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

Fatemeh Kalroozi, Soodabeh Joolaee, Mansoureh Ashghali Farahani, Behzad Haghighi Aski, Ali Manafi Anari

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.3,5

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

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.
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. There is no accurate statistics about the occurrence of medical errors in Iran. 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, inadequate organizational management, insufficient resources, and problems in reporting system. Inadequate and inappropriate use of electronic feedback systems and Improper management of medical centers.

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.

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).

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. 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).

**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. There are no accurate statistics on this issue in Iran. However, many studies in Iran have reported an undesirable condition in terms of observing hand hygiene by medical personnel. Different reasons for this problem have been mentioned, such as the lack of a proper safety atmosphere at work, work overload, a special condition in ICUs, work shift, and lack of equipment like adequate quality hand sanitizer. The type of job or professional role, cultural

### 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) |

### 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                                        | 4.5                                | Undesirable          |
|                                            |            |            | Relatively desirable:6-9                              |                                   |                      |
|                                            |            |            | Undesirable:0-5                                        |                                   |                      |
| Medication administration                   | 18         | 0          | Desirable: 6.77-9                                       | 5.2                                | Relatively desirable|
|                                            |            |            | Relatively desirable:4.7-6.76                          |                                   |                      |
|                                            |            |            | Undesirable: 0-4.6                                      |                                   |                      |
| Communication during patient hand-over     | 12         | 0          | Desirable:10-12                                        | 6.2                                | Relatively desirable|
|                                            |            |            | Relatively desirable:7-9                              |                                   |                      |
|                                            |            |            | Undesirable:0-6                                        |                                   |                      |
| Performing correct procedure at the correct body site | 18   | 0          | Desirable:13.6-18                                       | 12.1                               | Relatively desirable|
|                                            |            |            | Relatively desirable:10-13.5                           |                                   |                      |
|                                            |            |            | Undesirable:0-9                                        |                                   |                      |
| Patient identification                      | 36         | 0          | Desirable:28-36                                        | 28                                 | Desirable            |
|                                            |            |            | Relatively desirable:19-27                             |                                   |                      |
|                                            |            |            | Undesirable:0-18                                       |                                   |                      |
| Avoiding catheter and tubing misconnections | 14         | 0          | Desirable:11-14                                        | 11.75                              | Desirable            |
|                                            |            |            | Relatively desirable:8-10.5                            |                                   |                      |
|                                            |            |            | Undesirable:0-7                                        |                                   |                      |
| Control of concentrated electrolyte solutions | 16    | 0          | Desirable:13-16                                        | 13.6                               | Desirable            |
|                                            |            |            | Relatively desirable:9-12                              |                                   |                      |
|                                            |            |            | Undesirable:0-8                                        |                                   |                      |
| Single-use of injection devices             | 36         | 0          | Desirable:28-36                                        | 35.6                               | Desirable            |
|                                            |            |            | Relatively desirable:19-27                             |                                   |                      |
|                                            |            |            | Undesirable:0-18                                       |                                   |                      |
Safety in PICUs based on the WHO’s standards

Factors, and heavy workload are among other causes mentioned by several studies. The lack of knowledge and wrong attitudes in health team personnel about hand hygiene are other factors effective in the performance of healthcare staff. 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. 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. Any improvement in this field needs accurate and long-term planning and short-term temporary measures may not lead to satisfactorily results.

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. 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. 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. Researchers have mentioned high workload, understaffed wards, assignment of multiple tasks, lack of knowledge and experience, lack of space and equipment, wrong medical decisions, administration of wrong drug or wrong dosage, lack of education for inexperienced nurses, and type of work shift for this problem. 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, increases hospitalization costs, and prolongs hospitalization term. 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. 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. Other reasons such as Improper patient handover, weakness in communication skills of care team members, how patients’ condition and negligence in using checklist in patient hand over.

In addition, personnel’s attitude towards quality patient hand-over is one of the factors in standard patient hand-over. Moreover, using the Situation-Background-Assessment-Recommendation (SBAR) tool for patient hand-over attenuates the risk of error. The tool is one of the safety standards for patient hand-over. 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. Another study in Turkey, showed similar to our results. 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. Failure to use the safety checklists properly along with the stressful situation of the ward and heavy workload add to the risk of errors. In another study, it was shown that the risk of medical errors in children is higher since they are not able to participate in the care. 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. Legal gaps, management, inadequate equipment were mentioned as other causes of hospital infections in ICUs and lack of understanding of infection prevention.

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.

Acknowledgements
The present study has been extracted from a PhD dissertation in Nursing conducted in Nursing Science Research Center, Iran University of Medical Science. The authors would like to appreciate all nurses for their cooperation.

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).

Funding
This study was financially supported by Iran University of Medical Sciences, Tehran, Iran.

References
1. Stang A, Thomson D, Hartling L, Shulhan J, Nuspl M, Ali S. Safe care for pediatric patients: a scoping review across multiple health care settings. Clin Pediatr (Phila). 2018; 57(1): 62-75. doi: 10.1177/00099228177691820
2. Institute of Medicine (US) Committee on Data Standards for Patient Safety. Patient Safety: Achieving a New Standard for Care. Washington, DC: National Academies Press (US); 2004. doi: 10.17226/10863
3. Butler GA, Hupp DS. Pediatric quality and safety: a nursing perspective. Pediatr Clin North Am. 2016; 63(2): 329-39. doi: 10.1016/j.pcl.2015.11.005
4. Elzagallaai AA, Greff M, Rieder MJ. Adverse drug reactions in children: the double-edged sword of therapeutics. Clin Pharmacol Ther. 2017; 101(6): 725-35. doi: 10.1002/cpt.677
5. Steering Committee on Quality Improvement and Management and Committee on Hospital Care. Policy statement—principles of pediatric patient safety: reducing harm due to medical care. Pediatrics. 2011; 127(6): 1199-210. doi: 10.1542/peds.2011-0967
6. Stocker M, Pilgrim SB, Burmester M, Allen ML, Gijseľaers WH. Interprofessional team management in pediatric critical care: some challenges and possible solutions. J Multidiscip Healthc. 2016; 9: 47-58. doi: 10.2147/jmdh.s76773
7. Sherburne E, Snethen JA, Kelber S. Safety profile of children in an enclosure bed. Clin Nurse Spec. 2017; 31(1): 36-44. doi:
10.1097/nur.00000000000000621
8. Kiarie P. Aspect on patient safety in intensive care unit: A literature review [Thesis]. Turku: Turku University of Applied Sciences; 2011.
9. Padgett J, Gossett K, Mayer R, Chien WW, Turner F. Improving patient safety through high reliability organizations. Qual Rep. 2017; 22(2): 410-25. doi: 10.4674/2160-3715.2017.2547
10. World Health Organization (WHO). Report on the burden of endemic health care-associated infection worldwide. Geneva: WHO; 2011. Available from: https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf. Accessed December 20, 2021.
11. Cathro H. Navigating through chaos: charge nurses and patient safety. J Nurs Adm. 2016; 46(4): 208-14. doi: 10.1097/nna.0000000000000326
12. Ministry of Health and Medical Education of Iran. Patient safety unit instructions. Iran: Ministry of Health and Medical Education; 2019. Available from: http://treatment.sbmu.ac.ir/index.jsp?fileid = &siteid = 62&pageid = 6282&siteid = 62. Accessed December 20, 2021.
13. Mousavi-Roknabadi RS, Momennasab M, Askarian M, Haghsenas A, Marjadi B. Causes of medical errors and its under-reporting amongst pediatric nurses in Iran: a qualitative study. Int J Qual Health Care. 2019; 31(7): 541-6. doi: 10.1093/intqhc/mzy0102
14. Haghsin S, Shabasvare S, Vazin A. Medication errors in pediatric intensive care unit: incidence, types and outcome. Trends Pharm Sci. 2016; 2(2): 109-16.
15. Baloh J, Thom KA, Perencevich E, Rock C, Robinson G, Ward M, et al. Hand hygiene before donning nonsterile gloves: healthcare workers’ beliefs and practices. Am J Infect Control. 2019; 47(5): 492-7. doi: 10.1016/j.ajic.2018.11.015
16. Clancy C, Delungawathotta T, Dunne CP. Hand-hygiene-related clinical trials reported between 2014 and 2020: a comprehensive systematic review. J Hosp Infect. 2021; 111: 6-26. doi: 10.1016/j.jhin.2021.03.007
17. Kalroozi F, Joolaei S, Ashghahi Farahani M, Haghsighi Ask F, Manafi Anari A. Factors affecting hand hygiene performance of pediatric intensive care unit health care team during the outbreak of COVID-19 disease in Iran: a qualitative study. Int J Pediatr. 2021; 9(11): 14783-800. doi: 10.22038/ijp.2021.56160.4418
18. Bayatmanesh H, Zagheri Tafreshi M, Manouchehri H, Akbarzadeh Baghban A. Evaluation of patient-related nursing safety unit instructions. Iran: Ministry of Health and Medical Education; 2011. Available from: http://treatment.sbmu.ac.ir/index.jsp?fileid = &siteid = 62&pageid = 6282&siteid = 62. Accessed December 20, 2021.
19. Behesht Aeen F, Zolfaghari M, Asadi Noghabi AA, Mehran A. Hand hygiene before donning nonsterile gloves: healthcare workers’ beliefs and practices. Am J Infect Control. 2019; 47(5): 492-7. doi: 10.1016/j.ajic.2018.11.015
20. Padgett J, Gossett K, Mayer R, Chien WW, Turner F. Improving patient safety through high reliability organizations. Qual Rep. 2017; 22(2): 410-25. doi: 10.4674/2160-3715.2017.2547
21. World Health Organization (WHO). Report on the burden of endemic health care-associated infection worldwide. Geneva: WHO; 2011. Available from: https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf. Accessed December 20, 2021.
22. Cathro H. Navigating through chaos: charge nurses and patient safety. J Nurs Adm. 2016; 46(4): 208-14. doi: 10.1097/nna.0000000000000326
23. Ministry of Health and Medical Education of Iran. Patient safety unit instructions. Iran: Ministry of Health and Medical Education; 2019. Available from: http://treatment.sbmu.ac.ir/index.jsp?fileid = &siteid = 62&pageid = 6282&siteid = 62. Accessed December 20, 2021.
24. Mousavi-Roknabadi RS, Momennasab M, Askarian M, Haghsenas A, Marjadi B. Causes of medical errors and its under-reporting amongst pediatric nurses in Iran: a qualitative study. Int J Qual Health Care. 2019; 31(7): 541-6. doi: 10.1093/intqhc/mzy0102
25. Vasconcelos RO, Alves DC, Fernandes LM, de Oliveira JL. Adhesion to hand hygiene by nursing team in intensive care unit. Enferm Glob. 2018; 17(2): 430-76. doi: 10.6018/ eglobal.17.2.284131
26. Kurtz SL. Identification of low, high, and super gelers and barriers to hand hygiene among intensive care unit nurses. Am J Infect Control. 2017; 45(8): 839-43. doi: 10.1016/j.ajic.2017.04.004
27. Sabahi Bidgoli M, Shahriz S, Kebrizhi A, Seyyedi H, Sarafraz Z. Assessment the status of patient safety in Kashan hospitals. Journal of Health Promotion Management (JHPM). 2011; 1(1): 62-73. [Persian]
28. Lai CC, Lu MC, Tang HJ, Chen YH, Wu YH, Chiang HT, et al. Implementation of a national quality improvement program to enhance hand hygiene in nursing homes in Taiwan. J Microbiol Immunol Infect. 2019; 52(2): 345-51. doi: 10.1016/j.jmii.2018.09.007
29. Alsuaibae S, Maither A, Alalmaei W, Al-Shammari AD, Tashkandi M, Somily AM, et al. Determinants of hand hygiene noncompliance in intensive care units. Am J Infect Control. 2013; 41(2): 131-5. doi: 10.1016/j.ajic.2012.02.035
30. Castro-Sánchez E, Holmes AH. Impact of organizations on healthcare-associated infections. J Hosp Infect. 2015; 89(4): 346-50. doi: 10.1016/j.jhin.2015.01.012
31. Arijaratne MH, Gunasekara TD, Weerasekara MM, Kottahachchi J, Kudawadanage BP, Fernando SS. Knowledge, attitudes and practices of hand hygiene among final year medical and nursing students at the University of Sri Jayewardenepura. Sri Lankan Journal of Infectious Diseases (SLJID). 2013; 3(1): 15-25. doi: 10.4038/sljid.v3i1.4761
32. Cruz JP, Bshaitawi MA. Predictors of hand hygiene practice among Saudi nursing students: a cross-sectional self-reported study. J Infect Public Health. 2016; 9(4): 485-93. doi: 10.1016/j.jiph.2015.11.010
33. Belela-Anacleto ASC, Kusahara DM, Peterlini MAS, Pedreira MLG. Hand hygiene compliance and behavioural determinants in a paediatric intensive care unit: an observational study. Aust Crit Care. 2019; 32(1): 21-7. doi: 10.1016/j.acc.2018.02.010
34. Ng WK, Shaban RZ, van de Mortel T. Healthcare professionals’ hand hygiene knowledge and beliefs in the United Arab Emirates. J Infect Prev. 2017; 18(3): 134-42. doi: 10.1177/1757177416677851
35. Thibe Quilab M, Johnson S, Schadt C, Mitchell A. The effect of education on improving hand hygiene compliance among healthcare workers. Hospice & Palliative Medicine International Journal (HPMJ). 2019; 3(2): 66-71. doi: 10.15406/hpmj.2019.03.00153
36. Taheri E, Nourian M, Rasouli M, Kavousi A. The study of type and amount of medication errors in neonatal intensive care units and neonatal units. Iran J Crit Care Nurs. 2013; 6(1): 21-8. [Persian]
37. Raesi A, Razani MA, Soltani F. Challenges of patient handover process in healthcare services: a systematic review. J Educ Health Promot. 2019; 8: 173. doi: 10.4103/jehp.jehp_460_18
38. Zarea K, Mohammadii A, Beiravand S, Hassan F, Baraz S. Iranian nurses’ medication errors: a survey of the types, the causes, and the related factors. Int J Afr Nurs Sci. 2018; 8: 112-6. doi: 10.1016/j.jans.2018.05.001
39. Miladimia M, Zarea K, Baraz S, Mousavi Nouri E, Pishgooh AH, Golamzadeh Baeeis M. Pediatric nurses’ medication error: the self-reporting of frequency, types and causes. Int J Pediatr. 2016; 4(3): 1439-44. doi: 10.22038/ijp.2016.6593
40. Soltanian M, Malazem Z, Mohammadii E, Sharif F, Rakhsan M, Iranian nurses’ experiences on obstacles of safe drug administration: a qualitative study. Glob J Health Sci. 2016; 8(10): 56009. doi: 10.5539/gjhs.v8n10p88
41. Bigham MT, Logsdon TR, Manicone PE, Landrigan CP, Hayes
LW, Randall KH, et al. Decreasing handoff-related care failures in children’s hospitals. Pediatrics. 2014; 134(2): e572-9. doi: 10.1542/peds.2013-1844

42. Sochet AA, Ryan KS, Miller W, Bartlett JL, Nakagawa TA, Bingham L. A longitudinal and sustainability assessment of pediatric interfacility transport handover standardization. Pediatr Qual Saf. 2018; 3(6): e118. doi: 10.1097/PQ9.0000000000000118

43. Bagnasco A, Costa A, Catania G, Zanini M, Ghirotto L, Timmins F, et al. Improving the quality of communication during handover in a Paediatric Emergency Department: a qualitative pilot study. J Prev Med Hyg. 2019; 60(3): E219-E25. doi: 10.15167/2421-4248/jpmh2019.60.3.1042

44. Müllerm J, Jürgens I, Redaëlli M, Klingberg K, Hautz WE, Stock S. Impact of the communication and patient hand-off tool SBAR on patient safety: a systematic review. BMJ Open. 2018; 8(8): e022202. doi: 10.1136/bmjopen-2018-022202

45. Sukeshi S, Faridah U. SBAR communication (situation, background, assessment, recommendation) on attitude and nursing behavior in improving patient safety. KEMAS: Jurnal Kesehatan Masyarakat. 2020; 16(2): 163-8. doi: 10.15294/kemas.v16i2.15954

46. Randmaa M, Mårtensson G, Engström M. SBAR improves communication and safety climate and decreases incident reports due to communication errors in an anaesthetic clinic: a prospective intervention study. BMJ Open. 2014; 4(1): e004268. doi: 10.1136/bmjopen-2013-004268

47. Shahid S, Thomas S. Situation, background, assessment, recommendation (sbar) communication tool for handoff in health care-a narrative review. Saf Health. 2018; 4(1): 7. doi: 10.1186/s40886-018-0073-1

48. Kisacik OG, Cigerci Y. Use of the surgical safety checklist in the operating room: operating room nurses’ perspectives. Pak J Med Sci. 2019; 35(3): 614-9. doi: 10.12669/pjms.35.3.29

49. Banihashemi S, Hatam N, Zand F, Kharazmi E, Nasimi S, Askarian M. Assessment of three “WHO” patient safety solutions: where do we stand and what can we do? Int J Prev Med. 2015; 6: 120. doi: 10.4103/2008-7802.171391

50. Ullman A, Long D, Horn D, Woosley J, Coulthard MG. The KIDS SAFE checklist for pediatric intensive care units. Am J Crit Care. 2013; 22(1): 61-9. doi: 10.4037/ajccc2013560

51. Corso R, Vacirca F, Patelli C, Leni D. Use of “Time-Out” checklist in interventional radiology procedures as a tool to enhance patient safety. Radiol Med. 2014; 119(11): 828-34. doi: 10.1007/s11547-014-0397-9

52. Vivekananthan S, Ravindran RP, Shanmugarajah K, Maruthappu M, Shalhoub J. Surgical safety checklists in developing countries. Int J Surg. 2014; 12(5): 2-6. doi: 10.1016/j.ijsu.2013.10.016

53. Kabiri Samani M, keivanfar M, Firouzi H, Seyedi SJ, Kianifar H. Bacterial infections and relevant factors in neonates hospitalized at intensive care unit. Iran J Neonatol. 2019; 10(3): 1-6. doi: 10.22038/ijn.2018.35356.1537

54. Barak M, Mamishi S, Siadati SA, Salamati P, Khotaii G, Mirzarahimi M. Risk factors and bacterial etiologies of nosocomial infections in NICU and PICU wards of children’s medical center and bahrami hospitals during 2008-2009. J Ardabil Univ Med Sci. 2011; 11(2): 113-20. (Persian)

55. Kilpatrick M, Hutchinson A, Manias E, Bouchoucha SL. Paediatric nurses’, children’s and parents’ adherence to infection prevention and control and knowledge of antimicrobial stewardship: a systematic review. Am J Infect Control. 2021; 49(5): 622-39. doi: 10.1016/j.ajic.2020.11.025