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The effectiveness of an educational program for pediatric nurses concerning acute rheumatic fever and rheumatic heart disease

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Abstract:

Background: *Rheumatic fever remains a major health problem in many low-income and middle-income countries.*
Purpose: *determine the pediatric nurses' information background, their understanding of the causative pathway and preventive measures, and the nurses' skills regarding acute rheumatic fever (ARF) and rheumatic heart disease (RHD) pre- and post-educational intervention and after one month.*
Methodology: *A quasi-experimental research design. Convenience sampling of 150 pediatric nurses was carried out in the pediatric departments of two hospitals, Banha University Hospital and Banha Teaching Hospital.* ***Tools****: A questionnaire was used to gather data on the nurses' understanding of ARF and RHD. The causative pathway of and preventive measures for ARF and RHD were presented graphically. An observation checklist supplied pre- and post-intervention was used to measure nurses' skills.*
Results: *The significant improvement in the pediatric nurses' information background, the preventive strategies employed, their understanding of the causative pathway, and their skills was observed post-intervention (93%,95%, and 85%, respectively). There was a statistically significant correlation between the pediatric nurses' age, qualifications, years of experience, residence status, marital status and their information background, understanding of the causative pathway and preventive measures, and the nurses' skills related to ARF and RHD.*
Conclusion: *The educational program delivered to pediatric nurses was effective in increasing their knowledge, skills, prevention of rheumatic fever, and control of RHD among children. Rheumatic fever and RHD, most aspects of their life are impacted, including their dietary habits, psychological state, and ability to participate in school activities. This highlights the importance of the pediatric nurse's role in teaching children and their parents about these conditions.*
Keywords: *pediatric nurses, educational program, ARF, RHD.*

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I. Introduction

Rheumatic fever (RF) is a common autoimmune disorder and a common cause of acquired heart disease in children worldwide, particularly in developing countries. It is caused by group A beta-hemolytic streptococcus (GAS) infection that can develop following pharyngitis. It remains highly prevalent in developing countries and is a major health challenge that results in devastating lifelong consequences **(Szczygielska, et al., 2018 and Engel, et al., 2015).**

Acute rheumatic fever (ARF) and its associated complication rheumatic heart disease (RHD) remain among the leading causes of cardiovascular disease worldwide and constitute a heavy burden for developing countries with incidence and prevalence varying considerably between nations **(Oliveira, et al., 2020)** and **(Watkins, et al., 2017).** ARF and its sequel RHD continue to cause significant morbidity and mortality in developing countries. It is strongly associated with restricted access to healthcare, overcrowding, and nutritional deficiencies and has a disproportionate impact on the underserved populations of low- and middle-income countries **(Lennon and Stewart., 2015).**

Global data from the World Health Organization's (WHO) databanks were retrieved for total deaths and age standardized death rate per 100,000 (ASDR) by age group, sex, and year (from 2000 to 2015).The highest total deaths were reported in Egypt, Pakistan, Iran, Afghanistan, and Yemen, representing 80% of the total death rates for the region (35,248). The highest ASDR was Afghanistan (27.5), followed by Yemen (18.78) and Egypt (15.59). The ASDR for RHD was highest in low-income countries **(Abul-Fadl, et al., 2018).**

According to the data, RHD has a high prevalence in Egypt. Although a high proportion of the abnormalities originally detected persisted at follow-up, both the progression and regression of valve lesions were demonstrated. Sixty children were initially diagnosed with definite RHD (19.6 per 1,000 children) and 35 with borderline disease (11.4 per 1,000) most had mitral valve disease **(Kotit, et al., 2017).**

As ARF is a preventable disease, emphasis is increasingly being placed on the importance of the control, prevention, and elimination of the condition. Primary prophylaxis simply consists of educating the populace to promote the importance of preventing the disease by accessing, at the primary care level, a throat swab evaluation of streptococcal pharyngitis. Then, the reporting and treatment of the disease, again at the primary care level, of the pharyngitis caused by group A beta-hemolytic streptococcus (GAS) can be achieved with widely available antibiotic regimens. Once an episode of acute rheumatic fever (ARF) occurs, or in the presence of RHD findings, secondary prophylaxis consists of benzathine penicillin (BPG) injections every 3-4 weeks to prevent recurrent infections and eradicate the causative agent, thereby reducing the risk of worsening cardiac involvement. Primordial prevention aims to avoid episodes of streptococcal pharyngitis by tackling poverty, improving living and housing standards, and increasing access to health care. Most of the observed secular trends in the reduction of the prevalence of RHD globally are due to primordial prevention activities **(Zuhlke, et al., 2017).**

Pediatric nurses have an important role to play in the prevention of ARF and RHD and represent the most successful and cost-effective means of reducing the risk factors for rheumatic fever (primordial prevention) and increasing primary and secondary prevention (prophylaxis) of these diseases **(De Dassel, et al., 2015).**

Significance of the study

In developing countries, the magnitude of ARF is enormous. Recent estimates suggest that 33.4 million people worldwide have RHD and that 300,000-500,000 new cases of RF (approximately 60% of whom will develop RHD) occur annually with 230,000 deaths resulting from its complications. Almost all of these cases occur in the developing world **(Mark, et al., 2021).**

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Children in Egypt are still heavily affected by RF with an attack occurring before 15 years of age in 10% of cases. It represents a serious health problem as 8-9 children between 6 and 15 per 10,000 of children are impacted **(Deraz et al., 2020).**The majority of the screened subjects were 5-15 years old (69.0%), female (63.2%), lived in a rural area (61.2%), had completed primary education (42.9%), and were of a low socioeconomic status (50.0%). Screening of siblings and relatives of RHD cases revealed that 22.5% of those screened had RF, 11.8% had RHD and 10.7% had rheumatic arthritis (RHA), suggesting the hereditary or familial tendency of the disease **(El Ghamrawy, et al., 2019).**

One study done by **(Mosbeh, et al., 2021)** on pediatric nurses in Egypt found that most had unsatisfactory knowledge if and were not competent to administer penicillin. The study recommends developing an educational program for pediatric nurses to improve their performance regarding penicillin administration. Moreover, a study done by (**Al-Husaunawy., 2015)** to evaluate pediatric nurses' knowledge and skills regarding electrocardiogram (ECG) found the most required intensive training to acquire the appropriate knowledge and skills**.**

The biggest gap in knowledge regarding the control of RHD is in implementing effective primary and secondary preventive measures. The current research aims to evaluate the effectiveness of the transmission and retention of knowledge and skills relating to preventive and curative measures, issues around the lifestyles of children, and rehabilitative care resulting from an educational intervention to promote awareness and training on pharyngitis, ARF, and RHD for pediatric nurses.

The research aims:

-To determine the pediatric nurses' information background, their understanding of the causative pathway and preventive measures, and the nurses' skills regarding acute rheumatic fever (ARF) and rheumatic heart disease (RHD) pre- and post-educational intervention and after one month.

- Discover the correlation between the socioeconomic status of pediatric nurses and their information background, understanding of the causative pathway and preventive measures, and skills pre- and post-educational intervention.

Research hypotheses

- H1: The pediatric nurses will have a sufficient information background around ARF and RHD after the educational intervention.
- H2: The pediatric nurses will have a full understanding of the graphical causative pathway and preventive measures after the implementation of the educational intervention on ARF and RHD.

- H3: The pediatric nurses will have mastered ARF and RHD skills after the implementation of the educational intervention.

II. Methodology

I. Technical design

Research design: A quasi-experimental design was employed among pediatric nurses.

Setting: The study was carried out in the pediatric departments of two hospitals: Banha University Hospital and Banha Teaching Hospital.

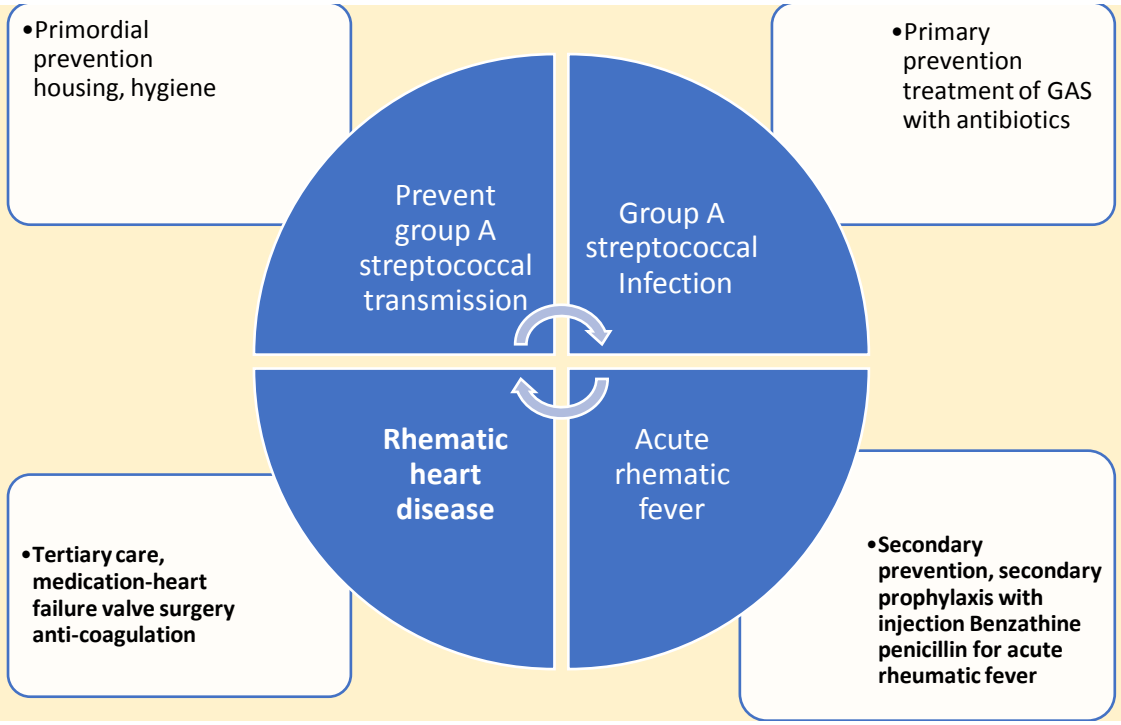
Sample selection: Convenience sampling of all the pediatric nurses at aforementioned hospitals was undertaken. The total study sample was 150 pediatric nurses.

Data collection tools

Tool 1: Part one: The demographic data of the pediatric nurses such as their age, qualifications, years of experience, residence and marital status.

Part two: A questionnaire to evaluate the pediatric nurses background information on ARF and RHD. It consisted of items regarding the magnitude of the problem, diagnosis, referral, burden of group A streptococcus, signs and symptoms, the history of RHD, the valve affected, RHD diagnosis, and the global burden of RHD.

Tool II: A graphical depiction of the causal pathway and preventive measures of ARF/RHD for pediatric nurses including primordial, primary, secondary, and tertiary prevention, to evaluate understanding.



Scoring system: Based on the participants answers, a score of 2 represented a good score for the participant, a score of 1 was an average score, and a score of 0 was a poor score. The total answers of the participants in the study were divided as follows: if over 80% of their total answers were correct, it was considered that they were adequately informed; 60-80% indicated that they were fairly informed; less than 60% indicated that they were underinformed.

Tool III: A pediatric nurses' skills observation checklist on throat examination, throat swab cultures, skin testing for penicillin sensitivity, administration of penicillin injection and electrocardiogram (ECG). Skills were categories as “master,” “professional,” and “competent.”

Scoring system: Participants who displayed over 90% of the skills assessed were considered a "master," from 90% to 80% "professional," and less than 80% "competent."

II. Operational design:

Pilot study:

A pilot study was conducted on 5% of the pediatric nurses surveyed to test the clarity of the study tools and identify the time needed to fill out the questionnaire. The researcher analyzed the data after applying the survey study. The researcher modified the elements of the study tools as needed and the participants of the pilot study were included in the study sample.

Tool validity and reliability:

The tools were reviewed by a panel of two experts in pediatric nursing to test content validity and to review the tools for clarity, relevance, comprehensiveness, simplicity. Minor modifications were made following feedback. The testing reliability of the proposed tools was determined statistically using Cronbach's alpha, which returned a result of 0.78.

Fieldwork:

Fieldwork was carried out from the beginning of December, 2019, until the end of March, 2020, in the aforementioned hospitals. Approval for the fieldwork was given by the hospitals' directors. The researcher visited the hospitals for three days per week (Saturday, Monday, and Wednesday) from 8.00 am to 1.00 pm. It took an average of 50 minutes to complete the research tools.

Ethical considerations:

Verbal informed consent was taken from all participants. Participants were informed that they were free not to participate in the study or to withdraw from the study at any point. Confidentiality and the privacy of data was assured.

Program component:

Assessment phase: Introduction and preparation

The educational program was conducted in four phases to achieve the study objectives. During the assessment phase, the researcher interviewed pediatric nurses and explained the purpose of the study, and tools. The first and second tools were applied taking an average of 5-10 minutes, while the third tool took 15-25 minutes to complete. The researcher divided the study sample into 30 subgroups with each session including 5 pediatric nurses.

Planning phase:

Based on the needs identified in the assessment phase and the literature review, the researcher developed a booklet about nurses' background information, the causal pathway, preventive measures, and skills related to ARF and RHD. This was prepared in English and Arabic to suit the nurses' language abilities.

Implementation phase:

The educational program was implemented over four months. It was carried out in four sessions: one session for the ARF background information of pediatric nurses including the magnitude of the problem, diagnosis, referral, the burden of group A streptococcus, signs and symptoms, the history of RHD, the valve affected, RHD diagnosis, and the global burden of RHD; one session for the ARF/RHD graphical causal pathway and preventive measure for pediatric nurses, include primordial, primary, secondary and tertiary prevention; two practice sessions including throat examination, throat swab cultures, skin testing for penicillin sensitivity, administration of penicillin injection and ECG. The duration of each session ranged between 40 and 50 minutes.

The researcher began the program by explaining the purpose and operation of all sessions using suitable language and pamphlets, posters, videos, and other materials, as well as equipment for the training workshops, such as child models for injections, throat examinations and cultures, and an ECG device. The researcher began using a conventional pedagogical method, namely, expository classes with slides, and then the

experimental method, which involved an example-based learning strategy utilizing worked examples provided in interactive tablet-based modules. After the conclusion of the practical session, the participants were asked to demonstrate their skills.

These interventions or multifaceted combinations of interventions are used to promote ARF and RHD awareness and prevention. Different social communication routes were achieved between the researcher and pediatric nurses to ensure understanding, with answers provided to all questions and clarification of the information given.

Evaluation phase: Evaluate outcomes and improve practices:

The program was evaluated using post-testing, specifically, by using the same pre-test tools immediately after implementation of the program and following up after one month to assess the changes in pediatric nurses' background information, understanding of the causal pathway and preventive measures, and skills.

III. Administrative design:

Official letters were issued to the directors of the selected hospitals explaining the aim of the study and asking permission for data collection to be carried out on hospital premises and pediatric nurses to be included in the study.

IV. Statistical design:

The data collected was entered into Microsoft Excel. We analyzed the data using the software Epi Info version 7. We applied continuous variables as means ± standard deviation and discrete variables as frequencies and percentages with 95% confidence intervals. Pearson's correlation test for the association between the two quantitative variables was conducted. A paired sample t-test was used to measure the performance of a sample before and after completing the program and to analyze the differences. Probability (p-value): $P<0.05$ was considered statistically significant for the observed associations, $P<0.001$ was considered highly significant, and $P>0.05$ was considered insignificant.

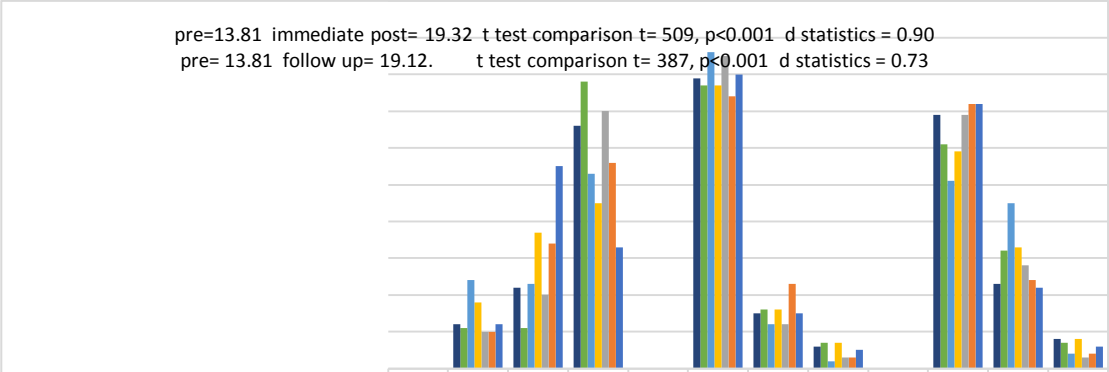
III. Results:

Table 1: Pediatric nurses' demographic data (N= 150)

Items	Categories	No	%
Age	20-30	33	22
	31-40	99	66
	41-50	18	12
	Mean and SD	31.23 ± 2.12	
Qualification	Diploma	52	34.6
	Bachelor	88	58.7
	Post graduate	10	6.7
Years of experience	1-10	115	76.7
	11-20	23	15.3
	21-30	12	8
Residence	Rural	70	46.7
	Urban	80	53.3
Marital status	Single	35	23.3
	Married	99	66
	Divorced	9	6
	widow	7	4.7

Table 1: It was found less than two thirds of pediatric nurses were aged 31-40 and were married. Additionally, over half held bachelor's degrees and lived in urban areas. More than three quarter of pediatric nurses had from 1-10 years' experience.

Figure 1: Percentage distribution of pediatric nurses regarding change in information background about ARF and RHD pre-intervention, post-intervention, and at the follow-up



	Pre	Good	Average	Poor	post	Good	Average	Poor	Follow up	Good	Average	Poor
Definition of ARF and RHD		%12	%55	%33		%80	%15	%5		%72	%22	%6
Magnitude of the problem		%10	%34	%56		%74	%23	%3		%72	%24	%4
Burden of group A streptococcal, and RHD		%10	%20	%70		%85	%12	%3		%69	%28	%3
Diagnosis of ARF and RHD		%18	%37	%45		%77	%16	%7		%59	%33	%8
Signs and symptoms ARF and RHD		%24	%23	%53		%86	%12	%2		%51	%45	%4
Management ARF and RHD		%11	%11	%78		%77	%16	%7		%61	%32	%7
Complication ARF and RHD		%12	%22	%66		%79	%15	%6		%69	%23	%8

Note: The d statistics represent the effectiveness of the program, describing the magnitude of difference between pre- and immediate post-intervention knowledge or between pre-intervention and follow-up knowledge.

Figure 2: The findings show strong knowledge of ARF and RHD signs and symptoms and the burden of group A streptococcus among pediatric nurses immediately after the program. One month after the intervention, knowledge about the magnitude of the problem and definitions of ARF and RHD was strong.

Table 2: Percentage distribution of pediatric nurses' knowledge about ARF and RHD preventive strategies pre-intervention, post-intervention, and at the follow-up

Variable	Pre			post			t-test P-value	Follow up			t-test P-value
	Good N (%)	Average N (%)	Poor N (%)	Good N (%)	Average N (%)	Poor N (%)		Good N (%)	Average N (%)	Poor N (%)	
-Primordial prevention											
-Housing, hygiene to prevent group A streptococcal transmission	14 (9.3)	22 (14.7)	114 (76)	133 (88.6)	12 (8)	5(3.3)	4.21 (<0.01)	125(83.3)	22(14.7)	3(2)	7.21 (<0.05)
-Improve quality of primary health care	8 (5.3)	34 (22.7)	108 (72)	108 (72)	33(22)	9(6)	3.61 (<0.05)	115(76.7)	33(22)	2(1.3)	5.04 (<0.05)
-Improve socio-economic status of the poorer strata	9 (6)	22 (14.7)	119 (79.3)	126 (84)	22(14.7)	2(1.3)	6.21 (<0.01)	125(83.3)	24(16)	1(0.6)	4.98 (<0.05)
-Ensure proper housing to reduce overcrowding	7 (4.7)	24 (16)	119 (79.3)	126(84)	24(16)	0	5.32 (<0.01)	114(76)	34(22.6)	2(1.3)	7.23 (<0.05)
-Address malnutrition	9 (6)	15 (10)	126 (84)	122(81.3)	22(14.7)	6(4)	7.21 (<0.01)	124(82.6)	23(15.3)	3(2)	8.12 (<0.05)
-Primary prevention											
-Awareness about management of sore throat	3 (2)	32 (21.3)	115 (76.7)	127(84.6)	19(12.6)	4(2.6)	5.32 (<0.01)	126(84)	21(14)	3(2)	7.12 (<0.05)
-Improve access to primary health-care	2 (1.3)	45 (30)	103 (68.7)	136(90.6)	11(7.3)	3(2)	5.43 (<0.01)	136(90.6)	12(8)	2(1.3)	8.23 (<0.05)
-Antibiotic for pharyngitis-single intramuscular injection of benzathine penicillin	5 (3.3)	23(15.3)	122(81.3)	133(88.6)	12(8)	5(3.3)	5.32 (<0.01)	131(87.3)	14(9.3)	5(3.3)	7.43 (<0.05)
-Training health providers- early diagnosis	4 (2.6)	25(16.6)	121(80.6)	131(78.3)	13(8.6)	6(4)	4.32 (<0.01)	128(85.3)	16(10.6)	6(4)	6.98 (<0.05)
-Treatment of GAS with antibiotics	6(4)	31(20.6)	113(75.3)	128(85.3)	15(10)	7(4.7)	5.32 (<0.01)	146(97.3)	18(12)	3(2)	9.97 (<0.05)
-Secondary prevention											
-Secondary prophylaxis with injection Benzathine penicillin for acute rheumatic fever	12(8)	37(24.7)	101(67.3)	132(88)	15(10)	3(2)	5.32 (<0.01)	113(75.3)	34(22.7)	3(2)	9.96 (<0.05)
-Tertiary care											
-Prevention of endocarditis	5(3.3)	27(18)	118(78.6)	121(80.6)	27(18)	2(1.3)	6.90 (<0.01)	117(78)	31(20.6)	2(1.3)	8.97 (<0.05)
-Brushing teeth twice daily	6 (4)	45(30)	99 (66)	131(78.3)	14(9.3)	5(3.3)	5.09 (<0.01)	109(72.6)	35(23.3)	6(4)	9.59 (<0.05)
-Dental review 6 months	9 (6)	23 (15.3)	118 (78.6)	126(84)	18(12)	6(4)	6.02 (<0.01)	114(76)	32(21.3)	4(2.6)	8.76 (<0.05)
-Endocarditis prophylaxis at time of dental procedures	7 (4.7)	26(17.3)	117(78)	123(82)	19(12.6)	8(5.3)	3.14 (<0.01)	110(73.3)	37 (24.7)	3(2)	8.60 (<0.05)
-Medication-heart failure valve surgery anti-coagulation	8(5.3)	19(12.6)	122 (81.3)	134(89.3)	12(8)	4(2.6)	6.32 (<0.01)	109(72.6)	39 (26)	2(1.3)	9.01 (<0.05)

Table 2: It was revealed that more than three quarters of the participants had good knowledge of primordial, primary, secondary, and tertiary prevention immediately post-intervention and at the one-month follow-up.

Table 3: Percentage distribution of pediatric nurses' skills in throat examination and swab cultures pre-intervention, post-intervention, and at the follow-up

Variable	Pre			post			t-test P-value	Follow up			t-test P-value
	Correct N (%)	Incomplete N (%)	Incorrect N (%)	Correct N (%)	Incomplete N (%)	Incorrect N (%)		Correct N (%)	Incomplete N (%)	Incorrect N (%)	
Wash hands thoroughly	12(8)	17(11.3)	121(80.7)	145(96.7)	3(2)	2(1.3)	5.43 (<0.01)	133(88.7)	9(6)	8(5.3)	7.21 (<0.05)
Wear gloves, surgical mask, gown and protective eye-wear	11(7.3)	22(14.7)	117(78)	144(96)	5(3.3)	1(0.6)	3.71 (<0.01)	121(80.7)	26(17.3)	3(2)	6.98 (<0.05)
Examination of sore throat in good light or use torch	19(12.7)	35(23.3)	96(64)	123(82)	23(15.3)	4(2.7)	4.87 (<0.01)	118(78.7)	25(16.7)	7(4.7)	5.73 (<0.05)
The child head backwards, open their mouth, and stick out their tongue	33(22)	61(40.7)	56(37.3)	147(98)	2(1.3)	1(0.7)	5.89 (<0.01)	137(91.3)	7(4.7)	6(4)	8.23 (<0.05)
Fix the head with left hand	8(5.3)	27(18)	115(76.7)	143(95.3)	4(2.7)	3(2)	5.23 (<0.01)	133(88.7)	21(14)	6(4)	7.10 (<0.05)
Hold the tongue in place through use a tongue depressor	11(7.3)	45(30)	56(37.3)	145(96.7)	4(2.7)	1(0.7)	5.90 (<0.01)	123(82)	23(15.3)	4(2.7)	8.09 (<0.05)
Look for enlargement of tonsils as redness or intense red purple color of post wall of throat	9(6)	17(11.3)	124(82.7)	133(88.7)	16(10.7)	1(0.7)	5.95 (<0.01)	111(74)	37(24.7)	2(1.3)	7.34 (<0.05)
Patch yellow exudate in posterior wall of throat and /or tonsil	5(3.3)	14(9.3)	131(87.3)	133(88.7)	13(8.7)	4(2.7)	6.21 (<0.01)	122(81.3)	22(14.7)	6(4)	8.60 (<0.05)
Open the package containing the flocked swab and aseptically remove swab from package	7(4.7)	19(12.7)	124(82.7)	147(98)	3(2)	3(2)	5.63 (<0.01)	139(92.7)	6(4)	5(3.3)	6.09 (<0.05)
Collect swab material from both tonsil and pharynx/Without touching the sides of the mouth, use the sterile flocked swab to swab the posterior nasopharynx and the tonsillar arches	9(6)	17(11.3)	130(86.7)	141(94)	9(6)	0	4.32 (<0.01)	142(94.7)	5(3.3)	3(2)	5.91 (<0.05)
Unwrapping of filter paper	15(10)	15(10)	120(80)	126(84)	18(12)	6(4)	4.95 (<0.01)	123(82)	20(13.3)	7(4.7)	4.67 (<0.05)
Use forceps for filter paper do not touch by hand	18(12)	9(6)	123(82)	143(95.3)	5(3.3)	2(1.3)	6.10 (<0.01)	132(88)	11(7.3)	7(4.7)	5.98 (<0.05)
Do not touch the strips of butter paper which faces the filter paper	11(7.3)	23(15.3)	116(77.3)	139(92.7)	8(5.3)	3(2)	5.80 (<0.01)	134(89.3)	8(5.3)	8(5.3)	5.09 (<0.05)
Roll the cotton swab on the filter paper, spread uniformly the material cancelled.	13(8.7)	43(28.7)	94(62.7)	142(94.7)	6(4)	2(1.3)	6.87 (<0.01)	138(92)	9(6)	3(2)	9.10 (<0.05)
Do not touch the filter paper by hand then fold it after dry.	12(8)	23(15.3)	115(76.7)	137(91.3)	9(6)	3(2)	5.73 (<0.01)	132(88)	13	5(3.3)	8.34 (<0.05)
Do not touch cotton portion of the slick	11(7.3)	12(8)	127(84.7)	146(97.3)	3(2)	1(0.7)	3.89 (<0.01)	142(94.7)	5(3.3)	3(2)	6.02 (<0.05)
Do not touch other parts of mouth, tongue or face by swab	14(9.3)	15(100)	121(80.7)	142(94.7)	3(2)	5(3.3)	4.97 (<0.01)	138(92)	5(3.3)	7(4.7)	5.73 (<0.05)
At scored breakpoint line break the swab handle	9(6)	17(11.3)	124(82.7)	137(91.3)	7(4.7)	6(4)	4.96 (<0.01)	134(89.3)	9(6)	7(4.7)	7.98 (<0.05)
Replace cap and tighten to secure	10(6.7)	11(7.3)	129(86)	142(94.7)	4(2.7)	4(2.7)	5.93 (<0.01)	139(92.7)	5(3.3)	6(4)	7.40 (<0.05)
transport system vial after Insert swab into sterile liquid amies	16(10.7)	19(12.7)	115(76.7)	145(96.7)	3(2)	2(1.3)	5.81 (<0.01)	142(94.7)	5(3.3)	3(2)	8.09 (<0.05)
Remove dispose gloves and mask aseptically	17(11.3)	22(14.7)	111(74)	145(96.7)	1(0.7)	4(2.7)	4.08 (<0.01)	142(94.7)	3(2)	5(3.3)	8.54 (<0.05)
Label liquid amies vial with appropriate information	21(14)	14(9.3)	115(76.7)	140(93.3)	7(4.7)	3(2)	3.87 (<0.01)	137(91.3)	8(5.3)	5(3.3)	7.34 (<0.05)
Deliver samples to laboratory for testing	23(15.3)	12(8)	115(76.7)	141(94)	4(2.7)	5(3.3)	5.86 (<0.01)	139(92.7)	5(3.3)	6(4)	8.09 (<0.05)

Table 3: An improvement in the skills of pediatric nurses related to examining the throat and taking a culture was observed after the tutorial. The highest percentage of known skills (98%) included positioning the child's head backwards, getting them to open their mouth and stick out their tongue.

Table 4: Distribution of pediatric nurses' skills regarding skin testing for penicillin sensitivity

Variable	Pre			post			t-test P-value	Follow up			t-test P-value
	Correct	Incomplete	Incorrect	Correct	Incomplete	Incorrect		Correct	Incomplete	Incorrect	
Tracking the hand hygiene policy	14(9.3)	17(11.3)	119(79.3)	138(92)	9(6)	3(2)	5.32 (<0.01)	135(90)	11(7.3)	4(2.7)	7.01 (<0.05)
Respect ten rights	19(12.7)	11(7.3)	120(80)	142(94.7)	6(4)	2(1.3)	4.98 (<0.01)	139(92.7)	8(5.3)	3(2)	8.32 (<0.05)
Take consent from parents	13(8.7)	12(8)	125(83.3)	139(92.7)	7(4.7)	4(2.7)	4.96 (<0.01)	135(90)	9(6)	6(4)	9.12 (<0.05)
Use distraction in the test	9(6)	13(8.7)	128(85.3)	140(93.3)	8(5.3)	2(1.3)	6.12 (<0.01)	137(91.3)	10(6.7)	3(2)	6.94 (<0.05)
choice an appropriate skin site free from eczema and lotions for the skin test forearm	20(13.3)	18(12)	112(74.7)	140(93.3)	5(3.3)	5(3.3)	5.98 (<0.01)	138(92)	6(4)	6(4)	6.02 (<0.05)
not clean selected site with antiseptics or alcohol	15(10)	16(10.7)	119(79.3)	141(94)	3(2)	6(4)	4.21 (<0.01)	136(89.3)	7(4.7)	7(4.7)	6.01 (<0.05)
Support the arm on a pillow and sit the child on a parent's lap	21(14)	22(14.7)	107(71.3)	144(96)	4(2.7)	2(1.3)	3.09 (<0.01)	134(89.3)	8(5.3)	8(5.3)	6.02 (<0.05)
Prepare the injection with 3 ml of distilled water as in 2:3	14(9.3)	25(16.7)	111(74)	138(92)	9(6)	3(2)	3.87 (<0.01)	134(89.3)	11(7.3)	5(3.3)	6.90 (<0.05)
Draw out 0.1ml injection solution diluting with 1 ml distilled water	18(12)	21(14)	111(74)	141(94)	8(5.3)	1(0.7)	3.06 (<0.01)	135(90)	12(8)	3(2)	7.03 (<0.05)
In the left fore-arm introduce one drop subcutaneously as to raise a weat	17(11.3)	34(22.7)	99(66)	141(94)	7(4.7)	4(2.7)	4.87 (<0.01)	131(87.3)	13(8.7)	6(4)	8.31 (<0.05)
Immediately discarded lancet into the sharps bin.	16(10.7)	28(18.7)	106(70.7)	143(95.3)	6(4)	1(0.7)	5.87 (<0.01)	133(88.7)	12(8)	5(3.3)	7.34 (<0.05)
determine the time and circle the injected area on the fore-arm	12(8)	29(19.3)	109(72.7)	142(94.7)	5(3.3)	3(2)	(<0.01)	134(89.3)	9(6)	7(4.7)	8.23 (<0.05)
Wait for 10-15 minutes	10(6.7)	26(17.3)	114(76)	139(92.7)	9(6)	2(1.3)	5.67 (<0.01)	132(88)	14(9.3)	4(2.7)	7.91 (<0.05)
The child is not sensitive to penicillin and be given the injection if there is no itching at the site of the test, sweating, feeling of apprehension	11(7.3)	33(22)	106(70.7)	139(92.7)	8(5.3)	3(2)	4.97 (<0.01)	133(88.7)	12(8)	5(3.3)	8.23 (<0.05)
Less itchy through calamine lotion on area.	9(6)	12(8)	129(86)	137(91.3)	9(6)	4(2.7)	3.56 (<0.01)	131(87.3)	11(7.3)	8(5.3)	6.09 (<0.05)
In case of doubt repeat on the other arm with the double strength test dose.	8(5.3)	13(8.7)	128(85.3)	140(93.3)	8(5.3)	2(1.3)	4.43 (<0.01)	133(88.7)	13(8.7)	4(2.7)	6.02 (<0.05)
Well, document test form as name, age and hospital number, any recent antihistamine medication and when last taken, the wheal size of each response in millimeters, skin prick solution or prick to prick method, and signature.	7(4.7)	16(10.7)	127(84.7)	138(92)	7(4.7)	5(3.3)	3.64 (<0.01)	127(84.7)	14(9.3)	9(6)	4.98 (<0.05)

Table 4: A statistically significant difference was found between the skills of pediatric nurses pre- and post-intervention. The highest percentage was identified in relation to supporting the arm on a pillow and sitting the child on a parent's lap (96%).

Table 5: Percentage distribution of pediatric nurses' skills regarding the administration of penicillin injections pre-intervention, post-intervention, and at the follow-up

Variable	Pre			post			t-test p-value	Follow up			t-test p-value
	Correct N (%)	Incomplete N (%)	Incorrect N (%)	Correct N (%)	Incomplete N (%)	Incorrect N (%)		Correct N (%)	Incomplete N (%)	Incorrect N (%)	
Informed consent.	40(26.7)	22(14.7)	88(58.7)	145(96.7)	2(1.3)	3(2)	5.12 (<0.01)	141(94)	4(2.7)	5(3.3)	6.09 (<0.05)
Follow infection control and aseptic non-touch technique guidelines.	14(9.3)	15(10)	121(80.7)	140(93.3)	6(4)	4(2.7)	6.81 (<0.01)	137(91.3)	7(4.7)	6(4)	7.93 (<0.05)
Weight the child to ensure the dose charted is appropriate.	13(8.7)	2214.7)	115(76.7)	139(92.7)	5(3.3)	6(4)	3.90 (<0.01)	135(90)	7(4.7)	8(5.3)	7.42 (<0.05)
Give 900 mg (1,200,000 units) benzathine benzylpenicillin for child who weigh 30 kg and above.	9(6)	11(7.3)	130(86.7)	140(93.3)	7(4.7)	3(2)	3.65 (<0.01)	138(92)	8(5.3)	4(2.7)	8.12 (<0.05)
prepare 450 mg (600,000 units) benzathine benzylpenicillin for Child who weigh less than 30 kg.	7(4.7)	9(6)	134(89.3)	139(92.7)	5(3.3)	6(4)	4.53 (<0.01)	135(90)	7(4.7)	8(5.3)	8.93 (<0.05)
Check the: children ten right and expiry date	17(11.3)	11(7.3)	122(81.3)	137(91.3)	8(5.3)	5(3.3)	4.21 (<0.01)	131(87.3)	11	8(5.3)	7.34 (<0.05)
Prepare the syringe.	8(5.3)	13(8.7)	129(86)	139(92.7)	4(2.7)	7(4.7)	4.65 (<0.01)	134(89.3)	7(4.7)	9(6)	8.12 (<0.05)
Remove the cap from prefilled Bicillin syringe and draw back a 0.25 mL space for the lignocaine	11(7.3)	19(12.7)	120(80)	143(95.3)	4(2.7)	3(3.3)	4.98 (<0.01)	139(92.7)	6(4)	5(3.3)	7.87 (<0.05)
Add 0.25 mL of 2% lignocaine from the 1 mL syringe, dosage is for children who weigh 30 kg and above.	8(5.3)	17(11.3)	125(83.3)	143(95.3)	4(2.7)	3(2)	4.86 (<0.01)	141(94)	5(3.3)	4(2.7)	9.01 (<0.05)
Prepare the 3 mL syringe by drawing back to 1.15 mL for children who weigh less than 30 kg	22(14.7)	33(22)	95(63.3)	139(92.7)	5(3.3)	6(4)	4.54 (<0.01)	136(90.7)	6(4)	8(5.3)	6.45 (<0.05)
decant 1.15 mL (450 mg/600,000 units) Bicillin into the 3 mL syringe.	16(10.7)	21(14)	113(75.3)	140(93.3)	3(2)	7(4.7)	3.54 (<0.01)	136(90.7)	5(3.3)	9(6)	7.45 (<0.05)
Draw back on the 3 mL syringe to 1.4 mL and add the 0.25 mL of 2% lignocaine.	18(12)	9(6)	127(84.7)	139(92.3)	5(3.3)	6(4)	3.65 (<0.01)	137(91.3)	6(4)	7(4.7)	8.67 (<0.05)
Attach with guard the Bicillin needle to expel air from the prepared syringe containing lignocaine and Bicillin.	11(7.3)	12(8)	127(84.7)	144(96)	4(2.7)	2(1.3)	4.56 (<0.01)	142(94.7)	5(3.3)	3(2)	7.90 (<0.05)
Warm the prepared syringe between hands.	13(8.7)	24(16)	113(75.3)	139(92.3)	7(4.7)	4(2.7)	3.85 (<0.01)	136(90.7)	9(6)	5(3.3)	8.04 (<0.05)
Based on best practice and child preferred assess the injection site.	11(7.3)	33(22)	106(70.7)	145(96.7)	2(1.3)	3(2)	6.01 (<0.01)	141(94)	4(2.7)	5(3.3)	5.90 (<0.05)
Before inserting the needle 10 seconds pressure on the injection site by thumb.	8(5.3)	6(4)	136(90.7)	144(96)	4(2.7)	2(1.3)	5.32 (<0.01)	139(92.7)	7(4.7)	4(2.7)	6.90 (<0.05)
Apply ethyl chloride cold spray if it is available.	3(2)	5(3.3)	142(94.7)	138(92)	5(3.3)	7(4.7)	5.96 (<0.01)	135(90)	6(4)	9(6)	8.01 (<0.05)
Re-locate the site and clean it with alcohol, allow to dry.	9(6)	12(8)	129(86)	139(92.3)	3(2)	8(5.3)	4.20 (<0.01)	132(88)	7(4.7)	11(7.3)	7.45 (<0.05)
Use age-appropriate distraction techniques	6(4)	8(5.3)	136(90.7)	141(94)	4(2.7)	5(3.3)	4.86 (<0.01)	133(88.7)	5(3.3)	12(8)	8.34 (<0.05)
Insert the needle at 90 degrees, give the first portion containing lignocaine and wait a few seconds, then give the remaining Bicillin L-A slowly with lignocaine (over approximately one to two minutes (leave Buzzy vibrating until needle is removed).	11(7.3)	10(6.7)	129(86)	140(93.3)	3(2)	7(4.7)	5.21 (<0.01)	130(86.7)	7(4.7)	13(8.7)	8.23 (<0.05)
Keep the child at the clinic for 20 minutes to note any anaphylaxis.	13(8.7)	14(9.3)	123(82)	134(89.3)	7(4.7)	9(6)	6.02 (<0.01)	125(83.3)	11(7.3)	14(9.3)	8.09 (<0.05)
Record the date, time, site of injection, drug, dose and adverse reactions.	16(10.7)	18(12)	116(77.3)	142(94.7)	5(3.3)	3(2)	5.86 (<0.01)	134(89.3)	9(6)	7(4.7)	8.95 (<0.05)
Inform the child and their family on expected side effects after the injection	14(9.3)	15(10)	121(80.7)	142(94.7)	5(3.3)	3(2)	4.65 (<0.01)	137(91.3)	8(5.3)	5(3.3)	9.01 (<0.05)

Table 5:A statistically significant difference between the skills of pediatric nurses pre- and post-intervention was found for all items related to the administration of penicillin injections. The highest percentage was identified in relation to using the thumb to apply pressure to the injection site for 10 seconds before inserting the needle (96%).

Table 6: Percentage distribution of pediatric nurses' skills regarding ECG pre-intervention, post-intervention, and at the follow-up

Variable	Pre			Post			t-test p-value	Follow up			t-test p-value
	Correct	Incomplete	Incorrect	Correct	Incomplete	Incorrect		Correct	Incomplete	Incorrect	
Wash hand, confirm child data, briefly explain and gain consent.	11(7.3)	34(22.7)	105(70)	147(98)	2(1.3)	1(0.7)	4.32 (<0.01)	143(95.3)	5(3.3)	2(1.3)	8.01 (<0.05)
First reassure that there is no danger or pain involved in performing the procedure and try to relax breathing steadily.	13(8.7)	43(28.7)	94(62.7)	143(95.3)	5(3.3)	2(1.3)	6.02 (<0.01)	141(94)	6(4)	3(2)	8.34 (<0.05)
Rest child arms by side and legs flat, making sure that legs aren't touching one another and remove any metal pieces	17(11.3)	23(15.3)	110(73.3)	141(94)	3(2)	6(4)	4.90 (<0.01)	140(93.3)	7(4.7)	3(2)	5.76 (<0.05)
Expose child chest as well as arms and legs.	19(12.7)	33(22)	98(65.3)	133(88.7)	8(5.3)	9(6)	7.02 (<0.01)	127(84.7)	12(8)	11(7.3)	5.98 (<0.05)
Clean the child skin with a sterile wipe prior to placing the electrodes in place	21(14)	36(24)	93(62)	147(98)	1(0.7)	2(1.3)	3.51 (<0.01)	144(96)	3(2)	3(2)	6.98 (<0.05)
Certain electrodes with a plastic head and an adhesive gel are placed	9(6)	20(13.3)	121(80.7)	144(96)	3(2)	3(2)	4.20 (<0.01)	141(94)	5(3.3)	4(2.7)	6.90 (<0.05)
Chest electrode and lead placement (V1 – V6) V1: the right sternal at 4th intercostal space.	7(4.7)	19(12.7)	105(70)	145(96.7)	3(2)	2(1.3)	5.01 (<0.01)	141(94)	4(2.7)	5(3.3)	7.94 (<0.05)
V2: the left sternal at 4th intercostal space.	8(5.3)	13(8.7)	129(86)	143(95.3)	3(2)	4(2.7)	4.87 (<0.01)	136	7(4.7)	7(4.7)	7.56 (<0.05)
V3: V2 and V4 midway.	6(4)	16(10.7)	128(85.3)	142(94.7)	6(4)	2(1.3)	3.86 (<0.01)	139(92.7)	8(5.3)	3(2)	8.45 (<0.05)
V4: in the midclavicular line at 5th intercostal space.	5(3.3)	15(10)	130(86.7)	139(92.7)	8(5.3)	3(2)	4.76 (<0.01)	135(90)	11(7.3)	4(2.7)	9.54 (<0.05)
V5: left anterior axillary.	8(5.3)	18(12)	124(82.7)	137(91.3)	10(6.7)	3(2)	5.01 (<0.01)	131(87.3)	13(8.7)	6(4)	9.56 (<0.05)
V6: left mid-axillary line.	11(7.3)	21(14)	118(78.7)	138(92)	11(7.3)	1(0.7)	5.01 (<0.01)	134(89.3)	13(8.7)	3(2)	8.23 (<0.05)
Limb electrode and lead placement •Red (RA): on the ulnar styloid of the right arm	12(8)	27(18)	111(74)	143(95.3)	5(3.3)	2(1.3)	4.86 (<0.01)	140(93.3)	7(4.7)	3(2)	8.21 (<0.05)
•Yellow (LA): on the left arm.	13(8.7)	26(17.3)	111(74)	148(98.7)	1(0.7)	1(0.7)	3.97 (<0.01)	142(94.7)	3(2)	5(3.3)	8.23 (<0.05)
•Green (LL): on the lateral malleolus of the left leg.	9(6)	25(16.7)	116(77.3)	145(96.7)	3(2)	2(1.3)	5.76 (<0.01)	141(94)	6(4)	3(2)	6.23 (<0.05)
•Black (RL): on the right leg.	10(6.7)	24(16)	116(77.3)	144(96)	4(2.7)	2(1.3)	6.02 (<0.01)	143(95.3)	4(2.7)	3(2)	7.43 (<0.05)
Avoid pressing hard on the center of the electrodes	6(4)	33(22)	111(74)	147(98)	2(1.3)	1(0.7)	6.03 (<0.01)	146(97.3)	4(2.7)	2(1.3)	8.45 (<0.05)
Ensure ECG paper has been loaded into the machine then turn the ECG machine.	8(5.3)	30(20)	112(74.7)	144(96)	3(2)	3(2)	4.76 (<0.01)	139(92.7)	7(4.7)	4(2.7)	8.90 (<0.05)
Recheck all the electrodes are connected in the appropriate locations.	9(6)	31(20.7)	110(73.3)	143(95.3)	5(3.3)	2(1.3)	4.87 (<0.01)	143(95.3)	5(3.3)	2(1.3)	8.98 (<0.05)
Ask the child to remain still and not talk during the recording that can interfere with the ECG trace.	11(7.3)	32(21.3)	107(71.3)	139(92.7)	10(6.7)	1(0.7)	5.92 (<0.01)	137(91.3)	11(7.3)	2(1.3)	9.67 (<0.05)
Record the ECG trace.	16(10.7)	33(22)	101(67.3)	137(91.3)	11(7.3)	2(1.3)	5.87 (<0.01)	134(89.3)	12(8)	4(2.7)	8.94 (<0.05)
Switch off the ECG machine.	15(10)	34(22.7)	101(67.3)	139(92.7)	8(5.3)	3(2)	4.86 (<0.01)	136(90.7)	9(6)	5(3.3)	7.56 (<0.05)
Remove the electrodes carefully after disconnect the ECG leads.	9(6)	21(14)	120(80)	132(88)	13(8.7)	5(3.3)	5.43 (<0.01)	127(84.7)	16(10.7)	7(4.7)	8.98 (<0.05)
Tell the child that the procedure is now complete.	7(4.7)	17(11.3)	126(84)	147(98)	2(1.3)	1(0.7)	4.97 (<0.01)	144(96)	3(2)	3(2)	9.78 (<0.05)
Label the ECG with the child's details:	8(5.3)	19(12.7)	123(82)	143(95.3)	4(2.7)	3(2)	3.98 (<0.01)	141(94)	5(3.3)	4(2.7)	7.89 (<0.05)
Wash hand and dispose of PPE appropriately.	11(7.3)	21(14)	118(78.7)	140(93.3)	8(5.3)	2(1.3)	4.76 (<0.01)	138(92)	9(6)	3(2)	6.89 (<0.05)
At the child's notes document the findings.	16(10.7)	22(14.7)	112(74.7)	142(94.7)	7(4.7)	1(0.7)	5.21 (<0.01)	134(89.3)	13(8.7)	3(2)	5.90 (<0.05)
Formulate plan based on the ECG findings.	13(8.7)	23(15.3)	11476)	142(94.7)	5(3.3)	3(2)	5.32 (<0.01)	141(94)	7(4.7)	2(1.3)	7.01 (<0.05)

Table 6: It was found that more than 90% of pediatric nurses' ECG skills were improved following the educational intervention.

Figure 2: Total distribution of pediatric nurses about their information background, preventive strategies and causative pathway, skills pre-intervention, post-intervention, and at the follow-up

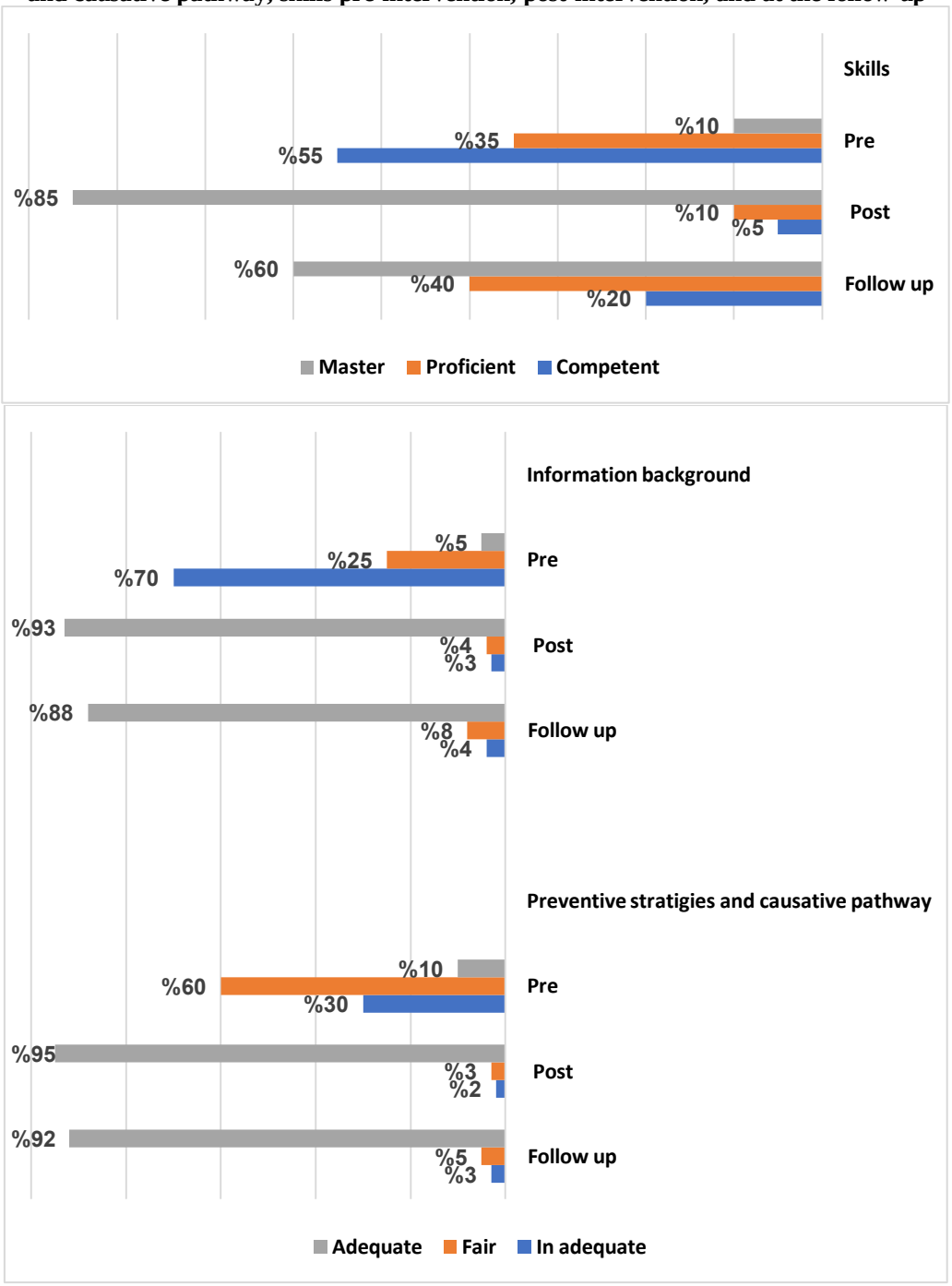


Figure 2: A significant improvement in the pediatric nurses' information background, understanding of relevant preventive strategies and causative pathway, and skills was found post-intervention (93%,95%, and 85%, respectively).

Table 7: Pearson's correlation between demographic factors and information background, understanding of the causative pathway and preventive measures, and skills of pediatric nursing in relation to ARF and RHD

Variable	Post			Follow up		
	Information Background	causative pathway and preventive measures	Skills	Information Background	causative pathway and preventive measures	Skills
Age	*r=0.1 p=<0.01*	*r=0.1 p=0.07*	*r=0.2* p=<0.01*	*r=-0.01 p=0.77*	*r=-0.01 p=0.05*	*r=0.04 p=0.22*
Qualification:	*r=0.1 P=0.02*	*r=0.2 P=0.05*	*r=-0.1 P=0.6*	*r=0.3 P=0.05*	*r=0.1* P=<0.01*	*r=0.2* P=<0.01*
Years of experience:	*r=0.1 p=0.05*	*r=0.1 p=0.05*	*r=0.2* p=<0.01*	*r=0.03 p=0.37*	*r=0.1 p=0.05*	*r=0.2* p=<0.01*
Residence:	*r=-0.2* p=0.05*	*r=-0.2* p=<0.01*	*r=0.1 p=0.05*	*r=0.2 p=<0.01*	*r=0.1 p=0.02*	*r=0.2 p=0.05*
Marital status:	*r=0.1* p=0.01*	*r=0.1* p=0.02*	*r=0.1* p=<0.01*	*r=-0.1 p=0.05*	*r=-0.1 p=0.06*	*r=0.2* p=<0.01*

NB: * Significant correlation noted

Table 7:A clear statistically significant correlation was found between the pediatric nurses'age, qualifications, years of experience, and residence and marital status and their information background, understanding of the causative pathway and preventive measure, and skills related to ARF and RHD.

IV. Discussion:

ARF is a leading cause of pediatric acquired heart disease and causes permanent disability that affects the productivity of sufferers and is expensive for nations to treat. ARF continues to be an important public health problem in Egypt. The educational program for pediatric nurses to update their knowledge about the disease increased their efficiency and awareness of how to prevent disease and achieve quality nursing care necessary for young patients.

The study shows that less than two thirds of the pediatric nurses surveyed were aged 31-40 and were married. Moreover, over half held a bachelor's degree, resided in urban locations, and had 1-10 years' experience. This finding reflects that of a study done by (**Funk, et al., 2017)** to monitor nurses' knowledge and quality of care related to ECG, who found that the nurse participants mean age was 38 years and the majority were married, 72% held a bachelor's degree or higher, and most lived in urban areas.

The present study reveals that the pediatric nurses had good knowledge of the signs and symptoms of ARF and RHD and the burden of group A streptococcus and RHD immediately following the program. At the one-month follow-up, the nurses had good knowledge of the magnitude of the problem and definitions of ARF and RHD. These results incongruent with a study of **(Techane, et al., 2021)** who examining the knowledge of RHD and related factors among cardiac center nurses, who found that 48.7% of the nurses had good knowledge of RHD. Additionally, our study recommends that regular training regarding RHD management and prevention should be incorporated into nursing and other health-related professional curriculums.This finding is similar to that of a study **(Regmi, and Sanjel., (2019)**about the effectiveness of awareness-raising interventions on nurses' knowledge of RHD, who found that awareness-raising interventions are effective in increasing knowledge about ARF and RHD. This is turn was shown to have a positive impact on primary ARF and RHD prevention activities.

Similar to our findings, a study **(Oliveira, et al., 2020)** who concerning health education about RHD reports a significant improvement in participants RHD-related knowledge and performance in the immediate post-test (pre- vs. post-: P<0.001). In the researcher's view, more effort to eradicate the disease need to be made, including cultivating a better understanding of the epidemiology and pathogenic mechanisms of the disease, development of a safe and effective group A streptococcus vaccine, better health services, early diagnosis, and adequate treatment of pharyngitis.

The current study finds that more than three quarters of participants had good knowledge of all items regarding primordial, primary, secondary and tertiary prevention immediately following the intervention and at the one-month follow-up. These results align with (**Katzenellenbogen., et al., 2017)** those of a study entitled "Rheumatic heart disease: infectious disease origin, chronic care approach, who found a significant reduction in the burden of RHD globally through strengthening healthcare institutions' links with well-performing and resourced services in conjunction with policies to adopt the chronic care model framework for the secondary and tertiary prevention of RHD in settings with imperfect resources.

Along the same lines, the study of **(Sanyahumbi., 2019)** who conducted in Malawi entitled "Education: The prevention of acute rheumatic fever and rheumatic heart disease" found that nurses' knowledge of preventive measures for RF and RHD, improved meaningfully between the pre- and post-test knowledge

scores, which rose from 43.8% to 78.5% (P< 0.01). The workshops received good feedback with an overall rating of 4.8 out of 5.

A statistically significant difference between the skills of pediatric nurses pre- and post-intervention for all items concerning the administration of penicillin injections was observed with the highest percentage identified in relation to using the thumb to apply pressure to the injection site for 10 seconds before inserting the needle (96%).This result corresponds with **(Derya, et al., 2015)** that of a study on the application of manual pressure before benzathine penicillin injections for rheumatic fever prophylaxis to reduce pain in children. This study found that manual pressure to the injection site is a simple way of reducing pain and applying this method in similar procedures may promote adherence to the prophylaxis regime, particularly in children.

Regarding pediatric nurses' skills in relation to skin testing for penicillin sensitivity**,** there was a statistically significant difference between the performance of these skills pre- and post-intervention, the highest percentage was observed for the skills of supporting the arm on a pillow and sitting the child on a parent's lap. These results agree with those of research **(Machila, et al., 2017)** who examining a training program for nurses in Zambia designed to increase the appropriate usage of benzathine penicillin for the management of streptococcal pharyngitis and RHD, who showed an improvement in the participants' injection performance skills after completing related training.

The current study reports that more than 90% of the pediatric nurses surveyed had improved all their ECG skills post-intervention. This finding matches that of a study done by **(Funk, et al., 2017)** who monitoring nurses' knowledge and quality of care related to ECG, who found that monitoring ECG education can increase nurses' knowledge, quality of care, and patient outcomes. These results are reinforced by research **(Colquhoun, et al., 2013)** who conducted in Fiji concerning the novel method of nurse-led RHD echocardiography. This study found that nurses can follow an algorithm to undertake RHD echocardiography in a developing country to facilitate clinical referral with reasonable accuracy. The researcher argues that better planning of medical and nursing convoys, which are required to target high-risk children infected with group A streptococcal infections and take measures to address the known determinants of RF and RHD, including poor housing, overcrowding, and delayed access to primary preventions, is needed to realize behavioral changes and reduce the burden of RHD.

The researcher opinion that according to a review of the literature, RF and RHD have an impact on most aspects of children's lifestyles, including dietary habits, psychological state, and school activities. It is thus necessary to raise awareness of RF and RHD in terms of prevention at all levels and information about these diseases and their impact on children's quality of life. Training programs for pediatric nurses raise their awareness and enhance their role in the prevention, care, and rehabilitation of children. Also, with regard to the care of children with RF and RHD, pediatric nurses are responsible for taking charge of this care for children and their family.

V. Conclusion:

- The educational program for pediatric nurses was effective in raising their knowledge, skills, and ability to prevent and control ARF and RHD among children.
- The program was based largely on secondary prevention (case finding, registration, secondary prophylaxis) and resulted in improvements in the quality of care for children with ARF and RHD and impressive reductions in the prevalence of RHD.
- There were statistically significant correlations between pediatric nurses' age, qualifications, years of experience, residence and marital status and their information background, understanding of the causal pathway and preventive measure, and skills related to ARF and RHD.

VI. Recommendation:

- The establishment of a health education program about ARF prevention and a plan to implement it in different health centers in Egypt.
- Health education messages about RF in the mass media especially radio and television. These messages can be delivered to a large health sector.

Further studies:

- The need for the development of a long-acting penicillin that might improve adherence to secondary prophylaxis regimens.
- It is necessary to establish a system to educate, monitor, and evaluate the self-control practices of children with ARF and RHD.
- Designing and carrying out education programs for children with ARF and their families about compliance with treatment to avoid complications associated with the disease and improve their lifestyle.

- Educating schools nurses through training programs to ensure they have the requisite knowledge and skills to provide better care for child ARF sufferers.

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