

A Comparative Study Based on Bloom's Theory on Infection Control Methods among Students and Surgical Technologists in Zanjan and Tabriz, Iran

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Background & Aims of the Study: Nosocomial infection control has found a significant importance in prevention of mental stress, disabilities, declined life quality, mortality and shorter hospitalization as well as reducing the treatment costs. The aim of this study is to compare Bloom's theory among operating room students and technologists about the infection control in 2014.

Materials and Methods: This descriptive-analytical study was performed on 244 technologists and 113 students who were classified by random sampling. The data collection was carried out by a standardized two questionnaires: demographic data and the knowledge, practice and attitudes about infection control questionnaire. Data analysis was conducted by SPSS V20 and Levene's test, T-test, Chi-square and Kendall tau-b correlation coefficient were investigated.

Results: The mean of knowledge and practice in terms of infection control were on medium level in both groups and they had positive attitudes. Based on T-test, the two groups showed no significant difference in knowledge and attitudes about infection control methods ($p > 0.05$). The mean of practice was however significantly higher among technologists as compared with the students ($P < 0.05$). In terms of the association between knowledge, practice and attitudes, the relationship between knowledge and practice was significant; while attitudes and practice showed no significant relationship ($P > 0.05$). Based on Kendall tau-b correlation coefficient, the relationship between knowledge and practice was direct and significant.

Conclusion: Regarding better practice of technologists, it is recommended to develop and establish clinical qualification tests on infection control for the students before their clinical practice. On the other hand, regarding the key role of technologists and students in prevention of nosocomial infections especially in operation rooms, enhancement of their knowledge and skills must be included in the educational and operational programs of authorities.

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Background

As a global priority (1), nosocomial infections are one of the important issues of health systems (2) which may result in mental stress,

disability, reduction of quality of life among the patients and has been known as one of the main mortality causes worldwide (3) which can result in longer hospitalization (4) and increased costs for the patients and health system (5). Based on

WHO statistics, the prevalence of nosocomial infection is 5-10% in developed countries while in developing countries its prevalence exceeds 25% (6). The results of various studies based on nosocomial infection control systems are variable and was estimated less than 1% in some researches which is less than the expected results (7). In Iran, underreport is one of the challenges on infection control programs. Mexico had the same problem (8). Moreover, records of infection prevalence revealed secrecy and not declaring the cases of infection (9); while correct statistics will have positive impact on prevention of this phenomenon and improve the people practice. Today, it is believed that the origin of surgical site infection is mainly bacteria which entered the wounds during the surgery (10); moreover, it is believed that the surgical wound mainly becomes infected in the operation room (11). Therefore, it can be said that the operation room staff are responsible for infection spread as many of these infections are transmitted by people who come from outside (12). In health sector, due to direct relation with human health and life, the enhancement of quality and its guarantee has increasingly drawn the attention (13). In this regard, application of evidence-based instructions is emphasized to reduce the controversies and fill the gap between the theory and action (14) as well as increasing the quality of care (15-17). Therefore, changes in care methods will reduce the prevalence of nosocomial infections. As nurses are among the health care team, they play a unique role in prevention of nosocomial infections; hence they have to have sufficient and correct information about this field (18). Undeniable role of nurses in preventing of treatment complications and reaching to desirable outcomes has been confirmed and their need for training on different fields is inevitable and important (19). Before education, investigation of the educational needs is of crucial importance and the training of nurses should resolve their future occupational requirements (20). Results of

previous studies showed that underreporting, infection of surgical incision and complications of nosocomial infections are extensive and operation room's personnel and students play a significant role in this procedure. As Bloom's classification is one of the most valid cognitive approaches with emphasis on specific aspects of different targets, it can develop and implement a system with required considerations. The framework of this study is based on Bloom's theory in three fields of cognitive, psychomotor and affective. In this theory, the cognitive field of knowledge and awareness evaluates the cares before, during and after surgery; psychomotor field assesses the physical skills of the personnel and the affective domain investigates emotions, interests, moods, beliefs and values among the technologists and students of operation room. As non-compliance with infection control principles is a health-behavioral issue, comparison and assessment of knowledge, practice and attitudes of hospital personnel (especially in the operation room) can result in strategies leading to behavior changes in infection control.

Aims of the study:

Present study aimed to assess and improve the care quality in terms of infection control among technologists and students. Based on searching databases and review of previous studies, some researches have addressed this issue in sections other than operation room. The knowledge, practice and attitudes of students and technologists have not been compared in Iran. Therefore, this study was conducted to provide some data in this field.

Materials & Methods

This research population of descriptive-analytical study included 655 technologists and 160 students of operation theater who were working in educational-treatment centers of Zanjan and Tabriz medical science universities. The sample volume was determined according to Morgan table which was estimated as 113

student and 244 technologists. After providing the framework from nursery offices of hospitals and education authorities of the faculties, the samples were entered the study by random regular sampling method.

After attaining written consent from faculty authorities, the researcher introduced herself to the centers and obtained their consent. Then she referred to the operation rooms of the selected centers in different shifts and distributed the questionnaires at the beginning and collected them at the end of the shifts. Regarding the limitations due to the impact of physical and mental factors on the accuracy of the answers, the researcher tried to control this limitation by providing proper environment. Obtaining the ethical confirmation of Tabriz university of medical science, anonymousness, freedom to participate in the study, presenting required education about the history and definition of infection control and the objective of the study and emphasis on presenting the results to obtain the comments for improving the cares, attaining required permissions to conduct the study, introduction of the researcher to headnurses of operation rooms for more cooperation and assuring the participants on the confidentiality of the information were among the ethical principles of this study.

It must be mentioned that despite the confidentiality of the information, some participants did not answer to especial questions. Therefore, out of 357 samples, 245 participants had answered completely to the infection control methods questions and the rest of them (31 technologists and 10 students) ignored that part or just answered the general questions. Data collection tool of this study was two researcher-made questionnaires: the first included demographic information and the second asked about the infection control in three sections. The first section was related to the knowledge and included 10 questions. These questions were derived and designed based on the Master thesis of Kim Malan entitled nurses knowledge on the infection

control and the principals of Strilization technique of infection control in operation theater, after attaining the author's consent (21). The second section involved questions about the practice and included 13 questions; while the third part dealt with attitude-related questions and included 5-9 scale Likert statements. The latter two sections were developed by research team based on library studies.

To determine the validity of the knowledge section, trans-with- trans and expert panel methods were used; while the validity of practice and attitude sections was confirmed based on the opinions of 10 academic board members of nursing-midwifery faculty of Tabriz and Zanjan Universities of medical science as these parts were derived from the literature. It must be mentioned that some modifications and comments of the experts were implemented in the final version of questionnaires. The reliability was confirmed by Cronbach's alpha coefficient and internal stability method. In this regard, the tool was presented to 30 students and technologists of surgery ($\alpha=0.873$).

The scoring of the knowledge in relation to infection control methods was such that each correct answer was assigned to score of 1 and each wrong answer was assigned to zero. As the number of questions on knowledge about infection control methods were 10,; if someone answered correctly to all 10 questions, he would score 10. If he answered all questions incorrectly, he would get zero. So, each person's score of 10 questions related to knowledge on infection control varied between 0 and 10. Scores in ranges of 0-3.9, 4-7.9 and 8-10 showed weak, average, and good levels. The scoring method of the practice section was the same and as this section included 13 questions, each person's score varied in the range of 0 to 13. Regarding the total score of 13 questions, the practice status was classified into three categories: unfavorable (0-4.3), somewhat favorable (4.4-8.7) and desirable (8.8-13). The

scoring method of attitude involved the score of 1 for complete agreement and 5 for fully opposite opinion. Therefore, the scores ranged from 9 to 45. In this content the attitudes were divided into three categories: positive attitude (9-20.9), moderate (21-32.9) and negative (33-45).

Data analysis was conducted by SPSS 20 software. Descriptive statistics as employed for description of data (mean and standard deviation). The data distribution in three aspects of knowledge, practice and attitudes was normal based on Kolmogorov-Smirnov test. To investigate the relationship between the variables by use of mean difference in three aspects between the students and technologists, Levene's test and T-test were used. Kendall tau-b correlation coefficient was also employed to evaluate the association between the practice and two variables of knowledge and attitude.

Results

Among 357 samples, 244 samples (68.3%) were staff and 113 samples (31.7%) were students. In terms of their gender, 191 subjects of the staff (71.8%) and 75 people of the students (28.2%) were men. Moreover, among the women, 53 samples (58.3%) were staff and the rest of them were students. Staff with more than 10 years of experience had the highest rate (28.0%) and those having less than one year of work experience (5%) had the lowest frequency. 122 people (34.25) were in the age group of 20-24 years old and 7 samples were younger than 20. Students studying in their 6th semester had the highest frequency (45 people, 12.7%) and those studying in their 8th semester had the lowest frequency (26 people, 7.3%). The highest frequency was for those working in general surgery department (39 people, 10.9%) while those working in plastic surgery department had the lowest number (4, 1.1%). Frequency distribution and percentage of the responders to knowledge variable indicators showed that technologists and students have low knowledge and adaption about the defects

in infection control measures to prevent disease transmittance from nurse to the patient, effective efficiency of air conditioning of operation theater and antibiotic-resistance bacteria and presence of bacilli and fungi. However, they showed high knowledge and adaption toward WHO standards of infection control, contamination factors in operation set or pack, principals of entering to operation room during surgery, correct traffic and proper methods of disposing syringe needles and sharp things.

In terms of practice indicators, frequency distribution and the percentage of responders showed that standard considerations, separating the bloods and fluids from the body of infected patients were in the center of attention of both groups. However, hands scrub, effective ventilation along with sterilization of physical environment, transport of stylized packs, set contaminating factors, operation room traffic principals, preventive measures about blood communicable diseases, sharp tools and syringe needle disposal and re-scrub between the two surgeries are in moderate condition and they showed somewhat favorable practice. Daily change of operation theater clothes to control the infection was in very weak adaption condition.

In terms of attitude variables, frequency distribution and responders percentage showed that the majority of research population agreed on high cost of nosocomial infection control, training in this field, the need for contribution of all the members of medical team, transmittance of nosocomial infections through preventable ways, presenting the information and enhancing the workplace safety and the need for further studies to improve the infection control methods. The statement of "technologists knowledge about the infection control methods will reduce the nosocomial infections" scored the highest "completely agree" respond (241, 67.5%). The two indicators of "transmittance of nosocomial infection from personnel to patients is rare" and

"I think that infection control measure are now implemented in the best way possible" had more "disagree" answers.

Findings of the study about the difference in knowledge, practice and attitudes among personnel and students are listed in table 1

Table 1) mean and standard deviation of knowledge, practice and attitudes of students and technologists about infection control

Variable	Group	number	means±SD	F-value	DF	T	P value
Knowledge on infection control method	Technologists	213	6.7±1.24	0.36	234	1.35	0.76
	Students	103	6.48±1.13				
Practice of infection control method	Technologists	213	6.96±2.03	4.66	237.5	2.26	0.02
	Students	113	6.47±1.44				
Attitudes toward infection control method	Technologists	231	2031±4.56	0.3	313	-0.92	0.35
	Students	104	20.82±4.6				

Based on table 1, the mean of practice was in moderate level in both groups; based on T-test, practice of technologists was significantly better than students ($p=0.02$).

To investigate the relationship between the knowledge, practice and attitudes, Chi square and Pierson tests were used which proved the presence of relationship between knowledge and practice ($df=4$, $p=0.003$). However, attitude had no impact on people's practice ($p=0.51$, $df=4$).

Kendall's tau-b correlation coefficient was used to investigate the relationship between knowledge and practice which showed a positive relationship ($p=0.16$). This means that increase of knowledge about the infection control methods will enhance their application.

Table 2) correlation between knowledge and practice about infection control methods

Correlation coefficient test	value	Probability
Kendall's tau-b	0.16	0.035

Discussion

In this study, technologists and students showed low knowledge and adaption concerning disease transmittance from nurse to the patients, effective efficiency of operation room ventilation, antibiotic-resistance bacteria, presence of bacilli and fungi. Regarding what mentioned above, it can be understood that

based on descriptive statistics and in Table 2 based on analytical statistics. The means were investigated and as the number of samples was high, parametric methods such as T-test and Levene's test were employed.

general knowledge of the technologists and students about the common issues of infection control is good but their specialized knowledge is in weak condition. In ICUs, only 0.5% of the nurses have knowledge about the tracheal tube role with specific lumen for suction of subglottic secretion in ventilator-induced pneumonia; and the majority of them, (75%) don't have knowledge on the time of suction system tube replacement (22). The nurses' knowledge about "the cases of HIV transmittance after accidental entrance of needle is less than 1%" was very low (23, 24). The most of subjects in the study of Sarani also had low knowledge (25) which indicates the weakness in specialized field knowledge of nurses. This could have negative impact on their practice. In the study of Mosaddegh, enhancement of knowledge and training the effective methods of sterilization was introduced as effective method of fighting with nosocomial infections (26).

As mentioned in various studies, the type of nosocomial infections differs from one ward to another and there exist different pathogens. Therefore, it is recommended to present the required especial education in relation with those infections specific to that department prior to clinical practice. Entering to the ward, this specialized information should be evaluated according to the department, patients and clinical conditions.

Noruzi assessed the nurses' practice as weak based on theirself-report. The lowest compliance was observed in washing the hands before entering to the department and the highest attention was paid to washing the hand after taking off the gloves (27). Most of people showed weak practice in washing their hands before wound dressing and application of antibacterial liquid soaps after each procedure (23). Some evidence-based measures such as prevention from ventilator-induced pneumonia were routinely implemented in the department. Lack of sufficient time and facilities, lack of independence in providing evidence-based cares, lack of knowledge and interest were among the major obstacles in implementing the evidence-based instructions in ICUs (22). The practice of nursery interns in terms of applying standard considerations on hands hygiene, personal protection tools, avoiding sharp tools, environmental health and transport of lab samples was weak which showed a significant increase after intervention (28). Based on the results, the practice of ICU nurses is moderate (29) and sometimes weak in terms of preventing from nosocomial infections (30). Ignoring the educational courses, lack of knowledge and facilities have been expressed among the practical and clinical obstacles for infection control measures (31).

In this study, hands scrub, effective ventilation along with sterilization methods of physical space of operation theater, sterile packs transportation, contaminating factors of the set, traffic principals and preventive measures for blood-communicable diseases, sharp tools and syringe needle disposal and re-scrub between two surgeries showed moderate adaption. Daily replacement of the operation theater clothes however was in very weak condition. In the majority of studies, hands washing or scrub and care for the patients and environment were defective and needed to be more emphasized among the nurses and technologists as hands hygiene and correct sterilization of the surfaces and tools have been introduced as important

factors (32). In this case, enhancement of the practice and application of standards among the personnel involved in healthcare and treatment sections in the departments or operation theater can be the most important defense barrier and play a crucial role in prevention and control of the diseases.

On the other hand, patients' satisfaction is the essential goal of the nurses. Dissatisfaction of the patients shows undesirable quality of the nursing care. In fact the nurses need to improve their skills to fill these gaps (33). In the competitive market of healthcare services, the institutes aimed to attain their clients' satisfaction will be more successful (34).

Control of nosocomial infections and nurses' behavior and practice are among the solutions to increase the quality of patients' care and their satisfaction. In this content, training and enabling these people can be mentioned as the effective steps in reducing the nosocomial infections and enhancement of hospitals service quality. The patients who got infected lost their confidence to medical team (doctors and nurses) in addition to imposing problems to the system. Hence the patients of small towns will refer to hospitals of large cities which will result in crowded large hospitals leading to shortage of beds and nurses.

The other important factor needed to be considered is that, similar to other fields of science, the information of the nurses will rapidly get old-fashioned and out of date as the result of fast progress of scientific fields (35). Application of evidence-based nursery and updating the measures and actions, especially in infection control, are essential due to new scientific evidences. In this regard, learning, changing the behavior and practice in the clinical environments are of crucial importance. Results of ranking the attitudes toward infection control statements showed that healthcare system has done his best about increasing the knowledge of technologists and its impacts on people's practice regarding infection control" and "necessity of medical team cooperation in

preventing of nosocomial infections". However, the studied population believe that infection transmittance from personnel to the patients is very weak and they ignored the role of personnel as the complementary component of infection control chain. There were some conflicts among the study population in terms of the methods to control the nosocomial infections. The reason was that they were aware of the methods of infection control and hence they asked for more measures are significant as it. Overall, regarding the positive attitudes of the students and technologists, it seems that there is no conventional insight about infection control and they has interactive attitudes toward that as the threat of nosocomial infection was well understood by personnel and nurses and their attitudes were positive (36, 18). However, some studies reported negative attitudes (24, 23).

Studying people's attitudes in different fields is important as it helps managers and administrators to get informed about people's thoughts on specific topics and to predict their behaviors and practices. After solving the problems and barriers in the system, the opportunities for the promotion and development of programs, especially infection control will be provided because changing the attitudes of individuals can change their behavior. Also, being aware of the attitudes of individuals can be more important. If we know their attitudes, we can predict their behavior and control it (37).

In this study, the daily replacement of operating room clothes, washing or scrubbing hands, and patient and environment care behaviors and transmission of infection from personnel to patients were defective and can be potential sources of pathogenic bacteria with an effective role in the infection cycle; and the results also demonstrated a significant association between knowledge and practice. Gold also introduced knowledge sharing and collection as a factor of competitiveness and practice in the organization (38), Choi and Lee showed that

explicit and implicit knowledge had the most effect on the personnel action (39). Therefore, the promotion of the people's knowledge regarding the their clothes and hands hygiene and their role in transmitting infection to patients and caring behaviors are considered as the most important control tool for nosocomial infections regarding the positive effect of knowledge on the practice of individuals.

Infection control has found its position in recent years. But the obstacles and challenges are evident. Some managers have not become completely sure about the necessity of costs and educations of infection control and on the other hand, infection control is faced with conceptual challenges due to its nature. Lack of a clear and deep belief on the requirement of knowledge and skills in the procedure of infection control by some high- and middle-rank managers, nurses and technologists is one of the major issues of infection control. So they don't completely support establishment of infection control measures. In most cases, the managers took some temporary measure as the result of their higher-rank managers' order or under the influence of advertisements and encouraging of the consultants to get more scores in validation processes. It wouldn't have the anticipated result. To solve this problem, personnel with higher education level and more work experience can make more effective decision for the organization. These people play a key role in infection control as they are known as science-oriented personnel. At the end, the future researches effective factors on the personnel's knowledge, practice and attitudes toward infection control in the future studies as well as the methods to enhance the care quality. Moreover, education of the managers let them identify the nature, features and positions of the conflicts in infection control control their condition and intensifying factors, predict the conflicts and prevent from them. In this way, they can choose the proper method for controlling the conflicts and guide it to a constructive and creative path. By the

application of necessary knowledge and proper attitudes, they can control the infection especially in operation theater and improve their smart practice and increase the organization efficiency.

Conclusion

In this research, a limited number of technologists had passed the educational courses of this field which can explain their low knowledge. This highlights the need for more concentration of the managers to educational programs and holding these courses or even dispatching the personnel to pass these courses for better infection control.

Footnotes

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Conflict of Interest:

The authors declared no conflict of interest.

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