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Effect of nursing educational protocol on Nurses' Knowledge and Practice regarding Antibiotics Administration and Anaphylaxis Management

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Abstract:

Background: Antibiotic administration can induce a life-threatening condition known as anaphylaxis, so correct administering antibiotics and efficient management of anaphylaxis from nurses is crucial for lifesaving all patients. **Aim:** Assess the effect of nursing educational protocol on the nurses' knowledge and practice regarding antibiotic administration and anaphylaxis management. **Method:** Aquasi-experimental research design (pre- and post-test). **Setting:** The study was conducted in the medical and pediatric departments at Assuit University Hospital. **Subjects:** 300 nurses employed in the medical and pediatric departments. **Tools: (1)**a structured questionnaire sheet to assess nurses` knowledge about antibiotic administration and anaphylaxis management (2) Pre/ Post Nurses' practice intradermal (ID) hypersensitivity skin test. **Results:** The mean age of the studied nurses was 36.1±7.0 years,82.0% of them were female , and highly statistically significant differences, indicating improvement was founded between nurses` knowledge and practice before and after implementing nursing educational protocol about antibiotic administration and anaphylaxis management (P=0.001***). **Conclusion:** The application of nursing educational protocols was effective and successfully improved the nurses' knowledge and practice regarding antibiotic administration and anaphylaxis management. **Recommendation:** Establishing nursing educational protocols in hospitals will improve the nurses' knowledge and practice about how to manage anaphylaxis occurrences.

Keyword: Antibiotic administration, Anaphylaxis management, Nurses' knowledge & Practice.

Introduction:

Anaphylaxis is a serious systemic hypersensitivity reaction that is usually rapid in onset and may cause death. Severe anaphylaxis is characterized by potentially life-threatening compromise in airway, breathing and/or the circulation, and may occur without typical skin features or circulatory shock being present **(Turner et al., 2019).**

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%, variations depending on the definitions used, study methodology, and geographical areas (**Turner et al., 2020**).

Despite an increasing time trend for hospitalizations due to anaphylaxis, mortality remains low, estimated at 0.05–0.51 per million people/year for drugs **(Mikhail et al., 2021).**

Anaphylaxis symptoms usually occur within minutes of exposure to an allergen. Sometimes, however, anaphylaxis can occur a half-hour or longer after exposure to an allergen. In rare cases, anaphylaxis may be delayed for hours. Signs and symptoms include: skin reactions, including hives and itching and flushed or pale skin, low blood pressure (hypotension), constriction of the airways and a swollen tongue or throat, which can cause wheezing and trouble breathing, a weak and rapid pulse, nausea, vomiting or diarrhea, and dizziness or fainting **(Goetz. et al., 2019).**

The most common anaphylaxis triggers in adults are certain medications, including antibiotics, aspirin and other pain relievers available without a prescription, and the intravenous (IV) contrast used in some imaging tests **(Dhopeshwarkar et al., 2019).**

There aren't many known risk factors for anaphylaxis, but some things that might increase the risk include: previous anaphylaxis, allergies or asthma, and certain other conditions; these include heart disease and an irregular accumulation of a specific type of white blood cell (mastocytosis). Therefore, the nurse's important role appears to be to take into account the history of the presence of previous allergies **(Frederico et al., 2020)**.

Rapid progression of symptoms often occurs minutes to hours following antibiotic administration. Therefore, early recognition of an anaphylaxis event by nurses is crucial for anaphylaxis management and lifesaving. The typical pattern of clinical features and the diagnosis of anaphylaxis rest primarily on a detailed history of the episode and all exposures and events in the hours preceding the onset of symptoms.

So taking the patient history by nurses is essential to reducing the severity of hypersensitivity reactions **(De salvia et al., 2021).**

All nurses should be aware with Intramuscular adrenaline is the primary line of treatment for anaphylaxis. The second lines of intervention include calling for help, proper positioning the patient, using high-flow oxygen, IV fluids resuscitation, and using inhaled short-acting bronchodilators **(Greenhawt et al., 2023).**

Previous studies have demonstrated a lack of knowledge among healthcare professionals regarding antibiotic administration and anaphylaxis, and nurses are not aware enough about the correct intervention used in the management of anaphylaxis and the choice of the first-line drug for treating this emergency condition. **(Dribin et al., 2022) .**

So, all nurses should be knowledgeable enough about all management protocols for anaphylaxis to reduce all risks produced by the wrong administration of antibiotics and incorrect management of anaphylaxis cases.

Significance of study:

Drugs are consistently found to be the most common cause of anaphylaxis in adolescents and adults, after insect venom. Causing 22.4% of the anaphylactic episodes, whereas in children (<18 years old) drugs were responsible for only 4.8% of the cases (**Victoria et al., 2020)**

From clinical experience of one of the researchers, who worked as educator in the continuous education center at Assuit university hospital found that the nurses who are worked in Medical department and pediatric department at Assuit University Hospitals does not have efficient knowledge and practice about antibiotic administration and anaphylaxis management.

So, there is a need to continue disseminating knowledge and correct practice among the nursing staff members about allergy skin testing for an early diagnosis of immediate and delayed drug hypersensitivity (DH) and how to manage such emergencies cases

Aim:

Is to evaluate effect of nursing educational protocol on nurses' knowledge and practice regarding antibiotics administration and anaphylaxis management

Hypothesis:

1. The study nurses' knowledge and practice score post implementing the nursing educational protocol regarding antibiotic administration and anaphylaxis management will be higher than before
2. A positive relationship will exist between the knowledge and practice scores obtained by nurse's post implementing nursing educational protocol.

Subjects and Method:

Research design:

Quasi-experimental (pre–posttest) research design was utilized.

Setting:

The study was conducted at the Medical department and pediatric department, which is affiliated with Assuit University Hospital in Egypt.

Sample:

A purposive sample composed of 300 nurses who working at the previously mentioned setting and who were dealing with anaphylaxis cases.

Variables

The designed nursing educational protocol is considered an independent variable, while nurses' knowledge and practices are considered the dependent variables in this study.

Tools of data collection:

Tool I: Structured questionnaire tool:

After the researchers reviewing recent text the researcher formulated this tool. It developed to evaluate nurses' knowledge regarding antibiotic administration and anaphylaxis management in addition to some selected demographic data for nurse. There are two parts:

Part 1: Nurses' demographic data: such as age, gender, marital status, qualification, years of experience, training courses regarding antibiotic administration and anaphylaxis management

Part 2: Pre/post Nurses' knowledge about antibiotics administration and anaphylaxis management:

It contained twelve multiple -choice questions. It involved the following items:- Nurses knowledge about antibiotics administration and anaphylaxis management it distributed as the best definition of anaphylaxis, is the type of hypersensitivity reaction related to antibiotic administration? , what are symptoms of anaphylaxis? , what is the first line of drug for anaphylaxis, what is the route of epinephrine administration? , the preferred site for administration of Epinephrine, what is the dose of the drug, what is the time it takes for allergy symptoms to appear? How do you manage patients, reporting previous anaphylaxis? , Nurses' knowledge about sensitivity test; volume of medication needed to inject intradermal for the hypersensitivity test, site of ID allergy test, and what are criteria for a positive immediate reading.

Scoring system:

The knowledge score was 12 degrees equal, or 100%. Every right response received one mark, while every wrong response received zero. Once all the scores were added up, these scores were transformed into a percent score. A score of at least 60% was considered satisfactory knowledge level (>7-degree correct

answers). Less than 60% had an unsatisfactory knowledge level (about 7 degrees of erroneous answers).

Tool II: Pre/ Post Nurses' practice intradermal (ID) hypersensitivity skin test:

It was adopted from **(Chandralekha et al., 2021)** to assess nurses practice regarding ID hypersensitivity skin test. It consists of 24 items used to investigate nurses' practice. Their practice was evaluated on a three-point scale, 3 = done correctly, 2 = done incorrectly, and 1 = not done. Practice steps included hand hygiene, wear clean gloves, maintain the patient privacy, identify patient identity, the injection site should be free from any bruises, inflammation, edema, masses, tenderness and sites of previous injections should be avoided, Select 1/4 to 5/8 inch 25 to 27 gauge needle, assist patient into a comfortable position, clean the injection site with antiseptic swab in a circular motion, remove the cap from needle, with non-dominant hand, stretch skin over site with forefinger and thumb, Insert needle slowly at 5 to 15 angles with bevel up until resistance is felt; then advance to no more than 1/8 inch below the skin. The needle tip should be seen through the skin, Inject pre-determined volume (maximum 0.05 ml) slowly in order to raise a bleb 4-6mm in diameter on the skin surface, Note a small bleb like a mosquito bite that forming under the skin surface, apply gently pressure with gauze after withdrawal the needle, Do not massage the site, return the patient into a comfortable position, Discard the uncapped needle and syringe in sharp container, make a mark around injection site, remove gloves and wash hands , obtain measure of wheel after 20 min; an increase in wheal size of 3mm in diameter beyond the initial bleb is considered positive and Record the outcome of the test .

Scoring system:

The practice score was 24 degrees (100%) related to all practice steps. Three point scale ranged from 1 to 3 used to assess their practice, 3 = done correctly, 2 = done incorrectly, and 1 = not done .Once all the scores were added up, these scores were transformed into a percent score. A score of at least 60% was considered adequate practice level (≥14-degree correct demonstration). Less than 60% had inadequate practice level (<14 degree incorrect demonstration).

Tool's validity and reliability:

Five professionals from Assiut University academic nursing and medical Academics assessed the content validity of the tool.

The Cronbach's alpha test was used to confirm the tools' consistency. Which indicate their reliability (0.85)

Nursing educational protocol:

It was developed by the researchers after reviewing the scientific text about the safe administration of antibiotics through a hypersensitivity test and how to manage anaphylaxis cases. The nursing educational booklet used to enhance the nurses' knowledge and practice about antibiotic administration and anaphylaxis management. It was prepared in Arabic booklet with pictures. It consisted from two parts:

Theoretical part about:

- Best definition of hypersensitivity
- Sign and symptoms of hypersensitivity
- Right medication name, dose and rout for anaphylaxis management
- Nurses' knowledge about sensitivity test; volume of medication needed to inject intradermal for the hypersensitivity test, site of ID allergy test, and what are criteria for a positive immediate reading.

Practical part:

It included all steps for a correct donning of intradermal hyper sensitivity skin test.

Procedure:

Assessment phase:

- During this phase the researchers reviewing of current national and international related literature review regarding to antibiotic administration and anaphylaxis management uses all scientific resources to design the study tools.
- Prior to gathering data, a formal letter from the dean of the Assuit Faculty of Nursing was submitted to hospital managers, heads of Medical, and Pediatric department requesting written consent to conduct the study.
- The study's objectives and findings were made clear.
- The trial was risk-free as well.
- Additional verbal consent was obtained from all participants.
- All participants have the right to withdraw from the study at any time.
- Studied nurses were reassured all information obtained would be confidential and utilized only for the study.

Pilot Study:

A pilot study was implemented on 10% of the total number of nurses (15 nurses) in the medical department and the same number was obtained from the pediatric department at Assiut University Hospital to test the tools' clarity and applicability. No changes were made to the study tools, so ten percent of the study sample was included in this study.

Planning phase:

According to the results of the assessment phase, the researcher was developed nursing educational protocol considering nurses' needs and their learning abilities.

The implementation phase:

- The duration of the data gathering process was twelve months, starting in March 2023 and ending in March 2024. The researchers were available in the previously mentioned setting in the morning and afternoon shifts on Sunday, Tuesday, and Wednesday.
- Assess nurses' knowledge by using the structured pre/posttest questionnaire (tool I).
- Prior implementing the nursing educational protocol the researcher assess nurses' practice intradermal (ID) hypersensitivity skin test using (tool II).
- The researcher created the nursing educational protocol in order to meet nurses' need from knowledge and practice.
- Nursing educational protocol was introduced to each nurse.
- The nursing staff was divided into small groups, with two to three nurses in each group, according to their number in each shift.
- Choose the optimal time for providing nursing education when they have minimal workload.
- Four sessions were provided to each group of nurses: two focused on the theoretical part, and another two focused on practical aspects.
- Every session lasted for forty minutes.
- In first session the researchers start the opening session by introducing themselves then collect base line assessment (tool I) and assess nurses' practice intradermal (ID) hypersensitivity skin test using (tool II).
- According to their educational level use the suitable language in each session to discussed the previous session and the aim of new session.
- Each session concluded with a summary of its contents and feedback from the nurses, ensuring the highest possible level of educational benefits.
- In the 2nd sessions, the researcher provided the theoretical part of the designed nursing protocol to nurses based on the results of the nurses' knowledge assessment tool about antibiotic administration and anaphylaxis management (Tool I Part 2).
- In last two sessions, the researcher implemented the practical part, which included how to apply a hypersensitivity skin test based on the results of the assessment (Tool II)
- The researcher used illustrated tools like graphic pictures, power points, and videos in small group discussions and demonstrations to apply nursing educational protocols.
- At the end of all sessions, all nurses were given hard a copy educational booklet to be used as references for the correct administration of antibiotics and anaphylaxis management**.**

The evaluation phase:

Immediately after implementing the nursing educational protocol nurses` knowledge and practice were assessed using (tool I part II and tool II) to evaluate the effect of the nursing educational protocol on nurses'` knowledge and practice.

Statistical analysis

Using SPSS version 26 (26), the gathered data were tabulated and statistically analyzed to determine the differences between the groups under study using frequencies and percentages with a mean ± SD. The association between the variables was examined using Pearson's correlation test, Chi-square testing, and independent sample T-tests. P values less than 0.05 are regarded as significant, P values less than 0.001 as very significant, and P values greater than 0.05 as non-significant.

Results:

Table (1): Demographic variables of study participants (N=300):

Demographic variables	Nurses	
	No. (n=300)	%
Age:		
22 to ≤ 35	128	42.7
36 to ≤ 45	165	55.0
< 46	7	2.3
Mean ± SD	**36.1±7.0**	
Range	**22.0 – 55.0**	
Gender:		
Male	54	18.0
Female	246	82.0
Marital status:		
Single	72	24.0
Married	220	73.3
Divorced	5	1.7
Widow	3	1.0
Education level:		
Nursing Diploma	226	75.3
Nursing technical institute	65	21.7
Bachelor of Nursing	9	3.0
Years of experience:		
1 to 10 Years	77	25.7
11 to 20 Years	132	44.0
> 20 Years	91	30.3
Mean ± SD	**15.6± 7.3**	
Range	**1.0 – 35.0**	
Have a previous training courses regarding antibiotic administration and anaphylaxis management?		
Yes	0	0.0
No	300	100.0

Table (2): Nurses' knowledge regarding antibiotic administration and anaphylaxis management pre and post implementing nursing educational protocol (N=300):

Nurses' knowledge	Study Group				F-test	P-value
	Pre		Post			
	No.	%	No.	%		
Satisfactory level (≥ 60%)	31	10.3	289	96.3	24.217	0.001***
Unsatisfactory level (< 60%)	269	89.7	11	3.7		

Qui square test and T test
Statistical significant differences (p < 0.05)

Table (3): Nurses' practice regarding intradermal hypersensitivity skin test pre and post implementing nursing educational protocol (N=300):

Nurses' practice	Study Group No. 300				F-test	P-value
	Pre		Post			
	No.	%	No.	%		
Adequate level (≥ 60%)	**11**	**3.7**	**258**	**86.0**	21.404	0.001***
Inadequate level (< 60%)	**289**	**96.3**	**42**	**14.0**		

Qui square test and T test
Statistical significant differences (p < 0.05)

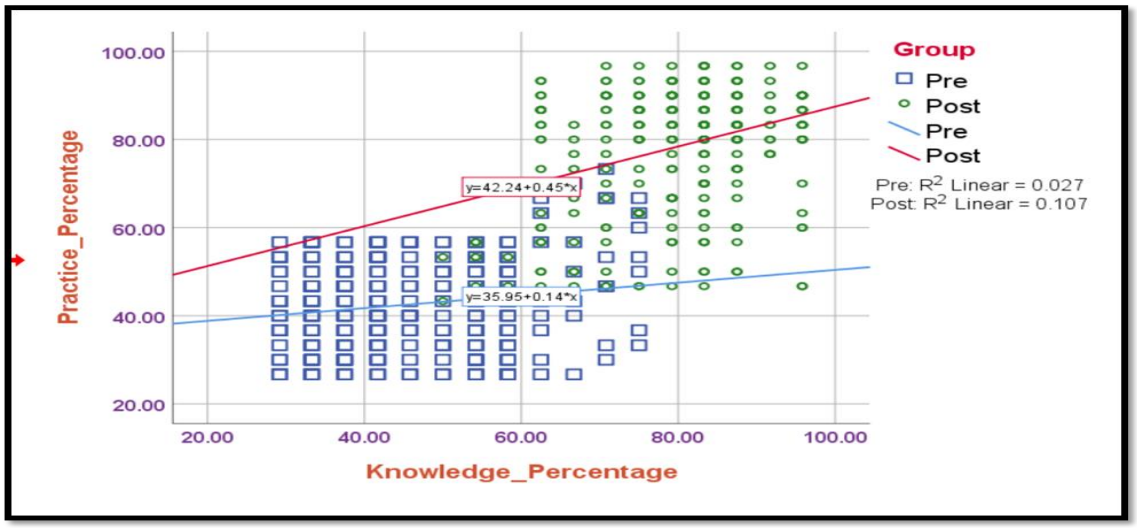

Figure (1): Relation between nurses' knowledge and practice toward antibiotic administration and anaphylaxis management

Table (1): Regarding the study sample characteristics: More than half of them (55.0%) were between (36 to 45) years old with mean age (36.1±7.0). The majority of them were female (82.0%). Nearly three quarter (73.3%) were married. Regarding the educational level three quarter of them (75.3%) had nursing diploma. About two fifth of nurse (44.0%) had between (11 to 20) years in the field. Lastly no nurses had a training program for antibiotic administration and anaphylaxis management.

Table (2): Demonstrates that there was very significant difference between nurses` knowledge about antibiotic administration and anaphylaxis management pre and post implementing nursing educational protocol (0.001***). Additionally, following the implementation of the nursing educational protocol, the vast majority of studied sample in pediatric and medical departments were having satisfactory level of knowledge (96.3%)

Table (3): The highly statistically significant difference (0.001***) between nurses' practices regarding the administration of antibiotics and the management of anaphylaxis before and after the implementation of the nursing education protocol is displayed in this table. After the nursing education protocol was implemented, the majority of nurses in pediatric and medical departments (86%) had an adequate level of practice.

Figure (1): The positive association between nurses' knowledge and practice scores is made clear by this figure. Through the improvement of their knowledge, nurses were able to improve their practice.

Discussion:

It is believed that the rate of anaphylactic deaths reflects, in part, how well nurses recognize clinical manifestations of anaphylaxis and how to appropriately manage it. Our goal was to evaluate a sample of nurses who were working in the medical department and pediatric department for their knowledge and practice regarding antibiotics administration and anaphylaxis management before and after applying the nursing educational protocol.

Concerning the demographic characteristic of the sample under study illustrated that, over half of nurses' ages fell between 30 and 45 years his may be due to about three-quarters of nurses having diploma degrees and graduated from many years. This result is in line with research conducted by **Torres & Blance (2021)** who established that the studied nurses' average age was 48.7 years old. However, this result did not align with the research conducted on the same point of study by **Mosbeh, (2021)** found the mean age of the nurses under study was 22.6±1.3 years old, and half of the nurses were between the ages of 20 and 3 years old. Also the majority of them were females. This result may be explained by the fact that women make up the majority of Egyptian nurses and continue to outnumber men in the nursing profession. This result was inconsistent with research conducted by **Macy & Poon, (2022)** they mentioned that about two third of the studied sample was male.

According to education level, about three-quarters of nurses had a diploma, and greater than two-fifths of them have between 11 and 20 years of experience. Despite many years of experience, not all nurses have received any training program about antibiotic administration or anaphylaxis management. So their knowledge and practice in this study about antibiotic administration and anaphylaxis management had

unsatisfactory and inadequate levels before applying nursing educational teaching.

Nurses' knowledge regarding antibiotic administration and anaphylaxis management

The current study's findings indicate that the great majority of the studied sample had unsatisfactory knowledge pre-test. This could be because none of them received any training on how to administer antibiotics or manage anaphylaxis, and it could also be because of their increased workload, which could make it difficult for them to keep up with reading recent textbooks and update their knowledge. Thus, there was a need to improve nurses' knowledge necessary to enhance their practice and so provide safe administration of antibiotics and avoid anaphylaxis.

The current study was consistent with that of **Mosbeh et al. (2021)**, which found that staff nurses were required to obtain nursing guidelines in this area due to their lack of knowledge on the administration of penicillin to pediatric patients.

Conversely, research by **Ibrahem et al. (2020)** found that most nurses understand anaphylaxis in an accepted fashion, and a large percentage of physicians and nurses can identify the symptoms of anaphylaxis.

As regarding the current study findings demonstrated that the level of knowledge for studied sample was at satisfactory level after applying the nursing educational protocol as regarding the total knowledge score for nurses' about antibiotic administration and anaphylaxis management. Similarly, the total score of nurses' knowledge about antibiotic administration and anaphylaxis management represented a significant statistical difference between the pre and post-tests (conducted immediately).

The nurses' interest in learning more about the study issue may have contributed to the improvement that was seen and the written materials they received about antibiotic administration and anaphylaxis management. These materials served as a valuable source of ongoing reference for the nurses and facilitated their knowledge acquisition. Along with encouraging participation, questions, interactions and their implementation of learning guidelines throughout the instructional sessions are crucial aspects.

The utilization of multimedia and the implementation of teaching guidelines through the instructional sessions, coupled with promoting with participation and interactions, are also important. This result was in line with **Fayed et al. (2022),** which showed that nurses' overall understanding of antibiotic stewardship varied statistically significantly between the pre and post-program implementation periods.

Nurses' practice regarding (ID) hypersensitivity skin test:

Before implementing the nursing education protocol, the overall level of nurses' practice with regard to hypersensitivity test and anaphylaxis management was inadequate. Likewise, over two thirds of nurses did not practice administering antibiotic in a adequate manner. This could be because none of the nurses in the study had access to an in-service training program on anaphylaxis management or did not have enough information about the steps needed to administer antibiotic treatment in a way that would reduce the severity of hypersensitivity reactions. This in the line with **Mosbeh et al, (2021)**, showed more than half of nurses in the study lacked the necessary skills to administer penicillin. **Also Patnaik et al (2020)** who denoted that about only one third of the respondents had managed a case of anaphylaxis.

The researcher discovered that after implementation of the nursing educational protocol, there was a great improvement in the nurses' practice scores in the post-test (immediately).This research supports the findings of **Fayed et al., (2022)**, who found an excellent level of practice after applying the educational program compared to before it, with a statistically significant improvement.

Ultimately, the study's findings demonstrated that, with highly statistically significant differences, nurses' knowledge and practice regarding the administration of antibiotics and management of anaphylaxis improved after implementing the nursing educational protocol. This finding aligns with the findings of **Mohamed & Said (2020),** who observed a positive association ($p<0.001$) between the total knowledge and total practice scores of nurses during the post-program implementation phase.

Correlation:

After applying the nursing educational protocol, mean overall adequate levels of nursing practice were noted. This occurs due to a positive connection between nurses' knowledge and practice regarding antibiotic administration and anaphylaxis management. From the perspective of the researcher, these abilities are easily developable, particularly when connected to their pertinent body of scientific information. They also emphasized the need to provide this kind of training to nurses who treat adult and pediatric patients with antibiotics.

Conclusion:

- After applying the nursing educational protocol a significant improvement in nurses' knowledge and practice was found post-procedure compared with that pre- procedure.
- A positive connection between nurses' knowledge and practice regarding antibiotic administration and anaphylaxis management after applying the nursing educational protocol compared with pre applying the procedure.

Recommendations:

1. All nurses' performance should be evaluated periodically regarding antibiotic administration and anaphylaxis management by training personnel in hospitals to assess the nurses' practice level and provide advice to correct their incorrect practices.
2. Attractive posters about hypersensitivity skin tests should be available in the medical and pediatric departments.
3. Apply such study on a sizable sample size in various medical and pediatric setting to generalize the research results and improve nurses' knowledge and practice toward antibiotic administration and anaphylaxis management.

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