

Assessment of Knowledge and Awareness of Acute Physiology and Chronic Health Evaluation (APACHE) II Tool Among Intensive Care Nurses in a Tertiary Institution

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Abstract: Background: This study is aimed at assessing the adequate knowledge and awareness of the trained Intensive Care Nurses working at the University of Abuja Teaching Hospital (UATH) on Acute Physiology and Chronic Health Evaluation (APACHE) II prognostic tool on patients who are being referred for intensive medical and nursing care from other departments of the hospital for cardiac and thoracic support, also for invasive and non-invasive procedures. This tool is an instrument of interest that is used in predicting the severity and prognosis of critical conditions such as severe trauma, and severe sepsis. The prognostic tool was first founded at George Washington University Medical Center in 1981. The acute physiological score was complex initially because it uses 34 physiological parameters, afterward a simple 12 parameter APACHE II system was invented in 1985 and it is widely applied in assessing the severity of diseases in the Intensive Care Unit. The same was published in 1985 and it remains useful for research, quality control, and clinical applications for patients admitted into the Intensive Care Unit within 24 hours. This study was a cross-sectional survey that used a structured electronic survey questionnaire to collect ethnography qualitative data. A total of 72 (98%) (n=72) of the respondents are trained intensive care nurses and 2 (2%) had no training in intensive care nursing. 27 (36%) of the respondents work in the intensive care unit, 10 (14%) works in the Post Basic Intensive Training School, 14 (19%) works in Post-Operative Recovery Room, while 23 (31%) of the respondent works in other departments of the hospital. And all these trained intensive care nurses had their training across different schools in Nigeria. In conclusion, the study showed that a larger number of the trained intensive care nurse in UATH who had their training across various schools in Nigeria do not have optimal knowledge and awareness of the utilization of this tool, and it is very important for nurses to have the background knowledge and for proper use of this prognostic tool. Therefore, there is a need for training and re-training for the Intensive Care Nurses across the board. Also, this tool should be inculcated into the Post Basic Critical Care Training Nursing Schools, curriculum across all the Post Basic Critical Care Nursing Training Schools in Nigeria.

Keywords: Trained Intensive Care Nurses, Prognostic APACHE II Tool, Intensive Care Training Schools

1. Introductions

At the University of Abuja Teaching Hospital - Gwagwalada, the Critical Care Unit is a four bedded capacity, situated close to the main theatre, post-operative recovery

room, and easily accessible to other departments. Furthermore, patients are not directly admitted into the Critical Care Unit, but are rather referred from the following department of the hospital; hence the Critical Care Unit of the University of Abuja is a referral center to the following: The Traumatology, Medical, Surgical, Pediatrics,

Otolaryngology, Obstetrics/Gynecology Departments and patients with Post-Operative Respiratory Distress (PORD) from the main theatre.

From the unit admission and discharge register; and it was discovered that 60% of patients admitted into the unit are with Traumatic Head Injured (TBI) from the Accident and Emergency Unit of the hospital, while 40% are other cases from the other above-mentioned departments. The patients are being referred to the ICU for intensive medical and nursing care, especially for cardiac and thoracic support, also for invasive and non-invasive procedures.

With this backdrop, there will be a need for accurate assessment of potential risk in these patients while on admission; the prognostic tool will enhance individualized care and, evidence-based care in an Intensive Care Unit [14]. Therefore, it is important to adopt an evidenced-based tool to predict the severity and prognosis of the condition of a patient in the Intensive Care Unit [23]. An ideal scoring tool should be simple, fast, timely, and accurate in describing the severity of a disease condition in an individual patient. One such scoring system is the APACHE 2 scoring system which uses a scorecard that depends on age, physiologic parameters, and previous state of health [18, 21]. Others are Sequential Organ Failure Assessment (SOFA), Simplified Acute Physiology Score II (SAPS - II) [22] and the Injury Severity Score (ISS) has been arguably the most used injury severity measure since its initial development. Although the ISS has several recognized mathematical, administrative and clinical limitations⁴, it's prominence in trauma monitoring and evaluation has resulted in the ISS being regarded as the 'gold standard' in trauma severity grading [16].

However, this research explores the baseline knowledge of the Acute Physiology and Chronic Health Evaluation II (APACHE II) prognostic scoring tools amongst Intensive Care Nurses at the University of Abuja Teaching Hospital – Gwagwalada, Abuja. From extensive studies, it is an instrument of interest that helps in evaluating the severity and prognosis of critical conditions such as severe trauma, severe sepsis. It is worthy of note that there have been various studies about this tool that enabled the understanding of its choices and importance. The elevated APACHE II score is associated with high mortality and prolonged hospital stay adequately estimates the risk of mortality [14]. Its components are the routine parameters that are being monitored in the Intensive Care Unit [20]. APACHE II scoring systems were founded at George Washington University Medical Centre in 1981. The acute physiological score was complex initially because it uses 34 physiological parameters. Therefore, a simple 12 parameter APACHE II system was invented in 1985 and it is widely applied in assessing the severity of diseases in an Intensive Care Unit. Assessment is done within 24 hours of ICU admission and it includes the level of consciousness (using GCS), Blood (WBC count and hematocrit), cardiovascular status (using Blood Pressure, heart rate), electrolytes and Biochemistry (K, Na, and creatinine); respiratory status (Respiratory Rate, Alveolar-Arterial O₂ level) and body temperature [16]. The

highest score is 71, a high score is related to increase mortality, and mortality is also related to the disease condition [12]. Also, the APACHE II score is a reliable and valid tool for predicting the Prognosis of disease [14]. For optimal utilization of this tool, nurses must have the background knowledge to properly use the tool [1].

Interestingly, in another study, APACHE II was the first index to indicate or contraindicate the use of a certain therapy (in particular, activated protein C in sepsis) [2]. Because it continues to exhibit good discrimination capacity, APACHE II remains a widely used index to describe severity in populations of critically ill participants in clinical trials. In 2016, 12 clinical trials involving critically ill patients were published in the 3 highest-impact medical journals. APACHE II was the index that was most frequently utilized to describe the severity of the patients included in these studies; this index appeared in 9 of these 12 studies [2].

On this premise, this has informed the importance of this study which explored whether the intensive care nurses, at the University of Abuja Teaching Hospital, possess adequate knowledge on the optimal use of the Acute Physiological and Chronic Health Evaluation (APACHE) II scoring system. And consequently, create awareness on the implementation of this essential APACHE II prognostic tool, though, over the years, there are upgraded versions (APACHE IV). Even with that, it has not rendered the APACHE II tool to be obsolete. Also with this understanding, there is a need to meet up with the international standard of quality of life (QoL) assessment and care, determining patients' length of stay (LOS) for economy reasons, to create bed space for the awaiting patients that need to benefit from the intensive care services, level of intensive care personnel that will need to be deployed for QoL, determining the various level of intensive care the patient will need to be admitted to and more training for appropriate proficient professional.

2. Method

A cross-sectional descriptive electronic on-line survey was employed which involves the collection of data from the trained intensive care nurses as a population of study at the University of Abuja Teaching Hospital – Gwagwalada. A total of 74 (n=74) respondents though, had 2 respondents who said was not a trained Intensive Care Nurse. Data were collected using a structured questionnaire consisting of fourteen questions. Sections A to D. Section A consists of sociodemographic variables, Section B consist of the duration of how long they have practiced as intensive care nurse, section C consists of questions on knowledge of the tools while section D consists of questions on the awareness of the tool.

Written permission to conduct the study was obtained from the University of Abuja Teaching Hospital Research Ethical Committee. The purpose and nature of the study were explained to the study participants. Informed consent was obtained from the respondents before administering the research instruments. All the respondents agreed to take part in the study. These respondents were in their usual work environment.

Confidentiality and anonymity were maintained in that the respondents' names were not recorded on the questionnaires. Instead, analytic graphical software was used. Data collected were analyzed using SPSS software version 21.0.

3. Results

Socio-Demographic Characteristics of Respondents

Overall, the summary statistics of the distribution of the respondents by age, sex, marital status, educational qualification, and unit gives the following information as shown on the table which indicates that 58 (78%) of the respondents are females while 16 (22%) are males. Also, 7 (9%) of the respondents ≤ 30 years, 5 (7%) were between the age range of 31-35 years old, 7 (9%) were in the age range of 36-40 years old, 18 (24%) were between the age range of 41-45 years old, 16 (22%) were between the age range of 46-50 and 51-55 years old while 5 (7%) of the respondents were 56 years and above.

The table further reveals that 57 (77%) of the respondents were married, 9 (12%) of the respondents were single while 8 (11%) are neither married nor single. The table also indicates that 72 (97%) of the respondents are trained intensive care nurses, and 2 (3%) had no training in intensive care nursing. 27 (36%) of the respondents were intensive care unit nurses, 10 (14%) were from Post Basic Intensive Training School, 14 (19%) were in Post-Operative Recovery Room, while 23 (31%) of the respondent were from other departments of the hospital.

Therefore, there was a highly statistically significant association of p-value ($P < 0.05$) between all the variables in the Socio-demographic characteristics of respondents and the assessment of knowledge and awareness of this tool, as seen in Table 1.

Table 1. Sociodemographic characteristics of respondents.

Variable	Count (%)
Sex	
Male	16 (22)
Female	58 (78)
prefer not to say	0
Age	
26-30	7 (9)
31-35	5 (7)
36-40	7 (9)
41-45	18 (24)
46-50	16 (22)
51-55	16 (22)
56-60	5 (7)
Marital Status	
Married	57 (77)
Single	9 (12)
Others	8 (11)
Educational Qualification	
Trained Intensive Care Nurse	72 (97)
Not a trained Intensive Care Nurse, but working at the ICU	2 (3)
Current Department	
Intensive Care Unit	27 (36)
Post Basic Intensive Training School	10 (14)
Post-Operative Recovery Room	14 (19)
Others	23 (31)

** Significant at $P < 0.05$.

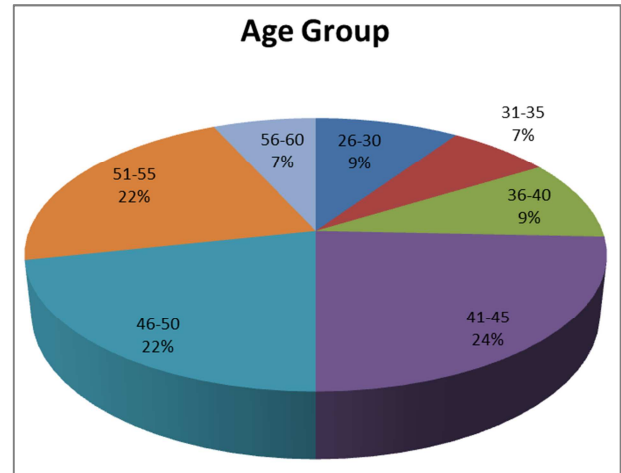


Figure 1. Age distribution of the respondents.

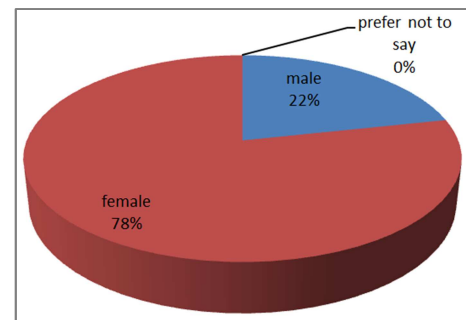


Figure 2. Sex distribution of the respondents.

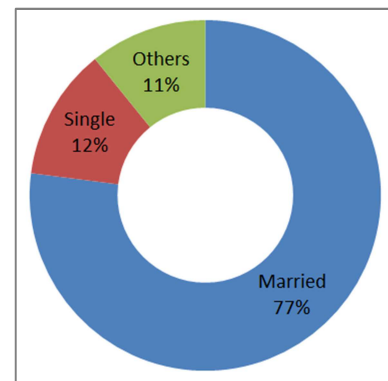


Figure 3. Distribution of respondents by marital status.

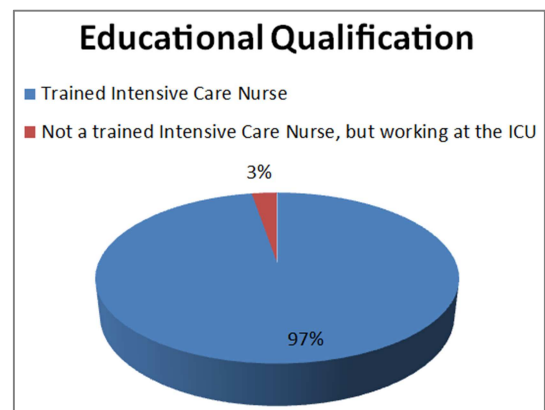


Figure 4. Distribution of respondents by educational qualification.

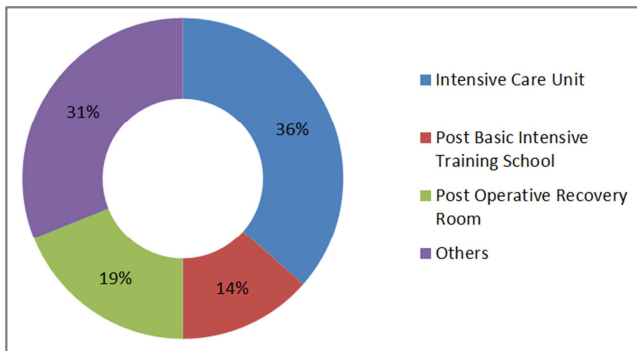


Figure 5. Distribution of respondents by current department.

Knowledge of the Apache II as a Prognostic Scoring Tool

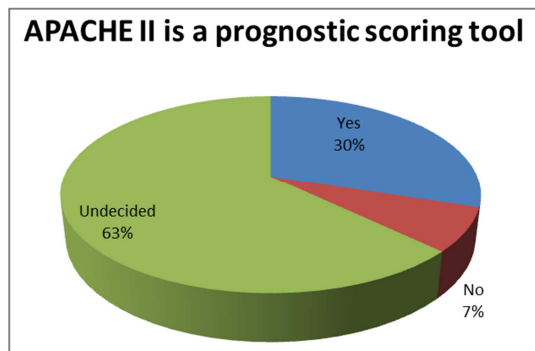


Figure 6. APACHE is a prognostic scoring tool.

Figure 5 shows respondents' opinions on whether

APACHE II is a prognostic scoring tool or not. Almost 30% said yes is a prognostic scoring system, 7.1% said is not a prognostic scoring tool while 62.9% were undecided. The respondent's important factors that informed their knowledge about APACHE II is a prognostic scoring system or not, 35 Want to know what the tool is all about, 16 wants to know How will the tool assist in knowing the following, 22 How will the tool measure the likelihood of death rate and How will the tool help in determining the level of ICU to admit the patient Can the tool help to know the length of recovery, respectively, 19 Assess the cost and complexity of the resources and treatments required, 17 Determining the likelihood and extent of permanent impairment, 20 How to measure energy dissipation or absorption, 25 How to determine the incidence of a particular trauma type, 39 How to determine the impact post-trauma quality of life.

Awareness of Apache II Prognostic Scoring Tool

Table 2 shows respondents' opinions on whether they are aware of the APACHE II prognostic scoring tool. 21 respondents representing 28.8% are aware and have knowledge of it, 31 respondents representing 42.5% are not aware, 15 respondents representing 20.5% have heard about it but have no knowledge of it, 3 respondents representing 4.1% have not heard about it before while 3 respondents representing 4.1 don't even know. Also, opinions of those who are aware and have knowledge of APACHE II on the tool can help determine patients' prognosis. 15 respondents strongly agreed, 4 respondents agreed, 1 respondent was undecided, and only 1 respondent strongly disagreed with the assertion.

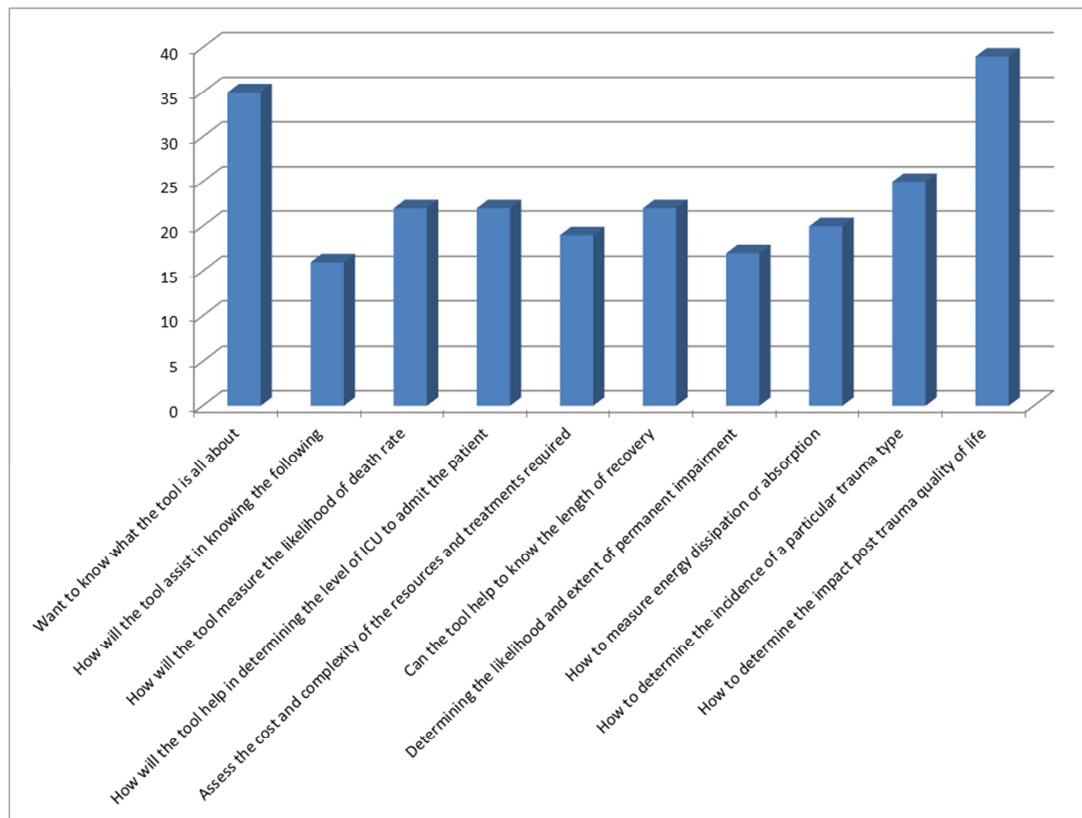
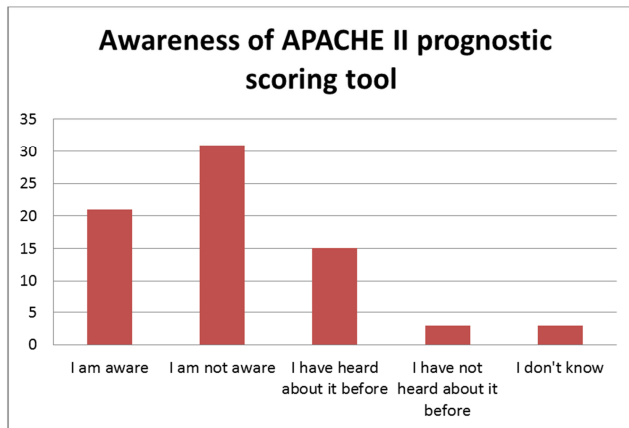


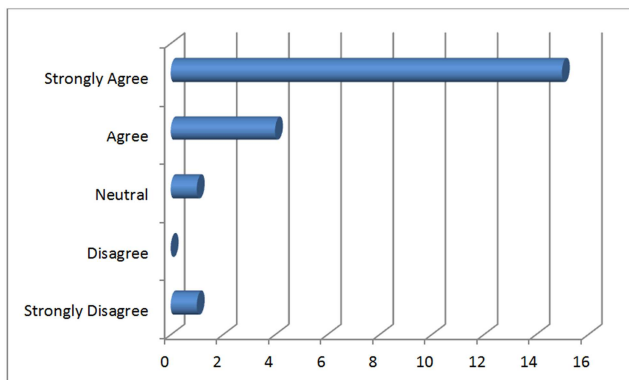
Figure 7. Factors that determine respondents' opinion about whether APACHE II is a prognostic tool.

Table 2. Are you aware of what APACHE II Prognostic Scoring Tool?

I am aware	I am not aware	I have heard about it before	I have not heard about it before	I don't know
21 (28.8)	31 (42.5)	15 (20.5)	3 (4.1)	3 (4.1)

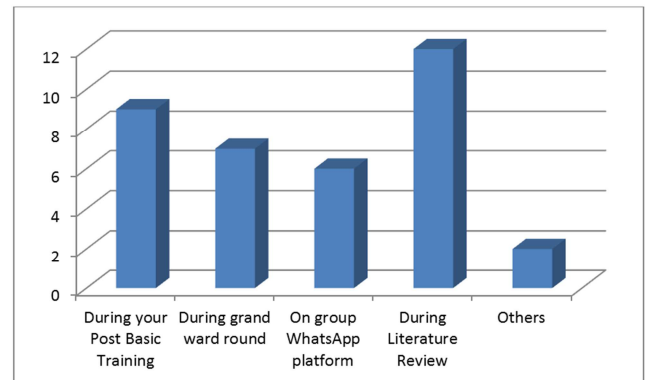
**Figure 8.** Awareness of APACHE II prognostic scoring tool.**Table 3.** Do you agree that, the tool can be helpful in determining patients' prognosis?

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	0	1	4	15

**Figure 9.** Respondents' opinion about how APACHE II can be helpful in determining patients' prognosis.

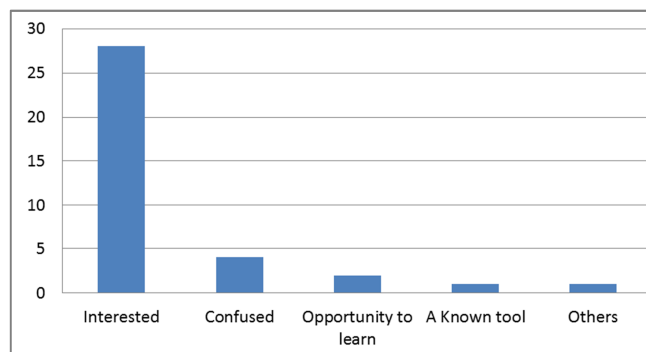
Learning about APACHE II

Figure 8 shows respondents' opinions on how they got to learn about APACHE II. To this effect, the 9 respondents got to learn about it during their post-basic training, 7 respondents said during the grand ward round, 6 respondents admitted that it was on WhatsApp group platform, 12 respondents got to learn it during literature review while 2 respondents said through other means which was not specified.

**Figure 10.** How respondents first learnt about APACHE II.

Reaction to APACHE II

Figure 9 shows respondents' opinions on their reaction when they first heard about APACHE II. To this effect, 28 respondents were more interested, 4 respondents got confused, 2 respondents see it as an opportunity to learn, and it was a known tool to 1 of the respondents, while 1 respondent said other means which was not specified.

**Figure 11.** Respondents' reaction to APACHE II.

Significance of Awareness of APACHE II

Table 4 shows the statistical significance of respondents' awareness of APACHE II. 23 respondents became very inquisitive, 9 respondents asked questions, 3 respondents dismissed the idea and one respondent was not interested. Besides, the attitude and intensity of how respondents' were inquisitive shows that 21 respondents very high, 7 respondents high, 3 respondents were undecided, and 2 respondents said their level of inquisitiveness was low to the assertion.

Table 4. What is the significance of this awareness?

Became inquisitive	Dismissed the idea	Asked questions	Not interested	Others
23	3	9	1	0

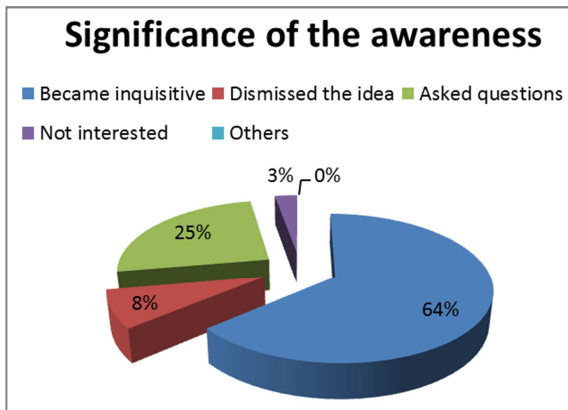


Figure 12. Significance of the awareness.

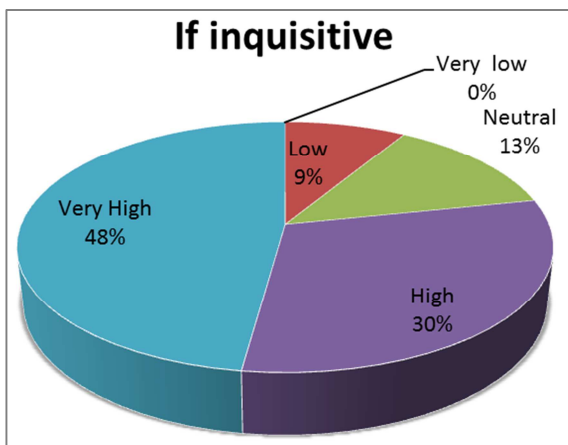


Figure 13. The level of respondent's inquisitiveness.

4. Discussion

According to Mehrzad Bahtouee, et. al [14] The Acute Physiology and Chronic Health Evaluation (APACHE) II is still commonly used as an index of illness severity in patients admitted to the intensive care unit (ICU) and has been validated for many research and clinical audit purposes.

Socio-demographic Characteristic

The majority of the respondents are female 58 (78%) compare to the male respondents that are 16 (22%) and no one denied their sexuality. The highest age bracket amongst the trained intensive care nurses are between the ages of 41–45 years (24%) while the least age is 31–35 years (7%) and the median age of the respondents is 43 years while the highest number are married (57) 77% and others are who are neither married or single are 8 (11%). It is also discovered that 72 (97%) are trained while 2 (3%) are non-trained intensive care nurses, but works in the department. All the trained intensive care nurses are distributed across other units but majorly at the intensive care unit 27 (36%) and the least number work at the post basic intensive care training school 10 (14%). The finding speaks to the fact that, more than half of the trained intensive care nurses are female which could be due to the assertion of a similar study done by Chitmwango (2017); in his study of knowledge, attitude and practice of Nurses to infection prevention measures at Ndola University

Teaching Hospital where 78% of the respondents in the study were female. This could be attributed to the fact that, health profession is mostly females dominating especially that nursing was viewed as a feminine career globally says, Evason Mandona et. al [8], but this assertion was refuted by Chaunie Brusie, (2019) that said, according to the U.S. Bureau of Labor Statistics (BLS), as of 2019 more than 12% of Registered Nurses in the U.S. are men. And while nursing has been a historically female-dominated industry, the tide is certainly changing for gender equality in all professions. Furthermore, according to a March 2020 article, the four central hospitals in Ohio all saw a marked increase in the number of male nurses. Nationwide, Children's hospitals' ratio of male nurses jumped 66%, while Ohio State University's Wexner Medical Center doubled their rates of male nurses over the past decade.

While 57 (77%) were married and it can be inferred that majority of the trained intensive care nurses had more than 20–22 years working experience hence, began the practice when they were unmarried and gradually grew into marriage during their work-life. 27 (36%) trained nurses domiciled in the intensive care unit, though it is a four bedded capacity unit, but it serves majorly for the 2 of 3 levels of intensive care unit which also accommodate both female and male patients, pediatrics and geriatrics. Level II - being capable of providing a high standard of general intensive care, including complex multi-system life support, and Level III - a tertiary referral unit for intensive care patients that is capable of providing comprehensive critical care including complex multi-system life support for an indefinite period and demonstrates commitment to academic education and research. While 10 (14%) is intensive care educator that trains other nurses for both nursing and medical intensive care.

Knowledge of the APACHE II as a Prognostic Scoring Tool

Amazingly, almost 30% acknowledged that, it can be a prognostic scoring tool, 7.1% said is not a prognostic scoring tool while 62.9% were undecided. The respondent's important factors that informed their knowledge about APACHE II is a prognostic scoring tool or not, 35 Want to know what the tool is all about, 16 wondered how will the tool assist in knowing the following, 22 How will the tool measure the likelihood of death rate and How will the tool help in determining the level of ICU to admit the patient. Can the tool help to know the length of recovery, respectively, 19 Assess the cost and complexity of the resources and treatments required, 17 Determining the likelihood and extent of permanent impairment, 20 How to measure energy dissipation or absorption, 25 How to determine the incidence of a particular trauma type, 39 How to determine the impact post-trauma quality of life. According to Lim [14], she said, "The APACHE (Acute Physiology and Chronic Health Evaluation) II Scoring System is a tool used to evaluate disease and mortality prediction in the intensive care units (ICUs). In June 2013, it was introduced in a medical ICU where the APACHE II scores are tabulated and accessible

from the patients' data system. As the primary users of APACHE II are physicians, the ICU nurses' knowledge of the APACHE II scores is unknown". Lim. [13] further stated in his study that, "Although APACHE II was relatively new in the setting, 83.6% of the respondents were keen to learn".

However, Shiu-Lien et al [19] made a strong assertion "that greater knowledge concerning the APACHE II is needed. Information and training concerning the proper use and purpose of APACHE II needs to be provided, especially for those intensive care unit nurses using this evaluation tool to score patients' conditions routinely".

After all, according to the Concise English Dictionary (2006), Knowledge is information understanding and skills acquired through experience or education.

Awareness of APACHE II Prognostic Scoring Tool

These group of nurse specialist was further asked about the awareness of this tool, even if you were not knowledgeable about the tool and understand it's use, but 21 respondents representing 28.8% are aware and have knowledge of it, 31 respondents representing 42.5% are not aware, 15 respondents representing 20.5% have heard about it but have no knowledge of it, 3 respondents representing 4.1% have not heard about it before while 3 respondents representing 4.1% don't even know. Also, opinions of those who are aware and have knowledge of APACHE II on the tool can help determine patients' prognosis. 15 respondents strongly agreed, 4 respondents agreed, 1 respondent was undecided, and only 1 respondent strongly disagreed with the assertion. It further got more interesting from the study that, more than half of the population, 31 respondents representing 42.5% is not aware. The results of the discovered that nurses are unconscious of APACHE II tool and its usefulness by the 21 respondents that are aware and have knowledge of the tool. It could be that, the nurses thought it is mainly for statistical purposes used by only the Physicians. It will suffice to say that, information and training concerning the proper use and purpose of APACHE II needs to be provided, especially for those intensive care unit nurses using this evaluation tool to score patients' conditions consistently.

5. Conclusion

The study was to assess the knowledge and awareness of the APACHE II prognostic tool. Data was collected from 74 (n=74) respondents, 72 were trained intensive care nurses while 2 were not, but working in the intensive care unit. An e-survey open ended questionnaire was posted to the group WhatsApp group where all these category of nurses belong to; there was a column to obtain consent. The Hospital Research Ethical Committee (HREC) gave a written permission to conduct the said research. The findings from the study showed the sub-optimal level of knowledge and awareness of the prognostic scoring tool. It is amazing that, these nurses who had training from different schools, had below average knowledge and awareness of the tool.

Therefore, it is recommended that this predictive patient scoring tool should be included in the curricula of all the Post

Basic Critical Care Nursing Training Schools in Nigeria. Also new approaches must be considered to apply these tools in all the critical care units which can be done through regular holding of clinical meetings, workshop, training update programs and seminars.

References

- [1] Bahtouee, M., Eghbali, S. S., Maleki, N., Rastgou, V. and Motamed, N., 2019. Acute Physiology and Chronic Health Evaluation II score for the assessment of mortality prediction in the intensive care unit: a single-centre study from Iran. *Nursing in critical care*, [e-journal] 24 (6), pp. 375-380. 10.1111/nicc.12401.
- [2] Bernard GR, Vincent JL, Laterre PF, LaRosa SP, Dhainaut JF, Is APACHE II a useful tool for clinical research? – NCBI.
- [3] Cates, C. J., Schmidt, S., Ferrer, M., Sayer, B. and Waterson, S., 2018. Inhaled steroids with and without regular salmeterol for asthma: serious adverse events. *The Cochrane database of systematic reviews*, [e-journal] 12, pp. CD006922. 10.1002/14651858.CD006922.pub4.
- [4] Chen, Y., Cao, W., Gao, X., Ong, H. and Ji, T., 2015. Predicting postoperative complications of head and neck squamous cell carcinoma in elderly patients using random forest algorithm model. *BMC medical informatics and decision making*: [e-journal] 15 (1), pp. 44. 10.1186/s12911-015-0165-3.
- [5] Elaine N. Marieb, Suzanne M. Keller., 2017a. *Essentials of Human Anatomy & Physiology, Global Edition*. [e-book] Twelfth edition. Global edition. ed. GB: Pearson Education. Available through: ARU Library.
- [6] Evason Mandona, Ebenezer Obi Daniel, Paul Olaiya Abiodun, Israel Olukayode Popoola, Olayinka Victor Ojo, Christie Omolola Adams, Stellamaris Moronkeji Assessment of Knowledge, Attitude and Practice of Infection Prevention among Health Care Providers in Chibombo District Zambia.
- [7] Fortis, S., O'Shea, A. M. J., Beck, B. F., Nair, R., Goto, M., Kaboli, P. J., Perencevich, E. N., Reisinger, H. S. and Sarrazin, M. V., 2018. An automated computerized critical illness severity scoring system derived from APACHE III: modified APACHE. *Journal of critical care*, [e-journal] 48, pp. 237-242.
- [8] Galbois, A., Das, V., Carbonell, N. and Guidet, B., 2013. Prognostic scores for cirrhotic patients admitted to an intensive care unit: Which consequences for liver transplantation? *Clinics and Research in Hepatology and Gastroenterology; Clin Res Hepatol Gastroenterol*, [e-journal] 37 (5), pp. 455-466. 10.1016/j.clinre.2013.05.001.
- [9] Gupta, S. and Mishra, M., 2016. Acute Physiology and Chronic Health Evaluation II score of ≥ 15 : A risk factor for sepsis-induced critical illness polyneuropathy. *Neurology India; Neurol India*, [e-journal] 64 (4), pp. 640-645. 10.4103/0028-3886.185356.
- [10] Huang, Y., Chen, J., Zhong, S. and Yuan, J., 2016a. Role of APACHE II scoring system in the prediction of severity and outcome of acute intracerebral hemorrhage. *International Journal of Neuroscience*, [e-journal] 126 (11), pp. 1020-1024. 10.3109/00207454.2015.1099099.

- [11] Kim, Y. H., Yeo, J. H., Kang, M. J., Lee, J. H., Cho, K. W., Hwang, S., Hong, C. K., Lee, Y. H. and Kim, Y. W., 2013. Performance assessment of the SOFA, APACHE II scoring system, and SAPS II in intensive care unit organophosphate poisoned patients. *Journal of Korean medical science*, [e-journal] 28 (12), pp. 1822-1826. 10.3346/jkms.2013.28.12.1822.
- [12] Lavoie et al, 2005; Rutledge, Hoyt, Eastman et al, 1997. Major Trauma and the Injury Severity Score.
- [13] Lim, Q. R., 2014. Nurses' knowledge and perceptions of APACHE II scoring system in a medical intensive care unit. *International Journal of Evidence-Based Healthcare*, [e-journal] 12 (3), pp. 206. 10.1097/01.XEB.0000455217.17939.87.
- [14] Mehrzad Bahtouee MD Seyed S Eghbali MD Nasrollah Maleki MD Vahid Rastgou MD Niloufar Motamed MD. Acute Physiology and Chronic Health Evaluation II score for the assessment of mortality prediction in the intensive care unit: a single-centre study from Iran. 29 March 2019 <https://doi.org/10.1111/nicc.12401>.
- [15] Okazaki, H., Shirakabe, A., Hata, N., Yamamoto, M., Kobayashi, N., Shinada, T., Tomita, K., Tsurumi, M., Matsushita, M., Yamamoto, Y., Yokoyama, S., Asai, K. and Shimizu, W., 2014. New scoring system (APACHE-HF) for predicting adverse outcomes in patients with acute heart failure: Evaluation of the APACHE II and Modified APACHE II scoring systems. *Journal of cardiology*, [e-journal] 64 (6), pp. 441-449. 10.1016/j.jcc.2014.03.002.
- [16] Oliver, C. M., Walker, E., Giannaris, S., Grocott, M. P. W. and Moonesinghe, S. R., 2015a. Risk assessment tools validated for patients undergoing emergency laparotomy: a systematic review. *British journal of anaesthesia: BJA; Br J Anaesth*, [e-journal] 115 (6), pp. 849-860. 10.1093/bja/aev350.
- [17] Samir Desai, Jitendra Lakhani, Jitendra Lakhani - Utility of SOFA and APACHE II score in sepsis in rural set up MICU - September 2013 - The Journal of the Association of Physicians of India 61 (9): 608-11 Source PubMed.
- [18] Schneider, A. G., Lipcsey, M., Bailey, M., Pilcher, D. V. and Bellomo, R., 2013. Simple translational equations to compare illness severity scores in intensive care trials. *Journal of critical care*, [e-journal] 28 (5), pp. 885. e1-885. e8. 10.1016/j.jcrc.2013.02.003.
- [19] Shiu-Lien ChenIen-Lan WeiYiing-Yiing SangYiing-Yiing SangFu-In TangFu-In Tang ICU nurses' knowledge of, and attitudes towards, the APACHE II scoring system April 2004Journal of Clinical Nursing 13 (3): 287-96.
- [20] Susan L, Bain, Lawrence W. B. S. The Journal of Trauma: Injury, Infection, and Critical Care: January 1988 - Volume 28 - Issue 1 - p 69-77.
- [21] Vimal, K. P., Nirmal, K. P., M3, V. and Sagiev, K. G., 2017. ICU scoring systems (APACHE II, APACHE IV, SAPS III) in an INDIAN ICU - observed mortality and its correlation with predicted mortality. *Journal of Evidence Based Medicine and Healthcare*, [e-journal] 4 (92), pp. 5605-5613. 10.18410/jebmh/2017/1123.
- [22] Wang, X., Chen, H., Liu, D., Zhang, Q. and Su, L., 2016. The correlation between CVP-derived parameters and the prognosis of critically ill patients. *Journal of critical care; J Crit Care*, [e-journal] 40, pp. 257-264. 10.1016/j.jcrc.2017.03.011.
- [23] Why Nursing is a Great Career Choice for Men – 2019 <https://nurse.org/articles/Male-Nurses-And-The-Profession>.