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Review Article

# Knowledge and Perception of Telemedicine among Medical Students of the University of Jos, Plateau State, Nigeria.

***Nathaniel Birdling Noel[1], Maryam Birdling Noel[2], Eric Yila[3], Chibuzo Anne-lise Nkala[4], Mathilda Edmund Banwat[5]**

[1]Department of Public Health, Modibbo Adama University Teaching Hospital, Yola, Adamawa State, Nigeria, [2]Centre for Advocacy Transparency and Accountability Initiative (CATAI), Yola, Adamawa State, Nigeria, [3]Community Readiness and Resilience Unit, World Health Emergencies Programme, World Health Organization, Geneva, Switzerland [4]Provider Behaviour Change Unit, Breakthrough Action Nigeria, Johns Hopkins Center for Communications Programs, Abuja, Nigeria, [5]Department of Community Medicine, University of Jos and Jos University Teaching Hospital, Jos, Plateau State, Nigeria

## Abstract

**Background:** Telemedicine has promising potential to address the challenges faced by healthcare systems in developing countries, in providing equitable access to quality care. However, the practice of telemedicine is generally poor in these countries. The success of telemedicine like any technology depends on numerous factors including users' knowledge and perceptions. Hence, this study aimed to examine the knowledge and perceptions of telemedicine among medical students at the University of Jos.

**Methodology:** This was a cross-sectional study among 305 clinical medical students selected through a stratified sampling technique. A self-administered questionnaire consisting of a 28-item 5-point Likert response scale was used to collect data, comprising 13 items for knowledge, 8 for the perception of benefits, and 7 for the perception of ease of use of telemedicine. Data was analyzed using IBM-SPSS.

**Results:** One hundred and eleven (36.4%) participants had good knowledge of telemedicine, while 113 (37.1%) had a good perception of the benefits and 103 (33.8%) had a good perception of the ease of use. Respondents with a good knowledge of telemedicine were about five times more likely (OR = 5.24, 95% CI = 3.15 – 8.69) to have a good perception of the benefits and about eight times more likely (OR = 8.33, 95% CI = 4.57 – 14.26) to have a good perception of ease of use.

**Conclusions:** Few medical students possess desirable levels of knowledge and perceptions of telemedicine which portrays a gap in the medical education curriculum. Therefore, training, and educational opportunities are recommended to improve their knowledge and perception of telemedicine.

**Keywords:** Telemedicine, Knowledge, Perception, Benefits, Ease of Use, Medical students

***Correspondence:** Nathaniel Birdling Noel, Department of Public Health, Modibbo Adama University Teaching Hospital, Yola, Adamawa State, Nigeria
**Email:** natebirdling@gmail.com

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**Quick Response Code:**

## Introduction

The traditional model of face-to-face doctor-patient interaction is not always feasible and can limit access to routine healthcare services, especially during health emergencies such as pandemics where physical distancing – even in healthcare settings, redeployment of resources including manpower, and travel restrictions are required to curb disease spread.[1–7] Telemedicine is capable of circumventing this barrier and allowing medical practitioners to live up to their obligations of duty of care without risking the lives of their clients.[1–3] Universal health coverage for all, is closely linked with the integration of telemedicine into a health system's overall strategy,[8] as it has the potential to minimize the impact of challenges of geographical inaccessibility and shortage of manpower.[9]

Similar to other technologies, most failures of telemedicine implementation are linked to human factors.[1] A health provider's acceptance is key in sustaining telemedicine services,[10] and clinicians need to perceive telemedicine positively for them to willingly sustain its usage.[11] Nevertheless, the adoption of telemedicine among health workers has been very slow and not encouraging, particularly in developing countries.[12,13] Major impediments to the use of telemedicine by professionals are related to inadequate education and training, and negative perceptions.[14–17]Undergraduate medical curricula have limited telemedicine training and experiential components and may be responsible for poor knowledge among professionals.[18] Telemedicine has been regarded by health professionals as disrupting the conventional process of healthcare delivery,[19] adding extra workload,[20] undermining their clinical autonomy,[21–23] being liable to diagnostic uncertainty and errors with potential for malpractice claims,[11,24] and lacking a legal framework to protect the provider.[25]

Most studies assessing telemedicine knowledge and perception have concentrated on practicing health workers with little attention to medical students, who are the future of the health workforce in a world rapidly evolving digitally and requiring a provider to be telemedicine-ready to ensure its long-term sustainability.[26] This study attempted to fill this gap in the study area by assessing the knowledge, perception of benefits, perception of ease of use, and the association between knowledge and the perceptions of telemedicine among medical students of the University of Jos, Plateau State. Since lack of education and training have been identified as major barriers to the implementation of telemedicine by health professionals,[14,15] medical school will provide an opportunity to address this gap from the early stages of their careers by equipping the future medical workforce with the requisite knowledge and skills. Hence, the findings of this study will provide insights that could guide medical schools in reviewing the telemedicine component of medical education and training.

## Methodology

### Study Area

The study was carried out at the University of Jos, Plateau State, Nigeria. It is a federal tertiary institution engaged in undergraduate and postgraduate education in several fields including medicine, nursing, natural sciences, humanities, arts, and social sciences.[27]The University of Jos is the largest tertiary educational institution in the state and has over 40,000 students.[27] Information from unpublished administrative sources has it that there are about 640 medical students in the clinical arm (400 – 600 levels) of the University of Jos medical school.

### Study design.

This was a cross-sectional study.

**Study population.**
The study was conducted among University of Jos' medical students majoring in medicine and surgery who have commenced clinical rotations. All clinical medicine and surgery students (400 – 600 level) were included in the study while those who were not available at the time of data collection because they were on postings outside Jos were excluded.

**Sample size determination.**
The minimum sample size was determined using Cochran's formula ($n=Z^2pq/d^2$), the formula for the determination of the sample size of a cross-sectional study,[28]where 76.4% was used as the level of good knowledge of telemedicine among medical students as obtained from a previous similar study.[29] To compensate for non-response, 10% of the calculated minimum sample size was added to arrive at a final sample size of 305.

**Sampling technique**
A stratified sampling technique was used, where the calculated sample size was proportionately allocated between the three levels of study (400, 500, and 600 levels). Stratification was done based on the level of study as follows:

Allocated sample size by level = number of students in a level x sample size/total number of students across 400 – 600 levels.

For each level of study, the allocated number of respondents was selected from a list of all the students in that level with the aid of computer-generated random numbers.

**Study instrument.**
Data was collected using a pretested self-administered questionnaire containing four sections based on the research objectives. The questionnaire was adapted from a previous study conducted in the Eastern province of Saudi Arabia among Healthcare professionals.[30]The questionnaire was pre-tested on 10% of the total sample size (30) among nursing students at the College of Nursing and Midwifery, Jos.

The first section of the questionnaire comprised items of inquiries on the demographic information of the study respondents and prior exposure to telemedicine education and training such as gender, age, level of study, self-rated ability to use a computer, and previous training/education in telemedicine.

The second, third, and fourth sections comprised 13 items on knowledge, 8 items on the perception of benefits, and 7 items on the perception of the ease of use of telemedicine respectively. The respondents' responses were elicited using a 5-point Likert response scale (strongly agree, agree, not sure, disagree, strongly disagree).

The content validity, face validity, and internal consistency were assessed by a panel of experts in the field of Medical Informatics in the Department of Community Medicine, Jos University Teaching Hospital to critically examine and determine the relevance of the items and indices drawn in measuring the variables included in the study. Their suggestions, corrections, and ideas were incorporated into the final draft of the research instrument.

**Data Analysis**
Data were analyzed using the IBM-SPSS software version 23. The response to each item in the knowledge, perception of benefits, and perception of ease-of-use sections were scored as follows: strong

agree = 5, agree = 4, not sure = 3, disagree = 2, and strongly disagree = 1. The total score for knowledge was calculated as the sum of scores for each of the 13 items in the knowledge section with a maximum obtainable score of 65. The total score for the perception of benefits and the total score for the perception of ease of use were calculated as the sum of scores for the 8 items in the perception of benefits section and 7 items in the perception of ease-of-use section. The maximum obtainable score in the perception of benefits section was 40 while it was 35 for the perception of ease-of-use.

In categorizing the total scores, each total score was converted to a percentage, and a percentage of≥ 80%, corresponding to a minimum score of 4 ("agree") per item, was categorized as good and < 80% as poor. For the knowledge score, a score of ≥ 52 was adjudged good knowledge while < 52 was poor knowledge. For the perception of benefits, a total score of ≥ 32 was categorized as a good perception of benefits and < 32 as poor perception of benefits. A total score of ≥ 28 for the perception of ease of use was categorized as good and< 28 as poor perception.

The sociodemographic characteristics of the respondents and their knowledge and perceptions categories were presented using frequencies and proportions in frequency tables. Chi-square test was used to explore associations between knowledge and perception of benefits on one hand and perception of ease of use on another hand. The strength of association was expressed as an odds ratio (OR) with a 95% confidence interval (CI). A p-value of ≤ 0.05 was considered statistically significant.

**Ethical considerations**

Ethical approval was obtained from the institutional research and ethics committee of the Jos University Teaching Hospital. Additionally, written informed consent was obtained from the study respondents.

**Results**

A total of 305 questionnaires were administered and all were returned, giving a response rate of 100%. The age of the study respondents ranged from 19– 42 years with a mean of 28.1 ± 4.4 years. One hundred and eighty-seven (61.3%) were male, 184 (60.2%) were at 500 level, none of them had been taught telemedicine while in school, 70 (23%) rated their ability to use a computer as high, and 41 (13.4%) had previously attended a training/workshop/seminar on telemedicine (Table1).

**Table 1:** Sociodemographic characteristics of the study respondents (n = 305).

| Variable | Frequency | % |
|---|---|---|
| **Age group (years)** | | |
| 19 – 26 | 105 | 34.4 |
| 27 – 34 | 187 | 61.3 |
| 35 – 42 | 13 | 4.3 |
| **Mean age ± SD (years)** | 28.1 ± 4.4 | |
| **Sex** | | |
| Male | 187 | 61.3 |
| Female | 118 | 38.7 |
| **Level of Study** | | |
| 400 level | 51 | 16.7 |
| 500 level | 184 | 60.2 |
| 600 level | 70 | 23.1 |
| **Self-rated ability to use Computer.** | | |
| Low | 19 | 6.1 |
| Average | 216 | 70.9 |
| High | 70 | 23.0 |
| **Taught Telemedicine in School** | | |
| No | 305 | 100.0 |
| **Attended training/workshop/seminar on Telemedicine.** | | |
| Yes | 41 | 13.4 |
| No | 264 | 86.6 |

One hundred and eleven (36.4%) respondents had a good knowledge of telemedicine (Table 2).

**Table 2:** Knowledge of Telemedicine among study respondents (n = 305).

| Knowledge of telemedicine | Frequency | % |
|---|---|---|
| Good | 111 | 36.4 |
| Poor | 194 | 63.6 |

One hundred and thirteen respondents (37.1%) had a good perception of the benefits of telemedicine in healthcare (Table3).

| Perception of benefits | Frequency | % |
|---|---|---|
| Good | 113 | 37.1 |
| Poor | 169 | 62.9 |

One hundred and three (33.8%) respondents had a good perception of the ease of use of telemedicine (Table 4).

**Table 4: Perception of ease of use of telemedicine among study respondents (n =305).**

| Ease of use of telemedicine | Frequency | % |
|---|---|---|
| Good | 103 | 33.8 |
| Poor | 202 | 66.2 |

A statistically significant association was found between the knowledge of telemedicine and the perception of the benefits of telemedicine. Respondents with a good knowledge of telemedicine were about five times more likely (OR = 5.24, 95% CI = 3.15 – 8.69, p = <0.0001) to have a good perception of the benefits of telemedicine compared to those with poor knowledge (Table 5).

**Table 5: Association between Knowledge of Telemedicine and Perception of Benefits of Telemedicine**

| Variable | Perception of Benefits | | $\chi^2$ | OR (95% CI) | df | p-value |
|---|---|---|---|---|---|---|
| | Poor (n = 192) f (%) | Good (n = 113) f (%) | | | | |
| **Knowledge of Telemedicine** | | | | | | |
| Poor | 149(76.8) | 45(23.2) | 43.864 | 1 | 1 | <0.0001* |
| Good | 43(38.7) | 68(61.3) | | 5.24 (3.15 – 8.69) | | |

OR = Odds Ratio, CI = Confidence Interval, *Statistically significant

A statistically significant association was found between the knowledge of telemedicine and the perception of ease of use of telemedicine. Respondents with a good knowledge of telemedicine had about eight times higher odds (OR = 8.33, 95% CI = 4.87 – 14.26, p = <0.0001) of good perception of the ease of use of telemedicine compared to those with poor knowledge (Table 6).

**Table 6: Association between Knowledge of Telemedicine and Perception of Ease of Use of Telemedicine**

| Variable | Perception of Ease of Use | | $\chi^2$ | OR (95% CI) | df | p-value |
|---|---|---|---|---|---|---|
| | Poor (n = 202) f (%) | Good (n = 103) f (%) | | | | |
| **Knowledge of Telemedicine** | | | | | | |
| Poor | 161(83.0) | 33(17.0) | 66.950 | 1 | 1 | <0.0001 |
| Good | 41(36.9) | 70(63.1) | | 8.33 (4.87 – 14.26) | | |

OR = Odds Ratio, CI = Confidence Interval, *Statistically significant

## Discussions

This study assessed the knowledge and perceptions of telemedicine among medical students at the University of Jos, Plateau State.

The suboptimal knowledge of telemedicine among medical students seen in previous studies,[31–33] was corroborated by this study as only about a third of the participants had adequate background knowledge of telemedicine. This is in sharp contrast to other similar studies where the majority showed an adequate level of knowledge.[34–36]. The generally poor knowledge of telemedicine in this study may be attributable to the lack of telemedicine systems for education and training purposes in the teaching hospital. Additionally, the fact that none of the participants had received a formal education on telemedicine may be partly responsible for the low level of knowledge. Poor knowledge of telemedicine among future healthcare providers does not sound promising for the fate of telemedicine services. Knowledge is a strong predictor of technology perception and behavioural intention,[37]hence, the respondents may not

appreciate telemedicine's potential and are less likely to have a favourable disposition toward its adoption in their practice.

Perceived ease of use of technology is a strong determinant of perceived benefits, while in turn, perceived benefit is an important factor in shaping behavioural intention towards the adoption of the technology.[38] In this study, most of the study participants perceived telemedicine as not easy to use and also had a poor perception of its benefits, which is consistent with previous findings.[35,39]The finding in this study differs markedly from previous studies where the majority of the participants reported a good perception of the ease of use and benefits of telemedicine.[31,32,34,40]The fact that only a few of the study participants rated themselves highly in the ability to use a computer may partly explain why a majority of them had a poor perception of the ease of use of telemedicine. Moreso, it is plausible that most of the participants perceived telemedicine negatively as none of them had been taught telemedicine in school. Failing to realize the benefits inherent in telemedicine may adversely impact the readiness of this future health workforce to use telemedicine, an outcome that may continue to compound the challenges of poor access to quality healthcare in Nigeria.

Consistent with a previous study,[41]a significant association was observed between knowledge and the perceptions of benefits and ease of use of telemedicine, implying that knowledge positively influences perception toward telemedicine. Therefore, ensuring that medical students have adequate knowledge of telemedicine could positively impact their perception of its benefits and ease of use.
This study is not without limitations as the cross-sectional design cannot establish a causal relationship between knowledge and perception.

## Conclusions

This study revealed that many of the medical students had inadequate knowledge and poor perceptions of the benefits and ease of use of telemedicine. A positive association was observed between knowledge and perception. The findings suggest a gap in the medical education curriculum which calls for action to improve the knowledge of telemedicine among medical undergraduates, by incorporating telemedicine components into the curriculum.

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**Conflicts of interest**
There are no conflicts of interest.

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