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The Perception of ABG Interpretation among Nursing And Respiratory Therapy Students at an Urban University

Hams Shrourou

ACCEPTANCE

This thesis, THE PERCEPTION OF ABG INTERPRETATION AMONG NURSING AND RESPIRATORY THERAPY STUDENTS AT AN URBAN UNIVERSITY, by Hams Shrourou, BSRT, was prepared under the direction of the Master's Thesis Advisory Committee of the Respiratory Therapy department at Georgia State University. It is accepted by the committee in partial fulfillment of requirements for the Master of Science degree in Respiratory Therapy at Byrdine F. Lewis School of Nursing and Health Professions, Georgia State University.

The Master's Thesis Advisory Committee, as representatives of the faculty, certifies that this thesis has met all standards of excellence and scholarship as determined by the faculty.

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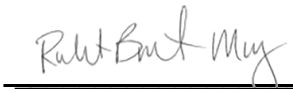

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DEDICATION

Initially, I am pleased to express my deep gratitude to God (Allah) for the consistent guidance and blessings that have supported me throughout the challenges of this academic endeavor. This thesis work is dedicated to my husband, whose continuous support has been fundamental in my journey towards achieving my goals. Having him by my side fills me with profound gratitude. His encouragement and efforts have propelled me to one of my greatest accomplishments. I cannot thank you enough for all you have done for me, and I am forever indebted to you. My love for you knows no bounds. To my loved son, Rawad, you are my source of inspiration. Your unwavering love and faith in me has strengthened my spirit, making me a stronger individual. You bring boundless beauty to my life, and I love you deeply. I am deeply grateful to my beloved mother and father, whose love unconditionally and has been a passionate foundation throughout my life and, I express my deepest gratitude. Thank you for encouraging me to work hard and for your endless support in pursuing my aspirations. I cannot thank you both enough for all you have done for me, and I am forever indebted to you. I want to express my heartfelt gratitude to my siblings for their constant love, support, and encouragement. Thank you for your unwavering support. To all those mentioned above and to everyone who has played a role in my journey, I extend my heartfelt gratitude for your constant support and presence throughout.

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THE PERCEPTION OF ABG INTERPRETATION AMONG NURSING AND RESPIRATORY THERAPY STUDENTS AT AN URBAN UNIVERSITY

By

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THE PERCEPTION OF ABG INTERPRETATION AMONG NURSING AND RESPIRATORY THERAPY STUDENTS AT AN URBAN UNIVERSITY

By

Hams Shrourou

(Under the Supervision of Dr. Douglas S. Gardenhire)

Abstract

Background: Arterial Blood Gas (ABG) is an important test that assesses the oxygenation and ventilation status. ABG tests are primarily obtained in intensive care units and emergency room patients. Blood gas analysis is a standard diagnostic method for measuring and assessing the acid-base composition and the various levels of the partial pressure of gases in the blood. These measured gases consist of partial pressure of carbon dioxide (PaCO2), partial pressure of oxygen (PaO2), the potential of hydrogen (PH), and oxyhemoglobin saturation (SaO2). It additionally assesses acid-base balance by measuring bicarbonate (HCO3) and base excess (BE). Healthcare professionals can evaluate and assess patient conditions because of circulatory, metabolic, and respiratory diseases by interpreting ABG results. The interpretation of ABG results provides detailed information about the level and severity of diseases. Blood gas analysis assists in evaluating patient response to medical interventions, monitoring the condition of patients with pulmonary or cardiac diseases, assessing the severity and progression of cardiopulmonary disease, and determining if compensation is occurring. **Purpose:** This study aimed to evaluate the perception of ABG interpretation among nursing and respiratory therapy students from Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. **Methods:** A descriptive cross-sectional study was conducted at Georgia State University. Data was collected from nursing and respiratory therapy students using a convenience sample. Data were collected through a self-administered questionnaire with direct coordination with RT department directors. Data was analyzed using the statistical program of Statistical Package for the Social Sciences (SPSS). **Results:** A total of 236 responses were received from both programs. The majority of the study participants pursuing bachelor's degree in nursing n= 145 (61.4%); followed by a bachelor's degree in respiratory therapy n= 76 (32.2%); and a master's degree in respiratory therapy n= 15 (6.4%). The current study findings demonstrated that undergraduate and graduate healthcare students exhibited positive perceptions toward ABG interpretation. The findings revealed that healthcare students reported the strongest agreement on the importance of recognizing an abnormal ABG, with a total mean score of 6.85 and a standard deviation of (SD ± .684). There were significant differences in the familiarity regarding ABG interpretation between nursing and respiratory therapy students ($P< .001$). Lastly, there were significant differences in the perceptions regarding ABG between students who had clinical experience and those who had no clinical experience ($P< .001$). **Conclusion:** Healthcare students have positive perceptions toward ABG interpretation. The study's findings also support the theory that bachelor's and master's degree respiratory therapy students exhibited superiority in familiarity regarding ABG interpretation over bachelor's degree nursing students. Additionally, the current study's findings indicated that experience positively affects the perception regarding ABG interpretation.

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Chapter I

Introduction

Arteries are defined as thin, muscular tubes responsible for the transportation of oxygenated blood that originates from the heart and circulates throughout the entirety of the human body. Blood enriched with oxygen, essential nutrients, and hormones, is transported from the heart to the entire human body. The transportation of blood throughout the human body via the circulatory system plays a vital role in maintaining the health and functionality of critical organs, muscles, and tissues, thereby ensuring the continued sustenance of human life. Elimination of metabolic waste products from the human body is a critical process. The circulatory system is responsible for this process and plays a significant role (Clinic, 2021). The disruption in the equilibrium of these components can trigger physiological malfunctioning, thereby functioning as an indication of potential disorders. Hence, the measurement of these constituents in the blood can facilitate the identification of specific status. An arterial blood gas (ABG) test is used to investigate these elements. (Bendandi, 2019).

Arterial blood gas analysis is blood drawn from an artery and measures constituents in the blood. The blood sample for an ABG test is obtained from either the radial artery, brachial artery, femoral artery, or dorsalis pedis. The radial artery is most commonly used to collect samples. ABG tests are primarily obtained in intensive care units and emergency room patients. ABG tests are also performed in patients with pulmonary and cardiovascular diseases, as well as before, during, and post-surgery (Cleveland Clinic, 2022).

Blood gas analysis is a standard diagnostic method for measuring and assessing the acid-base composition and the various levels of the partial pressure of gases in the blood. These

measured gases consist of partial pressure of carbon dioxide (PaCO2), partial pressure of oxygen (PaO2), the potential of hydrogen (PH), and oxyhemoglobin saturation (SaO2). It additionally assesses acid-base balance by measuring bicarbonate (HCO3) and base excess (BE) (PMC, 2019). Furthermore, many blood gas analyzers can measure the levels of methemoglobin, carboxyhemoglobin, and hemoglobin (Theodore, 2022).

The two most significant partial pressures of the respiratory gases are the partial pressure of oxygen, which indicates oxygenation status, and the partial pressure of carbon dioxide, which assesses the ventilation status. These two partial pressures of gases in the ABG indicate the gas exchange's efficiency (Trulock, 2019). Healthcare professionals can evaluate and assess patient conditions because of circulatory, metabolic, and respiratory diseases by interpreting ABG results. ABG analysis is the recommended method of evaluating oxygenation and ventilation, even though pulse oximetry and end-tidal carbon dioxide monitoring are non-invasive methods for measuring oxygenation and ventilation (PMC, 2019).

The interpretation of ABG results provides detailed information about the level and severity of diseases. Furthermore, ABG interpretation aids in determining if the disorder is acute or chronic and classifying the underlying cause as respiratory or metabolic disorder. Researchers have mentioned several disorders identified by utilizing ABG interpretation, which provides information that helps in providing the level of severity of disorders, including acute respiratory distress syndrome (ARDS), acute respiratory failure, septic and hypovolemic shock, cardiac arrest, and asthma. Blood gas analysis assists in evaluating patient response to medical interventions, monitoring the condition of patients with pulmonary or cardiac diseases, assessing the severity and progression of cardiopulmonary disease, and determining if compensation is occurring. (Castro & Keenaghan, 2022).

ABG analysis in most hospitals is often performed by a team of healthcare providers, including doctors, nurses, and respiratory therapists (PMC, 2019). Thus, Interprofessional Team interaction, collaboration, and communication are significant among healthcare providers (PMC, 2019).

Statement of Problem

Blood gas analysis is a frequently utilized diagnostic method among healthcare practitioners, which impacts their decision to treat the patient and determine the severity of the disease. However, no published studies have investigated the perception of ABG interpretation among interdisciplinary healthcare college students, including nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. Consequently, evaluating healthcare students' perceptions of ABG interpretation is significant for the performance of educational sessions, which results in graduating healthcare students with adequate levels of ABG interpretation.

Purpose of The Study

Understanding how ABG interpretation influences healthcare workers' decisions and the lives of their patients is crucial. Therefore, the current research aims to evaluate the perception of ABG interpretation among nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University.

Research Questions

The following research questions will be investigated in this study:

1-What are healthcare nursing and RT students' perceptions toward ABG interpretation?

2- Are Respiratory therapy students more familiar with ABG interpretation than nursing students?

3- Do healthcare students with clinical experience have superior perceptions compared to students without clinical experience?

Significance of The Study

This research will evaluate the perception of ABG interpretation among healthcare college students, including nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. Furthermore, the present study is worthwhile since it impacts the decisions of healthcare providers in diagnosing cardiopulmonary and metabolic diseases, identifies the severity of the disorders, and assesses the impact of therapeutic interventions. Therefore, this research will provide detailed information on the perception of ABG among healthcare college students, including nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University which will help the future healthcare providers to enhance their level of experience in ABG interpretation. Besides that, this will increase the awareness of the importance of ABG interpretation in the healthcare field and improve the decisions made by healthcare providers in diagnosing, assessing severity, and treating patients.

Limitation

The present study is limited by its inability to encompass all healthcare students in the United States, specifically nurses and respiratory therapy students. The sample will be collected from nursing and respiratory therapy students during their second semester with some program clinical experience at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University.

Chapter II

Literature Review

The present literature review comprises a wide range of aspects about ABG interpretation and the perception of ABG interpretation among healthcare providers and healthcare students. The current literature review used PubMed, Ovid, Google Scholar, National Institutes of Health (NIH), and Europe PMC online databases. The following keywords used in the search were ABG, ABG analysis, ABG interpretation, knowledge of ABG interpretation, perception of ABG interpretation, the importance of ABG interpretation, healthcare providers and ABG interpretation, and healthcare students and ABG interpretation. The search revealed a significant number of relevant literature reviews that examine the extent of the perception of ABG interpretation among healthcare providers and students. This chapter explores the following topics:

- ABG overview.
- The importance of ABG interpretation among healthcare providers.
- The perception of ABG interpretation among healthcare providers.
- Strategies to improve ABG Interpretation Skills.
- The perception of ABG interpretation among healthcare college students.

ABG overview:

Theodore (2022) introduced the ABG test as the concentrations of oxygen (PaO2), carbon dioxide (PaCO2), acidity (PH), oxyhemoglobin saturation (SaO2), and bicarbonate (HCO3) in arterial blood are measured using ABG test. The oxygenation status is assessed by measuring PaO2 and SaO2, while the ventilation status is examined by measuring PaCO2, PH, and base excess. Ventilation assessments aid in evaluating the existence of respiratory acidosis and respiratory alkalosis. Besides that, both respiratory acidosis and respiratory alkalosis might be acute or

chronic. Respiratory acidosis occurs by alveolar hypoventilation and is represented by an elevated PaCO2> 45 mmHg, resulting in hypercapnia and a drop in PH. However, respiratory alkalosis happens by alveolar hyperventilation, which results in a reduction in PaCO2, which shows hypocapnia, and a rise in PH results (Theodore, 2022).

Maria and Pratinidhi (2018) defined Metabolic acidosis as a medical disorder marked by a drop in arterial PH, a decrease in plasma HCO3 concentration, and hyperventilation as a compensatory mechanism. On the other hand, metabolic alkalosis is a condition distinguished by an elevation in HCO3 levels within the extracellular space, accompanied by an associated compensatory rise in arterial PCO2. Combined disorders, additionally known as mixed disorders, can manifest as singular occurrences or a combination of multiple simple acid-base. This occurrence is observed prominently in patients who are critically ill (Maria & Pratinidhi, 2018).

According to NIH (2019), ABGs measure and assess arterial oxygenation, ventilation, and acid-base status. Moreover, the author mentioned that PH is a standard aspect concerning each ABG test. Additionally, PH is a measurement of hydrogen ion activity. The blood PH normal range should be between 7.35 and 7.45. Trulock (2019) explained that the two primary respiratory gases are oxygen (O2) and carbon dioxide (CO2). Moreover, the partial pressure of carbon dioxide in arterial blood is measured as PaCO2, whereas the partial pressure of oxygen is PaO2. Besides, the normal range of PaCO2 is between 35 and 45 mmHg, while PaO2 is between 80 and 100 mmHg. Furthermore, their partial pressures in arterial blood represent the entire effectiveness of gas exchange (Trulock, 2019). The standard bicarbonate concentrations range between 21 and 27 mEq/L and are measured in arterial blood as HCO3 (Theodore, 2022).

The importance of ABG interpretation among healthcare providers:

The ABG test is a fundamental and significant procedure in the evaluation of the clinical oxygenation, ventilation, and acid-base status of critically ill patients. These three interrelated physiological variables (PaO2, PaCO2, HCO3) are closely related and play a primary role in maintaining PH homeostasis (Thakur, 2019).

ABG interpretation plays a significant role in evaluating the patient's status and helps in the development of an effective plan of treatment. The ABG interpretation assists in managing ventilator settings for patients receiving mechanical ventilation. ABG interpretation helps direct treatment plans and patient's response to treatment (Puri et al., 2010). The ABG interpretation is a significant indicator for detecting acid-base imbalances (Puri et al., 2010).

Multiple studies were conducted about the importance of ABG interpretation among healthcare providers to provide patients with correct diagnoses and appropriate treatment. Maria and Pratinidhi (2018) conducted a study that demonstrated patients in intensive care departments require continuous assessment for their ABG results that helped in accurately diagnosing the underlying cause, providing patients with the proper therapy, determining the effectiveness of the medical treatment, and preventing potential complications. This study was carried out in a tertiary care teaching hospital in Maharashtra. The implementation of this study began with collecting ABG results for patients in the intensive care unit from the laboratories and examining them to identify prevalent blood derangements. The study revealed that 33.34% of the patients exhibited a highly acidic blood PH, while 24.08% patients showed alkaline blood PH. Also, 26.62% of patients suffer from respiratory acidosis, while 49.76% suffer from respiratory alkalosis. Besides that, 45.15% of patients showed metabolic acidosis, whereas 36.03% showed metabolic alkalosis. The authors conclude that ABG is a beneficial method for diagnosing and treating patients in the

intensive care unit. Thus, appropriate assessment at the proper time led to avoiding potential complications and confirmation of assistance with disorder control (Maria & Pratinidhi, 2018).

Begum et al. (2019) stated that analysis and interpretation of ABG can provide significant insight into a Patient's metabolic state, pulmonary function, acid-base balance, and oxygenation. Additionally, the authors mentioned that using ABG analysis and interpretation by healthcare providers enables them to evaluate and observe patients who are critically ill, particularly those in intensive care units, assess the effectiveness of treatments, monitor the clinical condition of patients, and choose the most appropriate course of treatment for each patient. Furthermore, the researchers in this study highlighted the importance of comprehensive understanding of the fundamental mechanisms of acid balance and the prevalent etiologies responsible for disrupting the balance of acid-base among healthcare providers (Begum et al., 2019). Finally, it is significant for healthcare providers to understand ABG interpretation to avoid inaccurate diagnoses and inappropriate therapy (PMC, 2019).

The perception of ABG interpretation among healthcare providers:

Several previous studies were conducted among healthcare providers, including nurses, consultants from emergency department, physicians from different specialties, and emergency doctors, reveal various levels of ABG interpretation knowledge. Austin and Jones (2010) conducted a study that included 37 consultants and 43 emergency doctors who were questioned using a survey about ABG interpretation. The results revealed that 31 was the score achieved by consultants out of 40, and 29.4 was the score achieved by emergency doctors. However, consultants and emergency doctors are not reaching the level of expertise, which is a score of 40 (Austin & Jones, 2010).

Cikman et al. (2014) conducted a study investigating the knowledge and approach of ABG among physicians working in different specialties. The present study includes a 27 questions questionnaire distributed among 100 physicians. This study revealed that physicians lacked expertise pertinent to the performance and assessment of ABG because of their clinical practice. This study demonstrated that they often chose the femoral artery as their primary choice of puncture. The authors recommended offering adequate education to physicians from various specialties. Also, preparing and arranging training courses to improve their knowledge and experience throughout their specialization, regardless of their specific field of expertise (Cikman et al., 2014).

Apsara et al. (2019) carried out a study that assessed the knowledge of ABG analysis among a group of nursing officers working in emergency care departments in assigned hospitals at Puducherry. A questionnaire was administered to 50 nursing officers, revealing that only 1 (2%) participant had insufficient knowledge, 18 (36%) participants had intermediate knowledge, and 31 (62%) had adequate knowledge. The study concluded that a significant number of nursing officers exhibited adequate knowledge regarding ABG analysis. Consequently, this study revealed that working in critical care departments increases knowledge (Apsara et al., 2019).

Abd Elkader et al. (2020) conducted a study that investigated the impact of implementing a program-based learning approach on the performance and self-efficacy of nurses concerning arterial blood gas puncture. The sample of this study included 70 nurses and was carried out at four hospitals associated with the Ministry of Health. The collection of data was achieved using three tools, including a questionnaire, an observational checklist, and a self-efficacy scale. The initial instrument was a questionnaire designed to evaluate the awareness of nursing staff concerning arterial blood puncture. The second instrument was an observational checklist used to

examine and scrutinize the procedure of arterial blood puncture. The self-efficacy scale, categorized specifically for arterial blood puncture, was the final one. The application of a program resulted in a statistically significant difference in the self-efficacy levels of nurses concerning arterial puncture practice, as indicated by the p-value of (0.000). The authors concluded that program-based learning regarding arterial puncture enhances nurses' knowledge, practice, and self-efficacy (Abd Elkader et al., 2020).

Joel and Choudhary (2022) conducted a study that evaluated the knowledge level of analyzing and interpreting ABG, and the survey was distributed to 30 nursing staff. The result revealed that 16.7% received a grade of A, 20% a grade of B+, 43.3% a grade of B, 13.3% a grade of C, and 6.7% a grade of D. According to the result, this demonstrates that most of the nursing staff 80% scored a B or higher on the ABG knowledge assessment. Overall, results from these studies could encourage healthcare providers to develop plans and strategies to improve their perceptions and attitudes regarding ABG interpretation.

Strategies to improve ABG Interpretation Skills:

Kaur and Charan (2018) carried out a study that investigated the effectiveness of the structured teaching program (STP) in the knowledge and practice of ABG analysis on a group of nurses working in an intensive care unit in assigned hospitals at Jalandhar, Punjab. In addition, this study included 60 nurses working in the intensive care unit, and assessment was performed by utilizing a questionnaire to evaluate knowledge and a checklist for the practice. According to the pre-test findings of this study, 7 (11.7%) nurses had sufficient knowledge,39 (65%) nurses had an average level of knowledge, and 14 (23.3%) nurses had inadequate knowledge. However, nurses' post-test knowledge scores showed that 40 (66.7%) nurses had adequate knowledge, 20 (33.3%) nurses had an average level of knowledge, and none of the nurses had scored below average level.

Knowledge scores and practice scores between the pre-test and post-test show a significant level. As a result, this study proved that STP had a significant impact on the knowledge and practice of ABG analysis among nurses working in the intensive care unit (Kaur & Charan, 2018).

Divya and Rakhi (2020) conducted a study to evaluate the planned teaching program about the knowledge and practice of ABG analysis and interpretation among a group of nursing staff working in selected hospitals in critical care departments in the Delhi/ National Capital Region. A survey was distributed among 30 staff nurses working in critical care units before and after the planned teaching program. These critical care units include medical intensive care units, surgical intensive care units, and cardiovascular and vascular surgery. In addition, this revealed that for the pre-test results of staff nurses, 43.4% had average knowledge, 36.6% had good knowledge, 6.6% had excellent knowledge, and 13.4% had poor knowledge. However, the post-test results of staff nurses showed that 80% had advanced knowledge, and 20% had good knowledge. The pre-test and post-test mean knowledge scores about ABG analysis were 17.8 and 26.4, respectively, with a standard deviation of 4.25, indicating that the mean difference 8.6 was statistically significant. As a result, the teaching program helped enhance the knowledge and practice of ABG analysis and interpretation among staff nurses working in the critical care departments (Divya & Rakhi, 2020). Researchers have proven that multiple studies on nursing staff and students demonstrated that attending Teaching Programs about ABG knowledge interpretation leads to significant improvement in ABG interpretation levels (Kaur & Charan, 2018; Adhikari, 2019; Divya & Rakhi, 2020).

Bajgiran et al. (2016) conducted a study that examined the impact of formative assessment with appropriate feedback for the improvement of ABG interpretation skills among nurses working in critical care units. The study used 90 nursing staff working in critical care units. ABG

interpretation skills among nursing staff were assessed during pre- and post-educational sessions. The result of this study demonstrated that the score for the oral, written, and control group pre-education session showed no significant difference (p =0.157), while the score for the oral, written, and control group post-educational session exhibited significantly different ($p < 0.001$). The authors conclude that implementing formative assessment and giving appropriate oral and written feedback is beneficial for learning and enhancement of the skills of ABG interpretation. Also, they suggested that educational programs implement formative assessment and give appropriate oral and written feedback (Bajgiran et al., 2016).

Basnett et al. (2016) conducted a study investigating the efficiency of pocket reference upon ABG analysis among a group of nursing staff working at critical care departments in Central Referral Hospital, Sikkim. This study includes 30 staff nurses and contains a survey and checklist to obtain data. Moreover, the data collected pre-test and post-test scores for knowledge. The result of this study for the pre-test and post-test demonstrated that skills of ABG analysis of nursing staff in respiratory acidosis and respiratory alkalosis showed a significant difference (p =0.001). In conclusion, this study revealed that using pocket references was beneficial for increasing knowledge and skills of ABG analysis in nursing staff (Basnett et al., 2016).

Begum et al. (2019) performed a study published in the International Journal of Current Advanced Research (IJCAR). The current study aims to evaluate the efficiency of a structured teaching program about knowledge of ABG analysis among a group of nursing staff working in an intensive care unit in assigned private hospitals in Guwahati, Assam. The sample size of this study includes 68 nursing staff working in intensive care units. Additionally, knowledge of ABG analysis was examined before and after implementing a structured teaching program among nursing staff. The study revealed that the pre-test scores exhibited that 38 participants had

insufficient knowledge, and 30 had moderately sufficient knowledge. However, following the implementation of a structured teaching program, the post-test scores demonstrated that 35 participants had moderate knowledge, and 33 had excellent knowledge. The authors concluded that a structured teaching program was efficient in improving knowledge about ABG analysis among nursing staff (Begum et al., 2019).

Mali and Menon (2021) conducted a study published in the International Journal of Nursing Research (IJNR). The present study aims to evaluate the efficacy of a self-instructional module in enhancing the knowledge about ABG among a group of nursing staff working in the intensive care department and wards in assigned hospitals located in Metropolitan City. The sample size of this study includes 60 nursing staff comprising 30 nurses from the intensive care department and 30 nurses from wards (general care floors). A semi-structured questionnaire was used to evaluate nurses' knowledge. In this study, knowledge of ABG analysis was examined pre- and post-the self-instructional modules. This study demonstrated that the pre-test scores for both groups of nursing staff, comprising nurses working in the intensive care unit and nurses working in wards, were classified based on their knowledge levels into poor, adequate, and excellent. However, the post-test scores exhibited for both groups were the level of knowledge increased by 100%, ultimately being classified as excellent. Therefore, the study revealed that the self-instructional module was efficient in enhancing the ABG knowledge among staff nurses who work in both intensive care departments and wards (Mali & Menon, 2021).

Bayomi and Taha (2022) performed a study on 30 staff nurses working at three intensive care departments, including the anesthetic, surgical, cardio, and chest intensive care departments at Zagazig University Hospital. Further, this study aims to assess the impact of the self-learning package on the knowledge and practice of ABG analysis for critically ill patients on the staff

nurses. In this study, a survey and checklist are used to evaluate nurses. The authors concluded that using the self-learning package improved nurses' knowledge and practice results for ABG analysis. Moreover, they recommended the significance of implementing the self-learning package in a broader field that includes all hospitals to improve the quality of nursing care provided (Bayomi & Taha, 2022).

In brief, current studies recommended considering educational sessions, formative assessments, structured teaching program, pocket reference, self-instructional module, self-learning package, and other strategies. These strategies can be used to improve the perceptions and attitudes regarding ABG interpretation among healthcare providers and healthcare college students.

The perception of ABG interpretation among healthcare college students:

Understanding and comprehending the perceptions of ABG interpretations of healthcare college students has a beneficial effect on enhancing their awareness and improving their perceptions and attitudes about ABG interpretations. Several studies demonstrated varying levels of ABG interpretation perceptions among healthcare college students. In 2016, Hernández-Padilla et al. conducted a study aiming to develop and perform a psychometric assessment of a self-efficacy measuring tool for arterial puncture. The sample of the current study includes 342 nursing students. The authors conclude that the Arterial Puncture Self-Efficacy Scale (APSES) demonstrated beneficial psychometric features in evaluating self-efficacy in ABG analysis via arterial puncture. The Arterial Puncture Self-Efficacy Scale (APSES) was designed in Spanish and comprised 26 items. The first version was based on Bandura's self-efficacy theory. (Hernández-Padilla et al., 2016).

Adhikari (2019) conducted a study at Lumbini Medical College and Teaching Hospitals, including 65 nursing students who were questioned about their knowledge of ABG analysis before and after the structured teaching program. This study revealed that regarding the knowledge of ABG analysis for most of the students, 70.8% of participants had moderate knowledge in the pre-test score, 15.3% had sufficient knowledge, and 13.9% of the participants had insufficient knowledge. However, 63.1% of participants had sufficient knowledge in the post test score, 35.4% had moderate knowledge, and 1.5% had insufficient knowledge. Consequently, this indicates that the post-test score was higher than the pre-test. Therefore, a structured teaching program was effective in improving the level of knowledge of ABG analysis in nursing students (Adhikari, 2019).

Reddy et al. (2023) conducted a study that investigated the effectiveness of a self-instructional module about the knowledge of ABG among a group of nursing students in the assigned college of the city. A structured survey was used in this study to collect the knowledge score. The sample size is 60 nursing students in their 3rd year of the bachelor's degree program. The result of this study demonstrated that 26.67% of the nursing students exhibited an inadequate level of knowledge in the pre-test score, 58.33% showed a medium level, and 15% exhibited adequate knowledge. However, the post-test scores illustrated that 5% of the nursing students showed a medium level of knowledge, 35% had adequate knowledge, and 60% exhibited outstanding knowledge. Therefore, researchers have statistically concluded that the self-instructional module about ABG analysis was efficient among nursing students (Reddy et al., 2023).

Tesseyman et al. (2023) conducted a study to investigate using a Decision-Based Learning (DBL) tool among nursing students to teach ABG analysis. Besides that, a survey is distributed

among the nursing students and filled out with their DBL knowledge. Also, this revealed that nursing students had excellent experience utilizing DBL and acquired confidence in ABG analysis. As a result, DBL is an effective method for teaching nursing students about ABG analysis (Tesseyman et al., 2023).

Summary

The primary objective of this study is to evaluate the perceptions of ABG interpretation among healthcare college students, including nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. Several studies have been carried out to evaluate the perception and knowledge of ABG interpretation among nursing staff, nursing students, consultants from emergency department, physicians from different specialties, and emergency doctors. Additionally, multiple studies were conducted about the importance of ABG interpretation among healthcare providers to provide patients with correct diagnoses and appropriate treatment. It is necessary to determine the perception of ABG interpretation among healthcare college students at Georgia State University. Finally, it is significant for healthcare providers to understand ABG interpretation to avoid inaccurate diagnoses and inappropriate therapy.

Chapter III

Methodology

The researcher conducted a descriptive cross-sectional study to investigate the perceptions of ABG interpretation in undergraduate and graduate students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. In this descriptive study, the researcher used a self-administered questionnaire to investigate undergraduate and graduate students' perceptions in different healthcare fields involving nursing and respiratory therapy programs. The current chapter presents the methodology and procedures implemented in the present study.

Research Questions

The following research questions will be investigated in this study:

1-What are healthcare nursing and RT students' perceptions toward ABG interpretation?

2- Are Respiratory therapy students more familiar with ABG interpretation than nursing students?

3- Do healthcare students with clinical experience have superior perceptions compared to students without clinical experience?

Instrumentation

In this study, the instrument used is a survey consisting of 25 items. The questionnaire was modified to ensure a precise evaluation of student's perceptions regarding ABG interpretation. The questionnaire comprised two sections distributed to healthcare students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. The first section of the instrument consists of ten questions that concentrate on socio-demographic characteristics

comprising gender, age, educational background, semesters of clinical experience, and training background in ABG interpretation. The second section includes fifteen questions designed to evaluate students' perceptions of ABG interpretation and technique. In this survey, a seven-point Likert scale, varying from strongly disagree to strongly agree, for the assessment of the students' perceptions. These questions represent information on students' attitudes, beliefs, and opinions regarding ABG interpretation and techniques.

Research Design

The current study uses a cross-sectional design, including hand-delivered paper copies of the self-administered questionnaire. The purpose of the survey will be informed to the participants, followed by paper copies of the questionnaire distributed via manual delivery. Upon completion of the survey, the questionnaire will be collected. Survey research is an essential scientific investigation that requires considerable planning and analysis. Further, a survey's goal is to collect reliable and accurate data obtained from a representative sample of participants (Burns et al., 2008).

Sample

In this cross-sectional study, a convenience sample was used, and respondents were selected based on their availability to participate. The inclusion criteria, which indicate the target population, involve undergraduate and graduate students registered in nursing and respiratory therapy program at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. The exclusion criteria include any respondent who is not a nursing or respiratory therapy student or employees during the study's conduction.

Protection of Human Subjects

The Institutional Review Board (IRB) at Georgia State University will undergo a comprehensive review of the research proposal to ensure the protection of the rights of human subjects. The study will start after obtaining approval from IRB. Respondents will be anonymous, and no personal identification data will be utilized to protect confidentiality. The study is predicated on the assumption that participation is voluntary and consent is given when the comprehensive survey form is submitted.

Data Analysis

The obtained data for each respondent was analyzed using the latest version of the Statistical Package for the Social Sciences (SPSS) program (version 28). Descriptive statistics involving mean, frequency, percentage, and standard deviation were performed to evaluate and identify differences among the respondents. A one-way ANOVA test was performed to determine statistically significant differences in perceptions of ABG interpretation among healthcare students. Also, a one-way ANOVA post Hoc test was performed to ascertain the existence of statistically significant differences in the familiarity of ABG interpretation between students specializing in respiratory therapy and nursing and to assess clinical experience regarding perceptions of ABG interpretation among healthcare students.

Chapter IV

Results

This chapter aimed to assess the nursing and respiratory therapy students' perceptions regarding ABG interpretation and to differentiate among students' perceptions based on their current academic program and clinical semester experience. Data was collected through the manual distribution of validated questionnaires to students, coordinated with RT department directors. The convenience sampling received 236 responses in total. This chapter will provide a comprehensive and distinct description of the study results that answer the research questions.

Research Questions

1-What are healthcare nursing and RT students' perceptions toward ABG interpretation?

2- Are Respiratory therapy students more familiar with ABG interpretation than nursing students?

3- Do healthcare students with clinical experience have superior perceptions compared to students without clinical experience?

Demographic Findings

The current study comprised a convenient sample of healthcare students at the undergraduate and graduate levels. This convenience sample includes a total of 236 participants who were selected from two academic programs, nursing and respiratory therapy. Additionally, this study was carried out at Georgia State University. The majority of participants were female, n= 207 (87.7%), while only n= 29 (12.3%) were male. The age groups of participants from 18 to 25 were n= 196, from 26 to 35 were n= 31, from 36 to 45 were n= 7, and from 46 to 55 were n= 2.

The majority of the study participants were bachelor's degree in nursing n= 145 (61.4%); followed by a bachelor's degree in respiratory therapy n= 76 (32.2%); and a master's degree in respiratory therapy n= 15 (6.4%). Most of the study participants were in their first academic year in the program n= 134 (56.8%); subsequently followed by the second academic year in the program n= 102 (43.2%). In addition, the study found that 42 respondents (17.8%) had graduated from an accredited clinical program, whereas 194 respondents (82.2%) had not. Moreover, the 43 participants (17.8%) who had graduated from the accredited clinical program showed varied years of clinical experience in healthcare, ranging from one to ten years. More specifically, 18 participants (7.6%) had one year of clinical experience in healthcare, 22 participants (9.3%) had two years of clinical experience, 2 participants (0.8%) had three years of clinical experience, and 1 participant (0.4%) had ten years of clinical experience. Furthermore, the study revealed that 224 participants (94.9%) had clinical experience but had not graduated from an accredited program, while only 12 participants (5.1%) did not. The number of semesters of clinical experience in healthcare varies among the 224 participants (94.9%) who had clinical experience in the program. More precisely, 82 respondents (34.7%) had one semester of clinical experience in the program, 47 respondents (19.9%) had two semesters of clinical experience, 18 respondents (7.6%) had three semesters of clinical experience, 70 respondents (29.7%) had four semesters of clinical experience, 6 respondents (2.5%) had five semesters of clinical experience, and 1 respondent (0.4%) had more than five semesters of clinical experience (See Table 4). Most of the study participants n= 178 (75.4%) self-reported had received formal training regarding ABG interpretation, whereas 58 participants (24.6%) had not. Participants who had received training regarding drawing ABGs were n= 112 (47.5%), while 124 participants (52.5%) had not. The demographic data characteristics of all respondents are presented and summarized in (Table 1).

Table 1. Demographic data and characteristics of all study respondents (n= 236).

Demographic Variable		**N**	**N%**
Gender	Male	29	12.3%
	Female	207	87.7%
Age	18-25	196	
	26-35	31	
	36-45	7	
	46-55	2	
Academic degree and program	Bachelor's degree in respiratory therapy	76	32.2%
	Master's degree in respiratory therapy	15	6.4%
	Bachelor's degree in nursing	145	61.4%
Level of the program	First year	134	56.8%
	Second year	102	43.2%
Graduated from credited clinical program	Yes	42	17.8%
Years of experience	1	18	7.6%
	2	22	9.3%
	3	2	0.8%
	10	1	0.4%
	No	194	82.2%
Clinical experience in the program	Yes	224	94.9%
Semesters of experience	1	82	34.7%
	2	47	19.9%
	3	18	7.6%
	4	70	29.7%
	5	6	2.5%
	10	1	0.4%
	No	12	5.1%
Received training regarding ABG interpretation	Yes	178	75.4%
	No	58	24.6%
Received training regarding drawing ABGs	Yes	112	47.5%
	No	124	52.5%

Findings Related to Research Question 1

The first research question of the study asked, " What are healthcare nursing and RT students' perceptions toward ABG interpretation?" Data findings were organized and presented in Table 2, which includes item numbers in the survey, survey statements, the mean score and standard deviation of perceptions of all healthcare students participating in the study, and students' perceptions of nursing and respiratory therapy programs. These questions represent information on students' attitudes, beliefs, and opinions regarding ABG interpretation and techniques. Participants answered this research question via 15 statements, using a 7-point Likert scale, varying from " strongly disagree" (1) to " strongly agree" (7).

Generally, healthcare students reported the strongest agreement with the statement that "It is important for me as a healthcare student to recognize an abnormal ABG" with a total mean score of M= 6.85 and standard deviation of (SD ± 0.684). On the other hand, the statement "I feel comfortable applying Winters' formula in the interpretation of ABG" received the least agreement in response with a total mean score of M= 3.43 and standard deviation of (SD ± 2.289). (See Table 2).

Additionally, the findings show that bachelor's degree in respiratory therapy students have positive perceptions toward ABG interpretation and their highest agreement was to the statement that "I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery" with a mean score of M= 6.99 (SD ± 0.115). Conversely, their lowest agreement was to the statement that "I feel comfortable applying Winters' formula in the interpretation of ABG" with a mean score of M= 5.45 (SD ± 1.814). (See Table 2).

Furthermore, the findings indicated that master's degree in respiratory therapy students have a positive response toward ABG interpretation. Respiratory therapy master degree students demonstrated the highest level of agreement to four statements which were: "I understand the importance of performing an Allen's test", "I understand that drawing an ABG requires a specialized syringe", "I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery", and "I understand that the ABG syringe should be inserted through the skin at a 45-degree angle" with a mean score of M= 7.00 (SD ± 0.000). Nevertheless, master's degree in respiratory therapy students least agreed to "I feel comfortable applying Winters' formula in the interpretation of ABG," with a mean score of M= 4.87 (SD ± 1.506). (See Table 2).

Likewise, the findings revealed that bachelor's degree in nursing students have positive perceptions toward ABG interpretation. Bachelor's degree in nursing students showed the most robust agreement with this statement: "It is important for me as a healthcare student to recognize an abnormal ABG," with a mean score of M= 6.81 (SD ± 0.819). In contrast, their lowest agreement was to the statement that "I feel comfortable applying Winters' formula in the interpretation of ABG," with a mean score of M= 2.22 (SD ± 1.669). (See Table 2).

Table 2.Healthcare nursing and respiratory therapy students' perceptions toward ABG interpretation.

Item No.	Survey Statement	Total Mean (±SD)	Bachelor's degree in respiratory therapy Mean (±SD)	Master's degree in respiratory therapy Mean (±SD)	Bachelor's degree in nursing Mean (±SD)
11	It is important for me as a healthcare student to understand how to interpret ABG.	6.78 (±.766)	6.92 (±.317)	6.93 (±.258)	6.70 (±.938)
12	It is important for me as a healthcare student to recognize an abnormal ABG.	6.85 (±.684) *	6.92 (±.392)	6.93 (±.258)	6.81 (±.819) *
13	I feel comfortable obtaining an ABG.	4.20 (±2.119)	5.67 (±1.491)	5.07 (±1.981)	3.34 (±1.955)
14	I understand the importance of performing an Allen's test.	5.04 (±2.243)	6.83 (±.500)	7.00 (±.000) *	3.90 (±2.163)
15	I can recognize the indication for drawing an ABG.	5.33 (±1.815)	6.46 (±.855)	6.33 (±.976)	4.64 (±1.910)
16	I understand that ventilation affects PaCO2.	6.30 (±1.201)	6.61 (±.967)	6.67 (±.724)	6.10 (±1.309)
17	I am aware that PaCO2 influences PH in an ABG.	6.53 (±.969)	6.78 (±.624)	6.93 (±.258)	6.36 (±1.116)
18	I recognize that the level of PaO2 measures oxygenation status in an ABG.	6.62 (±.850)	6.83 (±.500)	6.80 (±.561)	6.49 (±.987)
19	I understand that drawing an ABG requires a specialized syringe.	5.38 (±2.087)	6.87 (±.472)	7.00 (±.000) *	4.43 (±2.156)
20	I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery.	5.77 (±1.828)	6.99 (±.115) *	7.00 (±.000) *	5.01 (±1.981)
21	I understand that the ABG syringe should be inserted through the skin at a 45-degree angle.	5.28 (±2.167)	6.95 (±.225)	7.00 (±.000) *	4.23 (±2.183)
22	I am aware that CBG can be a specific substitute in the pediatrics and neonates population.	4.38 (±2.447)	6.50 (±1.352)	6.53 (±.915)	3.04 (±2.020)
23	I feel comfortable applying Winters' formula in the interpretation of ABG.	3.43 (±2.289) +	5.45 (±1.814) +	4.87 (±1.506) +	2.22 (±1.669) +
24	It is important for me as a healthcare student to attend continuing education sessions regarding ABG interpretation.	6.00 (±1.456)	6.43 (±1.037)	6.40 (±.910)	5.73 (±1.621)
25	I will attend continuing education sessions regarding ABG interpretation after graduation.	5.51 (±1.680)	6.09 (±1.235)	6.07 (±.961)	5.14 (±1.837)

SD: Standard Deviation.
(*): Highest Score, (+): Lowest Score.
Note: Means are based on a 7-point Likert scale in which 1 indicates strongly disagree and 7 indicates strongly agree. A score above 4.5 indicates agreement with the statement.

Findings Related to Research Question 2

The second research question asked, "Are respiratory therapy students more familiar with ABG interpretation than nursing students?" responses to eight survey statements regarding familiarity with ABG interpretation were tabulated and presented in Table 3. A one-way ANOVA test was performed to compare familiarity statements related to ABG interpretation between nursing and respiratory therapy students, comprising eight statements in total. The study indicated significant differences in familiarity levels between nursing and respiratory therapy students across seven of these statements. In addition, the statements" I feel comfortable obtaining an ABG", "I understand the importance of performing an Allen's test", "I can recognize the indication for drawing an ABG", "I understand that drawing an ABG requires a specialized syringe", " I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery", "I understand that the ABG syringe should be inserted through the skin at a 45-degree angle", and "I am aware that CBG can be a specific substitute in the pediatrics and neonates population" exhibited statistically significant differences in familiarity regarding ABG interpretation between nursing and respiratory therapy students ($P < .001$). However, there was no significant difference in the familiarity regarding ABG interpretation between nursing and respiratory therapy students in the statement, " It is important for me as a healthcare student to understand how to interpret ABG" ($P = .086$). (See Table 3).

More precisely, in statement 13, " I feel comfortable obtaining an ABG", bachelor's degree respiratory therapy students showed greater familiarity compared to bachelor's degree nursing students, with a mean difference of (2.333 ± .258). Master's degree respiratory therapy students demonstrated more familiarity in comparison to bachelor's degree nursing students, with a mean difference of (1.729 ± .494). Furthermore, in statement 14, "I understand the importance of

performing an Allen’s test", bachelor's degree respiratory therapy students exhibited a higher familiarity level than bachelor's degree nursing students, with a mean difference of (2.932 ± .244). Master's degree respiratory therapy students indicated greater familiarity compared to bachelor's degree nursing students, with a mean difference of (3.103 ± .467). Also, in statement 15, "I can recognize the indication for drawing an ABG", bachelor's degree respiratory therapy students displayed more familiarity than bachelor's degree nursing students, with a mean difference of (1.819 ± .226). Master's degree respiratory therapy students illustrated a higher familiarity level in comparison to bachelor's degree nursing students, with a mean difference of (1.692 ± .433). Additionally, in statement 19, "I understand that drawing an ABG requires a specialized syringe", bachelor's degree respiratory therapy students showed greater familiarity than bachelor's degree nursing students, with a mean difference of (2.434 ± .243). Master's degree respiratory therapy students displayed more familiarity compared to bachelor's degree nursing students, with a mean difference of (2.566 ± .465). Likewise, in statement 20, "I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery", bachelor's degree respiratory therapy students demonstrated higher familiarity level in comparison to bachelor's degree nursing students, with a mean difference of (1.980 ± .221). Master's degree respiratory therapy students indicated greater familiarity compared to bachelor's degree nursing students, with a mean difference of (1.993 ± .423). Similarly, in statement 21, "I understand that the ABG syringe should be inserted through the skin at a 45-degree angle", bachelor's degree respiratory therapy students have more familiarity than bachelor's degree nursing students, with a mean difference of (2.713 ± .244). Master's degree respiratory therapy students revealed a higher familiarity level compared to bachelor's degree nursing students, with a mean difference of (2.766 ± .467). Further, in statement 22, "I am aware that CBG can be a specific substitute in the pediatrics

and neonates population", bachelor's degree respiratory therapy students illustrated a greater familiarity level in comparison to bachelor's degree nursing students, with a mean difference of (3.459 ± .252). Master's degree respiratory therapy students showed more familiarity than bachelor's degree nursing students, with a mean difference of (3.492 ± .482).

Table 3. Respiratory therapy students' familiarity with ABG interpretation in comparison to nursing students.

Item No.	**Survey Statement**	**Total Mean (±SD)**	**Bachelor's degree in respiratory therapy N=76**	**Master's degree in respiratory therapy N=15**	**Bachelor's degree in nursing N=145**	***P*-value**
			Mean (±SD)	**Mean (±SD)**	**Mean (±SD)**	
11	It is important for me as a healthcare student to understand how to interpret ABG.	6.78 (±.766)	6.92 (±.317)	6.93 (±.258)	6.70 (±.938)	=.086
13	I feel comfortable obtaining an ABG.	4.20 (±2.119)	5.67 (±1.491)	5.07 (±1.981)	3.34 (±1.955)	<.001*
14	I understand the importance of performing an Allen's test.	5.04 (±2.243)	6.83 (±.500)	7.00 (±.000)	3.90 (±2.163)	<.001*
15	I can recognize the indication for drawing an ABG.	5.33 (±1.815)	6.46 (±.855)	6.33 (±.976)	4.64 (±1.910)	<.001*
19	I understand that drawing an ABG requires a specialized syringe.	5.38 (±2.087)	6.87 (±.472)	7.00 (±.000)	4.43 (±2.156)	<.001*
20	I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery.	5.77 (±1.828)	6.99 (±.115)	7.00 (±.000)	5.01 (±1.981)	<.001*
21	I understand that the ABG syringe should be inserted through the skin at a 45-degree angle.	5.28 (±2.167)	6.95 (±.225)	7.00 (±.000)	4.23 (±2.183)	<.001*
22	I am aware that CBG can be a specific substitute in the pediatrics and neonates population.	4.38 (±2.447)	6.50 (±1.352)	6.53 (±.915)	3.04 (±2.020)	<.001*

SD: Standard Deviation.
* The significant level is .050
Note: *p*-value was obtained from ANOVA test.
Note: Means are based on a 7-point Likert scale in which 1 indicates strongly disagree and 7 indicates strongly agree. A score above 4.5 indicates agreement with the statement.

Findings Related to Research Question 3

The third research question asked, "Do healthcare students with clinical semester experience have superior perceptions compared to students without clinical semester experience?" responses to seven survey statements regarding clinical experience concerning perceptions about ABG interpretation among healthcare students were tabulated and presented in Table 4. A one-way ANOVA test was performed to assess clinical experience regarding perceptions of ABG interpretation among healthcare students, comprising seven statements in total. In regard to the clinical experience regarding perceptions toward ABG interpretation among healthcare students, the study revealed significant differences in clinical experience among healthcare students across three of these statements. Furthermore, the statements "It is important for me as a healthcare student to recognize an abnormal ABG", "I understand that ventilation affects PaCO2", and " I recognize that the level of PaO2 measures oxygenation status in an ABG" demonstrated statistically significant differences in clinical experience regarding perceptions of ABG interpretation among healthcare students ($P< .001$) ($P= .002$) ($P= .003$), respectively. In contrast, there was no significant difference in the clinical experience regarding perceptions of ABG interpretation among healthcare students in the following statements, " I am aware that PaCO2 influences PH in an ABG"($P= .052$), "I feel comfortable applying Winters' formula in the Interpretation of ABG"($P= .252$), "It is important for me as a healthcare student to attend continuing education sessions regarding ABG interpretation"($P= .685$), and "I will attend continuing education sessions regarding ABG interpretation after graduation"($P= .153$). (See Table 4).

Table 4. Experience in healthcare students and the perceptions toward ABG interpretation.

Item No.	Survey Statement	Yes experience N=224 Mean (±SD)	No experience N=12 Mean (±SD)	*P*-value
12	It is important for me as a healthcare student to recognize an abnormal ABG.	6.90 (±.482)	5.92 (±2.065)	<.001*
16	I understand that ventilation affects PaCO2.	6.35 (±1.094)	5.25 (±2.301)	=.002*
17	I am aware that PaCO2 influences PH in an ABG.	6.56 (±.866)	6.00 (±1.954)	=.052
18	I recognize that the level of PaO2 measures oxygenation status in an ABG.	6.66 (±.741)	5.92 (±1.929)	=.003*
23	I feel comfortable applying Winters' formula in the Interpretation of ABG.	3.39 (±2.307)	4.17 (±1.850)	=.252
24	It is important for me as a healthcare student to attend continuing education sessions regarding ABG interpretation.	6.01 (±1.430)	5.83 (±1.946)	=.685
25	I will attend continuing education sessions regarding ABG interpretation after graduation.	5.54 (±1.670)	4.83 (±1.801)	=.153

SD: Standard Deviation.
* The significant level is .050
Note: *p*-value was obtained from ANOVA test.
Note: Means are based on a 7-point Likert scale in which 1 indicates strongly disagree and 7 indicates strongly agree. A score above 4.5 indicates agreement with the statement.

Findings regarding survey statements

A one-way ANOVA test was performed to evaluate perceptions of ABG interpretation between nursing and respiratory therapy students. The study illustrated that the survey statement 24," It is important for me as a healthcare student to attend continuing education sessions regarding ABG interpretation" exhibited statistically significant differences regarding perceptions of ABG interpretation between nursing and respiratory therapy students ($P< .001$). Also, the survey statement 25, "I will attend continuing education sessions regarding ABG interpretation after graduation" demonstrated a statistically significant difference regarding perceptions of ABG interpretation between nursing and respiratory therapy students ($P< .001$).

Following the post hoc test in statement 24, "It is important for me as a healthcare student to attend continuing education sessions regarding ABG interpretation," bachelor's degree respiratory therapy students exhibited a greater tendency towards attending additional education sessions related to ABG interpretation compared to bachelor's degree nursing students, with a mean difference of (.703 ± .201). Additionally, in statement 25 "I will attend continuing education sessions regarding ABG interpretation after graduation", bachelor's degree respiratory therapy students showed more susceptibility to attend continuing education sessions regarding ABG interpretation after graduation than bachelor's degree nursing students, with a mean difference of (.947 ± .230).

Chapter V

Discussion

The purpose of this chapter is to discuss the study findings presented in Chapter IV. The current chapter comprises six main sections, including an overview of the study results, a detailed discussion of the findings, implications for research, study limitations and strengths, recommendations for future research, and a conclusion.

Overview of the Study

This descriptive cross-sectional study aimed to investigate undergraduate and graduate healthcare students' perceptions of ABG interpretations. Data were collected from two healthcare programs, including nursing and respiratory therapy, at Georgia State University. These three research questions guided the study:

1-What are healthcare nursing and RT students' perceptions toward ABG interpretation?

2- Are Respiratory therapy students more familiar with ABG interpretation than nursing students?

3- Do healthcare students with clinical experience have superior perceptions compared to students without clinical experience?

Discussion

The first research question of this study asked, "What are healthcare nursing and RT students' perceptions toward ABG interpretation? " The overall findings from the first research question demonstrate that both undergraduate and graduate healthcare students exhibited positive perceptions toward ABG interpretation. These findings are consistent with Apsara et al. (2019) when they assessed nursing officers working in emergency care departments regarding knowledge of ABG analysis. They conclude that nursing officers exhibited adequate knowledge regarding

ABG analysis. However, the findings of Austin and Jones (2010) revealed that consultants and emergency doctors are not reaching the level of expertise toward ABG interpretation, with only 31 being the score achieved by consultants and 29.4 being the score achieved by emergency doctors out a score of 40. Likewise, the finding of Cikman et al. (2014) reported that 100 physicians working in different specialties, when assessed regarding knowledge and approach of ABG, demonstrated that physicians lacked expertise in the performance and assessment of ABG.

In general, healthcare students showed a positive perception toward ABG interpretation, as evidenced by their calculated mean and standard deviation for the 15 perception statements, as they scored a mean of more than 4.00 for most of the perception statements, except for one statement. The statement, "I feel comfortable applying Winters' formula in the interpretation of ABG." received the lowest agreement in response among respiratory therapy and nursing students with a mean score of M= 3.43 and standard deviation of (SD ± 2.289), which indicated a negative perception toward the ABG interpretation.

Several previous studies were conducted among healthcare providers, including nurses, consultants from emergency departments, physicians from different specialties, and emergency doctors, revealing various levels of knowledge regarding ABG interpretation. It has been suggested to offer adequate education to physicians from various specialties. Also, preparing and arranging training courses to improve their knowledge and experience throughout their specialization, regardless of their specific field of expertise (Cikman et al., 2014). Likewise, the authors recommended that program-based learning regarding arterial puncture enhances nurses' knowledge, practice, and self-efficacy (Abd Elkader et al., 2020). Additionally, it has been recommended that a structured teaching program is effective in improving the level of knowledge of ABG analysis in nursing students (Adhikari, 2019). Similarly, researchers have statistically

concluded that the self-instructional module about ABG analysis was efficient among nursing students (Reddy et al., 2023). Further, it has been suggested that Decision-Based Learning is an effective method for teaching nursing students about ABG analysis (Tesseyman et al., 2023). Understanding and comprehending the perceptions of ABG interpretations of healthcare college students has a beneficial effect on enhancing their awareness and improving their perceptions and attitudes about ABG interpretations.

The findings of our study highlight the importance of implementing educational sessions aimed at improving healthcare students' perceptions of ABG interpretation. This emphasizes the idea that healthcare students with a background in education and experience in ABG interpretation have a greater understanding of ABG interpretation.

The second research question asked, "Are Respiratory therapy students more familiar with ABG interpretation than nursing students? " There were significant differences in the familiarity regarding ABG interpretation between nursing and respiratory therapy students across seven of eight statements. According to our findings, bachelor's degree respiratory therapy students and master's degree respiratory students showed higher familiarity regarding ABG interpretation than bachelor's degree nursing students based on their calculated mean, standard deviation, and *P*-value for the seven familiarity statements. However, there was no significant difference in the familiarity regarding ABG interpretation between nursing and respiratory therapy students in the statement, " It is important for me as a healthcare student to understand how to interpret ABG" based on calculated mean, standard deviation, and *P*-value.

Nevertheless, the familiarity regarding ABG interpretation among healthcare students and providers varies between studies. Joel and Choudhary (2022) findings that assessed the knowledge

level of analyzing and interpreting ABG in a sample of nursing staff. They found that 80% of the nursing staff scored a B or higher on the ABG knowledge assessment.

Although our study assessed familiarity at a single educational institution, it encompassed a sample of healthcare students, including nursing and respiratory therapy students. Bachelor's and master's degree respiratory therapy students showed high levels of knowledge, awareness, and positive perceptions regarding ABG interpretation. These findings emphasize that respiratory therapy students are the most current in their understanding of ABG interpretation and exhibit greater familiarity with ABG interpretation compared to nursing students.

The third research question asked, "Do healthcare students with clinical experience have superior perceptions compared to students without clinical experience? " In the context of this study, the clinical experience regarding perceptions of ABG interpretation among healthcare students was investigated using seven statements that assess clinical experience. In regard to the clinical experience regarding perceptions toward ABG interpretation among healthcare students, our findings showed that there were significant differences in the perceptions regarding ABG between students who had clinical experience and those who had no clinical experience across three of these statements, as evidenced by the *P*-value. Healthcare students with clinical experience regarding ABG interpretation exhibited more positive perceptions regarding ABG interpretation. These findings are aligned with Apsara et al. (2019) findings. According to Apsara et al. (2019), nursing officers with clinical experience in emergency care departments exhibited an increase in the level of knowledge of ABG analysis (62%). This finding supports the idea that clinical experiences for healthcare providers regarding ABG interpretation lead to positive perceptions toward ABG interpretation.

In contrast, there was no significant difference in the perception of ABG interpretation between students who had clinical experience and those who had no clinical experience across the remaining four statements based on the *p*-value. Only twelve students without clinical experience participated in the study, which provides insufficient power to detect significant effects on clinical experience regarding ABG interpretation and explains the insignificant difference found between healthcare students with clinical experience and those without clinical experience in the study population. However, the clinical experience regarding perceptions of ABG interpretation among healthcare students and providers varies between studies. Tesseyman et al. (2023) assessed the experience and knowledge of ABG analysis in a sample of nursing students. They found that participants had acquired confidence in ABG analysis.

Implications for Research

The findings of this study provide valuable insights into healthcare students' perceptions of ABG interpretation. The information and insights obtained from the present study can be utilized to improve and enhance the understanding of perception regarding ABG interpretation among healthcare students. These findings emphasize the necessity of providing opportunities for healthcare students to gain clinical experience through participating in and attending ABG interpretation sessions, which aim to foster their awareness and understanding. As future healthcare providers who will interact directly with patients, healthcare students must receive a comprehensive education in ABG interpretation within their curriculum. This inclusion is essential to prevent inaccurate diagnoses and inappropriate therapy, ensuring the provision of effective and safe care by healthcare practitioners in the future. Overall, the current study highlights the importance of ABG interpretation sessions and emphasizes the necessity to promote its significance and encourage its use in the education and training of healthcare students.

Limitations and Strengths

It is important to acknowledge that the current study has various limitations due to several reasons that should be considered. One of the main limitations of this study is that the present study was conducted at a single educational institution, which limits the findings' generalizability to the perceptions of other healthcare students. Furthermore, there is a lack of studies that discuss healthcare students' perceptions of ABG interpretation, making it challenging to compare the findings of this study to those of other studies involving healthcare students' perceptions of ABG due to the lack of research that had been carried out in this particular field. Notwithstanding the limitations of the present study, it is noteworthy as it represents the first study, according to our knowledge, to evaluate the perceptions of ABG interpretation among healthcare students, particularly nursing and respiratory therapy students.

Recommendations for Future Research

Future research is strongly advised to evaluate healthcare students' perceptions regarding ABG interpretation due to the limited number of studies on this topic. Furthermore, replication of this study across several educational institutions is highly recommended to generalize findings. In addition, future research suggested to be conducted during respiratory therapy students first semester prior to any clinical experience.

Conclusion

This study was the first study to our knowledge that assessed the perception of ABG interpretation among nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University. The study found that healthcare students have positive perceptions toward ABG interpretation. The study's findings also support that bachelor's and master's degree respiratory therapy students exhibited superiority in familiarity

regarding ABG interpretation over bachelor's degree nursing students. Additionally, the current study's findings indicated that experience positively affects the perception regarding ABG interpretation. Finally, the present study recommends and suggests implementing a comprehensive education in ABG interpretation within the curriculum of healthcare students, providing opportunities for healthcare students to gain clinical experience and training regarding ABG interpretation.

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Appendix A: Informed Consent and Study Questionnaire

Georgia State University

Department of Respiratory Therapy

Informed Consent

Title: The perception of ABG interpretation among nursing and respiratory therapy students at an Urban University.

Principal Investigator: Douglas S. Gardenhire, EdD, RRT-NPS, FAARC

Student Principal Investigator: Hams Shrourou, BSc, RT

Dear Healthcare Students,

You are invited to take part in a research study because you are an undergraduate or graduate healthcare student. The purpose of this study is to evaluate the perceptions of healthcare students toward ABG interpretation.

The research is being conducted by Hams Shrourou, a master's student at Georgia State University, under the direction of Dr. Douglas S. Gardenhire, Chairman of the Respiratory Therapy Department at GSU. You will receive no direct benefit from participating in this study, but the information gained will help evaluate and assess the perceptions of healthcare students toward ABG interpretation. If you are willing to participate in this study, you will be asked to complete the following survey. The survey should take approximately 5 minutes or less to complete.

Please note that your responses will be used for research purposes only and will be strictly confidential. To protect your confidentiality, no names or codes will be used to identify you or your survey. All surveys will be shredded after they have been analyzed. There is no

compensation or known risk associated with participation. We don't foresee this study causing you any harm or discomfort. You do not have to be in this study. You may skip questions or stop participating at any time. We hope that you will submit a completed survey. However, if you choose not to participate in this study, you may withdraw at any time by not completing or submitting a blank survey.

If you have any questions about the research, please contact Hams Shrourou at hshrourou1@student.gsu.edu or Dr. Douglas S. Gardenhire, at dgardenhire@gsu.edu. The department's contact information can be found at the bottom of this page. If you are 19 years of age or older and agree to the above, please proceed to the survey. When finished, please place your survey in the designated envelope in the room.

Thank you in advance for your cooperation.

Sincerely,

Hams Shrourou

Department of Respiratory Care Georgia State University

P.O. Box 4019

Atlanta, GA 30302

(404) 413-122

Questionnaire of the perceptions of healthcare students toward arterial blood gas (ABG) Interpretation

Socio-demographic Questions:

1.Gender:

- Male
- Female

2.What is your age in years?

3.What academic degree and program are you currently studying:

- Bachelor's degree in respiratory therapy.
- Master's degree in respiratory therapy.
- Bachelor's degree in nursing.
- Master's degree in nursing.

4.What is your current year in the professional program?

- First year
- Second year
- Third year
- Fourth year

5.Have you graduated in credited clinical program?

- Yes
- No

6.If so, how many years of clinical experience do you have in healthcare?

……..

7.Do you have clinical experience in the program?

- Yes
- No

8. If so, how many semesters of clinical experience do you have in healthcare?

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9. I have received training regarding ABG interpretation.

- Yes
- No

10. I have received training regarding drawing ABGs.

- Yes
- No

The Perceptions of Arterial Blood Gas

Please answer each of the following questions by circling the number that best describes your opinion.

To what extent do you agree with each of the following statements?

Strongly Disagree ↔ Strongly Agree

11. It is important for me as a healthcare student to understand how to interpret ABG.	1 2 3 4 5 6 7
12. It is important for me as a healthcare student to recognize an abnormal ABG.	1 2 3 4 5 6 7
13. I feel comfortable obtaining an ABG.	1 2 3 4 5 6 7
14. I understand the importance of performing an Allen's test.	1 2 3 4 5 6 7
15. I can recognize the indication for drawing an ABG.	1 2 3 4 5 6 7
16. I understand that ventilation affects PaCO2.	1 2 3 4 5 6 7
17. I am aware that PaCO2 influences PH in an ABG.	1 2 3 4 5 6 7
18. I recognize that the level of PaO2 measures oxygenation status in an ABG.	1 2 3 4 5 6 7
19. I understand that drawing an ABG requires a specialized syringe.	1 2 3 4 5 6 7

20. I am aware that the ABG sample can be drawn from the radial artery, brachial artery, femoral artery, or dorsalis pedis artery.	1 2 3 4 5 6 7
21. I understand that the ABG syringe should be inserted through the skin at a 45-degree angle.	1 2 3 4 5 6 7
22. I am aware that CBG can be a specific substitute in the pediatrics and neonates population.	1 2 3 4 5 6 7
23. I feel comfortable applying Winters' formula in the Interpretation of ABG.	1 2 3 4 5 6 7
24. It is important for me as a healthcare student to attend continuing education sessions regarding ABG interpretation.	1 2 3 4 5 6 7
25. I will attend continuing education sessions regarding ABG interpretation after graduation.	1 2 3 4 5 6 7

Appendix B: IRB Approval

INSTITUTIONAL REVIEW BOARD

Mail: P.O. Box 3999 In Person: 3rd Floor
Atlanta, Georgia 30302-3999 58 Edgewood
Phone: 404/413-3500 FWA: 00000129

January 12, 2024

Principal Investigator: Douglas Gardenhire

Key Personnel: Gardenhire, Douglas; Shrourou, Hams M

Study Department: Georgia State University, Respiratory Therapy

Study Title: The perception of ABG interpretation among nursing and respiratory therapy students at Byrdine F. Lewis College of Nursing and Health Professions at Georgia State University

Submission Type: Exempt Protocol Category 2

IRB Number: H24314

Reference Number: 377667

Determination Date: 01/12/2024

Status Check Due By: 01/11/2027

The above-referenced study has been determined by the Institutional Review Board (IRB) to be exempt from federal regulations as defined in 45 CFR 46 and has evaluated for the following:

1. Determination that it falls within one or more of the eight exempt categories allowed by the institution; and
2. Determination that the research meets the organization's ethical standards

If there is a change to your study, you should notify the IRB through an Amendment Application before the change is implemented. The IRB will determine whether your research continues to qualify for exemption or if a new submission of an expedited or full board application is required.

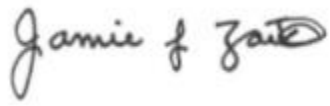
A Status Check must be submitted three years from the determination date indicated above. When the study is complete, a Study Closure Form must be submitted to the IRB.

This determination applies only to research activities engaged in by the personnel listed on this document.

It is the Principal Investigator's responsibility to ensure that the IRB's requirements as detailed in the Institutional Review Board Policies and Procedures For Faculty, Staff, and Student Researchers (available at gsu.edu/irb) are observed, and to ensure that relevant laws and regulations of any jurisdiction where the research takes place are observed in its conduct.

Any unanticipated problems resulting from this study must be reported immediately to the University Institutional Review Board. For more information, please visit our website at www.gsu.edu/irb.

Sincerely,



Jamie Zaikov, IRB Member