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Original Article

Assessing Safety Status of Pediatric Intensive Care Units of Tehran, Iran according to the World Health Organization's Safety Standards

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Abstract

Introduction: Given that children in pediatric intensive care units (PICUs) are more vulnerable to safety risks, health care officials are required to identify the weaknesses and strengths of care and ensure the safety of these children. In this study, the safety status in PICUs of selected educational children's hospitals in Tehran, Iran, was examined and compared with standards proposed by the World Health Organization (WHO).

Methods: In this descriptive study, the performance of nurses with a bachelor's degree or higher and minimum work experience of six months in the PICU was examined. The study environment included four selected educational hospitals located in Tehran, Iran. Data collection tools were eight safety observation checklists based on the safety standards of WHO. Data collection took five months and the nurses' performance was categorized into three groups of undesirable, relatively desirable, and desirable. The data were analyzed using SPSS software version 13, descriptive statistics, and regression analysis.

Results: Consistency of nursing care for the safety of hospitalized children was found undesirable in hand hygiene in accordance with the WHO standards. Nurses' performance was relatively desirable in the fields of being more cautious about drugs with similar names or spelling to avoid medication errors, communication during patient hand-over, and performance of correct procedure at correct body site. Regarding other fields, the consistency was at a desirable level.

Conclusion: Children's safety in the PICUs is not desirable in terms of observing health codes and there is a long way to go to meet the international standards.

Introduction

Safety in health care system means observing the principles that by embracing them, the patient's safety is guaranteed or the probability of damages is minimized.[1]

The American Institute of Medicine (IOM) defines safety as avoiding any accidental and intentional damages by the health care team.[2] This means that the health care team should not be harmed while caring for the patient and performing any care and treatment.[3]

Providing safety in medical centers, and particularly in pediatric intensive care units (PICUs), is of dire importance as children are not capable of looking after themselves, and they depend completely on health personnel for medical care.[1] In addition, the immune system in children is weaker than that of adults so that the mortality rate and injuries caused by medical errors in children are higher than adults.[2] On the other hand, nurses in PICUs have to handle several tasks and deal with different conditions like seizure, poisoning,[4] loss of consciousness, and many other problems. All these issues along with many other factors increase the risk of damage to children in hospitals.[5,6]

The World Health Organization (WHO) introduces children's safety in hospitals as one of the endemic and pandemic concerns and emphasizes that failure to observe children's safety increases financial costs,[7] the tension in patients and families, hospitalization term, and health system costs.[8] International bodies like the WHO, Patient Safety Foundation (PSF), American Society for Health Care Risk Management (ASHRM),[9] and The Ministry of Health and Medical Education of Iran (MOHME) have attempted to improve the safety of patients in PICUs, especially through introducing and implementing safety guidelines in health centers. These guidelines include hand hygiene, surgical safety, patient identification, single-use of injection devices, avoiding catheter and tubing misconnection, patient falls, bedsore prevention, informed consent for procedures, medication administration safety throughout hospitalization and transfer, communication during patient hand-over, performance of correct procedure at correct body site, and

control of concentrated electrolyte solutions. Inspectors and supervisors are responsible to make sure that the safety guidelines introduced by the ministry of health are observed; the inspections are periodical and once a year.[10] There is no accurate statistics about the occurrence of medical errors in Iran.[11] Expectedly, the occurrence rate of these errors in Iran is not better than that in the USA and Europe. Clearly, the rate of medical errors by physicians and nurses in health centers is relatively high and the healthcare staff do not have a good performance in observing safety standards of the WHO. There are several reasons for the failure in implementing the guidelines perfectly, such as the type of culture in wards,[12] inadequate organizational management,[13] insufficient resources,[14] and problems in reporting system,[15] Inadequate and inappropriate use of electronic feedback systems.[16] and Improper management of medical centers.[17]

Given the importance of the topic, this study attempted to compare the safety status in PICUs of Tehran, Iran with the safety standards of WHO. The results might help us to solve some probable problems and improve the safety of hospitalized children.

Material and Methods

In this descriptive study, we evaluated the performance of nurses observing safety standards in the PICUs of four selected educational hospitals in Tehran, Iran in 2019. To do so, eight patient safety observation checklists were used. These checklist included: (1) hand hygiene (six items), (2) medication administration (being cautious about medicines with similar names and spelling) (nine items), (3) patient identification (eighteen items), (4) avoiding catheter and tubing misconnection (seven items), (5) communication during patient hand-over (six items), (6) surgical safety (performing correct procedure at correct body site) (nine items), (7) control of concentrated electrolyte solution (eighteen items), and (8) sterilization or single use of injection devices (eight items).

After obtaining an approval letter from the Nursing Sciences Research Center and approval of the Ethics Committee of Iran University of Medical Sciences (ethics code: IR. IUMS.REC1397.492), the researcher visited the research and technology departments of Shahid Beheshti University of Medical Sciences and Tehran University of Medical Sciences and received the required permissions to attend the PICUs under study. To respect the ethical codes and requirements of the wards, the hospitals remained anonymous in this study. In addition, the hospitals' officials were ensured about the confidentiality of the information. The researchers attended the morning shifts one month before recording the performance of nurses to reduce the bias caused by the presence of an observer.

The reasons for choosing these eight checklists were the request by the hospitals under the study and that the officials admitted that the issues covered by the checklists were not their first priority.

Although the first researcher (FK) had the experience of working in PICUs and was familiar with the environment, she decided to attend the ward for one month and in different work shifts to attenuate the concerns about her presence. It is notable that all the nurses working in the wards were briefed about the study and that the researcher was a passive observer. The nurses signed an informed consent letter. The study population consisted of 100 nursing experts working in different work shifts in the PICUs with at least six months of experience. Based on Morgan's table of sample size, the performance of 80 nurses was observed for five months from August to December 2019. The observer did not intervene in the nurses' duties and performance. The care provided by the nurses who were off-duty for more than two weeks during the study were not considered.[18]

Since the validity and reliability of checklists had not been supported by similar studies in Iran, after confirmation by the research team and the checklists were provided to a panel of five faculty members and 10 clinical nurses and physicians for feedback. The checklists were revised based on the feedback. Content validity ratio (CVR) and content validity index (CVI) of the checklists were also examined (CVR = 0.7 and CVI = 0.8). To examine the reliability of the checklists, 15 members of the medical team were observed. Therefore, the observations by the researcher and a colleague were compared and Pearson's correlation coefficient (r) of both observers was obtained. The value of (r) for all the checklists was higher than 0.8.

The checklists included 81 items based on Likert's three-point score. Scores ranged from 0 to 2 for "not observed", "observed but not completely", "completely observed". The mean total score of each checklist and the percentages were obtained and the score for each field was reported in percentages of the complete score (less than 50% = undesirable; 50%-75% = relatively desirable; and 76%-100% = desirable).[19]

The researcher observed each nurse four times at three work shifts (morning, afternoon, and overnight). Given that 81 different care procedures were covered by the checklists, a total of 25920 care units were observed in this study. To remove the confounding factors and the effect of nurses' awareness of observer's presence, the first observations were omitted and only observations number 2, 3, and 4 for each nurse were considered.[18] Therefore, 19440 care units were observed and the collected data were analyzed in SPSS (ver.13).

Results

The performance of 80 nurses in PICUs were observed in detail. The nurses had a bachelor's degrees or higher. Most nurses were female (86.25%) and had a bachelor's degree (88.75%); in addition, they had a work experience of 11-16 years (26.25%) and were at the age range of 26-30 years (42.5%) (Table 1).

Consistency of nursing care units or children in the

PICUs with the requirement of a hand hygiene checklist was undesirable. Based on the checklists of medication administration, communication during patient hand-over and performing correct procedure at the correct body site were relatively desirable in terms of adherence to the guidelines. Furthermore, based on the checklists of patient identification, avoiding catheter and tubing misconnection, control of concentrated electrolyte solution, and sterilization or single use of injection devices were at a desirable level (Table 2).

Table 1. Participants' characteristics (n = 80)

Variable	N0. (%)
Age (y)	
21-25	14 (17.5)
26-30	34 (42.5)
31-35	22 (27.5)
>35	10 (12.5)
Gender	
Female	69 (86.25)
Male	11 (13.75)
Educational degree	
Bachelor's	71 (88.75)
Master's	9 (11.25)
Work experience (y)	
5>	20 (25)
5-10	14 (17.5)
11-16	21 (26.25)
17-22	15 (18.75)
>22	10 (12.5)

Discussion

In this study, the consistency of each nursing care in terms of patient safety in PICUs with eight safety standards of the WHO and the MOHME was examined. Our results showed that the performance of nurses in the field of hand hygiene was undesirable, while it was relatively desirable in medication administration, communication during patient hand-over, performing correct procedure at the correct body site and desirable in avoiding catheter and tubing misconnections, patient identification, control of concentrated electrolyte solutions, and single-use of injection devices.

Hand Hygiene

Failure to observe hand hygiene based on the principles or negligence of its importance is a global issue.[20] There are no accurate statistics on this issue in Iran.[21] However, many studies in Iran have reported an undesirable condition in terms of observing hand hygiene by medical personnel.[22-24]

Studies in other countries have also reported an undesirable condition in this regard. The problem is more pronounced in doing the aseptic procedure.[25,26] Different reasons for this problem have been mentioned, such as the lack of a proper safety atmosphere at work,[27] work overload,[28] a special condition in ICUs, work shift, and lack of equipment like adequate quality hand sanitizer.[29] The type of job or professional role, cultural

Table 2. Consistency of nursing care in terms of patient safety

Field	Max. score	Min. score	Interpretation of score	Mean score of nurses' performances	Final categorization
Hand hygiene	12	0	Desirable:10-12 Relatively desirable:6-9 Undesirable:0-5	4.5	Undesirable
Medication administration	18	0	Desirable: 6.77-9 Relatively desirable:4.7-6.76 Undesirable: 0-4.6	5.2	Relatively desirable
Communication during patient hand-over	12	0	Desirable:10-12 Relatively desirable:7-9 Undesirable:0-6	6.2	Relatively desirable
Performing correct procedure at the correct body site	18	0	Desirable:13.6-18 Relatively desirable:10-13.5 Undesirable:0-9	12.1	Relatively desirable
Patient identification	36	0	Desirable:28-36 Relatively desirable:19-27 Undesirable:0-18	28	Desirable
Avoiding catheter and tubing misconnections	14	0	Desirable:11-14 Relatively desirable:8-10.5 Undesirable:0-7	11.75	Desirable
Control of concentrated electrolyte solutions	16	0	Desirable:13-16 Relatively desirable:9-12 Undesirable:0-8	13.6	Desirable
Single-use of injection devices	36	0	Desirable:28-36 Relatively desirable:19-27 Undesirable:0-18	35.6	Desirable

factors, and heavy workload are among other causes mentioned by several studies.[30] The lack of knowledge and wrong attitudes in health team personnel about hand hygiene are other factors effective in the performance of healthcare staff.[31,32] In a study in Brazil, the researchers recommended following the instructions of WHO in educations and practices and altering environment layout to facilitate access to hand sanitizers so as to solve the problem of nurses' hand hygiene in PICUs. They reported that following the intervention, hand hygiene level in the nurses improved from 27.3% to 37%; however, they concluded that despite strict implementation of the instructions, hand hygiene was still at a low level. They assumed cultural, behavioral, and personal issues in nurses for this issue. Solving these problems needs time and it is very hard.[33] It appears that understaffed wards, lack of equipment, improper physical environment, heavy workload, and personnel educations are the main causes of the poor performance of nurses as to hand hygiene.[34] Any improvement in this field needs accurate and long-term planning and short-term[35] and temporary measures may not lead to satisfactorily results.[36]

Medication Administration [Look-Alike/Sound-Alike (LASA) Medication Names]

In this study, the performance of nurses regarding medication administration and being cautious about medicines with similar names and spelling was relatively desirable. The literature review, however, revealed different findings. The results of a study showed that error rates in the wards understudy were notably high and taking error control measures such as risk management, introducing error reporting programs, and removing the causes of errors were recommended.[17] Another research found that 37.8% of ICU nurses had at least two medication errors over the past six months and the main error was a failure to administer medicines at the right time, a mistake in calculating dosage, neglecting drug interaction, and administering wrong doses.[37] Other research, reported similar results and showed that errors in medication administration by physicians, wrong administration or preparation, and administration at the wrong time by nurses were the most common errors by medical personnel in PICUs.[14] Researchers have mentioned high workload, understaffed wards, assignment of multiple tasks, lack of knowledge and experience, lack of space and equipment,[38] wrong medical decisions, administration of wrong drug or wrong dosage, lack of education for inexperienced nurses,[39] and type of work shift for this problem.[40] The fact that our subjects had relatively desirable conditions in terms of medication administration is an indicative of problems in administration of medicines by nurses.

Communication During Patient Hand-Over

The performance of nurses regarding communication during patient hand-over was relatively desirable, meaning that there were some problems in this regard. Studies have shown that patient hand-over process without observing the safety codes creates the risks of medical and care errors, increases the number of unnecessary tests,[37] increases hospitalization costs, and prolongs hospitalization term.[41] Given that children are more vulnerable, it was also found that while this issue is more important in PICUs, it has not received the attention it deserves.[42] The existing literature supported the findings of this study. The quality of performance in this area depends on communication between the personnel, structural issues, and context factors,[43] Other reasons such as Improper patient hand over, weakness in communication skills of care team members,[37] how patients' condition and negligence in using checklist in patient hand over.[44]

In addition, personnel's attitude towards quality patient hand-over is one of the factors in standard patient hand-over.[45] Moreover, using the Situation-Background-Assessment-Recommendation (SBAR) tool for patient hand-over attenuates the risk of error.[46] The tool is one of the safety standards for patient hand-over.[47] Based on the evidence in this study, it was found that work overload, lack of communicational skills, and failure to see the importance of this procedure by the nurses were effective in the poor performance of patient hand-over process. Patient hand-over normally happens next to the patient's bed unless there are laboratory or radiological reports that need examination in a computer system. In the latter case, patient hand-over happens in the nursing station where a computer system is available. More than one-half of the nurses in the wards did not follow SBAR to hand-over patients to the next work shift or other wards. Hand-overs were mostly based on reports in patients' charts and nurses' memory, which explain the poor performance in this area.

In the field of performing correct procedure at the correct body site, nurses performance was desirable, while a study on an ICU ward in Yasuj health center and another ICU ward in Shiraz, Iran showed that nursing care undesirable nursing performance for this item.[18] Another study in Turkey, showed similar to our results.[48] Another study showed that using surgery control checklists, skin control checklist, communication with parents, and mouth and wound check did not receive the attention needed in PICUs.[49] Failure to use the safety checklists properly along with the stressful situation of the ward and heavy workload add to the risk of errors.[50,51] In another study, it was shown that the risk of medical errors in children is higher since they are not able to participant in the care.[48] The observation showed that there was a guideline to control the correct body site for operation on children and the nurses observed the guideline; however, there was no specific guideline for some of the procedures in the ICU, such as inserting gastrostomy tube, wound dressing, and attaching urine catheter. On the other hand, there was no checklist to inform the parents and children (if able

to understand), and the nurses would give information to the parents based on their own discretion, which could increase the risk of errors.

The nurses' performance in terms of patient identification, avoiding catheter and tubing misconnection, control of concentrated electrolyte solution, and sterilization or single use of injection devices was desirable. As far as the researchers investigated, there is no similar study in Iran on each of these areas; however, one study on patient identification showed that losing identification bracelet, mistakes in identification, and issuance of a bracelet with wrong information were the most common errors in patient identification.[16] Among the few studies on other areas of performance in PICUs, researchers argued that one of the main causes of hospital infections was urinary and vein catheters.[52,53] Legal gaps, management, inadequate equipment were mentioned as other causes of hospital infections in ICUs[54] and lack of understanding of infection prevention.[55]

The observations in this study showed that because nurses and physicians are constantly present next to patients' beds in understudy PICUs checking patients regularly in each shift, and recognizing the patients by their names and age, there was no problem in the identification of patients. The nurses' awareness about the presence of first researcher and being observed by her was the main limitation of this study. To reduce this effect, the first researcher attended the wards continuously and in different work shifts one month in advance.

Conclusion

This study results indicated that the consistency of nursing care units in terms of patient safety and being cautious about medicines with similar names and spelling, hand hygiene, communication during patient hand-over, and performance of correct procedure at the correct body site with international guidelines was not desirable and need to be improved. It is recommended that besides training nurses to improve their knowledge and professional skills regarding the importance of safety measures in PICU wards, managers and health care system leaders, along with researchers, develop and validate accurate tools, for evaluating the health care team safety performance and also have more effective clinical control and supervision and to create motivated employees striving to provide quality care. Conducting research to further investigate the causes of non-compliance of care with standards will be helpful.

Research Highlights

What is the current knowledge?

Ensuring the safety of hospitalized children is of particular importance due to their special circumstances. WHO emphasizes that non-observance of the safety of patients admitted to intensive care units increases financial costs, creates stress on the sick children and their families, and prolongs the time of hospitalization.

What is new here?

Observance of hand hygiene to maintain the safety of children hospitalized in PICUs is one of the standard priorities of medical centers that did not have favorable conditions in the study.

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Authors' Contributions

FK, SJ, MAF: Study design; FK, BHA, AMA: Data gathering; MAF: Methodology; FK: Data analysis; FK: Writing-original draft preparation; FK, SJ: Writing-review and editing; MAF, SJ: Supervision; FK, BHA, AMA: literature search. All authors have read and agreed to the published version of the manuscript.

Conflict of Interests

The authors declare no conflict of interest in this study.

Data Accessibility

The datasets are available from the corresponding author on reasonable request.

Ethical Issues

The Medical Research and Ethical Committee of Nursing at Iran University of Medical Science, Tehran, Iran approved this study (ethics code: IR.IUMS.REC1397.492).

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