, research settings, statistical analysis, inclusion and exclusion criteria, and so on. The literature with a score higher than 70% evaluated as low-risk literature.

2.4. Data synthesis and analysis

This study used Stata software, Version 16.0 (StataCorp, College Station, Texas, USA) for meta-analysis. The researchers first collected the prevalence from all studies, then calculated the variance of LBP based on the binomial distribution, and assigned the weight of each study based on the inverse of the variance. The

I^2 statistic was used to assess heterogeneity between studies and categorized into four parts based on the I^2 score: no heterogeneity (0%), low (25–50%), moderate (50–75%), and high (>75%).¹⁵

The random effects model was used to calculate the combined prevalence of LBP and the log-transformed odds ratio. Researchers examined the causes of heterogeneity in the study by subgroup analysis, and the Egger's test was performed to analyze the literature publication bias. The $p < 0.05$ was considered statistically significant. Data about the prevalence of LBP among nurses were presented through a forest chart. The line chart used to indicate the trend of LBP among nurses from 2010 to 2019.

3. Results

3.1. The result of the literature search

Through database keywords search, a total of 514 research papers were identified. A total of 14 literature were selected for meta-analysis after excluding duplicate literature, literature with unrelated title and abstract, irrelevant in-text information, literature that not met eligibility criteria, and high-risk literature, as shown in Figure 1. The total number of participants involved in those studies was 8,179, and the quality scores of each selected literature exceeded 80% (Table 1).

Figure 1. PRISMA process of the systematic literature search.

Author	Year	Study sites	Sample sizes	Gender	Age (years)	Measures	Literature quality (%)
Chen et al. ¹⁶	2010	Quanzhou	171	100% female	20–46	Self-made questionnaire	90
Deng et al. ¹⁷	2010	Dongguan	120	100% female	17–56	Self-made questionnaire	80
Xu et al. ¹⁸	2010	Harbin	108	88.0% female	19–49	Self-made questionnaire	100
Yin et al. ¹⁹	2013	Hebei	672	89.3% female	N/A	Self-made questionnaire	80
Wei et al. ²⁰	2014	Nanjing	256	91.0% female	22–40+	Self-made questionnaire	100
Wang et al. ²¹	2016	Yinchuan	909	N/A	31.93 ± 7.42	Self-made questionnaire	90
Zhang et al. ²²	2017	Shizuishan	172	100% female	20–35+	Self-made questionnaire and NRS scale	100
Zhang et al. ²³	2017	Lvliang	100	93% female	N/A	NRS scale and BDI scale	90
Tang et al. ²⁴	2018	Mainland China	1279	93.7% female	20–45	VAS scale and FABQ questionnaire	100
Guan et al. ¹³	2019	Mainland China	2458	96.4% female	20–30+	Self-made questionnaire and VAS scale	100
Huang ²⁵	2019	Zunyi	203	N/A	20–50	Self-made questionnaire	90
Li et al. ²⁶	2019	Sichuan	783	98.5% female	19–55	RMDQ and FABQ questionnaires	100
Wu ²⁷	2019	Nanyang	648	N/A	20–53	Self-made questionnaire and VAS scale	80
Zhang et al. ²⁸	2019	Shandong	498	85.3% female	31.1 ± 7.6	Self-administered questionnaire	100

Table 1. Characteristics of literature included in a systematic review.

3.2. The prevalence and trend of LBP among nurses

According to statistics included in 14 literature, the lowest and highest prevalence rates of LBP were 63.0% and 92.4%, respectively. The meta-analysis using a random effects model showed that the prevalence of LBP among Chinese nurses was 78% [95% confidence interval (CI) = 0.72–0.83], as shown in Figure 2. From the study findings, the researchers found the gradual decrement in the prevalence of LBP among Chinese nurses over the last decade. However, the prevalence of LBP was still seemed to be high (Figure 3).

3.3. Subgroup analysis

According to the results of the subgroup analysis, female nurses (75.6%, 95% CI = 67.4–83.8, $p < 0.001$) had higher prevalence of LBP than male (46.4%, 95% CI = 27.9–54.8, $p < 0.001$). 35–55 years old nurses (75.5%, 95% CI = 70.9–80.1, $p < 0.0001$) and married nurses (69.8%, 95% CI = 49.9–89.6, $p < 0.0001$) had proportion of LBP compared with 19–34 years old nurses (64.9%, 95% CI = 53.0–76.7, $p < 0.0001$) and unmarried nurses (33.2%, 95% CI = 16.8–49.7, $p < 0.0001$), respectively. Among nurses with a bachelor's degree or above, the proportion of LBP was 63.5% (95% CI = 48.9–71.5, $p = 0.001$) which was higher in comparison with nurses with junior college-level education (69.3%) and secondary school level education (73.6%). Regarding BMI of the nurses, obese or overweight nurses (75.6%, 95% CI = 71.7–79.5, $p = 0.006$) reported having high LBP than normal BMI (50.1%) and low BMI nurses

(37.7%). Furthermore, nurses who had worked for >10 years (82.2%, 95% CI = 76.8–87.6, $p = 0.014$) had a higher prevalence than nurses who were working for 5–10 years (72.5%) and <5 years (56.3%). The details are given in Table 2.

3.4. The risk factors of LBP

Female nurses were 2.38 times more likely to have LBP than male nurses (95% CI = 1.23–3.44, $p < 0.0001$). Married nurses were 2.79 times more likely to have LBP than unmarried nurses (95% CI = 1.57–3.86, $p < 0.0001$). Similarly, obese or overweight nurses (OR = 2.03, 95% CI = 1.18–3.08, $p < 0.0001$) have a higher risk of getting LBP than nurses with normal BMI. Nurses who were working for >10 years had 2.54 times (OR = 2.54, 95% CI = 2.03–3.32, $p < 0.0001$) more chance to experience LBP than nurses who were working for <5 years.

4. Discussion

From the findings of this literature review, researchers found that the prevalence of LBP among Chinese nurses was 78%, which shows that the current government measures are not effective enough in preventing and controlling LBP among Chinese nurses. Similar to the current result, studies from Turkey, Slovenia, and Saudi Arabia reported the prevalence of LBP >60%, which indicates that developing countries have a high risk of LBP among nurses.^{12,29,30} However, the prevalence rate of LBP in nurses of developed countries, such as Japan (11.8%) and Sweden

Figure 2. The prevalence of low back pain.

Figure 3. The trend of low back pain from 2010 to 2019.

Variables	Prevalence (%)	CI (%)		P-value
		Lower	Upper	
Gender				
Male	46.4	27.9	54.8	0.001
Female	75.6	67.4	83.8	0.001
Age (years)				
19–34	64.9	53.0	76.7	0.0001
35–55	75.5	70.9	80.1	0.0001
Marital status				
Unmarried	33.2	16.8	49.7	0.0001
Married	69.8	49.9	89.6	0.0001
Education background				
Secondary school	73.6	67.8	79.3	0.0001
Junior college	69.3	56.9	76.6	0.003
Bachelor's degree or above	63.5	48.9	71.5	0.001
BMI				
24 ≤ BMI < 28	75.6	71.7	79.5	0.006
18.5 ≤ BMI < 24	50.1	46.4	53.8	0.0001
BMI < 18.5	37.7	30.1	45.2	0.001
Years of working experience				
<5	56.3	43.5	69.0	0.0001
5–10	72.5	64.1	80.9	0.0001
>10	82.2	76.8	87.6	0.014

Note: CI, confidence interval; LBP, low back pain.

Table 2. The demographic information of LBP

(19.0%), found to be lower compared with the current study result.^{31,32} The probable reason behind the high prevalence of LBP in nurses of developing countries, including China, could be due to the inadequate health workforce, unmatched nurse-patient ratio, and working in the unhealthy work settings with high workload.³³

The trend analysis of LBP among Chinese nurses found a downward trend of LBP in the past 10 years. Nonetheless, the overall declination was seemed to be slow. It reflects that some hospitals in China have begun to address the problem of LBP among nurses by adopting LBP prevention strategies, which appeared as less fruitful. Similar reasons were illustrated in the study from Guan et al.¹³

This article indicated a significant association between LBP and female nurses. The previous study supported the current result that female nurses are at higher risk of LBP, which could be exacerbated by the menstrual cramps and their pain threshold.³⁴ Marital status was found as another influencing factor of LBP in nurses. The relevant Chinese literature has shown

that married female nurses involve in both domestic-work and occupational-work, which lodged them to the high susceptibility of LBP.¹⁸ A study by Danish added up the evidence that married nurses are more prone to LBP during their pregnancy. Pregnancy causes natural softening and stretching of the ligaments, which puts a strain on the joints of the pelvis and lower back, resulting in LBP.³⁵

The results of this study identified that nurses working for >10 years were 2.54 times more likely to develop LBP than nurses working for <5 years. The relevant research shows that long-term repeated bending postures of clinical nurses may increase uneven spinal pressure causes LBP.¹⁶ A study mentioned about the professionalism of nursing work requires continuous ability to grow their skill and adopt in the changing measures as well as health technologies. The majority of the senior nurses are not able to match the changing demand skill and cannot apply the mechanical principles correctly in various operations leads to the deterioration of bones, muscles, and other physiological functions possessing the high LBP risk.²⁴

In this article, obese or overweight nurses found to have a higher risk of getting LBP than nurses with normal BMI, which is similar to the result reported in the study of Zhang et al..²⁸ Several studies identified that people with increased BMI and unhealthy lifestyles, including lack of physical activity and inappropriate diet, were more likely to suffer from chronic LBP.^{36,37} A study by Li et al. demonstrated that due to a high workload and less leisure time, nurses are practicing unhealthy dietary habits and inadequate physical activity, which are known significant drivers of increased BMI and LBP itself.²⁶

The nationwide survey is needed to uncover the significant stressors of LBP among nurses, which could provide the platform for the development of effective policy, plans, and interventions to prevent LBP and its complications among Chinese nurses.

5. Conclusions

The prevalence of LBP among Chinese nurses in this study was found to be decreased in the past decade. However, the prevalence rate still seemed to be higher compared with developed countries. The interventions that include healthy dietary habits and regular physical activity should be implemented to control the burden of LBP, focusing on female married nurses who are working for at least 10 years. The government health departments and policy-makers need to update the current LBP prevention guidelines and implement them

accordingly to overcome the foreseeable risk of LBP and its complications.

Limitations

This article has a high degree of heterogeneity, mainly caused by different factors such as geographical, hospital grades, departments, and follow-up time of each study, which limits the scope of interpretation of this article.

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Ethics approval

This article was approved by the ethics committee of Mae Fah Luang University (IRB approval number: 129/2562).

Conflicts of interest

All contributing authors declare no conflicts of interest.

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