

Needle Stick Injuries among Nurses in China: Meta-analysis

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ABSTRACT

Background: Needle stick injury is a common occupational injury in all clinician who are working in health care setting. It leads to increase the risk of getting blood-borne diseases infections. Nurses are the main victims of needle stick injuries among health workers, and needle stick injuries expose higher risks among them in developing countries, especially in populous countries such as China. More than half of Chinese nurses face the risk of needle stick injuries in their busy nursing work.

Objective: This study aims to assess the prevalence of needle stick injuries among nurses in China in the past decade by meta-analysis. **Methods:** We reviewed all relevant literatures in the PubMed, Science Direct, PMC and CNKI databases and conduct meta-analysis to find the associated factors for needle injuries among the nurses. By removing duplicate articles, filtering articles by title and abstract, and filtering the article based on inclusion criteria, the number of articles that were eventually included in the study was 16 articles. **Results:** The results showed that the prevalence of needle stick injuries among nurses in China was 57.3% (95%CI= 0.46-0.69). The prevalence of needle stick injuries among nurses in China had declined in the past decade. **Conclusion:** Needle stick injuries in China could be reduced the risk by improving for the nurses particularly strengthening occupational safety training for nurses, increasing protective equipment for needle stick injuries, and optimizing the working environment of hospitals.

Keywords: *Needlestick injuries, China, Nurse, Occupational exposure*

Introduction

Based on China's huge population and the "Healthy China 2020" initiative, China has now established a relatively complete health care system. However, the establishment of China's health care system has experienced a long history. It is mainly composed of four stages.

The first stage (1949-1983), due to lack of health resources, China established a Rural Cooperative Medical System (RCMS) in rural areas consisting of traditional Chinese traditional medicine practitioners in rural areas. The system provides farmers with basic medical and health care services. Government officials and workers living in cities enjoy a free labor medical security system paid by the government and businesses. The system's health care services are provided by professional doctors and nurses. The doctors are mainly general practitioners, and the education level of nurses is only secondary school education [1].

The second stage (1984-2002), due to the economic reforms in China, the fully established RCMS system collapsed and farmers did not receive free medical insurance. At this stage, farmers could go to

rural private clinics and urban public hospitals for medical treatment, but they need to pay for them by individuals. In the city, in order to reduce the medical and economic burden of the government and enterprises, the Urban Employee Basic Medical Insurance (UEBMI) system has been established. The government and enterprises pay part of the expenses for individuals, and individuals can pay for medical expenses themselves. At this stage, doctors began to change from general practitioners to specialists, medical assistants began to specialize, and nursing also established an undergraduate education system [1-3].

The third stage (2003-2008), the government established the New Rural Cooperative Medical Scheme (NRCMS) system to fully protect farmers' health care services and the Urban Residents Basic Medical Insurance (URBMI) to offer the health care serves for unemployed, elderly, students, women and children in the city. At this stage, the doctor's degree is generally above the bachelor's degree, the urban doctors reach the master's degree or above, and the nurses and other health care practitioners have generally established a relatively

complete medical education system for undergraduate-master's-doctoral [4, 5].

The fourth stage (2009-present), China has gradually established a relatively complete Chinese health care system consisting of professional public health services, primary public health and clinical care, curative health care and rural health care systems. Professional public health services are mainly composed of Centers of Disease Control and Prevention (CDC) at all levels and women's and children's health institutions. Primary public health and clinical care is mainly composed of community health service centers and rural government clinics, which provide basic medical and health care services for urban residents and farmers. Curative health care is mainly composed of secondary and tertiary medium and large hospitals, which provide professional medical services for critically ill patients. Rural health care systems consist of rural private clinics, which are partially funded by the government to protect farmers in poor and remote areas without rural government health facilities [1, 6].

Today, a more comprehensive health care system has made more and more Chinese urban residents have more choices in health care. Most urban residents distinguish between clinical treatment and health care, modern medicine has become the first choice for clinical treatment, and traditional Chinese medicine plays an important role in preventing disease and body health [7]. This has slowed the development of Chinese medicine hospitals in recent years, and the number of outpatients and hospitalizations in modern medicine hospitals has increased significantly. At the same time, it also exacerbates the work pressure of nurses and other health workers in modern medical hospitals [8].

As of 2015, the total number of registered nurses in China was 3.24 million, and the number of registered nurses per thousand population reached 2.36 [9]. They are distributed at all levels of health care institutions, nursing education institutions and public health agencies. In these institutions, they play the important roles of caregivers for patients, planner of the nursing program, manager of the nursing works, educator of nursing knowledge, coordinator of clinical works, advocate of patient benefit and the researcher in nursing science [10]. American Association of Critical-Care Nurses (AACN) defines the core competence of nurses as critical thinking, assessment, communication, and technical skills [11]. At present, the highest level of expectation for clinical nurses in Chinese patients is communication skill and technical skill, because good communication between nurses and patients and superb nursing technology have become the important part of the hospital experience hospital service in recent years [12]. However, as the patient's expectations for the nurse grow, the burden of work among nurses increases.

Nurses face many contradictions and problems in clinical work, but they have not yet been effectively solved. The most important work burden comes from the

following four aspects. The first aspect is medical violence and occupational injuries. In the past year, nearly 41.2% of nurses experienced violence by patients or their families. In addition, about 79.0% of nurses have suffered sharp and needle stick injuries at work. In the second aspect, nurses are unable to obtain sufficient recognition and respect from patients and society. 83.3% of nurses experienced an intense relationship between nurses and patients. In addition, more than 90.0% of Chinese nurses believe that the public has a narrow understanding of the work content of nurses, and the public does not have enough respect for the nurses. In the third aspect, nurses bear a heavier financial burden. 76.5% of nurses earn less than \$700 a month. In terms of nursing training, 67.7% of the nurses' units do not provide support for nurse training. In the fourth aspect, the nurse suffers from a heavier clinical workload and psychological burden. Nearly 10.0% of nurses work more than 60 hours a week. In addition, 86.0% of nurses need psychological counseling and mental decompression due to poor nurse-patient relationship and high work intensity [13].

Due to the work burden of nurses, how to deal with the increasingly tight relationship between nurses and patients and improve social recognition? How to ease the stress and psychological burden of nurses? How to improve the quality of nursing, reduce the sharp and needle stick injuries to ensure the occupational safety of nurses? These are the challenges facing current and future Chinese nurses. Among them, the most important challenge in the clinical work of nurses is how to reduce sharp and needle stick injuries.

Needle stick injury (NSI) is a common occupational injury that caused by clinical needles such as hypodermic needles, blood collection needles, intravenous (IV) cannula or needles used to connect part of IV delivery systems, it brings health workers the opportunity to be infected with blood-borne diseases [14-16]. After a needle stick injury, the infected blood or body fluid enters the human body through the wound, which may cause health workers to have a high risk of contracting Hepatitis B, Hepatitis C and HIV/AIDS [17].

Nurses are the most vulnerable group of all health workers to get needles stick injuries, because they provide the most common clinical needles and sharps in clinical service to patients [18]. Needle stick injuries have a great impact on them, which exacerbates their psychological burdens such as anxiety and depression [19, 20]. In addition, the average cost of \$747 for nurses suffering from needle stick injuries also increases the financial burden on governments and medical institutions [21].

Needle stick injuries among nurses have a high prevalence in developing countries, especially in some populous countries. In India, the prevalence of needle stick injuries in nurses in clinical work is as high as 75.8% [22]. In Pakistan and Iran, they also reached 44.0% and 41.2% respectively [23, 24]. The prevalence

of needle stick injuries in these countries is much higher than that of developed countries such as the UK (25.0%) and Italy (13.9%) [25, 26]. But in China, the prevalence of nurse needle stick injuries has reached an astonishing 64.9%, this data is much higher than the average of the worldwide prevalence of needle stick injuries [27].

At the present, due to the large time span of reports on needle stick injuries and the large difference in sample size and the prevalence of needle stick injuries among nurses in China, this has brought certain difficulties to clinical reference. This study intends to combine the previous studies by meta-analysis to analyze the overall prevalence of needle stick injuries among nurses in China and the prevalence of needle stick injuries with years.

Methods

The meta-study in this study was to review the prevalence of needle stick injuries among nurses in China and the prevalence of needle stick injuries with years. The inclusion criteria for data collection are mainly the following four items; 1) The selection of the article comes from the databases of PubMed, Science Direct, PMC and CNKI from January 2010 to September 2019; 2) Published in English and Chinese languages; 3) English articles are peer-reviewed articles, and Chinese articles are from Chinese core journals included in PKU; 4) The following keywords appear in the title or abstract: needle stick injury, occupational exposure, prevention, sharp injury, nurse, and; 5) Research design for cross-sectional study.

In the process of data processing, the researchers combined the data on the prevalence of needle stick injuries among nurses in China and the prevalence of needle stick injuries with years in all the literature. Before the data was merged, the investigator tested the heterogeneity of the included data. This study used the chi-square test to test the heterogeneity of the data, $p\text{-value} = 0.100$ and heterogeneity of data included in I^2 analysis while 25.0% was low grade heterogeneity, 25.0%-50.0% was medium grade heterogeneity, >50% was high grade heterogeneity. When $p\text{-value} > 0.100$ and I^2 are satisfied, there was no heterogeneity between studies. The data was analyzed by Stata 15.1. The result showed the prevalence of needle stick injury from the forest plot, and the prevalence of needle stick injuries in different years from the line graph.

Results

General situation of inclusion of research results: according to the Chinese and English database search results, a total of 998 Chinese literature and 136 English articles were included. Then, exclude articles of 1,008 that did not match by reading the title and abstract of the literature. Then through reviewing the remaining literature, a total of 110 articles that did not meet the inclusion criteria. Finally, the total number of articles included in the standard were 16 and the total number of nurses were 3,167 (Figure 1).

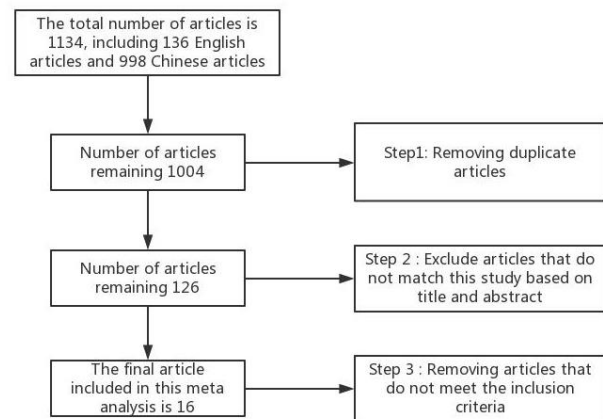


Figure 1 Process of selecting articles for review.

The study showed that a total of 1,939 nurses had at least one needle stick injury in the clinical work. Heterogeneity test showed greater heterogeneity between studies, $I^2 = 98.2\%$, $p\text{-value} < 0.010$. Therefore, this study used a random effects model to merge data. The meta-analysis shows that the prevalence of needle stick injuries among nurses was 57.3% (95%CI=0.46 - 0.69) (Figure 2). The prevalence of needle stick injuries in different years shows that the decline in the prevalence of needle stick injuries among Chinese nurses in recent years (Figure 3).

The investigators used the egger test during the merger of prevalence of needle stick injuries and did not detect statistically significant publication bias, $p\text{-value} > 0.050$.

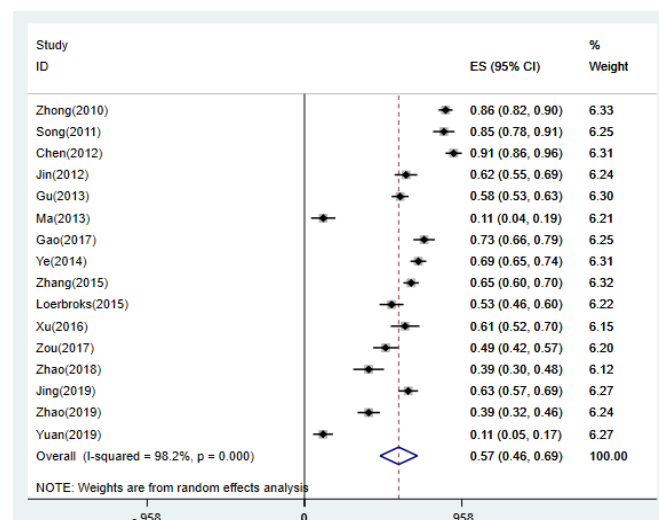


Figure 2 The meta analysis of prevalence of needle stick injuries among nurses in China

Discussion

This meta-analysis shows that there is a large difference in the prevalence of needle stick injuries between the various literature. The prevalence of needle stick injuries investigated by Chen in 2012 [28] was as

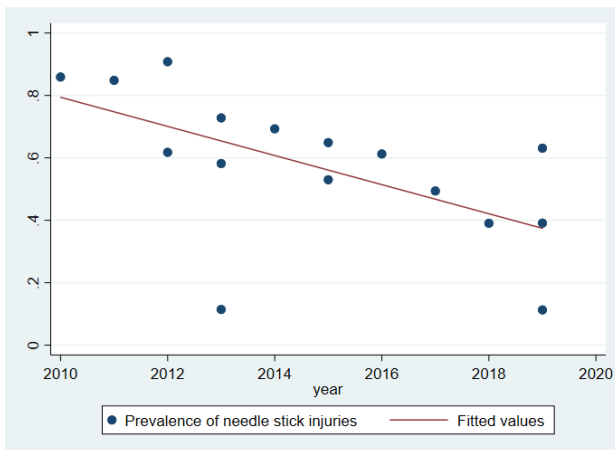


Figure 3 The prevalence of needle stick injuries among nurses in China in different years

high as 91.0%, while the lowest prevalence of needle stick injuries appeared in the literature from Ma (11.0%) and Zhao (11.0%) [34,41], but the result of this meta-analysis shows that the prevalence of needle stick injuries among nurses in China is 57.3%. It's not optimistic that the result is significantly higher than that of China's neighboring Korea (36.4%), Japan (4.8%) and Thailand (27.0%) [44-46]. However, it's relatively low compared to other populous countries in developing countries such as India (75.8%) and Indonesia (71.9%) [22, 47].

The prevalence of needle stick injuries depends mainly on hospital conditions and standards, overcrowded and noisy environments, education levels, knowledge, attitudes and skills of caregivers. In addition, cultural background and differences in the ability to access social resources are also the main causes of needle stick injuries in different regions [48]. Through time stratification analysis, the researchers found that the prevalence of needle stick injuries among nurses in China has gradually declined in the past decade. This has a great relationship with the nursing education institutions and hospitals in China in recent years to strengthen the occupational safety education for nurses and strengthen the safety supervision measures [49]. The number of needle stick injuries in Chinese nurses has gradually declined in the past decade, but this trend is slow, and there is still a big gap between the control level of needle stick injuries in developed countries. Therefore, how to continuously strengthen nurses' occupational safety education and formulate strategies to prevent needle stick injuries is still a problem that Chinese health departments, nursing education institutions and hospitals need to face for a long time.

The current research has certain limitations in two aspects. The first aspect is based on a large number of reports that Chinese nurses reported lower rates after needle stick injuries, which led to greater differences in the prevalence of statistical needle stick injuries in various literature [50, 51]. The second aspect is due to

the lack of information provided by some literature, the large differences between the study areas, the different follow-up times of each study, the small sample size, and the different hospital grades included in the study, it led to a large heterogeneity in this meta-analysis. This heterogeneity limits the scope of interpretation of the research results, but the combined effect value has a certain reference value in discussing the prevalence of needle stick injuries among nurses in China.

Conclusion and suggestion

Needle stick injuries have a high prevalence among nurses in China, but the prevalence of needle stick injuries has declined in the past decade. Nursing education institutions and hospitals can reduce nurses' needle stick injuries by strengthening occupational safety training for nurses, increasing protective equipment for needle stick injuries, and optimizing the working environment of hospitals.

The researcher suggest that future research can accurately assess the epidemiological situation of needle stick injuries among nurses in China, and that meta-analysis can be used to assess the differences in the prevalence of needle stick injuries among Chinese nurses and other national nurses. The researchers also suggest that future research can investigate the differences in nurses and other health workers in needle stick injuries.

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