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Acceptance and adoption of tele-rehabilitation by physiotherapists from Nigeria, a low resource setting: a mixed-method study

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Abstract

Background Adoption of tele-rehabilitation among physiotherapists in developed countries has risen exponentially to complement conventional physical contact physiotherapy. However, many low- and middle-income countries like Nigeria where barriers to utilization of tele-physiotherapy were earlier identified still demonstrates limited evidence on its acceptance and adoption till date.

Method This was a mixed-method design of quantitative and qualitative study, aimed at investigating acceptance and adoption of tele-rehabilitation among physiotherapists in Nigeria. Respondents comprised 331 physiotherapists practising in Nigeria and registered with the Medical Rehabilitation Therapists (Registration) Board of Nigeria (MRTB). Quantitative approach involved completion of a 33-item structured questionnaire shared as Google Forms to respondents' WhatsApp and emails. Qualitative aspect involved in-depth interview with 12 physiotherapists at the clinics, using a 10-item semi-structured interview guide, and recorded with a voice recorder. Quantitative data was analysed using descriptive and inferential statistics at $p < 0.05$ alpha level. Qualitative data was analysed using thematic content analysis.

Results Respondents comprised 172 males and 159 females. Their mean age and years of experience were 33.42 ± 8.95 and 8.86 ± 8.037 years, respectively. Pre-lockdown, only 62 (18.7%) respondents offered tele-physiotherapy. During the 35-day total lockdown, 114 (34.4%) offered tele-physiotherapy. Majority (155 (46.8%)) used smartphone apps. Fifty-seven (17.2%) respondents were confident that tele-rehabilitation can complement conventional physiotherapy, while 72 (21.8%) kept offering post-lockdown. Use of digital technology was highest for patient education (97 (29.3%)), especially for musculoskeletal conditions (85 (25.7%)). There were significant associations between pre-lockdown duties ($p = 0.036$), post-lockdown duties ($p = 0.005$) and use of digital health technology ($p = 0.001$) with respondents' age. Significant associations also existed between respondents' years of practice and each of post-lockdown duties ($p = 0.017$) and use of digital health technology ($p = 0.001$). Qualitative approach revealed that facilitators to adoption and acceptance of tele-rehabilitation included patient education, training of physiotherapists, availability of evidence-based guidelines and tele-health software and hardware systems. Barriers were lack of or limited technological infrastructures, finances, hospital management support, and knowledge of information and communication technology.

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Conclusions Physiotherapists in Nigeria demonstrated moderate acceptance but low adoption of tele-rehabilitation, in varied comparison with clinicians and physiotherapists in other climes. Training of physiotherapists in tele-rehabilitation and provision of enabling technological environment by regulatory bodies and policy makers are recommended.

Keywords Tele-rehabilitation, Physiotherapy, Acceptance, Adoption

Background

During the acute phase of COVID-19 that necessitated lockdown in many countries including Nigeria, many medical services were reduced or shut down entirely in 'hard-hit' areas. There was a prohibition on health professionals (HP) performing non-urgent medical examinations, treatments and interventions during the first phase of lockdowns, due to the SARS-CoV-2 pandemic [1]. There was also the need to safeguard caregivers from infection [2]. To combat this, the Centers for Disease Control and Prevention developed guidelines for provision of healthcare services during the pandemic, in which the major recommendation was tele-rehabilitation [3]. This is associated with many evidence-based benefits of tele-rehabilitation including maintaining continuity of care; patient education; consultation; monitoring improvement; increasing care efficiency while controlling costs, distance and time; and minimizing waiting lists [4]. Tele-rehabilitation also allows patient care and rehabilitation in their familiar environment rather than in a clinical setting, thereby facilitating recovery in regular living situation. Although this might have been easy to implement in economically advanced countries, the case is different in many low- and middle-income countries (LMIC) like Nigeria.

The COVID-19 pandemic exacerbated numerous pre-existing flaws in Nigeria's healthcare delivery system, most notably the infrastructure required to establish effective tele-rehabilitation services [5]. Some of the challenges facing the adoption of tele-rehabilitation are lack of awareness, low acceptance and technical know-how among stakeholders [6]. This is not unconnected with high level of poverty experienced by persons living within Nigeria (133 million people), 63% of who are multidimensionally poor according to the National Multidimensional Poverty Index (MPI), 2022. Multidimensional poverty is higher in rural areas, where 72% of people are poor, compared to 42% of people in urban areas (MDI) [7]. Coincidentally, few published studies on the use of tele-rehabilitation in Nigeria provided evidence of great potential impact to millions of Nigerians [8]. By providing clinic-based therapy in remote settings from the cities where health facilities are situated, associated burden of distance, time and finance can be addressed [8–11]. Although the level of acceptance of technology for

healthcare provision by health professionals is identified as the primary determinant of the success and continuous use of tele-rehabilitation, these have been sparsely researched among physiotherapists in Nigeria [12]. Odole et al. [13], in an earlier study, identified challenges to the utilization of tele-physiotherapy in Nigeria such as insufficient/weak infrastructures, ethical issues, training of physiotherapists, patient education, physiotherapist-patient interaction during treatment, cultural barriers and finances. It was concluded that successful implementation of tele-physiotherapy in Nigeria could be achieved if the problems were addressed. Potential strategies such as infrastructure development through collaboration of government and private sectors, mobile solutions using mobile technologies with less bandwidth for low-connectivity areas, clear ethical guidelines and standards, training of healthcare professionals, patient education through user-friendly materials and programmes, effective communication tools, subsidies, funding and insurance coverage and policy advocacy can pave the way for successful adoption and implementation of tele-rehabilitation in Nigeria. In addition, awareness, acceptance and technical know-how can be improved among stakeholders through extensive awareness campaigns using various media channels; collaborations between healthcare institutions, technology providers, academia and government agencies to develop and implement tele-rehabilitation initiatives effectively; as well as workshops, seminars and training sessions targeting different stakeholder groups [5, 13].

Consequent to the aforementioned, 6 years after the study by Odole et al. [13], a number of novel and creative approaches to tele-physiotherapy have emerged in Nigeria [10, 11]. Notwithstanding these efforts, there is dearth of evidence on uptake of tele-rehabilitation among physiotherapists in many LMIC including Nigeria, the most populous African country. The use of mobile communication in low- and middle-income countries opens up an opportunity to overcome the challenges of geographical accessibility of healthcare [14]. Digital health, and in particular mobile health (mHealth), has been shown to improve the quality and coverage of care; facilitate access to health information, services and knowledge; and promote healthy behavioural changes to prevent acute and chronic diseases [14]. With this evolution, there is an

important need to assess the level of acceptance and adoption of the various innovations in tele-physiotherapy among physiotherapists in Nigeria.

Methods

Aim

This study was aimed at investigating acceptance and adoption of tele-rehabilitation among practising physiotherapists in Nigeria.

Design and setting

This study adopted a mixed-method design of quantitative and qualitative approach. The quantitative approach involved the use of a questionnaire adapted from an earlier study on physiotherapists' use and perceptions of digital remote physiotherapy in Switzerland [15]. The domains of the questionnaire were developed through discussion and consensus within the working group of physiotherapists and researchers [15]. The items were found to be applicable to situation of physiotherapists in Nigeria and were adopted for this study. The questionnaire was administered online via Google Forms with the link shared directly with the physiotherapists via a series of 8 emails and WhatsApp direct messages within a span of 4 months, from November 2022 to February 2023. The qualitative approach involved a semi-structured face-to-face interview of 12 physiotherapists who had 10 years or more of clinical practice in a tertiary health institution setting using an interview guide, and their voices were recorded using an audio recorder. Respondents for both quantitative and qualitative aspects of the study were selected purposively from among physiotherapists in Nigeria.

Sample size determination

Using the Yamane formula for the sample size determination of quantitative aspect of the study [16], sample size was determined as follows:

$$n = \frac{N}{[1 + N(e)2]}$$

where n is the sample size, N is the population size and e is the level of precision.

$N=2000$ (number of physiotherapists in Nigeria as obtained on the Medical Rehabilitation Therapists (Registration) Board of Nigeria (MRTB)'s website), $e=0.05$ and $n=334$ respondents.

A total of 334 practising physiotherapists in private, secondary and tertiary health and educational institutions were purposively selected for the quantitative aspect of this study. Out of these, 331 responded to the online survey giving a 99% response rate from the sampled physiotherapists. For the qualitative aspect of the

study, a sample of 12 physiotherapists were interviewed which was the maximum number until data saturation was reached.

Procedure

This study was approved by appropriate Health Research and Ethics Committee. Through respondents' information sheet, the purpose and procedure of this study was explained to each respondent, their written informed consent was obtained and they were assured of confidentiality. Specific ethical considerations addressed in this study involved data security and the anonymity of respondents by ensuring that no IP addresses, name, email address or mobile phone number were collected. The study was conducted through an online survey (Google Forms). The link to the Google Form was shared with the physiotherapists directly through WhatsApp and email. A series of 8 emails was sent biweekly to a mailing list of the 2000 licensed Nigerian physiotherapists gotten from the database of the MRTB. The Google Forms were pre-set to allow only one response per individual, in order to avoid duplicate answers. Emails and WhatsApp invites (to complete online questionnaire) were sent to all the 2000 physiotherapists over a period of 4 months, until the sample size was reached. Qualitative approach involved a face-to-face in-depth interview at the clinics, using an interview guide used by Buabbas [17] and probing questions as necessary. Data saturation was determined when no additional information was provided by respondents. For respondents who did not consent to be recorded, their responses were written in short forms to effectively capture the contents of the interview. Informed consent was obtained from all physiotherapists who participated in the interview. They were informed about the recording of the conversations and assured about the confidentiality of the information they provided.

Data analysis

Descriptive statistics of mean, standard deviation, frequency and percentages were used to summarize the data. Acceptance of tele-physiotherapy was summarized using pre-lockdown duties and post-lockdown duties, while adoption of tele-physiotherapy was summarized with digital technology use for patient management. Chi-square test was used to determine the association between acceptance and adoption and each socio-demographic characteristic (age, gender and years in practice) of the physiotherapists. Alpha level was set as $p < 0.05$. Qualitative data were analysed using thematic content analysis with descriptive and interpretative coding strategy. This included verbatim transcription, followed by

preparation of raw data, content analysis and finalization. The content analysis consisted of four substeps which are systematic reading, creating themes, categories and sub-categories, as well as refinement and revision.

Results

Respondents’ mean age and years of experience were 33.42 ± 8.95 and 8.86 ± 8.037 years, respectively. Majority were males (172 (52%)) in the age group of 21 to 40 years (81.6%) (Table 1). Duties of physiotherapists before the

lockdown indicated that while over half (178 (53.7%) of the respondents had contact with patients, only 62 (18.7%) offered tele-physiotherapy. During the lockdown, 114 (34.4%) physiotherapists offered video tele-physiotherapy (Fig. 1) and research was the duty performed by the majority (140 (42.2%)). Mean working hours reduced from 31.80 ± 17.73 to 20.51 ± 16.50 h per week on patient contact for 178 (53.7%) respondents post lockdown. Patient contact reduced from 53.7% before lockdown to 13.5% after lockdown (Table 2). Although a vast majority of respondents use smartphone apps (312 (94.3%)) for personal purposes out of all the digital tools employed, about half (155 (46.8%)) of respondents used smartphone apps for professional purposes every day (Table 3). Tele-rehabilitation was confidently perceived to complement conventional physiotherapy by 57 (17.2%) respondents, while 72 (21.8%) kept offering video tele-therapy/online therapy since the COVID-19 pandemic, and preferred individual patient settings (106 (32%)), although patient contact reduced to 13.5% after lockdown (Table 4).

The highest increase in the use of digital technology was in patient education (97 (29.3%)), especially for musculoskeletal conditions (85 (25.7%)), while majority (206 (62.2%)) of respondents need support in knowledge

Table 1 Socio-demographic characteristics of respondents (N=331)

| Variable | Frequency (n) | Percentage |
|--------------------|---------------|------------|
| Age (years) | | |
| 21–30 | 169 | 51.1 |
| 31–40 | 101 | 30.4 |
| 41–50 | 41 | 12.4 |
| 51–60 | 14 | 4.2 |
| Over 60 | 6 | 1.8 |
| Gender | | |
| Female | 159 | 48.0 |
| Male | 172 | 52.0 |

Offered video tele-physiotherapy during the lockdown

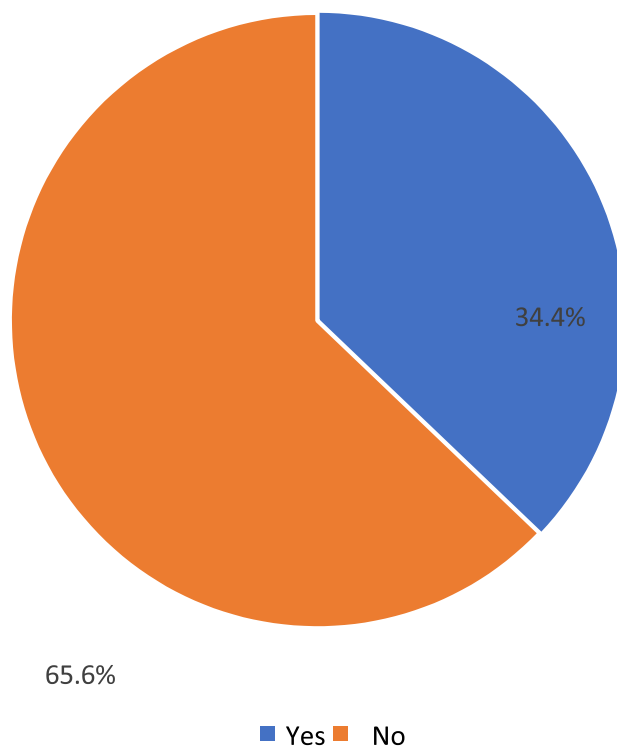


Fig. 1 Physiotherapists’ responses on the use of video tele-physiotherapy during the lockdown

Table 2 Distribution of activities/duties of physiotherapists ($N=331$)

| Variable | Frequency | Percentage |
|---|-----------|------------|
| Contacts with patient at work | | |
| Yes | 317 | 95.8 |
| No | 14 | 4.2 |
| Activities before the lockdown | | |
| Patient contact | 178 | 53.7 |
| Administration (e.g. personnel and payroll) | 71 | 21.4 |
| Teaching | 43 | 12.9 |
| Research | 13 | 4.0 |
| Other | 12 | 3.9 |
| Activities after the lockdown | | |
| Patient contact | 45 | 13.5 |
| Administration (e.g. personnel and payroll) | 67 | 20.2 |
| Teaching | 75 | 22.6 |
| Research | 140 | 42.2 |
| Other | 4 | 1.2 |

Table 3 Respondents' attitude towards technology ($N=331$)

| Variable | Frequency | Percentage |
|--|-----------|------------|
| Personal use of digital tools | | |
| Smartphone apps (online) | 312 | 94.3 |
| Meeting tools | 12 | 3.6 |
| Smart watches | 1 | 0.3 |
| Other wearables | 6 | 1.8 |
| Professional use of digital tools | | |
| Smartphone apps | 155 | 46.8 |
| Online meeting tools | 115 | 34.7 |
| Smart watches | 29 | 8.8 |
| Other wearables | 32 | 9.7 |
| Personal digital tools | | |
| Never | 0 | 0 |
| 1 or 2 times | 7 | 2.1 |
| Once per week | 0 | 0 |
| 3–5 times | 14 | 4.2 |
| Everyday | 310 | 93.7 |
| Professional digital tools | | |
| Never | 3 | 0.9 |
| 1 or 2 times | 32 | 9.7 |
| Once per week | 34 | 10.3 |
| 3–5 times | 115 | 34.7 |
| Everyday | 147 | 44.4 |

about digital health applications (Table 5). There were significant associations between pre-lockdown duties (p value=0.036), post-lockdown duties (p value=0.005) and area of patient management involved in digital technology (p value=0.001) with the respondents' age (Table 6).

There was no significant gender association in acceptance and adoption of tele-rehabilitation (p value=0.988) (Table 7). Significant associations existed between respondents' years of practice and each of post-lockdown duties (p value=0.017) and area of patient management involved in digital technology (p value=0.001) (Table 8).

Result of the qualitative study

Twelve participants were involved in the qualitative aspect of this study. They comprised two females and ten males aged 44 to 61 years with 17 to 31 years of experience as physiotherapists. Among the participants, 6 (50%) held master's degrees, and all of them were registered with the Medical Rehabilitation Therapists Board of Nigeria (Fig. 2).

Results from the interview are presented in themes, categories and subcategories relating to the respondents' use of information and communication technology (ICT) and tele-rehabilitation in their workplace. All of the themes are interconnected, and the relationships between the themes are presented in Fig. 3. The in-depth interviews revealed three themes. Theme 1 highlights the facilitators of tele-rehabilitation, with two categories which are enablers and infrastructures and nine subcategories as presented in Fig. 4. Theme 2 states the barriers of tele-rehabilitation with three categories of finance, knowledge of ICT and hospital management with nine subcategories as presented in Fig. 5. In theme 3, the advantages of adopting tele-rehabilitation are highlighted in two categories which are benefits to patients and benefits to physiotherapists. It has seven subcategories as presented in Fig. 6.

Another participant linked it to cost from the patient and from hospital management.

...patients may face additional costs associated with Tele-rehabilitation, such as purchasing or renting devices and paying for internet access. Health care providers may also need to invest in new technologies and software to offer Tele-rehabilitation services (Participant 4).

The issue of cost is important for use of tele-rehabilitation among the patients, healthcare providers and the hospital management in economically less advanced setting like Nigeria. Potential strategies to alleviate this challenge can be through collaboration between private sectors and government to provide data at subsidized rates, funding to the hospital management for appropriate IT infrastructure, insurance coverage and policy advocacy. Internet service providers as stakeholders can provide mobile solutions through mobile technologies with less bandwidth for locations with poor Internet connectivity [5, 13, 14].

Table 4 Distribution of technical tools and support

| Variable | Frequency | Percentage |
|--|-----------|------------|
| Technical tools | | |
| Did you already offer video tele-physiotherapy before the lockdown (n=317) | | |
| Yes | 48 | 14.5 |
| No | 269 | 81.3 |
| Did you offer video tele-physiotherapy after lockdown (n=109) | | |
| Yes | 72 | 66.1 |
| No | 25 | 22.9 |
| Uncertain | 12 | 11 |
| Setting where tele-physiotherapy was offered (n=109) | | |
| Individual therapy | 106 | 97.2 |
| Group therapy | 3 | 2.8 |
| Which tool did you use to perform tele-physiotherapy on patients? | | |
| FaceTime | 8 | 2.4 |
| Microsoft Teams | 17 | 5.1 |
| Phone | 64 | 19.3 |
| WhatsApp | 94 | 28.4 |
| Skype | 8 | 2.4 |
| Zoom | 48 | 14.5 |
| Physiotherapy app | 2 | 0.6 |
| Google Meet | 1 | 0.3 |
| Google Classroom | 1 | 0.3 |
| Support | | |
| Therapeutic interventions with patients before and during the lockdown (n=109) | | |
| Better | 38 | 34.9 |
| Much better | 16 | 14.7 |
| Neutral | 47 | 43.1 |
| Worse | 8 | 7.3 |
| Confidence level on how tele-therapy/online therapy can complement the usual physiotherapy interventions (N=109) | | |
| Confident | 57 | 52.3 |
| Neutral | 23 | 21.1 |
| Not confident | 5 | 4.6 |
| Very confident | 24 | 22.0 |

One of the participants spoke that people who are not familiar with using technology may have limited technical skills, which can make it difficult for them to access and use Tele-rehabilitation services.

Theme 1: facilitators of adoption of tele-rehabilitation

This theme presents the respondents' opinion on factors that promote the use of tele-rehabilitation among physiotherapists (Fig. 4). One participant strongly described what could encourage wide adoption of tele-rehabilitation by saying:

I believe we have to enlighten the society about Tele-rehabilitation first, how it can benefit them and woo them to make the adoption of Tele-

rehabilitation seamless. Many people will come to accept it and use it because they will have the option to choose either Tele-rehabilitation or the traditional physiotherapy (Participant 12).

The quotation above highlights the society; in this case, the patients is a key pillar of tele-rehabilitation, and that if the community knows about tele-rehabilitation, it will be easy for physiotherapists to adopt it in their clinical practice.

All of the participants felt that tele-rehabilitation has become an increasingly popular method of delivering physiotherapy services to patients, particularly in the wake of the COVID-19 pandemic. However, one participant described how he felt on how training could move tele-rehabilitation forward:

Table 5 Use of technical tools and support (N= 109)

| Variables | Subgroups | Yes, n (%) | No, n (%) |
|--|--|------------|------------|
| Patient to which tele-therapy/online therapy was offered | COVID-19 risk groups | 28 (8.5) | 81 (24.5) |
| | COVID-19 patients | 13 (3.9) | 96 (29.0) |
| | Musculoskeletal conditions | 85 (25.7) | 24 (7.3) |
| | Geriatrics conditions | 54 (16.3) | 55 (16.6) |
| | Internal organs and vessels | 2 (0.6) | 107 (32.3) |
| | Neuromotor and sensory | 51 (15.4) | 58 (17.5) |
| | Paediatrics | 25 (7.6) | 84 (25.4) |
| | Others | 6 (1.8) | 103 (31.1) |
| Part of patient management/phase of therapy digital technology is used | History taking | 74 (22.4) | 35 (10.6) |
| | Examination and evaluation | 53 (16.0) | 56 (16.9) |
| | Define diagnosis | 49 (14.8) | 60 (18.1) |
| | Provide treatment | 65 (19.6) | 44 (13.3) |
| | Patient education | 97 (29.3) | 12 (3.6) |
| | Follow-up | 70 (21.1) | 39 (11.9) |
| | Improve treatment adherence | 71 (21.3) | 38 (11.5) |
| | Therapy monitoring | 64 (19.3) | 45 (13.6) |
| Useful form of support | Knowledge about infrastructure | 161 (48.6) | 129 (39.0) |
| | Knowledge about applications | 206 (62.2) | 86 (26.0) |
| | Knowledge about law and data Protection | 171 (51.7) | 121 (36.6) |
| | Knowledge about settlement with cost units | 140 (42.3) | 151 (45.6) |
| | Knowledge about the needs of patients | 143 (43.2) | 149 (45.0) |
| | Knowledge about effectiveness | 179 (54.1) | 113 (34.1) |
| | Knowledge of communication method | 153 (46.2) | 138 (41.7) |
| | Knowledge of the examination and treatment process | 191 (57.7) | 99 (29.9) |
| Knowledge of suitable methods | 178 (53.8) | 114 (34.4) | |
| Knowledge of other | 5 (1.5) | 287 (86.7) | |

Table 6 Association between age and acceptance and adoption of tele-rehabilitation

| Variables | Age group (years) | | | | | χ^2 | p value |
|---|-------------------|--------------|--------------|--------------|-------------|----------|---------|
| | 21–30, f (%) | 31–40, f (%) | 41–50, f (%) | 51–60, f (%) | > 60, f (%) | | |
| Before the lockdown | 19 | 18 | 6 | 2 | 3 | 16.509 | 0.036 |
| During the lockdown | 45 | 42 | 13 | 4 | 5 | 21.893 | 0.005 |
| Area of patient management involved in digital technology | 169 | 101 | 41 | 14 | 6 | 209.886 | 0.001 |
| Tools used for tele-physiotherapy on patients | 169 | 101 | 41 | 14 | 6 | 80.318 | 0.926 |
| Useful form of support | 86 | 45 | 20 | 9 | 1 | 13.215 | 0.105 |

Table 7 Association between gender and acceptance and adoption of tele-rehabilitation

| Variable | Male, f (%) | Female, f (%) | χ^2 | p value |
|---|-------------|---------------|----------|---------|
| Before the lockdown | 26 | 22 | 0.567 | 0.967 |
| During the lockdown | 60 | 49 | 1.697 | 0.791 |
| Area of patient management involved in digital technology | 172 | 157 | 33.296 | 0.988 |
| Tools used for tele-physiotherapy on patients | 172 | 157 | 19.989 | 1.000 |
| Useful form of support | 83 | 77 | 0.378 | 0.984 |

Table 8 Association between years in practice and acceptance and adoption of tele-rehabilitation

| Variable | Age group | | | | | χ^2 | p value |
|---|-------------|--------------|--------------|--------------|--------------|----------|---------|
| | 0–10, f (%) | 11–20, f (%) | 21–30, f (%) | 31–40, f (%) | 41–50, f (%) | | |
| Before the lockdown | 33 | 8 | 4 | 2 | 0 | 13.302 | 0.102 |
| During the lockdown | 75 | 20 | 8 | 4 | 1 | 18.597 | 0.017 |
| Area of patient management involved in digital technology | 240 | 50 | 33 | 5 | 2 | 157.501 | 0.001 |
| Tools used for tele-physiotherapy on patients | 240 | 50 | 33 | 5 | 2 | 53.571 | 1.000 |
| Useful form of support | 118 | 21 | 20 | 2 | 0 | 10.756 | 0.216 |

Socio-demographic characteristics of Participants

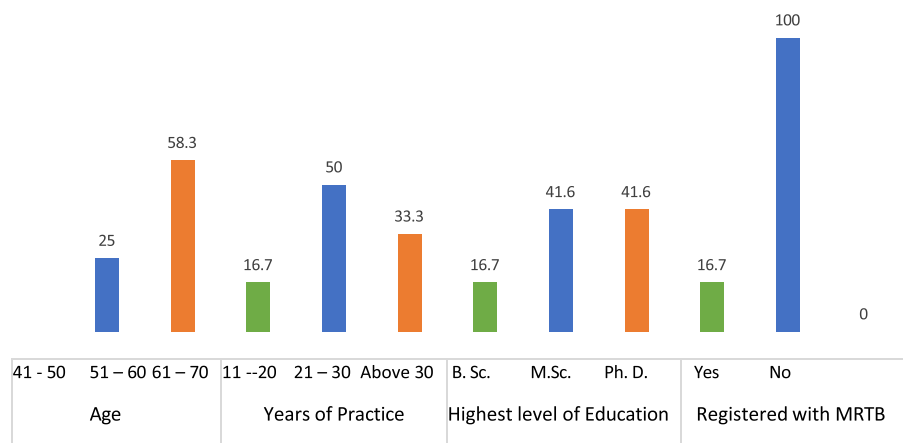


Fig. 2 Frequency distribution of socio-demographic variables of interviewees

I believe that by providing adequate training to therapists on how to use tele-rehabilitation platforms effectively. Therapists need to learn how to create a safe and supportive therapeutic environment online, how to manage technical issues, and how to ensure confidentiality and privacy (Participant 2).

Professional training through continuous education programmes for physiotherapists to familiarize and update them with tele-rehabilitation tools and techniques, focusing on ethical considerations specific to tele-rehabilitation, and patient education through user-friendly materials and programmes, and effective communication tools can address challenges associated with limited technical skills that may hinder adoption of tele-rehabilitation [5, 13, 14].

One participant suggested that:

Government can help by developing and implementing guidelines for Tele-rehabilitation that reflect best practices in the field. For example, guidelines should specify what type of technology is acceptable for

Tele-rehabilitation, how to manage emergencies and crises, and how to document and store client information securely (Participant 5).

Interestingly, participants 6 and 9 highlighted that affordability of ICT, provision of computers and Internet availability with selecting the right video conferencing platform, and tele-health software can help enhance tele-rehabilitation adoption.

Specific content of the guidelines may include introduction, scope and significance of tele-rehabilitation in Nigeria’s healthcare system, regulatory framework and legal considerations and technical infrastructure requirements, including Internet connectivity, hardware, software and data security measures; clinical practice guidelines on the appropriate use of tele-rehabilitation; professional standards and training; patient engagement and involvement; ethical and cultural considerations specific to tele-rehabilitation; quality assurance and evaluation; financial and reimbursement policies; and implementation and adoption strategies. Creating

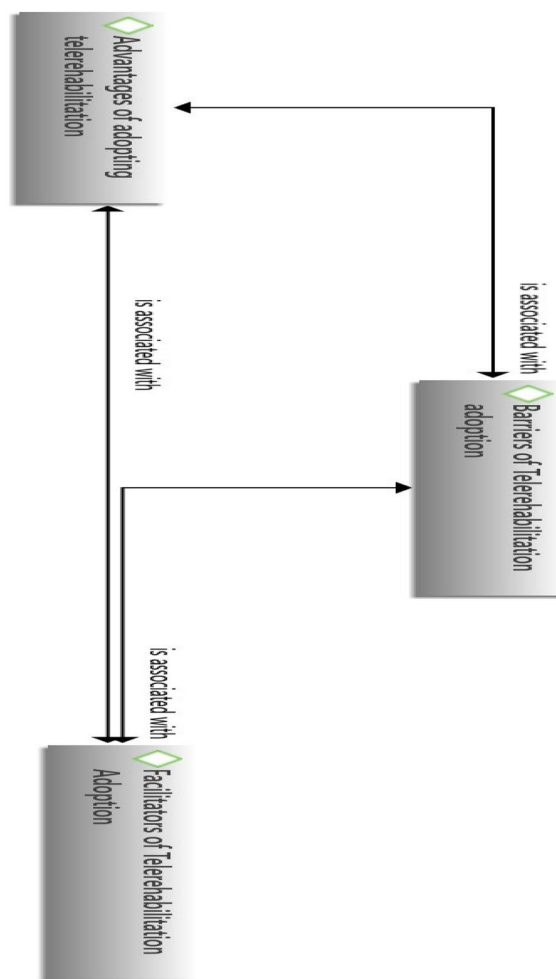


Fig. 3 Relationship between generated themes

comprehensive guidelines that cover these aspects can serve as a roadmap for the successful integration and standardized practice of tele-rehabilitation in Nigeria while ensuring quality, ethical and culturally sensitive care for patients [5, 13, 14].

Theme 2: barriers to adoption of tele-rehabilitation

All participants acknowledged that the existence of barriers was an important aspect of note in the movement of tele-rehabilitation in Nigeria. It was mentioned that these barriers could be lack of finances, willingness of the hospital management support, inadequate or low infrastructures and knowledge of ICT (Fig. 5).

Tele-rehabilitation requires patients to have access to a reliable internet connection and a device, such as a smartphone, tablet, or computer, to participate in videoconferencing or use rehabilitation software. Patients who lack the necessary technology or who live in areas

with limited broadband infrastructure may have difficulty accessing tele-rehabilitation services (Participant 1).

Another participant linked it to cost from the patient and from hospital management.

...patients may face additional costs associated with Tele-rehabilitation, such as purchasing or renting devices and paying for internet access. Health care providers may also need to invest in new technologies and software to offer Tele-rehabilitation services (Participant 4).

One of the participants spoke that people who are not familiar with using technology may have limited technical skills, which can make it difficult for them to access and use Tele-rehabilitation services.

Theme 3: advantages of adopting tele-rehabilitation

Four of the participants acknowledged that there are many amazing benefits associated with tele-rehabilitation (Fig. 6) especially using telecommunication technologies such as video conferencing, phone calls and messaging platforms to both the patients and healthcare provider:

It has allowed patients to receive rehabilitation services from the comfort of their own homes or in a local clinic, eliminating the need for travel to a distant medical facility. This increases access to care for individuals who live in remote or rural areas, have limited mobility, or cannot travel due or other reasons. They also responded that can increase patient engagement in their rehabilitation process by providing them with more frequent communication and support from their healthcare providers. Patients can communicate with their healthcare providers easily and quickly through communicating platforms, which can lead to increased adherence to their rehabilitation program (Participant 7).

One of the participants described better adherence to treatment plans:

...can improve patient adherence to treatment plans by providing them with easier access to healthcare professionals and increasing the frequency of appointments. Patients can also receive ongoing support and guidance, which can help them stay motivated and on track with their rehabilitation goals (Participant 10).

Discussion

This study assessed the level of acceptance and adoption of tele-rehabilitation using a validated questionnaire and explores personal experiences using an in-depth

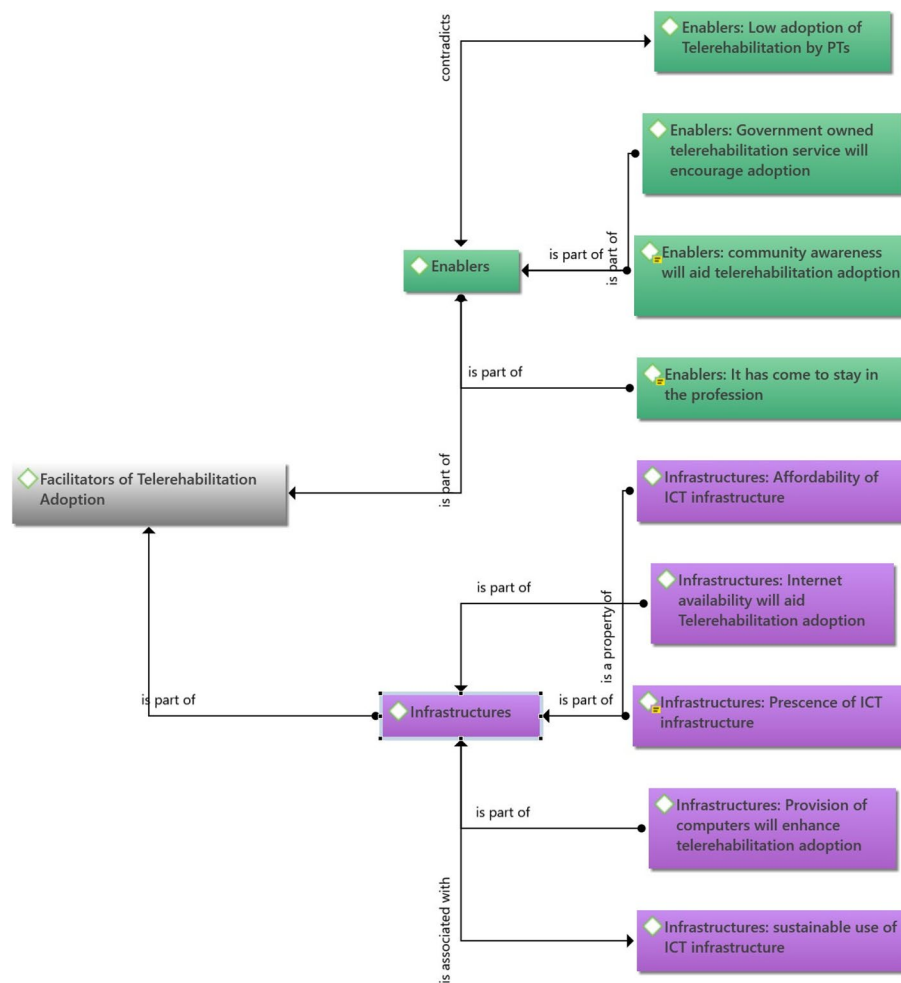


Fig. 4 Facilitators of adoption to tele-rehabilitation

interview among physiotherapists practising in Nigeria. It gives a clear picture of real-life experiences of the subject matter and suggestions on what can be done to facilitate uptake of tele-rehabilitation among physiotherapists in Nigeria. This is important to reduce the cost of health-care delivery in Nigeria, and by extension, other similar contexts. It may also reduce medical tourism by Nigerians. It also shows that physiotherapists and researchers in Nigeria are moving with technological innovation within the limits of available resources.

Findings from the online survey indicated that majority of the participants were young adults, with a significant proportion having more than 10 years of professional experience. The use of smartphone apps has been adopted by physiotherapists in their professional interventions or professional practice as highlighted from the outcome of this study. This aligns with a finding from a previous research suggesting that social media platforms tend to attract digital natives, i.e. younger populations, as well as

some digital immigrants, i.e. older populations [13, 18]. This trend may be due to the younger generation’s greater adaptability to various forms of technology, particularly ICT. This phenomenon appears to be global, with younger individuals from all walks of life being more at ease with and possessing a better comprehension of ICT than their older counterparts.

This study also revealed that a significant number of physiotherapists who participated in the research incorporated tele-rehabilitation platforms into their practice. More so, before the COVID-19 lockdown, many physiotherapists were involved in patient contact practice, administrative role and teaching. However, there was a paradigm shift during the lockdown. Many physiotherapists moved from their previous duties to other areas of profession interests, with the highest focus on research work. This finding is in congruent with Arzani et al. [19] and Sidelil et al. [20] that professional focus tends to shift if there was a break in what an individual has been

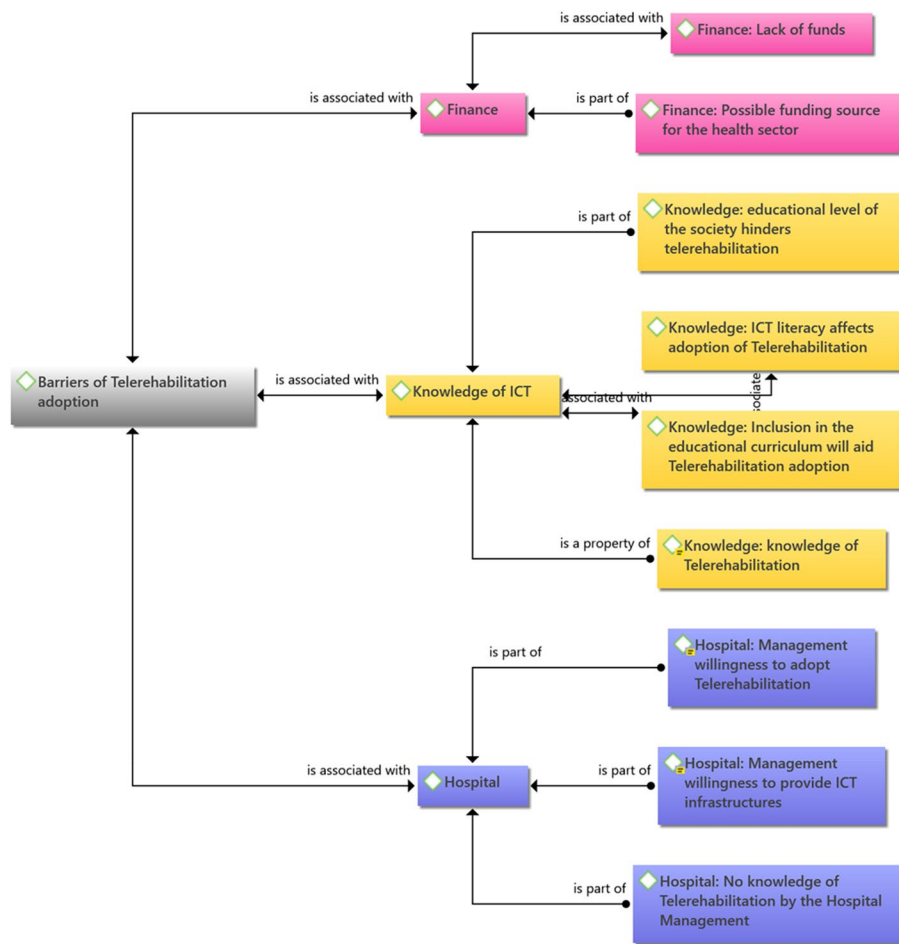


Fig. 5 Barriers to adoption of tele-rehabilitation

involved in or used to before. Only few physiotherapists adopted tele-rehabilitation before the lockdown; however, there was significant change during the lockdown that made a lot of physiotherapists to embrace tele-physiotherapy especially with the use of WhatsApp and phone. The findings of this study indicated that adoption of tele-rehabilitation using digital tools by physiotherapist has helped to improve patient management including history taking, examination and evaluation, and treatment adherence. This is supported by a study conducted by Awotidebe et al. [18] who reported that young professionals have demonstrated the practice and utilization of online therapy in their treatment interventions. Additionally, the majority of respondents reported that they preferred to work in individual settings that offer tele-rehabilitation to musculoskeletal conditions which align with a previous research demonstrating physiotherapists' willingness to utilize digital physical therapy for their clients with orthopaedic cases [21]. Nonetheless, the survey uncovers an appreciable degree of doubt among the

respondents regarding the effectiveness of tele-rehabilitation. Majority of the respondents expressed confidence in patients' comfort with being treated through tele-rehabilitation, while some were neutral about the communication judgement and quality of therapeutic intervention given. The difference in attitude could be attributed to the varying degrees of familiarity with tele-rehabilitation among the physiotherapists involved in this study especially the age and years of experience of respondents in this study. Significant association between respondents' age and duties done (before and after lockdown) and patient management using digital technology further supports the trend of the younger generation's greater adaptability to various forms of technology. This is further supported by previously documented studies similar to the present study [22–24]. Statistically significant association was also found between years of practice and duties done after lockdown, and patient management of therapy digital technology. This is supported by Cottrell et al. [25] who documented that association was found

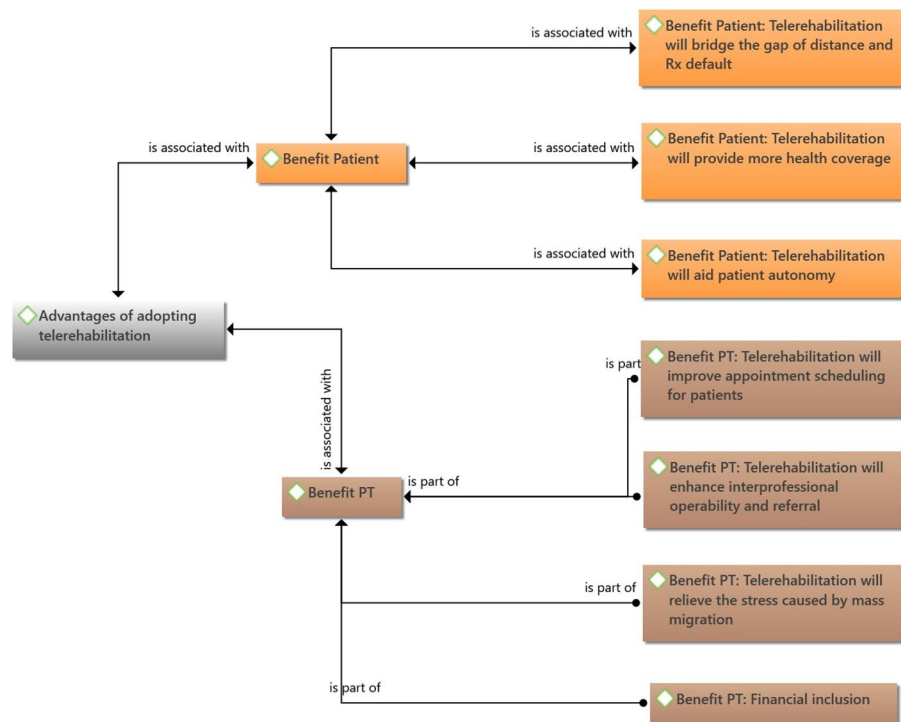


Fig. 6 Advantages of adopting tele-rehabilitation

between years of practice and adoption of tele-rehabilitation. Lack of significant association between gender and acceptance/adoption in this study was supported by an earlier study by Awotidebe et al. [18] who reported that knowledge, attitude and practice of digital physical therapy were not influenced by gender.

The acceptance and adoption of tele-rehabilitation among physiotherapists is a growing trend in the health-care industry. However, the use of inadequate infrastructures and facilitators of tele-rehabilitation has been a significant hindrance to the successful adoption and acceptance. Qualitative analysis of this study revealed that facilitators including the government play a key role in acceptance and adoption of tele-rehabilitation by creating awareness and owning rehabilitation centres where people can be trained in the use of tele-rehabilitation. This was supported by studies conducted by Rajmohan and Johar [26] which highlighted the critical role and the influence of governments on people to participate and encourage them in tele-rehabilitation. More so, one of the significant barriers to the adoption and acceptance of tele-rehabilitation as revealed in the study is the lack of knowledge and training on the use of telecommunication technologies. Many patients are not familiar with the use of telecommunication technologies, leading to resistance to its adoption. In addition, the cost of implementing tele-rehabilitation by the hospital management

and by the patients as revealed in the current study plays a significant barrier in acceptance and adoption in tele-rehabilitation. This aligns to the study conducted by Sarfo et al. [27] who reported same findings that managements in the hospital and patients find it difficult to pay for the usage of tele-rehabilitation.

The qualitative interview also revealed that tele-rehabilitation presents various benefits for both physiotherapists and patients. Geographical barriers are overcome, and patients from rural or remote areas can now access rehabilitation services without having to travel long distances to access healthcare facilities. This is in congruent with Hale-Gallardo et al. [28] who reported similar findings. The flexibility of scheduling appointments has been enhanced, giving patients the opportunity to receive treatment at a suitable time and location. Furthermore, tele-rehabilitation encourages patient-centred care, allowing patients to play an active role in their rehabilitation process. Lastly, this mode of rehabilitation offers a cost-effective alternative to traditional rehabilitation services, reducing healthcare expenses for both patients and healthcare providers. These results are consistent with studies of Duruflé et al. [24] and Cottrell et al. [25] who reported extensive benefits of tele-rehabilitation to the health providers and patients.

Regulatory bodies and policy makers play pivotal roles in supporting the adoption and successful implementation of tele-rehabilitation in Nigeria. Their involvement

is crucial in creating an enabling environment, setting standards and ensuring the ethical, legal and technical frameworks necessary for its effective operation [29]. This can be achieved in many ways. Regulatory bodies can establish regulatory frameworks by defining licensing requirements for healthcare professionals involved in tele-rehabilitation, and can establish criteria for accreditation of quality and safe tele-rehabilitation services. Policy makers can draft policies that promote the adoption of tele-rehabilitation as part of the national healthcare system; they can collaborate with healthcare experts to create guidelines that outline best practices, ethical considerations and technical standards for tele-rehabilitation services. Regulatory bodies can establish protocols to ensure patient data privacy and security are maintained during tele-rehabilitation sessions, and define guidelines for obtaining informed consent from patients during remote rehabilitation sessions [30]. Policy makers can allocate funds or grants to support the development of tele-rehabilitation infrastructure and training programmes for healthcare professionals, and work on policies to reimburse healthcare providers for tele-rehabilitation services, encouraging wider adoption by making it financially viable.

In addition, regulatory bodies and policy makers can conduct awareness campaigns to educate the public, healthcare professionals and stakeholders about the benefits and safety of tele-rehabilitation. They can also engage with various stakeholders, including healthcare providers, technology companies and patient advocacy groups, to gather input and foster collaboration for successful implementation. These bodies can establish mechanisms to monitor and assess the quality and effectiveness of tele-rehabilitation services regularly, and evaluate patient outcomes, satisfaction rates and adherence to established standards to ensure continuous improvement. Working in collaboration with other government agencies and private sectors, the bodies can address infrastructural gaps, such as improving Internet connectivity and access to electricity, to facilitate widespread adoption [29, 30].

This study has some limitations that may need to be considered in interpreting and generalizing its findings. Respondents in this study are physiotherapists accessed through the database of the MRTB. Distribution of respondents may be skewed to one part of the country than the other, which may obscure the opinion of few physiotherapists from other part of the country. Respondents for qualitative interview were drawn majorly from selected tertiary hospitals in southwest Nigeria, for convenience. This may create some bias in the responses in favour of physiotherapists from this area. Although federal government-owned and managed tertiary hospitals in Nigeria are similar in settings and

staff working conditions, personal experiences may bring variations in the responses of the interviewee.

Conclusion

Implementation of tele-rehabilitation in Nigeria is relatively low before the lockdown. Many physiotherapists in Nigeria are not familiar with tele-rehabilitation, and those who are familiar with it do not use it frequently due to various reasons such as inadequate infrastructure, lack of awareness and inadequate knowledge on how to implement it. Although some physiotherapists are experienced in tele-rehabilitation, they faced challenges such as poor Internet connectivity, lack of technical support and a shortage of specialized equipment which hinder the acceptance and adoption of tele-rehabilitation in Nigeria. Age and years of practice are significantly associated with acceptance and adoption tele-rehabilitation. Gender has no significant influence on acceptance and adoption of tele-rehabilitation among physiotherapists in Nigeria. Involvement of regulatory bodies and policy makers is vital to creating an enabling environment, to support the adoption and successful implementation of tele-rehabilitation in Nigeria.

Recommendations

The following are the recommendations drawn from the study:

1. The Medical Rehabilitation Therapists (Registration) Board of Nigeria should create guidelines for the use of tele-rehabilitation to ensure that best practices are followed.
2. Providing training and education to physiotherapists in the form of online courses, webinars and workshops on how to effectively use tele-rehabilitation can help to improve acceptance and adoption.
3. The Nigerian government should support the adoption of tele-rehabilitation by creating policies and regulations that facilitate its use. This could include funding for research and development, subsidies for equipment and tax incentives for physiotherapy practices that use the technology.
4. Patients should be educated on the benefits of tele-rehabilitation and how to use the technology which can increase their acceptance and adoption of the technology. This can be done through patient education materials, such as brochures and videos, or through tele-rehabilitation consultations.
5. More researches should be conducted on the effectiveness of tele-rehabilitation in order to help increase its acceptance and adoption among physiotherapists. This can also provide evidence-based information on the benefits and limitations of the technology.

Abbreviations

| | |
|------|---|
| MPI | Multidimensional Poverty Index |
| LMIC | Low- and middle-income countries |
| MRTB | Medical Rehabilitation Therapists (Registration) Board of Nigeria |

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Authors' contributions

MO conceptualized the study, was involved in research design, took part in data analysis and interpretation and prepared the manuscript. AM was involved in the conceptualization of the study, research design and proofreading of the manuscript. PA was involved in the conceptualization and design of the study, data collection, collation and interpretation, initial draft of the manuscript and proofreading. AT was involved in research design, proofreading and intellectual contribution. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analysed during this study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Health Research and Ethics Committee of the Institute of Public Health (HREC), Obafemi Awolowo University, Ile-Ife, Osun State, Nigeria, with the registration number IPH/OAU/12/1987.

Consent for publication

Not applicable.

Competing interests

Not applicable.

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