

# Effectiveness of Planned Teaching Programme on Knowledge regarding Arterial Blood Gas Analysis among Nurses in a Selected Hospital, Gwalior

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**Abstract:** *The nurse catalyzes the healing process means making complex, timely judgments and decisions and taking actions for which they remain accountable. So, they should have a clear understanding of the nature of the procedures that they would have to perform for the patients. The knowledge base is upgraded continuously by new clinical and educational experiences that reinforce the nurse's professional practice and autonomy. Many investigative tests are performed to diagnose the patient. Arterial Blood Gas Analysis (ABGA) is one of them. It is also used to assess the progress of the patient. A nurse has to be competent and skillful in removing blood from arteries and handling situations that will affect the ABG analysis of the patients. The present study evaluated the effectiveness of the planned teaching programme on knowledge regarding arterial blood gas analysis among nurses in a selected hospital, Gwalior. A convenient sampling technique was used to collect data from thirty nurses. The Pre experimental, one group pre and post test design was used. The result showed that, compared to the total level of knowledge between pre test and post test, the difference mean value was 11.30 with a standard deviation of 3.68, and calculated t value was 16.78. It was statistically significant at  $P < 0.05$  level. This shows a significant increase in nurse's level of knowledge regarding arterial blood gas analysis after the planned teaching program.*

**Keywords:** Effectiveness, Arterial Blood Gas Analysis, Nurses, knowledge, planned teaching program

## 1. Introduction

Arterial blood gases (ABG) analysis is a blood test indicating ventilation, gas exchange, and acid-base status in blood taken from the artery [1]. It entails puncturing an artery with a thin needle and a heparinized syringe and taking a small amount of blood (approximately 1ml). The radial artery at the wrist is the most usual puncture location, but the femoral artery in the groin or other sites are also used. An arterial catheter can also be used to take blood. Arterial blood gas analysis is a critical investigation for determining clinical oxygenation and acid-base status in critically ill patients. It provides information on ventilation, oxygenation, and acid-base status, the three closely related physiological parameters maintain pH homeostasis in critically ill patients [2].

Nurses work in the most difficult work environment because they are primary caregivers at the bedside and monitor, manage, and support critically ill patients [3]. A typical problem for nurses is determining the association between aberrant blood gas findings and a patient's overall clinical status. To meet this challenge, nurses must understand the mechanism underlying acid-base balance and the common cause of acid-base imbalance [4].

During the clinical experience, the investigator discovered that, despite continuous monitoring with a pulse oximeter, most patients' breathing is monitored by ABG analysis. Although the nurses actively collect ABG samples, their expertise in how to read ABG data is limited. With this in mind, the researcher has justified the necessity to improve nursing knowledge.

## 2. Literature Survey

A study on arterial blood gas (ABG) interpretation for health care professionals was undertaken by Maag M.M. (2005), who concluded that arterial blood gas analysis is a vital skill required by nurses to deliver safe and competent patient care. Nurses may ensure that the patient's alveolar exchange of CO<sub>2</sub> or O<sub>2</sub> is maintained by measuring arterial blood gas concentrations. The findings showed that the teaching programme improved health care professionals' grasp of ABG analysis and aided in applying knowledge in the clinical context [5].

Sarah Dodds (2007) evaluated the nurse-led arterial blood gas collection of patients in a study of nurses. After completing a practical training and instruction programme, respiratory nurse specialists became skilled in ABG sampling, demonstrating how a doctor-led service is now nurse-led. As a result, ABG sampling has become a standard competence for nurses, and it is also utilized onwards for acute medical assessment and respiratory patients [6].

Schneiderman J, et al. (2009) investigated staff nurses' competence of arterial blood gas (ABG) interpretation. After completing the learning module, staff nurses' knowledge rose significantly ( $t=6.3$ ;  $P.001$ ). The study stated that such research should be done on a big basis. [7].

Varsha Sehrawat, et al. did a non-experimental descriptive study in 2019. According to the findings, half of the staff nurses (50%) were between the ages of 20 and 28, and 33.5 percent of the staff nurses were GNM nurses. The majority (68%) of Staff nurses were female, 33.4 percent of Staff nurses worked in the ICU, and almost half (46.6%) of Staff nurses had 1-3 years of experience. Study findings also

revealed a significant association between knowledge score and selected demographic variables [8].

Another study by Padma, et al. found that 4 (13.3 %) of staff nurses had A grade knowledge, 7 (23.3 %) had B + grade knowledge, 12 (40 %) had B grade knowledge, 5 (16.7 %) had C grade knowledge, and 2 (6.7 %) had D grade knowledge, with a mean value of 19.0 and a standard deviation of 3.5. The study concluded that the majority of staff nurses had D grade knowledge [9].

Akashpreet Kaur and Gopal Singh Charan (2018) conducted a pre-experimental one-group pre and post-test study with 60 ICU nurses in Jalandhar to assess the efficiency of a structured teaching programme on knowledge and practice of arterial blood gas analysis. The study's findings revealed that the mean difference between the nurses' pretest and post-test knowledge score was 7.83, and the practice score had a significant difference between the pretest and post-test practice score [10].

### Statement of the problem

A study to evaluate the effectiveness of planned teaching programme on knowledge regarding arterial blood gas analysis among nurses in a selected hospital, Gwalior.

### Objectives of the study

- To assess the level of knowledge regarding arterial blood gas analysis among nurses before planned teaching programme.
- To assess the level of knowledge regarding arterial blood gas analysis among nurses after planned teaching programme.
- To find out the effectiveness of planned teaching programme on arterial blood gas analysis among nurses.

## 3. Methodology

### Research approach

An evaluative approach was adopted for the study to evaluate the effectiveness of planned teaching programme on knowledge regarding arterial blood gas analysis among nurses in a selected hospital, Gwalior. The main goal was to evaluate the success of PTP.

### Research design

In this study, pre experimental "one group pre and post test design" was used to evaluate the effectiveness of planned teaching programme on knowledge regarding arterial blood gas analysis among nurses.

### Setting

This study was conducted in Harsh Vardhan Memorial Hospital, Gwalior, M.P. It is 200 bedded and multispecialty hospital, has various departments like OPD, Emergency, ICU, Medical and surgical ward, Operation theatre, Obstetrical and gynecology ward and Pediatric ward.

### Population

The population of the present study consisted of trained nurses working in a hospital with various positions.

### Sample and sample size

The sample of this study consists of trained nurses working in Harsh Vardhan Memorial Hospital, Gwalior, M.P and the sample size was thirty.

### Sampling technique

For this study, the samples were selected by using a convenient sampling technique.

### Criteria for sample selection

#### Inclusion criteria

- The nurses who were willing to participate in the study.
- The nurses who were available at the data collection time.
- Both male and female nurses were included.

#### Exclusion criteria

- The nurses who were not willing to participate in the study.
- The nurses who were not available during the study.
- The nurses who were not able to read and write in English.
- The nurses who are in the position of female ward assistant and superintendent.

### Description of the tool

The tool consists of two parts.

#### Part-I

Part-I describes the demographic variables including age in years, gender, professional qualification in nursing, designation, monthly income, total experience, area of work, number of times ABGA was done previously and previous exposure to any kind of education programme regarding arterial blood gas analysis. The investigator developed this part by referring various textbooks, internet, journals and experts' opinion from nursing professionals. **PART-II**

The structured questionnaires were developed on based on the review of literature, discussion with the experts and personal experience of the investigator. This part has 36 questions regarding arterial blood gas analysis. It is divided into two sections like Section A - General aspects of arterial blood gas analysis and Section B - Interpretation of arterial blood gas analysis report.

Section A - General aspects of arterial blood gas analysis: It contains 14 questions regarding definition, uses, indications of ABGA, puncture site & articles needed for the sampling of ABGA, steps of procedure, blood gas analyzer, side effects and nurse's responsibility in ABGA.

Section B- Interpretation of arterial blood gas analysis report: It contains 22 questions regarding normal values of ABGA according to the National Institutes of Health, important points to remember for the interpretation of the ABGA and abnormalities of ABGA including respiratory acidosis, metabolic acidosis, respiratory alkalosis and metabolic alkalosis.

**Scoring procedure of structured questionnaires**

The possible score for this tool were 0 and 1. That was 'score 1' for the right answer and 'score 0' for the wrong answer. The scores were interpreted as given below.

Total score was 36

0-50 % (0- 18) -- Inadequate knowledge

51-75 % (19- 27) -- Moderately adequate knowledge

Above 75 % (28-36) -- Adequate knowledge

**Description of structured teaching programme**

The PTP covered the following areas:

- 1) Definition of arterial blood gas analysis
- 2) Uses of Arterial Blood Gas Analysis (ABGA)
- 3) Indications of ABGA
- 4) Puncture site for sampling of ABGA
- 5) Articles needed for the sampling of ABGA
- 6) Steps of procedure
- 7) Blood gas analyzer
- 8) Interpretation of results of arterial blood gas analysis
- 9) Side effects of ABGA
- 10) Nurse's responsibility in ABGA

**Data collection procedure**

The main study was conducted in Harsh Vardhan Memorial Hospital, Gwalior, M.P. Formal approval was obtained from the concerned authority prior to the study. The data collection period was 05.10.2020 to 17.10.2020. The thirty nurses were selected by using a convenient sampling technique. The willingness of the nurses was obtained with a consent form. After the self-introduction, the investigators explained the purpose of the study and requested to give frank and honest replies. The investigators collected the demographic variables and monitored nurses' existing level of knowledge regarding arterial blood gas analysis using structured questionnaires (pretest). After that, a structured teaching programme was conducted to the nurse regarding arterial blood gas analysis. After 7 days, the post test was conducted by distributing the same questionnaires to the same samples. The data were analyzed by using a statistical method and the result was interpreted.

**4. Results****Demographic variables**

In the age of the nurses, 05 (16.67%) were in 21-30 years, 14(46.67%) in 31 – 40 years, 10 (33.33%) in 41-50 years and remaining 01(03.33%) in above 50 years. Out of thirty nurses, 06(20.00%) were male and 24(80.00%) were female. Regarding a professional qualification in nursing, most of the nurses [18(60%)] were G.N.M. Four (13.33%) and 08 (26.67%) nurses have completed P.B.B.Sc. Nursing and B.Sc. Nursing respectively. No one qualified with M.Sc. Nursing.

With consideration of designation, staff nurse were 18(60.00%), ward in charge were 08(26.67%) and nursing supervisor were 04(13.33%). The monthly income of 08(26.67%) nurses were less than Rs. 10000, 12 (40.00%) had income of Rs. 10001 to Rs. 20000, 09(30.00%) had income of Rs. 20001 to Rs. 30000 and 01(03.33%) had income of above Rs. 30000.

Eight nurses (26.66%) were having less than one year of experience, 18 (60.00%) nurses were having 1 to 5 years of experience, 02 (06.67%) were in 6 to 10 years of experience and 02 (06.67%) were having more than 10 years. With regards to the area of work, 13 (43.33%) nurses were in the general ward, 10 (33.33%) were in ICU/CCU, 05 (16.67%) were in pre and post operative ward and 02(06.67%) were in triage.

According to a number of times ABGA was done previously, 20(66.67%) nurses performed less than 10 times, 2 (06.67%) nurses did more than 10 times and 8(26.66%) nurses had never done before. Five (16.67%) staff nurses had previous exposure to the education programme regarding arterial blood gas analysis and the remaining 25(83.33%) were not having any exposure.

Table 1 shows the distribution of demographic variables of the nurses.

**Table 1:** Distribution of demographic variables of nurses

S. No.	Demographic variables	N=30	
		Frequency	Percentage
1.	Age in years		
	a) 21 – 30	05	16.67%
	b) 31 – 40	14	46.67%
	c) 41 – 50	10	33.33%
2.	Gender		
	a) Male	06	20.00%
	b) Female	24	80.00%
	Professional qualification in nursing	18	60.00%
3.	a) G.N.M.	04	13.33%
	b) P.B.B.Sc. Nursing	08	26.67%
	c) B.Sc. Nursing	00	00.00%
	d) M.Sc. Nursing		
4.	Designation		
	a) Staff nurse	18	60.00%
	b) Ward in charge	08	26.67%
5.	c) Nursing supervisor	04	13.33%
	Monthly income		
	a) Less than Rs. 10000	08	26.67%
	b) Rs. 10001 to Rs. 20000	12	40.00%
6.	c) Rs. 20001 to Rs. 30000	09	30.00%
	d) Above Rs. 30000	01	03.33%
	Total experience		
	a) Less than one year	08	26.66%
7.	b) 1 to 5 years	18	60.00%
	c) 6 to 10 years	02	06.67%
	d) More than 10 years	02	06.67%
	Area of Work		
8.	a) General ward	13	43.33%
	b) ICU / CCU	10	33.33%
	c) Pre and post operative ward	05	16.67%
	d) Triage	02	06.67%
9.	Number of times ABGA done previously		
	a) None	8	26.66%
	b) Less than 10 times	20	66.67%
9.	c) More than 10 times	02	06.67%
	Previous exposure to any kind of education programme regarding arterial blood gas analysis.		
	a) Yes	05	16.67%
b) No	25	83.33%	

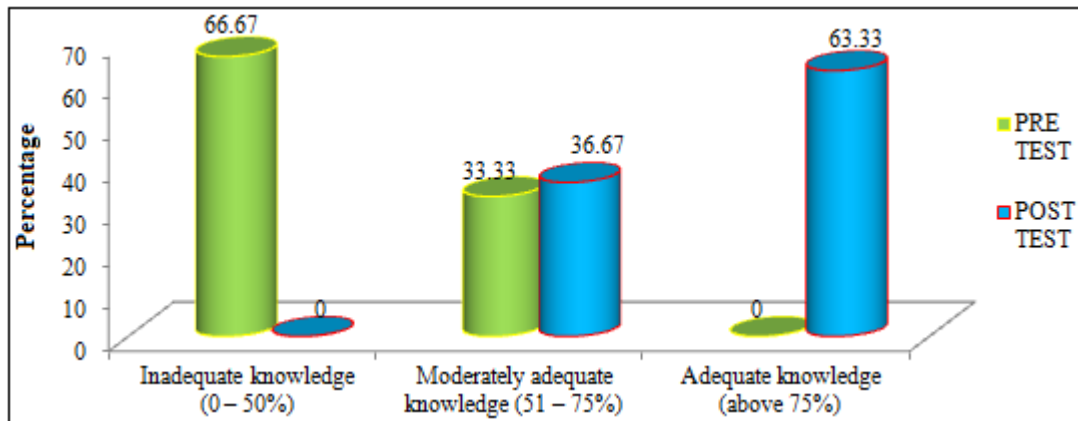
**Knowledge regarding arterial blood gas analysis among nurses during pre and post test**

The pre-test result revealed that 20 (66.67%) nurses had inadequate knowledge, 10 (33.33%) had moderately adequate knowledge and one had adequate knowledge. In post test, out of 30 nurses, 11 (36.67%) had moderately

adequate knowledge, 19 (63.33%) had adequate knowledge and no one had inadequate knowledge. Table 2 and Figure 1 show the distribution of the level of knowledge regarding arterial blood gas analysis among nurses during pre and post test.

**Table 2:** Distribution of the level of knowledge regarding arterial blood gas analysis among nurses during pre and post test

Sl. No.	Level of knowledge	Pre-test (n=30)		Post -test (n=30)	
		Percentage	Frequency	Percentage	Frequency
1.	Inadequate knowledge (0 – 50%)	20	66.67	0	00.00
2.	Moderately adequate knowledge (51 – 75%)	10	33.33	11	36.67
3.	Adequate knowledge (above 75%)	0	00.00	19	63.33



**Figure 1:** Distribution of level of knowledge regarding arterial blood gas analysis among nurses between pre-test and post-test

**Comparison of the level of knowledge between pre-test and post-test**

Table 3 shows the area wise distribution of level of knowledge regarding arterial blood gas analysis among nurses. Regarding general aspects of arterial blood gas analysis, pre and post test mean were 7.73 and 11.00 respectively, with a standard deviation of 2.10 and 1.64.

Considering the interpretation of arterial blood gas analysis report, pre and post test mean were 8.56 and 16.60 respectively, with standard deviation of 3.53 and 2.25. Total pre test mean and standard deviation were 16.30 and 5.02 respectively with standard error of the mean 0.91. Post test mean and standard deviation were 27.60 and 3.37 respectively with standard error of the mean 0.61.

**Table 3:** Area wise distribution of level of knowledge regarding arterial blood gas analysis among nurses

Sl. No.	Classification of knowledge	Pre test			Post test		
		Mean	Standard Deviation (s)	Standard error of the mean	Mean	Standard Deviation (s)	Standard error of the mean
1.	General aspects of arterial blood gas analysis	7.73	2.10	0.38	11.00	1.64	0.29
2.	Interpretation of arterial blood gas analysis report	8.56	3.53	0.64	16.60	2.25	0.41
3.	Total	16.30	5.02	0.91	27.60	3.37	0.61

Table 4 shows the area wise distribution of difference in level of knowledge regarding arterial blood gas analysis among nurses between pre and post test. With regards to general aspects of arterial blood gas analysis, mean difference and standard error of the mean were 3.26 and 0.37 respectively with SD of 2.06 and calculated t value was 8.65. It was significant at 0.05 level. The level of knowledge about interpretation of arterial blood gas analysis report was

significant at 0.05 level. Mean difference was 8.03 with SD of 2.77. Standard error of the mean was 0.50 with calculated t value 15.86. While comparing the total level of knowledge between pre-test and post-test, the difference mean value was 11.30 with a standard deviation of 3.68 and calculated t value was 16.78. Standard error of the mean was 0.67. It was statistically significant at P<0.05 level.

**Table 4:** Area wise distribution of difference in level of knowledge regarding ABG analysis among nurses between pre and post test

S. No.	Classification of knowledge	Difference mean (d)	Standard deviation (s)	Standard error of the mean	't' test value & p-value
1.	General aspects of arterial blood gas analysis	3.26	2.06	0.37	t = 8.65, P<0.05, (S)
2.	Interpretation of arterial blood gas analysis report	8.03	2.77	0.50	t = 15.86, P<0.05, (S)
3.	Total	11.30	3.68	0.67	t = 16.78, P<0.05, (S)

Note: S – Significant



## 5. Discussion

The findings of this study, 20 (66.67%) nurses had inadequate knowledge, 10 (33.33%) had moderately adequate knowledge and one had adequate knowledge in pre test at the same time in post test, 11 (36.67%) had moderately adequate knowledge, 19 (63.33%) had adequate knowledge and no one had inadequate knowledge is correlated with other research study conducted by V. Hemavathy, et al., (2016) [10]. That study result reveals that before implementing a structured teaching programme, out of 30 samples 4(13.3%) had inadequate knowledge, 20 (66.7%) had moderately adequate knowledge and only 6 (20%) had adequate knowledge about arterial blood gas analysis. However, in the post-test, 4 (13.3%) had moderate adequate knowledge, 26 (86.7%) had adequate knowledge, and none had poor knowledge regarding arterial blood gas analysis.

This study finding is also relevant to the study conducted by M. Karpukkarasi and N. Arasumani (2020). The result of that study revealed that most of them 35 (70.0%) had inadequate knowledge, 15 (30%) had moderate knowledge, none of them had adequate knowledge in pre-test and 40 (80%) had adequate knowledge, 10 (20%) had moderate knowledge and none of them had inadequate knowledge in post-test [11].

Comparison of the level of knowledge between pre-test and post-test result revealed that, difference mean value was 11.30 with a standard deviation of 3.68 and calculated t value was 16.78. The standard error of the mean was 0.67. It was statistically significant at  $P < 0.05$  level. This result is correlated with another study conducted by Anita Kumari, et al. (2020). That study result shows that, the mean difference was 7.56 with a calculated t value 20.82 statically significant at  $P < 0.05$  level [12].

## 6. Conclusion

Nurses are frequently the first members of the health care team to view ABG findings, so they must grasp their relevance and be able to determine when medical staff should be notified. This study result shows a significant increase in nurses' level of knowledge regarding arterial blood gas analysis after planned teaching programme. So, it indicates that planned teaching programme can be an effective tool to improving the level of knowledge regarding arterial blood gas analysis among staff nurses.

## 7. Future Scope

### Implications for nursing practice

The planned teaching programme regarding ABG Analysis can be utilized to create awareness among the nurses who are doing work in various units in the hospital. Nurses are the key persons who spend maximum time with the patient in all hospital units; they can provide quality care to patients when they have an appropriate level of knowledge regarding all, especially ABGA. Nurses are providing quality care means it will reduce the mortality, morbidity and number of days stay in hospital.

### Implications for nursing education

To impart knowledge, various new techniques on ABG analysis should be taught to the student nurses. This planned teaching programme can be utilized by the nurses to develop skills by creating awareness among other nurses in selected hospitals.

### Implications for nursing research

This study will motivate other investigators to conduct further studies regarding the effectiveness of planned teaching programmes on ABG analysis in various settings. The study reveals that more studies need to be done for nurses with updated teaching strategies to educate the nurses on ABG analysis.

### Implications for nursing administration

The responsibility of the nursing administrator is to increase the knowledge of nurses and nursing students regarding ABG analysis. The administrator should organize in-service education programmes, refresher courses and workshops for nurses on ABG analysis and encourage them to participate in these activities. The nursing administrator should conduct a demonstration class regarding technique on ABG analysis.

## 8. Recommendations

- 1) The same kind of study can be conducted for a larger group.
- 2) A comparative study can be carried out to check the knowledge level of CCU/ICU and general ward nurses regarding ABG analysis.
- 3) Further studies should be conducted about the attitude and practice regarding ABG analysis among nurses.
- 4) An experimental study can be conducted with a control group.
- 5) A longitudinal study can be done using post test after one month, six months and one year to see the retention of knowledge.

## 9. Acknowledgment

We sincerely convey our thanks to the nurses who participated as a sample in a study and management of Harsh Vardhan Memorial Hospital, Gwalior, M.P. for permission granted for the research study.

## 10. Conflict of interest

The authors have no conflict of interest to declare.

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