

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

Fatemeh Kalroozi¹, *Soodabeh Joolae², Mansoureh Ashghali Farahani³, Behzad Haghghi Aski⁴, Ali Manafi Anari⁵

1 Instructor, Pediatric Nursing Department, Aja University of Medical Sciences, PhD Candidate of Nursing and midwifery, Iran University of Medical Sciences, Tehran, Iran.

2 Research Ethics Specialist, Fraser Health Authority, BC, Canada; Professor, Nursing Care Research Center, Iran University of Medical Sciences, Tehran, Iran; Center for Health Evaluation & Outcome Sciences, University of British Columbia, Vancouver, Canada.

3 Professor, Nursing Care Research Center, Medical-Surgical Nursing Department, School of Nursing and Midwifery, Iran University of Medical Sciences, Tehran, Iran.

4 Assistant Professor of Pediatrics, Department of Pediatrics, Aliasghar Children's Hospital, Iran University of Medical Sciences, Tehran, Iran.

5 Assistant Professor of Pediatrics, Department of Pediatrics, Aliasghar Children's Hospital, Iran University of Medical Sciences, Tehran, Iran.

Abstract

Background: This study aimed to determine factors affecting compliance with Hand Hygiene (HH) from the perspective of the health care team working in the pediatric intensive care unit of a children's tertiary center, Ali-Asghar hospital, in Tehran, Iran.

Methods: we recruited 35 Pediatric ICU health care workers, including nurses, attending physicians and medical students, selected by purposive sampling between February to November 2020. Data were collected using deep semi-structured interviews, and analyzed through Graneheim and Lundman's (2004) qualitative conventional content analysis method. All interviews were recorded and typed in the MAXQDA software and then analyzed in eight steps including writing interviews, determining the semantic units, text coding, matching codes with text, categorizing and developing categories, reviewing the categories, identifying the sub themes and reporting the findings.

Results: 68.5% of the participants were female, with an average age of 32.7 years and work experience of 8.6 years. After reviewing all codes obtained, 4 main categories were finally extracted. (I) Meta-organizational factors including two subcategories of macro-health policy, sanctions and economic problems, (II) Organizational factors including three subcategories of incoherence in observing the rules, monitoring and evaluation, and the prevailing attitude of the organization, (III) Individual factors including three subcategories of attitude of the health care team towards patients, skin reactions to hand sanitizers, concerns about their own health and health of their family, (IV) Characteristics of the clinical environment including three subcategories of professional relationships, special conditions governing the pediatric ICU, and care facilities.

Conclusion: Overall, 234 codes were extracted from the interviews and after the integration of similarities, four key themes including Meta-organizational factors, Organizational factors, Individual factors and Characteristics of the clinical environment were obtained indicating factors affecting hand hygiene performance of the PICU health care team.

Key Words: COVID-19, Hand hygiene, Health care team, Pediatric ICU, Perspective, Qualitative research.

*Please cite this article as: kalroozi F, Joolae S, Ashghali Farahani M, Haghghi Aski B, 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. Int J Pediatr 2021; 9 (11): 14783-14800. DOI: **10.22038/IJP.2021.56160.4418**

*Corresponding Author:

Soodabeh Joolae, Research Ethics Specialist, Fraser Health Authority, BC, Canada; Professor, Nursing Care Research Center, Iran University of Medical Sciences, Tehran, Iran; Center for Health Evaluation & Outcome Sciences, University of British Columbia, Vancouver, Canada.

Email: sjoolae@mail.ubc.ca

Received date: Mar.5,2021; Accepted date:Mar.18,2021

1- INTRODUCTION

The COVID-19 disease has been diagnosed since November 2019 in Wuhan, the capital of Hubei Province in China (1). It quickly spread around the world, turning into a global crisis (2). Similar to the epidemics of other infectious diseases such as SARS and Ebola, the health care team is the first line of treatment for this disease and has the main responsibility of caring for patients (3). In addition, they must be careful not to transmit this dangerous virus to other patients and themselves (4, 5, 6). For this reason, providing safe care for patients has become one of the top priorities of healthcare systems worldwide (7). In this regard, the World Health Organization (WHO) considers hand hygiene as one of the most effective ways to ensure the health of medical care team and patients, especially during the COVID-19 pandemic and emphasizes the active participation of countries in the global hand hygiene campaign with the slogan "save lives, clean your hands" together with the correct performance of the medical care team in observing hand hygiene, prevents the death of countless people (8). This organization has introduced the observance of hand hygiene using alcohol-based hand rubs as one of the cheapest and most effective ways to combat COVID-19 transmission (1). Global statistics before COVID-19 outbreak showed that the rate of hand hygiene compliance among health care staff was about 40% (9). In addition, studies in different countries revealed that the level of health care team compliance with hand hygiene was low and they did not do hand hygiene properly before performing aseptic procedures (10- 13). However, in recent months, the increasing prevalence of COVID-19 and the increase in information on its prevention and spread have attracted the attention of the general public, especially health workers (14). This issue has led to an increase in compliance

with hand hygiene by the health care team in different communities (4, 15, 16). In two studies conducted during the COVID-19 pandemic, the rate of hand hygiene compliance by the health care team was 79.4% (17) and 74% (18). A recent study on the COVID-19 epidemic in Guangzhou, found that the rate of COVID-19 infection among nurses in infected cities dropped to zero due to strict hand hygiene compliance and observance of safety issues related to hand hygiene by the health care team (19). Having searched the available documents and studies, we did not find any accurate statistics on the rate of hand hygiene compliance among the health care team during the outbreak of COVID-19 in Iran; although researchers' observations at the bedside showed an increase in the rate of hand hygiene observance among the health care team. Most studies in Iran indicated poor hand hygiene compliance by the health care team. Before the outbreak of COVID-19, this rate averaged between 35-43.5% (20). It was also found that the rate of hand hygiene compliance among nurses was higher than physicians and other members of the health care team (21, 22). In another study, the rate of hand hygiene compliance was reported to be 27.7 % (23). The reasons for inadequate hand hygiene compliance seem to vary among the health care team in developed and developing countries. The most common reasons in developing countries are facing a heavy workload and large number of patients (24). Shortage of manpower and financial resources, time-worn and poor quality equipment, inappropriate health and physical environment, lack of criteria for evaluating and controlling infection, and inadequate use of guidelines (25, 26). Obstacles such as lack of time and the team's point of view about the possibility of transmitting the infection to themselves or others have been mentioned as factors negatively affecting the performance of the health care team in complying with hand hygiene (27). Existence of inappropriate

safety atmosphere (28) and insufficient knowledge of the health care team (20, 29, 30) and changes in COVID-19 condition are among other factors. Given the importance of hand hygiene compliance during the outbreak of COVID-19, the purpose of this study was to determine factors affecting hand hygiene compliance from the perspective of the health care team working in the Pediatric ICU of a pediatric tertiary center during the outbreak of COVID-19 disease in Tehran, Iran.

2- MATERIALS AND METHODS

2-1. Study design

This qualitative study (content analysis) was conducted from February to November 2020 to achieve the purpose of the study in the pediatric intensive care unit of a children's tertiary center Ali-Asghar hospital- a specialized pediatric hospital affiliated to Iran University of Medical Sciences and Health Services, Tehran, Iran.

2-2. Participants

Participants were selected by purposive sampling from the Pediatric ICU of a pediatric tertiary hospital in Tehran, the capital of Iran, as a large pediatric referral center. The researcher interviewed 35 participants, including 21 nurses, 3 attending physicians, and 11 medical students. Inclusion criteria were willingness to participate in the study, being able to express their experiences well, and speaking Persian. Inclusion criteria for nurses were having at least a bachelor's degree and at least six months of experience working in the pediatric ICU. Inclusion criteria for medical students were having at least three months of experience working in the pediatric ward (having worked in the pediatric ICU for one month). The reluctance to participate in the study for any reason at any stage of the interviews was defined as one of the exclusion criteria in this study.

It should be noted that none of the participants withdrew from the study.

2-3. Data Collection

Data were collected using semi-structured interviews, field notes, and observation. Interviews were initiated with open-ended questions, such as "What factors do affect your performance in hand hygiene compliance while caring for or treating a child admitted to the Pediatric ICU?", and then other questions were asked based on the participants' answers to gain more details, such as "Can you explain more about it?", "Do you have any experience with this?", "Why?". The interviews were conducted by the first researcher of the study in the nurses' rest room or Pediatric ICU conference room, and some interviews were performed in the place coordinated with the participant. All interviews were recorded using a digital voice recorder, with the consent of the participants. The interviews lasted between 40-90 minutes, 50 minutes on average. The interviews continued until data saturation was achieved and no additional data was obtained. All interviews were conducted by the first researcher.

2-4. Ethical considerations

This article was part of the Ph.D. dissertation written by the first author. The dissertation was done through a Participatory Action Research approach. The Ethics Committee of Iran University of Medical Sciences, Tehran, Iran, approved this study (code: IR.IUMS.REC.1397.492). At baseline, participants were given complete explanations about the aims and procedure of the research, then, they were asked to sign an informed consent form if they volunteered to participate in the study.

2-5. Data Analysis

Data analysis was performed based on five stages of the content analysis approach proposed by Graneheim and Lundman)

2004) (31). For this purpose, in the first stage, the recorded voice was transcribed after each interview. The transcriptions were read and reviewed line by line and word by word for several times, and the initial codes were categorized, and subcategories were written based on differences and similarities. In the next step, the subcategories were reviewed again and compared with each other to identify the main categories. Preliminary initial codes, subcategories, and categories were constantly reviewed and compared to ensure the soundness of the analysis. The ambiguous points that need attention, in addition to being reviewed by the participants, were also used in subsequent interviews so that the ambiguous points were removed and the status of the codes was completely determined. The researchers avoided predefined categories and extracted the categories based on the obtained data. Finally, the categories were summarized, the main concept of each category was defined and the main concepts were extracted. This approach helps generate findings directly from the data without any belief imposition (32). MAXQDA 10 software was used to manage the data. In summary all interviews were analyzed in eight steps including writing interviews, determining the semantic units, text coding, matching codes with text, categorizing and developing categories, reviewing the categories, identifying the sub themes and reporting the findings. All researchers' extracted codes were compared, and the final codes were confirmed with an agreement of more than 90%.

2-6. Data trustworthiness and rigor

To ensure the trustworthiness of the study, four criteria, including credibility, dependability, confirmability, and transferability introduced by Guba and Lincoln were used (33). The first author (F.K) has 18 years of experience in the pediatric department, is responsible for

educating nursing students in these departments, and has sufficient knowledge of the research environment. The researcher's long-term interaction with the participants in the study environment helped her to gain the participants' trust and thus ensure the credibility of the study. Besides, the two members of the research team were ICU attendants (B. H. A and M. A. A.).

The main findings of the study were provided to five participants to check the congruence between results and their experiences. Another technique used to ensure credibility was asking a researcher with experience in qualitative studies and two Ph.D. nursing students to review raw data and findings. In addition to the second and third researcher, two expert qualitative researchers supervised all codes. All research-related activities related to the study were documented, and the documents related to the study were maintained in order to ensure confirmability and dependability and provide others with the opportunity to follow the stages taken in the study. Maintaining such documents can help readers and reviewers develop greater trust in the data. In addition, we attempted to provide a rich description of the data to enhance the vividness and the transferability of the findings.

3- RESULTS

The participants of this study included 30 females and 5 males. 68.5% of the participants were female, with an average age of 32.7 years and work experience of 8.6 years. The demographic information of the participants is given in **Tables 1** and **2**. After reviewing the 324 codes, Factors affecting hand hygiene compliance by the health care team were divided into 4 main categories and 11 subcategories. The main categories included Meta-organizational factors, and individual factors as well as clinical environment characteristics. The categories and subcategories are shown in

Table 3 and are described in more detail below.

Table-1: Demographic characteristics of the participants

Participant's code	Job	Age	Sex	Work Experience
1	Nurse	32	Male	8
2	Nurse	29	Female	5
3	Nurse	31	Female	9
4	Nurse	43	Female	17
5	Nurse	39	Female	15
6	Nurse	32	Female	8
7	Nurse	28	Female	3
8	Nurse	27	Female	4
9	Nurse	43	Male	15
10	Nurse	43	Male	14
11	Nurse	40	Male	11
12	Nurse	34	Female	4
13	Nurse	30	Female	3
14	Nurse	38	Female	11
15	Nurse	29	Female	3
16	Nurse	31	Female	5
17	Nurse	30	Female	4
18	Nurse	30	Female	2
19	Nurse	32	Female	5
20	Nurse	28	Female	4
21	Nurse	29	Female	3
22	Attending physician	51	Male	12
23	Attending physician	43	Male	14
24	Attending physician	39	Male	16
25	medical student	32	Male	4
26	medical student	29	Male	2
27	medical student	28	Female	2
28	medical student	37	Female	6
29	medical student	31	Female	3
30	medical student	30	Female	5
31	medical student	31	Female	3
32	medical student	29	Female	2
33	medical student	31	Female	3
34	medical student	29	Male	2
35	medical student	30	Male	3

Table-2: Participants' characteristics

Characteristics		N
Age (years)	20-30	8
	31-40	16
	41-50	11
Sex	Female	30
	Male	5
Professional role	Nurses	21
	Attending Physicians	3
	Medical students	11
Work experience (years)	0-5	13
	6-11	4
	12-17	10
	18-23	8

Table-3: Categories and Subcategories extracted from data analysis

Categories	Sub categories
Meta-organizational factors	Macro -health policy Sanctions and economic problems
Organizational factors	Incoherence in rules Monitoring and evaluation The prevailing attitude of the organization
Individual factors	Attitudes of the health care team towards the patient Skin reactions to hand sanitizers Concerns about their own health and the health of their family
Characteristics of the Clinical Environment	Professional relationships Special conditions governing the ward Care facilities

3-1. Meta-organizational factors:

3-1-1. Macro-health policy

The participants stated that Meta-organizational factors influenced their performance in hand hygiene compliance during the COVID-19 epidemic. These factors are major policies implemented by the Ministry of Health and Medical Education of Iran. These policies include the implementation of Assistant plan (implemented since 2013 by the Ministry of Health and Medical Education of Iran in medical centers which obliged these centers to admit all patients transferred by the ambulances), restrictions on the recruitment of new staff, and the

implementation of health transformation plan (a plan to reduce people's out-of-pocket payments and afford the cost of treatment through health insurance coverage). These policies were implemented before the outbreak of COVID-19 in Iran medical centers. The continuation of these programs simultaneously with the outbreak of COVID-19 disease in the country has put additional pressure on the health care team, which had been effective on hand hygiene performance of the health care team from the participants' point of view.

"Previously, we had a call from another governmental hospital to get an admission

for the patient. If we did not have an empty bed, we would not have admitted the patient. However, after the implementation of the Assistant plan, we must admit the patient in any way, like moving some patients and providing a bed for a new patient, and that means double pressure on us. So, hand hygiene will take a low priority for us in these conditions" (Participant 1).

"We have a shortage of nurses here and we have to bear the conditions. The government has restricted the recruitment of new staff. On the other hand, some of the staff leave the work shift due to COVID-19 infection" (Participant 2).

3-1-2. Sanctions and economic problems

It seems that the economic problems resulting from international sanctions and its impact on the economic condition of the Iranian government affected the quality of healthcare team Compliance with hand hygiene.

"The hospital is facing shortages due to sanctions. Now, due to COVID-19, the situation is even worse. We need to clean our hands more. Buying poor quality detergents is a simple example. Purchased hand rub solutions usually do not have emollients; the skin of our hands becomes dry and starts to crack. On the other hand, the gloves are of poor quality, they tear quickly, and the hospital has shortages of them" (Participant 5).

"We have shortcomings here affecting our hand hygiene practice. For example, we used to have foam hand washing liquid, which had a high cleaning power and did not damage our hands, but because it was imported, we do not have access to it now due to the sanctions and government financial problems. Either our poor quality gloves will tear quickly. Eventually, we will have to wash our hands less and use gloves more, even though we know our work is wrong in this situation" (Participant 14).

"Our country is under sanctions. They want us to economize. We have a shortage of masks and personal protective equipment. What were you doing in this situation? It is well known that these issues affect my preoccupation with hand hygiene. I'm tired of shortcomings; I leave myself to God and less observe the hand hygiene" (Participant 29).

3-2. Organizational factors

3-2-1. Incoherence in rules

One of the factors affecting the observance of hand hygiene in the pediatric ICU from the participants' point of view was the lack of coherence in the existing rules. According to them, some rules were taken seriously but soon forgotten, in alignment with the views and performances of hospital and ward authorities.

"For example, at the beginning of COVID-19 outbreak, the specialists and ward authorities emphasized hand hygiene, and they were constantly reminding us to be careful, and we complied with hand hygiene 100%, but after a while, they gave up all that emphasis. We also become less adhered to hand hygiene compliance due to crowdedness of the ward and the large number of patients"(Participant 28).

"Every day, we face a new law and notification. Every day and every moment, a new decision is made. Nursing management gives an order; hospital management gives another one that is often forgotten soon. This incoherence in decisions and laws causes our minds to be disturbed. Although we are worried about ourselves and our family, the mental turmoil caused by the constant change of instructions and rules causes us to get tired and not do a series of things; one of which is hand hygiene" (Participant 17).

3-2-2. Monitoring and evaluation

According to the participants, monitoring the performance of the health care team was effective in observing hand hygiene.

They considered the supervision of the hospital nursing management to be superficial and inadequate and believed that it could not affect their hand hygiene performance.

"Hospital nursing management supervision is not enough. It is limited to a series of quick visits to the ward and superficial supervision. We do not see nursing managers by our side" (Participant 9).

"There is no proper supervision here. They give an order. Then, it becomes normal, and gradually it is forgotten like the order of regular hand hygiene. They emphasized hand hygiene practice for a short time, and then everything was forgotten" (Participant 12).

3-2-3. the prevailing attitude of the organization

One of the factors that affected hand hygiene performance of the health care team, based on participants' view, was the prevailing attitude of the organization towards hand hygiene.

"Senior hospital managers do not prioritize hand hygiene. They do not care what we do. They are involved in their own heavy work in this situation. For example, providing personal protective clothing is a higher priority for them in these conditions"(Participant 15).

"I believe that our hand hygiene is not a priority for the hospital Authorities. The situation in the hospital is disturbing now. We are in a pandemic and have a large number of patients. They have to deal with so many problems, among which hand hygiene is lost. Hand hygiene is not the first priority for them" (Participant 3).

3-3. Individual factors

3-3-1. Attitude of the health care team towards the patient

It seems that the young age of the patients under the care of the healthcare team,

made the care team feel more companionate and positive towards them:

"I'm very interested in my work. In addition, my patients are children. I always observe hand hygiene and I do not want to transmit COVID-19 disease to the sick child admitted here" (Participant 2).

"These are sick children. I do not want to cause them any additional harm. So, I am careful, and one of the things I do is observing hand hygiene strictly" (Participant 10).

3-3-2. Skin reactions to hand sanitizers

The effect of skin allergies, as an individual factor, on inadequate hand hygiene performance was repeatedly mentioned by the participants. The health care team attributed this issue to the poor quality of hand wash solutions, and the high frequency of using them due to the COVID-19 outbreak, and the special conditions of the ward and the children hospitalized in this ward.

"It is not difficult for me to wash my hands, but the quality of the hand wash liquid used is poor, drying the skin on my hands and causing cracks" (Participant 5).

"We have to wear gloves when we want to work. The reason is that we have to wash our hands regularly and this damages the skin of our hands, so I prefer to wear two gloves instead of doing hand hygiene. This in itself deteriorates my hand skin irritation, because my hands sweat inside the gloves" (Participant 19).

3-3-3. Concerns about their health and the health of their family

The outbreak of COVID-19 raised fears about transmitting the disease to members of the health care team and their families. Participants repeatedly stated that this concern was the most important factor affecting their hand hygiene performance.

"We all have a family. I do not want to transmit the virus to them. So, as far as

possible, I observe hand hygiene and use personal protective clothing" (Participant 23).

"Many nurses and doctors lost one of their family members in this pandemic. That means that the virus has reached their homes. I am anxious about this. I try to follow the protective rules like hand hygiene" (Participant 30).

3-4. Characteristics of the clinical environment

3-4-1. Professional relationships

The health care team believed that the kind of relationship they had with other healthcare team members affected their hand hygiene compliance. In other words, the relationship dynamics could have a positive or negative impact on their hand hygiene performance.

"Our relationship with the other members of the team, both the nurses and the doctors, is excellent. Now it has gotten better in COVID-19 outbreak. We are a team. If we see that there is failure to do tasks, especially regarding the hand hygiene practice in these conditions, we will remind our colleagues. We do not get upset with each other" (Participant 12).

"We also had cases where one of the nurses very respectfully reminded one of the surgeons, who came to the ward, to wash his hands. The surgeon got upset and shouted: It is not your business! You do not have the right to tell me what to do. He did not think that in these conditions, high and low ranks are no longer in question" (Participant 21).

3-4-2. Special conditions governing the unit

The conditions of the intensive care unit are one of the factors that, from the participants' point of view, could affect the performance of the health care team in observing hand hygiene. The crowdedness and workload of the ICUs, emergency

conditions of the patients admitted in this unit, and high probability of patients' mortality were among the differences between the ICU and other units from the perspective of the health care team.

"One of the obstacles in hand hygiene practice is the crowdedness of our ward. There are many times when we cannot act according to scientific principles and guidelines. Most of the time, the workload is so huge that the staff forget or do not have time to wash their hands" (Participant 2).

"Sometimes we have to do some tasks together. For example, I want to do NGT now and I should do other work at the same time, like resuscitating a patient. So, how much time do I have for performing the principles of hand hygiene? Sometimes in the ward, we do some work together. For example, when we should write the doctor's orders, take the patient from the operating room, and check the patient's tests, I do not really think about hand hygiene. However, when the ward is not crowded and we do not have critically ill patients, I surely observe hand hygiene since I love the patients and myself" (Participant 17).

"There are many times when my shift has not started yet and I am not ready to come to the ward, but my coworkers call me and say: hurry up we have resuscitation. The patient is dying. Come for help. Therefore, what do you expect from me in this situation? Can I work both fast and with quality?" (Participant 6)

"Most doctors and nurses are tired of these conditions. They have long shifts. They just want to do something fast and leave the ward soon. Residents have fourteen 12-hour shifts in addition to their own special training programs and courses. Nurses, in addition to their scheduled shift, must also work overtime, and this affects their performance in relation to hand hygiene" (Participant 17).

3-4-3. Care facilities

The members of the health care team in this study stated that the existence of sufficient and high-quality facilities was effective in Hand Hygiene compliance among the health care team of pediatric ICU, and it seems that the health care team had problems in this regard.

"I must say that the lack of facilities negatively affected our hand hygiene performance. Some nurses bring hand washing liquid with them, because the quality of the hand washing liquid provided by the hospital is low and leads to skin dryness; so we cannot wash our hands regularly"(Participant 22).

"Until last year, the hospital provided tissues. Since the outbreak of COVID-19, the use of tissues has also increased. Like many other things, the hospital is short of supplies. Now, parents buy, or we get help from donors. The quality of the tissues is not good, either"(Participant 19).

"Right now, because of the outbreak of COVID-19, we are performing endotracheal intubation, and suctioning a lot. We often have to suction using clean technique and we cannot do it through sterile technique since we do not have sterile gloves"(Participant 3).

"We do not have a suitable hand -wash sink in this ward. For example, the hand -wash sinks in the operating room have a pedal and a dryer, but these facilities do not exist here" (Participant 18).

"There are not enough hand-washing sinks in the ward. We have only one wash basin next to the nursing station and one at the end of the ward, which often contains the patient's blood and secretions. I do not want to wash my hands there" (Participant 3).

"I saw in other wards that air pressure is used to dry the hands, but we do not have it here. We have to dry our hands with a

tissue, which most of the time does not exist" (Participant 29).

"If I'm at the end of the ward, I have to come to the front to wash my hands. I saw in the intensive care wards of other hospitals that the hand wash sinks are close to each other. This means that doctors and nurses have easier access to disinfectants, soap, and water. This easy access itself helps to overcome our laziness for washing hands. In the current situation that the ward is crowded, I think it is not worthwhile for me to go to the front of the ward and wash my hands"(Participant 11).

4- DISCUSSION

This study was performed to explore factors behind hand hygiene compliance from the perspective of the pediatric ICU health care team in a pediatric hospital in Tehran, Iran, at the time of COVID-19 outbreak. Four main categories of Meta-organizational, Organizational, Individual factors, and Characteristics of the clinical environment were identified. In this study, we found that one of the main factors affecting the performance of the health care team with respect to hand hygiene compliance were the Meta-organizational factors that were beyond the control of the health care team, and they could not manage them. These factors include three policies implemented by the Ministry of Health and Medical Education in Iran, namely the implementation of an Assistant plan, restrictions on the employment of new staff, and implementing the health transformation plan. The Assistant plan was implemented in 2013 by this Ministry in medical centers. According to one of its rules, hospitals are obliged to admit all patients transferred by ambulances to emergencies. After examining the patient's condition and performing the necessary consultations, if the hospital does not have the essential health care facilities or expertise, with the coordination of the

assistants, the patient will be referred to other medical centers (34).

On the other hand, the health transformation plan is being implemented by the Iranian government in university hospitals to reduce people's out-of-pocket payments and treatment costs through health insurance coverage. Following this plan's implementation, people have rushed to government and university hospitals to receive health services (35, 36). These two factors have significantly increased the workload of hospitals and health centers. Despite the severe shortage of nursing staff (37), recruitment of new staff also has been faced with limitations due to Paragraph (B) of Note (21) of the Budget Law and the National Employment Law of Iran (38) regarding Programs and Budgets (34).

Restrictions on Iran's financial relations with the world and the lack of financial resources due to sanctions, in addition to creating problems in medical centers' access to medicine and medical equipment (39- 42) have caused problems such as restrictions on purchasing high-quality raw materials; and severe quality decline has happened. Detergents have caused skin problems for the team members in a situation where the need for hand hygiene has widely increased.

Moreover, the findings of this study showed that incoherence in observation of the rules, monitoring, and evaluation, as well as the prevailing attitudes of the organization were among the effective factors in compliance with hand hygiene among the health care team. The type of management and policies used in the organization is always one of the biggest challenges faced by the working manpower (43). Developing professional rules, enforcing rules strictly, and monitoring over proper implementation of rules help patients, the health care team, and ultimately the community a lot (44). Various studies indicated that

organizations' attitudes toward hand hygiene affected the performance of the healthcare team (45- 48). In this regard, the findings of studies conducted in the United States (49), Iran (50), and Nigeria (51), showed that the organization's monitoring over hospital staff performance affected the quality of their work. However, the findings of a study in Italy showed that improvement of hand hygiene performance depended on the facilitation of quality hand hygiene products rather than the implementation of training interventions or strict monitoring over the performance of the healthcare team, which were often ineffective (52, 53).

Another finding of this study was about the effect of individual factors, namely the attitude of the health care team towards the patient, and skin allergies to hand sanitizers, and concerns about their health and health of their family, on the observance of hand hygiene by the health care team. Nurses in pediatric ICUs care for young patients. They are in contact with restless and anxious parents and know that the dangerous and life-threatening conditions of these children need careful management (54). They provide their care based on their patient's age and developmental stage. All of these factors strongly affect their emotions (55- 57), which can manifest itself in the form of fatigue and burnout (58). It also seems that with the prevalence of COVID-19 disease and due to the increased frequency of hand hygiene practice by the health care team, the incidence of hand dermatitis has increased (59). A recent study found that nurses' hand dermatitis incidence increased by nearly 30 percent during COVID-19 outbreak (60). The researcher attributed this issue to the frequent hand washing and sweating of the skin in the gloves. This finding was also confirmed in studies performed in Iran (61- 64). Meanwhile, the concern of transmitting the disease to the family was one of the reasons for the health care team to observe hand hygiene

more strictly. This concern was reported in most studies done during the COVID-19 pandemic outbreak (65- 67).

In this study, we found that the characteristics of the clinical environment, including professional relationships, special conditions governing the ward, and the care facilities were other important factors affecting the observance of hand hygiene by the health care team based on the participants' perspective. Working in Pediatric ICU's stressful environment requires close collaboration and interaction between caregivers, especially during the outbreak of COVID-19 disease (68). A study found that balancing the correct performance of staff and their work quality, especially during this pandemic when the workload was usually increasing, was closely related to professional relationships among staff (69, 70). The physically unfavorable environment of the ward and the particular environmental conditions of the ward, expose the health care team to various stresses. This excessive stress leads to nurses' fatigue and reduction of some of their work (57).

On the other hand, the available health facilities were one of the important and effective factors affecting the performance of hand hygiene among the health care team. In this study, the physical space of the ward and the location and availability of sanitary equipment, such as hand wash sink or the lack of foot pedal for hand wash sinks, caused problems for members of the health care team. In a study conducted in Iceland, it was found that adequate physical space and having hygienic equipment, such as an appropriate number of toilets and foot pedal hand wash sink or hand wash sink with a camera, had doubled hand hygiene compliance among the staff of the special care unit (71). Studies conducted in Iran reported similar results in this regard (63, 72, 73). The existence of problems in the interior design of hospital ICUs is one of the challenges

that can be seen in different parts of the world.

4-1. Limitations of the study

Due to the Pediatric ICU's special conditions and the sensitivity of hand hygiene compliance, participants in this study might not have shared some aspects of their experiences. Although we tried to gain the participants' trust while collecting data, some might have considerations during the interviews such as organizational constraints or the pediatric ICU condition. In addition, due to the type of study which is a qualitative research, cautions should be considered in the generalizability of the findings.

5- CONCLUSION

According to the findings of this study, the main factors affecting the observance of hand hygiene by the health care team during the COVID-19 pandemic period include Meta-organizational factors, organizational factors, individual factors, and clinical environment characteristics.

The reason for conducting this study in the pediatric intensive care unit was that Observing safety in health service systems means observing the principles that by embracing them, the patient's safety is guaranteed or the probability of damages is minimized (74). The US Institute of Medicine (IOM) defines safety as avoiding any accidental and intentional damages by the health care team (75, 76). 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 (74). 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 (75). On the other hand, nurses in PICUs have to handle several tasks and deal with different diseases like seizure,

poisoning, loss of consciousness, and many other problems. All of these issues along with many other factors increase the risk of damage to children in hospitals (77, 78, 79).

The change in the Meta-organizational factors including two subcategories of macro-health policy and sanctions and economic problems is beyond the responsibility and power of the health care team. However in other categories, based on the findings, suggestions can be made to improve hand hygiene performance among the health care team. These categories include: Organizational factors including three subcategories of incoherence in observation of rules, monitoring and evaluation, the prevailing attitude of the organization, Individual factors including three subcategories of attitude of the health care team towards patient, skin reactions to hand sanitizers, concerns about their own health and health of their family and Characteristics of the clinical environment including three subcategories of professional relationships, special conditions governing the pediatric ICU, and care facilities. Hence, the following suggestions can be made for improving the hand hygiene performance among the health care team: training and monitoring over the staff performance, providing the necessary facilities for easy access of the staff to hand hygiene equipment, providing mental and intellectual comfort for staff through the provision of the essential manpower and accurate and coherent management as well as planning to meet the needs of the healthcare team.

6- ACKNOWLEDGMENTS

The research team would like to thank all the Physicians, Nurses, Managers, and Authorities of the research environment who provided the necessary facilities for performing this study.

7- CONFLICT OF INTEREST: None

8- REFERENCES

1. WHO. Clinical management of severe acute respiratory infection when Novel coronavirus (nCoV) infection is suspected: interim guidance World Health Organization 2020 [Available from: <https://www.who.int/internalpublications-detail/clinicalmanagement-of-severe-acute-respirat>].
2. Chan JF-W, Yuan S, Kok K-H, To KK-W, Chu H, Yang J, et al. A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster. *The Lancet*. 2020; 395: 514-23. DOI: 10.1016/S0140-6736(20)30154-9.
3. Gao J, Zheng P, Jia Y, Chen H, Mao Y, Chen S, et al. Mental health problems and social media exposure during COVID-19 outbreak. *Plos one*. 2020; 15(4):1-10. DOI: 10.1371/journal.pone.0231924.
4. WHO. Infection prevention and control during health care when novel coronavirus (nCoV) infection is suspected Interim guidance, 19 March 2020. [Available from <https://www.who.int/publications/i/item/10665-331495>].
5. Hoffmann M, Sendlhofer G, Pregartner G, Gombotz V, Tax C, Zierler R, et al. Interventions to increase hand hygiene compliance in a tertiary university hospital over a period of 5 years: An iterative process of information, training and feedback. *Journal of Clinical Nursing*. 2019; 28: 912-9. DOI: 10.1111/jocn.14703.
6. Birnbach D, Rosen L, Fitzpatrick M, Arheart K, Everett-Thomas R. Current Hand Hygiene Education is Suboptimal. *The Clinical Teacher*. 2019; 16:1-4.
7. Mueller BU, Neuspiel DR, Fisher ERS. Principles of pediatric patient safety: Reducing harm due to medical care. *Pediatrics*. 2019; 143(2):e20183649. DOI: 10.1542/peds.2018-3649.

8. WHO. WHO SAVES LIVES: Clean your hands in the context of COVID-19 WHO in Geneva WHO; 2020 [Available from: <https://www.who.int/docs/default-source/coronaviruse/who-hh-community-campaign-finalv3.pdf?sfvrsn=5f3731ef2>].
9. Erasmus V, Daha T, Brug H, Richardus J, Behrendt M, Vos M, et al. Systematic review of studies on compliance with hand hygiene guidelines in hospital care. *Infection Control Hospital Epidemiology*. 2010; 31(3):283-94. DOI: 10.1086/650451.
10. Vasconcelos RO, Ignácio Alves DC, Magnani Fernandes L, Campos de Oliveira JL. Adherence to Hand Hygiene by Nursing Team in Intensive Care Unit. *Enfermeria Global*. 2018; 50:462-76. DOI: 10.6018/eglobal.17.2.,284131.
11. Nawab T, Mehnaz S, Abedi AJ, Rehman Safwi S. KAP study of hand hygiene among medical and nursing students in a tertiary teaching hospital. *International Journal of Sciences & Applied Research*. 2015; 2(6): 29-39.
12. Ngugi S, Murila F, Musoke R. Hand Hygiene Practices among Health Care Workers in a Newborn Unit of a Tertiary Referral Hospital in Kenya. *Journal of Infection Prevention*. 2018:1-7. DOI: 10.1177/1757177418815556. (persian)
13. Baek E-H, Kim S-E, Kim D-H, Cho O-H, Hong SI, Kim S. The difference in hand hygiene compliance rate between unit-based observers and trained observers for World Health Organization checklist and optimal hand hygiene. *International Journal of Infectious Diseases*. 2020; 90:197-200. DOI: 10.1016/j.ijid.2019.10.004.
14. Emami A, Javanmardi F, Pirbonyeh N, Akbari A. Prevalence of underlying diseases in hospitalized patients with COVID-19: a systematic review and meta-analysis. *Archives of academic emergency medicine*. 2020; 8(1):1-14. (persian)
15. Alzyood M, Jackson D, Aveyard H, Brooke J. COVID-19 reinforces the importance of hand washing. *Journal of Clinical Nursing*. 2020; 29:2760-2761. DOI: 10.1111/jocn.15313.
16. Ng Y-M, Peggy PL. Coronavirus disease (COVID-19) prevention: Virtual classroom education for hand hygiene. Elsevier; 2020:1-7. DOI: 10.1016/j.nepr.2020.102782.
17. Zhou Q, Lai X, Zhang X, Tan L. Compliance measurement and observed influencing factors of hand hygiene based on COVID-19 guidelines in China. *American Journal of Infection Control*. 2020:1-24. DOI: /10.1016/j.ajic.2020.05.043.
18. Wong S-C, AuYeung C-Y, Lam G-M, Leung E-L, Chan V-M, Yuen K-Y, et al. Is it possible to achieve 100 percent hand hygiene compliance during the COVID-19 pandemic? *Journal of Hospital Infection*. 2020:1-3. DOI: 10.1016/j.jhin.2020.05.016.
19. Huang L, Lin G, Tang L, Yu L, Zhou Z. Special attention to nurses' protection during the COVID-19 epidemic. *BioMed Central*; 2020:1-3. DOI: 10.1186/s13054-020-2841-7
20. Najafi Ghezalje T, Abbas Nejjhad Z, Rafii F. A Literature Review of Hand Hygiene in Iran. *Iran Journal of Nursing (IJN)*. 2013; 25(80):1-13. (persian)
21. Vafaei Nezhad R, Yaghoubi A, Ghazvini K. Compliance of Healthcare Workers with Hand Hygiene Practices in the Northeast of Iran: An Overt Observation *International Journal of Public Health Science (IJPHS)*. 2018; 7(4):289-92. (persian)
22. Arshadi bostan abad m, assadollali m, jebreili m, mahallei m, abdolalipour m. Nurses' attitudes towards barriers in hand hygiene in the neonatal units of Tabriz. *Journal of Pediatric Nursing*. 2014; 1(1):20-9. (persian)

23. Kouhi R, Amin Sobhani M, Khodakarim S, Panahi R, Ramezankhani A. Hand Hygiene Predictors in the Staff of Tehran Dentistry Centers Based on the Health Belief Model. *Journal of North Khorasan University of Medical Sciences*. 2019; 11(2):45-52. (persian)
24. Lai C-C, Lu M-C, Tang H-J, Chen Y-H, Wu Y-H, Chiang H-T, et al. Implementation of a national quality improvement program to enhance hand hygiene in nursing homes in Taiwan. *Journal of Microbiology, Immunology and Infection*. 2019; 52(2):345-51. DOI: 10.1016/j.jmii.2018.09.007.
25. Allegranzi B, Nejad S, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of Endemic Health-care-associated Infection in Developing Countries: Systematic Review and Meta-analysis. *Lancet*. 2011; 377:228-41. DOI: 10.1016/S0140-6736(10)61458-4.
26. Ataiyero Y, Dyson J, Graham M. Barriers to Hand Hygiene Practices Among Health Care Workers in sub-Saharan African Countries: A Narrative Review. *American Journal of Infection Control*. 2018; 1-9. DOI: 10.1016/j.ajic.2018.09.014.
27. Smith JD, Corace KM, MacDonald TK, Fabrigar LR. Application of the Theoretical Domains Framework to Identify Factors that Influence Hand Hygiene Compliance in Long-term Care. *Journal of Hospital Infection* 2019; 101:393-8. DOI: 10.1016/j.jhin.2018.12.014.
28. Sabahi Bidgoli M, Shahri S, Kebriai A, Seyedi H, Sarafraz A. Assessment the Status of Patient Safety in Kashan Hospitals. *Kashan. Health Promotion Management Journal*. 2012; 1:62-73. (persian)
29. Ariyaratne M, Gunasekara T, Weerasekara M, Kottahachchi J, Kudavidanage B, Fernando S. 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*. 2015; 3(1):15-25. DOI: 10.4038/sljid.v3i1.4761.
30. Cruz JP, Bashtawi MA. Predictors of hand hygiene practice among Saudi nursing students: a cross-sectional self-reported study. *Journal of infection and public health*. 2016; 9(4):485-93. DOI: 10.1016/j.jiph.2015.11.010.
31. Graneheim U, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Education Today*. 2004; 24(2):105-12. DOI: 10.1016/j.nedt.2003.10.001.
32. Elo S, Kynga's H. The qualitative content analysis process. *J Adv Nurs* 2008; 62(1):107-15.
33. Guba E, Lincoln Y. *Competing paradigms in qualitative research*. Thousand Oaks, CA: SAGE, 2009.
34. Ministry of Health and Medical Education of Iran MEM. Assistance plan. In: Center MEaAM, editor. Tehran: Ministry of Health and Medical Education of Iran; 2013: 1-6.
35. Homaie Rad E, Yazdi-Feyzabadi V, Yousefzadeh-Chabok S. Pros and cons of the health transformation program in Iran: evidence from financial outcomes at the household level. *Epidemiol Health*. 2017; 39:e2017029:1-7. DOI: 10.4178/epih.e2017029. (persian)
36. Griffon. Investment in Iran's Healthcare Sector. In: Capital G, editor. tehran: Ministry of Health and Medical Education; 2016: 1-24.
37. Tabrizi J, Karamouz M, Sadeghi-Bazargani H, Nikniaz A. Health Complex Model as the Start of a New Primary Healthcare Reform in Iran: Part B: The

- Intervention Protocol. *Iran J Public Health*. 2019; 18(1):147-55.
38. Iran Program and Budget Organization i. National Budget Law 1399. Iran-Tehran: Iran Program and Budget Organization; 2019: 45-6. (persian)
39. Aloosh M, Salavati A, Aloosh A. Economic sanctions threaten population health: the case of Iran. *Public Health*. 2019; 169:10-4.DOI: 10.1016/j.puhe.2019.01.006. (persian)
40. Behzadifar M, Bragazzi NL, Arab-Zozani M, Bakhtiari A, Behzadifar M. The challenges of implementation of clinical governance in Iran: a metanalysis of qualitative studies *Health Research Policy and Systems*. 2019; 17(3):1-14.DOI: 10.1186/s12961-018-0399-5. (persian)
41. Zartab S, Koopaei NN, Abbasian H, Koopaei MN, Koopaei NN. The impact of sanction and healthcare system reform on the healthcare performance and pharmaceutical market in Iran; 2001-2016. *Journal of Pharmaceutical Policy and Practice*. 2020; 13(1):1-9. DOI: 10.1186/s40545-020-00245-z. (persian)
42. Behzadifar M, Ghanbari MK, Bakhtiari A, Behzadifar M, Bragazzi NL. Ensuring adequate health financing to prevent and control the COVID-19 in Iran. *International Journal for Equity in Health*. 2020; 19:1-4.DOI: 10.1186/s12939-020-01181-9. (persian)
43. Negahban A, Maleki M, Abbassian A. Policies and laws related to the integration of traditional and complementary medicine into the Iranian health system based on the WHO definition: A document analysis. *J Educ Health Promot*. 2019; 8(221):1-7.DOI: 10.4103/jehp.jehp_321_19. (persian)
44. Driscoll K, Masters K. *Law and Professional Nursing Practice*. Fifth edition ed. United States: Jones and Bartlet Learning; 2018.
45. Al Ghafari Z, Eid AbuRuz M. Hand Hygiene Knowledge, Attitude and Barriers among Jordanian Nurses. *IMJ*. 2019; 24(3):385-400.
46. Atif S, Lorcy A, Dubé E. Healthcare workers' attitudes toward hand hygiene practices: Results of a multicentre qualitative study in Quebec. *Canadian Journal of Infection Control*. 2019; 34(1):41-8.DOI: 10.36584/cjic.2019.004.
47. McLaws M-L. The Relationship between Hand Hygiene and Health Care-Associated Infection: It's Complicated. *Infection and Drug Resistance*. 2015; 8:7-18. DOI: 10.2147/IDR.S62704.
48. Günther F, Rudolph K, Frank U, Mutters N. Improvement of Hand Hygiene Quality and Compliance Using Bioburden Measurement and Online Feedback in Germany. *Infection control & hospital epidemiology*. 2017; 38(1).DOI: 10.1017/ice.2016.238.
49. Kirk J, Kendall A, Marx J, Pincock T, Young E, Hughes J, et al. Point of care hand hygiene—where's the rub? A survey of US and Canadian health care workers' knowledge, attitudes, and practices. *American Journal of Infection Control*. 2016; 44:1095-101.DOI: 10.1016/j.ajic.2016.03.005.
50. Sharif A, Arbabisarjou A, Balouchi A, Ahmadidarrehsima S. Knowledge, Attitude, and Performance of Nurses toward Hand Hygiene in Hospitals. *Global Journal of Health Science*. 2016; 8 (8):57-65.DOI: 10.5539/gjhs.v8n8p57. (persian)
51. Ekwere T, Okafor f. Hand hygiene knowledge and practices among healthcare providers in a tertiary hospital, South West Nigeria. *Int J Infect Control*. 2013; 9:1-10.
52. Nobile C, Montuori P, Diaco E, Villariz P. Healthcare personnel and hand decontamination in intensive care units: knowledge, attitudes, and behaviour in Italy. *Journal of Hospital Infection*. 2002; 51:226-32.

53. Goel Sh, Rudraiah Chandrashekar B. Evaluating the efficacy of handwashing demonstration on hand hygiene among school students – An interventional study. *Journal of Education and Health Promotion*. 2020; November. DOI: 10.4103/jehp.jehp_94_20.
54. Zulfiqar L, Rafiq M. Exploring experiences and coping strategies of nurses working in intensive care units: A qualitative study. *Anaesthesia, Pain & Intensive Care*. 2020; 24(1):42-9. DOI: 10.35975/apic.v24i1.1223.
55. Nascimento L, Alvarenga W, Caldeira S, Mica T, Oliveira F. Spiritual Care: The Nurses' Experiences in the Pediatric Intensive Care Unit religions. 2016; 7(27):1-11. DOI: 10.3390/rel7030027.
56. Fogaça M, Carvalho B, Albuquerque V, Nogueira-Martins LA. Factors that cause stress for physicians and nurses working in a pediatric and neonatal intensive care unit: bibliographic review. *Rev Bras Ter Intensiva*. 2008; 20(3):261-6. DOI: 10.1590/S0103-507X2008000300009.
57. Tzu-Ching L, Huey-Shyan L, Su-Fen C, Li-Min W, Mei-Chen Y. Work stress, occupational burnout and depression levels: a clinical study of paediatric intensive care unit nurses in Taiwan. *Journal of Clinical Nursing*. 2016; 25:1120-30. DOI: 10.1111/jocn.13119.
58. Buckley L, Christian M, Gaiteiro R, Parhuram CS, Watson S, Dryden-palmer K. The relationship between pediatric critical care nurse burnout and attitudes about engaging with patients and families. *Canadian Journal of Critical Care Nursing*. 2019; 30(3):22-28.
59. Abtahi-Naeini B. Frequent handwashing amidst the COVID-19 outbreak: prevention of hand irritant contact dermatitis and other considerations. *Health science reports*. 2020; 3(2). DOI:10.1002/hsr2.163.
60. Gupta MK, Lipner SR. Personal protective equipment recommendations based on COVID-19 rout of transmission. *Journal of the American Academy of Dermatology*. 2020; 83(1):e45-e6.
61. Sibbald RG, Ayello EA. Hand Dermatitis, Hand Hygiene, and Healthcare Professionals. *LWW*; 2020.
62. Guertler A, Moellhoff N, Schenck TL, Hagen CS, Kendziora B, Giunta RE, et al. Onset of occupational hand eczema among healthcare workers during the SARS-CoV-2 pandemic—comparing a single surgical site with a COVID-19 intensive care unit. *Contact Dermatitis*. 2020. DOI: 10.1111/cod.13618.
63. Araghi F, Tabary M, Gheisari M, Abdollahimajd F, Dadkhahfar S. Hand Hygiene Among Health Care Workers During COVID-19 Pandemic: Challenges and Recommendations. *Dermatitis*. 2020; 31(4):233-7. DOI: 10.1097/DER.0000000000000639. (persian)
64. Tabary M, Araghi F, Nasiri S, Dadkhahfar S. Dealing with skin reactions to gloves during the COVID-19 pandemic. *Infection Control & Hospital Epidemiology*. 2020; 1-5. DOI: 10.1017/ice.2020.212. (persian)
64. Gawande A. Keeping the coronavirus from infecting health-care workers. *The New Yorker*. 2020.
66. Biswal M, Angrup A, Rajpoot S, Kaur R, Kaur K, Kaur H, et al. Hand hygiene compliance of patients' family members in India: importance of educating the unofficial 'fourth category of healthcare personnel. *Journal of Hospital Infection*. 2020; 104(4):425-9. DOI: 10.1016/j.jhin.2019.09.013.
67. Kalateh Sadati A, Zarei L, Shahabi S, Heydari ST, Taheri V, Jiriaei R, et al. Nursing experiences of COVID-19 outbreak in Iran: A qualitative study.

- Nursing Open. 2020; 00:1-8.DOI: 10.1002/nop2.604. (persian)
68. Matsumori N. An Ethical Practice Intervention Program for Pediatric Nurses with Varied Nursing Experience. *Open Journal of Nursing*. 2020; 10(04):411-428.DOI: 10.4236/ojn.2020.104028
69. Anderson M, Turbow S, Willgerodt M, Ruhnke G. Education in a Crisis: The Opportunity of Our Lives. *Journal of Hospital Medicine*. 2020; 15(5):287-9.DOI: 10.12788/jhm.3431.
70. Oyapero A, Oyapero O. An assessment of hand hygiene perception and practices among undergraduate nursing students in Lagos State: A pilot study. *Journal of Education and Health Promotion* .2018; 7:1-8.DOI: 10.4103/jehp.jehp_56_17.
71. Alhasani AS, Maier-Speredelozzi V. Assessing Hand Hygiene Compliance in Healthcare Workers to Reduce Infectious Disease [Ph.D]. Island: University of Rhode Island; 2017.
72. Khodadadi E. Investigating the Factors Affecting the Hand Hygiene Compliance from the Viewpoints of Iranian Nurses Who Work in Intensive Care Units. *Surgical Infections-Some Facts*. Tehran,Iran: IntechOpen; 2019: 1-12. (persian)
73. Goodarzi Z, Haghani S, Rezazadeh E, Abdolalizadeh M, Khachian A. Investigating the Knowledge, Attitude and Perception of Hand Hygiene of Nursing Employees Working in Intensive Care Units of Iran University of Medical Sciences, 2018-2019. *Maedica-a Journal of Clinical Medicine*. 2020; 15(2):230-237.DOI: 10.26574/maedica.2020.15.2.230. (persian)
74. 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: 10.1177/0009922817691820.
75. Institute of Medicine (US) Committee on Data Standards for Patient Safety. *Patient Safety: Achieving a New Standard for Care*. Aspden P, Corrigan JM, Wolcott J, Erickson SM, editors. Washington (1): National Academies Press (US); 2004.
76. 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.
77. Elzagallaai AA, Greff M, Rieder MJ. Adverse Drug Reactions in Children: The Double-Edged Sword of Therapeutics. *Clin Pharmacol Ther*. 2017; 101(6):725-735. doi: 10.1002/cpt.677.
78. American Academy of Pediatrics. *Principles of Pediatric Patient Safety: Reducing Harm Due to Medical Care*. Pediatrics. 2011; 127(6): 1199-1210. doi:10.1542/peds.2011-0967.
79. Stocker M, Pilgrim SB, Burmester M, Allen ML, Gijsselaers WH. Interprofessional team management in pediatric critical care: some challenges and possible solutions. *J Multidiscip Health*. 2016; 9:47-58. DOI: 10.2147/JMDH.S76773.