

Perspectives of Anesthesiologists Towards the Use of Artificial Intelligence in Anesthesia Practice in a Developing Country

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Abstract

Objective: Several aspects of healthcare have seen tremendous growth with the help of artificial intelligence (AI). Anesthesiology has not been left out with a remarkable increase in the application of AI in recent times. The aim of this study was to explore the perspectives of anesthesiologists in a developing country on the use of AI in their practice.

Methods: An online survey was carried out and the survey included questions on sociodemographic data, knowledge, opinion, and concerns on the use of AI in their practice. 44 responses were received and analyzed.

Results: A large majority (88.6%) of anesthesiologists had heard about AI but only 6.8% considered themselves to have sufficient knowledge on AI. 68.2% of respondents agreed that AI has useful applications in anesthesia practice, and 56.8% believed that AI would lead to drastic changes in their field. Only a minority of respondents believed that AI abilities will surpass the clinical abilities of human anesthesiologists (13.6%), and that AI will completely replace anesthesiologists in the future (6.8%). There was a significant association between duration of practice and the opinion that AI had useful application in anesthesia practice, as well as between awareness of AI and the opinion that AI abilities are currently superior to the clinical experience of human anesthesiologists.

Conclusion: Anesthesiologists do not have sufficient knowledge of AI, and while they are open to applying AI to their practice, anesthesiologists do not expect AI to replace physicians in their practice.

Keywords: Artificial intelligence; AI, Anesthesia; Anesthesiology; Anesthesiologists; Developing country.

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Introduction

AI is defined as “the study of algorithms that give machines the ability to reason and perform functions such as problem-solving, object and word recognition, inference of world states, and decision making” [1]. Anesthesiology, by cutting across several domains of clinical care is well-positioned to potentially benefit from the advances of AI [2].

The goal of incorporating AI into anesthesiology is to increase the performance of anesthesiologists by automating more simple tasks and so far, this has led to positive outcomes [3]. However, AI errors can result in severe adverse patient outcomes [4].

The most important limitation to AI in healthcare is the need to develop a trusted AI; physicians need to know that a machine will not generate a wild response in unforeseen conditions [5]. More so, several ethical concerns also exist in the application of AI in clinical practice including the confidentiality of patient data, integration of bias into codes for AI, and socio-economic implications of AI on the human workforce [6-8].

Several literatures have documented information on the perspectives of practitioners in the developed world about the impact of AI technologies in the medical profession [9-12]. However, there remains a dearth of studies on physicians’ attitudes towards AI in developing countries like Nigeria, and no known published study in our environment. Therefore, this study is designed to reveal the perspectives of anesthesiologists in Nigeria on AI and its application to anesthesia practice.

Materials and methods

Study design

This study was a descriptive, cross-sectional online survey conducted between 10/01/2022 and 16/02/2022 among physician anesthesiologists across Nigeria.

Sampling methodology

A convenience sampling methodology was used with snowballing technique. A link to the online questionnaire was distributed to the WhatsApp platforms of physician anesthesiologists over a four-week period.

Survey development and pretesting

Data was obtained using a structured, self-administered electronic questionnaire adapted from previous studies [12,13]. The electronic questionnaire was pretested for technical functionality with anesthesia residents who were not on the WhatsApp platform. There were twenty-one non-randomized items on the questionnaire with no use of adaptive questioning. Participants were able to review and change their responses.

Survey administration and data collection

Data collection was by open survey with no prior initial contact with potential participants. The survey was advertised and distributed electronically with open access on WhatsApp platforms of Anesthesiologists in Nigeria. WhatsApp is a messaging application which supports online groups that allow interactions between users. Participation of the survey was voluntary and there were no

incentives offered to participants. Data was collected over a period of 4 weeks. Duplicate entries were avoided by preventing users access to the survey twice.

Data analysis

Of the 62 participants who agreed to participate, only 44 completed and submitted the questionnaire, giving a completion rate of 71%. Only completed questionnaires were analyzed. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 23 software. Data was expressed as frequencies and percentages. Categorical parameters were compared using chi-squared test to elicit relationships between variables. P value was set at <0.05.

Ethics

Ethical approval for the study was obtained from the Institutional Review Board of Enugu State University of Science and Technology Teaching Hospital. Informed consent was sought and obtained from the respondents before administering the questionnaire. The extent, purpose and duration of the study was disclosed to the participants, as well as the management of the data obtained from the study. Personal/identifying data were not collected during the study.

Funding

This study had no external funding, and the funding source has no influence on this study.

Characteristic	Frequency (%)
Age (years)	
21-30	2 (4.5)
31-40	21 (47.7)
41-50	15 (34.1)
51-60	5 (11.4)
>60	1 (2.3)
Sex	
Male	28 (63.6)
Female	16 (36.4)
Duration of experience(years)	
0-10	28 (63.6)
11-20	11 (25.0)
21-30	5 (11.4)
Practice type	
Public	40 (90.9)
Private	4(9.1)
Level of hospital	
Secondary	6 (13.6)
Tertiary	38 (86.4)

Table 1: Sociodemographic characteristics of physician anesthesiologists (N=44).

Results

Sociodemographic characteristics

A total of 44 physicians completed the questionnaire and were included in this study. Of the respondents, 28 (63.6%) were male, and the modal age group was 31–40 years.

28 (63.6%) respondents had practiced for a decade or less of the respondents, 40 (90.9%) of them worked in government-owned

facilities and 38 (86.4%) of them practiced at a tertiary level of care in Table 1.

Exposure of physicians to AI

While 39 (88.6%) of the participants had heard about AI, only 21 (47.7%) had heard of deep learning or machine learning and only 3 (6.8%) thought they had sufficient knowledge on AI. When asked if any form of AI was applied to their practice, only 18 (40.9%) of anesthesiologists responded positively in Figure 1.

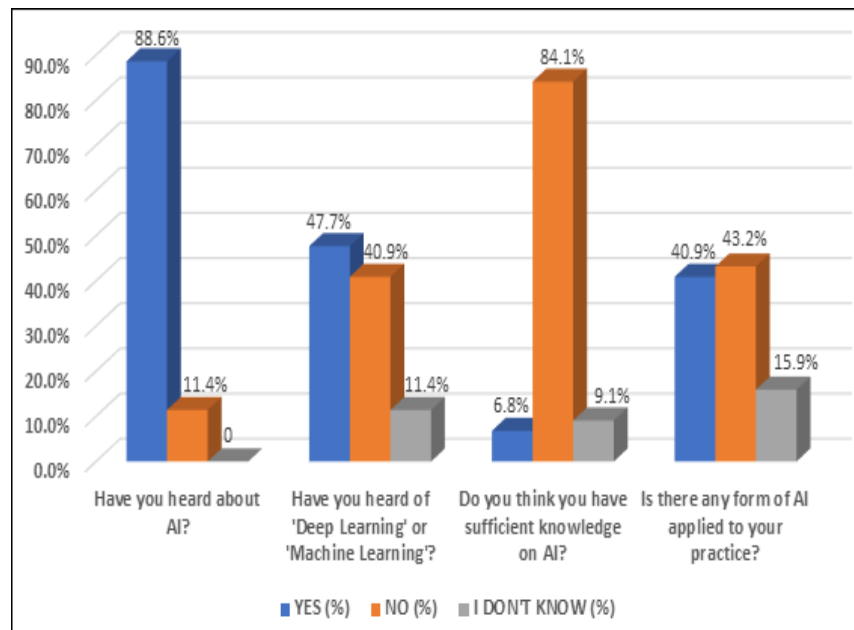


Figure 1: Exposure of physician anesthesiologists to artificial intelligence.

Perspectives of physicians on the use of artificial intelligence in anesthesia practice

Inquiring into their opinions on the domains AI could be applied to in their practice, many of the physicians believed AI could be applied to monitoring the depth of anesthesia 33 (75%), control of anesthesia delivery 28

(63.5%) and ultrasound guidance 29 (65.9%). Fewer respondents were aware of the role of AI in predicting recovery and complications, pain management and in operating room logistics. Examining the advantages of AI in their practice, many anesthesiologists were aware that AI can help reduce medical errors 35 (79.5%), and AI can deliver large amounts of high-quality data in real time 29 (65.9%).

Variables	Frequency (%)
Domains in which AI can be used	
Monitoring the depth of anesthesia	33 (75)
Control of anesthesia delivery	28 (63.6)
Predicting recovery and complications	20 (45.5)
Ultrasound guidance	29 (65.9)
Pain management	20 (45.5)
Operating room logistics	18 (40.9)
Advantages of AI	
Can speed up processes in anesthesia	24 (54.4)
Can deliver large amounts of high-quality data in real time	29 (65.9)
Can reduce medical errors	35 (79.5)
Has no emotional or physical limitation	25 (56.8)
Has no space-time constraint	12 (27.3)
AI has useful applications in anesthesia practice	
Agree	30 (68.2)
Neutral	9 (20.5)
Disagree	5 (11.4)
AI would lead to drastic changes in the field of anesthesiology	
Agree	25 (56.8)
Neutral	15 (34.1)
Disagree	4 (9.1)
AI abilities are currently superior to the clinical experience of anesthesiologists	
Agree	3 (6.8)
Neutral	9 (20.5)
Disagree	32 (72.8)
AI abilities will surpass the clinical abilities of anesthesiologists	
Agree	6 (13.6)
Neutral	10 (22.7)
Disagree	28 (63.6)
AI will completely replace anesthesiologists in the future	
Agree	3 (6.8)
Neutral	10 (22.7)
Disagree	31 (70.4)
I will always use AI when making medical decisions in the future	
Agree	14 (31.8)
Neutral	16 (36.4)
Disagree	14 (31.8)
If your medical judgement as a physician anesthesia provider differs from that of AI technology, which will you follow?	
Physician's opinion	43 (97.7)
Artificial intelligence technology	1 (2.3)

Table 2: Perspectives of physician anesthesiologists on the use of AI in anesthesia practice (N=44).

On their opinions on the use of AI in anesthesia practice, 30 participants (68.2%) believed that AI has useful applications in anesthesia practice. 25 (56.8%) respondents opined that AI would lead to drastic changes in the field of anesthesiology.

Comparing the abilities of AI with humans in anesthesia practice, only three (6.8%) participants thought that AI abilities are currently superior to the clinical experience of anesthesiologists, six (13.6%) participants thought that AI abilities will surpass the clinical abilities of human anesthesiologists in the future, and three (6.8%) agreed that AI will completely replace anesthesiologists in the future. When asked whether they will always use AI when making medical decisions in the future, 14 (31.8%) anesthesiologists

responded positively. However, in a situation where the physician anesthesiologist's judgement differed from that of AI technology, 43 (97.7%) participants claimed they would follow their own (physician's) opinion.

Relationship between sociodemographic characteristics and perspectives on AI use in anesthesia practice

In a chi-square analysis of the relationship between socio-demographic factors and respondents' perspectives on the use of AI, statistically significant association was found between age of respondents and the belief that AI will completely replace anesthesiologists in the future ($p=0.024$ respectively).

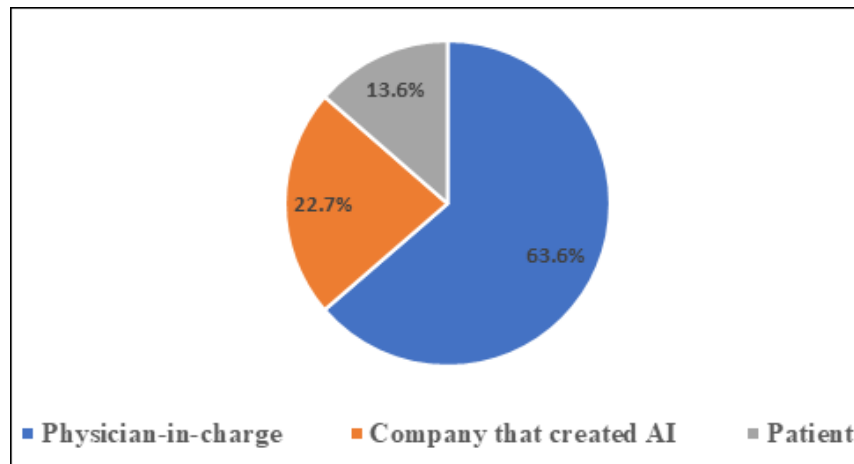


Figure 2: Who will most likely be liable for legal problems caused by Artificial Intelligence?

Concerns regarding the use of AI in anesthesia practice

Common concerns noted by the anesthesiologists on the use of AI in their practice included its opinions in unpredicted situations (32[72.7%]), its application to controversial subjects (34[77.3%]), its

inability to sympathize and consider emotional well-being of patients (32[72.7%]). In the case of legal problems, 28 (63.6%) respondents believed the physician would be liable as opposed 10 (22.7%) and 6 (13.6%) participants who believed in the liability of the company and the patient respectively.

Characteristic	Frequency (%)
Age (years)	
21-30	2 (4.5)
31-40	21 (47.7)
41-50	15 (34.1)
51-60	5 (11.4)
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Practice type	
Public	40 (90.9)
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Level of hospital	
Secondary	6 (13.6)
Tertiary	38 (86.4)

Table 3: Concerns about the application of AI in anesthesia practice among anesthesiologists (N=44).

Discussion

A large majority of our study participants did not think they had sufficient knowledge on AI (84.1%) even though many had heard of AI (88.6%). These findings are corroborated by a similar study conducted among physicians in Nigeria that showed that nearly half the participants (47.2%) had no idea about what AI is, even though 94.31% had heard of AI [14]. In this study, most of the physicians reported the internet as their primary source of information regarding AI, and no form of formal training regarding AI being offered in their facility [14]. This suggests that even though AI is an emerging entity, there is limited exposure of physicians to the concept in their training and practice. Another study in Turkey which sampled the knowledge,

attitude, and perspectives of anesthesiologists on AI also reported a low (36.8%) rate of having sufficient knowledge of AI [13]. Our study revealed that approximately 41% of anesthesiologists admitted to the application of AI in their practice, a remarkable improvement from a previous study among Nigerian physicians that showed no form of AI practice in their facilities [14]. This difference might be due to our sample population which examined only anesthesiologists, as well as the likely increase in the adoption of technology in clinical practice since the study was conducted two years ago. There was relatively high rate of knowledge on the domains where AI could be applied to in anesthesia practice among sampled anesthesiologists in our study, including monitoring anesthesia depth,

control of anesthesia delivery, ultrasound guidance, prediction of recovery and complications, pain management and operating room logistics. This reflected good exposure to the subject. When the advantages of AI in the practice of anesthesia was examined, a relatively high positive response rate was obtained for reduction of medical errors (79.5%), the delivery of large amounts of high-quality data in real time (65.9%), lack of physical and emotional limitation (56.8%) and increased speed of anesthesia processes (54.4%). This is supported by the reports of a study among physicians in Malaysia which documented a similar percentage of positive responses regarding the advantages of AI in medicine including increased speed, lack of emotional exhaustion or physical limitation, and reduction of medical errors [15].

Exploring the opinions of participants on the use of AI in their practice, our study showed that 68.2% of anesthesiologists considered that AI has useful applications in anesthesia practice. This is comparable to 58.8% reported among anesthesiologists in Turkey and the 55.8% of sampled physicians in Nigerian that believe that AI would improve healthcare services, but considerably less than the reports of a survey of Korean physician where 83.4% of the 699 sampled physicians believed AI to be useful in the field of medicine [12-14]. This difference might be due to the larger sample size when compared to our study. When asked on their thoughts on AI abilities relative to anesthesiologists' abilities, only 6.8% of our participants opined that AI abilities are currently superior to the clinical experience of anesthesiologists while 13.6% of our participants thought AI abilities will surpass that of anesthesiologists in the

future. When asked their opinions on whether AI will completely replace anesthesiologists in the future, only 6.8% of participants responded positively. This agrees with a study among Turkish anesthesiologists which showed that only 2.9% of the participants think that AI will completely replace physicians in the future and a survey carried out among American Psychiatrists which reported a 4% agreement when asked if AI will replace them reported a much higher rate of physician acceptance to the possibility that AI will preplace physicians (35.4%) [12,13,16]. The reason for this difference is unclear.

It is important to note that despite the high rate of knowledge of the advantages and applications of AI in the field of anesthesiology, only 31.8% of participants in our study agreed to use AI when making clinical decisions. This suggests that a lack of trust in the abilities of AI among the physicians. Furthermore, when asked whose judgement would be followed if their medical opinion as a physician anesthesia provider differed from that of AI technology, the overwhelming majority (97.7%) claimed they would follow their own opinion. Tasdogan reports very similar findings (94%) in his study among anesthesiologists in Turkey [13]. These results also agree with the findings, in which 78.9% and 82% of physicians respectively preferred the doctors' opinions over the input of AI technology [12,15].

Despite practicing in a resource-poor country, only 2.3% of our participants reported concern over the high cost of AI use in practice, compared to over two-thirds of our participants who were concerned about

the limitations of AI in practice viz the inability to provide opinions in unpredicted situations (72.7%), the lack of flexibility for use in all kinds of patients (68.2%), the poor applicability to controversial subjects (77.3%) and the lack of sympathy and consideration of emotional aspects of patient care (72.7%). The potentially limitless characteristics and peculiarities of patient population makes it difficult to predict patient presentations. Therefore, physicians are concerned that unpredicted and peculiar situations will not be adequately addressed as AI largely relies on previously inputted data to be efficient. Also, the absence of emotions in patient care as a source for concern is supported by a study among primary care physicians in which most participants opined that technology cannot provide empathic care (94%) as well a survey among psychiatrists where several participants (55-67%) noted that AI is unlikely to replace them in complex tasks [16,17].

When asked who would be held liable for legal problems involving AI use in clinical practice, the majority (63.6%) of anesthesiologists in our study believed the physician-in-charge would be liable as opposed to the company that created the AI in question (22.7%) and the patient who agreed to use AI (13.6%). This mirrors the results in which half the physicians voted for

doctor-in-charge, followed by the creating company and then the patient who agreed to follow AI's input [15]. This highlights the need for a proper legal and ethical framework that would guide the application of AI in the medical practice. Our study was limited by a relatively small number of participants, as well as the lack of an objective assessment for knowledge levels on AI among the participants. However, this study, to the best of our knowledge, is the first study in the literature to examine the attitudes and opinions of anesthesiologists towards the use of AI in their practice in Nigeria. In conclusion, this study found insufficient knowledge on AI among participants, and that even though AI is considered useful in anesthesia practice, there is a reluctance to embrace the use of AI in their practice by anesthesiologists. Despite its wide range of applications and advantages in anesthesia practice, AI is not expected to surpass or replace anesthesiologists. Also, there were concerns regarding the ability of AI to offer empathetic, patient-specific care and the efficacy in unpredicted situations. Overall, the anesthesiologists maintain a superior judgement to AI opinion in clinical care. We recommend that studies be carried out on a larger number of anesthesiologists, eliciting quantitative knowledge scores and a deep and broader perspective and attitude towards the use of AI in their practice.

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