Assessment Of Emergency Care Services In Nigerian Hospitals: A Cross-Sectional Study

Kelechi Herbert Umoga

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ASSESSMENT OF EMERGENCY CARE SERVICES IN NIGERIAN HOSPITALS:
A CROSS-SECTIONAL STUDY

A Thesis Submitted to the Yale University School of Medicine
in Partial Fulfillment of the Requirements for the Degree of Doctor of Medicine
by

KELECHI UMOGA (2022)
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The Accident and Emergency (A&E) unit in Nigeria is a key entry point to access health care for patients with various diseases. Currently there are limited data assessing the functionality of these units and their capacity for care. This study aims to evaluate the functional capacity of A&Es in Nigeria and to identify factors impeding optimal care.

We conducted a cross-sectional study of seven hospitals in Nigeria, randomly selecting one hospital from each of the six geopolitical zones, and purposively including National Hospital Abuja. We used a universal sampling technique interviewing all doctors and nurses identified as routine A&E staff. We used a modified version of the Emergency Care Assessment Tool (ECAT) which assesses provision of key medical interventions (signal functions) used to treat six common, life-threatening conditions (sentinel conditions) in the Emergency department. For each condition, there was a “bundle” of signal functions and respondents evaluated the frequency of performance of each of the signal functions in the setting of a given condition. Respondent-evaluated performance for each signal function is reported as “Generally Not Done”, “Sometimes Done” and “Always Done” (1, 2, and 3, respectively). To assess differences in the facilities’ capacity to manage varying conditions, the values obtained from each of the signal functions in the “bundle” for each condition,
were averaged. To measure each facility’s overall performance, the values obtained from each of the signal functions across all conditions for a given facility, were also averaged. A total of Five hundred and three health care providers (393 doctors and 110 nurses) were interviewed. Of these, 390 were medical doctors and 110 nurses with 3 non-specified. Among the doctors, there were 7 consultants (post-residency), 235 residents, 143 general practitioners and 5 interns (or house officers). Of all conditions, respiratory failure had the lowest mean score of 2.53 (95% CI, 2.1 - 2.97) across all the facilities. Conversely, altered mental status had the highest: 2.77 (95% CI, 2.41 – 3). A two-way ANOVA test comparing mean scores for all sentinel conditions across all sites, returned an F statistic of 1.353 (p=0.27) showing that no significant difference exists among the mean scores obtained for the sentinel conditions. Of all the 7 sites studied, FMC Katsina representing the north-west geopolitical zone had the highest mean score of 2.90 (95% C.I 2.84-2.96) out of a maximum score of 3, while UCTH representing the south-south had the lowest mean score of 2.37 (1.92 – 2.91). A two-way ANOVA test comparing the mean scores of all sites (across all conditions) returned an F statistic of 3.621 (P<0.01), showing that a significant difference exists among the mean scores obtained for the sites.

This study provides insight into the capacity of emergency units in Nigeria to manage certain critical conditions, which reflect overall functionality. Our findings showed that while there was no significant difference in the facilities’ overall capacities to provide emergency care with varying sentinel conditions, some facilities overall performed better than others. The results showed FMC Katsina in Northwest region had the highest functional capacity while UCTH in the south-south region had the lowest functional capacity to handle emergencies. More research is needed to further explore the reasons
underlying these regional differences. Furthermore, although the difference in performance of functions for respiratory failure may not be statistically significant, more research is needed to explore the state of respiratory care in Nigeria, especially in light of the ongoing COVID-19 pandemic.
ACKNOWLEDGEMENTS
I would like to use this opportunity to appreciate my friends and family who have supported me in the course of finishing up this work, amidst the travels to all 7 sites. I want appreciate the Office of student research who provided the financial resources that enabled me to make multiple trips to and from Nigeria and to all the seven sites to build my research teams. I want to thank the other members of our research team - Dr Kehinde Ogunyemi and Muzz Muhammed for their valuable input and technical assistance with data analysis throughout this process. I would also like to thank all the Emergency Department heads, the medical students and house officers across all 7 sites in Nigeria who helped facilitate the data collection process. I want to also specially appreciate Lee Wallis and Jenn Pigoga from South Africa, encouraging me to build on their work thus far and for making sure to connect me to the right people. I’m also thankful for Teri Reynolds and Pryanka Relan at the WHO for their much needed expertise and collaboration. Finally, I want to appreciate Dr Ngaruiya for her unwavering support throughout this process. First, I want to thank her for pushing me to pursue this project at a time when no Yale faculty in the department was doing work in Nigeria. Her patient rebuke when needed and constant words of encouragement not only made this work possible but also contributed tremendously to my personal and professional development. I am forever grateful.
INTRODUCTION
A functional emergency care system impacts mortality and morbidity at all levels - both nationally and locally [1-3]. The WHO highlights emergency care systems as the “first point of contact with the health system”, and emphasizes the importance of “development of quality, timely emergency care accessible to all”[4]. Consequently, many High-Income Countries (HICs) have developed facilities and trained professionals in emergency care. However, in Low- and Middle-Income Countries (LMICs), there are still significant barriers impeding access to similar care [5-8]. A study showed that South-East Asia and Africa have the highest burden of ‘emergency conditions. This was based on an estimate of the number of deaths and disability-adjusted life-years (DALYs) due to conditions commonly associated with death or serious disability if not treated within hours to days of onset, or those commonly associated with acute decompensation leading to serious disability [9]. The Accident & Emergency (A&E) unit in these regions are also the first points of access for many infectious disease complications like severe diarrheal illness, pneumonia and sepsis, emergencies from non-communicable diseases like strokes, heart attacks, diabetes and trauma [10-15]. This highlights the importance of developing emergency care to reduce morbidity and mortality in such regions [16].

An increasing number of countries in Africa have recognized this need and have made significant strides in developing emergency care systems, including the establishment of Emergency Medicine (EM) specialist training programs [17-21]. The first EM specialist training program in Sub-Saharan Africa was established jointly at the University of Capetown and Stellenbosch University in South Africa [20, 22]. Egypt’s EM training program was started in 2001 [21] and South Africa’s in 2004 [20]. As of 2017, at least 10
more African countries have followed suite in establishing their own EM residency programs. These include Botswana, Malawi, Mozambique, Tanzania, Kenya, Sudan, Rwanda, Ethiopia, Ghana and Libya [23]. Creation of these programs is largely due to the African Federation of Emergency Medicine (AFEM) which was established in 2009 and has provided a valuable platform for information exchange among practitioners and experts in the African continent [24]. Nigeria is among the African nations that currently do not have a dedicated EM specialist training program. This is particularly noteworthy given that it is the most populous country on the continent [25]. With a population of about 206 million, Nigeria shares a significant proportion of the continent’s deaths and disability due to injury and trauma as well as other emergencies [25, 26]. Compared to the Years of life lost (YLLs) – which quantify premature mortality – in Nigeria due to Road Injury in 1990, that of 2010 showed a 134% rise in its share of the total YLLs (from 2.1% to 4.3%) [27].

The World Health Organization (WHO) estimated that about 5.8 million premature deaths occur per year globally due to injuries – more than the combined deaths due to HIV/AIDS, tuberculosis, malaria and Ebola in 2014. This number is projected to increase to 8.4 million in 2020, and contribute to disability among millions more [26]. Currently, among the 193 countries of the world, Nigeria has the second highest rate of Road Traffic Injuries (RTIs) [28]. Data from the WHO shows that for every 100,000 vehicles in Nigeria, there are 1042 deaths per year – one of the highest in the world – towering far above equivalent figures for the United States and Britain which are 15 and 7 respectively [29]. Besides road motor vehicle accidents, the rise in attacks by insurgents, especially Boko Haram, within the past few years has contributed to the burden of injury and trauma, especially in Northern Nigeria. In 2015, 4,799 people were killed from attacks of different kinds by Boko Haram.
According to reports, the effects of these attacks have reversed years of investment in health care in Nigeria and significantly contributed to Nigeria’s failure to achieve the Millennium Development Goals (MDGs) [31]. As the world grapples with the ongoing COVID-19 pandemic and acute respiratory distress syndrome being the most proximal cause of mortality [32], issues pertaining to emergency respiratory care have gained prominence. As of 2019, lower respiratory tract diseases constituted the 4th highest cause of death a disability in Nigeria [33]. Additionally, when gauging overall preparedness for COVID-19 in Nigeria, a study found an average of 4 ventilators per tertiary hospital [34]

In sum, these data points highlight the need for a thorough evaluation of Nigeria’s emergency care system, to enable a more efficient allocation of resources to address acute and emergent injuries and conditions in the country. While a few studies on the state of pre-hospital care in Nigeria have been conducted [35-39], there are no studies to date assessing the capacity for emergency department care which currently comprises the backbone of emergency care in Nigeria. To enable such assessments, the African Federation of Emergency Medicine (AFEM) developed the Emergency Care Assessment Tool (ECAT) which is a standardized context-specific tool to evaluate the capacity of emergency care facilities in Africa [40]. Since development in 2015, the tool has been used in nations like Cameroon, Botswana, Uganda and Egypt where its use has been informative in guiding policies [40]. This study aims to evaluate the functional capacity of emergency care units of hospitals in Nigeria, using the ECAT, in order to appropriately determine the current state of in-hospital emergency care in Nigeria. This study is the first of its kind to perform this evaluation in the country.
STATEMENT OF PURPOSE

Significant data gaps exist in LMICs and this makes the quantification of the burden of medical emergencies in such contexts more difficult than in High-Income Countries (HICs) [6]. From the available data, compared to MICs and HICs, LICs had the highest burden of emergency conditions with almost three times the burden of emergency conditions in HICs [9]. Among these LICs, Nigeria bears a decent proportion of the weight of injuries, having the second highest rate of Road Traffic Injuries among the 193 countries the world with about 4 million people injured and 200,000 killed due to road traffic crashes annually [28].

There has been no study to assess emergency care services in Nigerian hospitals with an internationally standardized and validated tool, and none has been done at the national level. Our study seeks to provide answers to this research question namely, what is the current functional capacity of Emergency units in Nigerian tertiary hospitals as determined by its ability to manage 6 sentinel conditions namely: Respiratory failure, Shock, Trauma, Maternal and Child Health, Severe pain and Altered mental status. Given the mortality rates observed in the emergency units [41-44], we hypothesize that the functional capacity is well below the reference standard as determined by the Emergency Care Assessment Tool developed by AFEM.
METHODS:

Study design and sites

For this cross-sectional study, we randomly selected one tertiary hospital from a list of all the tertiary hospitals in each of the six geopolitical zones in Nigeria. Specialty hospitals and secondary hospitals were excluded from this list. This random selection was done using random.org. In addition to the 6 facilities randomly selected, a 7th facility - National Hospital in the Federal Capital Territory was purposively selected because of the dedicated Trauma center present in the facility.

Inclusion Criteria

Survey data was collected using a universal sampling technique. We interviewed doctors who were identified as commonly staffing the A&E as determined by their rotation schedules. These doctors were required to have worked there in the preceding three months as identified by the head of each A&E. These doctors thus included mostly resident doctors, medical officers (general practitioners who were yet to do their residency) and consultants (i.e. doctors who had completed their residency). We also interviewed nurses who worked permanently in each A&E.

Tools

We used the ECAT which “assesses the provision of key medical interventions (signal functions) that emergency units should be able to perform to adequately treat six common, life-threatening conditions (sentinel conditions)[40].” The ECAT was slightly modified to incorporate some elements of the WHO Hospital Emergency unit Assessment Tool (HEAT) [45], as well as additional questions to account for some context-specific
differences in the operation of emergency departments specifically in Nigeria. In the first section of the tool, we asked demographic questions like: Role, Job start date, average time spent working in the A&E annually, opening hours/days of A&E, and presence/absence of payment requirements or requirements to purchase supplies before service is rendered to patients in the A&E. We also modified the scoring of the signal functions to match that of the WHO HEAT. The original version of the ECAT uses Yes/No responses in gauging performance of signal functions with ‘Yes’ meaning that functions were ‘performed at least 90% of the time’ and ‘No’ signifying that functions were performed ‘less than 90% of the time’[46]. In our version as in the HEAT, to gauge performance of signal functions we used a more stratified scoring system where each signal function was reported as “Generally Not Done”, “Sometimes Done” and “Always Done”. These responses were coded as numerical values, 1, 2 and 3 respectively. The sentinel conditions assessed by the tool are: Trauma, Respiratory failure (RESP), Altered Mental Status (AMS), Shock, Severe pain (PAIN), and Maternal and Child Emergencies (MCH). A total of 73 signal functions were evaluated across all 6 conditions. For each condition, there was a “bundle” of signal functions and respondents evaluated the frequency of performance of each of the signal functions in the setting of a given condition.

**Outcomes**

Respondent-evaluated performance for each signal function is reported as “Generally Not Done”, “Sometimes Done” and “Always Done”. These responses were coded as numerical values, 1, 2 and 3 respectively for statistical analyses. To measure the overall performance in the setting of a given clinical condition, the values obtained from each of the signal
functions in the “bundle” for each condition, were averaged. This enabled stratification of overall performance by condition. To measure each facility’s overall performance, the values obtained from each of the signal functions across all conditions for a given facility, were also averaged with higher scores reflecting higher performance (to a maximum of 3). Given that Nigeria’s Ministry of Health designated these facilities as Tertiary hospitals, we compared these facilities to a previously-established reference standard score of 3, or a perfect score, given that ‘Advanced facilities’ in the Sub-Saharan African context are expected to have this level of capacity [47]. The extent to which these expectations are met or not were intended to give us a sense of Nigeria’s performance with respect to in-hospital emergency care.

Data Collection and Statistical Analysis

An electronic version of the ECAT was uploaded to KoboToolbox, a software developed by the Harvard humanitarian initiative for data collection in settings with limited internet access. There were approximately two to three data collectors per site which consisted of medical students who were from the respective region. Each of the medical students were educated on best practices for informed consent, as well as provided with three hours of training on administration of research interviews which included practice scenarios with the given tool that allowed the students time to become familiar with the tool and prepare for potentially difficult situations that they might encounter during interviews. They also had regular meetings with the Kelechi Umoga – the Principal Investigator – during the data collection period where they were able to discuss either in group format or one-on-one on ad hoc issues; these primarily consisted of how to clarify certain questions.
In order to administer the tool, the students each created account on KoboToolbox and were able to access the ECAT tool from either a secured phone or other hand-held device. As they interviewed respondents, responses were electronically recorded on the form and stored securely offline until they were able to have sufficient internet access to upload completed forms to the online cloud.

The data from the surveys were downloaded to excel and analyzed using the analytical software ‘R’. Across the dataset, the overall proportion of missing data was very low. 98.2% of responses were complete. Thus, the missing data were excluded from the analysis, since it was unlikely that the remaining 1.8% that was missing could result in any significant bias. Two-way ANOVA tests were run to compare mean scores across all the sentinel conditions and the mean scores across all the sites with the national average scores. T-tests were run to compare the average score for each sentinel condition with the ‘reference score’ of 3. They were also used to compare the mean score of each site with the ‘reference score’.

**Ethical Approval and Role of funding source**

The study was approved by the Human Research Protection Program Institutional Review Board, the National Health Research Ethics Committee of Nigeria, and the Ethical Review boards of each of the 7 Tertiary Hospitals involved in the study. The funder - Yale School of Medicine Office of Student Research, had no role in the study design, data collection, analysis, interpretation or writing of the report.
Student Contribution

For this project, I developed the research plan, established, and managed relationships with contact persons across all 7 research sites and pursued the process of seeking ethical approval. For each site, I recruited the research assistants responsible for data collection, trained them on the data collection process and monitored them throughout the data collection process. I also uploaded the ECAT tool on the Kobotoolbox software for easy data collection by our assistants. Another member of the research team – Muzz Muhammad – assisted in carrying out the data analysis using R and I independently wrote our findings.
RESULTS:
A total of Five Hundred and three health care providers were interviewed across all 7 facilities. See Table 1 below for breakdown of the facilities that participated in the study and the corresponding number of providers interviewed per facility:

<table>
<thead>
<tr>
<th>FACILITY</th>
<th>No. of Providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Medical Center, Katsina (FMC Katsina)</td>
<td>102</td>
</tr>
<tr>
<td>Lagos University Teaching Hospital (LUTH)</td>
<td>78</td>
</tr>
<tr>
<td>University of Calabar teaching hospital (UCTH)</td>
<td>76</td>
</tr>
<tr>
<td>Federal Teaching Hospital Gombe (FTH Gombe)</td>
<td>70</td>
</tr>
<tr>
<td>University of Ilorin teaching hospital (UIFH)</td>
<td>64</td>
</tr>
<tr>
<td>Federal Medical Center Owerri (FMC Owerri)</td>
<td>63</td>
</tr>
<tr>
<td>National Hospital Abuja (NHA)</td>
<td>50</td>
</tr>
</tbody>
</table>

Of the 503 healthcare providers surveyed, 390 were doctors, 110 were nurses and 3 did not indicate the specific type of health care workers they were. The doctors interviewed were at different levels in their careers and training. Doctors undergoing their residency training program (Registrars and Senior Registrars) constituted the majority of the respondents who were doctors (n= 235), while the doctors undergoing their one-year preregistration internship (interns or house-officers) were in the minority (n=5). See Table 2 below for a breakdown of the doctors interviewed with respect to their levels of training.
All the nurses interviewed worked in the A&E full-time. However, the doctors varied in how much time they spent working in the A&E. The doctors who were in the process of completing or had completed their residency had a primary department of employment that was not the Emergency Department. However, they spent some time staffing the emergency department. Internal Medicine and Surgery were the most represented departments (n=97 and n=90 respectively). The departments represented and their corresponding number of doctors surveyed can also be seen in Table 2.

<table>
<thead>
<tr>
<th>Table 2: Characteristics of Health Care Providers Surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Provider</strong></td>
</tr>
<tr>
<td>Registrar (Junior resident)</td>
</tr>
<tr>
<td>Nurse</td>
</tr>
<tr>
<td>Medical Officer (working full-time in the A&amp;E)</td>
</tr>
<tr>
<td>Medical Officer (working part-time in the A&amp;E)</td>
</tr>
<tr>
<td>Senior Registrar (Senior resident)</td>
</tr>
<tr>
<td>National Youth Corper (1st year post Intern year)</td>
</tr>
<tr>
<td>Consultant</td>
</tr>
<tr>
<td>House officer (Intern)</td>
</tr>
<tr>
<td>Other (Not Specified)</td>
</tr>
</tbody>
</table>

Departments represented by Residents & Consultants

<table>
<thead>
<tr>
<th><strong>Department</strong></th>
<th><strong>Frequency</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Medicine</td>
<td>97</td>
</tr>
<tr>
<td>Surgery</td>
<td>90</td>
</tr>
<tr>
<td>Obstetrics and Gynecology</td>
<td>35</td>
</tr>
<tr>
<td>Family Medicine</td>
<td>6</td>
</tr>
</tbody>
</table>
The ECAT was used to assess how equipped the facilities were to manage the 6 sentinel conditions based on the signal functions that needed to be performed for those conditions. Of all the 6 sentinel conditions, respiratory failure had the lowest mean score of 2.53 (95% C.I. 2.50 - 2.58). This means that the sites were on average least equipped to manage respiratory failure. Conversely, altered mental status (AMS) had the highest score of 2.77 (95% C.I, 2.74 – 2.81), followed by Shock and Severe Pain with the same mean score of 2.74 and 95% C.I of (2.71 - 2.77) and (2.72 - 2.76) respectively. Maternal and Child Emergencies (MCH) and Trauma tied with the 3rd highest mean score of 2.67 (2.66 - 2.68) and (2.64 - 2.70) respectively. (See Table 2 and Fig 1)
Table 2: Frequency table and mean scores across all sites broken down by sentinel condition

<table>
<thead>
<tr>
<th>Sentinel Condition</th>
<th>Score</th>
<th>Frequency</th>
<th>Total Respondents</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>MCH</td>
<td>44</td>
<td>73</td>
<td>369</td>
<td>17</td>
</tr>
<tr>
<td>TRAUMA</td>
<td>46</td>
<td>69</td>
<td>377</td>
<td>11</td>
</tr>
<tr>
<td>RESP</td>
<td>72</td>
<td>85</td>
<td>342</td>
<td>4</td>
</tr>
<tr>
<td>AMS</td>
<td>47</td>
<td>19</td>
<td>434</td>
<td>3</td>
</tr>
<tr>
<td>SHOCK</td>
<td>35</td>
<td>61</td>
<td>405</td>
<td>2</td>
</tr>
<tr>
<td>PAIN</td>
<td>45</td>
<td>41</td>
<td>413</td>
<td>4</td>
</tr>
</tbody>
</table>

Fig 1. Response Distribution by Sentinel Condition

- 1: Generally not done
- 2: Sometimes Done
- 3: Always Done
- Response Not Provided
A two-way ANOVA test comparing mean scores for all sentinel conditions across all sites, controlling for the different sample sizes between sites, returned an F statistic of 1.353 (p=0.27). This showed that there was no significant difference among the mean scores obtained for the sentinel conditions. In other words, these scores did not differ significantly from the national average score of 2.68. T-tests comparing the individual scores for the sentinel conditions to the reference score of ‘3’ showed that, with the exception of AMS (p=0.104), the scores for the other 5 sentinel conditions differed significantly from the reference score. The conditions and their corresponding p-values are as follows: MCH (p=0.009), Pain (p=0.01), Resp (p=0.001), Shock (p=0.002) and Trauma (p=0.03). (See Fig 2).

**KEY:**
- **MCH**: Maternal & Child Emergency
- **AMS**: Altered mental status
- **RESP**: Respiratory failure
- **AVG**: National Average
Of all the 7 sites studied, FMC Katsina representing the north-west geopolitical zone had the highest mean score of 2.90 (95% C.I 2.84-2.96) out of a maximum score of 3, while UCTH representing the south-south had the lowest mean score of 2.37 (1.92 – 2.91). LUTH representing the southwest had the second highest mean score of 2.83 (2.76 - 2.9), followed by FMC Owerri representing the south-east with a mean score of 2.72 (2.63 - 2.81), then National Hospital Abuja (the purposively selected site) with a mean score of 2.65 (2.53 - 2.77). FTH Gombe representing the North-east had the 5th highest mean score of 2.61 (2.49 - 2.73) with UITH, Kwara state representing the North-central having the second to lowest mean score of 2.60 (2.46 - 2.74). (See Table 3 and Fig 3)

### Table 3: Frequency table and mean score across all conditions broken down by site

<table>
<thead>
<tr>
<th>Sites</th>
<th>Frequency</th>
<th>Total Respondents</th>
<th>Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>NHA, Abuja</td>
<td>6</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>UCTH, Cross-River</td>
<td>14</td>
<td>20</td>
<td>42</td>
</tr>
<tr>
<td>FMC Gombe, Gombe</td>
<td>5</td>
<td>18</td>
<td>47</td>
</tr>
<tr>
<td>FMC Owerri, Imo</td>
<td>8</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>FMC Katsina, Katsina</td>
<td>3</td>
<td>4</td>
<td>95</td>
</tr>
</tbody>
</table>
As was done for the sentinel conditions, a two-way ANOVA test was run to compare the mean scores of all sites (across all conditions) controlling for the different sample sizes between sites. The test returned an F statistic of 3.621 (P<0.01), showing that a significant difference exists among the mean scores obtained for the sites. T-tests run to determine
where these differences exist showed that UCTH, LUTH and FMC Katsina had mean scores that were statistically different from the national average score across all sites of 2.68 (p=0.0005, 0.005 and 0.00007 respectively). T-tests comparing the individual scores for each site to the reference score of ‘3’ showed that with the exception of Katsina (p=0.07), the national average score as well as the scores for the other 6 sites differed significantly from the reference score. The sites and their corresponding p-values are as follows: National average (p<0.001), NHA (p<0.001), UCTH (p<0.001), FMC Gombe (p<0.001), FMC Owerri (p<0.001), UITH (p<0.001), LUTH (p<0.001). See Table 4 and Fig 4.
## Table 4: Mean Scores by sentinel condition and site

<table>
<thead>
<tr>
<th>Sentinel Condition</th>
<th>Site Description</th>
<th>Site Code</th>
<th>National (n=503) Mean Score</th>
<th>LUTH, Lagos (n=78) Mean Score</th>
<th>FMC Owerri, Imo (n=63) Mean Score</th>
<th>FMC Katsina, Katsina (n=102) Mean Score</th>
<th>UITH, Kwara (n=64) Mean Score</th>
<th>FMC Gombe, Gombe (n=70) Mean Score</th>
<th>UCTH, Cross River (n=76) Mean Score</th>
<th>NHA, Abuja (n=50) Mean Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Conditions</td>
<td></td>
<td></td>
<td>2.68</td>
<td>2.83 (p=0.005)</td>
<td>2.72 (p=0.544)</td>
<td>2.90 (p=0.0007)</td>
<td>2.60 (p=0.298)</td>
<td>2.61 (p=0.307)</td>
<td>2.37 (p=0.0005)</td>
<td>2.65 (p=0.605)</td>
</tr>
<tr>
<td>RESP</td>
<td></td>
<td></td>
<td>2.54</td>
<td>2.80</td>
<td>2.64</td>
<td>2.87</td>
<td>2.32</td>
<td>2.42</td>
<td>2.03</td>
<td>2.55</td>
</tr>
<tr>
<td>MCH</td>
<td></td>
<td></td>
<td>2.67</td>
<td>2.37</td>
<td>2.29</td>
<td>2.99</td>
<td>3.00</td>
<td>2.33</td>
<td>2.89</td>
<td>2.64</td>
</tr>
<tr>
<td>TRAUMA</td>
<td></td>
<td></td>
<td>2.67</td>
<td>2.72</td>
<td>2.78</td>
<td>2.84</td>
<td>2.71</td>
<td>2.44</td>
<td>2.49</td>
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**KEY:**
- MCH: Maternal & Child Emergency
- AMS: Altered mental status
- RESP: Respiratory failure
- In red: Mean score statistically different from national average score
Fig 4: Average Score by Sentinel Condition
DISCUSSION
Our study constitutes the first national assessment of emergency care capacity in Tertiary Hospitals in Nigeria, the most population nation in Africa [25]. Capacity for emergency care in African countries has had increased attention as a result of key events like the 2019 World Health Assembly Resolution on emergency and trauma care and the launching of the Global Emergency and Trauma Care initiative by the WHO in 2018, both unprecedented in their nature [48, 49]. Nevertheless, evaluation of capacity has lagged behind this increased awareness. To fill this gap, a context specific tool – the Emergency Care Assessment Tool – was developed by stakeholders at the African Federation of Emergency Medicine (AFEM) which serves to address this disparity in surveillance of the status quo of emergency care on the continent [40]. During its development, the tool was utilized in 4 other countries - Egypt, Cameroon, Uganda and Botswana. Our findings were reported by priority sentinel conditions (represented by the signal functions needed to manage them) and by site. We chose to bundle the signal functions and analyze them by sentinel conditions, to determine if functional capacity for care varied with condition or if it stayed consistent across all conditions. Such analysis provides valuable insight in understanding root causes for specific disease burdens in Nigeria. We chose to analyze the data by geographical location of the facility to determine if functional capacity varied across geographical locations. In both cases, our data provides valuable insight that can help health administrators more efficiently allocate scarce resources to areas where they are most needed.

We found that the average reported capacity assessment score across all sites was 2.68 out of 3. We also found that the capacity to care for the sentinel condition respiratory failure was the worst with an average score of 2.53, whereas capacity to care for altered mental
status was the best with a score of 2.77. Although the average scores differed across sentinel condition, these variations were found to not be statistically significant (p=0.27), suggesting that facilities’ functional capacity was consistent across conditions. While variability across regions was also noted, it was in contrast, found to be statistically significant (P < 0.01) with Katsina, ranking the highest with an average of 2.90. We had responses from across specialty and cadre (including doctors, nurses and trainees); analyses by type of cadre and specialty will be published elsewhere.

The national average capacity score of 2.68 across all sentinel conditions and study sites was lower than the expected reference score of 3 (p<0.02). This estimate indicates that the capacity to perform signal functions ranges in frequency between “sometimes” (indicated by a score of 2) and “always” (indicated by a score of 3). Of note, this relatively high national average from our study is divergent from existing literature on emergency care capacity in Nigeria and posits that it may be more promising than what is currently understood. While the available literature on the topic is scant, the few that exist belie our findings. A 2011 analysis of the literature defined the Nigerian health care system as “poorly developed” [50]. A qualitative study published in 2021 involving emergency care providers at an emergency care symposium expressed a sense of helplessness and “vulnerability” as they described their experiences with caring for patients in these settings[51]. Another observational study conducted from 2005-2007 at the University of Calabar Teaching Hospital, showed a mortality rate of 8.8% during that period[43]. That study is consistent with a similar but retrospective study carried out in the University College Ibadan for in 2011, which showed a mortality rate of 6.0% [44]. Specifically, this was a 2.7% increase from what was observed from data collected in 2005 at the same
hospital. This rate stands in stark contrast to the 0.14% average rate in U.S EDs and the 1.8% rate observed after a systematic review of 195 reports from 192 health facilities in 59 low and middle-income countries [52, 53]. Two major factors could account for this disparity between our score and the data from current literature. Firstly, our results could be due to response bias from respondents who were asked to report responses verbally and may have a tendency towards showcasing their hospital in a favorable light [54]. Secondly, it could be that the existence of alternative approaches to health such as traditional healers and religious centers delay patient presentation to the emergency unit causing these patients to present when diseases are advanced. As a result, the high mortality rates indicated in other studies may reflect the healthcare system and healthcare seeking behaviors overall, and less so a reflection of the functionality of emergency units. To address these potential confounders, studies that incorporate additional observational data such as inspection of the facility to supplement reported or survey-based data and triangulate individual findings would be ideal [55]. Thus, A prominent limitation of our study is the absence of triangulation of the data provided by out providers. All the same, our results provide an incipient set of data points that quantify the capacity of the country’s emergency care system that set the stage for further exploration.

Of the sentinel conditions that make up this national average score, respiratory failure had the lowest average score. Previous studies exploring respiratory cases presenting to the emergency department of tertiary hospitals in Southern Nigeria showed a 24 hour mortality rate due to respiratory failure ranging from 7.1-7.4% [56, 57]. When compared to the 3.7% rate found in a similar study done in North Denmark [58] – a higher income country – it
highlights the significant work that remains to be done in managing respiratory illnesses in LMICs such as Nigeria. This finding is also particularly relevant in light of the ongoing COVID-19 pandemic where respiratory failure is the leading cause of mortality [59]. In India, a similar densely populated country, early intubation was associated with improved survival rates from COVID [60]. However, when gauging overall preparedness for COVID-19 in Nigeria, a study found an average of 4 ventilators per tertiary hospital [34]. Similar gaps can be observed from a human resource perspective where the ratio of registered respiratory physicians to the national population is estimated at 1 per 2.3 million individuals with 13 states having a combined population of 57.7 million people offering no specialist respiratory services [61]. Our findings, in addition to the aforementioned literature, further highlight the need for intentional investment in both the equipment and human resources necessary for optimal respiratory care in emergency care populations; this is particularly relevant for seasonal outbreaks, epidemics and pandemics as highlighted by COVID-19 [62, 63]

Our study showed that Altered Mental Status had the highest average performance of all the sentinel conditions. This is surprising in light of the fact that studies exploring the top causes of mortality in the emergency department point to cerebrovascular diseases (CVD) as the most common cause of mortality [41, 64]. Although ‘Altered mental status’ involves any cases ranging from mild confusion to coma, existing literature tend to focus primarily on coma and point to cerebrovascular diseases as the most common etiology of coma in emergency departments in Nigeria [65, 66]. It is likely that this disparity between the ostensible high performance in AMS management and the dismal outcomes from strokes
stated above comes from the fact that only 2 out of 10 signal functions in our tool are geared specifically towards the management of cerebrovascular disease. Important time sensitive interventions like thrombolytics and blood pressure control are lacking from the list of functions. In light of the relative high prevalence of CVD as a contributor to AMS [67] and its overall contribution to the general mortality in Emergency departments in Nigeria[41], future assessments should include a significant number of key signal functions specifically geared towards the management of CVDs. Furthermore, any future interventions to address management of altered mental status must prioritize management of acute stroke.

As noted, there was significant variation by region. FMC Katsina from the North West Region performed the best with a mean score of 2.90 and UCTH from the South-South region had the worst performance with a mean score of 2.37. Thus, FMC Katsina was the only facility whose score did not differ significantly from the reference score of 3. These findings appear to be at odds with the current studies on health care in Northern Nigeria. A cross-sectional study of 34 pediatric emergency departments conducted between 2017 to 2018 across Nigeria showed a worse performance of the north with regards to equipment availability [68]. Furthermore, a comparative analysis of health expenditure found health care financing to be significantly lower in the North compared to the south leading to poorer health status in the North [69]. Large scale studies have further corroborated this point, showing that the Northwest and Northeast zones lag behind their southern counterparts with regards to utilization of maternal care [70, 71]. These findings have been attributed to the armed conflicts in these regions[72]. However, the data on under-5 mortality is equivocal, with the South-South having the highest burden in some studies[73]
while both the Northwest and Northeast zones are shown to have the highest burden in others [74]. Several reasons exist for our divergent findings on relatively improved access to resources in the North. Firstly, while lower healthcare financing may exist in the North, the high score obtained by the facility in this region could suggest a more efficient use of limited resources. Secondly, this is a single site study, and may be unique to this particular facility. Thirdly, it could also be that more resources are allocated to the Adult emergency department where our study was focused as compared to the pediatric department as in the study by Enyuma et al [68]. Fourthly, FMC Katsina’s outperformance of other hospitals may also be a reflection of the state’s intentional investment in emergency care at this site. In 2008, Katsina introduced a mobile clinic service referred locally as Mobile Ambulance Service to provide basic primary health care services, antenatal care, and basic emergency care free of charge to remote areas of all its 34 local government areas, leading to higher health indices in Katsina compared to other northern states [75]. It is possible that this intentional investment at the primary level of care led to the Tertiary centers being less overwhelmed and better able to efficiently allocate resources for emergency care. Further exploration of the consequences of this innovation by the state government is warranted.

In addition, results from National Hospital Abuja (NHA) were noteworthy given the hospital is located in the country’s capital city of Abuja. This facility was purposively selected given the presence of a dedicated trauma center in the hospital (the first of its kind in the nation) [76, 77] and its proximity to the resources and federal legislative influence that characterize the Nation’s capital. As such, we hypothesized that NHA would constitute the highest capacity score but the converse was true. In fact, NHA had the fifth highest
trauma score. This suggests that the existence of a trauma center does not guarantee optimal emergency care. It must involve a seamless interaction among the components of the continuum of emergency care such as the adequate training of providers to know when to perform certain interventions, functional equipment and timely presence of specialists. NHA’s relatively average performance despite its proximity to the federal ministry of health - a setting where federal health policies are expected to take somewhat rapid effect – can be accounted for by multiple reasons. First, it could be the objective reality with other sites being overly optimistic self-reports. Second, this could be due to high patient volumes relative to available staff, due to its strategic location as the only public tertiary hospital in the city (the only other one is located in the outskirts of Abuja rendering it less accessible). Third, it could also be the case that the sickest patients end up getting referred to NHA compared with other places. Furthermore, with being located in the capital city with several hospitals, independent diagnostic centers and laboratories, it is highly likely that patients come with lab and imaging studies that have already been performed in other facilities from which they are referred. Thus, these patients don’t need certain ‘signal functions’ repeated. In addition, it could be differences in the understanding of the questions between sites or in how the question was asked between the Research assistants at different sites. Finally, it could be due to an absence of policies and guidelines for in-hospital care or ineffective implementation of these policies if existent. The latter is supported by the absence of evidence of clearly articulated policy statements or formal emergency medicine bodies or training programs in the country [78]. However, this is not a problem unique to NHA. This buttresses the need for health policies specifically focused on emergency care and for the establishment of training programs to support these policies. When compared to the
national average UCTH and LUTH performed worse and better, respectively. Although both are located in the Southern region of the country, this intra-regional variation warrants further exploration. Data comparing emergency care within the south is sparse. However, the strategic location of LUTH in Lagos likely explains this disparity. Lagos is the commercial capital of Nigeria and being the state with the highest GDP in the country [79], it would no doubt would be expected to attract more resources compared to Calabar – a smaller city.

Following the management of Altered Mental Status, ‘Shock’ and ‘Severe Pain’ came in second with an average score of 2.74. Management of severe pain in this context primarily revolves around rapid access to diagnostics like urine dipstick tests, diagnostic imaging such as bedside Ultrasound, and Xray. One study at the emergency department of a tertiary hospital in Lagos found that 96% patients in need of emergency surgical intervention had to wait at least 6 hours with laboratories and X-ray services being the cause of delay in most cases [80]. The data on access to emergency ultrasound is sparse. While the data on the availability of diagnostic imaging in the Emergency department in Nigeria is scant, one report showed that these imaging modalities are not readily available and if available, their use is hampered by fitful power supply [81]. Although the data on shock is equally sparse, the few available which are focused on septic shock do not appear promising either. Similar to the studies on diagnostic imaging, the studies on the management of shock are limited, with the available ones focusing specifically on sepsis. Even these studies are equally not promising. A 2019 national survey of resources to manage sepsis in pediatric populations in 31 tertiary hospitals found that no consensus national guidelines were being used for
management of pediatric sepsis [82]. It is possible that the contrary is the case for adult populations, however no data supports this. These dismal data points may shed some light on why these two sentinel conditions might have performed more poorly than the AMS. Although relatively speaking, they have lower scores, the objectively high scores appear to be inconsistent with current literature, albeit limited. These limitations in data availability could explain these inconsistencies. The aforementioned literature findings weigh heavily on treatment guidelines and imaging availability. In our tool on the other hand, only 2 out of 8 signal functions for severe pain highlight imaging while none of the functions seem to touch on adherence to specific guidelines. That said, more research is needed to shed more light on the availability of laboratory diagnostics which accounts for the bulk of the signal functions in the tool.
CONCLUSION:
This study provides useful insight into the capacity of emergency units in Nigeria to manage certain critical conditions, which reflect overall functionality. Our findings showed that while there was no significant difference in the facilities’ overall capacities to provide emergency care with varying sentinel conditions, some facilities overall performed better than others. The results showed FMC Katsina in Northwest region to have the highest functional capacity while UCTH in the south-south region to have the lowest functional capacity to handle emergencies. More research is needed to further explore the reasons underlying these regional differences. Furthermore, although the difference in performance of functions for respiratory failure may not be statistically significant, more research is needed to explore the state of respiratory care in Nigeria, especially in light of the ongoing COVID-19 pandemic.
REFERENCES