# ANALYSIS OF AVAILABILITY AND USE OF AUTONOMOUS SYSTEM AS PREDICTORS OF ICT LITERACY AMONG HEALTH WORKERS

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## Abstract

The growing integration of artificial intelligence and robotics has transformed healthcare operations and patient care. However, access to autonomous systems does not automatically enhance the digital competence of healthcare workers, creating a critical knowledge gap. This study examined the effect of availability and active use of autonomous systems on ICT literacy among healthcare workers in Akinyele Local Government Area, Ibadan, Nigeria. A quantitative descriptive survey design was adopted, and 158 healthcare workers were selected from public and private hospitals using proportional stratified sampling. Data were collected via a validated Google Form questionnaire, and instrument reliability was established using Cronbach's Alpha. Descriptive statistics and Ordinary Least Squares (OLS) regression were used for analysis. Results revealed low mean scores for availability (M = 1.86) and use (M = 1.88) of autonomous systems in public hospitals. Regression findings showed that availability and use significantly predicted ICT literacy, explaining 58.1% of its variance ($R^2 = 0.581$, $p < 0.05$). These findings imply that access alone is insufficient; active utilization and training are essential to improve digital competency. The study concludes by recommending targeted policies that promote not only provision but effective adoption of autonomous technologies to build a digitally skilled healthcare workforce.

**Keywords:** *ICT literacy, Autonomous systems, Healthcare workers, Technologies, Digital tools*

## Introduction

The advancements introduced by Artificial Intelligence (AI) and sensor technologies are responsible for the rapid evolution experienced in the field of autonomous systems. An autonomous system – a system that operates with minimal human intervention encompasses a wide range of applications, which include self-driving cars, drones, and robots, all of which have moved from conceptual stages to real-world applications (Takahashi *et al*., 2023). This technological shift towards autonomy is reshaping industries such as healthcare, transportation, and manufacturing, thereby introducing benefits such as improved safety, efficiency, accessibility, and more cost-effective measures. These systems integrate advanced technologies to perceive and navigate their environments autonomously (Zhang *et al.*, 2022). Autonomous robots in healthcare have shown great promise recently as robotic surgical systems as well as support care for the vulnerable patients and the elderly. Additionally, the advent of the COVID-19 pandemic has increased the demand for autonomous robots especially in healthcare and service industries where they assisted in cleaning, delivering supplies, and reducing the risk of virus transmission. Likewise, the deployment of autonomous system in health sector has also mitigated the shortage of qualified healthcare workers, assisted overworked medical professionals, an improved the quality of healthcare (Anderson & Chen, 2020).

The integration of autonomous systems, including artificial intelligence and robotics, into healthcare has significantly transformed patient care and operational efficiency. These technologies perform tasks such as patient monitoring, diagnostic support and administrative functions thereby, reducing the workload on healthcare workers. For instance, AI-driven tools assist in automated routine tasks, allowing clinicians to focus more on taking care of patient (Jiang *et al.*, 2023).
However, despite the recognized importance of autonomous systems in the health sector, the acceptance of AI and ICT literacy among healthcare professionals is vital to its success. The relationship between the availability of autonomous systems and ICT literacy among health workers is cumbersome and complicated as access to advanced technologies alone does not guarantee their effective use. For effective and efficient use of the systems, healthcare professionals must acquire the requisite skills and confidence to operate them (Garcia *et al.* 2023). With the rapid and continuous integration of autonomous systems in healthcare to enhance patient care and operational efficiency, the successful adoption of these technologies is contingent upon healthcare workers' Information and Communication Technology (ICT) literacy. Hence, the need to investigate the relationship between the availability and use of autonomous systems and ICT literacy among health workers.

The remainder part of this paper is organized as follows: Section 2 reviews related work, Section 3 the methodology deployed. Section 4 presents the results and discussion and Section 5 concludes the paper and suggests future research directions.

## 2. Related Work

The presence of autonomous systems in healthcare settings necessitates a certain level of ICT literacy among health workers. This statement was supported by (Shiferaw *et al.*, 2020) which conducted a study on a low-income country setting and discovered that healthcare providers' digital competency was influenced by the availability of digital tools and infrastructure. The study highlighted that limited access to autonomous systems hindered the development of ICT skills among health professionals. Similarly, research conducted in Portharcourt Metropolis revealed a poor level of ICT knowledge among health centre workers, with an aggregate of 41.39% correct responses on ICT knowledge assessments. The study emphasized the need for increased availability and training on ICT tools to improve literacy levels (Advance Scholars Publications, 2025).

Also, in agreement to the statement – Active engagement with autonomous systems can enhance ICT literacy among health workers, a study was conducted by (Kuek & Hakkennes, 2020). The United Theory of Acceptance and Use of Technology (UTAUT) model is employed in the study to demonstrate that healthcare staff who regularly use information systems exhibited digital literacy levels and more positive attitudes towards technology. The results indicated that performance expectancy and effort expectancy were significant predictors of technology use, which in turn correlated with ICT literacy. Furthermore, research by Ovwasa (2022) focusing on nurses in a Nigerian teaching hospital found that performance expectancy were the most rated factors influencing nurses' use of nursing informatics technologies. The study recommended adopting models that measure nurses' perceptions of technology use of identify reasons for acceptance or rejection and to enhance ICT literacy through adequate training.

The relationship between training in autonomous systems and ICT literacy is well-documented. Ma *et al.,* (2024) reviewed AI competencies for medical students. The research highlighted the essence of a structured training program in building confidence in the use of AI tools. An AI literacy framework that emphasized the need for personalized education strategies to build an AI-competent healthcare workforce was designed and deployed. Wong *et al.*, (2014) in their research work discovered that self-efficacy and

confidence in learning new ICT skills are two important factors associated with students' attitudes towards the use of e-health. In their findings, successful implementation of e-health initiatives is largely possible through self-efficacy in training.

Ali *et al.*, (2023) conducted a systemic review on the integration of AI in health systems and the role of individuals within the system in adoption. This study highlighted the black box challenge in the acceptance of AI models in healthcare decision-making and the need for coexistence between workers and AI in an evolving healthcare workplace. Petersson *et al.*, (2022) in their study discussed the models and frameworks that could facilitate the AI adoption process in healthcare. The study highlighted the lack of informed investigation in understanding the AI acceptable level among patients, health workers, and policymakers. Moreover, the ethical challenges, such as accountability, privacy, and transparency, were examined by Secinaro *et al.*, (2021) in their structural review of the role of AI in healthcare. The adoption of AI in healthcare organizations has established a new avenue for research exploration, bringing several opportunities and challenges for industry and academia alike.

## 3. Methodology

In this study, a descriptive survey design, which is a quantitative research was employed. The target population consists of all hospitals (private and public) and healthcare workers in Akinyele Local Government Area, Ibadan, Oyo State. The L.G.A. consists of seventy-four (74) hospitals, with a population of 1,488 workers, comprising thirty-three (33) public and forty-one (41) private hospitals, with populations of 659 and 729, respectively. This study adopted a proportional stratified sampling technique in selecting the actual sample size. In this research, 20% of each stratum was selected, producing 7 public and 8 private hospitals. However, in selecting the actual sample size (healthcare workers) for this study, 50% of the staff of the participating hospital were used as the respondents to the research instruments.

A structured e-questionnaire in Google Form was prepared and shared with the workers. This instrument is structured into four sections. Section A is designed to collect the demographic data of health workers in the selected hospitals, Section B to collect data on the availability of autonomous systems, Section C to investigate the use of autonomous systems by health workers, and Section D to measure the ICT literacy among healthcare workers.

To ascertain the instrument's face validity, the questionnaire was subjected to correction by the expert and an authority in the field. Also, to establish the instrument's internal reliability, a pre-field study was done. In doing so, twenty (20) copies of the instrument were administered on the healthcare workers of another LGA (Ibadan North) in Ibadan. The instrument's reliability was tested using Cronbach's Alpha. To analyse the data, Python code was used to generate results for each research objective and clearly interpreted using bar charts, histograms, graphs, etc.

## 4. Results and Discussion

This section presents the results of the data analysis as related to the objectives of the study. It begins with the analysis of the demographic characteristics of the respondents, assessing the level of availability of autonomous systems, examining the extend of use of autonomous systems by health workers, investigating whether the availability and the use of autonomous systems significantly predict ICT literacy levels.

### 4.1 Analysis of Demographic Characteristics of the Respondents

#### 4.1.1 Gender

Analysis revealed 83 (52.5%) and 75 (47.5%) respondents were female and male respectively.

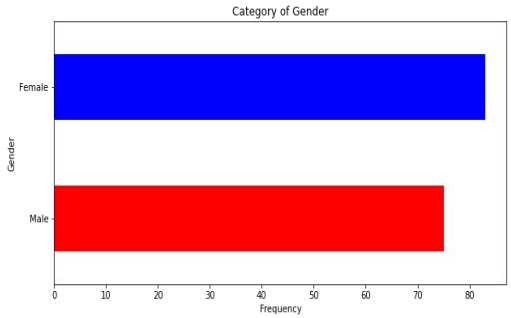


Figure 1: Respondents' Gender

4.1.2 Age Range

In terms of age range, 80 (50.6%), 33 (20.9%) and 27 (17.1%) respondents were between ages 30 and 39, ages 40 and 49 and ages 20 and 29 respectively. This implies that most healthcare workers were between the ages of 20 and 49. Hence, considerably young healthcare workers. This is represented in Figure 2.

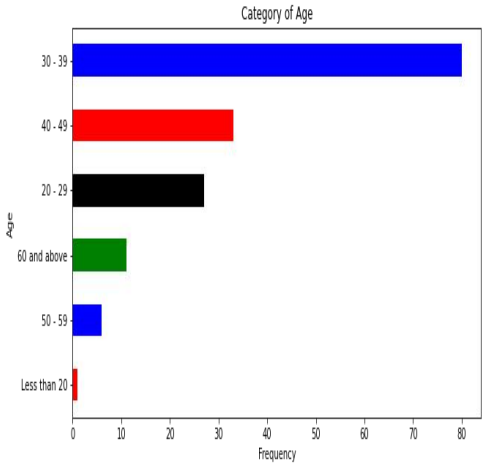


Figure 2: Respondents' Age Range

4.1.3 Highest Educational Qualification

For the respondents' highest educational qualification, analysis revealed that 70 (44.3%), 48 (30.4%), 23 (14.6%), and 15 (9.5%) respondents had Bachelor's degree, HND, Master's, and OND respectively. This implies that most healthcare workers had the minimum of HND (i.e.) most of them were well educated. This is represented in Figure 3.

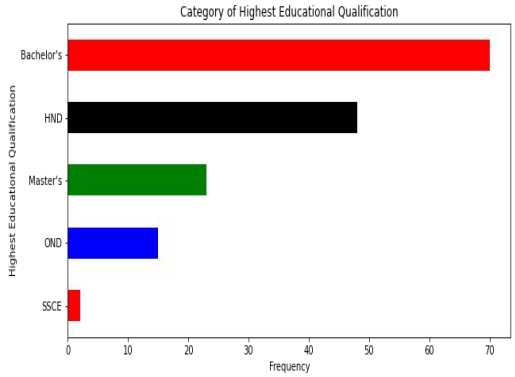


Figure 3: Respondents' Highest Educational Qualification

4.1.4 Types of Hospitals

Analysis revealed that 85 (53.8%) of the respondents worked in private hospitals while 73 (46.2%) worked in public hospitals. This implies that both hospitals were well represented in healthcare services but with private hospitals having a little edge. This is represented in Figure 4.

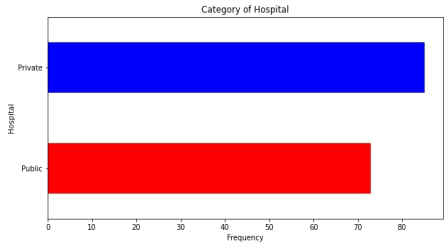


Figure 4: Types of Hospitals

4.1.5 Profession

For the respondents' profession, analysis revealed that (18.4%) respondents were CHEW; (17.1%) respondents were nurses; (13.9%) respondents were laboratory technicians; (8.9%) respondents were Health Information Officers; and (22.8%) respondents had other professions aside from the ones stated. This implies that the most readily available healthcare workers were CHEW, Nurses, Laboratory Technicians, and Health Information Officers. This is represented in Figure 5.

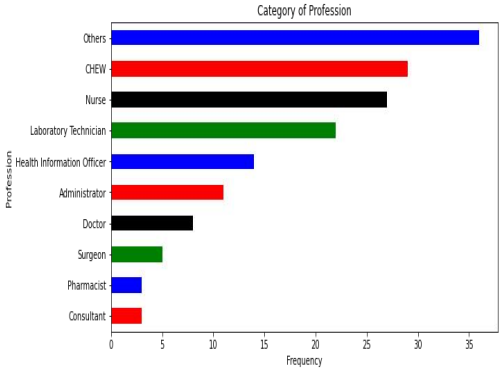


Figure 5: Profession of the Respondents

## 4.1.6 Grade Level

Considering the grade levels of the respondents, analysis revealed that (47.5%), (10.8%), (8.9%), (8.2%) and (7.0%) of the respondents were in grade levels 8, 7, 10, 9 and 12 respectively. This implies that majority of the healthcare workers were between grade levels 7 and 12. This buttressed the fact that most healthcare workers were young. This is represented in Figure 6.

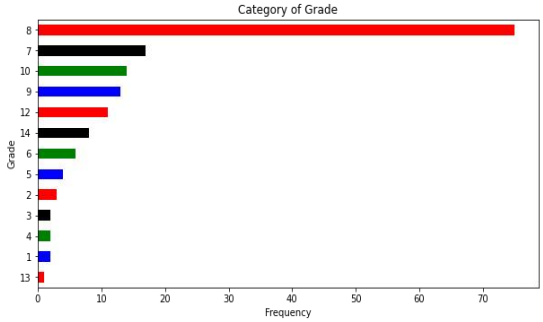


Figure 6: Grade Level of the Respondents

### 4.2 Assessing the Level of Availability of Autonomous Systems

The analyses below revealed that, with a mean score of 1.862025, the availability of autonomous systems in hospitals in Akinyele Local Government Area, Ibadan, Oyo State was low. The analyses further revealed that, even with this low availability, private hospitals still had more autonomous systems available than public hospitals as shown in Figure 7. In addition, the analyses in Figure 8 revealed that the available autonomous systems were mostly used by surgeons, consultants, Health Information Officers, doctors, administrators, and pharmacists.

In addition, there was a significant difference in the availability of autonomous systems between public and private hospitals as shown in Table 1. Since $p < 0.05$. This means hospital type affected the availability of autonomous systems, with private hospitals having the edge. Also, there was a significant difference in the availability of autonomous systems across different professional groups as shown in Table 2. Again, $p < 0.05$ showed that profession played a role as some professions (e.g., surgeons, consultants) reported higher availability than others (e.g., nurses, pharmacists).

| Descriptive Statistics of Availability of Autonomous System | |
|---|---|
| Count | 158.00000 |
| Std | 1.862925 |
| Min | 0.837619 |
| 25% | 1.000000 |
| 50% | 1.000000 |
| 75% | 1.800000 |
| Max | 2.400000 |

Name: Availability_Score, dtype: float64

### Interpretation

Mean scores:
1.0–2.0 → Low Availability
2.1–3.0 → Moderate Availability
3.1–4.0 → High Availability
4.1–5.0 → Very High Availability

**Table 1 ANOVA (Hospital):**

| | sum_sq | df | F | PR(>F) |
|---|---|---|---|---|
| C(Hospital) | 3.267459 | 1.0 | 4.768911 | 0.030472 |
| Residual | 106.884693 | 156.0 | | |

**Table 2 ANOVA (Profession):**

| | sum_sq | df | F | PR(>F) |
|---|---|---|---|---|
| C(Profession) | 32.758379 | 9.0 | 6.960422 | 2.423293e-08 |
| Residual | 77.393772 | 148.0 | | |

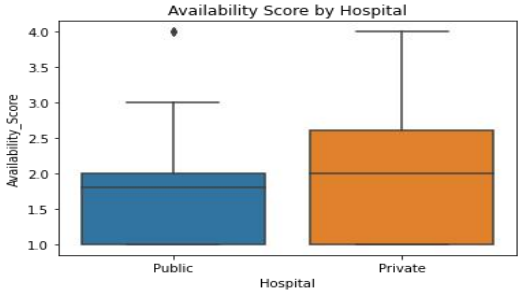


Figure 7: Availability Score by Hospital

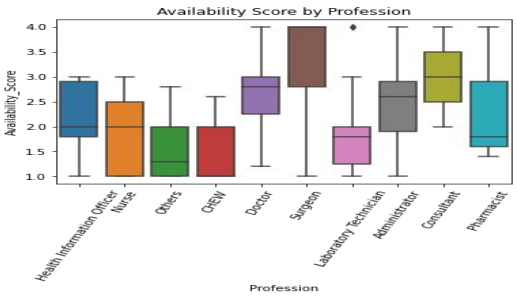


Figure 8: Availability Score by Profession

### 4.3 Examining the Extent of Use of Autonomous Systems by Health Workers.

The analyses below revealed that, with a mean score of 1.879747 for general use of autonomous systems and a mean score of 1.586306 for specific use of autonomous systems, the use of autonomous systems in hospitals in Akinyele Local Government Area, Ibadan, Oyo State was low. The analyses further revealed that, even with this low use, private hospitals still used more autonomous systems than public hospitals as shown in Figure 10. In addition, the analyses in Figure 9 revealed that autonomous systems were mostly used by surgeons, consultants, doctors, pharmacists, and administrators.

In addition, there was a statistically significant difference in the use of autonomous systems among the various professional categories as shown in Table 3. Professions like surgeons or administrators used these systems more often than others. The low p-value (< 0.01) indicated this difference. Also, there was also a statistically significant difference in the use of autonomous systems between public and private hospitals. The p-value (< 0.05) meant hospital type influenced how much these systems were used, with private hospitals showing higher usage.

| **General Use Score:** | |
|---|---|
| Count | 158.00 |
| Mean | 1.879747 |
| Std | 0.853992 |
| Min | 1.000000 |
| 25% | 1.000000 |
| 50% | 2.000000 |
| 75% | 2.400000 |
| Max | 4.000000 |

Name: General_Use_Score, dtype: float64

| **Specific Use Score:** | |
|---|---|
| Count | 158.00000 |
| Mean | 1,586306 |
| Std | 0.977321 |
| Min | 1.000000 |
| 25% | 1.000000 |
| 50% | 1.090909 |
| 75% | 1.545455 |
| Max | 5.000000 |

Name: Specific_Use_Score, dtype: float64

### Interpretation

Mean scores:
1.0–2.0 → Low use
2.1–3.0 → Moderate use
3.1–4.0 → High use
4.1–5.0 → Very high use

**Table 3 ANOVA (Profession):**

| | sum_sq | df | F | PR(>F) |
|---|---|---|---|---|
| C(Profession) | 37.235162 | 9.0 | 7.833554 | 2.116983e-09 |
| Residual | 78.165228 | 148.0 | | |

**Table 4 ANOVA (Hospital):**

| | sum_sq | df | F | PR(>F) |
|---|---|---|---|---|
| C(Hospital) | 2.046738 | 1.0 | 2.816769 | 0.095286 |
| Residual | 113.353652 | 156.0 | | |

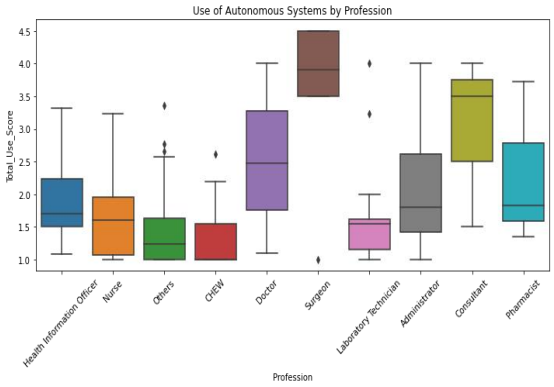


Figure 9: Use of Autonomous Systems by Profession

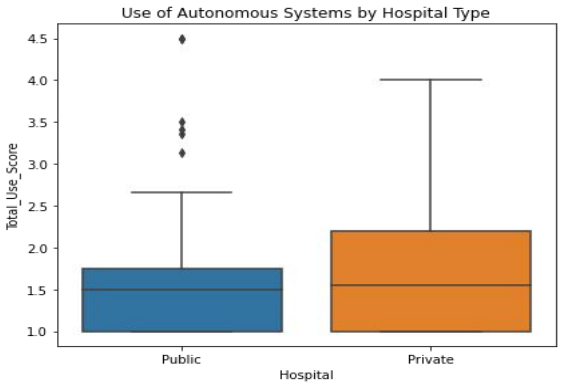


Figure 10: Use of Autonomous System by Hospital Types

### 4.4 Investigating Whether the Availability and Use of Autonomous Systems Significantly Predict ICT Literacy Levels.

The results below in Table 5 revealed that, with $R^2$ value being 0.581, the availability and use of autonomous systems were able to jointly significantly predict only 58.1% variation in ICT literacy level of healthcare workers in Akinyele Local Government Area, Ibadan, Oyo State with the remaining variation predicted by other factors not considered in this study.

The results in Figure 11 further revealed that ICT literacy relatively increased with more availability of autonomous systems. However, the results in Figure 12 revealed that there was a relatively low improvement in ICT literacy when the actual uses of the available autonomous systems were considered.

**Table 5: OLS Regression Results**

| | | | |
|---|---|---|---|
| Dep. Variable: | ICT_Literacy_Score | R-squared: | 0.581 |
| Model: | OLS | Adj. R-squared: | 0.575 |
| Method: | Least Squares | F-statistic: | 107.2 |
| Date: | Sat, 05 Jul 2025 | Prob (F-statistic): | 5.77e-30 |
| Time: | 11:05:42 | Log-Likelihood: | -178.28 |
| No. Observations: | 158 | AIC: | 362.6 |
| Df Residuals: | 155 | BIC: | 371.8 |
| Df Model: | 2 | Covariance Type: | nonrobust |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Const | 0.8732 | 0.147 | 5.947 | 0.000 | 0.583 | 1.163 |
| Availability_Score | 0.6170 | 0.165 | 3.748 | 0.000 | 0.292 | 0.942 |
| Total_Use_Score | 0.4529 | 0.161 | 2.816 | 0.005 | 0.135 | 0.771 |

| | | | |
|---|---|---|---|
| Omnibus: | 21.188 | Durbin-Watson: | 1.290 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 25.335 |
| Skew: | 0.887 | Prob(JB): | 3.15e-06 |
| Kurtosis: | 3.838 | Cond. No. | 11.1 |

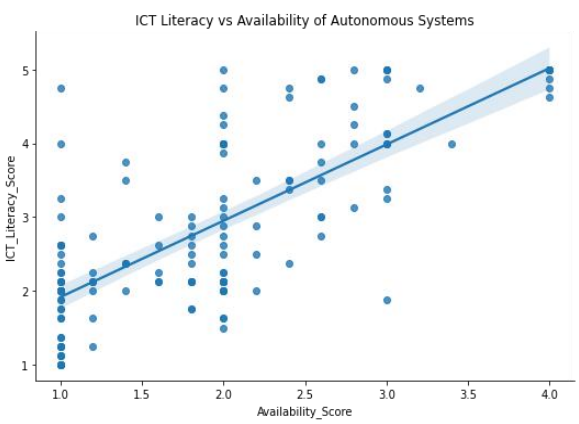


Figure 11: ICT literacy vs Availability of Autonomous Systems

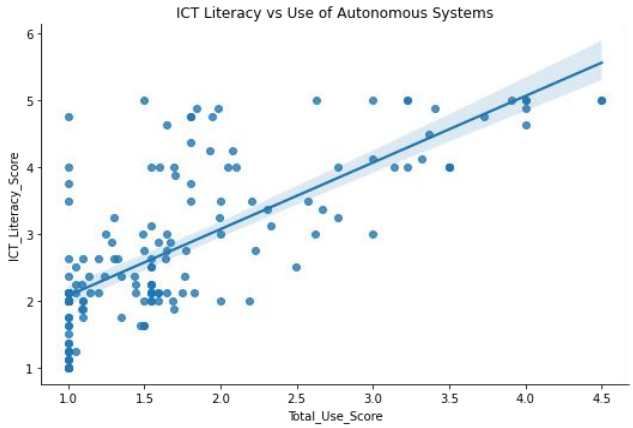


Figure 12: ICT literacy vs Use of Autonomous Systems

## 4.5 Discussion of Findings

This study examined the availability and use of autonomous systems as predictors of ICT literacy among health workers in Akinyele Local Government Area, Ibadan. These findings were discussed with relevant reviewed literature.

This study found that the availability of autonomous systems among health workers was generally low, especially in public hospitals, while private hospitals demonstrated a slightly higher level of availability. This corroborated Ajibola and Ojo (2022), who explained that although autonomous systems are emerging in healthcare, their presence in Nigeria remains limited due to infrastructural challenges and financial constraints. Similarly, Ali et al., (2023) highlighted inadequate government funding and a lack of prioritization of technology in the health sector as reasons why Nigerian public healthcare institutions are faced with difficulties in accessing modern digital tools.

The study also revealed a low score in the use of autonomous systems, with most low usage reported among administrators, surgeons, and consultants. This finding aligns with Chibuike et al., 2024), who pointed out that despite the introduction of ICT tools in Nigerian hospitals, their use remains limited to specific professional groups who are more exposed or have roles that necessitate such tools. Ehidiamen and Oladapo (2024) also reported healthcare workers' inexperience and lack of exposure have hindered the wide adoption and usage of advanced technologies. Khalid and Ali (2023) in their work also supported low usage and discovered lack of training, resistance to change, and minimal ICT support structures contribute to underutilization of available technologies, even when they are present in the workplace.

A major finding of the study was the discovery of the availability and use of autonomous systems as predictors for ICT literacy among health workers, accounting for 58.1% of the variance. This supports the assertion by Laar *et al.,* (2020) that technology integration in the workplace positively influences the development of digital competencies. This means that the exposure of health workers to ICT tools will not only improve service but also make them acquire technical skills over time. Furthermore, the findings align with Yasuhara et al., (2019), who emphasized that access to and interaction with technology enhances both acceptance and proficiency. This implies that the availability and use of autonomous systems seem to be what is needed for improving ICT literacy among health workers in this context.

## 5. Conclusion

This study concluded that the availability and use of autonomous systems were significant predictors of ICT literacy among health workers. However, despite their potential, both the availability and actual utilization of these technologies remained low, especially in public healthcare institutions. The implication was that for ICT literacy to improve among health workers, stakeholders must ensure not only that autonomous systems are provided but also that health workers are trained and encouraged to use them

effectively. The study further confirmed a bidirectional relationship where increased availability can foster digital literacy, and enhanced literacy can, in turn, promote more meaningful use of digital tools. The findings aligned with prior research suggesting that technology alone is insufficient unless accompanied by adequate training, support, and a conducive working environment.

Further studies can be comparative studies on the healthcare workers of two or more states in the same or different geo-political zones in Nigeria so as to reveal the extent and variation in the use and availability of autonomous systems, and their relationship with ICT literacy among health workers in Nigeria. Equally, the instrument used in this study was questionnaire, further studies can use both questionnaire and focus group discussion so that various opinions and perspectives of the health workers can be captured. In addition, a larger sample of the population should be used in future researches so that more responses can be captured and used to get a clearer picture and further contributions to the study. Moreover, further studies should examine specific types of autonomous systems and their individual contributions to ICT literacy development among healthcare workers, and lastly, investigations could focus on the cost-benefit analysis of deploying autonomous systems in public hospitals, especially in resource-constrained settings.

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