



RESEARCH ARTICLE

**REVISED** Assessment of injection safety in Ha Dong General Hospital, Hanoi, in 2012 [version 4; referees: 2 approved, 1 approved with reservations]

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**Abstract**

**Background:** Injection is one of the most frequently used medical methods to introduce drugs or other substances into the body for purposes of treatment or prevention. Unsafe injection can cause adverse outcomes, such as abscess and anaphylactic shock, and increases the risk of blood-borne transmission of viruses to patients and health care workers, as well as the community. Recognizing the importance of injection safety, in 2000 the Vietnamese Ministry of Health (MOH) collaborated with the Vietnam Nurses Association to launch the “Safe injection” program throughout the country, including Hanoi.  
**Methods:** This cross-sectional study, combining quantitative and qualitative analysis, was conducted from February to August 2012 in Ha Dong General Hospital using a structured questionnaire and observation checklist. The target population of the study was 109 nurses working in clinical departments and 436 injections were observed.  
**Results:** The percentage of nurses who are familiar with injection safety standards was found to be 82.6%. The proportion of practical injections that met the 23 standards of injection safety set by the MOH amounted to 22.2%. The factors related to safe injection practice of nurses who were younger age group (OR=3.1; p<0.05) and fewer number of years working as a nurse (OR=2.8; p<0.05).  
**Conclusions:** While nurses have high level of knowledge about safe injections but a small proportion actually practiced. Experience may not always guarantee safe practices. Injection safety training should be regularly imparted upon all categories of nurses.

**Open Peer Review**

**Referee Status:**

|                                                         | Invited Referees |            |            |
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**REVISED** Amendments from Version 3

We have revised based on the comments of Dr. Arshad Altaf. We have revised the results and conclusions sections in Abstract to make the sentence clearer. In Results, we clarified the data in Table 1 and reduced the text of Table 4. We also revised the Discussion, and added references 5, 6 into References section.

See referee reports

## Introduction

Injection plays an important role in medical treatment at hospitals and other medical institutions, especially those where many patients with serious health conditions are treated<sup>1</sup>. In terms of preventive medicine, vaccination has a significant impact on reducing the incidence and mortality of infectious diseases, which can be prevented by children's vaccination<sup>2</sup>.

Despite such positive outcomes, injection can also cause risk of abscess at the site of injection, nerve paralysis, allergic reaction, and anaphylaxis, and, in particular, the risks of transmission of blood-borne viruses to patients, healthcare workers (HCWs) and the community<sup>3,4</sup>. According to the World Health Organization (WHO), unsafe injection has become a very common issue and is practiced in many countries; it is the major cause of transmission of diseases such as hepatitis B, hepatitis C and HIV<sup>2,5-7</sup>. The WHO estimates that 50% of injections performed in developing countries are unsafe, and that as many as 20–80% of cases of hepatitis B virus infections are caused by unsafe injections<sup>2,5</sup>.

In Vietnam, realizing the importance of safe injection and the risks caused by unsafe injections, in 2000, the Ministry of Health, in collaboration with the Vietnam Nurses Association, launched and implemented the "Safe injection" program across the country<sup>8</sup>. However, results from some studies after this program was launched show that the rate of injections complying with adequate injection safety standards are not high enough, ranging from 6.0 to 22.6%<sup>8-13</sup>. This leading causes related to this low rate of safe injections are: nurses working in understaffed conditions, updated information on injection safety not being conveyed to nurses, non-compliance of technical procedures, and poor infection control operations in injection practices and sample handling, as well as poor management of sharp medical wastes<sup>14,15</sup>.

Ha Dong General Hospital, a level I hospital in Hanoi, with a capacity of 550 beds, including 33 departments and specialties, is responsible for the health care of people in the western part of Hanoi city. Following social development trends, the hospital always invests in quality improvement and advancement, including the "Safe injection" program launched by the Vietnam Nurses Association. To provide a description of the situation regarding injection safety in Ha Dong General Hospital, we have conducted a study with the following objectives: (1) Describing the status of injection safety in the hospital; (2) Describing the status of knowledge and injection safety practice of nurses working in the hospital; and (3) Identifying the factors related to nurses' knowledge and safe injection practice.

## Methods

### Study setting and design

A cross-sectional study was conducted from February to August 2012 in Ha Dong General Hospital, Hanoi.

### Sample and sampling method

The required sample size was calculated based on the WHO manual for sample size determination (<http://apps.who.int/iris/handle/10665/40062>). Applying the formula for calculating the one-ratio sample size where the expected rate of safe injections for Ha Dong General hospital was 51.2% (based on a previous study<sup>4</sup>), confidence level = 95%; and margin of error = 0.05; the minimum sample size was 384 injections. An additional sample size of 10% was added to the minimum sample size to avoid observation failure, resulting in the final sample size = 422 injections. All 109 nurses of the hospital were involved in the administering of injections. Therefore, the number of injections observed for each nurse was  $422 / 109 = 3.87$ , which was rounded up to 4 injections per nurse. Therefore, the total number of injections to be observed was  $109 \times 4 = 436$  injections.

The selection of target objects for in-depth interviews and focus group discussions ([Supplementary File 1](#)): 2 in-depth interviews with leaders (Director and hospital Chief Nurse); 14 in-depth interviews with injection performing nurses (randomly recruited); 4 discussion focus groups with the participation of 4 to 6 chief nurses from treatment departments.

### Data collection and measurements

For quantitative research, we used a structured questionnaire with an observation checklist ([Supplementary File 2](#) and [Supplementary File 3](#)) to collect data from 109 participants. Only one observer observed one nurse at one time. The observers were the chief nurses of this hospital. Meanwhile, we conducted in-depth interviews and focus group discussions about key topics, which included work intensity; equipment and instruments; financial factors; forms of reward and encouragement; risk and risk management in injection practices; and other factors affecting nurses' practices of injection safety.

### Data processing and analysis

Data was encrypted, entered into Epidata 3.0 software, and analyzed using SPSS 16.0 software. Frequency and percentage were used to describe the quantitative data. Chi-squared was used to measure the differences between variables. Odd ratios were calculated to identify the factors associated with safety injection practice. Regarding qualitative data, content transcription from the in-depth interviews and focus discussion groups were categorized into the following topics: workload, equipment, financial factor, incentive and judgement; risk management in safety injection.

### Ethical approval

The study was approved by the IRB of Hanoi University of Public Health (No 029/2012/YTCC-HD3). Data collection procedures and the use of data for analysis were also approved by the directors of the Ha Dong General Hospital. Participants were asked to give written informed consent. They could withdraw from the study anytime

without effects on their work or their benefits. Since we observed the regular tasks of the nurse, no informed consent was required from the patients.

**Results**

**The injection situation in Ha Dong General Hospital**

Figure 1 shows that 85.1% were intravenous injections; deep intramuscular injections accounted for 3.6%; and only 1.1% were

subcutaneous injections, which were usually used for antibiotics testing.

Injection rate in gluteal muscles accounted for 0.2% (Figure 2). In the in-depth interviews, where injection-performing nurses were interviewed about why gluteal muscles injections only accounted for 0.2% of the 3.6% of deep intramuscular injections, it was said that “using deep intramuscular gluteal muscles causes less pain

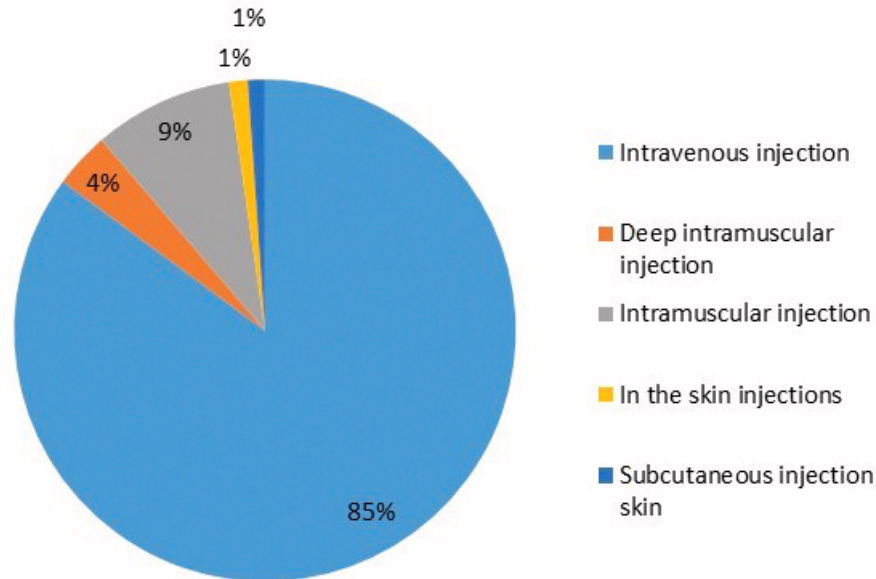


Figure 1. Number of injections by parenteral administration.

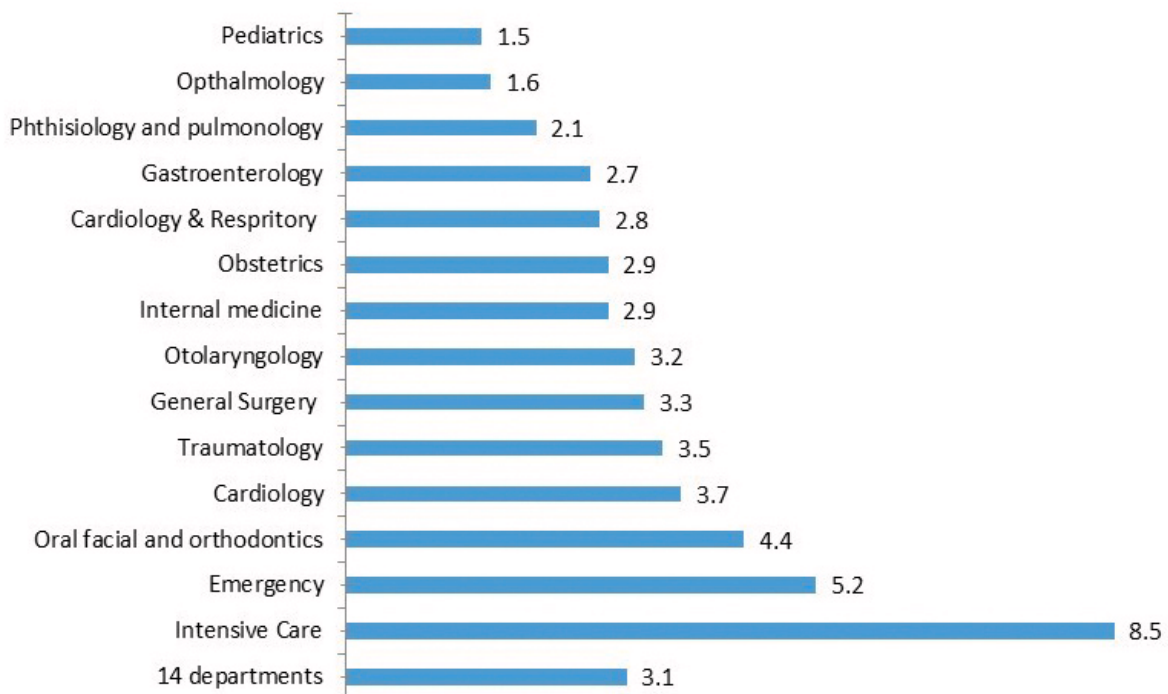


Figure 2. The average number of injections / patient / day by Department.

for the patient, but both patient and staff are reluctant to use this method due to cultural reasons” (In-depth interview). As for the time of injection, among the 436 observations, the majority of injections were performed in the morning (62.6%) and 7.3% of injections performed in the evening; other injections were performed in the afternoon. In average, each patient received 3.1 injections.

### The situation of nurses' injuries from sharp objects related to injection

Of the total target population, 41 nurses, accounting for 37.6% of the target population, had been injured by sharp objects, including 36.6% who had been injured 2-3 times. It was mainly caused by performing the wrong injection procedure (75.6%), or due to the unexpected movement of the patient (17.1%), and negligence (7.3%). The majority of injuries were to the fingers, accounting for 97.6% of injuries. Regarding the time of day, most injuries happen in the morning (68.3%) followed by the evening (14.6%) and the afternoon (9.8%).

### Demographic of the nursing population

Of the 109 nurses observed in the study, men accounted for 12.8%. The professional qualification of the majority of the nurses in this study was secondary level graduate (83.5%); the average age of nurses in the study was  $38.4 \pm 11.7$  years. Among the overall nursing population, 75.2% were nurses, 22.9% were midwives, and only 1.8% were technicians. The proportion of young nurses working for 5 years or less accounted for 25.7%; 30.3% had more than 25 years of service.

### Current status of nurses' knowledge regarding providing safe injection

The results in Table 1 shows that 91.7% received training on safe injection in the past year. Up to 26% received training twice in the past year. Most were trained in hospitals (75.2%), only 11% participated in training courses at the Provincial Health Offices, and 8.3% had never been trained in injection safety. In addition to the general training program, the chief nurse often provided guidance on safe injection practices and knowledge for the nurses at the hospital (98.2%). The majority of nurses (95.4%) knew that in treatment rooms of departments, materials on injection safety are readily available.

### Nurses' knowledge of safe injection techniques

Table 2 shows that the proportion of nurses having good knowledge ( $\geq 17/21$  right answers;  $< 17/21$  right answers – insufficient knowledge) in injection safety was 82.6%, but there were only 1 in 23 questions in which 100% nurses gave the correct response, of which content involved checking the quality of drugs before injection. There were 4 departments where some nurses gave 100% correct responses: emergency, ophthalmology, internal gastrointestinal, and internal cardiovascular departments.

### Safe injection practices at Ha Dong General Hospital

**Practice in the preparation of materials and injection devices.** About 99.1% injections were fully prepared with a box for dealing shock during injections on the trolley, 97.7% with sharp object containers and hand antiseptic in a convenient location on the

injection trolley, 94.0% had sterile needles and syringes. Yet, 6% of injections were made when nurses had not checked the integrity of the needle packaging, and without injection trolley and equipment (2.1%). 86.5% of observed injections achieved all five main criteria.

### Practice of aseptic principles in the administration of injections.

Table 3 shows that the rate of injections performed in which nurses had cleaned their hands before administration was 63.1%. In 17% of injections, needles remained on the bottles, and 20% of injections were performed when no antiseptic techniques were applied to the medication containers, or with unchecked needles. The rate of injections performed by nurses in compliance with 4 sterile criteria in the injection process was only 45.0%.

**Practice of safe injection techniques.** In 97.9% of injections, the nurses identified the injection sites correctly, 83% of injections were performed in compliance with the 5 standard techniques (identify correct injection position, sterilize the skin before injection, check quality of drug, perform correct injection technique, and sterilize the skin after injection) and the rate of quality control of medicine was 85.1%. The rate of proper skin disinfection before injection was 91.1%, but only 81% complied with standard disinfection practice immediately after injection. The rate of injections complying with technical criteria of injection was 66.5%.

**Interactive communication with the patients.** Via observation, the rate of injections in compliance with the 5-correct injection techniques (correct patient, correct drug, correct dose, correct

**Table 1. The situation of providing safe injection knowledge for nurses.**

| Knowledge provided on safe injection (n=109)                   | Frequency (n) | Percentage (%) |
|----------------------------------------------------------------|---------------|----------------|
| <b>Training courses on safe injection in the past year</b>     |               |                |
| Yes                                                            | 100           | 91.7           |
| 1 time                                                         | 90            | 82.6           |
| 2 times                                                        | 8             | 7.3            |
| 3 times                                                        | 2             | 1.8            |
| No                                                             | 9             | 8.3            |
| <b>Unit responsible for the majority of training courses</b>   |               |                |
| Provincial Health Office                                       | 12            | 11             |
| Hospital                                                       | 82            | 75.2           |
| Provincial health Bureau & Hospital                            | 7             | 6.4            |
| <b>Chief nurse provides guidance currently</b>                 |               |                |
| Yes                                                            | 107           | 98.2           |
| No                                                             | 2             | 1.8            |
| <b>Documents on safe injection available in the department</b> |               |                |
| Yes                                                            | 104           | 95.4           |
| No                                                             | 5             | 4.6            |

**Table 2. Knowledge of injection safety of nurses by department.**

| No | Department                 | Knowledge of safe injection |             |            |             |            |            |
|----|----------------------------|-----------------------------|-------------|------------|-------------|------------|------------|
|    |                            | Insufficient                |             | Sufficient |             | Total      |            |
|    |                            | n                           | %           | n          | %           | n          | %          |
| 1  | Cardiovascular respiratory | 1                           | 33.3        | 2          | 66.7        | 3          | 2.8        |
| 2  | Pediatrics                 | 2                           | 20.0        | 8          | 80.0        | 10         | 9.2        |
| 3  | General external           | 2                           | 20.0        | 8          | 80.0        | 10         | 9.2        |
| 4  | Ophthalmology              | 0                           | 0.0         | 5          | 100.0       | 5          | 4.6        |
| 5  | Tuberculosis               | 1                           | 20.0        | 4          | 80.0        | 5          | 4.6        |
| 6  | Ears nose and throat (ENT) | 1                           | 33.3        | 2          | 66.7        | 3          | 2.8        |
| 7  | General internal           | 2                           | 22.2        | 7          | 77.8        | 9          | 8.3        |
| 8  | Intensive care             | 1                           | 10.0        | 9          | 90.0        | 10         | 9.2        |
| 9  | Obstetrics                 | 4                           | 20.0        | 16         | 80.0        | 20         | 18.3       |
| 10 | Internal gastrointestinal  | 0                           | 0.0         | 8          | 100.0       | 8          | 7.3        |
| 11 | Trauma                     | 2                           | 25.0        | 6          | 75.0        | 8          | 7.3        |
| 12 | Odonto-stomatology         | 3                           | 75.0        | 1          | 25.0        | 4          | 3.7        |
| 13 | Internal cardiovascular    | 0                           | 0.0         | 5          | 100.0       | 5          | 4.6        |
| 14 | Emergency                  | 0                           | 0.0         | 9          | 100.0       | 9          | 8.3        |
|    | <b>Total</b>               | <b>19</b>                   | <b>17.4</b> | <b>90</b>  | <b>82.6</b> | <b>109</b> | <b>100</b> |

**Table 3. Percentage of compliance with aseptic principles of injection safety, as collected via observation.**

| Aseptic principles of safe injection                             | Number of injection observed (n=436) |      |
|------------------------------------------------------------------|--------------------------------------|------|
|                                                                  | n                                    | %    |
| <b>Wash hands/fast hand disinfection before injection</b>        |                                      |      |
| Yes                                                              | 275                                  | 63.1 |
| No                                                               | 161                                  | 36.9 |
| <b>Sterile when taken drugs before injection</b>                 |                                      |      |
| Yes                                                              | 349                                  | 80.0 |
| No                                                               | 87                                   | 20.0 |
| <b>Injection needle kept on the bottle after taking the drug</b> |                                      |      |
| Yes                                                              | 362                                  | 83.0 |
| No                                                               | 74                                   | 17.0 |
| <b>Ensure sterile injection needle</b>                           |                                      |      |
| Yes                                                              | 349                                  | 80.0 |
| No                                                               | 87                                   | 20.0 |
| <b>Ensure the principle of sterile needles (at 4/4 standard)</b> |                                      |      |
| Yes                                                              | 196                                  | 45.0 |
| No                                                               | 240                                  | 55.0 |

injection way, correct time) was 100%, the rate of maintaining care records and medical order books was 93.3%, and the lowest rate was the communication and observation of patients while performing injections, especially interactive communication with patients after injection, which was only 67.7%. Results of in-depth interviews also showed that communication with patients while conducting injection was not sufficient; before injecting, most nurses performed observation, gave guidance and prepared for the injection, but communication during and after injection was given incompletely or superficially, *“their way of communication did not show any enthusiasm, or sympathetic and sharing attitude, and without motivation or encouragement to patients for their cooperation in the performance of injection”* - (Focus group discussion)

**Practice of prevention of infection risks for patients and the community.** 46.1% of the injections were performed in compliance with all the four technical standards (wear glove when intravenous, did not use hands to remove the needle, isolate syringes and needles, hand wash after injection) to prevent risks for people receiving injections and the community. Similar to the rate of hand disinfection before injection, only 61.9% performed quick hand disinfection after injection. 68.1% wore hand gloves when administering intravenous injection. It was reported by nurses in in-depth interviews that *“it is difficult to perform intravenous injection if gloves are worn, especially in providing injections to small children”*- (HCWs-PVS). The rate of nurses using their bare hands in covering and removing needle caps was 88.8%. The highest rate was the rate of injections in compliance with the provision of isolating needles immediately after injection, which was 93.3%.

**Practical injections meeting safety standards criteria.** The rates of injections that meet the safety injection (SI) criteria (correct preparation of injection equipment, ensure sterility requirement, correct injection technique, correct communication with patients, prevent risk for people receiving injection and ensure the safety standard of injection) at different departments ranged from 11.1% to 33.3%, with the lowest in the Emergency Department, with only 4 in 36 injections (8.3%), the rate in the Odonto-stomatology Department was 12.5%, and the highest was in the Pediatrics Department, with 14/42 injections, accounting for 33.3%.

**Table 4** shows that there are six nurses who do not have any of the four observed injections in compliance with the SI standards (5.5%). Only 9/109 nurses had all four observed injections meeting the criteria of injection safety (8.3%). There were 26 nurses who have at least three injections meeting the required standards (26.9%).

#### Factors related to the nurses' knowledge and practice of injection safety

**Factors related to safe injection.** The rate of nurses with knowledge of SI in the nurses aged up to 30 years was 93.2%, 3.3 times higher than those aged over 30 years (75.4%) (OR = 4.4;  $p < 0.05$ ). No statically significant difference was found in the rate of nurses having knowledge of good SI between nurses of different genders and different levels of education ( $p > 0.05$ ).

Among nurses with sufficient SI knowledge, the number of nurses with <10 years of work was 4.9 times higher than that of nurses with work experience of >10 years (OR = 4.9;  $p < 0.05$ ). The rate of nurses with sufficient SI knowledge among nurses who received training in the past year was 86.1%, which was 10.3 times higher than the untrained group. This difference was statistically significant ( $p < 0.001$ ). However, there was no statically significant difference in the rates of sufficient knowledge of SI and the different levels of nurses (for example: college nurses or university nurses) ( $p > 0.05$ ).

The rate of injury due to sharp objects during injections in the group with no knowledge of SI was 63.2%, which is 3.6 times higher compared to the group with knowledge about SI (32.2%). The difference was statistically significant ( $X^2 = 6.39$ ;  $p < 0.05$ ).

**Factors related to safe injection practice.** Age was a statistically significant factor with regard to safe injection practices ( $X^2 = 6.3$ ,  $p < 0.05$ ), the rate of correct practice of SI in nurses <30 years was found to be 3.1 times higher than those >30 years old.

**Table 5** shows the percentage of correct practices in the nursing team with work experience of <10 years (32.7%); 2.5 times higher than the senior group (work experience >10 years) (14.8%). This difference was statistically significant ( $p < 0.05$ ). Professional qualifications and the number of injections / day of each nurse had no statically significant association with SI practice ( $p > 0.05$ ). The rate of correct practice of the group with knowledge about SI (26.7%) was three times higher than the group with no knowledge (10.5%); this difference was not statistically significant (OR = 3, 09;  $p > 0.05$ ).

#### Factors related to injection safety in Ha Dong General Hospital

Of the 436 observed injections, 273 injections were observed in the morning (62.6%). Safe injection rate in the morning was 22%. The rate of injection safety at midday was the highest (88.9%); in the afternoon, 95 injections were observed, but no injections were found to meet all the 23 criteria of SI. There were statically significant differences regarding injection safety depending on the time of the day at which injections are applied, which the highest percentage of safety injection was at noon ( $X^2 = 120.4$ ;  $p < 0.001$ ).

Intravenous injections were observed at the highest rate (62.4%), but only 19.1% were found to be meeting SI standards. Safe injection rate of the observed subcutaneous injections was 57.1%, and for injection in the skin, this was 33.3%. The difference in the rate of safe injection according to injection type was statistically significant ( $X^2 = 23.4$ ;  $p < 0.001$ ). The number of intravenous injections was the most directly observed, with 173 injections out of 436 injections observed (50.5%), but the safety injection rate was only 21.4%. The safe injection rate was lowest in the intravenous injections via fork / rubber joints (9.3%) and the highest intramuscular injections in the thigh quadriceps (60%). However, this difference was not statistically significant ( $p > 0.05$ ).

The first observed injections had the highest safety rate of 58.7%. Safe injection rate of the observed second injections was 7.3%.

**Table 4. Percentage of nurses having correct safe injection procedure practice.**

| SI practice of the nurse (n=109) | No. of injections meeting required standards | Frequency (n) | Percentage (%) |
|----------------------------------|----------------------------------------------|---------------|----------------|
| Practice properly                | 4/4                                          | 9             | 8.3            |
|                                  | 3/4                                          | 17            | 15.6           |
| Not meet standards               | 2/4                                          | 24            | 22.0           |
|                                  | 1/4                                          | 53            | 48.6           |
|                                  | 0/4                                          | 6             | 5.5            |
| <b>Total</b>                     |                                              | <b>109</b>    | <b>100</b>     |

**Table 5. Relationship between qualifications, seniority, number of injections per day and SI practice of nurse.**

| Characteristics                     | Safety injection practice (n=109) |      |         |      | Validation value |                  |              |
|-------------------------------------|-----------------------------------|------|---------|------|------------------|------------------|--------------|
|                                     | Incorrect                         |      | Correct |      | OR               | 95% CI           | p            |
|                                     | n                                 | %    | n       | %    |                  |                  |              |
| <b>Qualification</b>                |                                   |      |         |      |                  |                  |              |
| Other                               | 22                                | 81.5 | 5       | 18.5 | 1.5              | 0.5 – 4.5        | 0.45         |
| Nursing                             | 61                                | 74.4 | 21      | 25.6 |                  |                  |              |
| <b>Seniority, years</b>             |                                   |      |         |      |                  |                  |              |
| ≥ 10                                | 46                                | 85.2 | 8       | 14.8 | 2.8              | 1.1 – 7.2        | 0.028        |
| < 10                                | 37                                | 67.3 | 18      | 32.7 |                  |                  |              |
| <b>Number of injections per day</b> |                                   |      |         |      |                  |                  |              |
| ≤ 10                                | 42                                | 71.2 | 17      | 28.8 | 0.5              | 0.2 – 1.3        | 0.18         |
| >10                                 | 41                                | 82.0 | 9       | 18.0 |                  |                  |              |
| <b>Age group, years</b>             |                                   |      |         |      |                  |                  |              |
| > 30                                | 55                                | 84.6 | 10      | 15.4 | <b>3.1</b>       | <b>1.3 – 7.8</b> | <b>0.012</b> |
| ≤ 30                                | 28                                | 63.6 | 16      | 36.4 |                  |                  |              |
| <b>Gender</b>                       |                                   |      |         |      |                  |                  |              |
| Male                                | 11                                | 78.6 | 3       | 21.4 | 1.1              | 0.3 – 4.6        | 0.82         |
| Female                              | 72                                | 75.8 | 23      | 24.2 |                  |                  |              |
| <b>Education</b>                    |                                   |      |         |      |                  |                  |              |
| Vocational training                 | 72                                | 79.1 | 19      | 20.9 | 2.4              | 0.8 – 7.1        | 0.1          |
| College/University                  | 11                                | 61.1 | 7       | 38.9 |                  |                  |              |

3rd was 10.0% and the fourth was 13.0%. This difference was statistically significant; ( $X^2 = 112.7$ ;  $p < 0.001$ ).

The results of the in-depth interviews show the cause of unsafe injection. One reason was mentioned is that nurses were overloaded their work: *“In the morning I have to injecting [sic] dozens of patients, so how can [I] follow the process!”*. With this workload, they felt stressful and therefore, they could not follow the procedure of safe injection practice. Additionally, some nurses injected as their habits with old procedures, which did not ensure the safe injection practice: *“Nurses with high age are very fluent in the use of fluids but often follow the old procedures, often bypassing, cutting down the process, changing the way they are”* (In-depth interview). Another reason also mentioned is the regular supervision of the chief nurse *“If the chief nurse regular[ly] supervises the injection procedure, the nurses will mandatorily follow the procedure of safe injection practice”*.

**Dataset 1. Raw data obtained from the questionnaire assessing knowledge for safe injection practice among nurses**

<http://dx.doi.org/10.5256/f1000research.11399.d165390>

**Dataset 2. Raw data obtained from the observation assessing practice for safe injection practice among nurses**

<http://dx.doi.org/10.5256/f1000research.11399.d165391>

## Discussion

This study provided baseline evidence for further interventions to improve safe injection practice in Vietnam. In this study, we found that while nurses have high level of knowledge about safe injections but a small proportion actually practiced. Moreover, regression results indicated that experience may not always guarantee safe practices.

This research showed that on average each patient received 3.1 injections. Compared to the results study in other countries, this rate is lower than result study of HAURI Global 2000 study<sup>16</sup>. However, this result is higher than Tu’s study<sup>17,18</sup> and research by the Vietnam Nurses Association in 2010<sup>14,19,20</sup>. About 37.6% nurses had been injured by sharp objects. The sharp injury rate at Ha Dong Hospital is higher than the results of Muc’s study<sup>14</sup>, Nguyen Tu’s 2005 study<sup>17</sup>, and lower than that of the Vong *et al*’s study in Cambodia<sup>21</sup>. Most of the injuries occurred in the morning.



Unintended activities is the cause of most injuries. Meanwhile, sharp instruments injuries accounted for most of the fingers wounds

### Knowledge and practice of injection safety among nurses Ha Dong General Hospital

**Knowledge about safe injection standards of nurses.** The ratio of nurses having knowledge about safe injection was found to be higher in the present study compared with the study of Ernest *et al.* at City Hospital Benin Nigeria<sup>22</sup>. These rates are lower than those of Phan Canh Chuong at the Hue Central Hospital<sup>10</sup>, but higher than that found in a previous study by Thanh<sup>8</sup>.

Nearly half of injections followed the 4 sterile standards. For example, 50% of injections followed regulation on communication standards, and most injections followed proper safety standards for injected persons; however, 17% and 32% of injections did not isolate the needle and syringe immediately after injection and only 32% used gloves when injecting intravenously.

### Factors related to knowledge and practice of safe injection in Ha Dong General Hospital

Nurses aged up to 30 years had better knowledge and higher rate of safe injection practices than nurses >30 years old. Nurses with less than 10 years of work experience had better knowledge level and higher safe injection practices than senior nurses with 10 years or more experience. Regarding training, nurses trained for 1 year had better knowledge than untrained groups, and as a result untrained groups were more likely to be exposed to accidental injuries than that of knowledgeable groups. These findings were similar to other previous studies<sup>9-11</sup>. The rate of correct practice of the group with sufficient knowledge was higher than the group with insufficient knowledge, but this difference was not statistically significant ( $p > 0.05$ ), which was consistent with other studies<sup>8,17,20</sup>. The results of the in-depth interviews also showed that old habits, e.g. bypassing the injection process, and the supervisor's supervision were also influential. Meanwhile, injection timing, parenteral administration and order injections were observed factors that have statistically significant relationship ( $p < 0.05$ ) with the rate of safe injections of the hospital.

A number of recommendations can be made based on the results of the study: (1) Enhancing the sterilization performance, reducing the risk of infection due to injury; (2) Promoting training courses to improve knowledge and skills, educational communication to increase knowledge and awareness of risk of injections;

(3) Establishing a regular injection safety monitoring and assessment program - the results and related information must be reported to management and disseminated to hospital staff; (4) Enhancing the inspection and supervision of regimes of reward and sanction, of emulation and commendation, and conducting research of SI assessment; (5) Focusing on the principles of sterilization, hand hygiene before injection, sterilization routine when taking drugs, and sterilization of needles in injection safety training, as well as on enhancing communication skills in dealing with patients.

### Conclusion

Despite the high level of knowledge about safety injection, a low proportion of nurses performed correct safety injection practice. Moreover, the results demonstrated that experience might not always guarantee better practice. The findings raise the need for further training about this issue, especially among older nurses.

### Data availability

Dataset 1: Raw data obtained from the questionnaire assessing knowledge for safe injection practice among nurses. doi, [10.5256/f1000research.11399.d165390](https://doi.org/10.5256/f1000research.11399.d165390)<sup>23</sup>

Dataset 2: Raw data obtained from the observation assessing practice for safe injection practice among nurses. doi, [10.5256/f1000research.11399.d165391](https://doi.org/10.5256/f1000research.11399.d165391)<sup>24</sup>

The transcripts of the in-depth-interview and focus group discussion are not available due to the sensitive information contained. However, this information will be made available for university researchers who send a request to Prof. Tuong Van Pham, PI of the study: [pvt@huph.edu.vn](mailto:pvt@huph.edu.vn).

### Author contributions

**PVT, TTMP, BTMA, THTN** was responsible for the research methods and prepared the first draft of the manuscript. **PVT, TTMP, BTMA, THTN** contributed to the experimental design and preparation of the manuscript. All authors were involved in the revision of the draft manuscript and have agreed to the final content.

### Competing interests

No competing interests were disclosed.

### Grant information

The author(s) declared that no grants were involved in supporting this work.

### Supplementary material

Supplementary File 1: In-depth interview guide and group discussion guide.

[Click here to access the data.](#)

Supplementary File 2: Questionnaire assessing knowledge for safe injection practice among nurses.

[Click here to access the data.](#)

Supplementary File 3: Observation checklist assessing practice for safe injection practice among nurses.

[Click here to access the data.](#)

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# Open Peer Review

Current Referee Status:



Version 4

Referee Report 06 December 2017

doi:10.5256/f1000research.14401.r27522



**Alexandre Hannud Abdo** 

Laboratoire Interdisciplinaire Sciences Innovations Sociétés (LISIS), Université Paris-Est, Paris, France

This is a mixed methods exploratory study on injection safety and related factors, including training programs, in a hospital in Vietnam. The article is aptly written, though with caveats to be mentioned. Statistical treatment is unsophisticated but sufficient for the kind and aims of observations made in the text. More advanced statistical treatment could potentially reveal further interesting features of the data.

I felicitate the authors for sharing their work on this important issue, and for having undertaken such work in the first place.

I would also first ask the authors to look at and respond to the comments by Dr. Sindhu. He makes a series of points that do need either clarification or correction. Some of the discrepancies he mentions, looking at your spreadsheets, might be caused by missing data. But where that is the case it should be reflected in the text, which it currently isn't, leading attentive readers to confusion.

*On language*, the text is of good quality, but there are a few mistakes that ought to be avoided as they may lead to confusing interpretations by unfamiliar readers:

(a) "unsafe injection (...) is **the** major cause of transmission of diseases such as hepatitis B, hepatitis C and HIV", one can see the authors mean "is **a** major cause";

(b) "Data was encrypted", one supposes the authors mean "anonymized";

(d) "The results of the in-depth interviews show **the** cause of unsafe injection", one supposes the author means "show **some possible** causes of";

*On the data provided*, I could not find the dataset with the 436 observed injections. Both datasets provided contain 109 entries, so both seem to have one entry per nurse. However, the columns of the second dataset seem to refer to the injection assessment questionnaire, which I would expect to have one entry per injection, thus 436 entries. I would ask the authors to either better explain what is showed in this spreadsheet, or provide the full dataset if there was some mistake - or both if this is an intermediate dataset.

It would also be useful, in case the original questionnaires were applied in Vietnamese, to have copies of those as well, for the sake of future research.

*On the analysis*, given the goal of understanding the impact of training programs, why wasn't the relationship between "trained in the last year" and "correct SI practice" considered? Also, table 5 doesn't show the numbers for "knowledge of SI" and "correct practice" which are mentioned in the text.

Still on the analysis, when the authors mention "A number of recommendations can be made based on the results of the study...", it seems those 5 recommendations are presented without a specific order or priority, and they are presented disconnected from the previous analysis. First, the lack of an established priority should be made explicit by avoiding numeric items. Other than that, it should be attempted to provide some cue to the reader as to whether a recommendation is supported by the statistical analysis, by the interviews, or both, even if the reader could in principle recover this by going back and forth in the text.

*On the discussion*, given that the account of qualitative interviews emphasizes nurse overload, I would suggest for this study to recommend that future studies include some quantitative account of the level of overload that goes beyond the simple number of injections, as nurses can be overloaded by other issues. I would mention, for one, the literature on burnout syndrome.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Partly

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Partly

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

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Version 3

Referee Report 21 November 2017

doi:10.5256/f1000research.13787.r27387



**Arshad Altaf**

Service Delivery and Safety, World Health Organization, Geneva, Switzerland

Overall the article is good and contributing to a serious health care issue. It would be really helpful if a native English speaker can review it one time to improve the flow of the language.

**Abstract**

**Results, 3<sup>rd</sup> sentence: suggestion** The factors that were related to safe injection practices included nurses who were younger OR... and fewer number of years working as a nurse OR...

**Conclusion:** While nurses have high level of knowledge about safe injections but a small proportion actually practiced. Experience may not always guarantee safe practices. Injection safety training should be regularly imparted upon all categories of nurses.

**Introduction:**

1. Please write full details of reference 1
2. Please delete reference number 5 and use these two references: 1 Pepin et al. Evolution of the global use of unsafe medical injections, 2000-2010. PLoS One. 2014 Jun 9;9(6):e99677. 2 Pepin et al. Evolution of the global burden of viral infections from unsafe medical injections, 2000-2010. PLoS One. 2014 Jun 9;9(6):e99677. According to the first study the global burden of unsafe injections is 5.5% and the number of infections associated with unsafe injections is mentioned in the second paper. Please read and update this detail.

**Results:**

1. Current status of nurses knowledge regarding safe injection: In the table it says 7.3% in front of 2 time?
2. Nurses knowledge of safe injection technique: Please reduce the text since tables are quite self explanatory. Long readings tend to distract the readers
3. Safe injection practices at Ha Dong hospital: First sentence is a comment. In the results please present what the study found and refrain from comments in the results section
4. "anti shock injection box" is not a common term. Suggestion is to please explain it.
5. Table 4: Suggestion to remove the column on cumulative percentage as it is not providing any objective information. It has the potential to confuse the reader.

**Discussion:**

Please use the first paragraph of discussion to highlight four or five key findings of the study. In subsequent paras please explain some of these findings in light of other published literature. If no study is available use your own judgement.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Not applicable

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Author Response 22 Nov 2017

**Trang Nguyen**, Institute for Global Health Innovations, Duy Tan University, Vietnam

Dear Dr.Arshad Altaf,

Thank you very much for your very constructive comments. We have revised according to your suggestion in the new version.

Best regards,

Authors

**Competing Interests:** No competing interests were disclosed.

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### Version 1

Referee Report 14 September 2017

doi:[10.5256/f1000research.12306.r24673](https://doi.org/10.5256/f1000research.12306.r24673)



**Mattias Larsson**

Department of Public Health Sciences, Karolinska Institutet, Stockholm, Sweden

Thank you for a well written article with an important message - that injection safety can be improved which might decrease injection related disease transmission.

Comments:

In Abstract it states:

1. The nurses who are familiar with injection safety standards ... 82.6%
2. The proportion of injections that met the 23 standards of injection safety ... 22.2%.
3. A low proportion of nurses performed correct safety injection...

This indicates a large difference between knowledge and practice. It would also be of use to have the average of the number of safety standards that was recorded.

In Table 1. the headline "Training courses on safe injection in the past year " occurs twice with different figures which is not clearly explained in the text.

Experience might not always guarantee better practice - "rate of correct practice of SI in nurses <30 years was found to be 3.1 times higher than those >30 years old"

Clarifications:

1. Question "Are all the source data underlying the results available to ensure full reproducibility?"

Partly as it would be good to have a shortlist of all 23 standards and how each of them was assessed as well as the result (average, SD, median)

2. Question "Are the conclusions drawn adequately supported by the results?"

Partly as there would be good to see a discussion regarding the large gap between knowledge and practice - why do people not behave as they know they should?

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Yes

**Are all the source data underlying the results available to ensure full reproducibility?**

Partly

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**I have read this submission. I believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Author Response 16 Sep 2017

**Trang Nguyen**, Institute for Global Health Innovations, Duy Tan University, Vietnam

Thank you very much for your feedback. We have added more details in conclusion of abstract and main text, which referred to the high level of knowledge but low level of practice; and the experience might not always guarantee better practice. We have also removed a part of table 1 that were duplications.

**Competing Interests:** No competing interests were disclosed.

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## Discuss this Article

Version 3

Reader Comment 15 Sep 2017

**Dr. Sindhu B.M.**, Dr. D. Y. Patil Medical College, Hospital and Research Center, India

Table 5 shows the percentage of correct practices in the nursing team with work experience of <10 years (32.7%); 2.5 times higher than the senior group (work experience >10 years) (14.8%).

Comment:  $32.7 / 14.8 = 2.2$  . Its 2.2 times that of senior group. Or 1.2 times greater than that of senior group

The rate of nurses with knowledge of SI in the nurses aged up to 30 years was 93.2%, 3.3 times higher than those aged over 30 years (75.4%) (OR = 4.4;  $p < 0.05$ ).

Comment:  $93.2/75.4 = 1.23$  . So, its 1.23 times of it. Or, 0.23 times higher.

Among nurses with sufficient SI knowledge, the number of nurses with <10 years of work was 4.9 times higher than that of nurses with work experience of >10 years (OR = 4.9;  $p < 0.05$ ).

Comment: Wrong interpretation.

The rate of correct practice of the group with knowledge about SI (26.7%) was three times higher than the group with no knowledge (10.5%); this difference was not statistically significant (OR = 3, 09;  $p > 0.05$ ).

Comment:  $26.7/10.5 = 2.54$  . So, rate is 2.54 times that of the group with no knowledge. Or, 1.54 times higher.



Among the group with knowledge about SI, the chance of practicing injection correctly was 3.09 times that of the group without knowledge about SI.

**Competing Interests:** No competing interests were disclosed.

Reader Comment 15 Sep 2017

**Dr. Sindhu B.M.**, Dr. D. Y. Patil Medical College, Hospital and Research Center, India

Antiseptic properly regulated injection sites after vaccination with antiseptic solution (alcohol 70<sup>0</sup>, 1% iodine alcohol)

- No antiseptic to be used after vaccination. It should have been after injection.

There were 26 nurses who have at least three injections meeting the required standards (26.9%).

It is  $26/109 = 23.8\%$

**Competing Interests:** No competing interests were disclosed.

Reader Comment 15 Sep 2017

**Dr. Sindhu B.M.**, Dr. D. Y. Patil Medical College, Hospital and Research Center, India

Injection rate in gluteal muscles accounted for 0.2% (Figure 2).

- Figure 2 doesnot show this.

Regarding the time of day, most injuries happen in the morning (68.3%) followed by the evening (14.6%) and the afternoon (9.8%).

- Doesnot add up to 100 %

**Training courses on safe injection in the past year is repeated twice in table 1.**

but there were only 1 in 23 questions in which 100% nurses gave the correct response,

- but there are only 21 questions in the questionnaire.

**Competing Interests:** No competing interests were disclosed.

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