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Research Article

A Comparative Study to Assess the Effectiveness of Self-Instructional Module on Knowledge Regarding Arterial Blood Gases among Staff Nurses from Intensive Care Unit and Wards in Selected Hospitals of Metropolitan City

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ABSTRACT

Introduction: Arterial blood gas (ABG) studies are common tool to aid in physiologic diagnosis and therapeutic managements of patients. Nurse must be alert to and able to recognize signs and symptoms of overcorrection of the condition. **Aim:** The aim of study was to compare the effectiveness of self-instructional module on knowledge regarding ABGs among staff nurses from intensive care unit (ICU) and wards in selected hospitals. **Materials and Methods:** A quantitative research approach and comparative study one-group pre-test and post-test design was used which consisted a group of 60 samples (30 ICU and 30 wards) that were selected using non-probability convenient sampling technique. Knowledge of nurses was assessed using semi-structured knowledge questionnaire. Data analysis was done by means of descriptive and inferential statistics. **Results:** In pre-test of ICU, 20%, 46.7%, and 33.3% of staff nurses were categorized into poor, good, and excellent knowledge level but after self-instructional module, it was improved by 100% which were categorized into excellent knowledge level. In pre-test of Wards, 53.3%, 43.3%, and 3.3% of staff nurses were categorized into poor, good, and excellent knowledge level but after self-instructional module, it was improved by 100% which were categorized into excellent knowledge level. The calculated *t*-value was found to be 12.631 of ICU and 15.098 of wards and the self-instructional module is significant at $P < 0.001$ for pre-test and post-test overall knowledge regarding ABGs. **Conclusion:** Self-instructional module was effective in improving the knowledge regarding ABGs among staff nurses from ICU and wards.

Keywords: Arterial blood gases, Effectiveness, Knowledge, Self-instructional module, Staff nurses

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Introduction

The body normally maintains a steady balance between acids produced during metabolism and bases that neutralize and promote the excretion of the acids. Many health problems may lead to acid-base imbalances in addition to fluid and electrolyte imbalances. Patients with diabetes mellitus, chronic obstructive pulmonary disease, and kidney disease frequently develop acid-base imbalances. Vomiting and diarrhea may cause loss of acids and bases in additional to fluids and electrolytes. In addition, tissue hypoxia from any cause may alter acid-base balance. The nurse must always

consider the possibility of acid-base imbalance in patients with serious illness.[1]

The body has two acid excretion systems: Lungs and kidneys. The lungs excrete carbonic acid; the kidneys excrete metabolic acids. When you exhale, you excrete carbonic acid in the form of CO_2 and water. If the $PaCO_2$ (i.e., level of CO_2 in the blood) rises, the chemoreceptors trigger faster and deeper respirations to excrete the excess. If the $PaCO_2$ falls, the chemoreceptors trigger slower and shallower respirations so more of the CO_2 produced by cells remains in the blood and makes up the deficit. These alterations in respiratory rate and depth maintain the carbonic acid portion of acid-base balance. Sometimes, people who have lung disease have difficulty with normal excretion of carbonic acid, which causes it to accumulate and make the blood more acid.[2]

An arterial blood gas (ABG) is a blood test that is performed using blood from an artery. It involves puncturing an artery with a thin needle and syringe and drawing a small volume of blood. The most common puncture site is the radial artery at the wrist, but sometimes the femoral artery in the groin or other sites is used.[3]

These studies determine blood pH, carbon dioxide tension (PCO_2), oxygen tension (PO_2), and percent of oxyhemoglobin saturation (SaO_2). Gas tension refers to partial pressure or that part of the total pressure exerted by a specific gas.[4]

Monitoring the ABGs, electrolytes, and the respiratory status are priorities of care for a client diagnosed with respiratory compromise, which leads to hypoxia or diminished ventilation, pre- or post-cardiopulmonary arrest or collapse, medical conditions that cause significant metabolic derangement such as sepsis, diabetic ketoacidosis, renal failure, heart failure, toxic substance ingestion, drug overdose, trauma, or burns.

It is important for the nurse to monitor the client's respiratory status and maintain support for the client's airway and breathing pattern. The nurse monitors the client for signs of recovery from respiratory alkalosis, respiratory acidosis, metabolic alkalosis, and metabolic acidosis and provides a report to health-care team on the client's progress.[5]

Objectives of study

- To compare the effectiveness of self-instructional module on knowledge regarding ANBGs among staff nurses from intensive care unit (ICU) and wards in selected hospitals
- To assess the knowledge regarding ABGs among staff nurses from ICU and wards before and after administration of self-instructional module
- To compare pre-test and post-test knowledge regarding ABGs among staff nurses from ICU and wards
- To find out the significant association between pre-test knowledge regarding ABGs among staff nurses from ICU and wards.

MATERIALS AND METHODS

Research approach

Quantitative research approach.

Research design

Comparative study one-group pre-test and post-test design.

Setting of the study

The study was conducted in the ICU and wards of selected hospitals.

Population

Staff nurses from ICU and wards.

Target population

Staff nurses from ICU and wards working in hospitals.

Accessible population

Staff nurses from ICU and wards in selected hospitals.

Sample

Staff nurses from ICU and wards who fulfilled the inclusion and exclusion criteria and were present at the time of data collection.

Sampling technique

Non-probability convenient sampling.

Sample size

Sixty staff nurses (30 from ICU and 30 from wards).

Variables

Independent variable

Self-instructional module on knowledge regarding ABGs.

Dependent variable

Knowledge regarding ABGs.

Extraneous variable

Are demographic variables such as age, sex, qualification, area of working, total years of experience (in years), numbers of years of experience in ICU, numbers of years of experience in wards, source of information regarding ABGs,

attended educational training regarding ABGs, if yes, when was last educational training attended.

Sampling criteria

Inclusion criteria

The staff nurses
- Who are willing to participate in this study
- Who have completed GNM, B.Sc. Nursing, and M.Sc. Nursing
- Who are available at the time of data collection.

Exclusion criteria

The staff nurses
- Who are on night shift
- Working in administrative level
- Working in outdoor department.

Subject withdrawal criteria

- Who are on period of resignation
- Who may be proceeding on longer leave.

Tools and technique

The tool used for the study consisted of three sections: Demographic variables, semi-structured knowledge questionnaire, and self-instructional module. Technique used was self-report.

Validity of tool

Content validity of the tool was done by experts in their respected fields which included two ICU intensivist and 20 experts from the field of medical surgical nursing.

Reliability of tool

The reliability was calculated by Cronbach's alpha correlation using SPSS (Statistical Package for the Social Sciences) software. A correlation coefficient of 0.72 which shows acceptance was obtained indicating that the tool was reliable.

Pilot study

Pilot study was conducted on 16 samples.

Method of data collection

The investigator informed about the study topic. After explaining the purpose of the study, verbal and written informed consent was obtained. After taking a written consent from the sample, they were provided with the questionnaire. The investigator explained about the questionnaire and asked them to complete the pre-test in about 30 min. After completion of the pre-test, the investigator administered self-instructional module. The post-test was administered on the 7th day of the pre-test with the same questionnaire.

Statistics

Data were analyzed using descriptive (frequency, percentage, mean and standard deviation) and inferential statistics (paired *t*-test). Calculation was carried out with the help of SPSS.

RESULTS

Section I

Frequency and percentage distribution of staff nurses of ICU and wards according to their selected demographic variables.

Table 1 shows that, 24 staff nurses from ICU and 16 staff nurses from Wards belongs to the age group of 21-30 years i.e., 80% and 53.3%. Female staff nurses from ICU are 26 and Wards is 30, that is, 86.7% and 100%. Educational qualification of the staff nurses shows that 18 staff nurses of ICU and 12 staff nurses of Wards had completed Basic B.Sc. Nursing, that is, 60% and 40%. The total years of experience of staff nurses from ICU and wards show that there are 19 staff nurses from ICU having 0–3 years of experiences, that is, 63.3%. 12 staff nurses from Wards having 4–7 experiences, that is, 40%. The number of years of work experience of staff nurses from ICU and wards shows that there are 27 staff nurses from Wards having nil years of experiences in ICU, that is, 90%. 22 staff nurses from ICU having 1–3 years of experiences in ICU, that is, 73.3%. The number of years of work experience of staff nurses from ICU and wards shows that there are 24 staff nurses from ICU having nil years of experiences in ward, that is, 80%. 13 staff nurses from Wards having 4–6 years of experiences in Wards, that is, 43.3%. The source of information regarding ABGs of staff nurses from ICU and wards shows that there are 15 staff nurses from ICU and 28 staff nurses from Wards gain information from books, that is, 50% and 93.3%. The staff nurses from ICU and wards who attended educational training regarding ABGs show that there are 25 staff nurses from ICU and 23 staff nurses from Wards have attended educational training regarding ABGs, that is, 83.3% and 76.7%. The staff nurses from ICU and wards who had attended last educational training regarding ABGs show that there are 27 staff nurses from Wards who had attended educational training less than 1 year ago, that is, 90%. 23 staff nurses from ICU had attended educational training 2–3 years ago, that is, 76.7%.

Table 1: Distribution of staff nurses of ICU and wards according to their selected demographic variables

Demographic variables	ICU		Wards	
	Frequency	Percentage	Frequency	Percentage
Age group (years)				
21–30	24	80	16	53.3
31–40	5	16.7	12	40
41–50	1	3.3	2	6.7
51 and above	0	0	0	0
Gender				
Male	4	13.3	0	0.0
Female	26	86.7	30	100
Qualification				
GNM	8	26.7	11	36.7
Post basic B.Sc. nursing	4	13.3	7	23.3
Basic B.Sc. nursing	18	60	12	40
M.Sc. nursing	0	0	0	0
Total years of work experience (in years)				
0–3	19	63.3	5	16.7
4–7	5	16.7	12	40
8–10	4	13.3	9	30
More than 11	2	6.7	4	13.3
Number of years of work experience in ICU				
Nil	0	0	27	90.0
1–3	22	73.3	3	10
4–6	5	16.7	0	0
More than 7 years	3	10	0	0
Number of years of work experience in ward				
Nil	24	80	0	0
1–3	6	20	6	20
4–6	0	0	13	43.3
More than 7 years	0	0	11	36.7
Source of information regarding ABGs				
Books	15	50	28	93.3
Journal	2	6.7	0	0
In-service education	13	43.3	2	6.7
Any other	0	0	0	0
Attended educational training regarding ABGs				
Yes	25	83.3	23	76.7
No	5	16.7	7	23.3
If yes, when was the last educational training attended regarding ABGs				
Less than 1 year ago	0	0	27	90.0
2–3 year ago	23	76.7	3	10
4–5 year ago	4	13.3	0	0
Do not remember	3	10	0	0

ABGs: Arterial blood gases

Section II

Part I

This section deals with the assessment of pre-test and post-test knowledge regarding ABGs among staff nurses of ICU and wards working in selected hospitals.

Figure 1 shows that in pre-test of ICU, 20% and 46.7% of staff nurses from ICU were categorized into poor and good knowledge level and 33.3% were categorized into excellent knowledge level, respectively, but after self-instructional module, it was improved by 100% into excellent knowledge level, respectively.

Figure 2 shows that in pre-test of Wards, 53.3% and 43.3% of staff nurses from ward were categorized into poor and good and 3.3% were categorized into excellent level of knowledge level, respectively, but after self-instructional module, it was improved by 100% which were categorized into excellent knowledge level, respectively.

Part II

Contentwise mean assessment of pre-test and post-test knowledge regarding ABG among staff nurses of ICU and Wards working in selected hospitals.

In Table 2, there was improvement in knowledge regarding ABGs after self-instructional module as it depicts differentiation in bar graphs of mean of all three sub-sections. In post-test, there was increased in mean of all three subsections and thus it raises the post-test score bar graph above the pre-test score bar graph.

Section III

This section deals with evaluation of the effectiveness of self-instructional module by comparing pre-test and post-test knowledge scores of samples analyzed in terms of *t*-test to find out the level of significance and proving of hypothesis.

Table 3 shows that the calculated *t* value was found to be 12.631 and the self-instructional module is significant at $P < 0.001$ for pre-test and post-test overall knowledge regarding ABGs. Thus, we reject the null hypothesis and accept research hypothesis.

Table 4 shows that the calculated *t* value was found to be 15.098 and the self-instructional module is significant at $P < 0.001$ for pre-test and post-test overall knowledge regarding ABGs. Thus, a null hypothesis is rejected and research hypothesis is accepted.

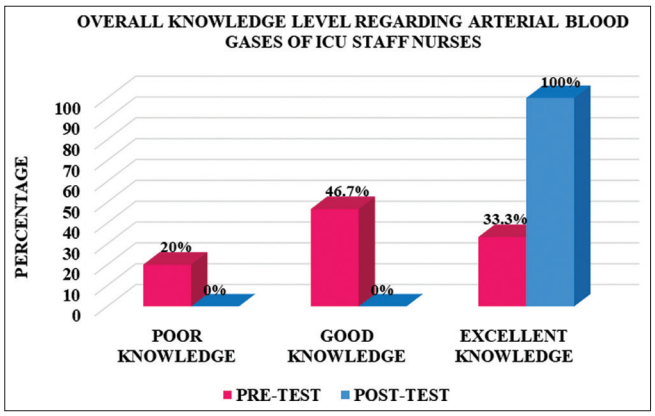

Figure 1: Distribution of staff nurses of intensive care unit based on overall knowledge level about arterial blood gases

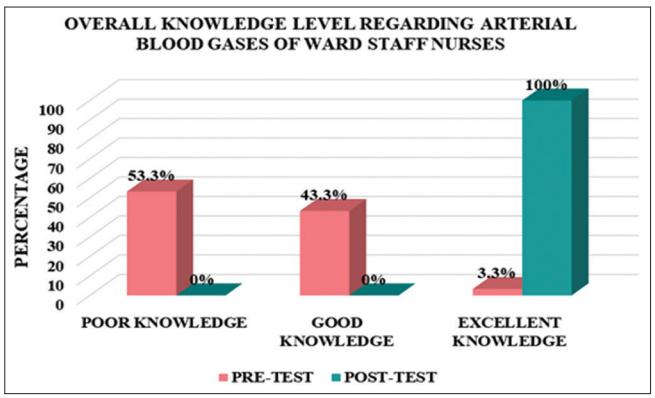

Figure 2: Distribution of staff nurses of wards based on overall knowledge level about arterial blood gases

Section-IV

To find out the significant association between pre-test knowledge among staff nurses from ICU and Wards.

Table 5 shows that in pre-test of ICU, mean is 16.93 and standard deviation is 5.61 and in pre-test of wards, mean is 11.20 and standard deviation is 4.11 which is significant at $P < 0.001$ level for pre-test knowledge regarding ABGs among staff nurses from ICU and wards. Thus, a null hypothesis is rejected and research hypothesis is accepted.

Discussion

A study was conducted by Kumari Anita on "A pre-experimental study to assess the effectiveness of structured teaching program on knowledge regarding ABG analysis and interpretation among staff nurses working in selected hospitals of district Mohali, Punjab." A quantitative research approach consisting one-group pre-test post-test design was used. Sample size for this study is 100 by convenient sampling technique. Results show that majority of staff nurses, that is, 72% were having average knowledge regarding ABG analysis and interpretation during pre-test whereas majority of staff nurses, that is, 75% were having good knowledge regarding ABG analysis and interpretation during post-test. Thus, it concluded that in pre-test, staff nurses have less knowledge and it get increase in post-test regarding ABG analysis and interpretation.[6]

A study was conducted by Begum Reshma on "A study to assess the effectiveness of structured teaching program on knowledge of ABG analysis among staff nurses of ICU in selected private hospitals of Guwahati, Assam." The results show that in pre-test, majority 38 (55.88%) of respondents

Table 2: Contentwise mean distribution of pre-test and post-test knowledge of ICU and wards staff nurses

Knowledge area	ICU				Ward			
	Pre-test		Post-test		Pre-test		Post-test	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Meaning of ABG	4.5333	1.3830	6.000	0.000	3.4667	1.2243	5.8333	0.3790
Procedure of ABG	5.1333	1.5698	8.000	0.000	3.8333	1.6833	7.600	0.6747
Interpretation of ABG	7.2667	3.9561	15.4000	0.7701	3.900	2.3245	13.7000	1.6640

Table 3: Effect of self-instructional module on overall knowledge regarding ABGs among staff nurses from ICU working in selected hospitals

Pre-test and post-test overall knowledge scores of ICU	Mean	Std. deviation	Paired *t*-test	*P*-value	Sig. at 5% level
Pre-test	16.93	5.61	12.631	<0.001	Yes
Post-test	29.40	0.77			

ABGs: Arterial blood gases

Table 4: Effect of self-instructional module on overall knowledge regarding ABGs among staff nurses from Wards working in selected hospitals

Pre-test and post-test overall knowledge scores of wards	Mean	Std. deviation	Paired *t*-test	*P*-value	Sig. at 5% level
Pre-test	11.20	4.11	15.098	<0.001	Yes
Post-test	27.47	2.79			

ABG: Arterial blood gas

Table 5: Analysis and interpretation of data to find out association of pre-test knowledge among staff nurses from ICU and wards

Test	Max. mean score	n	Mean	Std. deviation	Paired *t*-test	*P*-value	Sig. at 5% level
Pre-test (ICU)	30	30	16.93	5.61	4.519**	<0.001	Yes
Pre-test (ward)	30	30	11.20	4.11			

had inadequate knowledge and remaining 30 (44.12%) had moderately adequate knowledge. In post-test, majority 35 (51.47%) had moderately adequate knowledge, remaining 33 (48.53%) had adequate knowledge. Thus, it concluded that staff nurses have less knowledge score regarding ABG analysis in pre-test which got increased in post-test.[7]

A study was conducted by Adhikari Dipa on "Effectiveness of structured teaching program on knowledge regarding ABG analysis among nursing students, Palpa, Nepal." The results show that during pre-test, majority of the respondents 70.8% had average knowledge, only 15.3% of respondents had adequate knowledge and 13.9% had inadequate knowledge whereas during post-test, majority of the respondents 63.1% had adequate knowledge, 35.4% had average knowledge, and only 1.5% had inadequate knowledge regarding ABG analysis. Structured teaching program was highly significant at $P < 0.001$. There was significant association between age, educational level, exposure to critical areas, and level of knowledge score on pre-test and post-test. Thus, it concluded that the level of knowledge of nursing students regarding ABG analysis in pre-test is low and post-test, it has been increased.[8]

A study was conducted by Kaur Akashpreet on "To assess the effectiveness of structured teaching program on knowledge and practice regarding ABGs among ICU nurses in selected hospitals at Jalandhar, Punjab." The results show that during pre-test, most of the nurses 7 (11.7%) had good knowledge score, 39 (65%) had average knowledge score, and 14 (23.3%) had below average knowledge score whereas during post-test, majority of nurses 40 (66.7%) had good knowledge score, 20 (33.3%) had average score. Thus, it concluded that the post-test knowledge score of nurses regarding ABGs analysis was found to be higher than pre-test.[9]

A study was conducted by Thorat Rokesh on "To assess the effectiveness of structured teaching program on knowledge regarding ABG analysis among staff nurses of ICU hospitals of Sangli and Miraj." Results show that in pre-test, the majority of sample has good knowledge that is 50–75% but no one was at excellent level whereas post-test, the good knowledge was improve to 38% sample in excellent level. Mean knowledge score about ABG analysis of staff nurses in pre-test was 11.50 and post-test 15.98. This difference was statistically significant at $P = 0.000$ level with "$t = -8.694$." Thus, it concluded that in pre-test regarding ABGs analysis, staff nurses have less knowledge and hence it got increases in post-test.[10]

A study was conducted by Hemavathy on "A study on to assess the effectiveness of structured teaching program on knowledge regarding ABGs analysis among staff nurse at selected hospital, Chennai, Tamil Nadu." Results show that in pre-test, the majority of sample out of 30, 4 (13.3%) had inadequate knowledge, 20 (66.7%) had moderate knowledge, and only 6 (20%) had adequate knowledge about ABG analysis. However, in post-test, 4 (13.3%) had moderate knowledge and 26 (86.7%) had adequate knowledge and none had inadequate knowledge about ABG analysis. The pre-test mean value is 19.5 and the standard deviation value is 3.03. The post-test mean value is 25.1 and standard deviation value is 2.14. The mean difference is 5.6 and the standard deviation difference is 9. The paired "t" value is 8.4, which is statistically significant at $P < 0.001$. Thus, it concluded that the level of knowledge regarding ABG analysis among staff nurses in pre-test is low and hence it got increases in post-test.[11]

Conclusion

Based on the result of the present study, it can be concluded that research hypothesis is accepted and it was found that self-instructional module was effective in improving knowledge regarding ABGs among staff nurses from ICU and wards.

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References

1. Lewis SM, Heitkemper MM. Shannon Ruff Dirksen Textbook of Medical Surgical Nursing: Assessment and Management of Clinical Problems. 6th ed. Amsterdam, Netherlands: Elsevier Publication; 2011.
2. Suresh S. Potter and Perry's, Fundamental of Nursing, South Asian Edition. Amsterdam, Netherlands: Elsevier Publication; 2013.
3. Hariprasath P. Textbook Cardiovascular and Thoracic Nursing. 1st ed. India: Jaypee Publications; 2016.
4. Phipps WJ, Long BC, Woods NF. Shafer's, Textbook of Medical-Surgical Nursing. 7th ed. New Delhi: B. I. Publications; 1985.
5. White L, Duncan G, Baumle W. Medical Surgical Nursing an Integrated Approach. 3rd ed. Delmar: Cengage Learning Publication; 2013. p. 222-45.
6. Kumari A, Choudhary R, Sharma P. 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 J Nurs Educ Res 2020;10:235-9.
7. Begum R, Das RR, Saikia UB. A study to assess the effectiveness of structured teaching programme on knowledge of arterial blood gas analysis among staff nurses of ICU in selected private hospitals of Guwahati, Assam. Int J Curr Adv Res 2019;8:19508-13.
8. Dipa A, Pade T. Effectiveness of structured teaching program on knowledge regarding arterial blood gas analysis among nursing students. J Health Educ Res Dev 2019;8:1000307.
9. Kaur A, Singh CG. A study to assess the effectiveness of Structured teaching programme on knowledge and practice regarding arterial blood gases among ICU nurses in selected hospitals at Jalandhar, Punjab. Int J Health Sci Res 2018;8:182-8.
10. Thorat R, Dani P, Gupta H. Effectiveness of structured teaching programme on knowledge regarding arterial blood gas (ABG) analysis among staff nurses. Int J Sci Res 2016;6:1545-9.
11. Hemavathy V, Girijabhaskaran, Nongphud J. A study to assess the effectiveness of structured teaching programme on knowledge regarding arterial blood gas analysis among the staff nurses at selected hospital, Chennai. Int J Appl Res 2016;2:541-2.