*Original Article*

# Frequency of vaccination and exposure to needle-stick sharp injuries among a group of nurses in Turkey: A Meta regression analysis

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**ABSTRACT**

***Objectives:*** To determine the prevalence of needle stick sharps injuries (NSSIs) and the frequency of vaccination, and to determine the risk of exposure to hepatitis B virus (HBV) and hepatitis C virus (HCV) infections.

***Methodology:*** We found 14 NSSIs-related studies conducted between January 1996 and January 2006 in Turkey. Out of those, 10 studies selected according to systematic review were related to vaccination. Analyses were prepared using a Meta Regression Analysis.

***Results:*** In 14 case-control studies, the rate of NSSIs among nurses for the last year was found to be 64%. The frequency of injury among nurses aged 30 and below when compared to that of nurses aged 31 and over was 1.071-fold higher. The frequency of vaccination among nurses in the age of 30 and under was 1.01-fold lower when compared to those in the age of 31 and over.

***Conclusions:*** We conclude that the prevention of NSSIs through education and training of nurses, especially younger nurses, is of great importance.

**KEY WORDS:** Needle stick sharp injuries, Nurses, Blood borne infections, Turkey.

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## INTRODUCTION

Needle stick-sharp injuries (NSSIs) as well as splashes leading to exposure of the skin or mucosa to blood and body fluids are a daily concern for health care workers (HCWs) in both our country and developed countries such as the western countries during the course of normal everyday work in health care environment[1,2] due to blood-borne infectious diseases. Thus, various strategies such as vaccination of HCWs and optimal HCW practices regarding management of NSSIs have been introduced to help reduce that risk.[3] To recognize this occupational risk, the World Health Organization (WHO) and the International Labor Organization (ILO) accepted that blood born diseases were occupational diseases for those working in the health sector in 1992.[4]

The blood borne diseases among HCWs have an increased risk of at least three to six times when compared to that of the general population, and in developing countries such as Turkey, this figure is estimated to be at 6-18 times more.[5]

NSSIs may occur especially in the emergency departments, outpatient clinics, wards, the operating rooms, the radiology or other departments, and may be related to faulty needle insertion techniques,

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needle recapping, or incautious disposal of contaminated needles and sharps.[7]

The model developed by Kane et al. applied to world census data identified that unsafe injection practices could result in 8 million to 16 million persons acquiring HBV, 2.3 million HCV, and 80.000 to 160.000 HIV virus infections.[8] Projections have been made for seroconversions in Egyptian HCWs who sustain a NSSI, with 24.004 estimated new HCV infections and 8.717 new HBV infections.[9] Estimated seroconversions for HCWs in western Turkey due to NSSIs were 1.4% for HBV and 7.9% for HCV.[10]

Nurses, because of care giving function to patient at length, are also at significant risk from occupationally acquired infections, as many of their NSSIs involve devices that have been used on a patient prior to the NSSIs.[11] It has also been suggested that around two-thirds of all possible seroconversions following a NSSI would occur among nursing staff.[9]

Studies on this subject show that nurses had exposure to blood borne infections through NSSIs more than physicians and laboratory personnel, 44%, 28% and 15%, respectively.[2,11] NSSIs underreporting appears to be widespread within health environments, with many healthcare workers still not reporting their NSSIs to official sources.[12] Thus, they have to be encouraged to report the exposure, and should be vaccinated for hepatitis B infections before labor contract.

To better protect HCWs, CDC had designated a set of Universal Precautions such as the use of protective barriers such as gloves, gowns, aprons, masks, or protective eyewear, which can reduce the risk of exposure of HCWs' skin or mucous membranes to potentially infective materials in 1987,[13] and was then followed by many other countries including Turkey. A Medline literature search owing to this study showed that there is currently a lack of reliable data about the incidence and prevalence of NSSIs in Turkey. In fact, it was found that the Medline literature search showed that only about 10 studies addressing this issue were published in the past years. This analysis was therefore designated to elicit pertinent information related to the epidemiology of NSSIs and frequency of vaccination at this facility. Another aim was to determine the risk of exposure to HBV and HCV infections faced by Turkish nurses in relation to the factors such as the level of nurse education, length of service and place of work.

## METHODOLOGY

The means for the selection of relevant information was twofold. By both studying 45 NSSIs related studies conducted at different times and in different places or centers in Turkey, either published as such or appearing in press items on this subject between January 1996 and January 2006 in Turkey, we excluded 31 piece of research, taking our group down to 14. Studies not related to the correlation between NSSIs and age groups nor compatible with Meta analysis (MA) procedures were excluded.

The excluded studies was related to only age averages of nurses, not being specific age groups, not being any relationship between age groups and vaccination and not being appropriate with MA. Furthermore, some studies did not include the number of NSSIs and vaccination cases, or were review papers. The remaining 10 articles were selected according to systematic review. To find the relationships between the age groups and NSSIs, and the age groups and vaccination, a MA was conducted. According to Cochran's Q Test, there was a homogenous distribution among the researches.[14,15] Those 14 researches included data taken from 2118 nurses aged 30 and below, 1096 nurses aged 31 and over. Ten studies including vaccination covered 1456 nurses aged 30 and below, 681 nurses aged 31 and over. They were appropriate for the application of the MA. Analyses were prepared using NCSS Programme.[15]

In the second phase, we scanned 14 researches for vaccination by age groups. We found that there were 10 studies including vaccination to better understand whether vaccination had changed by age groups.

Statistical analysis was performed in consistent with the following literature information: In each study (n=14), an Odds Ratio (OR), which showed exposure to NSSIs of nurses aged 30 and below when compared to nurses aged 31 and over, and in each study including vaccination (n=10), an OR, which showed vaccination status of nurses aged 30 and below when compared to nurses aged 31 and over through MA [OR MH(Mantel-Haenszal Fixed Effect Model)] was used for illustration of the notations, with further 95% Confidence Interval (CI) by age groups.

Since this research is a case control study, we wanted to determine to find the relationships between the age groups and NSSI, and between the age groups and vaccination using the MA method. We included the nurses aged 30 and below into the study group and the nurses aged 31 and above into the control group, and the addition weight of each study alongside the individuals' injury frequency and vaccination were extracted using a Fixed Effect Model.

Potential sources of heterogeneity were examined through graphic methods such as the forest plot. For significance, p<0.05 was used. Statistical results were given as OR and 95% CI, and prevalence values as prevalence±standard error (se).

## RESULTS

In 14 case-control studies from 1996 to 2006, the data were taken from 2118 nurses aged 30 and below and from 1096 nurses aged 31 and over. Also, in 10 out of 14 researches including vaccination from 1456 nurses aged 30 and below, and from 681 nurses aged 31 and over.

In 14 case-control studies, the rate of injuries among nurses for the last year was found to be 64% (2066/3214). When assessing the rate of injuries among nurses by age, this figure for those aged 30 and below was 69% (1471/2118), and 54% (595/1096) for aged 31 and over.

In the results of the fixed effect model, for 14 researches, OR MH(Mantel-Haenszal Fixed Effect Model), which showed nurses' injury when compared to nurses without injury, was found to be 1.507, with a 95% CI of between 1.261 and 1.802 for the period 1996-2006. With reference to this, the frequency of injury among nurses aged 30 and below when compared to that of nurses aged 31 and over was 1.071-fold more [Risk Ratio (RR)=1.071; CI 95% 1.032-1.112]. It was found that the results of 14 studies had a homogeneous structure by years in analyses conducted according to NSSIs prevalence values. The result of Effect-Equality (Heterogeneity) test was (Q=22.1690, DF=13, p=0.053). In 10 including the nurses' vaccination out of 14 researches through MA, the proportion of vaccination was 68% (1456/2137). It was found that the proportion of vaccination among nurses aged 30 and below was 70% (1022/1456), and 70% (475/681) among those aged 31 and over.

In the result of this research, MA was conducted for the fixed effect model.[22,23] In the results of the fixed effect model, for 10 researches, OR MH(Mantel-Haenszal Fixed Effect Model), which showed nurses' injury when compared to nurses not experiencing injury, was found to be 0.990, with a 95% CI of between 0.802 and 1.223 for the period 1996-2006. According to these figures, the frequency of vaccination among nurses aged 30 and below was 1.01-fold lower when compared to those aged 31 and over (RR=0.990) (CI 95% 0.935-1.048).

Accordingly, for both age groups, nurses' vaccination showed similarity. It was found that 10 research results had a homogeneous structure by years in analyses conducted according to vaccination prevalence values. The result of Effect-Equality (Heterogeneity) test was (Q=8.958, DF=9, p=0.441).

A Forest plot graph of injury and age groups for 14 studies conducted between the years 1996-2006 according to the fixed Effect Model is presented in Figure-1. A Forest plot graph of the nurses experiencing injury by age groups for 10 studies conducted between the years 1996-2006 according to the Fixed Effect Model is presented in Figure-2.

## DISCUSSION

In this study of 14 case-controls, the rate of injuries among nurses for the last year was 64%. This result is compatible with many researches, and different with some. Some studies in Turkey showed similar results, with the proportions of 47.5%[10] and 57.2%[16] NSSIs. Another study showed that nurses had the highest frequency of NSSIs with a proportion of 62.1%.[17] In parallel, a Japanese teaching hospital study found that the rate of NSSIs among nurses was 46%.[18] Conversely, some studies indicated less proportions: A study on nurses in a university

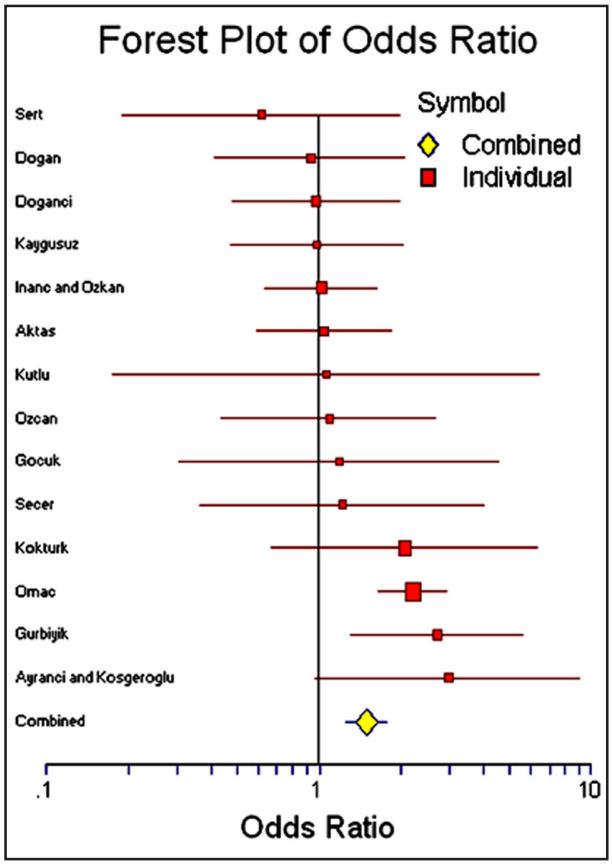


Figure-1: A Forest plot graph of injury and age groups ORs for 14 studies conducted between the years 1996-2006 according to the fixed Effect Model.

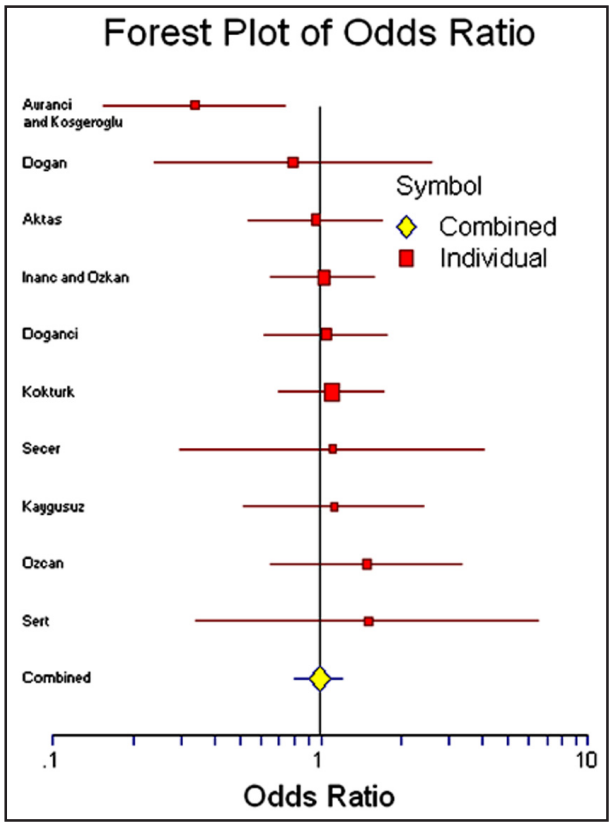


Figure-2: A Forest plot graph of injury and age groups ORs for 10 studies conducted between the years 1996-2006 according to the fixed Effect Model.

hospital showed that 22% of nurses had sustained at least one NSSI in the last 12 months.[19]

As to whether the proportion of NSSIs among nurses changed by age, it was determined that this proportion for those aged 30 and below was 69%, while it was 54% for aged 31 and above. The proportion was higher in younger nurses. This is in line with another studies indicating that younger nurses than average age (<27) were 4.5 times more likely to expose to NSSIs[18] and the older (>30 years) had a lower risk of NSSIs when compared to younger age group. Similarly, the nurses younger than 25 years of age were 2.18 times more likely to have sustained a single NSSI in the past 12 months.[20] These findings clearly indicate that younger nurses need some kind of educational programme about control by preventing the occurrence of NSSIs.

In this study, the frequency of injury among nurses aged 30 and below was 1.071-fold more when compared to that of nurses aged 31 and over. This finding points out that the frequency of injury among younger nurses was higher than in older age. This result emphasizes the importance of experience in nursing. Furthermore, a study on the frequency of injury amongst nurses showed that further education was correlated with a reduced frequency of injury from 86% to 12%.[21] Another reason could be that older nurses do not work in mixed shifts or rotating days and nights as a result of poor health policy in our country, and also those nurses work in simpler jobs in services. Conversely, younger nurses work in heavier health units in terms of workloads and begin to their job in the age of 18. In result, this status may be explained by the insufficient number of nurses in work places, lack of attention owing to workload, a desire to finish quickly owing to the length of some operations, and repeated attempts to complete a procedure.[22] In parallel, Alamgir et al. found that the higher relative risk of the youngest age group (<30years) for NSSIs and splashes could be the result of inexperience with procedures or ability to deal with stressful situations such as patients who are agitated.[17]

In ten studies including the nurses' vaccination out of 14 researches through MA, the proportion of the nurses vaccinated was only 68%. This result is consistent with other studies showing that the rate of vaccination ranged from 45% to 91.1%: A study in the Dominician Republic showed that only 45% of nurses at hospital had been fully immunized against HBV.[23] In Iran, 58.7% of nurses stated they have been vaccinated against HBV.[24] In a report involving participants from the ongoing Harvard Nurses Studies, Ascherio et al. found that an average of 64% of the nurses in three study groups had received vaccination against hepatitis B.[25]

In the current study, it was found that the proportion of vaccination among nurses aged 30 and below was 70%, and also 70% for those aged 30 and over. However, contrary to our study, a study reported that the nurses who were not immunized were significantly older than the immunized group, as the mean age for those getting the vaccine was 46.3 years when compared with 52.5 years for those not being vaccinated.[26]

## CONCLUSION

The facts that the proportion of nurses with injury for the last year was found to be 64%, that this proportion among those aged 30 and below was 69%, and that the proportion of vaccination was only 68% in this study indicated that there was no regulation providing prevention of exposure to NSSIs in professional health settings. We conclude that the prevention of NSSIs through the education and training of nurses, especially younger nurses, for universal precautions is of great importance.

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