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"A Pre–Experimental Study To Assess The Effectiveness Of Education Package On Knowledge Regarding Abg Analysis Interpretation Among Critical Care Nurses Of Selected Hospitals Of Punjab"

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Background-The ABG test is a critical diagnostic tool used to assess a patient's acid-base balance, oxygenation, and ventilation status. It measures acidity or alkalinity of blood, Partial pressure of carbon dioxide (respiratory component) Bicarbonate level (metabolic component) This test is commonly used in critical care, respiratory therapy, and emergency settings to evaluate conditions like respiratory failure, metabolic disorders, and shock. Nurses play a vital role in the clinical application of ABG results. They recognize abnormal values and correlate with patient symptoms.

Objective –The aim of the study was to improve knowledge regarding ABG analysis interpretation among critical care nurses of selected hospitals of Punjab.

Material and Method-A Quantitative approach with pre- experimental research design was used for the study. Total 100 Critical care nurses were working different critical care units were enrolled of selected hospitals of Punjab.Non randomized convenient sampling technique was used. A pre-validated, self-structured questionnaire was developed to assess the effectiveness of education package of knowledge regarding regarding ABG analysis interpretation among critical care nurses of selected hospitals of Punjab. Package On Knowledge Regarding ABG Analysis Interpretation was developed and implemented. It is divided in three parts.Part1 deals with knowledge related to ABG test, Part II deals with knowledge related to ABG procedure and Part III deals with knowledge related to ABG Interpretation. Post-Test was conducted after one week of nurse led education package of knowledge regarding regarding ABG analysis.

Results- The majority of the Critical Care Nurses are between 20-30 years i.e. 70%, the next main group is 31-40 i.e. 29%. Most of the critical were nurses are female (94%). (63% of the working were GNM, 24% were B.Sc. and 11% were P.B.BSc and 2% were M.Sc. Nursing A significant majority have 0-5 year experience 84%.The pre –test knowledge score was the majority of participants (88%) score in the "Poor" category range i.e. (0-49), with 10% scoring in the "Average" range i.e. (50-79) and only 2% achieving a "Good" range score i.e. (80-100) This indicates that critical care nurses have lower knowledge of ABG analysis interpretation before the interventions There was a significant improvement in knowledge scores from pre -test (Mean = 13.60) to post test (Mean = 33.59), with a T-value of 42.319 and a P-value <0.001, indicating the intervention had a strong positive effect In the post test.

Conclusion-, In the present study Education Package regarding the Interpretation of ABG analysis among critical care unit nurses was effective, as it improved the knowledge related to ABG test procedure and interpretation of critical care nurses.

Key Words –Critical care nurses, ABG Analysis interpretation, Education Package

Introduction

The ABG test is a cornerstone of critical care diagnostics. It involves sampling blood from an artery typically the radial, brachial, or femoral—to measure :pH (acid-base status), $PaCO_2$ (carbon dioxide levels), PaO_2 (oxygen levels), HCO_3 (bicarbonate concentration) SaO_2 (oxygen saturation) This test provides a real-time snapshot of a patient's respiratory efficiency, metabolic balance, and oxygenation status, making it indispensable in acute care settings.[1]

ABG analysis is indicated when clinicians need to: Assess respiratory function in conditions like COPD, asthma, pneumonia, or ARDS .Monitor acid-base disturbances such as metabolic acidosis (e.g., diabetic ketoacidosis) or alkalosis. Evaluate neurological status in altered consciousness or head trauma. Guide mechanical ventilation settings in intubated patients. Detect carbon monoxide poisoning via carboxyhemoglobin levels. Monitor lactate levels in sepsis or shock. Track critically ill patients in ICU for ongoing oxygenation and ventilation needs.

While ABG is generally safe, it should be avoided or approached cautiously in the following scenarios .Local infection or inflammation at the puncture site ,Distorted anatomy or inability to palpate the artery , Presence of an arteriovenous fistula . Known bleeding disorders or recent thrombolytic therapy, Severe peripheral vascular disease affecting the limb• Uncooperative or agitated patients where risk outweighs benefit In such cases, venous blood gas (VBG) may be considered as an alternative for partial insights.

Nurses have the clinical responsibility in ABG management. Their tasks span across. In Pre-Procedure role of nurse is educate the patient and obtain consent, perform Allen's test to assess collateral circulation, prepare sterile equipment and ensure proper positioning.[2]

During Sampling assist or perform arterial puncture (if trained and authorized) Ensure minimal discomfort and prevent complications, handle samples correctly to avoid air contamination or clotting post-procedure & Interpretation , monitor for bleeding, hematoma, or neurovascular compromise,

interpret ABG values in context of patient symptoms and clinical status, communicate findings promptly to the medical team, implement or adjust interventions (e.g., oxygen therapy, ventilation) document results and trend changes over time for clinical decision-making.

In India However ABG is not utilized for a particular diagnosis test e.g. patients have identical values of with varying diagnoses. But is the critical diagnosing tool of critically ill patients' care. It is mandatory that critical care nurses should interpret ABG and they can make certain their patients are getting appropriate timely care.

Review of literature

Review of literature provides the basis for future investigation and indicates constraints data collection. The literature review of this study goals to provide existing knowledge including finding of the related researches and methodological contributions in particular topic.

Section –A Review of literature related to knowledge regarding Arterial Blood Gas Analysis

Anthony L Byrne et al. (2014) did a systemic review and meta-analysis .The finding systemic literature of 18 studies in which 1768 subject were included on the meta -analysis. They find little differences between the ph. of peripheral venous and arterial blood gas analysis they discover that arterial ph generally 0.03 higher than venous ph (95%) wih the confidence interval 0.029, 0.038. The arterial and venous Pc02 were not comparable because the prediction interval i.e 95% was bias for venous pco2 was wide extending from 10.7 mmHg to +2.4 mm Hg. The po2 value could not compared arterial P02 36.9mmHg greater than the venous with significant variable i,e 95% confidence interval from 27.2 to 46.6 mmHg. Peripheral venous blood gas analysis only compares well with ABG analysis for ph estimation in adults but not to the PCO2 PO2. They found large difference in clinical significance.[3]

Sacha C. Rowling et al. (2013) conducted a multi-center historical cohort study, they included all patients performed ABG analysis at three Danish hospitals from January1, 1993 –Feb 2013.They analysis adult 473327 patient and they 669 adult patients led to major complications embolism, aneurysm, nerve damage, arterial venous fistula 49%, 15.4%, 1.5% and 0.6% and another kind 33.5%.They find major complications rates who are on antithrombotic medications. They consider ABG analysis for adult patient's procedures.[4]

Clementin Y F Yap et al. (2011) stated that indication of ABG result are giving information on the acid base status, oxygenation hemoglobin saturation and co2 elimination. Asked about limitation on the patient with bleeding diathesis, arterial venous fistulas, and absences of arterial pulse, hematoma and severe peripheral vessel diseases.[5]

Parmod Sood et al. (2010) Stated that disorder of acid base balance can lead to severe complications in many diseases and occasionally the abnormality may be too severe as to become life threatening risk factors.[11] The process of analysis and monitoring in arterial blood gas is an essential part of diagnosing and managing the oxygenation status and acid base balance of the high risk patients and as well as the critically ill patients of ICU. ABG measure blood oxygen and carbon dioxide levels in the blood and it also measure the acid, base balance in the blood and it also measure the acid, base balance in the blood. It gives information about the functioning of the lung and kidney. When imbalance of these gases can causes the life threatening conditions like increase acidosis and increase base alkalosis if not treated can life threatening. ABG analyzing the ph, partial pressure, serum bicarbonate in serious patients. It also helps in diagnosis multiple pathological conditions. The alveolar arterial oxygen gradient is a useful measure to lung gas exchange which is disturbed patients suffering from ventilation perfusion mismatch.[6]

Section -B Review of literature related to effectiveness ofteaching programme regarding Arterial Blood Gas Analysis

R Sumuel et al. (2018) created a newer graphical aid for ABG interpretation. Result of the study concluded that the newer graphical tool can assist in faster and simpler interpretation of ABG reports. When this too was compared with current graphical tool.[7]

Rokesh Thorat et al. 2017 the experimental research carried out to evaluate the efficiency of structured teaching program on effectiveness of structure teaching program on arterial blood gas the finding reveals that mean knowledge was 50% to75% but nobody was at excellent level on the other side in the post test. In the post test, the improvement in good knowledge was enhanced 38%. Sample in at excellent level.[8]

K. Padma et al. 2017 presented a descriptive cross sectional study to evaluate the knowledge about ABG analysis and interpretation of ABG report among 30 staff nurses. The findings of this study revealed that 13.3 of staff nurses possessed A Grade. 23.3 %possessed B + Grade, 40 % possessed a B Grade, 16.7% possessed C Grade knowledge and 6.7% possessed D Grade knowledge. [9]

D Thaulasimani et al. (2010) conducted a quasi-experiment study to assess the effectiveness of structured program regarding ABG analysis among nurses working in ICU the major result of the study showed the knowledge of experimental group was improved from 41.50%.81.93% On the hand the overall knowledge of contrast was 40.75 %in pre-test .They had improved 42.00 in post-test. The overall comparison of pre -test t with post-test to test knowledge e,g 16.6%to 32.7% and in control group and control group i.e.16.3% to 16.80, this was shown no improvement was found.[10]

J Schniderman et al. (2009) conducted a study of pre and post -test design was used to assess the ability of the staff nurses before and after involving in a computer based learning method. Total 58 nurses given pre-test, complete online learning module and given post-test Staff knowledge was significance improve after the computer based learning programme (t

=6.3; p ,0001).[11]

Material and Method

The present study was conducted in selected hospitals of Punjab. A Pre Experiment study design was conceded for the present study. Total 100 Critical care nurses those were working in different critical care units were registered. Non randomized convenient sampling technique was used. A pre validated self- structured questionnaire comprising of 20 questions related to knowledge about the ABG test, procedure and 20 questions related to ABG analysis interpretations was developed and administered to assess the knowledge of critical care nurses. Education Package On Knowledge Regarding ABG Analysis Interpretation was developed and implemented. It is divided in three parts. Part1 deals with knowledge related to ABG test, Part II deals with knowledge related to ABG procedure and Part III deals with knowledge related to ABG Interpretation. Post-Test was conducted after one week of nurse led education package of knowledge regarding regarding ABG analysis.

The total knowledge score was categorized in three categories i.e. poor, average and good according to score obtained by critical care nurses. Critical care nurses who scored > 80% were in good category, 50-79 average and <50 were in poor category.

SECTION- A –SOCIO DEMOGRAPHIC CHRACTERISTICS

Table no 1-Demographic profiles of subjects in terms of frequency &percentage distribution.

SECTION-1 SOCIO DEMOGRAPHIC PROFORMA		Experimental (%)	Frequency
Age	20-30	70%	70
	31-40	29%	29
	41-50	1%	1
	51-60	0%	0
Gender	Male	6%	6
	Female	94%	94
Religion	Hindu	52%	52
	Sikh	40%	40
	Muslim	3%	3
	Christian	5%	5
Marital Status	Unmarried	69%	69
	Married	31%	31
	Divorce	0%	0
Education	GNM	63%	63
	Post Basic Bsc Nursing	11%	11
	Basic Bsc Nursing	24%	24
	Msc Nursing	2%	2
	Phd Nursing	0%	0
Previous Knowledge	Yes	80%	80
	No	20%	20
In Service Education	Yes	46%	46
	No	54%	54
Critical Care Experience	0 -5 years	78%	78
	6-10 years	13%	13

	11-15 years	9%	9
	16 -20 years	0%	0
Total Work Experience	0 -5 years	65%	65
	6-10 years	26%	26
	11-15 years	9%	9
	16 -20 years	0%	0

- **Age:** The majority in the group age is between 20-30 years (70%) The next largest group is 31-40 years (29%).

- **Gender:** The group has a higher percentage of females (94%) while males make up 6% of

- **Religion:** The majority of participants in the group are Hindu (52%) followed by Sikh (40% experimental). A smaller proportion of Muslims and Christians are in the group.

- **Marital Status:** Most participants in the groups are unmarried (69% experimental,, with a small percentage married (31%). No participants are divorced.

- **Education:** The largest group has a General Nursing and Midwifery (GNM) qualification (63%). The next largest group have Basic B.Sc. Nursing (24%), Post Basic B.Sc. Nursing (11%).

- **Previous Knowledge:** A significant majority in the group has previous knowledge (80%).

- **In-Service Education:** A similar percentage of participants in the undergone in-service education (46%).

- **Critical Care Experience:** The majority in the group has 0-5 years of critical care experience (78%), with fewer participants having 6-10 years (13%)11-15 years (9%).

- **Total Work Experience:** The largest percentage in the group has 0-5 years of total work experience (65%), followed by 6-10 years (26%), . Fewer participants have 11-15 years of work experience.

SECTION B

KNOWLWDGE SCORES REGARDING ABG ANALYSIS INTERPRETATION

Table 2-Frequency & Percentage of distribution of pre-test knowledge regarding ABG analysis interpretation

PRE-TEST KNOWLEDGE SCORE	
CATEGORY SCORE	**PRE TEST f (%)**
GOOD(30-40)	2(2%)
AVERAGE(20-29)	12(12%)
POOR(0-19)	86(86%)

In the pre-test knowledge assessment of 100 respondents were majority of participants (86%) scored in the "Poor" category (0-19), with 12% scoring in the "Average" range (20-29), and only 2% achieving a "Good" score (30-40). This indicates low baseline knowledge before the intervention.

Table 3-Descriptive statistics of pre-test level of knowledge regarding ABG analysis interpretation

Descriptive Statistics	Mean	S.D	Median Score	Maximum	Minimum	Range	Mean %
PRE-TEST KNOWLEDGE	13.60	5.267	14	30	5	25	34 .00

The pre-test knowledge score regarding ABG analysis interpretation for the respondents show a mean score is 13.60 with a standard deviation of 5.267, indicating moderate variability in scores. The median score is 14, with scores ranging from 5 to 30. The mean percentage is 34.00%, indicating a relatively low level of knowledge at the start of the experiment.

Table 4-Frequency & Percentage of distribution of post-test knowledge regarding ABG analysis interpretation

PRE-TEST KNOWLEDGE SCORE	
CATEGORY SCORE	**PRE TEST f (%)**
GOOD(30-40)	90(90%)
AVERAGE(20-29)	10(10%)
POOR(0-19)	0 (0%)

In the post-test knowledge assessment of 100 respondents showed a great improvement here, where 90% of the participants score in the "Good" category (30-40), while 10% score in the "Average" category (20-29). There are no participants in the "Poor" category (0-19), reflecting significantly higher knowledge following the intervention. Hence it is concluded that majority of subjects had good knowledge regarding ABG analysis interpretation.

Table 5-Descriptive statistics of post-test level of knowledge regarding ABG analysis interpretation N =100

Descriptive Statistics	Mean	S.D	Median Score	Maximum	Minimum	Range	Mean %
PRE-TEST KNOWLEDGE	33.59	2.868	34	39	27	12	83.98

The Post-knowledge scores for the respondents reveal a standard deviation is 2.868 with a mean score of 33.59, which reflects a fairly stable performance level for participants. The median score is 34, and it

indicates that half of the participants scored above this. The range of scores is from 27 to 39 with a mean percentage of 83.98%, which demonstrates a high knowledge improvement level.

Table no.6-Comparison of frequency and percentage distribution of pre-test and post-test level of knowledge regarding ABG analysis interpretation

CRITERIA MEASURE KNOWLEDGE SCORE		
SCORE LEVEL	**PRE-TEST f (%)**	**POST-TEST f (%)**
POOR KNOWLEDGE (0 -19)	**86(86%)**	**0 (%)**
AVERAGE NOWLEDGE (20-29)	**12 (12%)**	**10 (10 %)**
GOOD KNOWLEDGE (30-40)	**2 (2%)**	**90 (90%)**

Table representing comparisons of pre- test and post-test knowledge score. In pre-test in the Group, 86% were "Poor" range (0-19), 12% were "Average" range (20-29), and 2% were "Good" range (30-40).There was a significant increase in the knowledge of the group, 90% were in the "Good" range, 10% in the "Average" range, and 0% in the "Poor" range

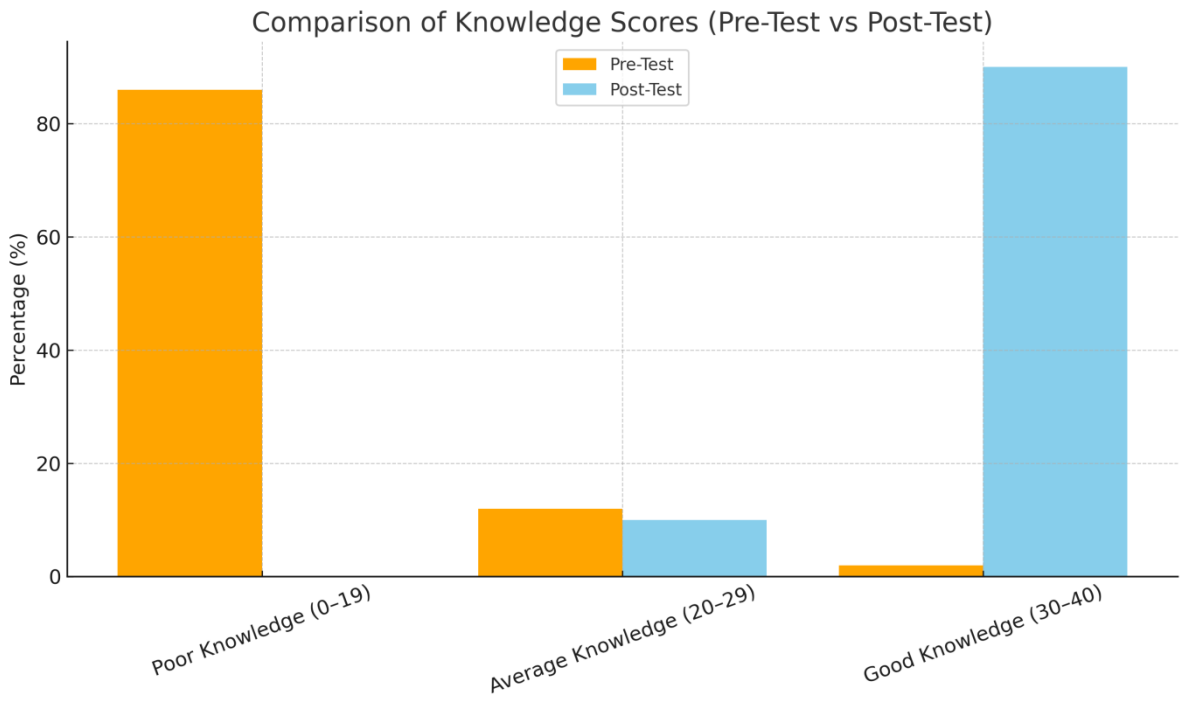

Figure 1 Comparison of the knowledge score

Table 7- Comparison of inferential statistics of pre-test and post-test scores of knowledge regarding ABG analysis interpretation

Paired t-test	N	Mean	SD	df	t	Result
PRE-TEST KNOWLEDGE	**100**	**13.60**	**5.267**	**99**	42.319	p value=<0.001 Significant
POST-TEST KNOWLEDGE		**33.59**	**2.868**			

Table representing comparison of inferential statistics of pre-test and post-test knowledge score among 100 critical care nurses. There was a significant improvement in knowledge scores from pre-test (Mean = 13.60) to post-test (Mean = 33.59), with a T-value of 42.319 and a P-value <0.001, indicating the intervention had a strong positive effect.

Discussion- An Arterial Blood Gas (ABG) test is an important diagnostic test that helps to identify respiratory failure by assessing the amount of oxygen (o2) and carbon dioxide (co2), ventilation and acid base level in the blood.

Arterial blood gases sampling is one of the practice nurses have in the treatment of patients admitted in the intensive care unit, especially those who are on respiratory support. Therefore the current study have been conducted with the aim to assess the effectiveness of education package on knowledge regarding ABG analysis interpretation among critical care nurses. The nurses should have knowledge about ABG procedure and ABG analysis interpretation so they can also participate in treatment plan of critical ill patient and save them from respiratory and metabolic complications.

In the present study the majority of the critical care nurses were aged between 20–30 years (70%), followed by those aged 31–40 years (29%). Most participants were female (94%). Regarding educational qualification, 63% were General Nursing and Midwifery (GNM) diploma holders, 24% had a B.Sc. Nursing degree, 11% held a Post Basic B.Sc. Nursing qualification, and 2% were M.Sc. Nursing graduates. A significant majority (84%) had 0–5 years of work experience in critical care settings. Another study conducted by **K Padma etal (2017)** that the majority of the findings indicate frequency and percentage distribution in terms of 28(93.3%) staff nurses between 21-24 years and 2(6.7%) between 25-27 years, in terms of gender 29(96.7%) staff nurses are females and 1(3.3%) staff nurse is male, in terms of educational qualification 29(96.7%) studied BSC (N) and 1(3.3%) studied PBBSC (N). With respect to professional experience 15 (50%) staff nurses are less than 1 year, 14(46.7%) nurses have 1-3 years and 1(3.3%) nurses has 3-5 years, referring to duration of experience in ICU, 16 (53.3%) have <1 year experience,[9]

In the pre-test, most participants (88%) scored in the **"Poor"** knowledge category (0–49), 10% in the **"Average"** category (50–79), and only 2% in the **"Good"** category (80–100). This indicates that critical care nurses initially possessed limited knowledge regarding arterial blood gas (ABG) analysis and its interpretation. After the educational intervention, there was a marked improvement in knowledge scores. The mean score increased from **13.60** in the pre-test to **33.59** in the post-test, with a **t-value of 42.319** and a **p-value < 0.001**, indicating that the intervention had a statistically significant and strong positive effect on nurses' knowledge. The finding of this study has also been found parallel to another study conducted **by U Zeb etal (2023)** in this study also) Pre-test and Post-test mean were contrasted. The mean pre-test knowledge score was 51.9963 and mean knowledge score of post-tests was 74.6 the difference between the pre-test and post-test was 22.6 and calculated t value was 3.13 which was significant at a p-value of 0.000.[12]

Conclusion

It was concluded through the findings of the study that the nurses were not on the mark in order to interpret and analyse the ABGs according to the required standards and practises. Thus, continuous instruction in the form of providing directions, written materials such as study modules and teaching conferences might need to plan often in order to provide quality care services within the critical care units.

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