

Assessment of Nurses' Perception Toward Antibiotic-Induced Anaphylaxis among Pediatric patients

Shaimaa Mohamed Mahmoud Rady⁽¹⁾, Hyam Refaat Tantawi⁽²⁾, Nehal Abdullatif Allam⁽³⁾

- (1) B.Sc. Nursing, (2017), Demonstrator of the pediatric nursing department, Al-Azhar University (2021).
- (2) Professor of Pediatric, Vice Dean for Community Service and Environmental Development, Faculty of Nursing, Ain Shams University.
- (3) Assistant Professor of Pediatric Nursing, Faculty of Nursing, Ain Shams University.

Abstract

Background: Pediatric nursing staff play a crucial role in administering medication, especially antibiotics, fully understanding the seriousness of its side effects, particularly allergic reactions, recognizing and responding to anaphylaxis, and advocating its safe use in pediatric care. **Aim of the study:** This study aimed to assess nurses' perception toward antibiotic-induced anaphylaxis among pediatric patients. **Research Design:** A descriptive design was used in this study. **Setting:** This study was conducted at the pediatric inpatient departments & outpatient clinic of Al-Sayed Galal Hospital affiliated with Al-Azhar University. **Subjects:** A convenience sample was composed of (52) pediatric nurses administering medication in the previously mentioned setting. **Tools of data collection:** (1) An interview questionnaire sheet to assess knowledge, & (2) Observational checklists to assess the practices of the pediatric nurses toward antibiotic-induced anaphylaxis among pediatric patients. **Results:** More than two-fifths of the studied nurses ranged from 20 to less than 30 years old, with a mean age of 31.9 ± 4.7 & more than half graduated from nursing school whilst the majority had poor knowledge, & an unsatisfactory level of practices toward antibiotic-induced anaphylaxis among pediatric patients. **Conclusion:** More than half had poor level of knowledge, approximately two-thirds had an unsatisfactory level of practices while there was a highly significant positive correlation between the studied nurses' total knowledge, & practices toward antibiotic-induced anaphylaxis among pediatric patients. **Recommendations:** Periodic assessment of pediatric nurses' perception toward antibiotics administration. Developing educational programs regarding allergy tests & conducting training courses regarding pediatric anaphylaxis.

Keywords: Nurses' Perception, Antibiotic-induced anaphylaxis, Pediatric patients.

Introduction

Considering the criteria acknowledged by the World Allergy Organization (WAO) and European Academy of Allergy and Clinical

Immunology (EAACI) anaphylaxis is defined as a rapid onset serious life-threatening systemic hypersensitivity response. In spite of the fact that possibly life-threatening, this hazard can be decreased with precise and incite

diagnosis and treatment. (*Tuttle & Wickner, 2020 & Muraro et al., 2022*).

An anaphylactic reaction produces symptoms ranging from mild to severe and differentiates according to several circumstances such as age, medical health condition, hospitalization, treatment, and type of antibiotics prescribed. It includes skin reactions such as hives, itching, and flushed or pale skin, shortness of breath as constriction of the airways and a swollen tongue or throat could cause wheezing and troubled breathing, hypotension, tachycardia, and dizziness (*Belleza, 2021 & Karunarathna et al., 2024*).

Drug hypersensitivity is one of the most common causes of anaphylaxis and more serious in children and hospitalized patients. Drug-induced anaphylaxis (DIA) is a potentially life-threatening condition that occurs after drug ingestion by any route, including non-therapeutic exposure through accidental contact. It is associated with more severe consequences than other anaphylactic triggers, and drugs account for most anaphylactic deaths. The incidence of both anaphylaxis and DIA seems to be increasing worldwide (*Regateiro et al., 2020*).

The most common causes of DIA are nonsteroidal anti-inflammatory drugs, analgesics, and beta-lactam antibiotics. Other antibiotics such as quinolones, chemotherapy drugs, biological agents such as cetuximab, rituximab, infliximab, and omalizumab are also becoming important triggers. Enzyme

replacement therapy, disinfectants such as chlorhexidine, additives in drugs and antibodies such as polyethylene glycol, exposed to latex, radiocontrast agents, perioperative rhabdomyolysis (rocuronium), thiopental, propofol (opiates), protamine (plasma expanders), skin prick test, intradermal test, immunotherapy, and idiopathic anaphylaxis may moreover trigger anaphylaxis (*Yagmur et al., 2023*).

Diagnosis of DIA involves skin testing, possibly in vitro testing, and very often drug induction is required to seek alternatives or, in some cases, to confirm the diagnosis. Often, the diagnosis must be performed in the context of confounding agents. Factors that contribute to severity include pre-existing medical conditions (such as cardiovascular disease) and the use of other medications such as beta-blockers. If a risky drug must be administered, the pediatric patient should be desensitized as concisely as possible (*Khan et al., 2022*).

Treatment of Antibiotic-induced anaphylaxis started by removing the triggers, airway, respiration, circulation, mental status, and skin should be assessed. Although intramuscular adrenaline is the first drug of choice to be administered, its use is still not at the desired level. IM Adrenaline is preferred at a dose of 0.01 mg/kg with a maximum dose of 0.3 mg in young children and 0.5 mg in adolescents. Pediatric patients who develop respiratory distress should be given oxygen at a rate of 6-8 L/min with a non-rebreather facemask, if bronchoconstriction occurs, a short-acting beta agonist (salbutamol/albuterol) should be inhaled & those with hypotension 10 mL/kg saline should be

administered via an intravenous line using broad cannula. Antihistamines and corticosteroids are the second used drugs as having a limited role in treating skin manifestations, may be harmful and their routine use is controversial (*Yilmaz et al., 2024*).

Nurses, as frontline health workers, have a significant role in the identification, prevention of antibiotic-induced anaphylaxis and practice the appropriate intervention regarding the diagnosis and management of drug allergies and anaphylaxis in the community (*ACN, 2019*). Proper antibiotic use in hospitals requires awareness of pediatric patients' needs and effective communication with physicians. Educating the public on the role of nurses is fundamental. This clarification will also help to dissociate the nurses from the stereotypes associated with the nursing profession (*Ahouah et al., 2019 & Aly-Eldin, 2024*).

Significance of thy Study

Epidemiologic data for DIA varies due to different diagnostic criteria, study designs, genetic and geographical differences, and children's inability to describe symptoms. Blood pressure and tryptase measurement are also challenging. It is important to note that recent publications show a global incidence of anaphylaxis between 50 and 112 episodes per 100,000 person-years while the estimated lifetime prevalence is 0.3–5.1%, According to a recent systematic review, in children, the incidence of anaphylaxis ranged from 1 to 761 per 100,000

person-years (*Bianchi, et al., 2024*).

The mortality rate reached 6.5%, and approximately 1 in 3,000 hospitalized patients suffer from drug-induced anaphylaxis (*Wang et al., 2019*). Anaphylaxis in Egyptian children was relatively high and the frequency rate among children and adolescents was 0.43% (80/18816) over 6 months (*Ezzat et al., 2021*). Anaphylaxis is a serious life-threatening hypersensitivity reaction with rapid onset, may cause death, and needs prompt and competent nursing qualifications to identify and intervene appropriately upon anaphylaxis occurrence (*Dhopeshwarkar et al., 2019*).

As known, nurses are the closest persons of the medical staff who provide care and support to pediatric patients, especially in emergencies. Nurses should screen all pediatric patients for allergies and previous reactions to antigens, assess their knowledge, their understanding of past reactions, the steps taken by them if they are old enough to understand and their family to prevent further exposure to the antigen. So, it is important to conduct this study to assess nurses' knowledge, and practices toward antibiotic-induced anaphylaxis among pediatric patients.

Aim of the Study

This study aimed to assess nurses' perception toward antibiotic-induced anaphylaxis among pediatric patients through:

- 1- Assessing nurses' knowledge of antibiotic-induced anaphylaxis among pediatric patients.
- 2- Assessing nurses' practices toward

antibiotic-induced anaphylaxis among pediatric patients.

Research questions:

- 1- What is the nurses' level of knowledge toward antibiotic-induced anaphylaxis among pediatric patients?
- 2- What are the nurses' practices toward antibiotic-induced anaphylaxis among pediatric patients?
- 3- Is there a relation between nurses' knowledge and practices toward antibiotic-induced anaphylaxis among pediatric patients?

Operational definition

Nurses' perception: Practices, knowledge, & mannerisms that are primarily focused on building and maintaining a relationship of trust with patients, giving patients their full attention, and protecting patients in hospitals (*Fikre et al., 2022*).

Subjects and Methods

The subjects and methods of the current study were discussed under the following four designs:

- I- Technical design.
- II- Operational design.
- III- Administrative design.
- IV- Statistical design.

I - Technical design

The Technical design included research design, study setting, subjects, sample size and tools of data collection used in the study.

Research design

A descriptive design was used to conduct this study.

Study setting

The study was conducted at the pediatric department of Al-Sayed Galal Hospital, affiliated with Al-Azhar University, Bab-Alsherya, Cairo Governorate, Egypt. The pediatric department at Al-Sayed Galal Hospital specializes in pediatric medical, surgical, NICU, PICU, and outpatient conditions, located on the 5th, 6th, and 7th floors of the 2nd building and the 7th floor of the emergency building, in addition to the outpatient pediatric clinic.

Subjects

A convenience sample of all available pediatric nurses administering medication in the previously mentioned setting was recruited.

Sample size

The approximate number of approved pediatric nurses was 52.

Tools of data collection

Data were collected by using the following tools:

Tool I.: Interview questionnaire sheet:

It was designed by the researcher after reviewing the related literature and reviewed by the supervisors. It was written in a simple Arabic language for gathering data concerning the following parts:

Part 1: Personal characteristics of nurses administering medication in pediatric departments as prescribed. Including (age, marital status, level of

education, job title, total years of experience, working department, attendance of training courses on antibiotic-induced anaphylaxis in pediatrics, & how to perform allergy testing for pediatrics & applied protocol for antibiotics administration in the department).

Part 2: Pediatric nurses' knowledge of antibiotic-induced anaphylaxis among pediatric patients. It was adapted from {the British Society for Allergy and Clinical Immunology (*BSACI*), 2014, *Rábano-Blanco et al.*, 2019 and *Patnaik et al.*, 2020}. 1st part focused on pediatric nurses' knowledge toward antibiotics & consisted of 14 multiple choice questions. 2nd part focused on pediatric nurses' knowledge toward antibiotic-induced anaphylaxis & consisted of 20 multiple choice questions. 3rd part focused on pediatric nurses' knowledge toward skin prick test & consisted of 14 multiple choice questions.

Scoring system. The nurses' knowledge was checked with a model key answer and, accordingly, the nurses' knowledge was categorized into either "correct answer was scored with a single point" or "incorrect answer was scored with zero points". These scores were summed up and converted into a percentage score. It was classified into 3 categories: Good knowledge with score of >75%, Average knowledge with score of 60-75%, and Poor knowledge with score of <60%.

Tool II. Observational checklists of

nurses' practices toward antibiotic-induced anaphylaxis among pediatric patients, which was divided into:

A. Skin Prick Testing (SPT). It was adapted from (*BSACI*, 2014) & consisted of 17 evaluative items to assess nurses' practices to apply SPT.

B. Intradermal antibiotic allergy test (IDT). It was adapted from (*Cydulka*, 2014) & consisted of 21 evaluative items to assess the pediatric nurses' practices toward allergy test prior to antibiotics administration as an intradermal test (IDT) must be performed, following a negative SPT.

C. Nurses' self-reported practices toward management of anaphylaxis among pediatric patients. It was adapted from {(*BSACI*), 2014, the American Academy of Allergy, Asthma, and Immunology (*WHO*, *AAAAI*), 2017, *Patnaik et al.*, 2020 and the Australasian Society of Clinical Immunology & Allergy (*ASCAI*), 2023}. It consisted of 24 evaluative items appraised self-reported nurses' practices regarding the management of anaphylaxis with items on assessment & immediate actions, supportive treatment, & evaluative actions for repeated episodes.

Scoring system: One grade was given to the step which was done correctly and zero was given to the step which was done incorrectly or not done so the incorrectly done step was considered not done. All pediatric nurses' practices were summed up and converted into a percentage. The total score was classified as follows:

-80% & more were considered

satisfactory level of practices.

-Less than 80 were considered unsatisfactory level of practices.

II. Operational Design:

The operational design for this study consisted of three phases: preparatory phase, pilot study and fieldwork.

Preparatory phase

A review of current & past, local & international related literature on various aspects related to antibiotic-induced anaphylaxis using textbooks, articles and periodical magazines was done to get acquainted with the nurses, the study setting and to develop the study tools. The tools were prepared under supervisors' guidance and experts' opinions were considered.

Face and Content Validity

To achieve the criteria of trustworthiness of the tools of data collection in the study, the tools were tested and evaluated for their face and content validity, by a jury group consisting of three experts, from the pediatric nursing department at the faculty of nursing, Ain Shams University to ascertain relevance, clarity, comprehensiveness, accuracy and completeness of the tool.

Tool Reliability

Reliability was assessed using the Cronbach's Alpha test, which indicated that the knowledge tool exhibited good reliability with a score of 0.840, the practice tool demonstrated excellent reliability with a score of 0.912, and the

attitude tool showed good reliability with a score of 0.829.

Pilot Study

A pilot study was conducted in the second half of May 2023, before data collection. The pilot study included 10% (6) of the nurses working in the previously mentioned setting. The purpose of the pilot study was to evaluate the applicability, clarity, relevance, and feasibility of the study tool and sequence of questions to maintain consistency. There are no modifications made. The nurses in the pilot study were excluded from the study.

Fieldwork

Data were collected over a 6-month period from the beginning of June 2023 to the end of November 2023. The fieldwork had been performed in the following sequence: The researcher visited the selected hospital from 9.00 a.m. to 1.00 p.m. for 2 days per week (Monday and Tuesday) during the morning shift to collect and implement the study. The researcher introduced herself to the studied nurses, explained the study's aim and the tools' components taking into consideration using simple and clear Arabic language. Data was collected through individualized interviews with each nurse. Questionnaire sheets were completed by the nurses and the average time needed was around (15-20 minutes). The researcher observed the nurses' practices regarding sensitivity reaction tests while administering antibiotics to the pediatric patients & the self-reported practices toward

antibiotic-induced anaphylaxis occurrence & management within around (40 minutes), respectively.

Ethical consideration

Research approval was obtained from the Faculty of Nursing Ain Shams University Ethical Committee before starting the study. The researcher explained the aim and objectives of the study to the nurses included before starting. Verbal approval was obtained from the nurses before inclusion in the study. The researcher guaranteed that all the gathered data was handled confidentially and used for research purposes only. The researcher ensured maintaining the anonymity of the subjects' data included in the study. The nurses were allowed to withdraw from the study at any time without any penalty.

III- Administrative design

An official permission to conduct the study was obtained from the dean of the faculty of nursing at Ain Shams University to the medical director of the previously mentioned setting requesting their approval for conducting this study. The researcher met the director to explain the purpose and methods of data collection.

IV- Statistical design

Data collected from the studied sample was revised, coded, tabulated, and entered using a personal computer (PC). Computerized data entry and statistical analysis were

fulfilled using the Statistical Package for Social Sciences (SPSS) version 22. Data were presented using descriptive statistics in the form of frequencies, percentages, and Mean SD. A correlation coefficient "Pearson correlation" is a numerical measure of some type of correlation, meaning a statistical relationship between two variables. Chi-square (χ^2) is a statistical test used to determine the relationship between categorical variables. Significance of the results: Highly

significant at p-value < 0.01.
Statistically significant was considered at p-value < 0.05.
Insignificant at p-value $\geq$ 0.05.

Results

In table (1), more than two fifths of the studied nurses (44.3%) range in age from 20 to less than 30 years old with mean 31.9 ± 4.7 years. In addition, three quarters of them (75.0%) are married. Besides, most of them their (84.6%) job title is staff nurse. As regards their years of experience, more than one third of them (38.5%) have from 1 to less than 3 years with the mean 4.98 ± 1.76 years. Additionally, a minority of them (5.8%) attended training courses about antibiotic-induced anaphylaxis in pediatrics, while one quarter of them (25.0%) attended training courses on how to perform allergy testing for pediatrics.

Figure 1: represents that more than half of the studied nurses (57.7%) have school nursing education, but only more than one tenth of them (11.5%) have bachelor education.

Figure 2: shows that nearly one third of the studied nurses (32.60%) are working at NICU and more than one quarter of them (28.80%) are working at medical department, but only less than one tenth of them (7.70%) are working at outpatients.

Figure 3: portrays that most of the studied nurses (81%) don't apply the protocol for administering antibiotics in the department, while only less than one fifth of them (19%) follow the protocol.

Figure 4: shows that more than half of the studied nurses (51.9%) have poor total knowledge toward antibiotic-induced anaphylaxis among pediatric patients. Also, more than one quarter of them (26.9%) have average total knowledge, while more than one fifth of them (21.2%) have good total knowledge.

Figure 5: reflects that nearly two-thirds of the studied nurses (63.5%) have unsatisfactory total practices toward antibiotic-induced anaphylaxis among pediatric patients, but more than one third of them (36.5%) have satisfactory total practices.

Table (2) indicates that there is a highly statistically significant relation between the studied nurses' level of knowledge about antibiotic-induced anaphylaxis among pediatric patients and their level of education, job title and

attending training courses on how to perform allergy testing for pediatrics at ($p < 0.01$). In addition, there is a statistically significant relation with their years of experience and attending training courses on antibiotic anaphylaxis in pediatrics at ($p < 0.05$), while there is no statistically significant relation with their age at ($p > 0.05$).

Table (3) reflects that there is a highly statistically significant relation between the studied nurses' level of practices toward antibiotic-induced anaphylaxis among pediatric patients and their level of education and job title at ($p < 0.01$). Furthermore, there is a statistically significant relation with their years of experience, attending training courses on antibiotic anaphylaxis in pediatrics and attending training courses on how to perform allergy testing for pediatrics at ($p < 0.05$), but there is no statistically significant relation with their age at ($p > 0.05$).

Table (4) highlights that there is a highly significant positive correlation between the studied nurses' total knowledge, & practices toward antibiotic-induced anaphylaxis among pediatric patients at ($p < 0.01$).

Part I. Demographic characteristics of the studied nurses.

Table (1): Distribution of the studied nurses according to their demographic characteristics (n=52).

Personal characteristics	N	%
Age		
20 - <30	23	44.3
30 - <40	19	36.5
≥40	10	19.2
Mean ±SD	x S.D	31.9±4.7
Marital status		
Single	9	17.3
Married	39	75.0
Divorced	3	5.8
Widow	1	1.9
Job title		
Staff nurse	44	84.6
Nursing specialist	8	15.4
Years of experience		
1 -<3	20	38.5
3 -<5	17	32.6
5 -<7	9	17.3
≥7	6	11.6
Mean ±SD	x S.D	4.98±1.76
Attendance of previous training courses on antibiotic-induced anaphylaxis in pediatrics		
Yes	3	5.8
No	49	94.2
Attendance of previous training courses on how to perform allergy testing for pediatrics		
Yes	13	25.0
No	39	75.0

Figure (1): Distribution of the studied nurses according to their level of education (n=52).

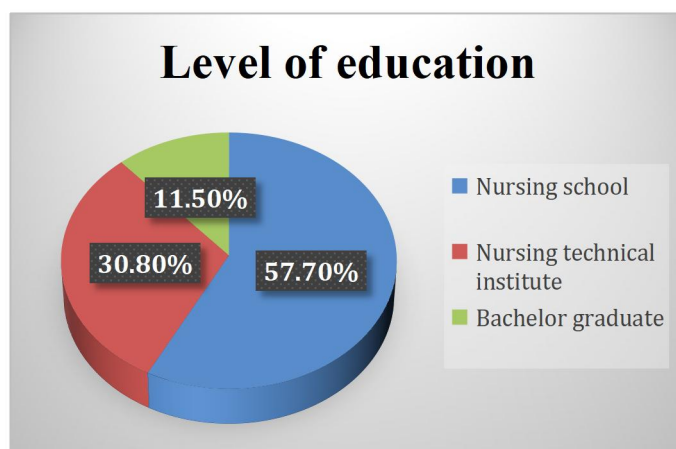


Figure (2): Distribution of the studied nurses according to their working department (n=52).

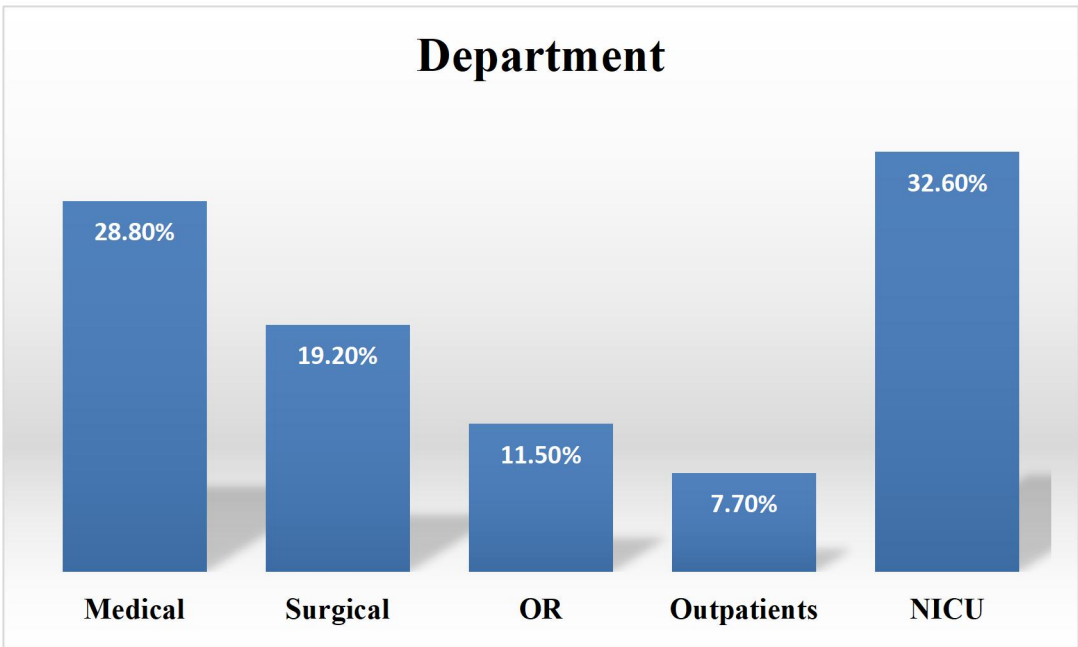
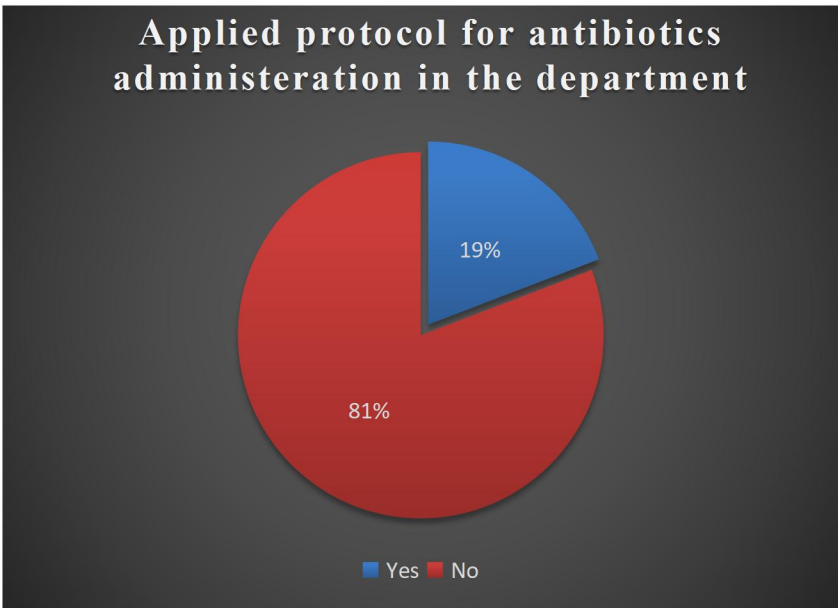
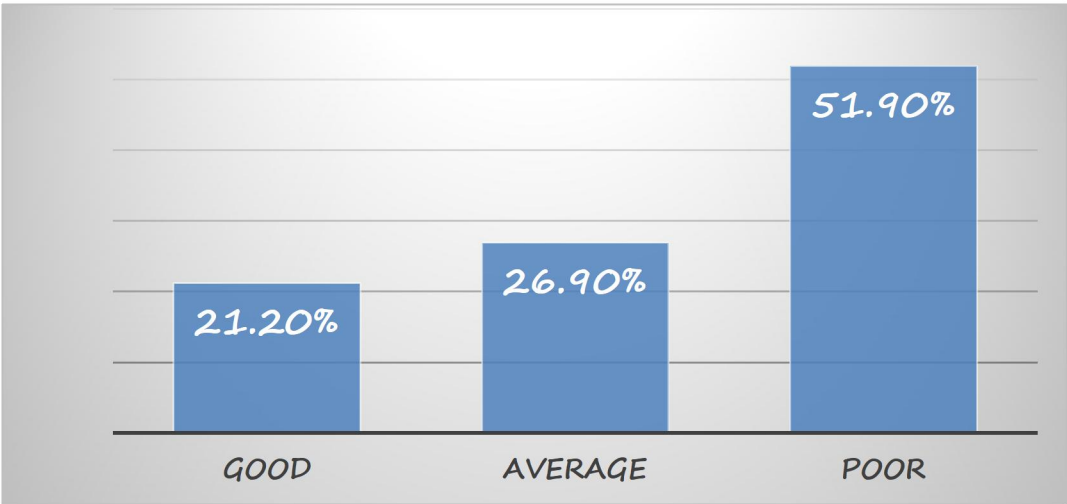


Figure (3): Distribution of the studied nurses according to the applied protocol for antibiotics administration in the department (n=52).



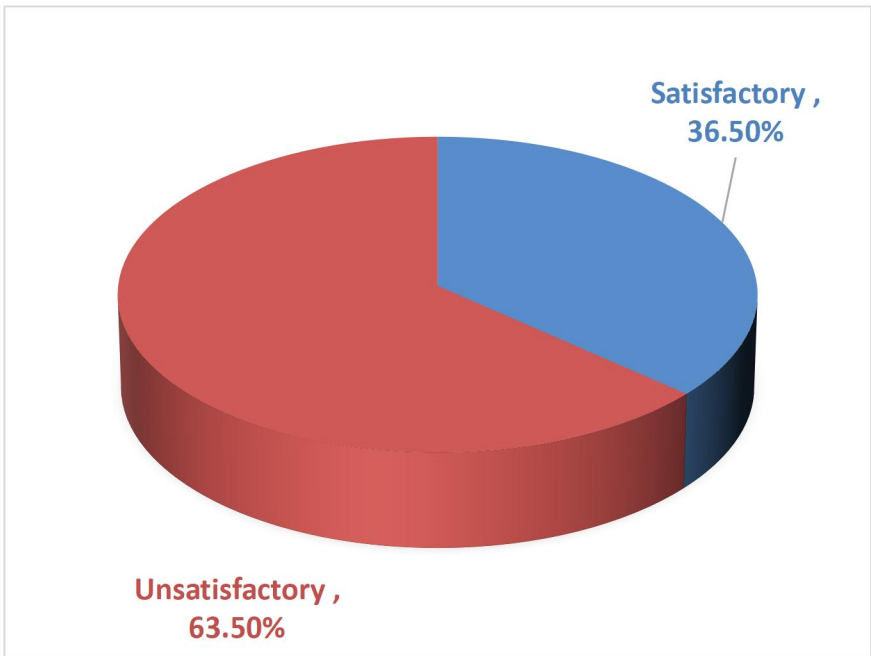
Part II. Pediatric nurses' knowledge toward antibiotic-induced anaphylaxis.

Figure (4): Distribution of the studied nurses according to their total knowledge toward antibiotic-induced anaphylaxis among pediatric patients (n=52).



Part III. Nurses' self-reported practices toward antibiotic-induced anaphylaxis among pediatric patients.

Figure (5): Distribution of the studied nurses according to their total practices toward antibiotic-induced anaphylaxis among pediatric patients (n=52).



Part V. Relation and correlation between the studied variables

Table (2): Relationship between socio-demographic characteristics of studied nurses and their total knowledge toward antibiotic-induced anaphylaxis among pediatric patients (n=52).

Items		Total knowledge						X ²	P- Value
		Good N=11(21%)		Average N=14(27%)		Poor N=27(52%)			
		N	%	N	%	N	%		
Age\years	20 -<30	7	63.6	3	21.4	13	48.1	1.290	.067
	30 - <40	2	18.2	3	21.4	14	51.9		
	≥40	2	18.2	8	57.2	0	0		
Level of education	Nursing school	2	18.2	4	28.6	24	88.9	8.253	.000**
	Nursing technical institute	4	36.4	9	64.3	3	11.1		
	Bachelor graduate	5	45.4	1	7.1	0	0		
Job title	Staff nurse	5	45.5	1 3	92.9	26	96.3	6.519	.001**
	Nursing specialist	6	54.5	1	7.1	1	3.7		
Years of experience	1-<3	10	90.9	7	50.0	3	11.1	4.017	.014*
	3-<5	1	9.1	4	28.6	12	44.5		
	5-<7	0	0	2	14.3	7	25.9		
	≥7	0	0	1	7.1	5	18.5		
Training courses on antibiotic anaphylaxis in pediatrics	Yes	2	18.2	1	7.1	0	0	3.562	.021*
	No	9	81.8	1 3	92.9	27	100		
Training courses on how to perform allergy testing for pediatrics	Yes	10	90.9	2	14.3	1	3.7	8.842	.000**
	No	1	9.1	1 2	85.7	26	96.3		

*Significant at p <0.05. **Highly significant at p <0.01. Not significant at p>0.05.

Table (3): Relationship between socio-demographic characteristics of studied nurses and their total practices toward antibiotic-induced anaphylaxis among pediatric patients (n=52).

Items		Total practices				X ²	P- Value
		Satisfactory N=19(36.5%)		Unsatisfactory N=33(63.5%)			
		N	%	N	%		
Age\years	20 -<30	11	57.9	12	36.4	1.462	.063
	30 - <40	5	26.3	14	42.4		
	≥40	3	15.8	7	21.2		
Level of education	Nursing school	5	26.3	25	75.8	6.278	.002**
	Nursing technical institute	9	47.4	7	21.2		
	Bachelor graduate	5	26.3	1	3		
Job title	Staff nurse	12	63.2	32	97	7.621	.009**
	Nursing specialist	7	36.8	1	3		
Years of experience	1-<3	4	21.1	16	48.5	3.856	.018*
	3-<5	2	10.5	15	45.5		
	5-<7	7	36.8	2	6		
	≥7	6	31.6	0	0		
Training courses on antibiotic anaphylaxis in pediatrics	Yes	3	15.8	0	0	4.522	.015*
	No	16	84.2	33	100		
Training courses on how to perform allergy testing for pediatrics	Yes	10	52.6	3	9.1	3.983	.012*
	No	9	47.4	30	90.9		

*Significant at $p < 0.05$. **Highly significant at $p < 0.01$. Not significant at $p > 0.05$.

Table (4): Correlation between the studied variables (n=52).

The studied variables		1.	2.
1. Total knowledge	r		
	p		
2. Total practices	r	.712	
	p	.000**	

(**) Statistically significant at $p < 0.01$. r Pearson correlation

Discussion

Anaphylaxis is a serious, life-

threatening generalized or systemic hypersensitivity response that needs prompting, accurate diagnosis, and

suitable management. Drug hypersensitivity is one of the most frequent causes of anaphylaxis, especially in hospitalized patients. The foremost common culprit drugs are non-steroidal anti-inflammatory drugs and beta-lactam antibiotics. Drug-induced anaphylaxis (DIA) is additionally related to more serious results than other anaphylaxis triggers, and drugs are capable of the largest part of deaths due to anaphylaxis **Patnaik et al., (2020)**.

This study aimed to assess nurses' perception toward antibiotic-induced anaphylaxis among pediatric patients by assessing nurses' knowledge, & practices toward antibiotic-induced anaphylaxis among pediatric patients.

Concerning the demographic characteristics of the studied sample, the results of the present study revealed that approximately more than two-fifths of the studied nurses ranged in age from 20 to less than 30 years old with the mean of 31.9 ± 4.7 years. This may be due to the majority of nurses usually graduating from the nursing school affiliated with Alsayed Galal Hospital. This finding agreed with a study done by **Patnaik et al., (2020)** about "knowledge, attitude, and practice regarding anaphylaxis among pediatric health care providers in a teaching hospital" which found that approximately half of the studied sample were aged from 20-30 years old.

On the other hand, this finding was incongruent with a study done by **Lalithabai et al., (2022)** who

studied "knowledge, attitude, and beliefs of nurses regarding antibiotic use and prevention of antibiotic resistance" which found that the mean age of the participants was 35.1 years old.

Concerning the educational level, the results of the present study revealed that more than half of the studied nurses graduated from the nursing school affiliated with Alsayed Galal Hospital and studied Arabic nursing basics, this explained a lack of knowledge & practices toward antibiotic-induced anaphylaxis. These findings were incongruent with **Lalithabai et al., (2022)** who found that 67.7% of them had a bachelor's degree in nursing.

Regarding the job title, the results of the present study revealed that majority of them were named as a staff nurse synchronized with the results of the educational level as a graduate from school or technical institute which represented 88.5% usually named as a nurse unless promoted to the 1st degree after the age of 40 which being equivalent to the nurse specialist's degree.

Concerning years of experience, the current study showed that more than one third of them have from 1 to less than 3 years with mean 4.98 ± 1.76 years. This result may be due to the immediate hiring of the graduated nurses to fill the deficit in the nursing staff. This finding was incongruent with a study conducted by **González-Díaz et al., (2021)** about the Knowledge of healthcare providers in the management of anaphylaxis which found that half of the nurses had experience of 30 years.

Considering attendance of previous

training courses on antibiotic-induced anaphylaxis in pediatrics, the current study results revealed that, minority of them attended training courses about antibiotic-induced anaphylaxis in pediatrics. From the researcher's perspective, the lack of training courses may be because of their awareness deficiency toward the priority importance of nursing intervention & expected outcomes. In addition to increased work overload which led to time consumption for nurses take place in any of these courses.

This disagrees with a study done by **Werner & Holden, (2015)** about "interpretation skills among pediatric nurses" which found that more than two-thirds of the studied nurses attended training courses regarding antibiotic administration.

Taking into account previous training courses on how to perform allergy testing for a pediatric child, the current study results revealed that one quarter of them attended training courses on how to perform allergy testing for pediatrics. The percentage was improved over the aforementioned courses as one of the hospital's policies to conduct such courses periodically and the nurses' attendance became obligatory.

Given the presence of a protocol applied for antibiotics administration in the different departments, the current study results revealed that most of the studied nurses didn't apply the protocol for administering antibiotics & informed the non-existence of such written protocols for administering antibiotics in the departments. While only less than

one fifth of them followed the protocol. This could be due to either the weakness of the nurses' knowledge regarding the topic or considering that its responsibility fell on the physicians only and that is what the researcher supposed.

Relating to the recent study, the total knowledge of the studied nurses toward antibiotics, anaphylaxis & allergy tests, more than half had poor level of knowledge, less than one third had an average level & more than two-fifths of the studied nurses had good level of knowledge.

Furthermore, the observed factors by the researcher during the study implementation can explain the poor level of knowledge including lack of internal educational services programs, training courses, and guiding workshops, shortage of resources, low level of qualifications as the majority of the studied nurses graduated from nursing school, poor ability of nurses for continuous research & low level of awareness ,and guidance from management.

Respecting the total level of pediatric nurses' practices toward antibiotic-induced anaphylaxis, this study displayed that nearly two-thirds of the considered nurses had unsatisfactory level of practices. That might be because of neglecting the importance of conducting training courses from the management & diminished level of awareness toward the seriousness of the administration of antibiotics due to a belief in the subject as deliverables and fundamentals to operate without supervision or guidance or continuous support.

As regard to relation between

socio-demographic characteristics of studied nurses and their total knowledge toward antibiotic-induced anaphylaxis among pediatric patients, there was a highly statistically significant relating between the studied nurses' level of knowledge and their level of education, job title and attending training courses on how to perform allergy testing for pediatrics. In addition, there is a statistically significant relation with their years of experience and attending training courses on antibiotic anaphylaxis in pediatrics, while there is no statistically significant relation with their age.

On the other hand, this finding was similar to a study done by **Bhatt et al., (2023)** who found that a significant association was highlighted between socio-demographic characteristics and high knowledge levels.

Relating to relationship between socio-demographic characteristics of studied nurses and their total practices toward antibiotic-induced anaphylaxis among pediatric patients, there was a highly statistically significant relation between the studied nurses' level of practices and their level of education and job title. Furthermore, there was a statistically significant relation with their years of experience, attending training courses on antibiotic anaphylaxis in pediatrics and attending training courses on how to perform allergy testing for pediatrics, but there was no statistically significant relation with their age. This was similar to **Ali et al., (2021)** which revealed that,

there was statistically significant relation between qualification and attending training courses of the studied nurses and their practice.

As regards this study which highlighted that there was a highly significant positive correlation between the studied nurses' total knowledge, & practices toward antibiotic-induced anaphylaxis among pediatric patients. That was congruent with **Kee Kwan et al., (2023)** which studied drug allergy knowledge, attitude, and practice & revealed positive correlation between the studied respondents' total knowledge, attitude, & practice. Furthermore, knowledge, attitude, and practice on drug allergy among respondents in “Sabah hospital” were poor. Adding that, they needed advanced educational programs on drug allergies to be stated and applied.

Conclusion

In the light of the study findings, the results revealed that more than half of the studied nurses had poor level of knowledge, approximately two-thirds had unsatisfactory level of practices & there was a highly significant positive correlation between the studied nurses' total knowledge, and total practices toward antibiotic-induced anaphylaxis among pediatric patients.

Recommendations

Based on the findings of the present study the recommendations were formulated:

- 1- The need to periodically evaluate nurses' perception & develop educational programs to promote and modify their practices toward antibiotic administration.

- 2- Develop educational and guidance programs on sensitivity tests & conduct training courses on pediatrics' anaphylaxis for all health care team.
- 3- Further studies on a large sample of nurses and in different settings to assess the problem and disseminate its solution more widely.

Financial Support

No funding was received.

Conflict of Interest

No

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