The Efficacy of Training and Application of Severity of Illness Scoring Systems on Knowledge and Attitude of ICU Staff

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ABSTRACT
The predicting scoring systems help us to patients' classification in order to receive services and medical care. It seems one of the reasons for not using these systems is unaware of staffs. The aim of this study was assessment the effect of training predicting scoring systems and applying SOFA on knowledge and attitude of nurses and specialists in ICU wards of educational hospital in Sari city. This pre-experimental study was performed using a self-made questionnaire to assess knowledge and attitude. After primary assessment, participants were trained and applied SOFA for three months. Evaluation was performed in four stages: before training, 10 days after training, one month and three months after SOFA application. Results were analyzed by SPSS software, descriptive tests and repeated measurement. Results show that there were 43 (71.7%) female and mean age was 32.53±7.3 years. The average knowledge score was improved from very weak to excellent and the average attitude score was improved from moderate to excellent after three months of applying SOFA. Regarding the importance of these systems in the ICU management, we recommend this topic is included in nursing and medical curriculums. Also strategies should be considered for applying them in all ICU wards in the country.

Keywords: knowledge, attitude, ICU staff, predictive scoring systems, SOFA

INTRODUCTION
Nowadays organ dysfunction can occur while managing critically ill patients and is considered the main cause of morbidity and mortality in intensive care units[1]. For this reason, one of the highest priorities for research in ICU is predicting mortality and morbidity of patients[2]. Due to limitation and costly of intensive care beds in hospitals, evaluating of patients causes that we can
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choose patient with more critical condition, as well nurse and physician do therapeutic options with more accuracy[3]. Application of scoring systems help stop patients’ classification regarding to types of medical care and provides better judgment for prediction of mortality, bed occupancy, and progress of treatment[4]. Outcome prediction can be useful in providing information on likely patient outcomes for relatives of critically ill patients and potentially for therapeutic decision making and guide to resource allocation. Determination of disease severity and outcome due to in evaluating various medical interventions, quality of care, better management of medical records, patient classification, standardization of clinical research, and plan optimal and cost-effective therapeutic approaches[5]. It is also important to viewpoint of managing because it provides logical state to priority patients in receiving special services, to alter human resources and occupancy rate[4, 5].

There are four severity of illness scoring systems that are more valid by most sources: 1) Acute Physiologic And Chronic Health Evaluation (APACHE II, III, IV); 2) Simplified Acute Physiologic Score (SAPS); 3) Mortality Prediction Model (MPM); and 4) Sequential Organ Failure Assessment (SOFA)[5-7] that the predictive value of these scores is approved after many studies[1,8]. These scoring systems have been used as an auxiliary tool categorize participants in many clinical trials[9-11].

The APACHE scoring system is widely used in the United States. The most recent versions include APACHE II through IV. APACHE requires the input of many clinical variables, from which a severity score is derived. This is including factors such as age, diagnosis, prior treatment location, numerous acute physiologic and chronic health variables. APACHE uses the worst values from the initial 24 hours of ICU admission. All of the APACHE instruments have excellent discrimination, but less impressive calibration.

Like most predictive models, APACHE requires periodic retesting, revising, and updating because its accuracy decreases as treatments and other factors influencing mortality change. The most frequently cited APACHE models are APACHE II and III, although APACHE IV has also been validated[7]. The SAPS streamlines data collection and analysis without compromising diagnostic accuracy. The SAPS II is the most widely used version. It calculates a severity score using the worst values measured during the initial 24 hours in the ICU for 17 variables. Several of the variables (i.e. AIDS, metastatic cancer, hematological malignancy) are dichotomous, meaning that they are either present or absent. The others are continuous variables that have been made categorical by assigning points to ranges of values [7]. The MPM II is the most common version of the MPM. A severity score is calculated from 15 variables, as assessed at the time of ICU admission. The MPM II severity score that is measured on admission (MPM II 0) can be refined after 24 hours (MPM II 24) by updating seven of the admission variables and adding six variables. An advantage of the MPM II 24 is that it can be compared to the SAPS and APACHE, since all three scores are determined after the first 24 hours of admission[7].

The SOFA uses simple measurements of major organ function to calculate a severity score. The scores are calculated 24 hours after admission to the ICU and every 48 hours thereafter. The mean and the highest scores are most predictive of mortality. In addition, scores that increase by about 30 percent are associated with a mortality of at least 50 percent. The SOFA severity score is based upon the following measurements of 6 organs function: Respiratory system, Cardiovascular system, Hepatic system, Coagulation system, Neurologic system, Renal system[7]. For example in study was performed at a teaching hospital in 2010 to compare the performance of five severity scoring systems: SAPS II, MPM II0 (at admission), MPM II24 (at 24 hours), MPM II48 (at 48 hours), and MPM Overtime; and their ability to predict mortality rate for the intensive care unit patients that All
five severity scoring systems showed accurate standardized mortality ratio[12].

Also another study performed at a teaching hospital in Brazil to evaluate the application of the SOFA in describing the severity of organ dysfunctions and the associated mortality rates in 1164 adult critically ill patients who were admitted consecutively into intensive care units indicated an increase in the mortality rate when the SOFA scores increased and patients with low scores (0—5) upon admission and who increased to the medium or high SOFA groups had a significantly higher mortality rate (51.7 and 100%, respectively, p < 0.001). In results applying SOFA to critically ill patients effectively described the severity of organ dysfunctions, and higher SOFA scores had a positive association with mortality[1].

Despite many recommendations and applications of these scores in medical literature, Iranian database research demonstrates only few studies about APACHE II, MPM, and SAPS and their results are not routinely utilized in ICU wards at national level. Since the best approach to manage organ dysfunction is prevention and first treatment, the organ dysfunction assessment systems like SOFA can be used as a bedside tool to monitor patients and may help decrease mortality[1]. However, it seems necessary using a valid score for evaluating intensive care unit patients in order to proper judgment about quality of services, especially nursing care.

Nonetheless, to evaluate patients in many hospitals and teaching centers is used the traditional methods such as checking vital signs and GCS[4]. It appears that one reason not to utilize these systems is lack of knowledge, so that critical care staff must have special knowledge and to be familiar with new approaches[13].

In order to applying knowledge in a society we need increasing attitude of it using both teaching and training but in many cases only are done teaching without training that cause missing acquired knowledge in during time. Education is a process in a set of knowledge and associated skills is transmitted and led to development of understandings, attitudes, skills, and capabilities in a specific field. Attitude is relatively persistent organization of beliefs about an object or situation where a person is ready to reaction in a particular direction. So attitude is created following knowledge, and when a person become with positive attitude, he can be physically and mentally ready for doing any cooperation[13].

According to these facts, we planned this study to assess knowledge and attitudes of Intensive Care Unit Staff about severity of illness scoring systems and then assess efficacy of training these systems and SOFA application on their knowledge and attitude; because SOFA is very simple, easily measurable, cost-effective, and continuous evaluation[1,14] in order to facilitate its utilization in intensive care units to benefit patients from more accurate and less expensive therapeutic approaches Nowadays organ dysfunction can occur while managing critically ill patients and is considered the main cause of morbidity and mortality in intensive care units[1]. For this reason, one of the highest priorities for research in ICU is predicting mortality and morbidity of patients[2]. Due to Limitation and costly of intensive care beds in hospitals, evaluating of patients causes that we can choose patient with more critical condition, as well nurse and physician do therapeutic options with more accuracy[3]. Application of scoring systems helps to patients’ classification regarding to types of medical care and provides better judgment for prediction of mortality, bed occupancy, and progress of treatment[4]. Outcome prediction can be useful in providing information on likely patient outcomes for relatives of critically ill patients and potentially for therapeutic decision making and guide to resource allocation.

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II MATERIALS AND METHODS
This is a quasi-experimental study in order to assess the efficacy of severity of illness scoring system training and SOFA application on knowledge and attitude of three ICU staff of the educational hospital, Sari, Iran. Because of the possibility of sharing information between participants and the different context of this ICU with other ICUs of the Mazandaran University of Medical Sciences, we used census sampling and 60 people from 65 personnel participated in our study comprising 50 nurse, 7 anesthesiologist, and 3 pulmonologists. 4 nurses and 1 anesthesiologist were reluctant to participate in the study. This study was designed in four steps that included: pretest of knowledge and attitude, evaluate 10 days after education, evaluate one month after applying SOFA, evaluate 10 three months after applying SOFA. The tool for data collection was a questionnaire prepared by researcher containing demographic information, 20 questions for evaluating knowledge (10 questions about knowledge of severity of illness scoring system and 10 questions about knowledge of SOFA), and 30 questions for evaluating attitude about the severity of illness scoring systems and the utilization of SOFA. Each question in the knowledge topic had provided four possible options: one correct answer which scored 1, two wrong answers which scored 0, and “I don’t know” answer which scored 0. The range of scores was (0-4; very weak knowledge), (5-9; weak knowledge), (10-15; moderate knowledge) and (16-20; excellent knowledge) that scores above 10 were considered as an aware personnel. The questions in the attitude section were arranged according to Likert scale, as the following: strongly agree, agree, no opinion,
disagree and strongly disagree with scoring from 5 to 1 respectively and the range of scores was (30-54; very low attitude), (55-79; low attitude), (80-104; moderate attitude), (105-129; good attitude) and (130-150; excellent attitude).

To assess questionnaire validity we used content validity. We prepared the questionnaire using literature and asked from 10 university professors that were expert opinions about it to apply their comments.

Also reliability of the questionnaire was assessed by test-retest method then questionnaires were completed by 18 ICU staff outside the study population and restested after ten days that intra-class correlation coefficient 0.84 was obtained. At first pretest was performed on all participants and then we conducted educating seminars comprising 8-12 persons [15]. After 10 days of this educating program and before the SOFA application, we performed a post-test [16].

This test show a differentiate between impact of education and SOFA application. Finally, the SOFA was applied by ICU staff in three months on patients who had including criteria for SOFA. The staff began scoring and assessing the outcome of each patient.

After one month through the study, staffs were examined again. At the end of the course, the questionnaire was completed to evaluate their knowledge and attitude.

We performed the first and third month test to determine the effects of time in this study. We classified knowledge scores into very weak (0-4), weak (5-9), moderate (10-15), and excellent (16-20) and those with scores 10 or more were considered knowledgeable people. The attitude scores were classified as very low (30-54), low (55-79), moderate (80-104), well (105-129), and excellent (130-150). Eventually, data were analyzed with SPSS (Statistical Package for Social Science, version 16) using descriptive statistics (frequency, mean, standard deviation and percentage) and analytical tests (repeated measurement, Mann–Whitney U and Greenhouse-Geisser).

[III] RESULTS

Results showed 43 (71.7%) were female and 27 (28.3%) were male. The mean age of participants was 32.53 ± 7.3 years. Only 26.7% of participants passed an ICU course that most of them were physician and 23.3% of them were familiar with severity of illness scoring systems. Mann–Whitney U test showed mean rank of knowledge and attitude of participants that had passed ICU course or took part in educating seminars were familiar with illness systems before education were significantly higher than those without these characteristics (Table 1). Greenhouse-Geisser statistic test demonstrates significant increase in mean scores of knowledge over time (p = 0.001). Also repeated measurement and Fisher’s test illustrate significant statistical improvement in attitudes over time (p = 0.001) (Table 2).

Table 1. Comparison of knowledge and attitude according to number of

<table>
<thead>
<tr>
<th>Mean rank &amp; P-value variables</th>
<th>Frequency</th>
<th>Knowledge mean rank</th>
<th>Mann–Whitney U</th>
<th>Attitude mean rank</th>
<th>Mann–Whitney U</th>
</tr>
</thead>
<tbody>
<tr>
<td>passing ICU course</td>
<td>16</td>
<td>38.28</td>
<td>P=0.019</td>
<td>43.47</td>
<td>P=0.001</td>
</tr>
<tr>
<td>No passing ICU course</td>
<td>44</td>
<td>27.67</td>
<td>P=0.001</td>
<td>25.78</td>
<td>P=0.026</td>
</tr>
<tr>
<td>Seminar attendance</td>
<td>7</td>
<td>55.29</td>
<td>P=0.001</td>
<td>44.14</td>
<td>P=0.026</td>
</tr>
<tr>
<td>No Seminar attendance</td>
<td>53</td>
<td>27.23</td>
<td>P=0.001</td>
<td>28.70</td>
<td></td>
</tr>
<tr>
<td>Studying about systems</td>
<td>16</td>
<td>45.56</td>
<td>P=0.001</td>
<td>42.00</td>
<td>P=0.002</td>
</tr>
<tr>
<td>No Studying about systems</td>
<td>44</td>
<td>25.02</td>
<td>P=0.001</td>
<td>26.32</td>
<td></td>
</tr>
<tr>
<td>experience of systems application</td>
<td>8</td>
<td>44.13</td>
<td>P=0.007</td>
<td>35.00</td>
<td>P=0.029</td>
</tr>
<tr>
<td>No experience of systems application</td>
<td>52</td>
<td>28.4</td>
<td></td>
<td>29.81</td>
<td>*NS</td>
</tr>
<tr>
<td>Familiarity with systems</td>
<td>14</td>
<td>50.39</td>
<td>P=0.001</td>
<td>42.86</td>
<td>P=0.002</td>
</tr>
<tr>
<td>No Familiarity with systems</td>
<td>46</td>
<td>24.45</td>
<td></td>
<td>26.74</td>
<td></td>
</tr>
</tbody>
</table>

*NS = Non Significant
Table 2. The mean ± SD of knowledge and attitude of examinees in evaluated intervals.

<table>
<thead>
<tr>
<th>Intervals</th>
<th>Variables</th>
<th>Before education</th>
<th>10 days after education</th>
<th>One month after application</th>
<th>Three months after application</th>
<th>Repeated measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Knowledge</td>
<td>3 ± 5.253</td>
<td>18.41 ± 0.961</td>
<td>16.40 ± 1.404</td>
<td>17.83 ± 1.342</td>
<td>P=0.001</td>
</tr>
<tr>
<td></td>
<td>Attitude</td>
<td>100.42 ± 11.337</td>
<td>122.30 ± 9.807</td>
<td>126.16 ± 7.783</td>
<td>128.15 ± 6.491</td>
<td>P=0.001</td>
</tr>
</tbody>
</table>

[IV] DISCUSSION

Our results from knowledge of participants before educating severity of illness scoring systems indicated that most of them had very weak knowledge. Also these findings were associated with direct correlation with educational status of participants. A study in Taiwan showed that the nursing staff in the ICUs lacked sufficient knowledge and attitudes about APACHE[17]. Also another study in Iran showed that 54% and 39% of ICU nurses had weak and moderate knowledge about patient care, respectively. Although it is expected that working in ICU should have resulted in increasing professional skills, but ICU personnel only became expert in activities that repetitively do them[18]. In our study, 94% of the participants had Bachelor of Science degree in nursing and they were about 30 year old and 96% of them had very weak knowledge, it seems that non-specialized and inefficiency of undergraduate nursing education, inefficiency of their curriculum and absence of well-defined criteria for employment nurses in ICU cause to the weak knowledge of participants. As we know that positive attitudes of participants concurrent with their knowledge imply this fact that they feel necessity of these trainings.

Actually, we believe their active participation during the course of the study roots in this concept. However we believe this issue needs further etiologic investigation. Also we found that the knowledge and attitudes of those with prior courses on ICU care were more than those who had not such courses. We believe that higher educational accomplishments sensitize individuals to do better quality care and lead to more study and attention to related topics, so cause to better attitudes. On the other hand, other studies emphasize that nurses who passed ICU courses besides enhancing experience they have increased their knowledge[18]. Our findings about 10 days after teaching predictive scoring systems showed that all of participants had excellent scores which clearly define the impact of education on increasing knowledge and attitude. Another study also found positive impact of the education on increasing knowledge and practice of nurses in neonatal ICU wards[19]. This conclusion was repeated in a study on knowledge and attitude of nursing students[20]. One distinguishing feature of the ICU nurses is need to comprehensive knowledge about theoretical and practical aspects of patient care to best satisfy patients’ needs[18]. The medical graduates are among those groups that their knowledge deficiencies would adversely affect individuals and the health system[21]. So it is suggested the nursing staff with higher knowledge and positive attitude are employed in ICUs. Although training the nursing staff is essential in all clinical fields, but ICU staff training is more priority because of its extraordinary sensitivity[22]. Results of study about knowledge and attitude after one and three month of SOFA application showed that mean scores of knowledge of participants at the end of third month was significantly increased prior to...
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pretest. But the knowledge scores were declined to moderate in 23.3% of them at the end of first month in comparison to 10 days after education. Nevertheless, at the end of third month the mean scores for knowledge was excellent in 96.7% which clearly demonstrates efficacy of SOFA application in improving knowledge of participants. Although this difference was not statistically significant it appears this low decrease resulted from the prolonged time after education and insufficient time for best application of these systems. Unfortunately, experience and practice is not considered in many educational courses which may result from deficiency of resources, inappropriate infrastructure and absence of skilled specialists for training and lack of financial support[23]. In one study that performed to assess the knowledge of ICU nurses and the effects of educational programs on their knowledge, the results two and 20 weeks after a training course showed that mean knowledge scores after two weeks was significantly more than pretest which confirms the positive role of education in improve of nurses knowledge, but after 20 weeks, the scores became similar to pretest[24]. Regarding our results if our examinees were evaluated in prolonged interval without any supervision on practical application of systems, their scores would have declined. The findings of current study emphasize the importance of education and persistent training, planning, evaluation, supervision and continuing application of learned knowledge to prevent decrement of knowledge and attitudes which is similar to other studies[25].

[V] CONCLUSIONS

According to our results, human resources training and application of learned knowledge is among the most confident ways to organizational optimization and not only develops individual talents, but also improves strategies and skills and can enhance occupational knowledge and skills and prevent wasting of human resources. Some of limitations of our study were possibility of sharing information between participants and the different context of this ICU with other ICUs in city that caused we couldn’t set into two groups. Also negative attitude in some colleagues caused slow progress in study.

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