

Effect of Video-Assisted Teaching Intervention on Nurses' Knowledge and Practice Regarding Arterial Blood Gases Sampling for Ventilated Children at Pediatric Intensive Care Units

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Abstract: Context: Arterial blood gases sampling is part of everyday nurses' practice in the care of children admitted to the pediatric intensive care unit, particularly for those receiving respiratory support. Aim: To evaluate the effect of video-assisted teaching intervention on nurses' knowledge and practice regarding arterial blood gases sampling for ventilated children at pediatric intensive care units. Methods: A quasi-experimental research design was utilized to conduct the current study. Settings: The study was conducted at Pediatric Intensive Care Units (PICUs) of Benha University Hospital and Benha Specialized Pediatric Hospital at Benha city. Sampling: A convenient sample of (70) nurses working at the above-mentioned settings were included in this study regardless of their personal characteristics. Tools of data collection: Two tools used, Tool 1: A structured interviewing questionnaire designed to assess nurses' personal characteristics, personal data of the studied children, and nurses' knowledge regarding arterial blood gases sampling. Tool 2: An observation checklist to assess nurses' practice regarding arterial blood gases sampling. Results: There was a significant improvement in nurses' total knowledge and practice regarding arterial blood gases sampling after video-assisted teaching intervention. Conclusion: It can be concluded that video-assisted teaching intervention had a positive effect on the improvement of nurses' knowledge and practice level, which indicates that the video-assisted teaching intervention is an effective method. Recommendation: The study recommended that applying the video-assisted teaching intervention for nurses caring for ventilated children helps to promote and update their knowledge and ensure competent practice.

Keywords: Video-Assisted Teaching Intervention, Nurses' Knowledge and Practice, Arterial Blood Gases Sampling, Ventilated Children, Pediatric Intensive Care Units.

1. INTRODUCTION

Arterial blood gases (ABG) analysis is a common investigation in intensive care units for the critical care of children and considers a valuable tool in the assessment of a multitude of illnesses and injuries. Also, it can guide in titrating ventilator support and weaning a ventilated children. It represents the criterion stander for determining a ventilated children's acid-base status, and to assess the response to therapeutic intervention such as mechanical ventilation (*Sabaq et al., 2019*)

Analysis of ABG is a basic and useful laboratory test for determining adequate oxygenation, ventilation and acid-base status. The plan of care includes the frequency of blood gases determination, and the health care provider's responsibility to be cognizant of each blood gases sample drawn (*LaMonica, 2020*).

Arterial sampling is specifically a test in which blood is taken from an artery. The sample is obtained through an arterial puncture or acquired from an indwelling arterial catheter. The preferred site in pediatric is the radial artery. Moreover, ABG analysis assesses a child's partial pressure of oxygen (PaO₂); the partial pressure of carbon dioxide (PaCO₂) that represents the status of respiratory function, and PH indicates the status of acid-base balance. Although, oxygenation can be assessed non-invasively through pulse oximetry but they don't give information about pH and bicarbonate (*Castro, et al., 2019*).

Measurement of arterial blood gases is the most effective way in making the correct diagnosis and deciding management strategies, especially for ventilated children. Furthermore, nurses are often the first member of the health care team to see arterial blood gas results and are playing a bigger role in the realm of blood gases analysis within the work area, particularly as more analysis are placed in these areas. Hence, it is very important that the nurses must be familiar with the knowledge obtained to be able to detect the disturbances in ventilation (*Sehrawat et al., 2019*).

Many diseases are evaluated using arterial blood gases analysis, including acute respiratory distress syndrome, sepsis, hypovolemic shock, acute respiratory failure, heart failure, cardiac arrest, and asthma. There are several potential complications related to ABG sampling during the performance of arterial puncture for ABG analysis as nerve injuries, acute compartment syndrome, hematoma, or excessive bleeding, and nerve damage. Thus, it is very important that the nurses who are responsible for collecting arterial blood samples are effectively trained (*Abd Elkader, et al., 2020*).

The pediatric intensive care unit is a stressful environment for ventilated children that need safety, comfort, and hemodynamic stability. Hence, ventilated children are requiring continuous monitoring and treatment because one or more vital functions are threatened by acute or chronic diseases. The clinical team that provides care in PICU is specially qualified inter-disciplinary and inter-professional as well as the care provided is more intensive than that elsewhere in the hospital. Moreover, the nurses should have advanced qualifications in critical care. Additionally, nurses working in PICU should use considerable time in drawing, documenting, and interpreting blood gases (*Ista et al., 2020*).

Education and training are necessary for all pediatric nurses carrying out arterial blood gases. It should include understanding the anatomy of arteries, the preferable sites of ABG in children, awareness of the risks from blood exposure, and the consequences of inadequate infection control. The video-assisted teaching methods provide a considerable pathway for research on an innovative method of creating awareness. Also, it helps in bringing out positive changes in the knowledge and improves the practice in dealing with life-threatening situations (*Kavitha, 2016*).

Training by using the video teaching method would help the staff nurses to develop and refine their existing skills and knowledge, which would lead to an improvement in the quality of care (*Basnett, et al., 2016*). Moreover, persistent education and updating nurses' knowledge and practices are very important, because they are working in different shifts and don't have an opportunity to participate in face-to-face teaching sessions. Video-assisted teaching module and online learning have emerged as an alternative means of providing continuing education to nurses (*Safwat & Khorais, 2018*).

Various teaching strategies are used to improve nurses' knowledge and practice, such as lecturing, demonstration, discussion, self-education, and video-assisted teaching strategy. Video is the technology of electronically capturing, recording, storing, transmitting, and reconstructing a sequence of images representing scenes in motion. Also, it helps to overcome language barriers because illustrations communicate without words (*Balasubramanian et al., 2018*).

The video teaching method improves nurses' learning because it uses sight, sound, and motion to present simple clarification of complex topics and issues. Also, it can present information in a manner that verbal descriptions or talking alone, simply can't convey and act as a bridge educational barriers. However, nurses with low reading skills can learn more easily from the video (*Devi et al., 2019*). Besides, video-assisted considered as one of the most important emerging technologies that help nurses especially those who done painful procedures (*Hassan, 2019*).

Furthermore, technology has largely influenced the need for improved methods of teaching and learning process for nurses. The teaching of different skills requires various techniques and contemporary methods. So, video-based education considered a suitable teaching method. The advantage of video-based education is that the voice of the broadcaster can be heard. Furthermore, the figures, movements, illustrations used and demonstrations presented can be seen (*Rubi & Rani, 2016*).

2. SIGNIFICANCE OF THE STUDY

The use of video teaching method in nursing education provides an easy and innovative way to engage today's nursing staff. Video teaching intervention can be easily adapted into nursing training at any level and considered an essential part of nursing education that links theory with practice. Today, it is expected that the nurse should use creative technologies to enrich the learning environment (*Devi et al., 2019*).

3. AIM OF THE STUDY

The present study aimed to evaluate the effect of video-assisted teaching intervention on nurses' knowledge and practice regarding arterial blood gases sampling for ventilated children at pediatric intensive care units through:

- Assessing nurses' knowledge and practice regarding arterial blood gases sampling
- Designing and implementing video-assisted teaching intervention regarding arterial blood gases sampling based on the nurses' actual needs.
- Evaluating the effect of video-assisted teaching intervention on nurses' knowledge and practice regarding arterial blood gases sampling.

3.1. Research hypotheses

- 1- Nurses who will receive video-assisted teaching intervention will have satisfactory knowledge regarding arterial blood gases sampling on post intervention than pre intervention.
- 2- Nurses who are subjected to video-assisted teaching intervention will have adequate practice regarding arterial blood gases sampling on post intervention than pre intervention.
- 3- There will be a significant relationship between the nurses' knowledge, practice and their personal characteristics

4. SUBJECT & METHODS

4.1. Research design

A quasi-experimental research design was utilized to achieve the aim of the present study.

4.2. Research settings

The current study was carried out in Pediatric Intensive Care Units (PICUs) at Benha University Hospital and Benha Specialized Pediatric Hospital at Benha city. The PICU at Benha University Hospital placed on the fourth floor which contains four rooms, the first room comprises (4) beds, the second room comprises (4) beds, the third room comprise (2) beds and the fourth room (isolation room) comprises (2) beds, while PICU at Benha Specialized Pediatric Hospital found in the third floor in building "B" which consisted of three rooms, the first room comprises (8) beds, the second room comprises (4) beds and the third room (isolation room) comprise (1) bed.

4.3. Subject

A convenient sample of (70) nurses working at the previously mentioned study settings included in this study. The sample size was calculated using the following assumptions: Z_1 (95% confidence interval) = 1.96, Z_2 (80% test power) = 0.84, S = estimation of the standard deviation score for each variable and $d = 0.70$.

4.4. Tools of data collection

Two tools were utilized to collect data pertinent to the present study. These tools consisted of the following:

Tool I: A structured interviewing questionnaire:

It was designed by the researchers in light of relevant researches *Goenka et al., (2012)*; *Shehata (2015)*; *Mohammed & Abdelatief, (2015)*. It was written in an Arabic language and composed of three parts:

Part 1: Nurses' characteristics such as; age, gender, academic qualifications, years of experience at PICU, work settings, and attendance to previous training courses regarding arterial blood gas sampling.

Part 2: Personal data of the studied children such as; age, gender, current weight, and medical diagnosis.

Part 3: Nurses, knowledge regarding ABG. It encompassed (29) multiple-choice questions in the form of multiple choice and true & false questions related to definition (1), indications (1), contraindications(2), selection of site(1), precaution (1), interpreting blood gases (5), complications of ABG puncture(1), prevention of ABG induced complications(2), and techniques of arterial blood gases sampling(15).

The scoring system for nurses' knowledge was evaluated upon fulfillment of the interviewing questionnaire as the nurses' knowledge checked with a model key answer. Therefore, correct answers scored (1), and incorrect or do not know answers scored (0). The total score ranged from 0-58 (29 questions ×2). Nurses' total knowledge was classified into ≥75% was considered a good level of knowledge, a score 60>75% was considered an average level of knowledge, while those who obtained a score <60% was considered a poor level of knowledge.

Tool II: Nurses' Practice Observation Checklist

It was designed by the researchers based on *Lynn & LeBon, (2011); Bowden & Greenberge, (2016) & Blair, (2018)*, to assess nurses' practice toward ventilated children undergoing ABG puncture. It involved the procedures of arterial blood gases sampling from radial and femoral arteries. Withdrawal of ABGs from the radial artery included (35 steps) distributed as pre sampling withdrawal procedure (8 steps), during (14 steps), and after (13 steps). While, withdrawal from the femoral artery included (34 steps) categorized as pre sampling withdrawal procedure (7), during (15 steps) and after (12 steps).

Scoring system for nurses' practice:

A score of (1) for correctly done, and a score of (0) for not done. The total score ranged from 0-69. Total practice scores converted into percent score where the score of ≥ 85% considered competent practice and a score < 85% considered incompetent practice.

4.5 Procedures

4.5.1- Preparatory phase:

The researchers reviewed the local and international related literature related to arterial blood gases sampling to cover the various aspect of the study and develop these study tools by using books, evidence-based articles, periodicals, and magazines of line reference and designing the videos that used for nurses' teaching. This period extended from the beginning of March 2020 to the end of April 2020.

Validity and reliability of study tools:

Tools were revised by a jury of three experts in the field of pediatric nursing to test its clarity, relevance, and applicability. Modifications were done accordingly based on their judgment. Testing the reliability of the tools was done by using Cronbach's alpha test. The reliability score was 0.86. This phase took one month in May 2020.

Ethical considerations:

According to the Faculty of Nursing Ethical Research Committee, the researchers got permission from the hospital managers and the supervisors of PICUs through the submission of an official letter. All studied nurses given verbal consent before conducting the study. Each nurse had the right to withdraw from the study at any time.

The pilot study carried out on 10% of the studied subject (7 nurses) over one month (June 2020) to ascertain the clarity, and applicability of the tools. Regarding the results of the pilot, the necessary modifications to the study tools made and pilot study subjects excluded later from the study sample.

Fieldwork: The actual fieldwork carried out through six months (from the beginning of July 2020 to the end of December 2020). The researchers were available in PICUs at the previously mentioned settings by rotation three days/week (Saturday, Monday, and Wednesday) in the morning shift to collect data by using the previous data collection tools.

Assessment phase: In the beginning, the researchers interviewed each nurse, introduced themselves to each nurse included in the study, explained the aim of the study, duration and took oral consent to participate in the study before data

collection. Then, each nurse asked to fill the structured interviewing questionnaire sheet individually to collect baseline data and to assess nurses' learning needs; after that, the researchers fill the children's data from the medical sheet (tool I). Also, the researchers observed each nurses' practice while demonstrating ABG sampling for children (tool II).

An average of 5-6 nurses were interviewed per/day. The study tools filled out by the researchers, (pre video-assisted teaching intervention) as following:

Firstly, the questionnaire sheets were distributed to all nurses individually to assess their knowledge regarding arterial blood gases sampling in the presence of the researcher to clarify and answer any questions. The average time needed 10-15 minutes. Then, the researcher observed nurses' practice regarding the withdrawal of arterial blood gases sampling from radial and femoral arteries during their shifts by using the observational checklist. The average time needed for completion of each direct observation was between 15-20 minutes. This period of pre-test (knowledge and practice) took one month (July 2020).

Planning phase: The videos were constructed by the researchers after reviewing the literature and the needs identified in the assessment phase.

Videos in the current study were constructed by the researchers using the following steps:

- 1- Review of literature and data collection.
- 2- Preparation and organization of the content.
- 3- Preparation of the video script by sequence.
- 4- Research the story.
- 5- Recording the videos.
- 6- Editing the videos.
- 7- Evaluating the videos.

1- **Review of literature and data collection:** Before beginning the video-assisted teaching intervention an extensive literature review was undertaken from textbooks, journals, online sources, and periodicals related to arterial blood gases sampling for ventilated children to prepare the videos. The literature review gives a critical summary of the topic of interest. Also, careful attention to ensure that the content was accurate, up to date, logically organized, simple and clear.

2- **Preparation and organization of the content:** The content of the videos was prepared and organized under various heading according to the study objectives.

3- **Preparation of the video script by sequence:** A script was made according to the prepared contents. It consisted of all scenes included in the videos such as aim, objectives, principles, and steps of ABG sampling. Videos script is a kind of map, a blueprint of what is going to be in the videos.

4- **Research the story:**

Nurses were interviewed by the researcher; make a note of their knowledge and practice of care while communicating with them through open-ended questions. Observe and make a note in which area they lack information.

5- **Recording the videos:**

- The video suited by the researcher in the (clinical lab) setting for the practical part and PowerPoint video record for the theoretical part according to the prepared script.
- The theoretical and practical videos begin in a motivating and interesting manner and meet the study objectives.
- All steps of the ABG sampling procedure in the videos were presented in a simplified way and accurate using simple and clear language that suits the nurses' educational level.
- The important contents were summarized at the end of each video.

- The video includes section breaks and section titles.
- The video had acceptable technical quality.
- The length and pace of each video are appropriate.
- The video meets the study objectives.

6- Editing the videos:

Videos editing is the process of manipulating and rearranging video shots. The goals of editing are to remove unwanted footage, choose the best footage, create a flow add effects, graphics, music, alter the style, pace, or mood of the video, give the video a particular angle then watch it and take notes. Titles, music, sound editing, color correction, and effects were added. The prepared videos were edited by a video expert.

7- Evaluating the videos:

The videos were evaluated by three experts in the field of pediatric nursing. Their critique, suggestion, opinion, and recommendation were accepted by experts and made.

The general objectives of the video-assisted teaching intervention were to improve nurses' knowledge and practice regarding arterial blood gases sampling for ventilated children

Specific objectives:

At the end of video-assisted teaching intervention the studied nurses were able to:

- List components of the blood.
- Enumerate function of the blood.
- Define arterial blood gases sampling test.
- Illustrate importance of arterial blood gas sampling.
- Understand the indication and contraindication of ABG.
- Explain principles for arterial puncture and ABG analysis.
- Show sites of ABG sampling.
- Mention precautions taken in ABG sampling.
- List components of the ABG sampling test.
- Discuss ABG value interpretation.
- List the errors of ABG sampling.
- Mention complications of ABG sampling.
- Enumerate prevention of ABG-induced complications.
- Explain steps of radial and femoral ABG sampling before, during, and after the procedure.
- Demonstrate steps of radial and femoral ABG sampling.
- Apply infection control measures for ABG sampling and transfer.

Implementation phase: The implementation phase was achieved through five sessions at a period of four months beginning from (August 2020 till the end of November 2020). Moreover, five videos containing the study objectives and carried out through (5) videos sessions (Two videos for the theoretical part and three videos for the practical part). A schedule suitable for nurses developed including date, time, place, topics, and duration of each video session. It was

challenging to take whole nurses at the same time; so, they divided into twelve groups of 5-6 nurses in each video session take into consideration precautionary measures.

Precautionary measures are taken into consideration during data collection and video sessions including:

- Personnel protective materials such as a face mask, gloves, antiseptic solution for hand hygiene.
- Personal distancing to maintain a minimum 1.5m distance.
- Avoiding shaking hands or hugging.
- Always cover the mouth while sneezing and coughing to prevent droplet transmission
- Avoid touching one's mouth, nose, or eyes to prevent the spread of infection.

These are the most important precautionary measures to control the rapid transmission of the infection during video sessions.

The duration of video sessions for each theoretical and practical session ranged from 40-45 minutes for three days per week (Saturday, Monday, and Wednesday) in the morning shift. The theoretical video sessions were started from 11:00 AM to 12:00 PM. The theoretical video sessions focused on knowledge about the definition of ABGs, indications, contraindications, selection of site, precaution, interpreting blood gases, complications of ABG puncture, prevention of ABG induced complications, and techniques of arterial blood gases sampling. The researcher continued to reinforce the acquired information, answered any raised questions, and gave feedback. The videos were projected to the nurses using a laptop and data show.

The practical sessions were started on the same 3 days from 12.30 PM to 1.30 PM. The practical parts cover the procedures related to arterial blood gases sampling from radial and femoral arteries.

Video-assisted teaching intervention helps in explaining complex information, using simple and apparent language to suit the nurses. Also, provides the nurses with the information they need when they need it, and in an interactive format. Motivation and reinforcement during video sessions were used in order to enhance sharing in this study.

Contents of each video in all sessions:

- The first theoretical video session focused on:

- Introduction about ABG and its purpose.
- Component of blood and its function.
- Anatomy of arteries, the preferable sites of ABG in children
- Indication and contraindication of ABG.
- Precautions taken in ABG sampling.
- Principles for arterial puncture and ABG analysis.

- The second theoretical video session focused on:

- Components of ABG sampling test.
- Normal range of ABG values in pediatrics and interpretation.
- Errors of ABG sampling.
- Safety measure before starting ABG procedure.
- Complications of ABG sampling.
- Prevention of ABG sampling-induced complications.

- The third practical video session focused on:

- Preparation of ABG sampling procedure from the radial artery.
- How to perform Allen test before obtaining a specimen from the radial artery.
- Steps during and after the withdrawal of ABG sampling procedure from the radial artery.

- The fourth practical video session focused on:

- Preparation of ABG sampling procedure from the femoral artery.
- Steps during and after the withdrawal of ABG sampling procedure from the femoral artery.
- ABG sampling withdrawal from arterial line.

- The fifth practical video session focused on:

- Infection control measures for ABG sampling withdrawal and transfer.

Following the video-based demonstration and practice, while watching sessions, real-life time simulations were practiced to reinforce the skills learned during the video session. Moreover, the importance of teamwork and coordination was also experienced by nurses in these simulation sessions. Nurses were provided a CD or flash drive of all videos. Video also formally advertised, through email for each nurse.

Evaluation Phase:

After the implementation of video-assisted teaching intervention, the nurses' knowledge and practice evaluated immediately. The post-tests administered using the same pretest data collection tools. This phase took about one month (December 2020).

4.5 Data analysis

The collected data were categorized, organized, analyzed, and tabulated using The Statistical Package for Social Sciences (SPSS version 21). Descriptive statistics were applied (e.g., mean, standard deviation, frequency and percentages). Chi-square is used to test the study hypothesis. Pearson correlation coefficients were used for correlation analysis and the degree of significance was identified. A highly statistical difference was considered at $p\text{-value} < 0.001$, a statistical significant difference was considered at $p\text{-value} < 0.05$, and no statistically significant difference was considered at $p\text{-value} > 0.05$.

5. RESULTS

Table (1) clarifies the nurses' characteristics; it was found that the mean age of the studied nurses was 24.51 ± 6.82 years, and more than two fifths (44.3%) of them graduated from the technical institute of nursing. Also, it was observed that more than two-fifths (41.4%) of them had experience from 5 to less than 8 years.

Figure (1) illustrates that the majority (92.9%) of the studied nurses are females, while the minority (7.1%) of them were males.

Figure (2) shows that less than three quarters (73.7%) of the studied nurses didn't attend training courses regarding ABG sampling.

Table (2) reveals the personal characteristics of children. It was found that the mean age of children were (10.56 ± 9.24) and more than half (57.2%) were females. In addition, nearly two fifth (40.5%) of studied children's weight are ranged from 19 to 27 kilograms.

Figure (3) shows that more than two thirds of children (69%) diagnosed with pneumonia.

Table (3) portrays the percentage distribution of the studied nurses' total knowledge regarding arterial blood gas sampling pre and post video-assisted teaching intervention. It was found that less than half (48.6%) of the studied nurses had a poor

level of knowledge pre video-assisted teaching intervention; while more than two thirds (68.6%) of them had a good level of knowledge post video-assisted teaching intervention.

Table (4) explained nurses' practice regarding radial arterial blood gas sampling pre and post video-assisted teaching intervention and reported that there were highly statistically significant differences ($P < 0.001$) between nurses' total practice level pre and post video-assisted teaching intervention

Table (5) clarified nurses' practice regarding femoral arterial blood gas sampling pre and post video-assisted teaching intervention and reported that there were highly statistically significant differences ($P < 0.001$) between nurses' total practice level pre and post video-assisted teaching intervention.

Table (6) cleared nurses' total practice regarding arterial blood gas sampling pre and post video-assisted teaching intervention and indicated that the majority (82.9%) of the studied nurses had incompetent level of practice pre video-assisted teaching intervention while the majority (88.6%) of them had a competent level of practice post video-assisted teaching intervention.

Table (7) clarifies the relation between nurses' total knowledge scores and their personnel characteristics. It was found that there is a statistically significant relation between the studied nurses' total knowledge scores and their age, academic qualification, and years of experience ($P < 0.05^*$).

Table (8) clarifies the relation between nurses' total practice scores and their personnel characteristics. It was found that there is a highly statistically significant relation between the studied nurses' total practice scores and their age, academic qualification, and years of experience ($P < 0.05^*$).

Table (9) reveals a correlation between the total knowledge score and total practice score of the studied nurses at pre and post video-assisted teaching intervention. It is obvious that there is a statistically significant positive correlation between studied nurses' total knowledge scores and total practice scores at the post video-assisted teaching intervention ($p < 0.001^{**}$).

Table (1): Frequency and percentage distribution of the studied nurses according to their characteristics (n=70).

Nurses' personal characteristics	No.	%
Less than 20	4	5.7
20->25	26	37.2
25->30	22	31.4
30-≥35	18	25.7
Mean ±SD	24.51±6.82	
Academic qualifications		
Bachelor of nursing science	12	17.1
Technical Institute of nursing	31	44.3
Diploma of secondary nursing school	27	38.6
Years of experience at PICU		
Less than two years	4	5.7
2->5	22	31.4
5->8	29	41.4
≥ 8 years	15	21.5
Work settings		
Benha University Hospital	38	54.3
Benha Specialized Pediatric Hospital	32	45.7

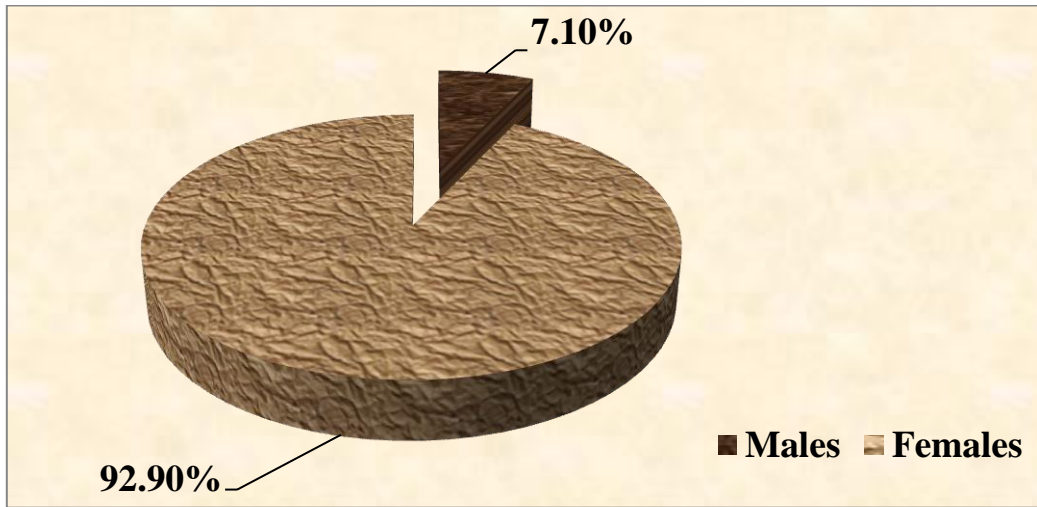


Figure (1): Percentage distribution of the studied nurses according to their gender (n=70).

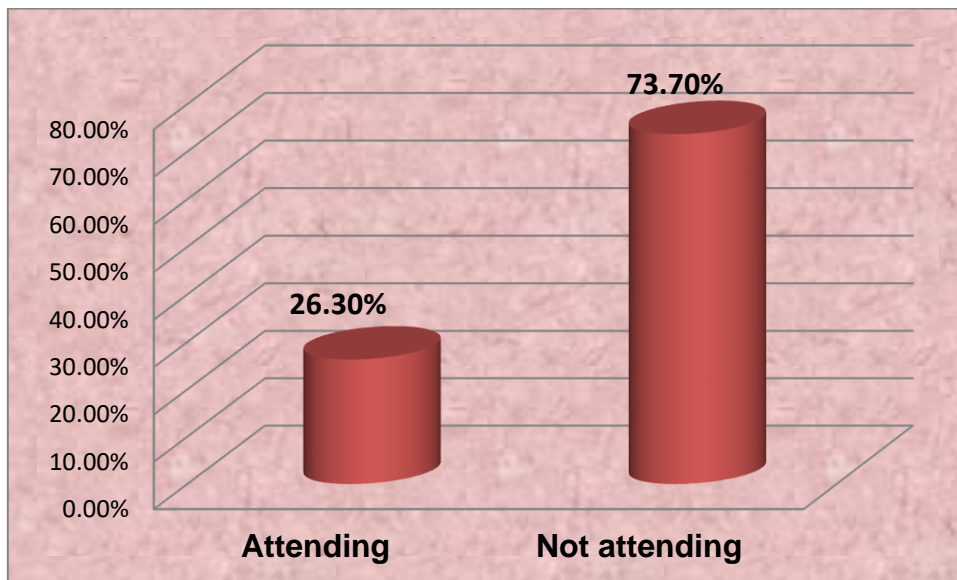


Figure (2): Percentage distribution of the studied nurses according to their attendance to training courses regarding ABG sampling (n=70).

Table (2): Percentage distribution of children according to their characteristics (n=42).

Children's characteristics	No	%
Age		
<3years	6	14.2
3-> 6years	15	35.8
6-> 9 years	12	28.6
≥ 9 years	9	21.4
Mean ±SD	10.56±9.24	
Gender		
Male	18	42.8
Female	24	57.2
Current weight in kilograms		
10-18 kg	8	19.1
19-27 kg	17	40.5
28-35 kg	11	26.2
≥36 kg	6	14.2
Mean ±SD	11.16±9.58	

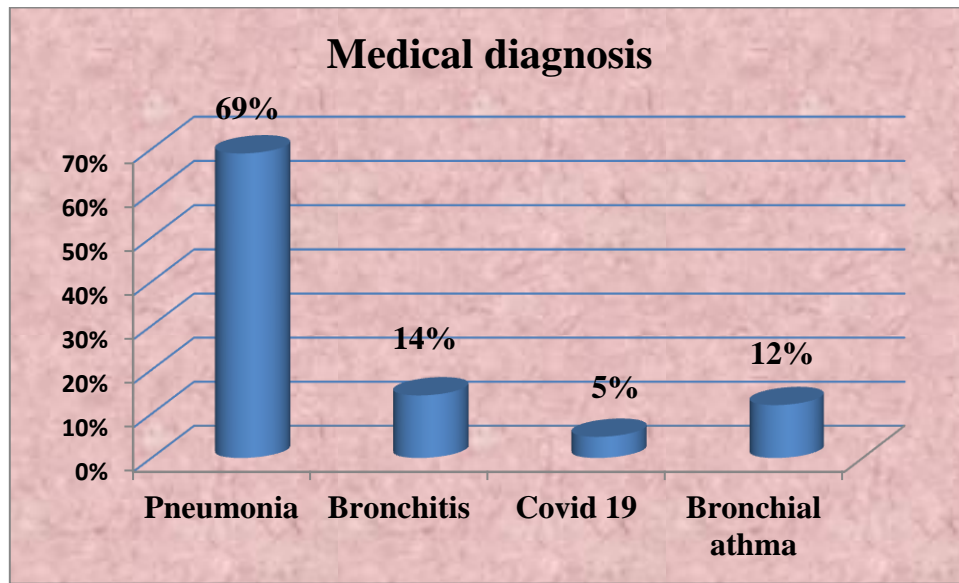


Figure (3): Percentage distribution of children according to their medical diagnosis (n=42).

Table (3): Percentage distribution of the studied nurses’ total knowledge regarding ABG sampling pre and post video-assisted teaching intervention (n=70).

Items	Pre video-assisted teaching intervention (n=70)		Post video-assisted teaching intervention (n=70)		X ²	P-value
	No	%	No	%		
Total knowledge level						
Good (≥75 %)	11	15.7	48	68.6	38.954	P<0.05*
Average (60 >75%)	25	35.7	17	24.3		
Poor (<60%)	34	48.6	5	7.1		

*A statistical significant at P value P<0.05.

Table (4): Percentage distribution of the studied nurses’ total practice regarding radial arterial blood gas sampling withdrawal pre and post video-assisted teaching intervention (n=70).

Practice Items	Pre video-assisted teaching intervention (n=70)				Post video-assisted teaching intervention (n=70)				X ²	P-value
	Competent practice		Incompetent practice		Competent practice		Incompetent practice			
	No	%	No	%	No	%	No	%		
Radial arterial blood gas sampling withdrawal procedure										
Pre the procedure	16	22.8	54	77.2	66	94.3	4	5.7	49.372	0.000**
During the procedure	13	18.6	57	81.4	64	91.4	6	8.6		
After the procedure	11	15.7	59	84.3	61	87.2	9	12.8		
Total	13	18.6	57	81.4	63	90.0	7	10.0		

**Highly statistically significant at P value <0.001.

Table (5): Percentage distribution of the studied nurses' total practice regarding femoral arterial blood gas sampling pre and post video-assisted teaching intervention (n=70).

Practice Items	Pre video-assisted teaching intervention (n=70)				Post video-assisted teaching intervention (n=70)				X ²	P-value
	Competent practice		Incompetent practice		Competent practice		Incompetent practice			
	No	%	No	%	No	%	No	%		
Femoral arterial blood gas sampling withdrawal procedure										
Pre the procedure	11	15.7	59	84.3	58	82.9	12	17.1	47.581	0.000**
During the procedure	12	17.1	58	82.9	60	85.7	10	14.3		
After the procedure	10	14.3	60	85.7	64	91.4	6	8.6		
Total	11	15.7	59	84.3	61	87.1	9	12.9		

**Highly statistically significant at P value <0.001.

Table (6): Percentage distribution of the studied nurses' total practice regarding arterial blood gas sampling pre and post video-assisted teaching intervention (n=70).

Items	Pre video-assisted teaching intervention (n=70)		Post video-assisted teaching intervention (n=70)		X ²	P-value
	No	%	No	%		
Total practice level						
Competent practice (≥ 85)	12	17.1	62	88.6	45.131	0.000**
Incompetent practice (< 85)	58	82.9	8	11.4		

**Highly statistically significant at P value <0.001.

Table (7): Relation between nurses' total knowledge scores and their personal characteristics pre and post video-assisted teaching intervention (n=70).

The total score of nurses' knowledge and their characteristics	Pre video-assisted teaching intervention (n=70)						Post video-assisted teaching intervention (n=70)						X ²	P-Value
	Good (n=11)		Average (n=25)		Poor (n=34)		Good (n=48)		Average (n=17)		Poor (n=5)			
	No	%	No	%	No	%	No	%	No	%	No	%		
Age/ Years:														
Less than 20	0	0.0	0	0.0	4	11.7	0	0.0	3	17.6	1	20.0	35.7	P<0.05*
20->25	2	18.2	4	16.0	20	58.9	16	33.3	7	41.2	3	60.0		
25->30	4	36.3	12	48.0	6	17.7	15	31.3	6	35.3	1	20.0		
30-≥35	5	45.5	9	36.0	4	11.7	17	35.4	1	5.9	0	0.0		
Academic qualifications														
Bachelor of nursing science	5	45.5	4	16.0	3	8.8	7	14.6	4	23.5	1	20.0	33.8	P<0.05*
Technical Institute of nursing	4	36.3	13	52.0	14	41.2	25	52.1	4	23.5	2	40.0		
Diploma of secondary nursing school	2	18.2	8	32.0	17	50.0	16	33.3	9	53.0	2	40.0		
Years of experience at PICU														
Less than two years	0	0.0	3	12.0	1	2.9	2	4.2	1	5.9	1	20.0	36.3	P<0.05*
2->5	1	9.1	4	16.0	17	50.1	13	27.1	6	35.3	3	60.0		

5->8	6	54.5	10	40.0	13	38.2	20	41.6	8	47.1	1	20.0		
≥ 8 years	4	36.4	8	32.0	3	8.8	13	27.1	2	11.7	0	0.0		
Work settings														
Benha University Hospital	7	63.6	15	60.0	16	47.0	26	54.2	10	58.8	2	40.0	28.9	P>0.05
Benha Specialized Pediatric Hospital	4	36.4	10	40.0	18	53.0	22	45.8	7	41.2	3	60.0		

*A statistical significant at P value P<0.05

No statistical significant at P value P>0.05.

Table (8): Relation between nurses' total practice scores and their personal characteristics pre and post video-assisted teaching intervention (n=70).

The total score of nurses' practices and their characteristics	Pre video-assisted teaching intervention (n=70)				Practices Post video-assisted teaching intervention (n=70)				X ²	P-Value
	Competent (n=12)		Incompetent (n=58)		Competent (n=62)		Incompetent (n=8)			
	No	%	No	%	No	%	No	%		
Age/ Years										
Less than 20	0	0.0	4	6.9	2	3.2	2	25.0	47.91	P<0.05*
20->25	3	25.0	23	39.6	23	37.2	3	37.5		
25->30	5	41.7	17	29.4	20	32.2	2	25.0		
30->35	4	33.3	14	24.1	17	27.4	1	12.5		
Academic qualifications										
Bachelor of nursing science	5	41.7	7	12.1	10	16.1	2	25.0	44.25	P<0.05*
Technical Institute of nursing	5	41.7	26	44.8	28	45.2	3	37.5		
Diploma of secondary nursing school	2	16.6	25	43.1	24	38.7	3	37.5		
Years of experience at PICU										
Less than two years	0	0.0	4	6.9	2	3.2	2	25.0	42.61	P<0.05*
2->5	2	16.7	20	34.5	18	29.1	4	50.0		
5->8	6	50.0	23	39.6	27	43.5	2	25.0		
≥ 8 years	4	33.3	11	19.0	15	24.2	0	0.0		
Work settings										
Benha University Hospital	7	58.3	31	53.4	33	53.2	5	62.5	26.04	P>0.05
Benha Specialized Pediatric Hospital	5	41.7	27	46.6	29	46.8	3	37.5		

*A statistical significant at P value P<0.05

No statistical significant at P value P>0.05.

Table (9): Correlation between total knowledge score and total practice score of the studied nurses pre and post video-assisted teaching intervention (n=70).

Variables	Pearson correlation coefficient			
	Total knowledge score			
	Post video-assisted teaching intervention (n=70)		Pre video-assisted teaching intervention (n=70)	
	r	P	r	P
Total practice score	.461	.000**	.628	.000**

** Correlation is significant at the 0.01 level

6. DISCUSSION

Arterial blood gases (ABG) sampling is currently the standard for determining acid-base status and oxygenation of children in the intensive care unit (*Kavitha, 2016*). Blood gases are the most common tests done for ventilated children. Moreover, arterial blood gas sampling has become an integral part of nurse's role when caring for the ventilated children. Through effective training, a nurse can learn the clinical skills required to obtain ABG sample for recognizing any abnormalities and take corrective action (*Sabaq et al., 2019*).

Video technology is becoming more popular because it has unique features that capture accurately the nature of nursing phenomena. Moreover, video technology is used extensively in nursing as an educational tool that is useful because it provides continuous multi-media, multisensory information about the topic and its context (*Balasubramanian et al., 2018*).

The present study was quasi-experimental included 70 nurses from Benha University Hospital and Benha Specialized Pediatric Hospital who worked at Pediatric Intensive Care Units (PICUs). This study aimed to evaluate the effect of video-assisted teaching intervention on nurses' knowledge and practice regarding arterial blood gases sampling for ventilated children at pediatric intensive care units

Regarding the characteristics of the studied nurses, the results of the present study revealed that the mean age of the studied nurses was 24.51 ± 6.82 years. This finding may be due to the appointment of new staff from newly graduated nurses each year in the hospital. This finding agrees with *Vahedian-Azimi et al., (2021)* in a study about the "Effect of the specific training course for competency in doing arterial blood gas sampling in the intensive care unit: developing a standardized learning curve according to the procedure's time and socio-professional predictors" who found that the mean age of the studied nurses was 24.6 ± 1.5 . From the researchers' point of view; young age nurses currently experience a stressful transition into the workforce; so that, the perceptions and needs of young nurses must be considered in order to ensure effective succession planning.

This finding disagrees with *Safwat & Khorais, (2018)* in a study about the "Effectiveness of a computer-based learning module on arterial blood gas interpretation among staff nurses in critical care units". The study found that the mean age of nurses was 28.67 ± 4.23 this may be due to different study samples and settings.

As regards the gender of the studied nurses, the present study revealed that the majority of studied nurses were females. This could be due to the fact that the profession of nursing in Egypt was mostly feminine. This finding was in the same context as *Padma et al., (2017)*, who conducted a study to assess the knowledge regarding arterial blood gases sampling among staff nurses in Nellore and found that, the majority of staff nurses were female.

Regarding nurses' academic qualifications, the present study revealed more than two-fifths of them had a technical institute of nursing. This result might be related to that the technical institute of nursing provides the community with a large number of nurses This finding supported by *Abd Elkader et al., (2020)*, in a study about "Effect of applying program based learning on nurse's performance and self-efficacy regarding arterial blood puncture" who found that 48.6% had technical institute of nursing.

Regarding years of experience for studied nurses, the present study revealed that more than two-fifths of the studied nurses had five to less than eight years of experience. This result probably may be due to the young age of the studied nurses. The decreases in years of nurses' experience have a negative effect on their performance regarding provided care for ventilated children. The study finding disagrees with *Abd-Elbaky et al., (2018)* in a study about the "Impact of a simulated education program on nurses' performance of invasive procedure at intensive care units," who showed that the majority of the studied nurses had less than five years of experience.

The present study showed that less than three quarters of the studied nurses did not attain training programs regarding ABG sampling. This result agreed with *Safwat & Khorais, (2018)* who revealed that 80 % of nurses not attended any training course related to ABG sampling and stated that critical care nurses are required to have specialized skills and knowledge to enable them to critically think rapidly in life-threatening situations. One of the most specific skill sets that it is foundational for critical care nurses to be able to competently practice ABG sampling.

Regarding the total knowledge of studied nurses about ABG sampling, the result of the present study showed that more than two-thirds of the studied nurses had good knowledge after video-assisted teaching intervention compared to less than half who had poor knowledge pre video-assisted teaching intervention with a statistically significant difference pre and post video-assisted teaching intervention. This finding supported by *Abd Elkader et al., (2020)*, who reflected that a statistically significant difference between total nurses' knowledge regarding ABG pre and post program based-learning implementation.

In the same context this finding supported by *Subin, (2017)* in a study about "Assessing the effect of video-assisted teaching on knowledge regarding arterial blood gas analysis and interpretation among nurses working in selected hospitals in Bhopal" who reported that there is a significant difference in pre and post video-assisted teaching intervention regarding knowledge level of selected staff nurses.

Also, this finding goes in the same line with *Kaur, & Charan, (2018)* who carried out a study about "Effectiveness of structured teaching program on knowledge and practice regarding arterial blood gases among intensive care unit nurses" and found that the majority of nurses had adequate knowledge and practice post- implementation of the program based learning regarding arterial blood puncture.

On the same line *Manju & Prasad, (2013)* who conducted a comparative study to assess the effectiveness of video-assisted versus lecture cum demonstration method of teaching on bag technique among second-year BSc nursing students in a selected nursing colleague at Mangalore and stated that video-assisted teaching module was a more effective method for nurses' education.

Concerning nurses' total practice regarding ABG sampling, the present study portrayed that the majority of the studied nurses who had competent level post video-assisted teaching intervention compared with the minority of them had competent level pre video-assisted teaching intervention. This finding may be due to the applicable scientific and technological advances as video-assisted teaching intervention lead to the obsolescence of professional skills in a short period of time. Therefore, a comprehensive basic professional preparation is no longer sufficient for nurses' practice. This finding was matched with *Kaur & Charan, (2018)* who showed that the majority of the studied nurses had a good score of practice in the post-test phase. Considering the rapid progress of training techniques for nursing education should be updated and efficient.

It was evident from the current study that, there was a significant relation between nurses' knowledge total scores and their personal characteristics at pre and post video-assisted teaching intervention. This finding was supported by *Mathew et al., (2014)* who carried out a study about "the effectiveness of structured teaching program regarding arterial blood gases sampling in terms of knowledge among nurses working in ICU" and found that there was a significant relation between nurses' knowledge scores and their personal characteristics at the pre and post- program phase.

In the same context this finding supported by *Sehrawat et al., (2019)* in a study about "Assessment of knowledge regarding arterial blood gases analysis among staff nurses working in selected hospital" who found that age, educational status, working area, and year of experience had significant association with knowledge score.

Finally, the current study revealed that there was a significant positive statistical correlation between nurses' knowledge and practices scores pre and post video-assisted teaching intervention. This might be attributed to the more time of ABGs sampling education could help the nurses to enhance their knowledge and improve their abilities to perform ABGs effectively as the researchers sent videos to their e-mail. This finding was on the same line with the study done by *Safwat & Khorais, (2018)* who revealed that there was a significant positive correlation between nurses' knowledge and practices at the post-program phases ($p < 0.001$).

7. CONCLUSION

Based on the results of the present study, it can be concluded that there is an improvement in the knowledge and practice level of nurses which indicates that the video-assisted teaching intervention is effective.

8. RECOMMENDATIONS

Based on the results of the current study, the following recommendations can be suggested:

- Development of a training program should be conducted periodically with various teaching methods for nursing staff in PICUs to improve their knowledge and practice regarding arterial blood gases.
- The hospitals should develop evidence- based guidelines on arterial blood gases to be available for all nurses in order to follow.
- Guideline protocol should be organized and available for the nurses in the Arabic language to guide them in dealing with ventilated children in the intensive care units.

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