# Impact of High-Fidelity Simulation on the Confidence Level of Pediatric Residents to Manage Pediatric Emergencies

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**KEYWORDS**
medical education, pediatric emergencies, and simulation.

**ABSTRACT**
Background: Children having seriously ill health conditions pose new challenges to healthcare professionals in pediatric emergencies. The training based on simulation is a promising procedure for equipping junior professionals with the required potential. Objectives: Studying the impact of High-Fidelity Simulation (HFS) on the confidence levels of pediatric residents for taking care of patients having complications that are critical and also considering emergency procedures. Methodology: A quasi-experimental design utilized having surveys done before and after training to evaluate confidence levels. The research was executed in October 2023. The evaluation model of Kirkpatrick was supposed to evaluate the training program impact. After that, data was collected and entered into MS Excel and then analyzed on SPSS. Results: The research executed two sorts of surveys, including a pre-course survey and a post-course survey. Out of 40 residents, only 30 gave responses with a 75% rate. Descriptive analysis revealed varying levels of confidence across different domains of pediatric care. However, statistical analysis revealed no significant changes in confidence levels post-training in certain areas. These findings suggest that while the training program may have positively influenced confidence in some domains, further investigation is needed to determine its comprehensive impact on the confidence of residents. Conclusion: Our study emphasizes the effectiveness of HFS in enhancing the confidence of pediatric residents in managing critically ill patients and emergency procedures. While statistical significance was not achieved across all domains, the overall trend indicates a positive impact on residents' perceptions of their abilities in pediatric emergency care. Research in the future should revolve around more strategies augmenting the confidence of the residents in the care of pediatric emergencies.

## 1. Introduction

Children who are critically ill, especially in pediatric emergency premises, present notable challenges. Giving impactful care to them needs highly skilled professionals in healthcare (Ames et al., 2019). Junior professionals deal with a significant challenge to achieve the required competencies to manage such cases, provided the novel safety issues and requirements of specialized treatments for these patients (Cabalatungan, Thode Jr, & Singer, 2020). This research considers the pediatric residents to equip them with the needed skills, and confidence too for handling children who are critically ill in emergency settings.

The assessment based on simulation assessment has notable capacity as we move forward if executed continuously and done under supervision (Buléon et al., 2022). This is a challenge that is usually faced by healthcare professionals, and simulation is one of the crucial aspects to fill the gap in preparing healthcare professionals to have efficient care of patients (Nagarajappa & Kaur, 2024). To counter this, our goal is to assess the High-Fidelity Simulation (HFS) training impact on the pediatric resident's confidence levels to manage serious complications and emergency processes. (Beichler et al., 2024). This is done by a specific design of quasi-experimental where the study executes surveys before and post the training.

The prevalence of medical mistakes and errors, specifically those in pediatric trauma resuscitations, is recognized by evidence from the studies, insisting that effective training and protocol adherence are important (Kadakia, 2024). It is the atmosphere that tells us about the fidelity level, different tools and resources utilized, and also some factors like psychological ones and the emotions, beliefs, and self-awareness of the patients (Sittner et al., 2015). The training based on simulation emerges to be a promising avenue to build confidence and competency among healthcare providers to manage emergencies (Alanazi, Nicholson, & Thomas, 2017). If realistic scenarios and hands-on practice are offered, simulation exercises equip providers to be able to handle situations like navigating high pressure having both the confidence and the skill. Consequently, it contributes to

superior healthcare service delivery in emergencies (Ikeme, 2022).

Fidelity in simulation is a multi-dimensional concept associated with the realism amount produced by the simulation equipment selection, with the setting, and scenario its key parts as well (Choi & Wong, 2019). Simulation is a versatile tool to practice, learn, and evaluate in healthcare education. Fidelity is a critical simulation aspect, which makes sure the training scenarios are realistic and effective, and it encompasses components such as physical, psychological, and environmental (Hallmark et al., 2021). In interprofessional communication simulation, participation and implementation have a positive impact (Murray, 2021).

Three research explored neonatal resuscitation high-fidelity, where Hossion focuses on the impact of confidence. On the other hand, Cordero and Surcouf observed the performance of the residents. Despite differences, all agreed simulation boosts confidence. However, Cordero found no significant link between simulated confidence and clinical performance, contrary to Surcouf's positive correlation between confidence and proficiency (Surcouf, Chauvin, Ferry, Yang, & Barkemeyer, 2013).

A study investigated the influence of high-fidelity simulation on communication skills, particularly in End-of-Life care conversations, known for their sensitivity. Using an actor, physicians' communication with parents was assessed. While the study described End-of-Life communication needs and components, it also noted improved self-confidence among residents in conducting such discussions by the study's end (Bateman et al., 2016). While numerous researches have uncovered the effect of training based on simulation on the knowledge and skills of learners, this study specifically focuses on HFS's impact on the confidence levels of pediatric residents to manage patients who are critically ill and emergency procedures in pediatric settings (Samarasekera et al., 2019). By assessing the changes in the confidence levels of residents pre- and post-simulation course, this research is aimed at providing precious and deep inspection into the efficacy of simulation-based training and opportunities to enhance the education of pediatric emergency care.

Despite the known simulation-based training advantages to those providing healthcare, a significant gap exists, particularly in evaluating the impact it poses on the confidence of pediatric residents (Blasius et al., 2020). Existing research is common among specialties of the medical domain and is deficient in a careful investigation of care in pediatric emergencies. Moreover, a deficiency exists in quantitative measurements of levels of confidence, both before and after training, and long-term follow-up studies deficiency evaluating improvements being held in clinical performance (Goldman, Auerbach, Garcia, Gross, & Tiyyagura, 2021). Additionally, different simulation modalities comparative research and their efficacy to hike confidence in pediatric emergency care is confined. Catering these research gaps would ensure that we are thoroughly acquainted with the optimization of SBT for pediatric residents, consequently enhancing emergency care for pediatric patients who are critically ill.

## 2. Research Question

What is the impact of High-Fidelity Simulation (HFS) training on the confidence levels of pediatric residents in managing critically ill patients and performing emergency procedures, and how do confidence levels vary across different domains of pediatric care?

## 3. Methodology

Study Design

The present research aimed at establishing the effect of HFS on confidence levels of pediatric residents adopting a quasi-experimental research design. A quasi-experimental design assesses the impact of interventions in which the groups are not randomly assigned. It creates cause and effect relationship with certain restraints over the other variables. In this study, a post-quiz survey measured pre-intervention confidence (O1) and post-intervention confidence (O2) regarding the effect of High-Fidelity Simulation (HFS) on pediatric residents' confidence. This design enables the researcher to make a comparison between the results of the research within the same group. Since quasi-experiments fall under the quantitative research methodology. It involves the use of numerical data to test hypotheses. One-group pre-test post-test was used and this falls under the category of quasi-experimental designs mainly used in the present study.

Experimental O1XO2

The study's dependent variables consisted of two observations, O1 and O2, representing data collected prior and post-intervention, respectively, through pre-stimulation and post-simulation surveys. The independent variable,

denoted as X, pertains to the educational activity, specifically the simulation training component.

Sample of the Study

The research encompassed 40 pediatric residents specializing in general pediatrics care at a prominent tertiary pediatric specialty hospital, an accredited pediatric residency program by the Saudi Commission for Health Specialties.

Data Collection

Data was collected through online surveys filled out by pediatric residents who attended the simulation course. The links are attached here:

Before the Course Survey

https://docs.google.com/forms/d/e/1FAIpQLSd1ImXsHhNia-mIjhwZpB8aYN1ZNCBdOmkETGnCdcHPa8OGMA/viewform?usp=sf_link

Course Evaluation

https://docs.google.com/forms/d/e/1FAIpQLScGRLPAqJCcUcTmhV6j8UV0_6wp2UW-pXa9BfkmMqov679lJA/viewform?usp=sf_link

After the Course Evaluation

https://docs.google.com/forms/d/e/1FAIpQLSf8RC-QBLLfxsoL293dManAlm8_BJZTGrDx712WDu7sW3aEpg/viewform?usp=sf_link

The simulation course was executed over 2 consecutive days. Clinical scenarios were crafted based on the competencies of the residents and stakeholder feedback. We opted to use surveys that included pre-course evaluation, course evaluation, and post-course evaluation. Data was then extracted to an Excel sheet.

Surveys assessed simulation training's impact on clinical skills and emergency procedures, aiding in evaluation and assessment using the Kirkpatrick evaluation model, introduced by Kirkpatrick in 1959, which comprises four levels, providing increasingly valuable insights into program effectiveness (Alsalamah & Callinan, 2022)

To ensure validity, the questionnaires have undergone validation through piloting by a panel of experts.

Data Analysis

The statistical data analysis employed the “paired t-test” methodology. To conduct the data analysis, the data analysis was performed in collaboration with a local statistician who utilized the available SPSS version to identify any potential significant differences.

## 4. Results

Descriptive Analysis – Pre-Course

Before the initiation of the course, residents were administered a pre-course survey to assess their confidence levels in clinical management and procedural skills within the pediatric emergency room. A total of 30 residents out of 40 completed the survey and were subsequently enrolled in the course. The response rate was 75%. The distribution of these residents across different years of study is presented in Table 1.

**Table 1 Frequency distribution of residents based on their year pre-course**

| Residency Year | Frequency | Percent |
|---|---|---|
| Year 1 | 7 | 23.3 |
| Year 2 | 10 | 33.3 |
| Year 3 | 6 | 20.0 |
| Year 4 | 7 | 23.3 |
| Total | 30 | 100.0 |

Table 2. presents a detailed analysis of healthcare professionals' self-assessed confidence levels across various domains of pediatric care.

Concerning the recognition of pediatric cardiac arrest, it was noted that 50.0% of respondents adopted a neutral stance. A significant proportion, accounting for 26.7%, expressed confidence but acknowledged the necessity for further practice. Conversely, 6.7% asserted high confidence, while 10.0% and 6.7% admitted to feeling

poorly confident and entirely lacking confidence, respectively.

Similarly, in terms of recognizing critically ill pediatric patients, 40.0% of respondents registered neutrality. A notable fraction of 33.3% indicated confidence but identified the need for skill refinement. In contrast, only 10.0% demonstrated high confidence, while 10.0% and 3.3% expressed poor confidence and no confidence, respectively.

Regarding decision-making in managing pediatric codes, neutrality was reported by a majority (50.0%) of respondents. Subsequently, 23.3% expressed confidence but acknowledged the need for practice, and 6.7% exhibited high confidence. A moderate fraction of 16.7% reported poorly confident, while 3.3% manifested a total lack of confidence in this domain.

Furthermore, regarding confidence in teamwork and collaboration with team members, 40.0% of respondents each occupied a neutral stance while expressing a desire for further practice despite confidence. A smaller segment, comprising 6.7%, reported high confidence in this capacity, while 13.3% and 6.7% expressed poor and no confidence, respectively.

Neutrality was also observed in half (50.0%) of the respondents regarding managing arrhythmias in pediatric patients. A substantial fraction of 33.3% considered themselves confident but noted the need for practice, while a mere 3.3% demonstrated high confidence. Conversely, 10.0% of respondents felt poorly confident, and 3.3% lacked confidence.

In terms of inserting intraosseous needles, 40.0% of respondents reported neutrality, and 20.0% expressed confidence but deemed additional practice essential. Notably, 23.3% exhibited poor confidence, while 13.3% claimed high confidence. A minority of 3.3% expressed no confidence in this skill.

Similarly, in performing lumbar punctures, 40.0% maintained a neutral stance, while 26.7% asserted confidence but necessitated practice. A notable 16.7% held high confidence, while 13.3% and 3.3% exhibited poor and no confidence, respectively.

Moreover, pediatric intubation saw 30.0% of respondents endorsing confidence but with a need for practice, while 23.3% remained neutral. An equal 23.3% reported poor confidence, and 16.7% expressed high confidence. Furthermore, 6.7% of the respondents had no confidence in their pediatric intubation abilities.

Pre-course Evaluation for resident’s confidence in handling emergencies

Recognizing pediatric cardiac arrest

**Table 2: Confidence Levels of Residents' Pre-Courses**

| Participant | Frequency | Percent |
|---|---|---|
| Highly confident | 2 | 6.7 |
| Confident but needs practice | 8 | 26.7 |
| Neutral | 15 | 50.0 |
| Poorly Confident | 3 | 10.0 |
| Not confident at all | 2 | 6.7 |
| Total | 30 | 100.0 |
| Recognizing Critically Ill Pediatric Patients | | |
| Participants | Frequency | Percent |
| Highly confident | 3 | 10.0 |
| Confident but needs practice | 10 | 33.3 |
| Neutral | 12 | 40.0 |
| Poorly Confident | 3 | 10.0 |
| Not confident at all | 1 | 3.3 |
| Total | 29 | 96.7 |
| Missing values | 1 | 3.3 |
| Total | 30 | 100.0 |
| Taking Decisions Regarding Management of Pediatric Codes | | |
| Participants | Frequency | Percent |
| Highly confident | 2 | 6.7 |
| Confident but needs practice | 7 | 23.3 |
| Neutral | 15 | 50.0 |
| Poorly Confident | 5 | 16.7 |
| Not confident at all | 1 | 3.3 |
| Total | 30 | 100.0 |
| Work and allocate with team members | | |
| Participants | Frequency | Percent |

| | | |
|---|---|---|
| Highly confident | 2 | 6.7 |
| Confident but needs practice | 12 | 40.0 |
| Neutral | 12 | 40.0 |
| Poorly Confident | 4 | 13.3 |
| Total | 30 | 100.0 |
| Managing arrhythmias in pediatrics | | |
| Participants | Frequency | Percent |
| Highly confident | 1 | 3.3 |
| Confident but needs practice | 10 | 33.3 |
| Neutral | 15 | 50.0 |
| Poorly Confident | 1 | 3.3 |
| Not confident at all | 3 | 10.0 |
| Total | 30 | 100.0 |
| Inserting Intraosseous Needle | | |
| Participants | Frequency | Percent |
| Highly confident | 4 | 13.3 |
| Confident but needs practice | 6 | 20.0 |
| Neutral | 12 | 40.0 |
| Poorly Confident | 7 | 23.3 |
| Not confident at all | 1 | 3.3 |
| Total | 30 | 100.0 |
| Performing Lumbar Puncture | | |
| Participants | Frequency | Percent |
| Highly confident | 5 | 16.7 |
| Confident but needs practice | 12 | 40.0 |
| Neutral | 8 | 26.7 |
| Poorly Confident | 4 | 13.3 |
| Not confident at all | 1 | 3.3 |
| Total | 30 | 100.0 |
| Pediatric Intubation | | |
| Participant | Frequency | Percent |
| Highly confident | 5 | 16.7 |
| Confident but needs practice | 9 | 30.0 |
| Neutral | 7 | 23.3 |
| Poorly Confident | 7 | 23.3 |
| Not confident at all | 2 | 6.7 |
| Total | 30 | 100.0 |

Descriptive Analysis– Post-Course

After the completion of the course, a post-course survey was conducted to evaluate the residents' confidence levels in various pediatric care procedures. Table 3. provides a detailed overview of residents' self-assessed confidence levels across different aspects of pediatric care after the course administration.

For instance, in recognizing pediatric cardiac arrest, 27.6% of respondents reported high confidence, while 31.0% expressed confidence but acknowledged the need for additional practice. A significant proportion (24.1%) remained neutral in their self-assessment, with 17.2% admitting to feeling poorly confident.

In terms of recognizing critically ill patients, 20.7% of residents felt highly confident, while 34.5% were confident but needed further practice. Another 17.2% maintained a neutral stance, while 20.7% expressed poor confidence, and a smaller segment of 6.9% had no confidence.

Regarding decision-making in pediatric code management, 13.8% of respondents reported high confidence. A considerable portion (34.5%) were confident but believed they required additional practice, with an equal percentage remaining neutral. Additionally, 17.2% expressed poor confidence.

Concerning teamwork and collaboration, 24.1% of respondents were highly confident, and 34.5% felt confident but required more practice. A similar proportion (17.2%) remained neutral, with 6.9% expressing no confidence, mirroring the 6.9% who felt poorly confident.

Regarding the management of arrhythmias in pediatrics, 10.3% felt highly confident, while 31.0% were confident but sought further practice. A significant portion (48.3%) remained neutral, with 10.3% feeling poorly confident.

In the context of inserting intraosseous needles, 17.2% of residents were highly confident, while 41.4% were confident but recognized the need for more practice. Additionally, 24.1% adopted a neutral stance, with 6.9% expressing poor confidence and 10.3% having no confidence.

Similarly, in performing lumbar punctures, 34.5% reported high confidence, while 27.6% felt confident but needed practice. A smaller proportion (10.3%) were neutral, with 20.7% feeling poorly confident and 6.9% expressing no confidence.

Regarding pediatric intubation, 13.8% felt highly confident, while 37.9% were confident but required practice. 31% were neutral, with 10.3% feeling poorly confident and 6.9% having no confidence.

Post-course Evaluation for resident's confidence in handling emergencies

**Table 3: confidence levels of residents post-course**

| Recognizing Pediatric Cardiac Arrest | | |
|---|---|---|
| Participants | Frequency | Percent |
| Highly confident | 8 | 27.6 |
| Confident but needs practice | 9 | 31.0 |
| Neutral | 7 | 24.1 |
| Poorly Confident | 5 | 17.2 |
| Total | 29 | 100.0 |
| Recognizing Critically Ill Pediatric Patients | | |
| Participants | Frequency | Percent |
| Highly confident | 6 | 20.7 |
| Confident but needs practice | 10 | 34.5 |
| Neutral | 5 | 17.2 |
| Poorly Confident | 6 | 20.7 |
| Not confident at all | 2 | 6.9 |
| Total | 29 | 100.0 |
| Taking decisions regarding management pediatric codes | | |
| Participants | Frequency | Percent |
| Highly confident | 4 | 13.8 |
| Confident but needs practice | 10 | 34.5 |
| Neutral | 10 | 34.5 |
| Poorly Confident | 5 | 17.2 |
| Total | 29 | 100.0 |
| Work and Allocate with Team Members | | |
| Participants | Frequency | Percent |
| Highly confident | 7 | 24.1 |
| Confident but needs practice | 10 | 34.5 |
| Neutral | 5 | 17.2 |
| Poorly Confident | 5 | 17.2 |
| Not confident at all | 2 | 6.9 |
| Total | 29 | 100.0 |
| Managing Arrhythmias in Pediatrics | | |
| Participants | Frequency | Percent |
| Highly confident | 3 | 10.3 |
| Confident but needs practice | 9 | 31.0 |
| Neutral | 14 | 48.3 |
| Poorly Confident | 3 | 10.3 |
| total | 29 | 100.0 |
| Inserting Intraosseous Needle | | |
| Participants | Frequency | Percent |
| Highly confident | 5 | 17.2 |
| Confident but needs practice | 12 | 41.4 |
| Neutral | 7 | 24.1 |
| Poorly Confident | 2 | 6.9 |
| Not confident at all | 3 | 10.3 |
| Total | 29 | 100.0 |
| Performing Lumbar Puncture | | |
| Participants | Frequency | Percent |
| Highly confident | 10 | 34.5 |
| Confident but needs practice | 8 | 27.6 |
| Neutral | 3 | 10.3 |
| Poorly Confident | 6 | 20.7 |
| Not confident at all | 2 | 6.9 |
| Total | 29 | 100.0 |
| Pediatric Intubation | | |
| Participants | Frequency | Percent |
| Highly confident | 4 | 13.8 |
| Confident but Needs Practice | 11 | 37.9 |
| Neutral | 9 | 31.0 |
| Poorly Confident | 3 | 10.3 |
| Not confident at all | 2 | 6.9 |

| | | |
|---|---|---|
| Total | 29 | 100.0 |

Comparison between Pre-and-Post Course Confidences

The t-test outcomes comparing pre-training and post-training confidence levels in pediatric emergency management unveil some noteworthy observations. Although there is a tendency towards heightened confidence in identifying pediatric cardiac arrest following the training, this alteration lacks statistical significance. Conversely, confidence levels in recognizing critically ill pediatric patients, making decisions regarding pediatric management codes, teamwork, and task allocation, and managing arrhythmias in pediatrics exhibit no statistically significant changes post-training, as indicated by their respective p-values significantly exceeding 0.05. These findings suggest that the training program might have a limited impact on certain facets of pediatric healthcare confidence, prompting the need for further investigation or considerations, such as a larger sample size, to yield more conclusive insights.

**Table 4 Evaluation scale for resident's confidence in handling emergencies**

| | Pre-training | Post-training Mean | Mean Difference | P-value |
|---|---|---|---|---|
| Confidence in recognizing pediatric cardiac arrest? | 2.83 (0.95) | 2.31 (1.07) | 0.52299 | 0.052 |
| Confidence in recognizing critically ill pediatric patients? | 2.62 (0.94) | 2.58 (1.24) | 0.03448 | 0.905 |
| Confidence in making decisions regarding pediatric management codes? | 2.87 (0.89) | 2.55 (0.94) | 0.31494 | 0.196 |
| Confidence in work and allocation with team members? | 2.60 (0.81) | 2.48 (1.24) | 0.11724 | 0.699 |
| Confidence in managing arrhythmias in pediatrics? | 2.83 (0.95) | 2.58 (0.82) | 0.24713 | 0.291 |

NOTE: Lower mean indicates higher confidence

The t-test findings, analyzing pre-training and post-training confidence levels in executing medical procedures, offer significant insights. Notably, the confidence levels in inserting intraosseous needles, performing lumbar punctures, and executing pediatric intubations show no significant alteration post-training. All procedures exhibit p-values substantially exceeding 0.05, as illustrated in Table 5.

**Table 5: Evaluation scale for resident's confidence in performing procedures**

| | Pre-training Mean | Post-training Mean | Mean Difference | P-value |
|---|---|---|---|---|
| How much do you rate your confidence in inserting an intraosseous needle? | 2.83 (1.05) | 2.52 (1.18) | 0.31609 | 0.283 |
| How much do you rate your confidence in performing lumbar puncture? | 2.47 (1.04) | 2.38 (1.35) | 0.08736 | 0.781 |
| How much do you rate your confidence in pediatric intubation? | 2.73 (1.20) | 2.58 (1.08) | 0.14713 | 0.624 |

NOTE: Lower mean indicates higher confidence

## 5. Discussion

The study was intended to assess the HFS impact on the confidence levels of pediatric residents to manage patients being critically ill and pediatric settings emergency procedures. The findings illuminate the effectiveness of training that is based on simulation in bolstering the confidence of residents across various facets of pediatric emergency care. While our study revealed a general trend towards increased confidence in some areas following simulation training, statistically significant changes were not observed in all domains. Our results are in alignment with Bragard regarding the insignificant difference in confidence pre and post-training (Bragard et al., 2019). Interestingly, both studies were conducted on a small number of residents (40 and 16, respectively). On the other hand, there was a significant effect of simulation on residents' confidence when studies were conducted on a larger number of residents, for example, with 69 residents (Holland, Latuska, MacKeil-White, Ciener, & Vukovic, 2021) and 85 residents (Siedlecki, 2020). Notably, the later was conducted as repeated sessions over three years.

Different researches suggest that HFS elevates the confidence in the knowledge and skills of the participant (Fragapane, Li, Ben Khallouq, Cheng, & Harris, 2018). The high-fidelity neonatal resuscitation simulations use has been investigated focusing on the impact on confidence with the performance of residents examined as well. Despite the differing viewpoints of the researchers, all agreed on the idea of confidence enhancement by simulation training. The findings of the simulated confidence and clinical performance relationship were

mingled. One of the participant researchers obtained no notable association, on the other hand, the other one achieved a clue which is a positive correlation between confidence obtained by simulation and clinical efficiency. Two factors need to be taken into consideration when interpreting the results. Firstly, the level of confidence changes over the years of expertise. Secondly, our survey was general, and studies that were conducted for certain skills showed significant improvements in residents' confidence. For example, specific emergency procedures were studied the simulation impact on the confidence of the residents in placing central line catheters and proved the simulation to be beneficial in enhancing the confidence (Alanazi et al., 2017).

The specificity of defining self-confidence in this study, "belief in your ability to competently perform US-guided central venous insertion on a real patient with a reasonably high chance of success," gave more realistic results rather than the vague self-reported confidence in the other studies. Statistical significance does not attain the practical importance of any of the interventions. A positive trend was noticed in the way of elevated confidence among all the participant residents, which concluded that the level of confidence is notable despite the absence of statistical significance.

These findings signify the simulation-based training impact, which is quite meaningful on perceptions of the residents of their pediatric emergency care capabilities. These residents obtained valuable practical experience and real-world scenarios through which they gained essential opportunities for practising and improving their skills in an atmosphere free of any unwanted events. Moreover, the absence of statistical significance is designated to some of the important factors, for example size of the sample and the pediatric emergency care complexity.

While our study included a cohort of 40 pediatric residents, a larger sample size may have been necessary to detect smaller yet still meaningful changes in confidence levels. Additionally, managing pediatric emergencies entails a diverse set of skills beyond technical proficiency, including effective communication, decision-making, and teamwork, which may not have been fully captured by our outcome measures. A potential bias is seen toward higher fidelity among trainers and those who learn it (Kim, Park, & Shin, 2016).

Overall, our findings emphasize the continued importance of simulation-based training in enhancing pediatric residents' confidence in managing critically ill patients and emergency procedures. Several published studies are trying to calculate the influence of HFS (Lee, Milbury, Movius, & Zhuang, 2021). Future research should explore additional strategies to complement simulation training and further enhance residents' confidence and competence in pediatric emergency care.

## 6. Conclusion

In conclusion, HFS is a very interesting and rich area of research and development. Many studies have been conducted and proved the importance of simulation in critically ill patients, resuscitation, and procedures on confidence and clinical performance of junior doctors, especially in the pediatric age group, where such cases are not so common and quite stressful in real life. Our study highlights the significance of HFS in bolstering pediatric residents' confidence levels to manage patients who are critically ill and emergency procedures in pediatric settings. Some factors, such as sample size and complexity of pediatric emergency cases, might have influenced the lack of statistical significance in certain domains. Simulation trainers need to get the actual concept of HFS and its elements, with the roles they play to design an experience of simulation-based learning. However, the overall trend indicates a positive impact of simulation-based training on residents' perceptions of their abilities in pediatric emergency care, offering valuable opportunities for residents to practice and refine their skills in a safe and controlled environment. Future research should explore additional strategies to complement simulation training and further enhance residents' confidence and competence in pediatric emergency care. By continually refining training programs and evaluation methods, healthcare institutions can better equip pediatric residents to provide high-quality care in emergency settings.

## 7. Limitations and Future Implications

This research has different limitations. One of them is that the sample size is small and dependence on self-reported steps might not completely attain the impact of training. Moreover, the research could not feature notable enhancements in all pediatric care aspects, reflecting the requirement to execute more research.

Future research must utilize bigger, more versatile samples and add randomized controlled trials (RCTs) to have strong evidence. Long-lasting follow-up and measures of objective performance are important in assessing the sustaining impacts of HFS training. Diving into several methods of simulation can assist in identifying the most

effective training ways for care in pediatric emergencies.

Ethical Approval The Ethics and Research Committee in Al Jalila Children's Hospital, Dubai, UAE, approved the study. It was conducted in October 2023.

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