Assessment of Anesthetist's Non-Technical Skills in Iranian Hospitals

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Abstract

Background: Safe performance and patient safety are two important issues in the delivery of healthcare services. Non-technical skills are necessary for safe performance of anesthesiologists in the operating room. This study aimed to assess the anesthetists' non-technical skills in Iranian hospitals.

Methods: This cross-sectional study was conducted on 38 anesthetists working in orthopedic surgery wards of two hospitals in 2019. The data were collected using the Anesthetist's Non-Technical Skills (ANTS) system, which included four domains, namely task management, teamwork, situation awareness, and decision-making. The anesthetists were assessed by a trained observer via observing and recording the events during surgeries.

Results: The mean score of ANTS was 10.12±1.66 out of 16. Among the four skills, the highest and lowest mean scores were related to "task management" (2.94 out of 4) and "decision-making" (2.26 out of 4), respectively. Work experience showed a significant positive relationship with "decision-making" (P=0.008, r=0.974). However, higher education level was not associated with improved anesthesiology skills.

Conclusion: The quality of non-technical skills was below the acceptable level in the studied anesthetists. Thus, it is recommended that the anesthetists' skills should be improved through educational and political interventions.

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Introduction

Currently, healthcare has been focused on performing safe care and ensuring the patient safety[1] due to concerns over these issues in the recent years.[2] It is extremely important in healthcare systems to avoid errors and negative events among the patients.[2] Surgical patients are at risk of harm due to adverse events in the delivery of healthcare services,[3] which takes place in approximately 10% of cases.[4] In other words, a considerable number of preventable incidents occur during surgical operations.[3] Medical errors in the operating theater can in turn result in irrecoverable outcomes for patients.[5]

Assessment of unpleasant events in healthcare has shown that many errors can occur due to defects in cognitive and social skills.[6] Although technical skills are important, they are not sufficient to prevent errors and incidents.[7] In other words, surgical competence requires more than technical skills to develop the patient safety and maintain the standards.[6] Non-technical skills are the social and cognitive skills that are involved in safe task performance.[8] Such skills include decision-making, teamwork, task management, and situation awareness,[9] which help to catch errors and are useful when a problem occurs.[10] Thus, assessment of non-technical skills is significant in the investigation of surgical[3] and patient safety.[11] Non-technical skills can reduce miscommunication and interruptions during the surgery.[12] A good level of non-technical skills can reduce errors, while a defect in these skills can cause errors,[13] resulting in patient injury.[14]

As to the role of anesthetists, we can briefly say that the anesthetist is the first surgical team member who enters the operating room. S/he talks to the patient and checks his/her identity, reason for surgery, history, sensitization to drugs, etc. After consultation with the anesthesiology specialist, the anesthetist anesthetizes the patient and ensures that her/his whole body and head are in the correct position. During the surgery, the anesthetist monitors the patient's consciousness, and brings him/her to the recovery unit when the surgery is complete.

Operational and organizational factors can cause incidents during anesthesia.[2] Defects in human factors play an important role in 82% of anesthesia problems.[6] Hence, it is necessary to pay special attention to safety in anesthesia practice.[2] Anesthesia is a risky domain[2] where patients and hospitals anticipate safe performance.[15] Non-technical skills play a crucial role in anesthesia[16] and should, consequently, be studied. Previous studies on anesthetists' non-technical skills have shown different results. For instance, Wunder[17] reported an acceptable level of these skills among the first-year student registered nurse anesthetists. However, Prattes et al.[18] concluded that "decision-making" and "situation awareness" skills obtained the lowest scores and had to be improved. Another study also revealed a moderate level of anesthetists' non-technical skills.[19] Furthermore, Garosi et al. reported a high rate of communicational patterns among the anesthetists, which could cause medical errors.[20] Considering the importance of the anesthetists' non-technical skills and their protective role in adverse events, the present study aimed to assess the anesthetists' non-technical skills in Iranian hospitals.

Materials and Methods

Participants

This cross-sectional study was conducted in census method on all 38 anesthetists working in the orthopedic surgery wards of two Iranian hospitals. The anesthetists were observed in 38 hand surgeries. The surgical wards and types of surgeries were selected randomly. The inclusion criterion of the study was the anesthetist's willingness to cooperate.

Data Collection Tool

A special assortment of non-technical skills has been developed for assessment of anesthetists.[17] In the present study, the data were collected using the Anesthetist's Non-Technical Skills (ANTS) system. This system is an assessment tool that was created after four years of cooperation among anesthetists and psychologists at the University of Aberdeen, United Kingdom.[15] The skills in the ANTS system were adopted from literature review, observation of surgeries, task analysis of anesthetists, and analysis of adverse events in the operating room.[13] The ANTS system contains four main skill categories, namely "task management", "teamwork", "situation awareness," and "decision-making", and 15 elements each including the examples of good and poor behaviors as behavioral markers.[21] These elements can receive a score from one to four as follows: 1=poor (weak performance), 2=marginal (performance causing concern), 3=acceptable (standard and satisfactory performance), and 4=good (excellent performance). There is also a "not observed" option for the elements that have not been seen. The description of the rating scores of ANTS is presented in Table 1. A previous study has confirmed the high acceptability, reliability, usability, and accuracy of the ANTS system.[16]

Psychometric Properties

To translate the ANTS system into Persian, wae used the standard forward-backward translation technique. First, the scale was translated into Persian by two experts in anesthesiology and human factors. Then, back translation was conducted by two other translators. Finally, a coordinator provided the Persian version of the ANTS system. In order to assess the content validity of the Persian version of the ANTS system, we gave the checklist to six anesthetists and six anesthesiology specialists. The Content Validity Ratio (CVR) and Content Validity Index (CVI) of all items were checked (CVR=0.54 and CVI=0.84). The concurrent validity of the ANTS system was also evaluated prior to data collection. In so doing, two observers (an anesthesiologist and a human factors specialist) observed 15 surgeries and separately rated the anesthetists in each surgery. The Interclass Correlation Coefficient (ICC) was found to be 0.88.

Data Collection

One hand surgery was randomly selected for each anesthetist. To collect the required data, a trained observer (human factors specialist) presented in the operating room before the anesthetists. The observer

Table 1: ANTS system rating options

Score	Level of behavior	Definition
1	Poor	Weak performance that can jeopardize patient safety. Quick solution is necessary.
2	Marginal	Performance causes concerns about patient safety. There is a huge need for improvement.
3	Acceptable	Performance is in standard level and is satisfying, but still can improve.
4	Good	Excellent performance that is in high standard level and increases patient safety. Exemplary one!
N/A	Not observed	The behavior was not observable in some cases.

dressed the operating room uniform and obtained permission from the patient as well as the surgical team members. He remained quiet during the surgery and did not disturb the surgical team members. He stayed in unsterile field behind anesthesia machine and observed all the anesthetists' behaviors and operating room events and rated the anesthesiologists using the ANTS checklist. The demographic information of the studied population was provided by the hospital.

Ethics

All ethical standards were observed in the data gathering process. Indeed, a letter was sent to the hospitals. Moreover, written informed consent forms were obtained from the study participants wduring the data collection. It should also be noted that the names of the participants, surgical cases, and anesthetists remained confidential.

Data Analysis

All data analyses were carried out using the SPSS 22 software. The Kolmogorov–Smirnov test showed the normal distribution of the data. Mean, Standard Deviation (SD), and range were used to report the mean score for each skill category. Pearson's correlation coefficient was used to assess the correlation between the behavioral categories as well as the relationship between the ANTS score and age and work experience. Moreover, independent-samples *t*-test was employed to evaluate the relationship between the ANTS elements and the participants' education level and gender. The significance level was set at 0.05.

Results

Demographics

The anesthetists' mean age and mean work experience were 38.05±4.87 and 14±5.32 years, respectively. In addition, 14 anesthetists (36.8%) were male and 24 were female. Moreover, 26 participants held ADs and the rest had B.Sc. degrees in anesthesiology.

Scores of Non-Technical Skills

The total score of ANTS was 10.12±1.66 out of 16 (range: 7.42-13.16). In addition, the participants' mean score of ANTS for individual items was 2.53±0.41 out of 4 (range: 1.65-3.29). The mean scores of the behavioral domains are presented in Table 2. Accordingly, task management had the highest mean score, while decision-making was the weakest behavioral domain.

All non-technical skill categories were positively correlated to each other, except for decision-making and task management (P=0.11).

Table 2: The means and standard deviations of the ANTS categories and elements

Categories and elements of ANTS	Mean±SD
Task management	2.94±0.47
Planning and preparing	3.36±0.50
Prioritizing	2.73±0.73
Providing and maintaining the standards	3.00±0.66
Identifying and utilizing the results	2.57±0.50
Teamwork	2.27±0.47
Coordinating activities with team members	2.42±0.76
Exchanging information	2.57±0.60
Using authority and assertiveness	2.00±0.57
Assessing capabilities	2.15±0.60
Supporting others	2.21±0.83
Situational awareness	2.64±0.51
Gathering information	2.89±0.56
Recognizing and understanding	2.57±0.69
Anticipating	2.47±0.61
Decision making	2.26±0.46
Identifying options	2.47±0.51
Balancing risks and selecting options	2.21±0.63
Re-evaluating	2.10±0.56

Table 3: The relationship between demographics and Non-technical skills

Demographics	P value
Age	0.248
Work experience	0.008*
Gender	0.136
Education level	0.359

*Significant

The Relationship between Non-Technical Skills and Demographic Features

The results revealed no significant relationship between age and the four ANTS behavioral categories. Only the subcategory of "identifying options" was moderately associated with age (P=0.048, Pearson's correlation coefficient=0.456). However, a significant strong relationship was found between work experience and decision-making scores (P=0.008, Pearson's correlation coefficient=0.974).

Independent samples t-test was used to evaluate the relationships between the ANTS scores and gender and education level. The results indicated no significant relationship between the four behavioral categories and the participants' gender, but females tended to have higher ANTS scores (2.50 vs. 2.54). The results also revealed no significant relationship between the education level and the ANTS behavioral categories. In other words, the anesthetists with B.Sc. degrees and ADs obtained equal mean scores (2.53). Table 3 shows the relationship between demographic features and non-technical skills.

Discussion

This study aimed to assess the anesthetists' non-technical skills in Iranian hospitals. All anesthetist technicians working in two orthopedic units were studied. Only one

type of surgical unit (orthopedic) was selected to make the results comparable. The study findings showed that the anesthetists' non-technical skills were moderate and below the acceptable level. Indeed, there was a significant relationship between work experience and decision-making skill.

In this study, the total mean score of ANTS was lower compared to the results reported by Wunder et al. (12.7±2.12)[17] who studied first-year student registered nurse anesthetists via simulated scenarios as well as the results obtained by Neuschwander et al. (12.2 out of 16)[22] who assessed these skills in anesthetist residents. However, the results were higher compared to those reported by Skelton et al. (8–9 in the control group)[6] who studied 20 anesthetists during cesarean deliveries. Different contexts of the studies could be one reason for the different mean scores. In addition, using a simulation-based design and assessing anesthetist residents could account for the higher scores in the studies performed by Wunder et al. and Neuschwander et al., respectively. Furthermore, the lower scores in the present study could be attributed to lack of attention and carelessness concerning non-technical skills in anesthetists' academic education. Lack of supervision could also be another reason for these lower scores. Many poor behaviors listed in the behavioral markers were recorded that led to lower ANTS scores. In this regard, several behaviors, such as exiting the operating room during surgery, using cell phones, distracting others, lack of attention, and poor decision-making were observed in the anesthetists' performance. Moreover, absence of an anesthesiologist was seen in about half of the surgeries, which could put the patient's safety at risk. Communication failure and irrelevant conversations were worrying issues, as well. Overall, it seems that the anesthetists were not aware of the importance of these skills. This was supported by another study on non-technical skills in Iran where all the skills were found to be at an intermediate level.[19] Some poor behaviors were also reported in another study on anesthesiology sub-teams in Iran.[23] These results might be attributed to the lack of significant attention to non-technical skills in the anesthesiology curriculum in Iranian medical universities.

Among the four behavioral categories, "decision making" had the lowest mean score, which was comparable to the findings of the research conducted by Prattes et al.[18] On the other hand, "task management" obtained the highest score. This category of skills needs lower collaboration and cooperation with other team members in the surgical procedure. Since the teamwork score was also under the acceptable level, it seems that Iranian anesthetists have better individual skills than the skills requiring more interaction with other team members.

Considering the relationship between the anesthetists' ANTS scores and demographic characteristics, a strong positive relationship was found between work experience and the decision-making category. In contrast, Wunder[17] showed no significant relationship between ANTS and demographics. In the present study, the anesthetists with higher work experience had higher scores. In addition, the anesthetists with ADs had better scores compared to those with B.Sc. degrees. This implies that the number of working years was more effective in enhancing the non-technical skills compared to the number of years studied in the university. The results indicated no significant difference between male and female anesthetists regarding the ANTS scores, but females showed higher positive behaviors and responsibility. In case a larger sample size was estimated, a significant difference might have been found.

The results of the current study showed that the anesthetists' non-technical skills were below the acceptable level. Training programs can play an important role in improvement of these skills. Some interventional studies have shown that training courses were useful and could reinforce the skills;[6, 17, 22] even a three-hour educational program led to remarkable improvements.[17] Thus, it is recommended that some courses related to anesthetists' non-technical skills in the anesthesiology curriculum in Iranian universities should be incorporated and emphasized. Some studies have recommended that setting policies in the operating room could be useful as well.[19] Regarding the current situation, policies like staying in the operating room until the end of surgery and not using cell phones as well as more supervision on the part of surgical ward supervisors could be useful. Asking the surgeons to instruct anesthesiologists regarding some items when they are careless could also be considered a solution.

One of the limitations of this study was its small sample size. Since it was intended to make the surgeries more comparable, only orthopedic wards were included. Future studies are recommended to assess a large number of anesthesiologists and to compare ANTS scores among different surgical wards.

Conclusion

The anesthetists' skills were below the acceptable level. Thus, there is a need for improvement in the knowledge and application of non-technical skills. Informing the anesthetists about decision making strategies and enhancing their teamwork ability is necessary. Interventions including educational or policymaking measures can be helpful in improving the current situation.

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