Effects of Applying Paper- Based Versus Electronic Nursing Process on Quality of Care among Nursing Students

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Background: Using thinking-based scientific methods such as paper-based and electronic nursing processes in nursing education can lead to education of skilled and efficient experts that can affect students' satisfaction in addition to their quality of care. The present study aimed to compare the effects of recording and implementing the nursing process based on two methods (paper-based and electronic) on the quality of patient care and nursing students' satisfaction.

Methods: This randomized-field trial was conducted in 2014 on 64 nursing students that were randomly assigned into two groups of paper-based and electronic nursing process. The intervention included a one-day training on the nursing process and then its implementation on patients using the two mentioned methods during two weeks of internship. Quality of care was measured through a researcher-designed care quality questionnaire before and after the intervention. Students' satisfaction with the implementation of the nursing process was measured through a researcher-designed students' satisfaction questionnaire after the intervention.

Results: The mean (±standard deviation) score of students' satisfaction in the paper-based nursing process and the electronic process was 37.3±4.7 and 68.9±14.2, respectively. There was a statistically significant difference between the two groups (P=0.015). After the intervention, the mean score of care quality in the electronic group was 46.9±5.6 and the mean score of the paper-based group was 39.9±9.2. This difference was also statistically significant (P<0.05).

Conclusion: Since electronic nursing process can increase quality of care and students' satisfaction more than the paper-based method, the use of electronic method may facilitate the implementation of the nursing process and change education and care giving from traditional forms to a thinking-based approach. Therefore, it is recommended to pay more attention to such method in planning nursing education.

Keywords: Nursing Process, Care Quality, Nursing Student

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Introduction

The purpose of nursing care is to improve and promote patients' health and physical needs as well as their emotional, mental, psychological and social needs (1). Nowadays, nursing reinforces the need to implement holistic and qualitative care. Therefore, it is important to educate nursing students to become reliable, skilled and efficient people since today's society is in dire need of such experts in the field of healthcare services (2). Due to increased awareness of patients, change of care strategies and the need of societies for enabled nurses, most countries pay particular attention to the education of nursing students. Each patient has unique characteristics in different clinical conditions and there is no constant solution for elimination or alteration of the problems in different patients. Nurses should be able to give new and appropriate care (3), since studies have shown that only 55% of the provided cares have followed the scientific evidence even in developed countries. For instance, researchers in countries such as the United States and Netherlands have estimated that 30% to 45% of patients receive cares that are not evidence-based and 20% to 25% of the provided cares are unnecessary and potentially harmful (5). In cases where nursing practice is in accordance with the nursing process, patients can receive proper care with maximum efficiency in minimum time (11). Therefore, lack of using the nursing process as care standard causes problems such as decreased job satisfaction, reduced academic and practical nursing, reduced quality of care and excessive dependence on physicians (12). The results of some studies show that nursing students' motivation and consequently satisfaction with their education and career are reduced by approaching clinical settings and the last years of their studies (4). The decline in students' satisfaction can be due to lack of positive social basis, inconsistencies of reality with initial impressions, negative attitudes of healthcare team toward this profession, inappropriateness of clinical setting, gap between doctors and nurses and low salary of nurses (2,3). This can make students leave aside their major, which is one of the important problems in the nursing profession in undergraduate and post-graduate levels. Every year, about 15-20% of nursing students give up continuing their education that has led to shortage of nurses worldwide. On the other hand, it has had other negative effects on professional motivation of other students. However, the need for health services and nursing care is increasingly felt due to rapid population growth. Therefore, any shortcomings in this group, directly affects the quality and quantity of healthcare and ultimately the health of individuals and society (3). Therefore, it is essential to use scientific methods such as the nursing process for giving care to patients to improve satisfaction in care providers and receivers.

One of the obstacles of implementing the nursing process is its implementation methods. The nursing process can be implemented in different ways in the patient's bedside. The implementation of nursing process requires completing multiple forms, choosing from menus, checking items and following up patients. Paper forms and recording by pen are used in conventional nursing process. Although availability and limited need for facilities are the advantages of this method, more opportunities and benefits such as possibility of implementing nursing process in electronic format are provided with the recent development of electronic systems (13). Due to statistics related to low usage of the nursing process, it seems necessary to take advantage of other means such as electronic tools to encourage nurses to implement this method in clinical practice (12). It seems that the traditional methods currently implemented cannot solely respond to the constantly changing needs of the informatics world and rapid advancement of science and knowledge (14). Electronic care record system will help to extend the standardization of care (15), which will make the components of nursing care more visible (16-18). It also enhances the quality and continuity of patient care, saves nurses' time, enhances accuracy and completeness of information (17,20), increases scientific levels of the nurse and reduces error (7). Despite the above advantages, one of the nurses' concerns is the impact of technology on their caring

role, because electronic documentation system requires spending more time with computer and may reduce the time allocated to direct care of patients (20). Access to a computer is also a major obstacle in using electronic care record systems for nurses. In addition, some researchers believe that interpersonal communication has somewhat decreased with the development of caring technology (16). However, due to divergent views and lack of conclusive evidence about the electronic recording of data, it is recommended to conduct a study on nurses who are directly related to this issue (19).Given the importance of strengthening the care quality in nursing students, its numerous benefits, the undeniable advantages of implementing nursing process and the gap of its application in clinical care, investigating the effect of implementing different methods of nursing process on the quality of patients' care among nursing students seems necessary (12, 21, 22). There are no relevant studies in Iran or other countries on the effect of implementing different methods of nursing process on the quality of patient's care among nursing students. Therefore, this study aimed to compare the effect of implementing nursing process using both paper and electronic methods on the quality of patient care provided by nursing students and students' satisfaction with the provided care.

Methods

This experimental study was conducted in 2014 on two groups (paper and electronic) with a pre- and post-intervention approach. Study subjects included 64 nursing students in the 5th and 6th semesters at the faculty of Nursing and Midwifery of Mashhad University, who had the inclusion criteria and were undergoing internship course in the department of neurology. Inclusion criteria consisted of willingness to participate in the study, lack of independent work experience (student work and employment) and participating in training program at the first day of internship. The main exclusion criteria included incompletion of the internship course for reasons such as transfer, cancellation, absence of more than one day, absence in the first day of the program and changing groups in the internship course between the paper-based and electronic groups. After obtaining permission from the ethics committee of the University and consent of clinical instructor and students, the subjects were randomly assigned into two groups of paper-based and electronic groups so that each group included half of the internship students (32 students in each group). The study intervention consisted of the nursing process implementation and recording using paper and electronic forms. For this purpose, a training program aimed at teaching the nursing process and method of its implementation was held. At the beginning of the program, demographic and educational form (including 7 questions about age, gender, marital status, total average, average marks of the internship course, interest in nursing profession and work experience) and a questionnaire (construct of assessing knowledge of nursing process) were given to students to answer in 15 minutes. The questionnaire consisted of 10 multiple-choice questions and had one correct answer designed according to reliable sources published in the past 5 years in Persian and English with scores ranging from 0 to 10. The content validity was confirmed by 10 experts. Test-retest reliability was used to determine the reliability of the questionnaire, which was found to be 0.81 using Pearson correlation coefficient. In order to unify students' basic information about the nursing process, nursing process education program was held at the first day of the internship course. At the beginning of the program, each student's awareness about the nursing process was measured using a researcher-designed nursing process awareness questionnaire, which was completed by the subjects in about 8 minutes. Whether the internship group was in the paper or electronic group, a one-day training program (5 hours) was held using group discussions. The training aimed to teach the nursing process and the method of its implementation (including the importance and meaning of the nursing process, definition, benefits, processes including: examination, nursing diagnosis, planning, implementation and evaluation, how to implement it in practice, and collection of data using the Gordon's patient evaluation form). Both

groups received the same training for the recording and implementation of the nursing process, but the last two hours of the program was devoted to practical training on its implementation. In the paper-based group, this included teaching how to work with the Nursing Process Electronic Software. The software was previously designed and evaluated by the research team. The main features of this software include listing nursing diagnoses based on matching patients' symptoms, choosing care plan tailored to each patient, defining a specific period to solve patients' problems, and possibility of printing the developed care plan in the software (7). At the end of the training, students' awareness of the nursing process was measured using the previously explained method. In the stage before recording and implementing the nursing process, the students' quality of patient care was measured by their instructor using a researcher-designed questionnaire on care quality. The questionnaire consisted of 10 items that was completed by the instructors in the department of neurology to evaluate the frequency of application of each item (the ability of examining the patient, nursing diagnosis, planning, implementation and evaluation) according to a rating scale. The score of each item ranged from 1 to 7, where score 1 means completely incompetent and score 7 means completely competent. The total scores ranged from 7 to 70. Validity and reliability of this tool were evaluated similar to the tool assessing awareness of the nursing process, which was reported to be 0.85. According to the provided trainings, nursing students in the paper-based and electronic groups implemented and recorded the nursing process for one patient for two weeks. At the end of the last day of the internship course, the quality of care was measured again using the care quality questionnaire. The rate of students' satisfaction with the nursing process was measured based on their group (electronic or paper) on a scale of four grades using Likert scale for each item, where zero means dissatisfaction with the nursing process and three means completely satisfied with its implementation. The scores ranged from zero to 24, but it was reported in form of percentages for ease of understanding. The content validity of this tool was confirmed by 10 experts (members of the Faculty of Nursing and Midwifery, Mashhad University) and its reliability turned out to be 0.88 using the Pearson correlation coefficient with the test-retest method. Satisfaction of each group was individually measured using the researcher-designed questionnaire of satisfaction with the nursing process. Once the data were collected and coded, they were entered into the computer. After ensuring the accuracy of data entry, SPSS-16 statistical software and descriptive statistical tests including Kolmogorov-Smirnov (to study the distribution of quantitative variables) independent t-test, paired t-test, chi-square and Pearson correlation coefficient were used for data analysis.A limitation of this study was the duration of intervention. Longer duration of the intervention would have caused more changes in terms of scientific care skills. However, since the students' internship lasts for two weeks in each department, it was impossible to prolong the time of intervention.

Results

In the paper group, 56.3% (n = 18) of the subjects were women, and 65.6% (n = 21) were women in the electronic group. Chi-square test showed no significant difference in the frequency of gender in the two groups (P=0.06) and the two groups were similar in terms of gender. The subjects were homogenous in terms of other demographic characteristics (Table 1). Before the intervention, mean and SD of the quality of patient care in students in the paper group was 19.8±3.0 and the care quality of students in the electronic group was 20.5±5.2. The results of independent t-test showed no statistically significant difference between the two groups. After the intervention, mean and SD of the quality of care in the electronic group (46.9±5.6) had a greater increase compared to the students in the paper group (39.8±9.2). The results of independent t-test showed that the difference between these two groups is statistically significant (P=0.001). The results of paired-t-test also showed that quality of care in both groups significantly increased after the intervention (p<.001) (Table 2).

Table 1: Mean and standard deviation (SD) of demographic and educational characteristics of the subjects

Variable	Paper-based	Electronic	P-value
	Mean ± SD	Mean ± SD	
Age (year)	21.0 ± 1.4	21.3 ± .9	*P=.41
Total average	16.5 ± .9	16.5 ± 1.2	*P=.98
average marks of the internship course	17.0 ± .9	16.8 ± 1.0	*P=.441
Interest in nursing (out of 10)	4.2 ± 2.2	5.2 ± 2.6	*P=.46
Awareness of nursing process before the training session	3.1 ± 1.5	2.8 ± 1.0	*P=.22
Awareness of nursing process after the training session	7.4 ± .9	7.0 ± 1.5	*P=.36

*Independent t-test

Table 2: Mean and SD of quality of care in the two groups

Quality of care	Paper-based	Electronic	Inter-group test results
	Mean ± SD	Mean ± SD	
Before intervention	19.8 ± 3.0	20.5 ± 5.2	P=.09; t=1.6
After intervention	39.9 ± 9.2	46.9 ± 5.6	P=.001; t=5.3
The difference between pre- and post-scores	20.1 ± 6.2	25.6 ± .4	P=.002; t=3.1
Intragroup test results	P<.001; t=15.3	P<.001; t=12.8	

Overall, the mean and SD of students' satisfaction with the method of implementing the nursing process was 52.8 ± 4.4 (out of 100). The mean and SD of satisfaction in the students of paper group and the electronic group with the method of nursing process implementation was 37.3 ± 4.7 and 68.9 ± 14.2, respectively. The results of independent t-test showed a statistically significant difference between the two groups in terms of satisfaction with the nursing process (P=.015).

Highest level of satisfaction in the paper group was related to the design of the paper forms (25%) and their efficiency for nurses (18.7%), while the lowest level of satisfaction was related to the use of paper forms for better implementation of the nursing process (71.9%) and the allocation of time for their completion (75%). Moreover, 93.7% of the students in the electronic group were satisfied with design of the software and 78.1% were satisfied with effectiveness of the software in improving patient's care. The lowest level of satisfaction was observed in efficiency of the software for employed nurses (15.7%) (Table 3).

Pearson correlation coefficient showed a direct significant linear relationship between the mean of the quality of scientific care in the student with awareness of the nursing process (P=0.002 , r=0.58) and average marks of the internship course (P=0.04 , r=0.26). There was no significant relationship between other demographic and educational variables with scores of the scientific care skill. There was also no significant relationship between demographic variables and nursing students' satisfaction with the nursing process implementation.

Table 3: Frequency distribution of students' satisfaction with the components of nursing process implementation in each group

Item	Paper-based				Electronic			
	Very high	High	Medium	Little	Very high	High	Medium	Little
To what extent does the use of paper forms / electronic software of nursing process affects the enhancement of patient care?	1(3.1%)	1(3.1%)	30(93.8%)	-	1(3.1%)	24(75.0%)	6(18.8%)	1(3.1%)
How satisfied are you with these forms / this software for better implementation of the nursing process in clinical practice?	-	3(9.4%)	6(18.8%)	26(71.9%)	5(15.6%)	15(46.9%)	11(34.4%)	1(3.1%)
How satisfied are you with the design of the forms / software?	1(3.1%)	7(21.9%)	5(15.7%)	19(59.4%)	1(3.1%)	29(90.6%)	2(6.2%)	-
How satisfied are you with educational content of the forms / software?	-	4(12.5%)	13(40.6%)	15(46.9%)	8(25.0%)	13(40.6%)	11(34.4%)	-
How satisfied are you with the time allocated to fill out the forms / software menu?	-	3(9.4%)	5(15.7%)	24(15.0%)	6(18.8%)	18(56.2%)	5(15.7%)	3(9.4%)
How effective is this form / software for employed nurses?	1(3.1%)	5(15.6%)	11(34.4%)	15(46.9%)	1(3.1%)	19(59.4%)	7(21.9%)	5(15.15%)
To what extend do you agree to use the form or similar forms/ software or similar software in other departments?	-	3(9.4%)	11(34.4%)	18(56.2%)	3(9.4%)	18(56.2%)	7(21.9%)	4(12.5%)

Discussion

The results show that the mean and SD of the quality of care provided by the students increased after the intervention in both groups and this increase was significantly greater in the electronic group. After the intervention, students' satisfaction in the electronic group was significantly higher than the paper group's satisfaction with the nursing process.

Since there was no study found in our extensive literature review on the impact of the nursing process implementation on the quality of care provided by nursing students, it was not possible to compare the results with similar studies. However, since the scores of caring skill in both groups increased after the intervention, it can be concluded that the training program of nursing process focuses on promoting professional performance and management of caring skills in students, while this skill of nursing students have been reported to be poor or average in most studies. For example, according to the opinion of students in study of Sabeti et al. (2011), 40% of them lack complete proficiency in performing physical examinations of palpation, auscultation and percussion, which may be due to the lack of providing care based on the nursing processes and inaccurate assessment of the patient (25). The results of Cooper et al. (2010) study also showed that nursing students have difficulty in managing critically ill patients (26). In Agha Mohammadi (2011) study on the attitude of nurses toward nursing students, most nurses believed that nursing students have not acquired sufficient clinical skills and they are not completely prepared to perform clinical tasks (27). Vahidi et al. (2002) also reported the ability of nursing students as average from their own perspective in providing care and services to patients (24). Given the advantages of the nursing process including increased critical thinking ability and independent performance, it can be expected that the nursing process can help increase caring skill of nursing students in both groups. Jerlock (2003) believes that in this caring method, students will face challenging situations during their professional career that require decision making and appropriate measures. Therefore, it is necessary to strengthen problem solving, decision-making and rethinking abilities to achieve this goal (29).

Electronic tools can be used to increase reinforcement and facilitate learning, because the results of this study showed that increase of caring skill among students in the electronic group was greater than the paper-based group. This may be due to the features of the software used in this study. This software offers nursing diagnosis and care to users, and the student should choose one that is tailored to the patient, implement nursing process for patients and perform later examinations based on the software's defined time to treat the patient. The regulatory system considered in this method makes it possible to precisely control students and nurses and understand their strengths and weaknesses. Concerning the nursing students' satisfaction with implementation of the nursing process, greater satisfaction of the electronic group may be due to the features of the software used. The software considers nursing process steps and helps its users (students or nurse) to raise awareness, provide individual care, increase accuracy, save time and increase the quality of care. In agreement with these results, the results of Sayadi et al. (2013) on "Nursing students' viewpoints on the application of nursing process software designed for mobile environment" and study of Mazloum and Rajabpoor (2015) titled "designing and evaluating electronic nursing process: a step to improve learning and nursing care". The mentioned studies also showed that working with the nursing process software is accompanied by satisfaction of most nursing students (7,12). The results in study of Chi et al. (2005) on the implementation of a computer software for nursing diagnosis showed that the software helps nurses in proper diagnosis of diseases, and implementation of this software improves process performance of nurses and ultimately improves quality of nursing. The results of Teresinha et al. (2013) study in Brazil and Medina-Valverde et al. (2012) study in Spain

showed that computerized nursing process provides the opportunity for nurses to consult with experts, increase their clinical judgment skills and enhances nurses' decision-making confidence (20,30). Experts believe that one of the issues that needs to be considered in universities' curriculum is the use of technology in education, since technology is accompanied with the satisfaction of its users as well as the above benefits (7,12). Nevertheless, further studies should be conducted in this regard to draw a more accurate conclusion.

The direct relationship between awareness of the nursing process and scientific caring skill indicates that, students who are more aware of the nursing process can take care of patients more appropriately and more scientifically. Because experts believe that the use of the nursing process would provide a safe and qualitative care for patients (8,9). The direct relationship between the average score of internship course and scientific caring skill score indicates that, students who have a stronger scientific basis have more caring skills compared to other students. This may be due to more accurate and more complete implementation of 5-stages of the nursing process.

Conclusion

The results of this study showed that electronic implementation of the nursing process increases the mean quality of care in nursing students more than the paper-based method. The use of software may increase quality of care and nursing students' satisfaction. Application of this technology in nursing training can prepare students for safer patients' care. It also helps students improve their skills and quality of care. However, more studies are required in this regard to investigate the opportunities and challenges of this method from different aspects. Implementation of the nursing process by any means changes traditional education and care to thinking-based method, therefore more attention should be given to this issue in planning nursing education.

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