

Field Study

The Effectiveness of a Training Program on Reducing Needlestick Injuries/Sharp Object Injuries among Soon Graduate Vocational Nursing School Students in Southern Taiwan

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Abstract: The Effectiveness of a Training Program on Reducing Needlestick Injuries/Sharp Object Injuries among Soon Graduate Vocational Nursing School Students in Southern Taiwan: Ya-Hui YANG, *et al.* Institute of Occupational Safety and Health, Kaohsiung Medical University, Taiwan—Needlestick/sharp injuries (NSIs/SIs) are a serious threat to medical/nursing students in hospital internships. Education for preventing NSIs/SIs is important for healthcare workers but is rarely conducted and evaluated among vocational school nursing students. We conducted an educational intervention for such students after their internship rotations before graduation. This program consisted of a lecture to the students after the internship training and a self-study brochure for them to study before their graduation. This study used the pre-test questionnaires completed by all students and the post-test questionnaires completed by 107 graduates after work experience as licensed nurses to assess the effectiveness of the intervention. After educational intervention, the incidence of NSIs/SIs decreased significantly from 50.5% pre-test to 25.2% post-test, and the report rate increased from 37.0% to 55.6%, respectively. In conclusion, this intervention significantly reduced the incidence of NSIs/SIs and increased the report rate of such events.

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Needlestick/sharp injuries (NSIs/SIs) can cause significant fatal blood-borne infection among healthcare workers and are a threat to medical/nursing students while at internship in hospitals^{1–5}. The goal of reducing NSIs/SIs has been launched in many countries and by organizations such as the International Council of Nurses, the World Health Organization, ever since NSIs/SIs first were published in the medical literature in the 1970s⁶.

Our previous study in Taiwan has found that the frequency of NSIs/SIs among vocational nursing school students is higher than that among nursing staff members (4.9 vs. 1.2~2.8 times/person/year)⁷. Therefore, an effective measure for reducing the incidence of NSIs/SIs in this vulnerable group is an issue of concern. Intervention strategies for preventing NSIs/SIs may include safety education to inspire personal precaution, using needle safety devices and enforcement of legal regulations^{1, 8, 9}. These interventions have not been applied in all countries; for instance, lack of safe needles, sharps containers and personal precautions enhances the risk of occupational transmission of blood-borne pathogens in developing countries¹⁰. For various reasons, including cost, monitoring, and regulation, except for educational programs, most of these interventions are not feasible or easily implemented. Some studies have shown that NSIs/SIs can be effectively curbed by educating healthcare workers or medical students on injury hazard and prevention measures against NSIs/SIs^{8, 11–13}.

Those studies, however, have not specifically investigated NSIs/SIs among nursing students. In Taiwan, nursing students generally acquire limited knowledge from school curricula about prevention of blood-borne infection associated with injuries, and healthcare workers acquire limited education about blood-borne infections

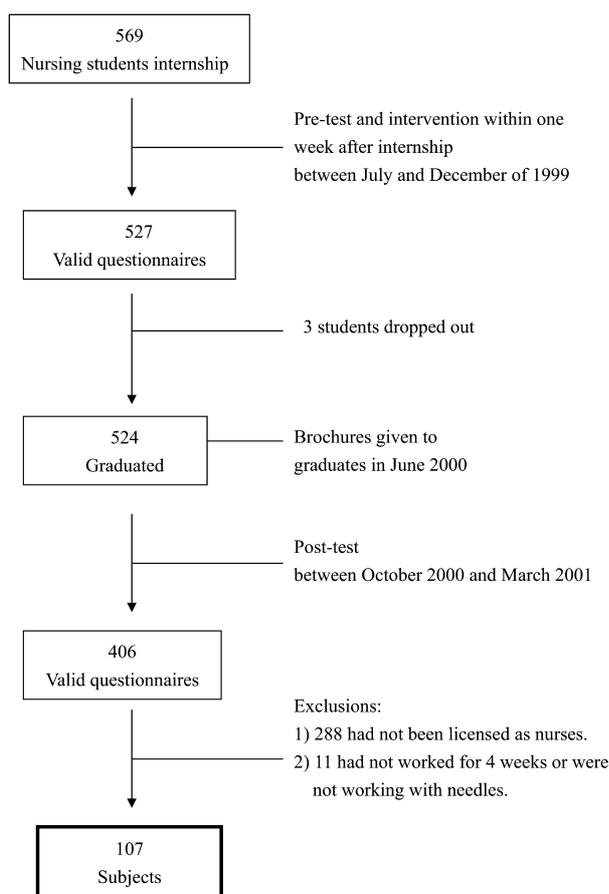


Fig. 1. The flow chart of the study.

from hospitals. Therefore, this study evaluated the changes in frequency of NSIs/SIs after student participants had been given a training program on prevention of NSIs/SIs.

Methods

This was a follow-up study. For the reason of educational ethics, no controls were included in this study. Figure 1 shows the flow chart of the study.

Subjects

The subjects of this study were 569 full-time third-year nursing students at one vocational school, consisting of about 3,000 students, in southern Taiwan. Five courses were provided for the nursing students during the internship period at hospitals, including courses lasting for 3 wk, 4 wk, 4 wk, 4 wk and 6 wk in sequence. Students were divided into groups at random and rotated on these courses by the course sequence. Students who finished the fifth course during the winter vacation could not participate in the training program. Therefore, the participants were those who had finished the fourth course

(4 wk long) or the fourth and the fifth courses (10 wk long; there were 71 students) for internship in the third year.

Each student completed a pre-test questionnaire within one week after completing her internship training (Fig. 1). Of the 569 questionnaires returned, 527 (92.6%) were considered valid. Three of the students dropped out, leaving 524 nursing school graduates in June 2000. Four months after the nursing students had graduated (in October 2000), post-test questionnaires were mailed to them. One of the authors contacted each non-respondent to the post-test by phone until March 2001. Among the 417 (79.6%) returning the post-test questionnaire, 406 (77.5%) were valid. And 118 (29.1%) post-test questionnaires were returned by those who had been licensed as nurses. Of these nurses, we excluded 11 persons who had not worked for longer than 4 wk or were not working with needles. The remaining 107 (26.4%) licensed nurses served as our study subjects for evaluating the intervention effectiveness. Except for the lower report rate, there was little difference between the 107 nursing students we used as study subjects and the 527 who originally returned the pre-test questionnaires (Table 1).

Needlestick/sharp injuries control needs assessment

The pre-test for NSIs/SIs used in for this study was a previous study of full-time third-year nursing students (N=569) between July and December of 1999⁷). Among these students, 50.1% reported experience of NS/SI at least once in clinics during the internship training; only 39% of the students reported the events. With such a high rate of NSIs/SIs, and low rate of reporting, we decided that it was necessary for those subjects to take part in a NSIs/SIs education and prevention program.

Educational intervention

Two education efforts for injury prevention were provided to all students prior to their graduation. One was a 30-min lecture, after the internship rotations, provided by an instructor at the vocational school in one of the regular classes. This lecture covered diseases that can be transmitted by NSIs/SIs, devices or nursing tasks that can cause injuries, and the importance of reporting any NSIs/SIs encountered. For the other, a set of website materials entitled "Danger and Prevention of Occupational NSIs/SIs" published by the Institute of Occupational Safety and Health of Taiwan was downloaded and prepared as brochures¹⁴). Brochures were given to students before graduation in June 2000. The brochure described information on diseases transmitted by NSIs/SIs, departments at higher risk of encountering injuries in hospitals, types of device and work associated with the injuries, skills for managing injuries, and the importance of reporting an injury.

Table 1. The baseline characteristics of all nursing students and subjects during internship of vocational nursing school

Variables	All nursing students n=527	Subjects n=107
Age	17.8 ± 0.5	17.8 ± 0.6
Grade	75.3 ± 5.3	75.2 ± 5.3
Needlesticks (sharp) injuries (NSIs/SIs), n (%)	264 (50.1%)	54 (50.5%)
Frequency of NSIs/SIs ^a (average)	8.0	8.1
Contaminated NSIs/SIs ^b , n (%)	96 (18.2%)	20 (18.7%)
Report rate ^c	38.6% (102/264)	37.0% (20/54)

^aTotal injuries × 52 [per year]/weeks of internship training; times/student/year. ^bThe injuries by a needle or sharp contaminated with a patient's blood (students with contaminated NSIs/SIs / Total students). ^cThe number of students reporting NSIs/SIs to instructors or hospital staff after injury incidents divided by the number of students with NSIs/SIs.

Evaluation instrument

The participants completed the pre-test questionnaire within one week after finishing their internship training between July and December of 1999. The 20-min questionnaire asked participants to recall the frequency of NSIs/SIs and provide the following information: (1) demographics such as age and ethnicity; (2) circumstances of NSIs/SIs such as frequency (total injuries × 52 [per year]/weeks of internship training; times/student/year); (3) the report rate which was obtained by the following equation: the number of students reporting NSIs/SIs to instructors or hospital staff after injury incidents divided by the number of students with NSIs/SIs.

The contents of the post-test questionnaire for post graduation services at healthcare settings were similar to that of the pre-test: (1) work environment with regard to the use of needles or sharp instruments; (2) circumstances of NSIs/SIs such as frequency (total injuries × 52 [per year]/weeks of work; times/nurse/year); (3) the report rate which was obtained by the following equation: the number of nurses report NSIs/SIs to hospital staff after injury incidents/nurses with NSIs/SIs.

Statistical analysis

Data analyses included both descriptive and inferential analyses. Methods of inferential statistics included Chi-square test and McNemar's χ^2 test. Statistical analyses were performed with SPSS for Windows 8.0 statistics program.

Results

Pre-test and post-test frequencies of needlestick/sharp injuries

In total, 107 (26.4%) of the graduating nursing students were included in this study for final evaluation. Based on the pre-test and post-test questionnaires obtained from

the 107 students, the incidence of NSIs/SIs decreased significantly from 50.5% (54/107) to 25.2% (27/107) (Table 2). The average frequency of the injuries post-test was 2.7 times/nurse/year (NSIs 1.0 times; SIs 1.7 times), and 17 of the 107 (15.9%) had injuries involving contaminated NSIs/SIs (Table 3). The average frequency of NSIs/SIs post-test was 0.7 time/nurse/year (contaminated NSIs 0.6 times; contaminated SIs, 0.1 times), and 38 of the 107 (35.5%) reported NSIs/SIs pre-test but not post-test, while 11 of the 107 (10.3%) persons did not report such an incident pre-test but did so post-test ($p < .0001$, McNemar's χ^2 test) (Table 2).

Pre-test and post-test departments of needlestick/sharp injuries

There were no significant differences in the frequencies of injury occurrence among clinical departments in the hospitals, both pre-test ($p=0.14$) and post-test ($p=0.17$). However, after educational intervention, the percentage of participants in each of the departments reporting NSIs/SIs post-test was lower than that pre-test (Table 3).

Pre-test and post-test report rates of needlestick/sharp injuries

In the pre-test, only 20/54 (37.0%) incidences of NSIs/SIs were reported. After intervention, the report rate, as evidenced by responses to the questionnaire, had increased 1.5 times (15/27, 55.6%) (Table 3). After reporting the incident, only 4 of the subjects made sure that their nursing supervisors had completed the forms used to report their NSIs/SIs. Seven reported that their nursing supervisors did not fill out any report form. The rest of those who reported NSIs/SIs said that they did not know whether their nursing supervisors had filled out a report form for them or not.

Table 2. Pair distribution of nursing students according to whether or not they had a needlestick or sharp injury pre-test and post-test of the intervention

Pre-test	Post-test		Total (%)
	Yes	No	
Yes	16	38	54 (50.5)
No	11	42	53 (49.5)
Total (%)	27 (25.2)	80 (74.8)	107 (100)

Odds ratio=38/11=3.5, Paired data with McNemar χ^2 test (df=1)=14.9; $p<0.0001$.

Table 3. The circumstances and departments of needlestick/sharp injuries pre-test and post-test

Variables	Pre-test			Post-test		
	Needlestick/ sharp injuries	Total (n=107) ^a	<i>p</i> -value ^b	Needlestick/ sharp injuries	Total (n=107)	<i>p</i> -value ^b
Circumstances						
Frequency of NSIs/SIs (average)	8.1	107		2.7	107	
Contaminated NSIs/SIs	20 (18.7)	107		17 (15.9)	107	
Reporting rate	20 (37.0)	54		15 (55.6)	27	
Departments						
			0.14			0.17
Internal Medicine	36 (37.5)	96		10 (37.0)	27	
Surgery	16 (33.3)	48		4 (25.0)	16	
Obstetric and Pediatric	2 (10.5)	19		2 (9.1)	22	
Other ^c	6 (40.0)	15		11 (26.2)	42	

^aSeventy-one students had finished two departments' training pre-test. ^bChi-square *p*-value, ^cEmergency, Outpatient, Ophthalmology, Ear-Nose-Throat (ENT), Operating Room, Respiratory Therapy (RT) and Nursing Home.

Discussion

This study investigated the effectiveness of intervention education for preventing NSIs/SIs among nursing students. The evaluation was based on 107 students who had been licensed as nurses after their graduation. These nurses were similar to the original student population in baseline demographic characteristics, frequencies of incidence of NSIs/SIs and encountering contaminated NSIs/SIs.

The departments that study subjects practiced nursing work in hospitals either in internship or in work after graduations were not significantly related to the occurrences of NSIs/SIs. When nursing students graduated, they could choose their workplace; therefore, it seems unlikely that the subjects would have continued working in the same departments as those during their internship. In spite of the subjects working in different departments, compared to pre-test outcomes, the reported occurrences of NSIs/SIs in all departments declined post-test. Interestingly, we supposed that individuals working in the surgery department would have more opportunities to use needles or sharps and thus be involved in NSIs/SIs; but in fact, after our educational intervention, injuries

in surgery were reduced by 75%.

In our recent study⁷⁾, we found that the incidence of those reported for NSIs/SIs among our vocational school nursing students were higher than nursing/medical students in other countries, and that our students were less likely to report the injury^{5, 13, 15-22)}. In Taiwan's nursing educational system, vocational school students are generally younger than 18 yr old. Therefore, they probably lack experience of performing invasive procedures at clinics¹⁸⁾. Apparently, by giving a lecture on hazard and prevention of NSIs/SIs and by handing out a brochure with prevention guidelines in it the incidence of injuries could be significantly decreased and the NSIs/SIs reporting rate could be raised. The effectiveness of the educational intervention for students was consistent with other studies^{12, 23, 24)}. The intervention was effective for the nursing students.

Many studies of intervention about universal precautions and the use of needle safety devices have evaluated the incidence of NSIs/SIs, but studies about educational intervention are rare. Most educational interventions for students for preventing NSIs/SIs have evaluated changes of knowledge and/or behavior rather than incidence of NSIs/SIs. This study evaluated the

change in incidence of NSIs/SIs after the intervention. The average frequency of the injuries was reduced from 8.1 to 2.7 times/person/year, reflecting a marked reduction in NSIs/SIs. The paired analysis showed that the odds ratio of having NSIs/SIs pre-test was 3.5, compared with post-test. Wang *et al.* conducted a comparative intervention study on prevention of NSIs/SIs among nursing students in Changsha, China. The controls were more likely to experience NSIs/SIs than the intervention group (OR=3.5, $p=0.004$)²³. This is a result similar to our study result. The educational intervention was found to significantly reduce the occurrence of these accidents.

Another relevant study conducted in Taiwan found that nursing staff in 1990–1997 had the experience of NSIs/SIs with average incidences of 1.2 to 2.8 times/person/year with 0.73 to 0.93 times/person/year involved in contaminated NSIs²⁵. In the present study, the average of NSIs/SIs was 2.7 times/nurse/year, falling within this range. Because the data was collected only for four months after students had graduated, their lack of experience could have resulted in the high average of NSI/SIs. Besides, the percentage of Taiwanese nurses involved in NSIs/SIs has been reported to range from 41.5% to 75.1%²⁵. While the frequency of NSIs/SIs in the pre-test fell within this range, in comparison with what is generally reported in Taiwan, NSIs/SIs and contaminated NSIs were less frequent among the nurses who underwent our training program^{25, 26}. Our study subjects were younger and a high-risk group. But, after the education, the rate of NSIs/SIs among them was lower than that among other nursing staff, indicating that regular lectures on injury prevention may also decrease the NSIs/SIs rates elsewhere.

The rate of reporting NSIs/SIs was increased after the intervention. However, we also found that, while the nursing students reported NSIs/SIs, their supervisors were less likely to. Therefore, future educational programs on NSIs/SIs should also include administrative supervisors, something which might not always be possible as the majority of recently graduated nursing students work in smaller clinics where the system of reporting is either less complete or goes no further than the immediate supervisor.

One study has reported that nurses reporting one NSI/SI are likely to have a higher rate of NSIs/SIs than those who do not, suggesting that the incidents are a result of habitual behavior²⁷. Our study, however, found a significant improvement could be achieved through education, suggesting that knowledge or awareness had more to do with NSIs/SIs frequency than habit.

Limitations

This study was a follow-up study without a control group. Needlestick/sharp injury is a significant cause of fatal blood-borne infections and educational intervention

regarding NSIs/SIs should be provided to nursing students. For ethical reasons, we didn't include controls in this study. Compared with the prevalence of NSIs/SIs found in general among nurses in Taiwan^{25, 26}, our intervention significantly reduced the incidence of injuries among the participants.

The low follow-up rate post-test is another limitation of this study. In Taiwan, larger hospitals generally hire college nursing graduates, and vocational school graduates tend to work at small hospitals and clinics of practicing physicians. Most vocational nursing school graduates transfer to college nursing programs. Nursing school graduates of vocational schools enter graduate schools or go to private preparation centers to ready themselves for the entrance exams to these graduate schools. Therefore, only 107 nurses could be included in the final data analyses. However, this low follow-up rate did not really affect the significance of the effectiveness of the educational program for the 107 subjects of this study.

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