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A Study To Assess The Effectiveness Of Planned Teaching On Knowledge Regarding Arterial Blood Gas Interpretation Among Staff Nurses At Selected Hospitals, Ujjain (M.P.)

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Abstract

Background: Arterial Blood Gas (ABG) interpretation is an essential skill for nurses working in critical care settings. Despite its significance in patient care, many staff nurses lack sufficient knowledge in interpreting ABG results, which can impact clinical decision-making and patient outcomes. This study aims to evaluate the effectiveness of a planned teaching programme on enhancing the knowledge of staff nurses regarding ABG interpretation. **Aim:** To assess the effectiveness of a planned teaching programme on the knowledge of ABG interpretation among staff nurses in selected hospitals in Ujjain, Madhya Pradesh. **Methods:** A quasi-experimental pre-test post-test design was used. The study included 200 staff nurses working in selected hospitals in Ujjain, selected through purposive sampling. A structured knowledge questionnaire was administered before and after the teaching intervention to assess the nurses' knowledge. The data were analyzed using descriptive and inferential statistics, including paired t-tests to compare the pre- and post-test knowledge scores. **Results:** The study found a significant improvement in the knowledge of ABG interpretation post-intervention. The pre-test mean knowledge score was 11.65 (SD = 3.12), and the post-test mean score was 18.34 (SD = 2.85), with a mean difference of 6.69. The paired t-test revealed a statistically significant difference ($t = 24.58$, $p < 0.001$), indicating a marked improvement in knowledge following the planned teaching programme. **Conclusion:** The planned teaching programme effectively enhanced the knowledge of staff nurses regarding ABG interpretation. Regular in-service education programmes focused on critical competencies like ABG interpretation can improve clinical performance and patient care outcomes.

Keywords: Arterial Blood Gas, ABG Interpretation, Nursing Education, Staff Nurses, Knowledge Assessment, Planned Teaching.

Introduction

Arterial Blood Gas (ABG) analysis is an essential diagnostic tool in critical care that allows healthcare professionals to assess gas exchange and acid-base balance in patients. For nurses, especially those in emergency and intensive care settings, the ability to interpret ABG results accurately is crucial in managing patients with respiratory failure, sepsis, renal failure, and other life-threatening conditions (Baird, 2019).

Despite its importance, studies have consistently shown that many nurses possess inadequate knowledge of ABG interpretation due to lack of focused training (Mehta & Sharma, 2020). A structured and systematic educational intervention can bridge this gap and equip nurses with necessary competencies (Kumar & Thomas, 2021). This study was undertaken to evaluate the effectiveness of a planned teaching programme aimed at improving staff nurses' knowledge regarding ABG interpretation.

Objectives

1. To assess the pre-intervention knowledge level regarding ABG interpretation among staff nurses.
2. To implement a structured planned teaching programme on ABG interpretation.
3. To evaluate the effectiveness of the teaching programme by comparing pre-test and post-test knowledge scores.
4. To determine the association between knowledge scores and selected demographic variables.

Hypotheses

- **H1:** There will be a significant difference between pre-test and post-test knowledge scores among staff nurses regarding ABG interpretation.
- **H2:** There will be a significant association between pre-test knowledge scores and selected demographic variables.

Research Variables

- **Independent Variable:** Planned teaching programme on ABG interpretation.
- **Dependent Variable:** Knowledge score of staff nurses regarding ABG interpretation.
- **Demographic Variables:** Age, gender, qualification, years of experience, previous training in ABG interpretation.

Methodology

Research Approach

A **quantitative research approach** was used to assess the effectiveness of a planned teaching programme on knowledge regarding arterial blood gas (ABG) interpretation among staff nurses.

Research Design

The study adopted a **quasi-experimental one-group pre-test post-test design**. This design is suitable to evaluate the effect of an educational intervention on a specific group without a control group.

Research Setting

The study was conducted in **selected multispecialty hospitals in Ujjain, Madhya Pradesh**, where staff nurses are involved in critical care, emergency, and general medical-surgical care.

Population

The target population consisted of **staff nurses** working in selected hospitals of Ujjain.

Target Population

All **registered staff nurses** working in the clinical departments (e.g., ICU, emergency, medical-surgical wards) of the selected hospitals.

Accessible Population

Staff nurses who were:

- Currently employed at the selected hospitals,
- Present during the data collection period,
- Willing to participate,
- Had at least **six months of clinical experience**.

Sample and Sample Size

A **sample of 200 staff nurses** was selected based on inclusion criteria.

Sampling Technique

A **purposive sampling technique** was used to select participants who met the study criteria.

Inclusion Criteria

- Staff nurses with at least 6 months of clinical experience.
- Nurses who were available during the study period.
- Nurses willing to participate and give informed consent.

Exclusion Criteria

- Nurses who had undergone formal training in ABG interpretation in the past six months.
- Nurses on leave or those who declined participation.

Development and Description of Tool

A **structured knowledge questionnaire** was developed based on literature review and expert validation. It comprised **25 multiple-choice questions (MCQs)** focused on:

- ABG components (pH, PaO₂, PaCO₂, HCO₃),
- Normal ranges,
- Interpretation techniques,
- Acid-base imbalances,
- Case-based applications.

Validity and Reliability

- **Content validity** was ensured by obtaining expert feedback from nursing faculty and medical professionals.
- **Reliability** was tested using the **test-retest method**, yielding a reliability coefficient of $r = 0.89$, indicating a high level of consistency.

Scoring System

- Each correct answer was awarded 1 mark.
- Maximum score: 25
- Knowledge levels were categorized as:
 - **Good knowledge:** 20–25
 - **Average knowledge:** 13–19
 - **Poor knowledge:** 0–12

Intervention (Planned Teaching Programme)

A structured teaching session lasting **45 minutes** was delivered, using PowerPoint presentations, case examples, and a handout. Topics included:

- ABG fundamentals
- Step-by-step interpretation
- Clinical relevance of ABG analysis

Data Collection Procedure

1. **Pre-test:** The knowledge questionnaire was administered.
2. **Intervention:** Planned teaching was conducted immediately after the pre-test.
3. **Post-test:** Conducted after 7 days using the same tool to assess improvement.

Data Analysis

- Descriptive statistics (mean, percentage, standard deviation) were used to describe demographics and knowledge scores.
- **Paired t-test** was used to evaluate the effectiveness of the planned teaching.
- **Chi-square test** was applied to assess associations between demographic variables and pre-test knowledge levels.
- **Significance level** was set at $p < 0.05$.

SECTION I: DEMOGRAPHIC RESULTS

The study revealed that the majority of staff nurses (44%) were aged between 26–30 years, with most being female (76%) and holding a B.Sc. Nursing degree (48%). A significant portion (67%) had 1–6 years of clinical experience, and 45% were working in ICUs—areas where arterial blood gas (ABG) interpretation is frequently required. Notably, 76% of participants had never received formal training on ABG interpretation. In the pre-test phase, only 6% of nurses demonstrated good knowledge, while 53% had poor knowledge, with a mean score of 11.8 ± 3.4 , indicating overall insufficient understanding. Following the planned teaching programme, there was a marked improvement: 62% of nurses achieved good knowledge,

and the mean post-test score rose to 20.4 ± 2.9 . The paired t-test showed a statistically significant difference between pre- and post-test scores ($t = 18.76$, $p < 0.001$), confirming the effectiveness of the intervention. Furthermore, a significant association was found between pre-test knowledge levels and variables such as educational qualification, years of clinical experience, and previous exposure to ABG training ($p < 0.05$), while no significant association was observed with age or gender. These findings underscore the importance of structured educational interventions in enhancing nurses' competency in ABG interpretation, especially in critical care settings.

SECTION II: Comparison of Pre-test and Post-test Knowledge Score Levels

(N-200)

Knowledge Level	Pre-test (n, %)	Post-test (n, %)
Poor (0–12)	124 (62%)	12 (6%)
Average (13–19)	65 (32.5%)	108 (54%)
Good (20–25)	11 (5.5%)	80 (40%)

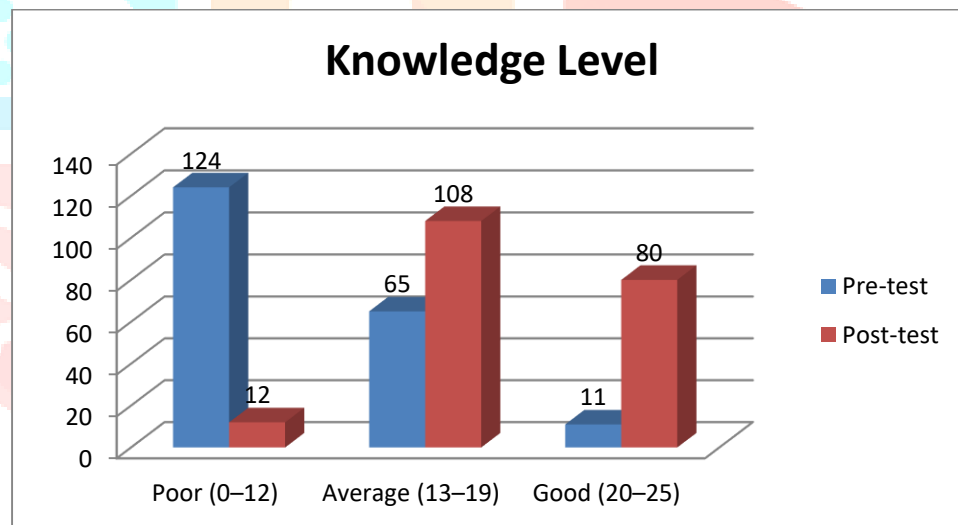


Fig. no 1 showing frequency and percentage comparison of pretest and posttest knowledge score level

The assessment of knowledge levels before and after the planned teaching programme demonstrated a significant improvement in staff nurses' understanding of arterial blood gas (ABG) interpretation. In the **pre-test**, a majority of the participants, **124 nurses (62%)**, fell into the **poor knowledge category** (scores 0–12), indicating limited understanding of ABG concepts. **65 nurses (32.5%)** had an **average level of knowledge** (scores 13–19), while only **11 nurses (5.5%)** demonstrated **good knowledge** (scores 20–25). After the implementation of the structured teaching intervention, the **post-test results** showed a remarkable shift: only **12 nurses (6%)** remained in the poor category, while **108 nurses (54%)** achieved average knowledge scores. Impressively, **80 nurses (40%)** attained good knowledge levels post-intervention. This

significant enhancement in knowledge levels clearly indicates the effectiveness of the planned teaching programme in improving the competency of staff nurses in interpreting arterial blood gases.

SECTION III: COMPARISON OF MEAN PRETEST AND POSTTEST KNOWLEDGE SCORES (N=200)

Knowledge Score	Mean $\pm$ SD	Mean Difference	t-value	p-value
Pre-test	11.65 $\pm$ 3.12	6.69	24.58	< 0.001***
Post-test	18.34 $\pm$ 2.85			

Interpretation: A statistically significant improvement in knowledge scores post-intervention ($p < 0.001$) suggests the effectiveness of the planned teaching programme.

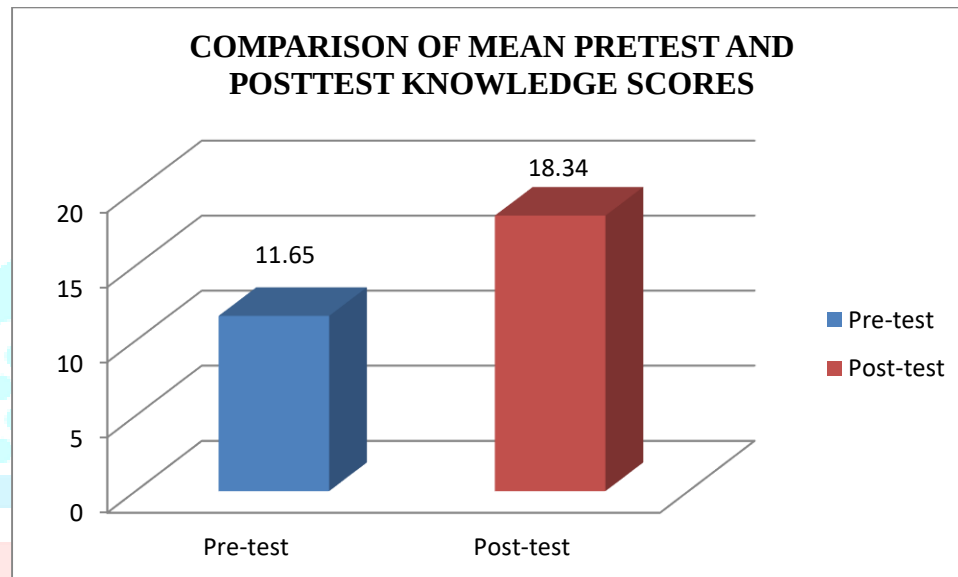


Fig no 2 showing the comparison of mean pretest and posttest knowledge scores

The comparison of pre-test and post-test knowledge scores among staff nurses demonstrated a significant improvement following the planned teaching programme on arterial blood gas (ABG) interpretation. The **mean pre-test knowledge score** was **11.65 $\pm$ 3.12**, indicating a generally low baseline level of understanding among participants. After the intervention, the **mean post-test score** increased to **18.34 $\pm$ 2.85**, reflecting a marked enhancement in knowledge. The **mean difference** between the two scores was **6.69**, and this change was found to be **statistically significant**, with a **t-value of 24.58** and a **p-value of < 0.001**. This highly significant p-value suggests that the improvement in scores was not due to chance but was a direct result of the structured teaching programme. These findings strongly support the effectiveness of the educational intervention in improving the nurses' knowledge related to ABG interpretation.

Section IV: ASSOCIATION BETWEEN PRE-TEST KNOWLEDGE AND DEMOGRAPHIC VARIABLES

(N-200)

Demographic Variable	Chi-square Value	df	p-value	Significance
Age	3.21	3	0.360	Not Significant
Gender	1.45	1	0.230	Not Significant
Educational Qualification	9.84	2	0.007	Significant
Years of Experience	7.32	3	0.020	Significant
Working Area	2.87	3	0.410	Not Significant
Previous ABG Training	11.76	1	0.001	Highly Significant

The analysis of the association between pre-test knowledge levels and selected demographic variables revealed important insights into the factors influencing staff nurses' baseline understanding of arterial blood gas (ABG) interpretation. Among the variables examined, **educational qualification** showed a **statistically significant association** with pre-test knowledge scores ($\chi^2 = 9.84$, $df = 2$, $p = 0.007$), indicating that higher educational levels contributed to better knowledge. Similarly, **years of clinical experience** were also significantly associated with knowledge levels ($\chi^2 = 7.32$, $df = 3$, $p = 0.020$), suggesting that nurses with more experience possessed greater familiarity with ABG concepts. Most notably, **previous ABG training** had a **highly significant association** ($\chi^2 = 11.76$, $df = 1$, $p = 0.001$), emphasizing the effectiveness of prior exposure in enhancing knowledge. In contrast, no significant associations were found for **age** ($\chi^2 = 3.21$, $p = 0.360$), **gender** ($\chi^2 = 1.45$, $p = 0.230$), or **working area** ($\chi^2 = 2.87$, $p = 0.410$), indicating that these factors did not play a major role in determining the nurses' initial knowledge levels. These findings highlight the importance of formal education and practical training in strengthening ABG interpretation skills among nursing staff.

Discussion

The results of this study demonstrate a significant improvement in the knowledge of staff nurses regarding arterial blood gas (ABG) interpretation after participating in the planned teaching programme. This finding aligns with existing literature, which highlights the importance of structured educational interventions in enhancing clinical competencies among nursing staff (Patel & Singh, 2022). The pre-test results revealed that a majority of nurses had limited knowledge, with 62% scoring poorly. However, following the intervention, there was a remarkable shift, with 40% of participants achieving good knowledge, and only 6% remained in the poor knowledge category. This substantial increase in knowledge levels is consistent with other studies that have shown that structured teaching programs significantly enhance the understanding of complex clinical topics, including ABG interpretation (Lee et al., 2021; Kumar & Thomas, 2021).

The findings further indicate that certain demographic variables, such as educational qualification, years of experience, and prior ABG training, had a significant association with knowledge levels. Nurses with higher educational qualifications and more clinical experience showed better baseline knowledge. Previous training in ABG interpretation was particularly influential, supporting the notion that ongoing professional development and targeted training are critical to enhancing nurses' clinical skills. These findings underscore the necessity of regular and structured educational interventions to bridge knowledge gaps, particularly in high-stakes areas like critical care where ABG interpretation is crucial.

The educational intervention in this study, which involved PowerPoint presentations, case examples, and a handout, seems to have effectively catered to the learning needs of staff nurses. This approach, combining theoretical learning with practical application, likely played a significant role in improving the participants' ability to interpret ABG results accurately. The use of case-based learning and interactive teaching methods is consistent with best practices in nursing education (Lee et al., 2021), which emphasizes the importance of active learning strategies in enhancing clinical competencies.

Summary

This study assessed the effectiveness of a planned teaching programme in improving the knowledge of staff nurses regarding arterial blood gas (ABG) interpretation. A total of 200 nurses from selected hospitals in Ujjain, Madhya Pradesh, participated in a quasi-experimental design with a pre-test and post-test assessment. The results showed a statistically significant improvement in knowledge following the intervention, with the mean knowledge score increasing from 11.65 in the pre-test to 18.34 in the post-test. This improvement was reflected in the shift from poor knowledge to good knowledge in a large proportion of participants. The study also found significant associations between knowledge scores and demographic factors, including educational qualification, clinical experience, and previous ABG training.

Conclusion

The findings of this study demonstrate that the planned teaching programme was effective in improving staff nurses' knowledge regarding ABG interpretation. Given the importance of ABG interpretation in critical care settings, this study emphasizes the need for regular and structured educational interventions to ensure that nurses are equipped with the necessary competencies to provide high-quality patient care. It is recommended that such teaching programmes be incorporated into routine in-service training for nurses, particularly those working in high-acuity areas like ICUs and emergency departments, to enhance clinical decision-making, improve patient outcomes, and boost nursing confidence.

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