



Effect of an Instructional Program on Nurses' Skills pertaining to Pediatric Interagency Integrated Triage Tool in Mosul Hospitals

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Abstract Background: Triage is a critical process in emergency medicine that involves the rapid assessment and prioritization of Pediatrics based on the severity of their conditions. **Objective:** The present study aimed to evaluate the effect of an instructional program on nurses' skills pertaining to pediatric Interagency Integrated Triage Tool at pediatric emergency departments in hospitals in Mosul. **Methods:** Quasi experimental design study was carried out at pediatric emergency departments in Mosul hospitals from September 5, 2024, to December 25, 2024. Sample selection was conducted in collaboration with nursing departments in Mosul hospitals for both the intervention and control groups. A random selection process was then used to choose nurses from hospitals for the experimental group and the control group. The instructional program was lecture-based and the questionnaire survey was constructed by the researchers and distributed among nurses to evaluate the effect of the instructional program on nurses' skills pertaining to pediatric Interagency Integrated Triage Tool. The instructional content contained five lectures with the questionnaire was divided into two sections. The validity was tested by a panel of 20 experts, who substantiated the construct validity and content clarity. To statistically test the reliability of instruments, a pilot test was run from September 22-26, 2024 by used Cronbach's alpha, the results was (0.810) **Results:** The statistical analysis of nurses' skills of the pediatric Interagency Integrated Triage Tool showed that all aspects of nurses' skills in the experimental group in the pretest were at a 70.0% non-acceptable level, while in the posttest they reached 66.7%, an excellent level. As well as the t-test and ANOVA test, which showed that the experimental group was high significant relationship between pretest and posttest results but there was non-significant relationship for control group at p-value ≤ 0.05 level. **Conclusion:** The effect of an instructional program was proven by the highly significant relationship between nurses' skills pertaining to pediatric interagency integrated triage tool in the two research groups, one receiving instructions on the guideline and the other not.

Key Words Effect, Instructional Program, Nurses' skills, Pediatric Interagency Integrated Triage Tool

INTRODUCTION

Triage is a critical process in emergency medicine that involves the rapid assessment and prioritization of Pediatrics based on the severity of their conditions, this systematic approach ensures that those who require immediate medical attention receive care promptly, thereby improving Pediatrics outcomes and optimizing the use of available resources, in the context of increasing Pediatrics volumes and limited healthcare resources, effective triage systems are essential for managing emergency departments (EDs) efficiently [1]. Historically triage originated in military settings, where quick decision-making was vital for saving lives, over the years this practice has evolved and been adapted for civilian healthcare particularly in emergency departments, the concept has gained importance globally especially in low- and

middle-income countries (LMICs), where the burden of acute illness and injury is significant and resources are often scarce [2]. Various triage systems have been developed, with nations with high incomes commonly using five-tier models such as the Emergency Severity Index (ESI) and the Australasian Triage Scale (ATS). However, these models may not be suitable for Low- and middle-income countries (LMICs) due to differences in healthcare infrastructure, workforce availability and disease epidemiology consequently there is a growing recognition of the need for context-specific triage tools that cater to the unique challenges faced by these settings [3,4]. One tool that stands out is the Integrated Interagency Triage Tool (IITT). It was developed in collaboration with the World Health Organization (WHO), the International Committee of the Red Cross (ICRC) and Médecins

Sans Frontières (MSF). The IITT is structured as a three-tier system, specifically tailored for use in resource-limited settings, emphasizing simplicity and efficiency in its application, its endorsement by leading global health organizations highlights the importance of standardized triage approaches in enhancing emergency care [5,6]. Children in pediatric emergency care require effective triage due to their varied symptoms and potential for critical illness, children represent a significant portion of ED visits and their symptoms can vary widely in terms of severity and urgency, rapid identification of critically ill children is crucial to prevent adverse outcomes, including increased mortality rates, pediatric triage systems must prioritize high sensitivity to ensure that severely ill children are promptly recognized and treated [7,8]. The implementation of the IITT in pediatric emergency wards has the potential to transform the triage process, enhancing nurses' competent in assessing and managing pediatrics, by equipping healthcare providers with the necessary skills and knowledge, the IITT aims to improve the overall efficiency and effectiveness of emergency care for children [9,10]. Despite the potential benefits evidence surrounding the performance of the IITT in pediatric settings remains limited, therefore, assessing the efficacy of this tool is imperative to validate its reliability and applicability in real-world scenarios, this study seeks to evaluate the impact of the IITT on nurses' competent in pediatric emergency wards, providing valuable insights into its effectiveness [11,12]. The reason for selecting this title stems from the urgent need to improve emergency care systems, particularly in resource-limited settings, as the demand for emergency services continues to rise, it is imperative to identify effective triage systems that can enhance patient outcomes, reduce waiting times and allocate healthcare resources more efficiently, by thoroughly evaluating existing triage tools and their application in various contexts, this study aims to contribute valuable insights that can inform healthcare policies and practices in Iraq and beyond, the findings could lead to improved training for emergency nurses, ultimately saving lives and enhancing the quality of care provided in emergency departments. The objectives of the study to assess the level of the nurses' skills pertaining to pediatric Interagency Integrated Triage Tool in Mosul hospitals. To evaluate how the instructional program has affected nurses' skills at pertaining to pediatric Interagency Integrated Triage Tool at Mosul hospitals between the pretest and posttest. To determine the correlations between demographic variables and the results of instructional program pertaining to pediatric Interagency Integrated Triage Tool.

METHODS

Design of Study

Quasi experimental design study was conducted to evaluate the effect of the Interagency Integrated Triage Tool (IITT) in enhancing the skills of nurses at pediatric emergency wards in Mosul hospitals. The study was implemented from September 5, 2024, to December 25, 2024.

Sample of study

The study sample was simple random selection. Sample selection was conducted in collaboration with nursing departments in Mosul hospitals for both the intervention and

control groups. After compiling lists of all pediatric emergency nurses in each hospital, 30 nurses were randomly selected from 114 nurses in the intervention group from three hospitals to participate in the study. The same procedure was followed for the control group, which numbered 93 nurses from two hospitals; they also selected 30 nurses.

Instrument

The program's lecture-based and the questionnaire was created and made available for nurses to evaluate how the instructional program has affected nurses' skills to utilize the pediatric interagency integrated triage tool. The content of the program included five lectures, two lectures each week and the questionnaire contained two parts, one enquiring about demographic information contain (Age, gender, education, years of experience overall, time spent in the emergency room, hospital name and involvement in pertinent training) and the other about the nurses' skills pertaining to pediatric Interagency Integrated Triage Tool Which includes (Nurses' skills in understanding the theoretical basis of triage and its importance in improving health care, Nurses' skills on how to correctly apply the Interagency Integrated Triage Tool in children, Nurses' skills about being able to determine the correct criteria for a particular patient's condition in children, Nurses' skills in being able to accurately measure and interpret vital signs in children).

Scoring

There were four levels of rating the nurses' skills: Failed is defined as a score of 0-1, not acceptable as 2 scores, acceptable as 3 scores, good as 4 scores and excellent as 5 scores. The overall ratings for total skills are as follows: failed = 0-4 scores, non-acceptable = 5-8 scores, acceptable = 9-12 scores, good = 13-16 scores and excellent = 17-20 scores.

Validity of findings

The program lectures' and the questionnaire's accuracy were confirmed by a panel of (20) experts who evaluated the clarity, relevance and sufficiency of the content.

Reliability of instruments

A pilot study was conducted from September 14 to 19, 2024, to statistically assess the reliability of the instruments used in the questionnaire survey. Ten nurses were selected randomly from the pediatric emergency ward of Mosul hospitals. This sample was subsequently excluded from the original study sample. The estimated Cronbach's alpha in SPSS26 was 0.810.

Data collection

The data were collected from the pediatric emergency ward of Mosul hospitals by used structured interview and self-administration methods. The total sample selection consisted of 60 nurses, which divided to (30) nurses as experimental group and (30) nurses as control group that are employed at Mosul General Hospital, Al-Khansa Teaching Hospital, Ibn Al-Atheer Teaching Hospital, Ibn Sina Teaching Hospital and Al-Salam Teaching Hospital. The data collection occurred between September 5, 2024 and December 25, 2024.

Statistical Analysis

The statistical analysis included both descriptive and inferential methods. Descriptive statistics, such as frequency and percentage, were employed to summarize demographic variables and calculate pretest and posttest skill scores. For inferential analysis, an independent t-test was used to compare two groups, while a one-way ANOVA was conducted to evaluate differences between groups for continuous quantitative variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The skill scores were categorized as follows: Failed (0-1), non-acceptable (2), Acceptable (3), Good (4) and Excellent (5). Data were presented using frequency (F) and percentage (%) (Table 1-2).

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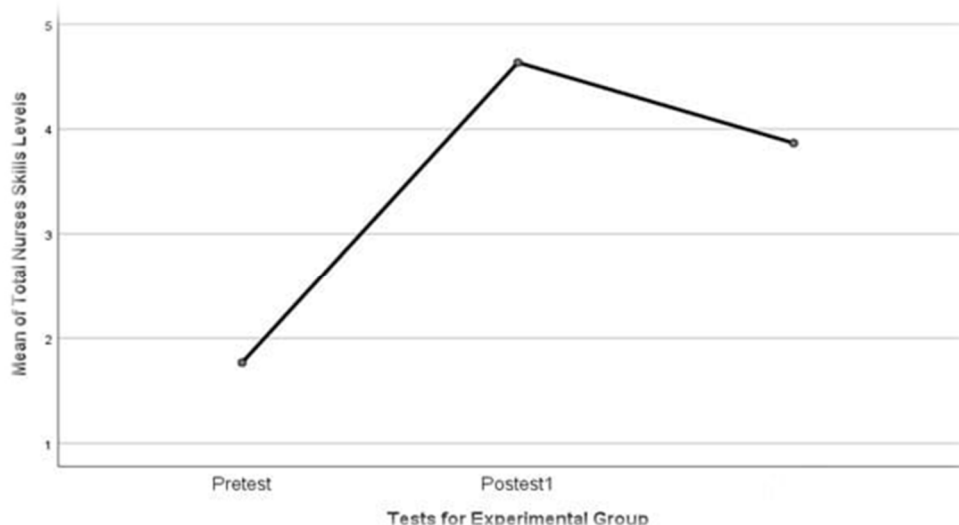


Figure 1: Mean plot distribution of total nurses' skills in (pretest and posttest) in experimental group

Table 1: The participants' demographic information

Demographic variables	Items	Study group		Control group		Test of homogeneity
		F.	%	F.	%	p-value
Age	(20-29) years	16	53.3	15	50	0.999
	(30-39) years	12	40	14	46.7	0.795
	(40-49) years	2	6.7	1	3.3	0.999
Sex	Male	21	70	24	80	0.671
	Female	9	30	6	20	0.748
Level of education	Secondary degree	7	23.3	6	20	0.999
	Diploma degree	8	26.7	10	33.3	0.779
	Bachelor degree	15	50	14	46.7	0.999
General years of experience	(1-5) years	15	50	15	50	1
	(6-10) years	8	26.7	10	33.3	0.779
	(11-15) years	4	13.3	3	10	0.999
	(16-20) years	1	3.3	1	3.3	1
	(21-25) years	2	6.7	1	3.3	0.999
The period in the current unit	(1-3) year	16	53.3	18	60	0.795
	(4-6) years	9	30	8	26.7	0.999
	(7-9) years	4	13.3	3	10	0.671
	(10-12) years	1	3.3	1	3.3	1
Hospital name	General Mosul hospital	7	23.3	0	0	-
	Alkansasa hospital	12	40	0	0	
	Ibn Alatheer hospital	11	36.7	0	0	
	Alsalam hospital	0	0	12	40	
	Ibn seena hospital	0	0	18	60	
Training courses	No	28	93.3	29	96.7	0.754
	yes	2	6.7	1	3.3	0.999

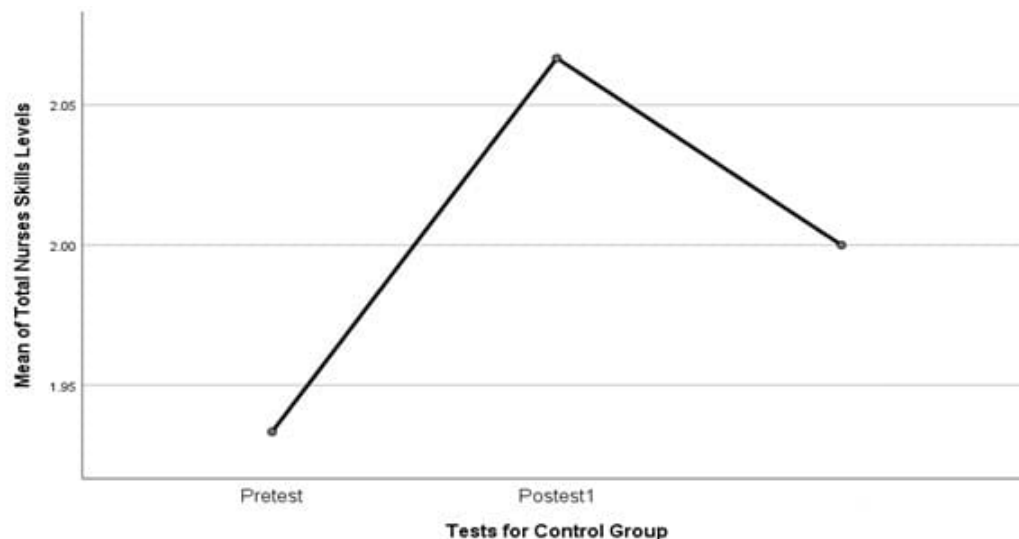


Figure 2: Mean plot distribution of total Nurses' skills in (pretest and posttest) in control group

Table 2: Statistical analysis of Nurses' skills of implementing pediatric interagency integrated triage tool

Skills	Estimate	Experimental group				Control group			
		Pre-test		Post-test		Pre-test		Post-test	
		F.	%	F.	%	F.	%	F.	%
Nurses' skills in understanding the theoretical basis of triage and its importance in improving health care	Failed	15	50	0	0	14	46.7	7	23.3
	Non acceptable	12	40	0	0	9	30	15	50
	Acceptable	3	10	4	13.3	7	30	8	26.7
	Good	0	0	9	30	0	0	0	0
	Excellent	0	0	17	56.7	0	0	0	0
Nurses' skills on how to correctly apply the Interagency Integrated Triage Tool in children	Failed	18	60	1	3.3	12	40	10	33.3
	Non acceptable	12	40	1	3.3	16	53.3	15	50
	Acceptable	0	0	3	13.3	2	6.7	5	16.7
	Good	0	0	11	10	0	0	0	0
	Excellent	0	0	14	46.7	0	0	0	0
Nurses' skills about being able to determine the correct criteria for a particular patient's condition in children	Failed	20	66.7	0	3.3	10	33.3	9	30
	Non acceptable	9	30	3	10	15	50	17	56.7
	Acceptable	1	3.3	2	6.7	5	16.3	4	13.3
	Good	0	0	9	30	0	0	0	0
	Excellent	0	0	16	53.3	0	0	0	0
Nurses' skills in being able to accurately measure and interpret vital signs in children	Failed	18	60	0	0	18	60	11	36.7
	Non acceptable	11	36.7	3	10	8	26.7	16	53.3
	Acceptable	1	3.3	4	13.3	4	13.3	3	10
	Good	0	0	9	30	0	0	0	0
	Excellent	0	0	14	46.7	0	0	0	0
Total		30	100	30	100	30	100	30	100

DISCUSSION

Based on the findings of the current study, it was found that Concerning socio-demographic profiles and general characteristics of pediatric emergency nurses, the findings showed that about Four-fifths of them were male and one-fifth were female. This finding was in line with [13,14] who stated that the majority of the nurses 63.3 % of the sample were males and 36.7% were female, as well as half of them have a bachelor's degree., most of the nurses were in early adulthood stage as their age was ranged from 20-29 years old, these findings were in accordance with [15], who reported that the

mean age of the study participants was between 20-30 years. Also, their years of experience in general hospital mean ranged from 1-5, this result settled with a study conducted by [16], which reported that 60.0% of participants had 1-5 years of experience. A significant portion of nurses, 96.7% in both the study and control groups, lacked prior training on the Interagency Integrated Triage Tool, primarily due to its non-implementation in hospitals and limited training programs. Only those affiliated with international organizations active in Iraq after 2014 received some exposure. This aligns with [17], who found that 84% of participants in their study had no prior training on ARDS. The

Table 3: Statistical analysis of total skills of implementing pediatric interagency integrated triage tool

Groups	Estimate	Total skills			
		Pre-test		Post-test	
		F.	%	F.	%
Experimental group	Failed	8	26.7	0	0.0
	Non acceptable	21	70.0	0	0.0
	Acceptable	1	3.3	1	3.3
	Good	0	0.0	9	30.0
	Excellent	0	0.0	20	66.7
Control group	Failed	6	20.0	1	3.3
	Non acceptable	20	66.7	26	86.7
	Acceptable	4	13.3	3	10.0
	Good	0	0.0	0	0.0
	Excellent	0	0.0	0	0.0
The total		30	100.0	30	100.0

Table 4: Statistical differences (Paired samples T-test) of pediatric interagency integrated triage tool skills

Groups	The Test	Mean	Std. D.	t	P-value	Sig.
Experimental Group	Pre	1.77	0.504	-21.500	0.000	HS
	Post	4.63	0.556			
Control Group	Pre	1.93	0.583	-1.278	0.211	NS
	Post	2.07	0.365			

Std. D: Standard deviation, t: t-test, Sig.: Significance at a p-value ≤ 0.05

Table 5: Statistical differences (ANOVA) of pediatric interagency integrated triage tool skills in instructional program (Pre-test, Post-test)

Groups		Sum of squares	df	Mean square	F	Sig.
Experimental group	Between groups	123.267	1	123.267	437.722	0.000
	Within groups	16.333	58	0.282		
	Total	139.600	59			
Control group	Between groups	0.267	1	0.267	1.126	0.293
	Within groups	13.733	58	0.237		
	Total	14.000	59			

Multiple comparisons: Bonferroni ANOVA is significant at p-value ≤ 0.05 level

Table 6: Statistical correlation between Nurses' demographic variables and the outcomes of the instructional program

	Demographic variables	Experimental group				Control group			
		Pre		Post		Pre		Post	
		P-value	Sig.	P-value	Sig.	P-value	Sig.	P-value	Sig.
1	Age	0.675	NS	0.025	NS	0.971	NS	0.954	NS
2	sex	0.596	NS	0.142	NS	0.760	NS	0.626	NS
3	Educational level	0.707	NS	0.003	S	0.561	NS	0.768	NS
4	Years of service	0.313	NS	0.003	S	0.869	NS	0.793	NS
5	Hospital Name	0.975	NS	0.131	NS	0.453	NS	0.022	S
6	Period of work in ER	0.251	NS	0.022	NS	0.415	NS	0.936	NS
7	Training	0.031	S	0.343	NS	0.062	NS	0.856	NS

Relationship is significant at p-value ≤ 0.05 level

statistical analysis of the study group's skills regarding the Interagency Integrated Triage Tool showed significant improvement following the educational intervention. In the pre-test, 50.0% of nurses failed to understand the theoretical basis of triage, which improved to 56.7%, achieving an excellent level in post-test 1. Similarly, 60.0% of nurses failed in the practical application of the tool in the pre-test, improving to 46.7% at an excellent level in post-test 1. These findings align with studies such as [18-22], which reported marked improvement in nurses' skills post-training, highlighting the effectiveness of educational interventions in enhancing knowledge and skills. The statistical analysis of the control group's skills regarding the Interagency

Integrated Triage Tool revealed that most nurses demonstrated unacceptable levels of skills across all test phases. For example, 46.7% of nurses failed in understanding the theoretical basis of triage during the pre-test, with the same level in post-test 1 (50.0%). Similar patterns were observed in applying the tool, determining criteria for patients and interpreting vital signs. These results highlight deficiencies in basic education, limited hands-on training and workplace challenges, emphasizing the need for targeted educational interventions, such as simulation-based training and regular competency assessments, to enhance nurses' skills in pediatric emergency care. This aligns with findings by [23,24], which also reported low levels of triage

skills among nurses and the need for improved training programs. The statistical findings of the study group's total skills regarding the Interagency Integrated Triage Tool revealed a significant improvement post-intervention. In the pre-test, 70.0% (21 nurses) demonstrated unacceptable levels of skills. Post-test 1 showed 66.7% (20 nurses) achieving an excellent level. This aligns with findings by [25] in Sri Lanka, where participants reported increased confidence and improved ICU competencies post-training. Conversely, the control group displayed the same level. In the pre-test, 66.7% (20 nurses) were at an unacceptable skill level, with post-test 1 showing 86.7% (26 nurses) remaining at unacceptable levels. These results align with [26], who reported only minimal skill improvements (3%-4%) in neonatal resuscitation among the control group, indicating a lack of effective intervention. The statistical analysis using a paired sample t-test demonstrated significant improvements in nurses' total skills regarding the Interagency Integrated Triage Tool. A high level of significance was observed between the pre-test and post-test 1 ($p = 0.000$). These findings indicate substantial advancements in the nurses' competencies following the implementation of the educational program. These findings align with a study by Twagirayezu *et al.* [23], conducted in Iraq, which reported significant improvements in nurses' practices after an educational program, with highly significant differences ($p < 0.01$) between pre- and post-training assessments. In contrast, the control group showed minimal or statistically insignificant improvements in total skills across the same time periods. These findings align with Bahlibi *et al.* [27], who reported slight, non-systematic improvements in the control group in their study on triage training among emergency department nurses. The statistical analysis of the study group using ANOVA revealed a statistically significant difference in the nurses' total skills between pretest and post-test (p -value = 0.000). This indicates a marked improvement in the nurses' competencies following the educational intervention, reinforcing the effectiveness of the triage training program. However, the control group showed no significant differences in skills (p -value = 0.293) between pretest and post-test, with p -values greater than 0.05. These results suggest that the control group did not experience meaningful improvements during this period. These findings align with studies such as Mohebbi *et al.* [28] conducted a quasi-experimental study on the effectiveness of outcome-based pediatric triage education in nursing students. The study used ANOVA to assess the knowledge and decision-making skills of the participants before and after the educational program. The results revealed statistically significant improvements, with p -values of 0.017 for knowledge enhancement and 0.009 for decision-making skills. while Control Group Findings is consistent with the studies of Madkhali *et al.* [22], both of which reported low levels of triage skills among nurses and the need for enhanced training programs to address these deficiencies. Regarding skill outcomes, the statistical analysis of the pre-test phase showed no significant correlations with any demographic variables. However, post-test 1 revealed significant associations with several demographic variables, including age ($p = 0.025$), educational level ($p = 0.003$), years of service ($p = 0.003$) and the period of work in the emergency department ($p = 0.022$). The

findings align with a study conducted in Sanaa, Yemen, by Haza'a *et al.* [29], which the lack of statistical significance in these correlations, the study did note disparities related to gender. Additionally, Haza'a *et al.* [29] found no significant differences in nurses' mean knowledge scores regarding the management of patients with lung embolism, even after an educational follow-up program. A similar trend was observed in a study by Al Shamandy *et al.* [30] in Egypt, which examined nurses' skills in interpreting fetal heart traces. The study showed a statistically significant relationship between participants' level of interpretation skills and personal characteristics, including age ($p \leq 0.05$), years of experience ($p \leq 0.05$) and previous educational certifications (pre-test at $p \leq 0.01$). However, post-test analysis revealed no significant correlations with marital status or previous certifications, suggesting that the impact of demographic factors on skill outcomes may fluctuate over time and be specific to the type of skill being measured.

CONCLUSIONS

The nurses working in the pediatric emergency wards of Mosul hospitals lack appropriate and adequate skills in pediatric interagency integrated triage tool. There is a significant difference between the pre-test and post-test results of the experimental group in terms of implementing the pediatric interagency integrated triage tool. The effect of the instructional program was proven by the highly significant relationship between the pre-test and post-test in the experimental group in terms of implementing the pediatric postural drainage guideline. There was no significant correlation between the nurses' skills and the demographic variables.

Recommendations

- Special programs, training courses and workshops can be designed on implementing the pediatric Interagency Integrated Triage Tool in pediatric emergency wards to enhance nurse's skills in this major issue
- The study is suggested to increase the number of nurses to work at the pediatric emergency ward for their better ability and valuable background

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Authors' Contributions: Saif Abdullah Mohammed is responsible for the entire manuscript. Both authors reviewed and approved the final draft of the manuscript.

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Conflicts of Interest

The authors declare that there are no conflicts of interest.

Ethical Approval

After getting an approval from the University of Mosul, a code of ethics was obtained from the collegiate committee for medical research ethics (CCMRE-Nur-24-22). Then, an approval was obtained from the ethical committee of Nineveh Health Directorate. And only then was the researcher allowed to do the research in Mosul Hospital.

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