

The barriers and challenges of using health information technology in medication administration process for pediatrics and neonates: A qualitative study

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Abstract

Background and Aims: Children and neonates are more susceptible to diseases and are a vulnerable group in medication administration (MA). Nurses interact directly with patients, ensuring safety and preventing unintended outcomes. Health Information Technology (HIT) has transformed health care, aiding nurses in decision-making and treatment responses. Despite its benefits, technology presents challenges that must be overcome to facilitate the nursing practice. Therefore, the present study aimed to explore the barriers to HIT use in the process of MA in children and neonates in a developing country.

Methods: Semi-structured face-to-face interviews were conducted with 22 health care professionals across seven pediatric and neonatal settings. Also, observations were made of these settings for 3 weeks. A qualitative analysis was performed using the conventional content analysis method, recommended by Colaizzi's seven-step approach.

Results: The results showed that the most significant barriers to adopting technology in MA process could be classified into two main categories: "inappropriate management approaches" with two sub-categories ("Managers' reluctance to adopt new technology", "lack of adequate budget for hardware resources"), and "resistance to change" with two sub-categories ("A desire to use conventional (traditional) approaches in care", "cultural issues and impracticality of providing some specialized technology services").

Conclusion: The findings revealed MA process complexities, which have been insufficiently examined in the current literature. We have highlighted the need for improved "effectiveness of HIT systems in administering medication processes, budget for hardware resources, and managers' interest in using new technology. The present findings can guide the development of more effective and user-friendly HIT systems in pediatric and neonatal care settings.

KEYWORDS

barrier, challenge, Health Information Technology (HIT), medication administration, Pediatrics and Neonatal Intensive Care Units (NICU)

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1 | INTRODUCTION

Children and neonates have specific medical needs and are more susceptible to certain diseases than adults.¹ The pharmacokinetic and pharmacodynamic parameters in pediatric patients can differ significantly from those observed in adults.² The prescription, dispensation, and administration of medications for children require a higher level of precision than for adults. This makes the medication management process for children more complex and prone to errors, leading to a higher risk of Adverse Drug Events.^{3,4}

The role of nurses in medication administration (MA) is critical. This stage of the medication process involves direct interaction between nurses and patients and is a critical step to ensure patient safety and prevent unintended outcomes.⁵ The well-being of pediatric patients should always be a top priority. Any negligence can raise serious health issues and can affect their overall development.⁶ Therefore, it is necessary to ensure that pediatric and neonate patients receive the best possible care.⁷

Information technology (IT) has the potential to greatly enhance nursing practice.⁸ Digital platforms and technologies can help nurses reduce medication errors⁵ and improve patient care by providing quick access to patient data, facilitating communication with other healthcare professionals, and making efficient decisions.⁹ However, the integration of IT in nursing practice is not without challenges.¹⁰ These challenges need to be identified and addressed to fully realize the potential of IT in health care. A body of research has explored many barriers such as "Equipment," "Lack of time," "lacking ability," and "distrust in technology" to the adoption of IT in different health settings.¹⁰⁻¹⁵ These barriers are context-dependent and can vary across different settings. Our study contributes to this body of research by focusing on a previously unexplored area. To our knowledge, so far, no study with a qualitative approach has been conducted on the barriers to the adoption of Health IT (HIT) in the MAP (medication administration process) for pediatrics and neonates.

Qualitative studies help identify more problems and barriers than other research methodologies. That is because qualitative studies largely depend on context.⁹ Therefore, the present study aimed to explore the barriers to adopting HIT in the process of MA in children and neonates in a developing country. The present study is significant because it fills the literature gap and can potentially improve patient safety and care quality in a vulnerable population. By identifying the specific barriers to the adoption of HIT in this context, we can inform the development of targeted strategies to overcome these barriers and enhance the use of HIT in pediatric and neonatal care.

2 | METHODS AND MATERIALS

The present qualitative study is part of an extensive research initiative that used interviews to develop a clinical decision support system tailored to administering medication in pediatric and neonatal care. The present study was financially supported by Kerman

University of Medical Sciences (#401000141). It adhered to the consolidated criteria for reporting qualitative studies (COREQ).¹⁶

2.1 | Study design and setting

A qualitative study was conducted to obtain specific information based on nurses' attitudes towards and behaviors in MAP, which led to the collection of rich and complex relevant data.¹⁷ The study was set in seven different pediatric and neonate educational environments and hospitals affiliated with Kerman University of Medical Sciences in Kerman, the largest city that hosts patients in the southeast of Iran within a radius of 500 km. Different high-tech surgical and healthcare procedures are conducted daily for pediatrics and neonates in hospitals. These settings include two general pediatric wards, two NICUs, one PICU, Pediatric Chemotherapy, and Pediatric Emergency. This hospitals pioneers in Iran in using IT applications for more than 20 years. The Iranian Ministry of Health centrally implements all healthcare policies in this hospital. The political agenda attends more to e-health applications, and all relevant contexts use Hospital Information Systems (HIS) to automate hospital tasks like clinical documentation and medication management.

2.2 | Sample size

A purposive random sampling was used to select 22 nurses with different professional specialties who participated in a daily MAP. Furthermore, the snowball sampling method was used by asking the participants to introduce peers to take part in the study. The inclusion criteria for nurses were going through daily MAP (the morning, evening, and night shifts), and working in one pediatric ward (e.g., NICU, PICU (pediatric intensive care unit), pediatric oncology, pediatric emergency, general pediatric). Participants who did not consent to having their interviews recorded were excluded from the study.

2.3 | Data collection (interview guide and participant observation)

In-depth, semi-structured interviews were conducted in a private room with the subjects in April 2021 and April 2023. In this study, two groups were interviewed. The first group consisted of nurses and residents who routinely worked in the target settings. The faculty members of nursing school who were experienced in educating nurses' students were also included. Moreover, they had been routinely engaged in MAP in the target settings. All interviews were held face-to-face by the first researcher (S. N.), a PhD student with a background in medical informatics and an expert in qualitative studies. Each interview took between about 15 min to 1hour. All interviews were audio-recorded. Note-taking was also done during the interview. In addition, the MA of the process was observed by SN while following the participants during daily work. Topic-guide

questions were made based on the objectives of study through the consensus of the research team.

2.4 | Data analysis

The data were organized in Word spreadsheets and analyzed based on Colaizzi's seven-step approach¹⁸ following several steps. As the initial step, all interviews were transcribed verbatim by the first author. In the next step, two researchers (S. N. and M. N.) independently read and reread the transcriptions to gain an in-depth understanding of content, determine semantic units, preliminary coding, and interpret the data. An inductive method was used to extract codes and analyze data. Two researchers independently extracted codes or labels based on the participants' interviews. Next, meaning units were generated and coded based on the similarity of content. New codes were merged into sub-subcategories based on similarities or differences. Similar sub-subcategories were remerged into sub-categories. Although the data analysis was inductive, we moved back and forth between the whole and part of text to reach a high level of internal consistency and a low level of external incompatibility. At this step, disagreements were resolved through discussion between the two authors (S. N. and M. N.). An external subject expert (L. A.) experienced in qualitative research was consulted if no consensus was made. Also, the coding process and categories were reviewed and approved by an external expert. For data analysis and interpretation, MAXQDA (2018) was used.

2.5 | The rigor of the study

Lincoln and Guba's criteria were used to ensure the trustworthiness of data, including Credibility, Dependability, Confirmability, Transferability, and Authenticity.^{19–21} For credibility, the researcher (S. N.) continuously engaged with the participants and the research field through different methods (interview, observation, and verbatim quotes) to clarify data. To assess dependability, the interviews were coded independently by two research team members simultaneously. In addition, an external expert in qualitative research peer-reviewed the data coding and analysis process. Finally, all research members discussed the tentative sub-categories and categories and approved the final results. To assess confirmability, the researcher has been engaged with the data and participants for a long time. In addition, the transcripts were read and reread several times to ensure a comprehensive understanding of content. A maximum variety of participants was considered by including diverse classifications of healthcare teams (nurses and physicians). In addition, the researchers considered reflexivity during the process and analysis to reduce potential biases associated with personal assumptions. To achieve this, the interviewer thoroughly documented her initial assumptions before each interview to ensure an unbiased interpretation of findings during the interview and analysis. The details of participants and researchers were provided for data transferability. To check

authenticity, the researchers fairly and honestly illustrated a diverse range of aspects of MAP.

3 | RESULTS

There was a total number of 22 participants in this study. Their age ranged from 22 to 50 years, and 21 participants were female. Of these, two were pediatric residents, and three were nursing school faculty members with experience in pediatric and neonatal units (See Table 1). The results showed that the most significant barriers to adopting technology in MAP could be classified into two main categories: "inappropriate management approaches" with two sub-categories, and "resistance to change" also with two sub-categories (See Table 2).

3.1 | Main category 1: Inappropriate management approaches

The inappropriate management approach has been identified as a significant barrier to the successful implementation of technology in MAP. This barrier is primarily associated with the challenges that emerge from the management's aspects of adopting technology in MAP. It has been observed that the necessary prerequisites for integrating technology into the MAP, particularly for pediatrics and neonates, are currently not met. The current state of unpreparedness can notably impede the effective implementation of technology in MAP.

This category of barrier is divided into two sub-categories. The first subcategory is the "Managers' reluctance to adopt new technology." This refers to the reluctance or indifference shown by the management towards the adoption of technology in MAP. This mindset could be due to an inadequate understanding of the potential advantages that technology can offer. The second subcategory is the "lack of adequate budget for hardware resources." This refers to the insufficient allocation of funds for the necessary hardware resources required for the implementation of technology in MAP. Without adequate funding, it becomes challenging to acquire, maintain, and upgrade the necessary technological resources, thereby impeding the successful adoption of technology in MAP (See Table 2).

3.1.1 | Subcategory 1.1: Managers' reluctance to adopt new technology

During the MAP, there has been resistance, especially from managers, to the adoption of new technology. This resistance is a significant barrier to technological progress in MAP. Nurses are at the front line of patient care and have emphasized the need for managerial support for successful technology implementation. They believe that if managers accept and endorse technology, it can streamline the

TABLE 1 Baseline data.

Participant	Age	Sex	Marital status	Education level	Job description	Setting	Work experience
P ₁	20-29	Female	Married	Bachelor	final-year nursing students	General pediatric	1 Year
P ₂	30-39	Female	Single	Bachelor	Nurse	NICU	9 Years
P ₃	20-29	Female	Married	Bachelor	Nurse	General pediatric	1 Year
P ₄	40-49	Female	Married	MSC	Nurse	NICU	25 Years
P ₅	20-30	Female	Married	MSC	Faculty member	N/A	3 Years
P ₆	40-49	Female	Married	Bachelor	Staff	NICU	16 Years
P ₇	40-49	Female	Married	Bachelor	Nurse	NICU	12 Years
P ₈	30-39	Female	Married	Diploma	Nurse	General pediatric	14 Years
P ₉	20-29	Male	Single	Bachelor	Nurse	Pediatric Emergency	2 Years
P ₁₀	30-39	Female	Married	Bachelor	Nurse	Pediatric Emergency	13 Years
P ₁₁	20-29	Female	Married	General Physician	Pediatric Resident	N/A	4 Years
P ₁₂	30-40	Female	Married	MSC	Faculty member	N/A	4 Years
P ₁₃	20-29	Female	Married	General Physician	Pediatric Resident	N/A	4 Years
P ₁₄	30-39	Female	Married	Associate's Degree	Nurse	General pediatric	13 Years
P ₁₅	30-39	Female	Married	MSC	Head nurse	PICU	10 Years
P ₁₆	40-49	Female	Married	Diploma	Nurse	PICU	25 Years
P ₁₇	40-49	Female	Married	Bachelor	Nurse	Pediatric Chemotherapy	18 Years
P ₁₈	30-40	Female	Married	PhD student	Faculty member	N/A	12 Years
P ₁₉	50-59	Female	Single	Bachelor	Head nurse	Pediatric Chemotherapy	25 Years
P ₂₀	40-49	Female	Married	Bachelor	Head nurse	General pediatric	25 Years
P ₂₁	40-49	Female	Married	MSC	Head nurse	NICU	21 Years
P ₂₂	20-29	Female	Single	Bachelor	Nurse	General pediatric	6 Years

Abbreviations: MSC, master degree; N/A, not applicable; P, participant; PICU, pediatric intensive care unit.

TABLE 2 The overview of the categories and subcategories.

Main categories along with sub-categories	
Inappropriate management approaches	<ul style="list-style-type: none"> Lack of adequate budget for hardware resources The managers' reluctance to adopt new technology
Resistance to change	<ul style="list-style-type: none"> Cultural issues and the impracticality of providing some specialized technology services A desire to use conventional approaches in the care <ul style="list-style-type: none"> The lack of skills necessary to use information technology in the nurses Lack of trust in technology Maintaining a view on the absence of medication errors in the MAP Adapting to current conditions and recognizing no necessity for additional technology The heavy workload of nurses and the time-consuming use of technology

integration process and improve patient care. However, nurses have raised concerns about managers overlooking workplace pressures and responsibilities, leading to a focus on issues not directly concerned with patient welfare. Therefore, to ensure the effective integration of technology in MAP, managers should embrace innovation and understand the difficulties encountered by the nursing staff.

For example:

"If we are to use technology in nursing, many people get involved. It has to do with the doctor, also the department manager. It also has to do with high-ranking officials, as well as supervisors. Unfortunately, sometimes managers emphasize issues that are not suitable for the patient, but the managers just want us to draw attention to those issues" (participant # 7)

3.1.2 | Subcategory 1.2: Lack of adequate budget for hardware resources

In line with the nurses' experiences, the participants pinpointed that an insufficient budget for the implementation of technology and hardware equipment is a significant barrier to the successful implementation of technology in MAP. They emphasized that the lack of financial resources hinders the acquisition of necessary technological tools and equipment, thereby impeding the full realization of HIT benefits for pediatric and neonatal care. As they viewed it, changes in policymaking are required to allocate a budget for purchasing the resources. They suggested that policymakers should prioritize the allocation of funds for HIT, recognizing its potential to improve patient safety and health care outcomes. They believed that such a change could not only facilitate the integration of technology into everyday clinical practice but also significantly enhance the quality of care provided to pediatric and neonatal patients.

For example:

"Once we were to do something to automate a series of scales in nursing, the biggest barrier we faced (and still have) was the issue of facilities in departments. For example, our records are not electronic and the departments have ultimately one or two computers available, one of which is for the secretary of the department and the other for the staff of the department. Sometimes the interns and residents wished to check the test reports of patients, yet the nurse could not do so for every patient using the same computer system." (Participant # 20)

3.2 | Main category 2: Resistance to change

According to the participants' insights, resistance to change is the main barrier to adopting technology into MAP. As our findings

showed, this resistance is more than a basic unwillingness to adopt new methods. This category emphasizes the nurses' tendency to adhere to traditional methods of care delivery, a preference largely driven by their familiarity with these established techniques. Moreover, it emphasizes that nursing professionals usually adopt new technologies that may not be completely appropriate or effective in pediatric and neonatal care. Adopting inappropriate technologies can exacerbate resistance to change, and lead to complex challenges in updating healthcare procedures, particularly in pediatrics and neonates.

3.2.1 | Subcategory 2.1: A desire to use conventional (traditional) approaches in care

This subcategory presents five barriers often encountered in implementing HIT in the MAP for pediatric and neonatal care.

These barriers were related to a skill gap in the nursing staff in using new technologies, possibly due to inadequate training. Trust issues also emerged, with nurses being hesitant to depend on technology for critical tasks like MA due to concerns about its accuracy, reliability, and possible technical disruptions. Also, the participants stated that introducing new technologies may initially add to the nurses' workload as they need to familiarize themselves and adjust to the new system. Adopting some of these technologies might potentially increase the time to administer medication. Additionally, there was resistance to change in nurses who were comfortable with traditional methods. They explained that it is hard to convert to technology-based processes. Some nurses pinpointed that they might not see the need to switch to technology-based methods because they believed the existing manual methods were satisfactory and sufficient. Another challenge was that the nurses believed there were no medication errors in the MAP. This belief prevailed among the nursing staff and could reflect their proficiency and overconfidence. However, this could also lead to a state of unwarranted satisfaction, potentially obstructing the recognition of the need for technological intervention.

Subcategory 2.1.1: The lack of skills necessary to use IT in the nurses
In the process of administering medication, elderly individuals frequently encounter difficulties with new technology due to an absence of required abilities. The participants noted that these elderly individuals often lack fundamental skills. These skills are needed for the successful use of these technologies. This lack of proficiency in IT is not limited to advanced operations. It also includes basic tasks. This barrier results in dependence on others, obstructing the effective application of HIT in MAP.

For example:

"As for technology, we as the young generation use it, but the older generation cannot use it really. Of course, they are not to blame, because it is a matter of their age. You see, there are colleagues here who are supposed to do certain things as their routine duties

with the computer system, such as registering their leave in the system, and they ask me to do it for them.” (Participant #3)

Subcategory 2.1.2: Lack of trust in technology

The interview process showed that a key barrier to the adoption of technology into MAP was a lack of trust in technology. Participants stated that the integration of technology into health care is not merely inevitable, but is already extensively used in other settings. However, they also shared their concerns about the potential negative outcomes that such advancements could bring to patient safety within health care facilities.

For example:

“I, in person, think it is very important to use technology and to be up-to-date. Technology is inevitable in life. Now that most people use mobile phones, we cannot use mobile phones at work. It is a good idea to allow nurses and patients to use mobile phones. In social networks, there is a lot of useful content to read and learn. Yet, it is open to debate that this technology sometimes distracts you from the main goal. Even you may think the mobile phone may cause injustice to the patient.” (Participant # 16)

Subcategory 2.1.3: Adapting to current conditions and recognizing no necessity for additional technology

Participants mentioned that MAP is a routine practice for them, especially in pediatric and neonate settings. They explained that as the formulation of medications in these situations and the types and dosages of drugs administered to pediatric and neonatal patients do not differ much, nurses can memorize all necessary medications without the need for additional tools. As they became more experienced with MAP, they found it easier to administer medications and saw no need for supplementary technologies. They believed the current methods are sufficient and effective in ensuring the safe and accurate administration of medications in the pediatrics and neonates.

For example:

“The medication process has become repetitive and routine for us. For example, vancomycin, which is 500 mL, is dissolved in 10 cc of distilled water, one cc of which is 100 mL. Now, with the syringes we have, we draw and inject whatever the baby needs. We also keep training the novices. After a while, because it is not a difficult job, they get used to it. Nurses keep almost all the drugs. The drugs are almost the same, for example, antibiotics.” (participant #2)

Subcategory 2.1.4: Maintaining view on the absence of medication errors in the MAP

The participants mentioned that the incidence of medication errors in pediatric and neonatal settings was low due to the high skill and competency of nurses. They are skilled at administering the types of medications, which significantly differ from those given to adults. This competency can sometimes lead to overconfidence and unintentionally become a barrier.

Despite the nurses' attention to detail and their meticulous approach to their work, the possibility of errors could remain. This was especially true in highly stressful situations or when faced with unfamiliar scenarios, which can compromise their usual vigilance and precision. In addition, the belief in the scarcity of errors can lead to a false sense of complacency, and reduce the perceived necessity for continuous improvement or adoption of new technologies that could minimize errors.

For example:

“To speed up drug calculations, we dilute a drug at a fixed volume. One may not dissolve it with 11 cc, and another with 5 cc. This is how we can keep it in mind. Maybe the first month of a newcomer's work passes hard on him/her, but after a short while, they get used to it. These repetitive acts can accelerate work. We do not make changes because the change slows the work down. Besides, we may make more mistakes. In pediatric wards, all nurses are very attentive, very experienced and highly alert, and they don't make mistakes. That is, it goes to the near-miss stage, but no mistakes happen. So, we don't let mistakes happen at all”. (Participant # 15)

Subcategory 2.1.5: The heavy workload of nurses and the time-consuming use of technology

The research showed varying viewpoints about the use of technology in MAP. Some participants perceived technology as a valuable way of increasing process efficiency, reducing errors, and improving patient safety. However, others showed concerns about the workflow disruption, particularly given the high workload in pediatric and neonatal settings. They feared that implementing technology might extend the time required to administer medication and increase their workload, negatively affecting patient care.

For example:

“It is very good that nurses receive drug interactions in the form of alarms. These alarms are effective. It is also good to have information about drugs. Yet the workload here is too high. It should not waste the nurse's time. There are times when the system itself is time-consuming.” (Participant # 13)

"If there is really a system or an application that explains how to measure up the medicine, how to prepare ourselves to give the medicine, in what to inject it and how to inject, that will be great, yet if it is not too time-consuming. For example, sometimes they give me something to read that is so long that I get cold feet and put it aside. I myself don't feel like reading something that is too long. I like doing things fast. For example, if I am supposed to give the medicine, I have to give the medicine quickly. I don't have the patience to spend, for example, an hour to dilute a certain medicine. Well, if there is something that will take us an hour to reach an important half-line, I think that will not work at all. These many explanations are OK when we have enough time and do not have more than two patients. The information should be brief and useful." (Participant # 7)

3.2.2 | Subcategory 2.2: Cultural issues and the impracticality of providing some specialized technology services

The participants were concerned about integrating technology into MAP, especially regarding cultural challenges. These concerns, influenced by personal experiences, shaped their attitudes toward implementing technology in healthcare settings. Numerous individuals reported facing barriers that impeded their efforts to incorporate medication mobile apps into their daily routines. Moreover, discussions centered on the desire to undertake major technological ventures to improve MAP. However, these initiatives often fail to live up to their anticipated benefits, highlighting a gap between their expected advantages and their actual use in daily practice. This detailed analysis provides a deeper understanding of the participants' experiences and the intricate challenges associated with integrating technology into critical domains such as MA.

For example:

"I myself installed a drug application on my phone, I could not work with it at all, so I deleted it eventually. That was because what I wanted from drugs could not be found in that application. I then managed to find what I was looking for in a book in a library." (Participant #16)

"Every time we attend training courses for drug calculations, drug dosages, there is never a course for infants. It has always been either for adults or for children. If the process of providing medicine is system-based, it should be for infants so that nurses can use it." (Participant #2)

"I think, one reason why technology is not welcomed and is not used in practice is that they adopt a too big project at the beginning. If you want to use technology in this ward, start with small issues. Don't devote too much attention to it, because there are great chances that the nurses will guard against it and not use it." (Participant #19)

4 | DISCUSSION

The present study explored the barriers and challenges of using HIT in administering medication in pediatric and neonatal settings. The data analysis was categorized into the main themes of "inappropriate management approaches" and "resistance to change."

One barrier found to the implementation of HIT in MAP was "inappropriate management approaches," which led to managers' reluctance to adopt new technology. According to the SURE framework²² and a systematic review,¹³ also one key barrier to implementing HIT in health care is the reluctance of care providers to adopt this technology. This reluctance was coupled with their focus on issues that may not be in the best interest of the patient. This problem could be partially due to a lack of understanding of the nursing workflow. In line with these findings, a study by Zadvinskis et al., which examined nurses' experiences with HIT, revealed that organizational factors such as hospital leadership's unawareness of the nursing workflow could lead to nurses' dissatisfaction with HIT.²³ Another barrier found in this study was the nurses' lack of necessary skills to use IT. These findings align with Koivunen et al. who highlighted this as a barrier for nurses in their systematic review of telehealth applications.¹⁵ The researchers recommend that to overcome this barrier it is necessary to hold a comprehensive training program tailored to older individuals, ensuring they are not left behind in the transition towards technologically advanced healthcare systems. It also highlights the importance of the user-friendly design of HIT, which can accommodate users of all age groups and skill levels.

One significant barrier found in this study was a shortage of budget for hardware resources. In line with this finding, a qualitative empirical study indicated that the main barrier to implementing virtual care programs is an insufficient budget for providing technology.¹² To overcome this barrier, policymakers should allocate an adequate budget at the level of the Ministry of Health and employ healthcare specialists in economic evaluation to assess the financial impact of HIT systems to justify the adoption of HIT in MAP.

Another main barrier found in this study was "resistance to change." The participants tended to use conventional approaches in MAP. Similarly, in a cross-sectional study in Spain, Villalba-Mora et al. introduced this item as a barrier to the use of HIT by physicians.²⁴ In their study, they showed evidently people who are not comfortable using similar tools outside of work may also be reluctant to use them in a professional setting. Also, a systematic

review of nursing professionals' experiences identified this barrier to the use of telehealth applications.¹⁵ To address this challenge effectively, the vendors and developers should avoid the hasty implementation of HIT systems.

The present study showed that distrust in technology is a barrier to the adoption of new technology in MAP. In this regard, Noblin et al. in their systematic study also mentioned this barrier to the use of HIT in patient care by care givers.²⁵ An issue raised in this systematic review is that the levels of distrust in technology are divided into arbitrary categories. One of the most important categories is technological malfunctions. It is noteworthy that in the present study, nurses also discussed the lack of trust in technology from this perspective. However, Asan et al. in their qualitative study which assessed PICU nurses' Perceptions of a novel HIT, showed technology can improve trust and transparency.²⁶ To overcome this barrier, developers, policymakers, and health care providers aiming to implement HIT in administering medication to pediatric and neonate settings should recognize that trust is essential for maximizing the potential advantages of HIT. It is crucial not only to highlight the benefits of HIT in this process but also to proactively address and mitigate any trust-related issues that could hinder its adoption.

Another barrier, found in the present study, to the adoption of HIT in MAP is the time-consuming technology and the increase in nurse's workload. In this regard, other studies also showed that HIT has been associated with an increase in nurses' working time.^{27,28} Empirical studies showed that the optimal usability of HIT systems can help mitigate workload and improve work performance and quality of care.^{29,30}

Another barrier the nurses reported in this study was the inapplicability of systems they intended to use. An important point to consider before designing and using IT systems in pediatric and neonates is the use of system functionalities that are specific to the setting. In their systematic literature review,⁷ Norouzi et al. identified the functionalities of CDSS for MA in children and neonates. In that study, the authors reported a list of characteristics, which could help with the final acceptance of HIT systems in children and neonates. Moreover, to improve the design, adhering to established guidelines or standards could aid in creating a user-friendly and secure interface.^{31,32} This study focused on the importance of identifying specific barriers early in the system design process to ensure the successful adoption of HIT in administering medication for pediatric and neonatal care. It recommended that developers, as an initial measure, employ a comprehensive model when designing the system. Such a model should include all relevant factors, such as identifying specific needs of pediatric and neonate settings, workflow integration, user interface design, and interoperability with the existing technologies. By employing a comprehensive approach from the outset, developers can anticipate potential challenges and incorporate solutions into the system architecture, thereby facilitating the adoption and more effective use of technology in MAP.

The present study attempted to identify barriers to HIT use for children and neonates. However, since the design of this study is

qualitative and it was set in a university hospital, due to the nature of qualitative studies, we cannot generalize the findings to other settings. However, we tried to solve this issue with a large sample size and diversity of participants. In addition, the codes extracted also showed many of these barriers can be generalized to other places and environments. The point that some studies raise in the design of HIT systems is that before designing any system, adequate attention should be paid to the existing barriers in the relevant context, and some field research is needed to identify these barriers.

5 | CONCLUSION

The present qualitative study identified certain barriers and challenges of using HIT for MA in pediatrics and neonates. The inherent complexities of this issue, which have been insufficiently examined in the literature, were illuminated by our findings. We highlighted the need to improve the effectiveness of HIT Systems, budget for hardware resources, and managers' interest in using new technology. These insights can guide the development of more effective and user-friendly HIT systems in pediatric and neonatal care settings. Furthermore, our study underscores the importance of considering the unique needs and challenges of MAP in the design and implementation of HIT systems. This focus represents significant progress in the field, as it draws attention to an often-overlooked aspect of HIT use. In conclusion, our study not only adds to the understanding of the relevant barriers and challenges but also provides a roadmap for future research and development efforts aimed at overcoming these barriers. We conjecture our findings can pave the way for more efficient and safer MA practices in pediatrics and neonates.

AUTHOR CONTRIBUTIONS

Somaye Norouzi, Monirsadat Nematollahi, and Leila Ahmadian conceptualized, designed, and conducted the study. Somaye Norouzi drafted the manuscript with significant intellectual input from Monirsadat Nematollahi and Leila Ahmadian assisted with revising the manuscript. Analysis and interpretation were done by Somaye Norouzi, Monirsadat Nematollahi, and Leila Ahmadian. All authors approved the final version of the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data sets used and analyzed in the study are available to interested individuals upon request to the corresponding author.

ETHICS STATEMENT

This study followed the Helsinki Declaration and Ethics Publication on Committee (COPE). In addition, by the ethical standards, the current study received approval from the Kerman University of Medical Sciences research ethics committee (Ethics Code: IR.KMU.REC.1401.162). The researcher obtained all participants' verbal and written informed consent before conducting and recording the interviews. The participants were assured that the data they gathered were used only for the research and analyzed only by the researchers and that they could withdraw from the study whenever they wanted. In addition, following the rules and regulations developed by the ethics committee for observation and interview was indeed an important aspect of conducting this study.

TRANSPARENCY STATEMENT

The lead author Leila Ahmadian affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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