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Original Article

Occupational exposure among Chinese nursing students: current status, risking factors and preventive interventions

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Abstract: This study aims to investigate the current status and risk factors of occupational hazards in nursing student attending clinical practicum, and to evaluate the effects of occupational preventive interventions. Through a cross-sectional approach, a self-administered questionnaire was offered to 342 nursing students attending clinical practicum at two hospitals participated. In addition to the general characteristics, the questionnaire inquired about knowledge, attitude about occupational safety and incidence of occupational injuries among nursing student. Descriptive statistics, multiple logistic regression analyses and Pearson correlation analyses were performed to analyze the statistical differences. Nursing care related stress was the most common and experienced by 96 (28.08%) students, followed by needle stick injuries (NSIs) with an incidence rate of 23.10%. The third common occupational injuries are excreta (17.25%) or body fluid (16.96%) plashed on skin and mucous membranes. Other common occupational injuries include physical injuries caused by sprain and stretch (16.09%), ampoule sharp injuries (15.50%), musculoskeletal disorders (MSDs) in lower back, neck and shoulders (13.16%), direct exposure to chemicals (15.50%), and other less common injuries. Multiple logistic regression analyses identified 8 factors contributed to nursing student occupational injuries, with the influence of OSHTE ranked highest. We analyzed the current status and risk factors of occupational injuries in nursing students in China and demonstrated the importance of formal on-the-job training for nursing students regarding job-related hazard recognition and avoidance strategies.

Keywords: Nursing students, occupational hazards, occupational safety and health training and education

Introduction

Nurses are an integral component of the health care delivery system. In discharging their duties, nurses encounter a variety of occupational health problems which may be categorized into mechanical hazards, biological hazards, chemical hazards, physical hazards, and psychosocial hazards [1-3]. The nursing students are younger, inexperienced, unskilled, less aware of self-protection, and lack of professional knowledge of protective measures as compared with the senior registered nurses, which make them more susceptible to occupational injury [4, 5]. To our knowledge, there are limited studies on occupational exposure as well as occupational safety education and training among college nursing students in China. Notable, the medical education systems are diverse in different countries. In China, majority of the nursing students are females and fresh graduates from senior or junior school, aged from 16 to 25 years. Therefore, there is a great need to assess the knowledge about hazards and risk factors of occupational injuries among contemporary nursing students in China. This study aims to examine the current status of occupational injuries, to identify various risk factors related to the injuries and to investigate the effect of occupational safety education and training in Chinese nursing students.

Methods

The study was conducted according to the declaration of Helsinki and approved by the institutional review boards at provincial level. Participants were enrolled to the survey after com-

plete explanation of the objectives and protocols. They were informed that participation in the study was voluntary, that they may decline to participate or they have the right to withdraw from the study at any time without any penalty. Moreover, participants were assured that their responses would remain anonymous and confidential. Written informed consents were obtained from all participants.

Participants

The participants were nursing students attending clinical practicum in Third Xiangya Hospital of Central South University and First People's Hospital of Changsha. All participants had direct patient contact and 97.1% were female. The data were collected from July 2010 to July 2011. All participants were informed about the purpose and the methods of the study.

Study instrument

Based on the comprehensive literature researches [6-8], we designed the questionnaire. The questionnaire included five parts, including the followings. The first part included general information, such as age, gender, birthplace, ethic group, level of education, whether or not attending any occupational safety related courses, *and etc.* The second part focused on the knowledge about occupational hazards, which included mechanical, biological, chemical, physical and psychological hazards. The third part focused on the attitude of nursing students towards the occupational safety and health protection. The forth part was to investigate the knowledge about occupational safety and health protection. The last part was to investigate the self-protective behaviors of nursing students. It included 12 protective behaviors. For each behavior, based on how often it was performed, four categories were provided as: (1) never, (2) seldom or occasionally, (3) frequently, and (4) always; and they were assigned a value of 1, 2, 3, and 4, respectively. The questionnaire was validated before delivered to participants.

OSHTE

Nursing department reinforced the engineering controls for occupational safety. It was mandated for each department to provide personal protective equipment (PPE, such as goggles, masks, and etc.), sharps disposal container, needles with built-in safety mechanisms, and patient transfer and lifting devices, *and etc.* Moreover, motion-sensor or foot-step faucet, hand dryer and hand sanitizer to reduce the incidence of occupational injury.

Nursing department organized monthly training sessions about occupational safety. These training sessions were considered an important component of the pre-practicum orientation for nursing students. During these sessions, nursing teachers introduced occupational safety-related law and regulations, importance of prevention and control of the infections, and knowledge about self-protective behaviors. Some examples of occupational injuries were discussed during the sessions, which helped the nursing students to recognize the hazard of occupational injuries and the importance of self-protection.

The nursing students were also required to complete trainings on 7-step hand washing techniques, correct techniques to put-on sterile gloves and gown, and usage of goggles and masks. During the training, the teachers did the demonstration and tested each student to ensure everyone mastered the skills. The teachers also supervised the students when they performed their clinical duties. In addition, a "Handbook of occupational safety" was provided to each nursing student to ensure the related knowledge and skills were readily available when needed.

Data collection

Three month before the end of clinical practicum, the objectives and importance of the questionnaire were well-explained and the questionnaire was delivered to all participants. Total of 360 questionnaires were handed out, and 352 were return (97.78% return rate), of which 10 were excluded because the questions were not all answered. After we analyzed the status of students' occupational injuries and evaluated the risk factors, OSHTE was implemented. Three month later, the second survey was performed with the same questionnaire and total of 342 questionnaires were returned (100% return rate).

The questionnaires were excluded if more than 3 answers were missing, or the questionnaires were identified as fraudulent.

Table 1. General Characteristics of participating nursing students

Characteristic	N=	%
Age		
16-18 years old	30	8.77%
18-22 years old	250	73.10%
>22 years old	62	18.13%
Sex		
Male	10	2.92%
Female	332	97.08%
Education		
JNP	40	11.70%
CNP	212	61.99%
BSNP	90	26.32%
Training		
Yes	80	23.39%
No	262	76.61%
Single child		
Yes	202	59.06%
No	140	40.94%
Nurse in the family		
Yes	63	18.42%
No	279	81.58%
Reasons for choosing nursing career		
Feeling better for career perspective	27	7.89%
Great interest in the nursing career	33	9.65%
Better income	97	28.36%
Stable career	120	35.09%
Decisions made with interferences by parents	65	19.01%
Living place before attending nursing school		
Urban	93	27.19%
Suburban	126	36.96%
Rural	123	35.96%

Statistical analysis

After the collection of all the valid questionnaires, we used double entry for data recording. The computer compares these entries to identify mismatches and then corrective efforts were made to ensure the accuracy of the data. The data analysis was then performed using SPSS 13.0 software. The statistical differences between the two groups were performed by using the Student's t-test. The statistical differences among the groups were performed by using the chi-square test. The multiple logistic regression analyses were used to analyze the logistic regression. The Pearson correlation analyses were used to analyze the correlation between the groups. A p value less than 0.05 was considered statistically significant.

Results

General information

A total of 342 nursing students (average age 21.27±3.48 years, range 16 to 24 years old) were enrolled in this study, of which 10 male, 332 female. Among the participants, 90 (26.3%) were attending Bachelor of Science in Nursing Degree Program (BSNP), 212 (62.0%) were attending College Nursing Program (CNP), and 40 (11.7%) were attending Junior College Nursing Program (JCNP). Eighty students (23.29%) had occupational safety training experiences while 262 (76.61%) didn't. Two-hundred and two nursing students (59.06%) were the single child in the family; 63 (18.42) students has blood relatives working as nurse. When chose nursing as their career, 27 (7.89%) had clear perspective about career, 33 (9.65%) like being a nurse, 97 (28.36%) because of better income, 120 (35.09%) because of the stability of the career, and 65 (19.01%) because of parents' recommendation. Before attending the nursing school, 93 students (27.19%) lived in urban area, 126 (36.85%) in suburban, and 123 (35.96%) in rural area. The detailed information was listed in **Table 1**.

Pre-OSHTE questionnaire

Before the questionnaire was delivered to participants, we first evaluated the questionnaire. The questionnaire had internal agreement of 0.93, content validity index of 0.88. Both values were more than 0.8, which suggested that the question items in the self-designed questionnaire were dependable. In addition, the test-retest reliability of the questionnaire had a validity index of 0.91, which suggested the questionnaire was reliable.

Needlestick injury (NSIs) was the most common reason for mechanical injuries with an incidence rate of 23.10%. The other reasons for mechanical injuries included ampoule sharps injuries, scissors and scalpel injuries and

Table 2. Incidence of occupational injuries in participating nursing students

Occupational injuries	Baccalaureate Nursing Programs; N (%)	College nursing students; N (%)	Junior college nursing students; N (%)	Total N (%)	χ^2	*p* Value
Mechanical hazards						
Needlestick injury	15 (16.67)	46 (21.70)	18 (45.00)	79 (23.10)	11.247	0.002*
Ampoule sharps injuries	14 (15.56)	25 (11.79)	14 (35.00)	53 (15.50)	8.144	0.006*
Scissors and scalpel injuries	13 (14.44)	23 (10.85)	7 (17.50)	43 (12.57)	2.841	0.910
Other sharp injuries	3 (3.33)	11 (5.19)	4 (10.00)	18 (5.26)	6.385	0.047
Physical hazards						
Back, neck and shoulder pain/injuries	15 (16.67)	23 (10.85)	7 (17.50)	45 (13.16)	3.275	6.541
Sprain and stretch	19 (21.11)	28 (13.21)	8 (20.00)	55 (16.08)	3.318	6.317
Assaults	0 (0.00)	1 (0.47)	0 (0.00)	1 (0.29)	1.034	8.362
Biological hazards						
Blood splashed on skin and mucous membranes	6 (6.67)	12 (5.66)	5 (12.50)	23 (6.73)	7.350	0.035*
Body fluids splashed on skin and mucous membranes	27 (30.00)	28 (13.21)	3 (7.50)	58 (16.96)	8.527	0.029*
Secretions splashed on skin and mucous membranes	11 (12.22)	27 (12.74)	6 (15.00)	44 (12.87)	3.200	1.525
Excreta splashed on skin and mucous membranes	18 (20.00)	33 (15.57)	8 (20.00)	59 (17.25)	3.149	1.425
Chemical hazards						
Direct exposure to sterilizing agent	11 (12.22)	28 (13.21)	11 (27.50)	50 (14.62)	7.232	0.007*
Exposure to cytotoxic drugs	6 (6.67)	11 (5.17)	3 (7.50)	20 (5.85)	0.864	6.852
Other chemical hazards	15 (16.67)	30 (14.15)	8 (20.00)	53 (15.50)	2.516	1.905
Psychosocial hazards						
Poor interpersonal relationship with teacher, patients, or other students	2 (2.22)	2 (0.94)	2 (5.00)	6 (1.75)	1.190	7.420
Stress	46 (51.11)	43 (20.28)	7 (17.50)	96 (28.08)	15.964	0.000*
Shift work	29 (32.22)	9 (4.25)	3 (7.50)	41 (11.99)	13.580	0.000*
Neurasthenia	0 (0.00)	2 (0.94)	0 (0.00)	2 (0.58)	0.251	11.590

Table 3. Multiple stepwise regressions analysis of the relationship between the incidences of occupational injuries and all the variables

Variables	Unstandardized coefficients		Standardized coefficients	χ^2	*p* value
	B	Std. Error (SE)	Beta		
Age	0.074	0.126	0.423	3.684	0.000
Education level	1.032	0.875	0.464	2.435	0.000
OSHTE	4.146	0.642	0.647	2.878	0.000
Protective skills	0.635	0.379	0.530	5.036	0.000
Single child	2.169	0.649	0.448	4.654	0.000
Nurses in blood relatives	1.032	0.875	0.215	2.435	0.000
Reason for selecting nurse career	1.642	0.326	0.484	2.846	0.000
Place of living before attending nursing program	1.134	0.764	0.453	5.942	0.000

other sharps. We also found that the incidences of NSIs, ampoule sharps injuries and other sharp injuries different significantly among nursing students with different education levels (P<0.01 and P<0.05, respectively), with the JCNP students had the highest incidence. However, the incidence of scissors and scalpel injuries was not different among BSNP, CNP and JCNP students (P>0.05, **Table 2**).

The most common reasons for biological hazard exposure was excreta splashed on skin and mucous membranes, followed by body fluids, secretions, and blood. The incidences of blood and body fluids exposure were significantly different among BSNP, CNP and JCNP students (P<0.05). Blood splashed on skin and mucous membranes occurred in 6 BSNP (6.67%), 12 CNP (5.66%) and 5 JCNP (12.50%) students, respectively. Body fluid exposure occurred in 27 BSNP (30.00%), 28 CNP (13.21%) and 3 JCNP (7.50%) students, respectively. The secretions and excreta exposures were not different among BSNP, CNP and JCNP students (P>0.05, **Table 2**).

Direct exposure to disinfectant occurred in 11 BSNP (12.22%), 28 CNP (13.21%) and 11 JCNP (27.50%) students, respectively. The difference was significant among BSNP, CNP and JCNP students (P<0.05). However, the incidences of direct exposure to chemotherapeutics and other chemicals were not different among groups (P>0.05, **Table 2**).

Sprains and strains were the most common reason s for physical injuries, followed by musculoskeletal symptoms (lower back, neck and shoulders) and assaults. The incidence of physical injuries was not different among BSNP, CNP and JCNP students (P>0.05, **Table 2**).

In addition, the percentages of students feeling stress and depression in BSNP (46, 51.11%), CNP (43, 20.28%) and JCNP (9, 4.25%) were different significantly (P<0.05). Complaints about irregular work shift occurred in 29 BSNP (32.22%), 9 CNP (4.25%) and 3 JCNP (7.5%). The detailed information was listed in **Table 2**.

Risk factors for occupational injuries in nursing students

In the 342 participants, a total of 312 (91.23%) nursing students had more than one occupational injury. We analyzed the risk factors of occupational injuries in these students, and identified eight factors associated with incidence of occupational injuries, which include age, education level, occupational safety education, technique skill for occupational injury prevention, being single child, having blood relatives working as nurse, the reasons to choose nurse career, and the living area before attending nursing program (P<0.05).

To assess the effect of each variable on the incidence of occupational injuries, we performed multiple regression analysis. First, we performed linear regression and found that except for gender of the students, all the other variables (age, education level, OSHTE, protective skills, being the single child at home, having blood relatives working as nurse, the reason for choosing nurse as career, and the living place before attending nursing school) were associated with the incidences of occupational injuries. To determine the most influential fac-

Table 4. The effects of occupational education and training

Measurements	Pre-OSHTE; N (%)	Post-OSHTE; N (%)	*p* value
Attitude			
Awareness of patients carry pathogens before nursing care	254 (74.27)	342 (100.00)	0.000**
Importance of universal precautions to prevent occupational hazards	280 (81.87)	342 (100.00)	0.034*
Importance of occupational knowledge and skills	286 (83.63)	342 (100.00)	0.036*
Importance of occupational safety training	233 (68.13)	342 (100.00)	0.000**
Knowledge and Skills			
Important infections and infectious diseases			
Know well	93 (27.19)	186 (54.9)	0.000**
Know a little	210 (61.40)	151 (44.15)	
Do not know	39 (11.40)	5 (1.46)	
Precautions used to prevent and control infection			
Know well	102 (29.82)	210 (61.40)	0.000**
Know a little	208 (60.82)	124 (36.26)	
Do not know	32 (9.36)	8 (2.34)	
Correct Hand washing techniques			
Know well	115 (33.63)	225 (65.79)	0.000**
Know a little	212 (61.99)	117 (34.21)	
Do not know	15 (4.39)	0 (0.00)	
When to wear gloves			
Know well	78 (22.81)	197 (57.60)	0.000**
Know a little	224 (65.50)	133 (38.89)	
Do not know	40 (11.70)	12 (3.51)	
Immediate action after accidental exposure to blood and body fluids			
Know well	90 (26.32)	254 (74.27)	0.000**
Know a little	222 (64.91)	88 (25.73)	
Do not know	30 (8.77)	0 (0.00)	
Immediate action after Needlestick injury			
Know well	112 (32.75)	268 (78.36)	0.000**
Know a little	207 (60.53)	74 (21.64)	
Do not know	23 (6.73)	0 (0.00)	
Self-protective behaviors	31.15±6.43	42.97±8.64	0.000**

Note: **P<0.01.

tors for occupational injuries, we performed stepwise multiple regression analysis (**Table 3**). The analysis results indicated that the OSHTE is the most influential factor for the incidence of occupational injuries, followed by protective skills, the motivation to be a nurse, education level, single child in the family, age and having blood relative working as nurse.

Post-OSHTE questionnaire

After 3 month of OSHTE, the nursing students recognized the importance of occupational safety. As shown in **Table 4**, the percentage of students who aware of patients carrying pathogens before nursing care increased from 74.27% (pre-OSHTE) to 100% (Post-OSHTE). Similarly, all the students (100%) understood the importance of universal precautions, occupational knowledge and skills, and the importance of OSHTE as compared with pre-OSHTE (81.87%, 83.63% and 68.13%, respectively). In addition, the students' knowledge about the occupational hazards significantly improved as compared with pre-OSHTE. After OSHTE, the most of the students learned universal precautions to prevent and control infection; correct hand washing techniques, when and how to put

on sterile gloves and gown, what to do in case of blood/body fluid spill, and what to do after a NSIs (**Table 4**). Moreover, the self-protective behaviors improved significantly, with average score of 42.97±8.64 for post-OSHTE as compare with average score of 31.15±6.43 for pre-OSHTE (P=0.000**).

Discussion

During the practicum period, nursing students have been identified to comprise a high-risk group for occupational injuries; this is attributed to the fact that they frequently provide direct patient care with insufficient risk-recognizing knowledge and experience as well as underdeveloped manual skills. In this study, we investigated the current status of occupational injuries among nursing students in China and analyzed the risk factors for occupational injuries. We also compared the students' attitude and knowledge improvement before and after OHSTE.

In this study, most common occupational injury is nursing work-related stress (28.08%). Being in the clinical practicum, nursing students are faced with heavy academic pressure and psychological stressors [9-11]. The majority of nursing students in this study are female and fresh graduates from senior or junior school, aged from 16 to 22 years. The high demand of taking care of patients and frequent interaction with patients may have caused greater psychological stress. In addition, patients may consider nursing students are inferior in technical skill and be more criticized during their interaction which further added the worries and stress of nursing students. The stresses will influence student' academic performance and well-being, and therefore needs to be addressed. Stress management in nursing students can be achieved through effective interventions and education by enhancing coping strategies and mental strength [11, 12].

The second common occupational injury is needlestick injuries (NSIs), which occurred in 23.10% nursing students. Twelve students had more than two NSIs. According to previous studies, incidence of NSIs among hospital staff is alarmingly high [13-16]. These injuries may lead to serious and potentially fatal infections with blood-borne pathogens. The nursing students are facing greater risks because of less clinical experience, higher level of ignorance and less knowledgeable about the blood borne pathogens. In addition, because of heavy workload of infusion, nursing students are too busy to follow the standard operating procedure (SOPs), often break the ampoule neck with bare hands, which lead to ampoule sharp injuries (15.50%). In other studies, ampoule sharp injuries because of not following SOPs accounts for 31.8% mechanical injuries among nurses [16, 17]. In our study, scissors and scalpel injuries are less common (12.57%) because nursing students have less opportunity to work with scissors and scalpel.

The next common occupational injury is MSDs caused by sprain and stretch. Most of the MSDs are due to the cumulative effect of repeated manual patient-handling activities and work done in extreme static awkward postures. Several key factors, including the heavy workload, inadequate staffing, lack of education, manual lifting of patients, incorrect work-related posture/movement, and lack of assistive devices may contribute to the observed MSDs in nursing students [18-20]. In this study, physical assault from patients' family members occurred in one nursing student, who was young, had less social skills to communicate effectively with patient, especially when patients don't trust their skills and decline their nursing practice.

Despite the engineering controls on occupational exposure, it was already been recognized that the interventions including educational approaches can significantly and sustainably reduced the overall rate of occupational injuries [21-24]. However, little information has been available on the intervention measures of occupational injuries among nursing students in China. In this study, we implemented both engineering controls and OSHTE. Post OSHTE survey showed great improvement in student's knowledge about occupational hazards. In addition, increase the student compliance of SOPs and will eventually reduce their risk of occupational injuries.

In conclusion, we analyzed the current status and risk factors of occupational injuries in nursing students in China and demonstrated the importance of formal OHSTE for nursing students regarding job-related hazard recognition and avoidance strategies.

Disclosure of conflicts of interest

None.

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References

[1] Chan CW, Perry L. Lifestyle health promotion interventions for the nursing work force: a systematic review. J Clin Nurs 2012; 21: 2247-2261.

[2] Geiger-Brown J, Lipscomb J. The health care work environment and adversehealth and safety consequences for nurses. Annu Rev Nurs Res 2010; 28: 191-231.

[3] Tomioka K, Kumagai S. Health risks of occupational exposure to anticancer (antineoplastic) drugs in health care workers. Sangyo Eiseigaku Zasshi 2005; 47: 195-203.

[4] Higgins DN, Tierney J, Lins M, Hanrahan L. School nurses: a resource for youngworker safety. J Sch Nurs 2004; 20: 317-323.

[5] Echternacht MR. Potential for violence toward psychiatric nursing students: risk reductiontechniques. J Psychosoc Nurs Ment Health Serv 1999; 37: 36-39.

[6] Aynalem Tesfay F, Dejenie Habtewold T. Assessment of Prevalence and Determinants of Occupational Exposure to HIV Infection among Healthcare Workers in Selected Health Institutions in DebreBerhan Town, North Shoa Zone, Amhara Region, Ethiopia, 2014. AIDS Res Treat 2014; 2014: 731848.

[7] Wiegand DM, Chen PY, Hurrell JJ Jr, Jex S, Nakata A, Nigam JA, Robertson M, Tetrick LE. A consensus method for updating psychosocial measures used in NIOSH health hazard evaluations. J Occup Environ Med 2012; 54: 350-355.

[8] Choobineh A, Ghaem H, Ahmedinejad P. Validity and reliability of the Persian (Farsi)version of the Job Content Questionnaire: a study among hospital nurses. East Mediterr Health J 2011; 17: 335-341.

[9] Makabe S, Takagai J, Asanuma Y, Ohtomo K, Kimura Y. Impact of work-lifeimbalanceonjobsatisfactionandqualityoflifeamonghospital nurses in Japan. Ind Health 2015; 53: 152-159.

[10] Adriaenssens J, DeGucht V, Maes S. Determinants and prevalence of burnout in emergency nurses: A systematic review of 25 years of research. Int J Nurs Stud 2015; 52: 649-661.

[11] Nowrouzi B, Lightfoot N, Carter L, Lariviere M, Rukholm E, Schinke R, Belanger-Gardner D. Work ability and work-related stress: Acrosssectional study of obstetrical nurses in urban northeastern Ontario. Work 2015; 52: 115-22.

[12] Taghinejad H, Suhrabi Z, Kikhavani S, Jaafarpour M, Azadi A. Occupational Mental Health: A Study of Work-Related Mental Health among Clinical Nurses. J Clin Diagn Res 2014; 8: WC01-3.

[13] Rozanska A, Szczypta A, Baran M, Synowiec E, Bulanda M, Walaszek M. Healthcare workers' occupational exposure to bloodborne pathogens: a 5-year observation in selected hospitals of the Malopolska province. Int J Occup Med Environ Health 2014; 27: 747-756.

[14] Prabhu A, Rao AP, Reddy V, Sugumaran K, Mohan G, Ahamed S. Needle safety awareness among dental nurses. Workplace Health Saf 2014; 62: 243-248.

[15] Rajkumari N, Thanbuana BT, John NV, Gunjiyal J, Mathur P, Misra MC. A prospective look at the burden of sharps injuries and splashes among traum a health care workers in developing countries: True picture or tip of iceberg. Injury 2014; 45: 1470-1478.

[16] Galazzi A, Rancati S, Milos R. A survey of accidents during the clinical rotation of student sina nursing degree program. GItal Med Lav Ergon 2014; 36: 25-31.

[17] Amira CO, Awobusuyi JO. Needle-stick injury among healthcare workers in hemodialysis units in Nigeria: a multi-center study. Int J Occup Environ Med 2014; 5: 1-8.

[18] Freimann T, Coggon D, Merisalu E, Animagi L, Paasuke M. Risk factors for musculo skeletal pain amongst nurses in Estonia: a cross-sectional study. BMC Musculoskelet Disord 2013; 14: 334.

[19] Lee SJ, Lee JH, Gillen M, Krause N. Job stress and work-related musculoskeletal symptoms among intensive care unit nurses: a comparison between job demand-control and effort-reward imbalance models. Am J Ind Med 2014; 57: 214-221.

[20] Vargas-Prada S, Martinez JM, Coggon D, Delclos G, Benavides FG, Serra C. Health beliefs, low mood, and somatizing tendency: contribution to incidence and persistence of musculoskeletal pain with and without reported disability. Scand J Work Environ Health 2013; 39: 589-598.

[21] Boiano JM, Steege AL, Sweeney MH. Adherence to safe handling guide lines by health care workers who administer antineoplastic drugs. J Occup Environ Hyg 2014; 11: 728-740.

[22] Daley J. Blood borne pathogen exposures and prevention in the perioperative environment. Can Oper Room Nurs J 2003; 21: 7-8, 31-3, 6.

[23] Carroll PL. Reducing the risk of needle stick injury associated with implanted ports. Home Healthc Nurse 1998; 16: 225-34; quiz 35.

[24] Cashman TM, Murray PM. Respiratory protection in occupational health-update. Mil Med 1995; 160: 168-171.