



Interventions on WHO Nine Patient Safety Solutions to Improve Safety in Nemazi Hospital, Shiraz, Iran - 2014

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Abstract

Introduction: Modern healthcare systems are composed of highly complicated sets of activities which can be beneficial to patients, but they may lead to negative outcomes. The aim of this study was to conduct an interventional study in two of our hospitals' pediatric wards concerning implementation and assessment of the WHO's 9 patient safety solutions. We also attempted to identify the ways to improve compliance in our hospital's pediatric cardiology and neurology wards.

Methods: In this experimental study conducted on all nurses in targeted wards of Namazi Hospital, Shiraz, Iran during 2014 to collect the data, we extracted the WHO guidelines on the 9 patient safety solutions for using in the research and educating healthcare workers. The completed forms were then analyzed through SPSS Version 18.0, using descriptive statistics, means, standard deviations and t-tests, when appropriate.

The two solutions with the lowest compliance scores were selected for intervention. These included "assuring medication accuracy at transitions in care" and "avoiding catheter and tubing misconnections." To improve these two solutions, an interventional program was designed and implemented.

Results: Compliance scores from the cardiology department concerning "assuring medication accuracy at transitions in care" solution increased from 34.16% to 75.00% after intervention. In the neurology department compliance scores increased from 36.66% to 68.33%. Regarding the "avoiding catheter and tubing misconnections" solution, scores increased from 46.87% to 72.91% in the cardiology ward and 40.27% to 67.53% in the neurology department.

Conclusion: Results indicate that interventions, such as training courses, checklists and reporting forms concerning medication reconciliation improved compliance. This was also true for use of checklists to improve compliance in the proper catheter and tubing connections solution area.

Keywords: World Health Organization, Patient Safety, Pediatrics, Cardiology, Neurology.

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Introduction

Quality is a main concern for all healthcare systems, and many countries have designed a variety of programs which emphasize quality improvement (1, 2). World Health Organization (WHO) initially assigned 6 dimensions of quality, among which patient's safety is a main indicator for quality of care in healthcare, minimizing dangers and possible injuries (3).

Modern healthcare systems are composed of highly complicated sets of activities, greatly dependent on human behavior and a variety of complex technologies. As we know, they can be

beneficial to patients, but they may lead to negative outcomes. This combination of complicated processes makes healthcare services capable of placing patients at increased risk (4). Recently, there has been increased awareness concerning the importance of patient safety worldwide. This has led to a better understanding of the environmental and human factors that lead to complications (5).

To address the problem, WHO launched the World Alliance for Patient Safety in 2005, identifying six action areas. One of them included developments and improvements for "solutions to patient safety." In 2007, an international committee suggested nine solutions

concerning patient safety. These are used today by WHO member countries (6). The “9 patient safety solutions” refers to patients’ safety and identifies the performance mandates required for reducing patient injuries. Chan, former Director-General of WHO, in 2007 stated that patient safety solutions are a way to improve the patients’ safety, identified during various treatments performed in different areas for reducing the injuries to patients and improve their safety. (7) Because of the significance of these 9 improvement solutions, the healthcare industry needs to use them to establish standards to protect patient health and avoid injuries (8). In this regard, hospitals play a key role due to their commitment to reduce improper care services, improve patients’ safety and achieve positive healthcare outcomes (9).

Provision of safer care is the main responsibility of healthcare officials (10). This means that healthcare officials must be committed to the highest quality of care, always trying to improve it (11). Hospital personnel must also play an active role in this regard.

In the hospital, pediatric wards have special significance. Unique aspects of pediatric care tend to increase medical risks, including patient injuries. Pediatric wards in general and specifically pediatric cardiology and neurology wards experience higher rates of errors and injury because of weight changes, varying levels of physiologic maturation, limited capability of patients to communicate, elevated levels of dependence on others and the relative rarity of pediatric diseases (12).

The Iranian Ministry of Health and Medical Education and the Iranian Universities of Medical Sciences are the main policymakers for the country, while hospitals serve as frontline service providers. All of them have addressed improvements in quality and safety of healthcare in numerous ways. The results of this study showed that in 2016 Namazi Hospital in Shiraz made a commitment to achieve top status in Southern Iran in terms of quality of safe medical practice and teaching.

We conducted an interventional study in two of our hospitals’ pediatric wards concerning implementation and assessment of the WHO’s 9 patient safety solutions. We also attempted to identify the ways to improve compliance in our hospital’s pediatric cardiology and neurology wards.

Methods

This is an experimental study conducted on all nurses in pediatric cardiology (8 nurses) and pediatric neurology wards (12 nurses) of Namazi Hospital, Shiraz during 2014 after obtaining oral informed

consent for the whole study. Exclusion criteria were the nurses who did not like to participate in this study. Approval for the study came from the Vice President of Research and Technology and the Ethics Committee (EC-9378-7118) of Shiraz University of Medical Sciences.

Data Collection Forms

To collect the data, we extracted the WHO guidelines on the 9 patient safety solutions from their official website and performed a backward translation for using in the research and educating healthcare workers; they included: 1) look-alike, sound-alike medication names; 2) patient identification; 3) communication during patient handovers; 4) performance of proper procedures at correct body sites; 5) control of concentrated electrolyte solutions; 6) assuring medication accuracy at transitions in care; 7) avoiding catheter and tubing misconnections; 8) single-use of injection devices; and 9) improved hand hygiene.

Then, we designed forms for all the 9 solutions to evaluate their current state of implementation. Data collection forms which included both closed and open ended questions with a total of 167 items were made after evaluating by a team of experts to ensure face validity. They were asked to comment on the items and finally some changes were made based on the received comments.

In data collecting forms, Items with a “Yes” answer were rated based on a Likert scale, including always=4, often=3, sometimes=2, seldom=1 and never=0. Responses of “No” or “I do not know” were considered similar and thus both received a score of 0.

Intervention Tools

To improve compliance with the two identified solutions, an intervention program based on an extensive search of websites related to patient’s safety, an extensive study of WHO guidelines, as well as numerous meetings with the heads of wards and advisors was designed. The intervention included a: 1) daily checklist for medication reconciliation; 2) medication reconciliation form; 3) list of medications taken by patients prior to admission; 4) list of medication prescribed after discharge; and 5) list of medications administered during hospitalization and required to be continued after discharge.

The intervention also included generation of a checklist for correct catheter and tubing connections, which included: 1) connection date; 2) warning label check and route retracing; 3) designing pamphlets for awareness on medication reconciliation; and 4)

correct catheter and tubing connections. Training courses on medication reconciliation and correct catheter and tubing connections were held for all nurses involved in this study.

Six months after distribution of the checklists and implementation of the intervention tools (design and distribution of pamphlets and holding two day training courses according to the activity plan and educational materials prepared by the study team members), the data collection forms were distributed again to reassess the two wards in terms of the two solutions under the study. The completed forms were then analyzed through SPSS Version 18.0, using descriptive statistics, means, standard deviations and t-tests, when appropriate.

Results

The participants were all 8 cardiology and 12 neurology nurses for pediatrics wards. The all filled out the 9 study forms. All were females holding bachelor's degrees. The mean ages of the nurses were 31.71 ± 8.25 and 31.25 ± 5.56 in the cardiology and neurology wards, respectively. Mean and standard deviation of work experience were 7 ± 6.19 and 9.2 ± 6.05 years for the nurses in cardiology and neurology wards, respectively.

After adding the scores together, two solutions - "assuring medication accuracy at transitions in care" and "avoiding catheter and tubing misconnections" received the lowest scores among the 9 solutions. This meant compliance for these two solutions was the lowest as compared to the others. Therefore, these two solutions were selected for the intervention. Table 1 lists the status of the cardiology and neurology wards in terms of medication accuracy at transitions in care.

Solution Number 4 ("performance of correct procedure at correct body site") generally evaluates a patient's condition at the time of surgery. Because our study involved two non-surgical wards, the solution

was excluded from our assessments.

Table 2 indicates that 87.5% of the cardiology nurses stated that they usually recorded a complete list of drugs, including herbal medicine and narcotics, used by the patients before admission into the Kardex System. It appears that no other forms for recording this information are available.

Seven neurology ward nurses stated there was no separate form for recording full medication histories, including a complete and accurate list of all drugs used prior to hospitalization, whether herbal, narcotic or otherwise. Only 16.7% of all nurses stated that such a form existed in their ward. Seven cardiology nurses and 11 neurology nurses reported that a new drug chart is given to all patients at the time of their discharge. This chart contains a list of medications started during their hospital stay.

In response to the open-ended question "what medication-related information other than drug names are provided in the drug chart given to patients at the time of discharge?", 62.5% of the cardiology nurses mentioned drug dosages, instructions for use and prescription dates. In the neurology ward, 41.7% of the nurses pointed to dosages, instructions to use and when to discontinue medication.

When asked the question "do the patients receive a new medication chart at the time of discharge containing a list of medication started in the hospital and required to be continued after hospitalization?", 62.5% of the cardiology nurses and 41.7% of the neurology nurses indicated that they did not know if such a list is given to patients. Only 25.0% and 33.3% of the nurses in cardiology and neurology wards, respectively, stated that they did fill out this form during the discharge process. The same number of nurses who mentioned prescription dates, drug dosages and instructions for use in response to the question "what medication-related information other than drug names are provided in the drug chart given to patients at the time of discharge?".

Table 1: Scores for patient safety solutions in pediatric cardiology & neurology departments

#	Nine patient safety solutions	Maximum score	Neurology Department		Cardiology Department	
			Total Score	Percentage	Total Score	Percentage
S1	Look-alike, sound-alike medication names	65	27.75	45	34.75	54.03
S2	Patient identification	21	13.66	68.25	16.5	82.14
S3	Communication during patient hand-overs	36	19.58	55.55	22.12	59.37
S5	Control of concentrated electrolyte solutions	47	25.66	53.19	33.5	71.27
S6	Assuring medication accuracy at transitions in care	15	8.5	36.66	5.5	34.16
S7	Avoiding catheter and tubing misconnections	48	16.66	40.27	21.37	46.87
S8	Single-use of injection devices	67	48.33	66.79	46.87	73.13
S9	Hand hygiene	45	28.33	66.66	37.25	74.44

Table 3: State of cardiology (ward E) and neurology (ward F) departments in regard to “assuring medication accuracy at transitions in care”

Assuring medication accuracy at transitions in care	Response: Rates (percentage)															
	Always		Often		Sometimes		Seldom		Never		Yes		No		I do not know	
	Ward E	Ward F	Ward E	Ward F	Ward E	Ward F	Ward E	Ward F	Ward E	Ward F	Ward E	Ward F	Ward E	Ward F	Ward E	Ward F
1. Is there a standard form in your department for collecting & recording data relating medication history? (a complete & accurate list of all medication a patient was using before admission, including herbal or narcotic)	2(25)	5(41/7)	3(37/5)	2(16.7)	1(12.5)	-----	-----	-----	-----	-----	6(75)	7(58/3)	1(12.5)	2(16.7)	-----	-----
											Recording in the separate form	Yes, there is a separate form				
2. If “Yes”, meaning that there is a separate form other than the Kardex, do you complete this form when admitting patients to the ward?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
3. If there is a separate form for medication history Other than the Kardex system, is this form added to the patient files?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6(75)	7(58/3)	-----	-----	-----	-----
4. At the time of discharge, do the patients receive a new medication chart containing a list of medication started during hospitalization?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	8(100)	11(91.7)	-----	1(8/3)	-----	-----
5. If “Yes”, do you provide this list when required?	6(75)	6(50)	2(25)	5(41/7)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
6. At the time of discharge, do the patients receive a medication chart containing a list of medication they were on before hospitalization and need to continue using after discharge?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	6(75)	9(75)	2(25)	3(25)	-----	-----
7. If “Yes”, do you provide this list when required?	3(37/5)	5(41/7)	3(37/5)	3(25)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Table 3 shows the conditions in the cardiology and neurology wards in terms of medication accuracy at transitions in care after the intervention. Both study wards demonstrated significant improvement six months after the intervention. Scores for “assuring medication accuracy at transitions in care” in the cardiology ward increased from 34.16% to 75%, while the scores of the neurology ward increased from 36.66% to 68.33%.

Table 4 reports on pre-existing conditions in the two study wards in relation to catheter and tubing misconnections before the intervention. Half the nurses at the neurology ward indicated there was a course for patients instructing them not to manipulate or disconnect the devices, catheters and tubes attached to their body for any reason. However, 62.5% of the nurses in the cardiology ward mentioned the lack of such a course.

Regarding provision of instructions to the patients’ relatives warning them not to manipulate or disconnect the devices, catheters and tubes attached to the patient’s body, 50% of the cardiology nurses said that the instructions were “sometimes” given, while 33.3% of neurology nurses indicated that patient relatives were “often” instructed on these matters.

One item in this section asked about “marking high-risk catheters, such as arterial, intrathecal and epidural catheters with warning labels.” Half of the cardiology nurses stated that they “sometimes” put warning labels on such catheters, while 66.7% of the neurology nurses indicated that they “never” used warning labels to mark the high-risk catheters. Moreover, 37.5% of the cardiology nurses and 58.3% of the neurology nurses stated that they “often” retraced the whole routes of catheters and tubes at transitions (e.g., during shift changes and patient transfers from one service or ward to another) to maintain proper connection.

Half the nurses in the neurology ward reported they “always” retraced the entire routes of catheters and tubes before administration of drugs, solutions or any other substance, to avoid misconnections. However, in the cardiology ward, 37.5% of the nurses indicated that they “sometimes” retraced the whole routes prior to drug administration. Furthermore, 62.5% of the cardiology nurses and 75% of the neurology nurses believed that no checklists were available in their ward for retracing the catheters and tubes. In cardiology, 62.5% of the nurses reported they “never” used catheters and tubes for any purpose other than their intended one. Answering the same question in the neurology ward, 58.3% of the nurses stated that they might “sometimes” use catheters and

tubes for purposes other than their original function. For example, half of them mentioned the use of feeding tubes for suction and another half had used IVs as oxygen tubing.

Table 4 also contains responses to the question “Is there a specific form for reporting faulty catheters and tubes to the hospital’s supply ward?”. Most (87.5%) cardiology nurses denied the existence of such forms, while 58.3% of the neurology nurses reported they were not aware if this form existed or not.

Table 5 shows the conditions of cardiology and neurology wards in relation to proper catheter and tubing connections after the intervention. After implementation, the scores for this solution increased from 46.67% to 72.91% in the cardiology ward. In the neurology ward, the scores increased from 40.27% to 67.53%.

Discussion

The limitation of this study was the limited number of nurses and areas of interventions which was due to time limitation. Unwanted drug complications can increase the time spent in the hospital. A study of six Massachusetts hospitals reported that drug complications led to an average increase of US\$3420 in patient treatment costs and 3.1 added days spent in the hospital (13).

Medication reconciliation is a process that requires comparison of medication prescribed by hospital physicians and the medications patients were taking prior to hospitalization. Obtaining the best possible medication history (BPMH) is essential to the process. BPMH lists all medications a patient is taking (prescribed or non-prescribed), along with medication names, dosages, consumption periods and methods of administration (14). Implementing the medication reconciliation process requires trained personnel and proper interaction with patients and their relatives to obtain a BPMH. In this study, the role of families was highlighted because the hospital population studied was children.

Rappaport et al. (2011) reported on certain interventions, including electronic registration of medications, automation of the medication charts, training courses, and provider compliance reporting. The results indicated that the use of medication reconciliation increased from essentially zero in 2005 to 71% in 2010. (15) This study, as well as ours, suggests that compliance with the solution “assuring medication accuracy at transitions in care” increases following interventional programs including medication reconciliation and training. This should play a significant role in reducing adverse side-effects

Table 4: State of cardiology (ward E) and neurology (ward F) departments in regard to “avoiding catheter and tubing misconnections

Choices	Response: Rates (percentage)																							
	Always			Often			Sometimes			Seldom			Never			Yes			No			I do not know		
	Ward E	Ward F		Ward E	Ward F		Ward E	Ward F		Ward E	Ward F		Ward E	Ward F		Ward E	Ward F		Ward E	Ward F		Ward E	Ward F	
1. Is there an instructional course for patients in your ward on avoiding unnecessary manipulation & disconnection of devices, catheters & tubes attached to their body?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
2. If “Yes”, do you provide such instructions? (assuming that the patient is conscious)	1(12/5)	3(25)	2(25)	3(25)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
3. Do the non-medical personnel receive any training on avoiding unnecessary manipulation & disconnection of devices, catheters & tubes attached to the patient’s body?	2(25)	3(25)	2(25)	2(16/7)	1(12/5)	3(25)	3(37/5)	1(8/3)	2(25)	3(25)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
4. Are patients family members, trained not to make any unnecessary tampering with devices and catheter attached to patients?	2(25)	3(25)	1(12/5)	4(33/4)	4(50)	1(8/3)	-----	2(16/7)	1(12/5)	2(16/7)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
5. Do you mark high-risk catheters (arterial, intrathecal, epidural, etc.) with a warning label?	3(37/5)	1(8/3)	1(12/5)	2(16/7)	4(50)	1(8/3)	-----	-----	-----	-----	-----	-----	-----	-----	8(66/7)	-----	-----	-----	-----	-----	-----	-----	-----	
6. Do you retrace the whole routes of catheters & tubes at transitions (during shift changes and patient transfers from one service or ward to another) to ensure their proper connection?	2(25)	4(33/4)	3(37/5)	7(58/3)	1(12/5)	-----	2(25)	1(8/3)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	
7. Is there a checklist in your ward for ensuring proper connection of catheters & tubes at the time of discharge?	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	2(16/7)	-----	-----	-----	-----	-----	-----	-----	-----	2(25)
8. If “Yes”, do you complete this checklist at during the process of discharge?	2(25)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
9. Do you retrace the whole routes of catheters & tubes before administration of drugs, solutions or other substances delivered through the catheters?	2(25)	6(50)	2(25)	6(50)	3(37/5)	-----	1(12/5)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

3. Do the non-medical personnel receive any training on avoiding unnecessary manipulation & disconnection of devices, catheters & tubes attached to the patient's body?	3(37/5)	2(16/7)	1(12/5)	5(41/7)	4(50)	5(41/7)	-----	-----	-----	-----	-----	-----	-----
4. Are patients family members, trained not to make any unnecessary tampering with devices and catheter attached to patients?	5(62/5)	4(33/4)	3(37/5)	7(58/3)	-----	1(8/3)	-----	-----	-----	-----	-----	-----	-----
5. Do you mark high-risk catheters (arterial, intrathecal, epidural, etc.) with a warning label?	2(25)	5(41/7)	6(75)	7(58/3)	-----	-----	-----	-----	-----	-----	-----	-----	-----
6. Do you retrace the whole routes of catheters & tubes at transitions (during shift changes and patient transfers from one service or ward to another) to ensure their proper connection?	4(50)	6(50)	4(50)	5(41/7)	-----	1(8/3)	-----	-----	-----	-----	-----	-----	-----
7. Is there a checklist in your ward for ensuring proper connection of catheters & tubes at the time of discharge?	-----	-----	-----	-----	-----	-----	8(100)	9(75)	-----	-----	-----	3(25)	-----
8. If "Yes", do you complete this checklist at during the process of discharge?	1(12/5)	8(66/7)	5(62/5)	1(8/3)	-----	-----	-----	-----	-----	-----	-----	-----	-----
⁹ . Do you retrace the whole routes of catheters & tubes before administration of drugs, solutions or other substances delivered through the catheters?	5(62/5)	3(25)	3(37/5)	5(41/7)	3(25)	-----	1(8/3)	-----	-----	-----	-----	-----	-----
¹⁰ . Is there a checklist in your ward for ensuring proper connection of catheters & tubes at the time of drug administration?	-----	-----	-----	-----	-----	-----	6(75)	9(75)	2(25)	3(25)	-----	-----	-----
11. If "Yes", do you complete this checklist when required?	5(62/5)	6(50)	1(12/5)	3(25)	-----	-----	-----	-----	-----	-----	-----	-----	-----
12. Are there any occasions when you use the catheters & tubes for purposes other than their intended one? (e.g. using a feeding tube instead of a catheter in venous cut-down)	-----	-----	-----	-----	-----	1(8/3)	1(12/5)	5(41/7)	7(87/5)	6(50)	-----	-----	-----

13. Do you ever place tubes with different purposes in close proximity to each other? (e.g. placing a CVP line close to an epidural catheter)	1(12/5)	3(25)	7(87/5)	9(75)	2(16/7)
14. In case the catheters and tubes have the potential for misconnections (i.e. they could be used for purposes other than their intended one), is there a specific form in your ward for reporting them to the supply department?				8(100)	10(83/3)
15. If your response to item 14 was "Yes", do you complete this form when encountering faulty catheters & tubes?					

among the patients, especially pediatric patients.

Regarding the solution “avoiding catheter and tubing misconnections,” scores increased from 46.87% before the intervention to 72.91% in the cardiology ward. The score was 40.27% in the neurology ward before the intervention and increased to 67.53% afterwards.

Tubes, catheters and syringes are the most significant aspects of the daily healthcare provision of drugs and fluids to patients (16). The Joint Commission on Accreditation of Healthcare Organizations reported on 117 cases of misconnections that directed enteral feeding solutions into IV lines resulting in 21 deaths. It is believed that tubing misconnections are underreported with adverse events sometimes not reported at all, especially when the mistake does not result in harm to the patient. Sometimes, they are reported under another category, such as a medication error. The risk for tubing misconnection is high, considering that almost all patients admitted to the hospital receive some type of IV. (17).

A study conducted by Exline et al. (2013) reported on the effect of a two-year long intervention. They concluded that the rate of central line-associated blood infections decreased from 2.65 infections per 1000 catheter days before the intervention to 1.24 infections after it (18). A study by Miller et al. (2010) investigated implementation of interventional programs, which included holding training courses on catheter replacement and devising a replacement checklist. They found that the rate of catheter-associated bloodstream infections had decreased to 43%. (19). Studies like these identify the influence the interventions have on the rate of adverse outcomes.

Results of this study suggest that we should achieve significant improvements regarding the WHO’s 9 solutions concerning the patient’s safety. In relation to the two initially low compliance solutions - “assuring medication accuracy at transitions in care” and “avoiding catheter and tubing misconnections,” the intervention included training the nurses, avoiding high-risk actions, designing a medication reconciliation form, and creating a checklist for proper catheter and tubing connections. Application of an implementation program seems to have improved the compliance with the two solutions in the pediatric cardiology and neurology wards of Namazi hospital, Shiraz, Iran.

Limitations of our study included: 1) the number of participants was limited; 2) the data came from self-reporting surveys; 3) only a single hospital was studied, and 4) only two wards were evaluated.

Conclusion

Namazi Hospital introduced an initiative to provide safe and quality care based on addressing the WHO’s 9 patient safety solutions. Results from this study suggest that the intervention used had a positive impact on medication reconciliation and the use of catheter and tubing retracing checklists at transitions in care. Hospital managers first need to evaluate the existing issues concerning the patients’ safety and then attempt to solve them by implementing necessary interventions. The current study shows that by discussing items in details and making standards for different procedures, we can improve the system properly. This was a pilot study showing the method for

quality improvement in all hospital wards.

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References

1. Organization WH. Quality of care: a process for making strategic choices in health systems. 2006.
2. World Health Organization. Health services development, More Information on Quality, Patient Safety. [Last accessed on 30 October 2017]. Available from: http://www.wpro.who.int/health_services/quality_patient_safety_more_information/en/index.html
3. World Health Organization. Patient safety. [Last accessed on 14 September 2017]. Available from: <http://www.who.int/patientsafety/about/en>
4. Forum NQ. Safe practices for better healthcare—2010 update: a consensus report. NQF Washington, DC; 2010.
5. Committee on Pediatric Emergency Medicine AAoP, Krug SE, Frush K. Patient safety in the pediatric emergency care setting. *Pediatrics*. 2007;120(6):1367-75. doi: 10.1542/peds.2007-2902.
6. World Health Organization. Patient safety solution preamble May 2007. [Last accessed on 14 September 2017]. Available from: <https://www.jointcommissioninternational.org/assets/3/7/PreambleandSolutionsENGLISH.pdf>.
7. World Health Organization. WHO launches 'Nine patient safety solutions. [Last accessed on 14 September 2017]. Available from: <http://www.who.int/mediacentre/news/releases/2007/pr22/en/>
8. Rekleiti M, Kyloudis P, Toska A, Saridi M. Patient safety and healthcare quality. *International Journal of Caring Sciences*. 2012;5(2):74-9.
9. Meyer JA, Silow-Carroll S, Kutyla T, Stepnick LS, Rybowski LS. Hospital quality: ingredients for success—overview and lessons learned. *New York, NY: The Commonwealth Fund*. 2004.
10. National Patient Safety Foundation's Lucian Leape Institute. Safety Is Personal: Partnering with Patients and Families for the Safest Care. Boston, MA: National Patient Safety Foundation; 2014. [Last accessed on 14 September 2017]. Available from: https://c.ymcdn.com/sites/npsf.site-ym.com/resource/resmgr/LLI/Safety_Is_Personal_Executive.pdf
11. Parand A. The role of acute care managers in quality of care and patient safety. London: Imperial College London, 2013.
12. Lannon CM, Coven BJ, Lane France F, Hickson GB, Miles PV, Swanson JT, et al. Principles of patient safety in pediatrics. *Pediatrics*. 2001;107(6):1473-5. doi: 10.1542/peds.107.6.1473.
13. Hug BL, Keohane C, Seger DL, Yoon C, Bates DW. The costs of adverse drug events in community hospitals. *Jt Comm J Qual Patient Saf*. 2012;38(3):120-6. doi: 10.1016/s1553-7250(12)38016-1.
14. Kwan JL, Lo L, Sampson M, Shojania KG. Medication reconciliation during transitions of care as a patient safety strategy: a systematic review. *Ann Intern Med*. 2013;158(5 Pt 2):397-403. doi: 10.7326/0003-4819-158-5-201303051-00006.
15. Rappaport DI, Collins B, Koster A, Mercado A, Greenspan J, Lawless S, et al. Implementing medication reconciliation in outpatient pediatrics. *Pediatrics*. 2011;128(6):e1600-7. doi: 10.1542/peds.2011-0993.
16. World Health Organization. Patient Safety Solutions: Avoiding Catheter and Tubing Misconnections. Geneva: World Health Organization. 2007.
17. Joint Commission on Accreditation of Healthcare Organizations. Managing risk during transition to new ISO tubing connector standards. *Sentinel Event Alert*. 2014(53):1-6.
18. Exline MC, Ali NA, Zikri N, Mangino JE, Torrence K, Vermillion B, et al. Beyond the bundle--journey of a tertiary care medical intensive care unit to zero central line-associated bloodstream infections. *Crit Care*. 2013;17(2):R41. doi: 10.1186/cc12551.
19. Miller MR, Griswold M, Harris JM, 2nd, Yenokyan G, Huskins WC, Moss M, et al. Decreasing PICU catheter-associated bloodstream infections: NACHRI's quality transformation efforts. *Pediatrics*. 2010;125(2):206-13. doi: 10.1542/peds.2009-1382.