Effect of Educational Guidelines on Nurses' Performance Regarding Arterial Blood Gases Sampling and Interpretation

Fatma Alzahraa Mahmoud Mohammed[1], Amany Mohamed Safwat[2], Dina Mohamed Maarouf [3,]

[1]B.Sc. Faculty of Nursing- Mansoura University

[2]Professor of Critical Care Nursing, Faculty of Nursing- Ain Shams University

[3] Assistant professor of Critical Care Nursing, Faculty of Nursing- Ain Shams University

Faculty of Nursing - Ain Shams University

Abstract

Background: Arterial blood gas analysis is a vital diagnostic tool used in the medical field to assess a patient's respiratory and metabolic status **Aim of the study:** The study aimed to assess the effect of educational guidelines on nurses' performance regarding arterial blood gases sampling and interpretation **Design:** A Quasi experimental research (pre/post test) design was utilized in this study . .**Setting:** The study was carried out at the Intensive Care Units of Emergency Hospital at Mansoura University. **Subjects:** A convenient sample of all available nurses (50) working at the Intensive Care Units of Emergency Hospital at Mansoura University **Tools**: **tool I** Nurses Self-administered questionnaire consists of two parts **part 1:** Demographic characteristics of nurses, **part 2:** Nurses' knowledge Assessment Questionnaire. **Tool II:** Nurses' practice Observational checklist for ABG sampling. **Results:** More than two third, 70.0 % of nurses had satisfactory level of total knowledge regarding arterial blood gases sampling and interpretation post - educational guidelines implementation. Also, the majority, 96.0% of them had satisfactory level of total practice regarding arterial blood gases sampling and interpretation post educational guidelines implementation. **Conclusion:** Based on the results of the present study it can be concluded that the educational guidelines were found to be highly effective method to improve the nurses' knowledge and practice related arterial blood gases sampling and interpretation guidelines**. Recommendations:** Based on the current study finding: the following recommendation was proposed: Create online platforms where healthcare professionals can share their experiences, knowledge, and practices regarding arterial blood gases sampling and interpretation.

Keywords: Educational Guidelines, Nurses' performance, Arterial blood gas

Introduction:

Blood gas analysis is a vital diagnostic tool used in the medical field to assess a patient's respiratory and metabolic status. It involves measuring the levels of oxygen (O2) and carbon dioxide (CO2) in the blood, as well as the acidity (pH) and the bicarbonate (HCO3-) concentration. Blood gas analysis is typically performed using a blood sample drawn from an artery, most commonly the radial artery in the wrist or the femoral artery in the groin. Arterial blood is preferred over venous blood because it more accurately reflects the oxygen and carbon dioxide levels in the body *(Abd Elaziz et al., 2021).*

Arterial blood gas analysis is a basic laboratory test and essential investigation for assessing clinical oxygenation and acid-base status in critically ill patients, providing information about ventilation, oxygenation, and acid-base status. Also, these parameters provide crucial information about the efficiency of the respiratory and metabolic systems, allowing healthcare professionals to diagnose and monitor a wide range of medical conditions *(Chaney and Emmady, 2022).*

This diagnostic test plays a vital role in various medical settings, including hospitals, emergency departments, intensive care units, and respiratory care units. Overall, blood gas analysis is an indispensable tool that aids medical professionals in making accurate diagnoses and delivering optimal care to patients with respiratory and metabolic imbalances *(Ibrahem et al, 2021).*

Interpreting ABG results requires an understanding of normal ranges for each parameter and their relationships to each other. Deviations from the normal ranges can indicate various respiratory and metabolic disorders, such as respiratory acidosis, respiratory alkalosis, metabolic acidosis, and metabolic alkalosis. Healthcare professionals, including doctors,

nurses, and respiratory therapists, use ABG analysis to tailor treatment plans, adjust ventilator settings, and monitor the progress of patients with conditions such as chronic obstructive pulmonary disease (COPD), acute respiratory distress syndrome (ARDS), kidney disorders, and more *(Neder et al., 2020).*

Nurses are playing a vital role in early detection, intervention, and ongoing management of patients at high risk for acid-base imbalances in critical care units. Their comprehensive understanding of acid-base balance, along with their skills in medication administration, oxygen therapy, and mechanical ventilation, ensures that patients receive timely and effective care. Moreover, nurses are well-equipped to monitor therapeutic responses and potential risks associated with these interventions, especially in extreme cases that require complex compensation strategies *(Kler et al., 2020).*

Nurses are often the first member of the healthcare team to see ABG results and are playing a bigger role in the realm of blood gas analysis within the work area. A critical care nurse is the first healthcare profession who receives ABG results, and monitor any changes in the ABG results during the patient's hospitalization so, nurses play an important role in early detection of high-risk patients with acid base imbalance. The nurses take an active part in collecting ABG samples, interpreting ABG so educating the staff nurses regarding ABG Analysis help them to develop and refine their existing skill and knowledge, which would lead to improvement in quality *(Yee et al., 2022).*

Significance of the study

Arterial blood gases analysis is an essential part of diagnosing and managing a patient's oxygenation status and acid-base balance. The usefulness of this diagnostic tool is dependent on being able to correctly interpret the results. Arterial blood gas interpretation is best approached systematically. Interpretation leads to an understanding of the degree or severity of abnormalities, whether the abnormalities are acute or chronic, and if the primary disorder is metabolic or respiratory in origin   *(Abd Elkader et al., 2020).*

Nurses are essential members of the healthcare team to manage arterial blood gases. Their responsibilities range from proper sample collection and interpretation, decision-making,

ongoing monitoring, and patient education. Effective collaboration and communication among nurses and other healthcare professionals are essential for optimal patient care *(Ragab & Mohamed, 2022).*

Aim of the study

The study aimed to assess the effect of educational guidelines on nurses' performance regarding arterial blood gases sampling and interpretation through the following:

- Assess nurses' level of knowledge regarding arterial blood gases sampling and interpretation.
- Assess nurses' level of practice regarding arterial blood gases sampling.
- Design and implement educational guidelines regarding arterial blood gases sampling and interpretation.
- Evaluate the effect of the educational guidelines on the nurses' performance regarding arterial blood gases sampling and interpretation.

Research hypothesis

This study was hypothesized that, an implementation of an educational guidelines regarding arterial blood gases sampling and interpretation would affect positively on nurses' performance.

Subjects and Methods:

I- Technical Design:

The technical design used for the study includes research design, setting of the study, sampling and tools for data collection.

Research design:

Quasi experimental research design (pre/post test) was conducted in this study.

Study Setting:

The present study was conducted at the Intensive Care Units of Emergency Hospital at Mansoura University which consist of three units (surgical ICU I, surgical ICU II and surgical ICU III).

Sample:

The subjects of the present study included: A convenient sample of all available nurses (50) working at the previous mentioned setting.

Tools of data collection:

Data was collected through the following two main tools:

Tool   I   (Nurses   Self-administered questionnaire):

This tool was developed by the investigator in an Arabic and English languages based on the review of relevant recent literature *Rabi, Derek Kowal & Ambalavanan (2016) , Akhtar & Hull (2018) and Holley (2019).*It consisted of two tools:

1. **Demographic Characteristics of Nurses' sheet:** it included; age, gender, marital status, educational level, years of experience, and previous training courses.

2. **Nurses' knowledge Assessment Questionnaire** It included 42 questions in the form of multiple-choice questions (MCQs). These questions divided as the following:
   o Questions related to definition: questions (1-4).
   o Questions related to sites of ABG insertion: questions (5-6).
   o Questions related to contraindication: question 7.
   o Questions related to nursing care for ABG withdrawal: questions (8-15).
   o Questions related to complications: question 16.
   o Questions related to interpretation: questions (17-42) which included questions related to normal levels, abnormal levels and questions related to respiratory acidosis, respiratory alkalosis, metabolic acidosis and metabolic alkalosis.

Scoring system: The correct answer scored "1" mark, while the incorrect answer scored zero. The total score for the questionnaire was 42 grades. Score less than 80% was considered unsatisfactory, and the score equal to or more than 80 % was considered satisfactory.

Tool II (Nurses' practice Observational checklist for ABG sampling): it developed by the researcher after reviewing recent related literatures *Hennessey & Japp (2016) , Kaur & Charan (2018) and Sharma (2019).* It composed of 26 steps that divided into 3 subitems (before sampling which included 9 items, radial and femoral sampling which included 10 items and after sampling which included 7 items).

Scoring system: Done step was given "1" mark, while not done step or done incorrectly was given "zero." The total score for the checklist was 26 grades. Score less than 80%

was considered unsatisfactory level of practice, and the score equal to or more than 80 % was considered a satisfactory level of practice.

Operational Design:

The operational design included preparatory phase, content validity, a pilot study, ethical consideration and field work.

Preparatory phase:

It included reviewing of related literature and theoretical knowledge of various aspects of the study using textbooks, articles, periodicals, and journals to develop tools for data collection.

Pilot study:

A pilot study was carried out on five nurses (10%) who were included in the study subjects to test feasibility, applicability, and clarity of the tools, and no modifications were done.

Content validity:

It was conducted to determine whether it covers the aim of the study or not. It was tested through a panel of 6 expertise, four lecturer, and two assistant professors of critical care and emergency nursing at Ain-Shams University, who review the tool to ensure its validity for comprehensiveness, accuracy, clarity, and relevance.

Content reliability:

Reliability test of the developed tools was tested to determine the extent to which the tool items are related to each other. The alpha Cronbach's model test, which is a model of internal consistency, was used to measure the internal consistency of two tools in the current study. Cronbach alpha assessed for knowledge and practice shows excellent reliability of 0.988& 0.964, respectively.

Fieldwork:

-   Official permission was obtained from the Emergency Hospital of Mansoura University in which the study was conducted.
-   The actual work of this study started and completed within three-months period, beginning in February (2023) and ending in April (2023). Data were collected by the researcher three days per week, in the morning and afternoon shifts in the previously mentioned settings.
-   The purpose of the study was explained to the studied nurses who agreed to participate in the study before data collection.

- Prior to data collection, the investigator visited the intensive care units at the previously mentioned settings to collect baseline data, explain the purpose of the study, and obtain written permission from the nurses to participate in the study.
- The nurses were then assured that the information collected would be treated confidentially and would be used only for the study.
- The nurses' performance (knowledge and practice) regarding arterial blood gas were evaluated using a structured questionnaire sheet and observational checklist (pre- post educational guidelines implementation) in the following phases: assessment, planning, implementation, and evaluation.

A- The assessment and planning phase:

The Knowledge Assessment Questionnaire (Tool I) was used to test nurses' knowledge regarding arterial blood gas sampling and interpretation. This instrument was a self-administered questionnaire provided to the nurses at their job; each questionnaire took around 30 minutes to be completed. To achieve the most realistic observations of the nurses' practices, the investigator used Tool II (nurses' observational checklist). This phase completed at 3 weeks. Maximum three nurses were observed per day during arterial blood gases sampling.

B- Implementation phase:

This period lasted roughly six weeks. The investigator developed teaching materials for the nurses under study. The teaching guidelines were prepared and provided to the nurses in the form of a booklet, which was discussed to the nurses after the pretest questionnaire.

The investigator conducted the educational guidelines for the studied nurses The educational guidelines were designed and presented to the nurses in a form of booklet that explained to nurses after pretest questionnaire done. The nurses were divided into 10 sub-groups (5 in each) to explain the booklet content that represented in 5 chapters which contains (introduction of acid base balance, definition of arterial blood gases, importance of ABG analysis, indications of ABG analysis, steps of ABG sampling, complications of ABG analysis, contraindications of ABG analysis, interpretation of ABG analysis result and acid base imbalance); each group included 5 nurses, and each session lasted approximately two

hours for theoretical and practical contents; however, these hours were often extended owing to questions and discussion to meet the goal of these sessions. The educational sessions were scheduled throughout the morning and afternoon shifts 3 days/week to ensure that all nurses could attend at a time that was convenient for them. The educational guidelines implementation took approximately 6 weeks to be completed. During the educational sessions, a variety of training methods were used, including lectures, question-and-answer techniques, group discussions, demonstrations, and redemonstrations.

C-Evaluation phase:

After implementation the educational guidelines the post- tests were administered to assess nurses' performance (knowledge & practice) by using the same tools of the pretest. This helped to evaluate the effect of implemented guidelines. This was done immediately after the intervention.

III. Administrative Design:

The necessary approval was obtained from the hospital director. A letter was issued to them from the Faculty of Nursing, Ain Shams University explaining the purpose of the study to obtain permission for conducting this study.

Ethical considerations:

An approval of the study protocol was obtained from the Research Ethics Committee of Faculty of Nursing-Ain Shams University before starting the study.

The researcher clarified the objectives and the aim of the study to the nurses included in the study. The researcher assured maintaining anonymity and confidentiality of the subject data. Nurses were informed that they could choose to participate or not in the study, and they have the right to withdraw from the study at any time without giving any reasons.

IV. Statistical Design:

Data analysis was performed by SPSS software, version 25 (SPSS Inc., PASW statistics for windows version 25. Chicago: SPSS Inc.). Qualitative data were described using number and percent. Quantitative data were described using mean± Standard deviation for normally distributed data after testing normality using Kolmogrov-Smirnov test.

Significance of the obtained results was judged at the (≤ 0.05) level. McNemar test was

used to compare qualitative data pre and post - treatment. The Spearman's rank-order correlation is used to determine the strength and direction of a linear relationship between two non-normally distributed continuous variables. Multiple linear regression was used to assess predictors of continuous normally distributed outcome with calculation of R2.

Results:

Table (1): illustrated that 66% of the studied nurses aged less than 35 years with mean age ranged from 19 to 41 years and 76% of them were females. Educational level of the studied nurses were distributed as following; 38% bachelor, 32% institutional and 30% diploma. Of the studied nurses; 82% were married, 56% had experience from 5 to 10 years and 12% had previous training.

Table (2): showed statistically significant increase in satisfactory level of nurses' total knowledge changed from 48% to 70% pre and post educational guidelines implementation at p<0.001.

Table (3): showed statistically significant increase in satisfactory level of total nurses' practice from 44% to 96% pre and post educational guidelines implementation at p<0.001.

Table (4): illustrates that nurses' marital status and previous training are statistically significant predictors of knowledge post educational guidelines implementation with 92.1% of knowledge score post educational guidelines implementation is predicted by combination of the previous 2 factors (R^2 =0.921) with the following prediction equation; Knowledge post-intervention =32.94 +0.272*marital status - 0.664*Previous training

Table (5): demonstrates predictors of practice post educational guidelines implementation among studied nurses and illustrates that previous training is statistically significant predictor with 75.3% of poor practice could be predicted by receiving previous training (R^2 =0.753) with the following prediction equation; Practice post-intervention =25.88 - 0.752*previous training.

Table (6) shows that there is total positive correlation between total score of knowledge and practice pre and post educational guidelines implementation.

Table (1): Frequency and percentage distribution of the studied nurses regarding their demographic characteristics (N = 50)

Items	N=50	%
Age group		
<35	33	66.0
≥35	17	34.0
Age/ years		
Mean ±SD	32.02±5.68	
Gender		
Male	12	24.0
Female	38	76.0
Educational level		
Institutional	16	32.0
Diploma	15	30.0
Bachelors	19	38.0
Marital status		
Single	9	18.0
Married	41	82.0
Experience (years)		
≤5	11	22.0
5-10	28	56.0
>10	11	22.0
Previous training		
No	44	88.0
Yes	6	12.0

Table (2): Relation between percentage distribution of total nurses' level of knowledge regarding arterial blood gases sampling and interpretation pre and post educational guidelines implementation (N=50).

Knowledge	Pre-intervention		Post -intervention		*p value*
	N=50	%	N=50	%	
Unsatisfactory	26	52.0	15	30.0	MC-Nemar test
Satisfactory	24	48.0	35	70.0	p<0.001*
Mean ±SD	25.82±15.70		39.16±6.41		

Table (3): Assessment the total score of nurses' level of practice regarding arterial blood gases sampling pre and post educational guidelines implementation (N=50).

Total practice score	Pre-intervention		Post -intervention		*p value*
	N	%	N	%	
Unsatisfactory	28	56.0	2	4.0	MC-Nemar test
Satisfactory	22	44.0	48	96.0	p<0.001*
Mean ±SD	17.82±7.61		25.46±1.96		

Table (4): Multiple linear regression for the most predictive factors regarding knowledge of post educational guidelines implementation among studied nurses (n=50).

	B	T	p value	95% Confidence Interval for β	
				Lower Bound	Upper Bound
(Constant)	32.943	5.331	.001*	20.480	45.407
Age / Years	.017	.222	.825	-.159	.198
Sex	-.036	-.430	.669	-3.015	1.955
Education	.010	.107	.915	-1.413	1.571
Marital status	.272	2.220	.032*	.413	8.589
Experience duration(years)	-.029	-.293	.771	-2.188	1.633
Previous training	-.664	-6.849	.001*	-16.786	-9.149
F=39.95 P<0.001* R2=0.921					

Table (5): Multiple linear regression for the most predictive factors regarding practice post educational guidelines implementation among studied nurses(n=50).

	B	T	p value	95% Confidence Interval for β	
				Lower Bound	Upper Bound
(Constant)	25.88	8.122	.001*	19.459	32.314
Age / years	.010	.072	.943	-.089	.095
Sex	.001	.009	.993	-1.276	1.287
Education	.002	.015	.988	-.764	.775
Marital status	.000	.001	.999	-2.107	2.109
Experience duration(years)	-.005	-.032	.974	-1.001	.970
Previous training	-.752	-4.603	.001*	-6.464	-2.525
F=9.40 P<0.001* R2=0.753					

Table (6): Correlation between total score of knowledge and practice pre and post educational guidelines implementation.

	Practice	
Knowledge	Pre	Post
	r=0.966 p<0.001*	r=0.924 p<0.001*

Discussion:

Arterial blood gas (ABG) sampling is a critical aspect of delivering high-quality healthcare, especially in the management of patients with respiratory and metabolic disorders. Nurses play an important role in early detection of high-risk patients with acid base imbalance in critical care units. In extreme circumstances in which therapeutic compensation is required, the nurse should be knowledgeable about potential risks of this therapy and able to carefully monitor administration rates and therapeutic responses **(Ibrahem et al, 2021).** The current study aimed to assess the effect of educational guidelines on nurses' performance regarding arterial blood gases sampling and interpretation.

The current study showed that more than two thirds of the studied nurses are aged less than 35 years with mean age ranges from 19 to 41 years. This result may be due that more than half of them newly graduated. This result agreed with the study by **Kaur and Charan, (2018)** entitled "A study to assess the effectiveness of STP on knowledge and practice regarding ABGs among ICU nurses in selected hospitals at Jalandhar, Punjab" who found that two thirds of the studied were found in the age group 21-25years.

According to gender, the current study showed that more than three quarter the studied nurses were females. This could be due to the fact that the profession of nursing in Egypt was mostly feminine, additionally male nurses prefer to travel abroad or working in private hospitals for high salary outcome. This finding is consistent with the study by **Vahedian-Azimi et al, (2021)** who found that most of the studied sample were females in the study entitled "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".

Regarding educational level of the studied nurses, the current study showed that more than one third had bachelor's degree. This finding represent increased flow to the faculty because of cancelling the school of nursing. This result partially congruent with the result of **Kaur and Charan, (2018)** who found most of the nurses were qualified as general nursing and midwifery and minority of them had bachelor's degree.

Also, this result congruent with the study by, **Safwat and khorais, (2018)**, who conducted a study about "Effectiveness of a computer-based learning module on arterial blood gas interpretation among staff nurses in critical care units" and found that, two thirds of the studied subjects were having bachelor's degree, and the rest were diploma.

As regards to experience years of the studied nurses, the current study revealed that more than half of the study sample had experience ranging from 5 to 10 years. This may be related to their age which was between 19 to 41 years. This result is consistent **Kaur and Charan, (2018)** who revealed that two thirds of the study sample had 2-4 years of experience.

The minority of the studied nurses had previous training in the current study. This reflected the unsatisfactory level of nurse's knowledge at the pre- program phase, this result inconsistent with the study, by **Upreti and Mishra, (2020)** entitled "Effectiveness of planned teaching program on knowledge and practice regarding arterial blood gas analysis and its interpretation among staff nurses working in critical care quantitative research approach." and found more than two thirds of the studied nurses attended workshops about arterial blood gas analysis and its interpretation.

Regarding satisfactory level of total knowledge of the studied nurses pre and post educational program. the current study showed that, there were statistically significant differences between number and percent scores of the pre and post-tests, satisfactory knowledge changed from less than half of the studied sample to more than two third pre and post educational guidelines implementation so, the educational guidelines implementation had significant positive effect on the studied nurses' level of knowledge post implementation of the educational guidelines compared to the preprogram level.

The researcher explication for nurses' unsatisfactory level of knowledge pre the educational program implementation that the years of experience of more than one fifth of studied nurses were less than 5 years, and the nurses didn't attend any in-service training program related to ABG sampling and analysis. So, the studied nurses' knowledge was obtained during school study years and it might be forgotten. Also, lack of continuing educational programs or sessions regarding arterial blood gases sampling and

interpretation after graduation, supervision, continuous evaluation of nurses' practice, and lack of cooperation between multidisciplinary healthcare team members (nurses–physicians).

Lifelong learning is essential for the nurse to maintain and increase competence in nursing knowledge. There are many different means to meet continuing professional development needs. Formal means include continuing education, staff development, academic education and research activities. The purpose here is to help the nurses to maintain and improve their competencies as required for the delivery of quality care to the consumer. Implementations based on educational program, specifically designed nursing protocols, perceive gaps in their knowledge and would welcome the opportunity to be updated regularly.

In harmony with the current study results, **Sabaq et al, (2019)** studied "Effect of educational program on improving nurses' performance regarding arterial blood gases sampling for critically Ill children." and showed that there was a significant improvement in the total scores of nurses who achieved satisfactory level of knowledge regarding arterial blood gases sampling. They indicated that more than three quarters of nurses have unsatisfactory level of knowledge at the pre-program phase and the majority of them had satisfactory level of knowledge at the post program phase. This improvement indicated that the program was a successful method to increase nurses' knowledge.

Similarly, **Abd Elaziz et al, (2021)** 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 regarding ABG interpretation, where total knowledge level changed from less than one fifth to more than three quarters.

Also, **Bayomi & Taha (2022)** studied "Effect of Self–Learning Package on Nurses' Knowledge and Practice Regarding Arterial Blood Gases Analysis for Critically Ill Patients." and showed that the majority of the studied nurses had unsatisfactory level of knowledge Preprogram while in post program the majority of them had satisfactory level.

The results of the current study contradicted with **Ibrahem et al, (2021)** who performed a study about "Arterial Blood Gases

Interpretation: critical care nurses' knowledge and practices at a university hospital− Kafr-Elsheikh Governorate." and showed that the total mean knowledge score of the study sample was low as regards to ABG' interpretation. Also, the results delineated that the majority of the study sample had unsatisfactory knowledge level about ABG interpretation.

Regarding nurses' level of total practice, the present study reveals statistically significant increase in mean practice score pre and post educational guidelines implementation. Satisfactory practice frequency changed from less than half pre educational guidelines implementation to most of the study sample post educational guidelines implementation. From the investigator point of view, this increase in nurses' level of practice regarding arterial blood gases sampling techniques, may be due to increased nurses' knowledge which subsequently affect their practice.

In consistency with the current study, **Luo et al., (2022)** discussed "Effect of PDCA Evidence-Based Nursing Practice on Arterial Blood Gas Analysis in the Respiratory Department" and found that the success rate of one-time puncture and the qualified rate of specimens in the observation group were higher than those in the control group after the implementation of the improvement plan.

Similarly, **Pakkirisamy, (2021)** studied "Effectiveness of Planned Teaching Program on Knowledge regarding Arterial Blood Gas Analysis among Nurses in a Selected Hospital, Gwalior "and found that a significant increase in nurse's level of practice regarding arterial blood gas analysis after the planned teaching program. Also, **Kumari et al., (2020)** studied "A pre-experimental study to assess the effectiveness of structured teaching program on knowledge regarding Arterial Blood Gas analysis and interpretation among staff nurses working in selected hospitals of district Mohali, Punjab" and showed that three quarters of staff nurses were having average practice level in pretest and also three quarters of staff nurses were having good practice in posttest regarding arterial blood gas analysis, sampling and interpretation.

In harmony with the current study, **Vahedian-Azimi et al, (2021)** evaluated the effect of a specific training course for competency in doing arterial blood gas

sampling in the intensive care unit. The study found that the training course significantly improved the nurses' competency in ABG sampling. Another study by **Mitchell et al., (2022)** who studied "Comparison of time taken to obtain an arterial blood gas result at the bedside using the Proxima TM point of care machine vs. a standard remote arterial blood gas analyzer: A randomized controlled trial." and found that it significantly improved the staff nurses' knowledge of ABG interpretation.

The current study indicated that there was a positive correlation between total score of knowledge and practice pre and post - intervention program. From the investigator's point of view, this finding confirmed the importance of baseline knowledge in shaping clinical practice. Nurses who had a solid understanding of ABG analysis principles were more likely to perform the procedure competently.

In agreement with the study results, **Sabaq et al, (2019)** revealed that there was a significant positive statistical correlation between nurses' knowledge and practices scores at the post- program phase. These results might be attributed to the more hours of ABGs sampling education that could help the nurses to enhance their knowledge and improve their abilities to perform ABGs competently. This finding was on the same line with the study done by **Abd Elaziz et al, (2021)** who revealed that there was a significant positive correlation between nurses' knowledge and practices regarding arterial blood gases sampling after video-assisted teaching intervention.

This result may be indicative of generational differences in educational backgrounds or exposure to evolving medical practices. Older nurses may had received their education at a time when ABG interpretation was not as emphasized in nursing programs. This finding underscores the importance of continuing education and updating skills for nurses, regardless of their age. Also, it may suggest that the nursing curriculum in these institutions may not adequately emphasize ABG interpretation.

The current study demonstrated that there was a statistically significant association between knowledge categories and socio demographic data including age, gender, educational level, years of experience and previous training courses of the study sample. In the same line with current study, **Abd Elaziz et al, (2021)** clarified the relation between nurses' total knowledge scores and their personnel characteristics. It was found that there was a highly statistically significant relation between the studied nurses' total knowledge scores and their age, academic qualification, and years of experience.

Conclusion

In the light of the current study findings, it can be concluded that:

More than two third of nurses had satisfactory level of total knowledge regarding arterial blood gases sampling and interpretation post educational guidelines implementation.

Furthermore, the majority of nurses had satisfactory level of total practice regarding arterial blood gases sampling and interpretation post -intervention of educational guidelines. In addition, there was statistically significant difference between total knowledge and practice mean score pre and post educational guidelines implementation.

Moreover, There was a total positive correlation between total score of knowledge and practice pre and post educational guidelines implementation

Recommendations

Based on the current study finding the following recommendations were proposed:
Healthcare Organizational level:

- Create online platforms where healthcare professionals can share their experiences, knowledge, and practices regarding arterial blood gases sampling and interpretation.
- Encourage interdisciplinary collaboration among healthcare professionals to enriches their knowledge and practices regarding arterial blood gases sampling and interpretation.

Educational level:

- Adoption of updated guidelines with heath care administrators and practitioners regarding arterial blood gases sampling and interpretation.

Further Research:

- Conduct further studies in different settings and populations regarding arterial blood gases sampling and interpretation.

- Explore the impact of individual motivation and organizational culture on nurses' performance regarding arterial blood gases sampling and interpretation.

References

Abd Elaziz, S. M., Hassan, G. A., & Mohamed, R. A. E. (2021). Effect of Video-Assisted Teaching Intervention on Nurses' Knowledge and Practice Regarding Arterial Blood Gases Sampling for Ventilated Children at Pediatric Intensive Care Units. International Journal of Novel Research in Healthcare and Nursing, 8(1), 607-623.

Abd Elkader, H. M., Shahin, E. S., & El-Ata, A. B. A. (2020). Effect of applying program based learning on nurse's performance and self-efficacy regarding arterial blood puncture. American Journal of Nursing Research, 8(2), 192-198.

Akhtar, N., & Hull, J. (2018). Interpreting arterial blood gases (ABGs). In The Beginner's Guide to Intensive Care (pp. 179-188). CRC Press.

Bayomi, R., & Taha, M. (2022). Effect of Self –Learning Package on Nurses' Knowledge and Practice Regarding Arterial Blood Gases Analysis for Critically Ill Patients. *Egyptian Journal of Health Care*.

Chaney, B., & Emmady, P. D. (2022). Blood gas temperature correction. In StatPearls [Internet]. StatPearls Publishing.

Hennessey, I., & Japp, A. (2016). Arterial blood gases made easy. Elsevier.

Holley, A. D. (2019). 2.6 Arterial blood gases. Textbook of Adult Emergency Medicine E-book,48.

Ibrahem, S. E., Morsy, W. Y. M., Mohamed, R. B., & Seloma, Y. A. E. (2021). Arterial Blood Gases Interpretation: critical care nurses' knowledge and practices at a university hospital− Kafr-elsheikh Governorate. Egyptian Nursing Journal, 18(3), 120.

Kaur, A., & Charan, G. S. (2018). A study to assess the effectiveness of STP on knowledge and practice regarding ABGs among ICU nurses in selected hospitals at Jalandhar, Punjab. International Journal of Health Sciences and Research, 8(8), 182-188.

Kaur, A., & Charan, G. S. (2018). A Study to Assess the Effectiveness of STP on Knowledge and Practice Regarding ABGs among ICU Nurses in Selected Hospitals at Jalandhar, Punjab. *International Journal of Health Sciences and Research*, 8(8), 182-188.

Kler, N., Garg, P., and Thakur, A. (2020). Handbook on Neonatal ICU: Jaypee Brothers Medical Publishers.

Kumari, A., Choudhary, R., & Sharma, P. (2020). A pre-experimental study to assess the effectiveness of structured teaching programme on knowledge regarding Arterial Blood Gas analysis and interpretation among staff nurses working in selected hospitals of district Mohali, Punjab. Asian Journal of Nursing Education and Research, 10(2), 235-239.

Luo, Z., Zhou, J., & Huang, Y. E. (2022). Effect of PDCA Evidence-Based Nursing Practice on Arterial Blood Gas Analysis in the Respiratory Department. American Journal of Nursing, 11(1), 43-47.

Mitchell, K., Salmon, K. E., Egbosimba, D., Troughton, G., & Grocott, M. P. (2022). Comparison of time taken to obtain an arterial blood gas result at the bedside using the Proxima TM point of care machine vs. a standard remote arterial blood gas analyzer: A randomized controlled trial. Journal of Intensive Care Society, 23(2), 95-102. https://doi.org/10.1177/1751143720973847

Neder, J. A., Berton, D. C., and O'Donnell, D. E. (2020). Arterial blood gases in the differential diagnosis of hypoxemia. Jornal Brasileiro de Pneumologia, 46.

Pakkirisamy, U. (2021). Effectiveness of Planned Teaching Programme on Knowledge regarding Arterial Blood Gas Analysis among Nurses in a Selected Hospital, Gwalior.

Rabi, Y., Derek Kowal, R. R. T., & Ambalavanan, N. (2016). Blood gases: Technical aspects and interpretation. Assisted Ventilation of the Neonate E-*Book*, 80.

Ragab Bayomi, R., & Mohamed Taha, N. (2022). Effect of Self–Learning Package on Nurses' Knowledge and Practice Regarding Arterial Blood Gases Analysis for Critically Ill Patients. Egyptian Journal of Health Care, 13(1), 57-69.

Sabaq, A. G., El-aasar, H. N., & Mohammed, M. (2019). Effect of educational program on improving nurses' performance regarding arterial blood gases sampling for critically Ill children. International Journal of Nursing Didactics, 9(05), 01-10.

Safwat, A.M.& Khorais, A.M.(2018) : Effectiveness of a computer- based learning module on arterial blood gases among staff nurses in critical care units: Innovative. Journal Medical & Health Science; 8(3), 31-40.

Sharma, S. K. (2019). Lippincott manual of nursing practice. Wolters kluwer india Pvt Ltd. Martin, L. (1999). All you really need to know to interpret arterial blood gases. Lippincott Williams & Wilkins.

Upreti, D., & Mishra, R. (2020). Effectiveness of planned teaching programme on knowledge and practice regarding arterial blood gas analysis and its interpretation among staff nurses working in critical care quantitative research approach. International Journal of Advances in Nursing Management, 8(1), 12-18.

Vahedian-Azimi, A., Rahimi-Bashar, F., Pourhoseingholi, M. A., Salesi, M., Shamsizadeh, M., Jamialahmadi, T., ... & Sahebkar, A. (2021). 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. Biomed research international, 2021, 1-10.

Yee, J., Frinak, S., Mohiuddin, N., et al. (2022). Fundamentals of Arterial Blood Gas Interpretation. Kidney360.