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Telemedicine ready or not? A cross-sectional assessment of telemedicine maturity of federally funded tertiary health institutions in Nigeria

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Abstract

Introduction and objective: Telemedicine has reinforced its position as a means for the continuity of healthcare services and a cost-effective approach to improving health equity as demonstrated during the COVID-19 pandemic. The preparedness of health systems for telemedicine is an indicator of the scalability of their services, especially during catastrophes. We aimed to assess the maturity and preparedness of federally funded tertiary health institutions in Nigeria, to deploy telemedicine as such data are currently lacking and are required to drive improvements in health services delivery.

Methods: We conducted a cross-sectional survey of thirty randomly selected federally funded tertiary health institutions in Nigeria using the Pan American Health Organization's tool for assessing the maturity level of health institutions to implement telemedicine between 17 September 2020 and 1 September 2021. Descriptive statistics were used for overall maturity levels and non-parametric tests to compare scores for overall maturity and specific Pan American Health Organization domains per region. The level of significance was set at p-value <0.05.

Results: The response rate was 77.4% (24 of 30 randomly polled federally funded tertiary health institutions responded). Overall, the median telemedicine maturity level was 2.0 (1.75) indicating a beginner level. No significant inter-zonal difference in the median overall maturity level ($p = 0.87$). The median maturity levels for telemedicine readiness in specific domains were organizational readiness – 2.0 (2.0), processes 1.0 (1.0), digital environment 2.0 (3.0), human resources 2.0 (1.0), regulatory issues – 1.5 (1.0) and expertise 2.0 (2.0); mostly at beginner level, with no inter-zonal differences. Most participating institutions had no initiatives in place for domains of processes and regulatory issues.

Conclusions: The current telemedicine maturity level of federally funded tertiary health institutions in Nigeria is at the beginner level. This behoves policy-makers to advance the implementation and deployment of telemedicine nationwide as part of digital quality healthcare, to improve health equity and to ensure continuity of healthcare services in the event of another pandemic.

Keywords

Telemedicine, telehealth, eHealth, virtual medicine, hospitals teaching, tertiary care centers, Nigeria

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Introduction

Healthcare providers and health systems have been inundated by enquiries about strategies to ensure continuity of access to preventive, diagnostic and therapeutic services in the wake of disruptions during the coronavirus disease 2019 (COVID-19) pandemic. Undoubtedly, the allure of delivery of health care services where patients and providers are separated by distance (telehealth as defined by the World Health Organization [WHO]) using information and communication technologies has escalated.[1] The benefits of telehealth beyond bridging the physical divide and enabling improved access include cost effectiveness, improved emergency preparedness, and a decrease in supply-demand mismatch, considering the low ratio of health workforce per population.[2] At the national level, health service prioritization is driven by extant policies. According to the WHO Global Observatory for eHealth (2015 latest data) in which 123 member states provided responses, 22.0% stated that their country had a specific national telehealth policy, 50.7% had no policy, and 35.0% had no policy but had a reference to telehealth within their national eHealth policy.[3] The survey identified specific barriers including lack of funding to develop and support telehealth programmes, lack of infrastructure (equipment and/or connectivity), competing for health system priorities and a lack of legislation or regulations covering telehealth programmes.[3] The feasibility of leveraging on telehealth services to effectively cushion the negative impact of the COVID-19 pandemic-associated disruptions to in-person access to diagnostic and therapeutic services was dependent on the level of maturity of such services. Beyond the pandemic, the advantages of telehealth as a viable alternative platform to the traditional in-person mode of healthcare delivery have made it an increasingly obvious imperative to incorporate telemedicine (TM) in the sustainable development of health systems, especially with the shortage of trained health personnel in many African countries, especially in rural areas. The public healthcare system in Nigeria operates on three tiers namely primary, secondary and tertiary systems with oversight by the local, state and federal governments respectively, though the federal government provides most of the funding at all levels.[4] Mostly, the current public healthcare system still has low financial accessibility of services by the populace, mostly through out-of-pocket payments with minimal health insurance coverage.[5] Prior to the COVID pandemic in Nigeria, there was a socio-cultural preference for an in-person review by the clinician though TM is technically not a new concept in the country.[6] Factors identified as impediments to the widespread deployment of TM pre-pandemic include lack of political will, poor IT infrastructure and poor attitudes of healthcare professionals and the public to TM.[6] In a survey of healthcare professionals at a state-funded teaching hospital in south-west Nigeria, ~ 35% had good knowledge of TM though ~ 92% of respondents supported the deployment of TM in the country.[7] Other challenges to an inclusive adoption of TM in Nigeria (like other countries in sub-Saharan Africa) include the cost of data and internet services, lack of awareness of TM, power outages and low literacy levels.[8,9] Therefore, in order to successfully implement TM services, a holistic approach that gives due consideration must be given to the interwoven components such as technical requirements, organizational structures and change management including population awareness, economic feasibility, societal impacts, perceptions, user-friendliness, evaluation and evidence, legislation, policy and governance.[10] The primary objective of this exploratory survey was to assess the maturity and level of preparedness of federally funded tertiary health institutions (FFTHIs) in Nigeria to deploy and integrate TM services in providing healthcare to the population. Such data are currently lacking, and are useful as a benchmark to guide policies aimed at driving improvements in healthcare services or developing services where non-existent.

Methods

Study design and inclusion criteria

We conducted a cross-sectional descriptive study of randomly selected federally-funded tertiary institutions across the six geopolitical zones of Nigeria using an electronic survey instrument between 17 September 2020 and 1 September 2021. A database of all federally funded tertiary hospitals (defined as institutions so designated by the Federal Ministry of Health on account of the level of care available at the facility) was built from multiple sources including a primary search of the Nigeria Health Facility Registry[11] using the filters for facility level (tertiary) and ownership (public). This was further refined using the pre-set inclusion criteria to identify institutions funded by the Federal Government of Nigeria generating a total of 66 FFTHIs. Ab initio, the plan was to randomly survey at least 50% of the institutions so identified ensuring that all states of the federation were surveyed and a minimum of three responses were received from each geopolitical zone. The initial e-mail requesting participation was sent to the Chief Medical Director/Medical Director of the institution with a preceding telephone call to verify contact details. The survey was completed and corroborated by a designated hospital official such as the Chairman Medical Advisory Committee or a similarly authorized official with sufficient information to credibly complete the survey. An initial period of 4–8 weeks was allowed for responses with e-mail and telephone reminders over an additional 4–8-week period on account of anticipated delays occasioned by the ongoing pandemic. One institution whose official declined to participate was replaced.

The survey instrument and survey processes

The study utilized an electronic survey designed using Google® forms and included a section on basic demographics of the participating institution, and the Pan American Health Organization (PAHO) COVID-19 and TM tool for assessing the maturity level of health institutions to implement TM services (developed by PAHO in collaboration with the WHO and the Inter-America Development Bank).[12] In summary, the instrument is a self-assessment tool that assesses the level of maturity to offer TM services, and is scored as none (no initiative in place – 1), beginner (some steps taken, but far from able to implement services – 2), advancing (good progress and some TM services could begin to be implemented – 3) and ready (everything is ready for TM services to operate at full capacity – 4). In addition, an unscored response option to request expert technical support to make further improvements is included. The component categories of questions within the tool explore six areas of maturity/preparedness: organizational readiness (32 questions), processes (12 questions), digital environment (27 questions), human resources (12 questions), regulatory issues (eight questions) and expertise (eight questions). In addition to the PAHO tool-specific questions, the preceding section of the survey required the baseline demographics of the institution including the following: location (state, city), hospital bed capacity, patient load (annual in-patient and outpatient load separately) in the preceding three-year period 2017 to 2019, avoiding 2020 due to anticipated issues with data verification and service utilization related to the pandemic restrictions), availability and use of electronic health records system in the institution, demographics of hospital attendees, that is, approximate proportion of paediatrics and adult patient population, clinical departments in the institution and the presence of residency training programmes.

Table 1. Baseline characteristics of the participating tertiary hospitals.

Characteristic	Summary data
Institutions offering residency training (*n*, %)	23 (95.8%)
Annual in-patient attendance in preceding 3 years (median (IQR))	10761.5 (18117.8)
Annual clinic attendance in preceding 3 years (median (IQR))	114470.5 (68720.8)
Proportion of hospital patients classified as adults (median (IQR))	79.0 (17.8)
Proportion of hospital attendees classified as paediatrics (median (IQR))	20.0 (19.5)
Institutional cut-off for defining paediatric age group (median (IQR))	16.0 (2.5)
Proportion of hospital patients aged > 60 years (median (IQR))	18.0 (20.3)
Institutions using electronic medical records for consultation (*n*, %)	9 (37.5%)
Institutions with a specific budget line for telemedicine (*n*, %)	4 (16.7%)
Hospital bed capacity	
< 500 beds	11 (45.8%)
≥ 500–1000 beds	13 (54.2%)

Data analysis

The survey responses were downloaded from the Google ® form as a Microsoft Excel document and analysed using the Statistical Package for Social Sciences (SPSS) version 21 (IBM Corp. Armonk, NY). Descriptive statistics of the baseline characteristics of the participating institutions and the survey responses (maturity level overall and by each category explored, that is, organizational readiness, processes, digital environment, human resources, regulatory issues and expertise) are presented with appropriate measures of central tendency and dispersion. Non-parametric Kruskal-Wallis test was used to compare median scores for overall maturity (combining all five categories) per region with a level of significance set at p-value <0.05. Available case analysis was used in generating overall frequencies of the different maturity scores for the items in the tool.

Results

Characteristics of participating institutions

A total of 24 tertiary hospitals of the 30 randomly polled completed the survey, giving a response rate of 77.4%. The institutions' characteristics are shown in Table 1 and Figure 1 (geopolitical regional distribution of participating institutions). There were participants from five of the six geopolitical zones with ~95% of respondents being residency-training institutions and ~54% having an in-patient bed capacity between 500 and 1000. The highest proportion of participating institutions came from the North-central geopolitical zone (7, 29.2%), whilst the South-south had the lowest proportion with only two institutions (8.3%). Slightly more than half of participating institutions (54.2%) had a bed capacity of between 501 and 1000; in the preceding 3 years, median annual in-patient and clinic attendance rates were 10761.5 and 114170.5, respectively. The proportion of paediatric to

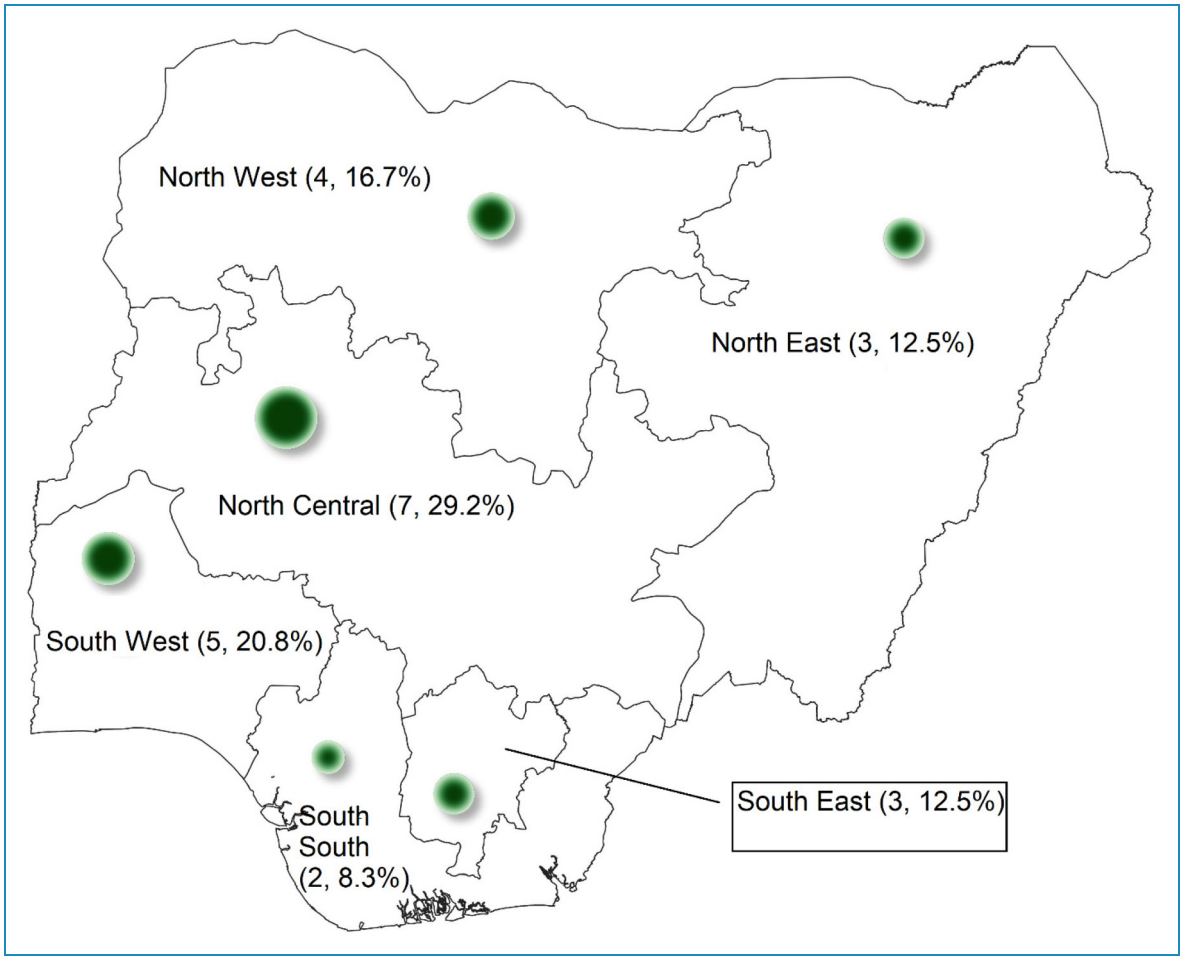

Figure 1. Geopolitical and regional distribution of participating tertiary institutions.
Footnote: The green bubbles represent the number and proportion (*n*, %) of participating institutions in each region. Median maturity levels per region: NC = 2.0, SE = 2.0 and SW = 2.0. SS = 1.75, NW = 1.5, NE = 1.0). No statistically significant inter-regional difference in median maturity overall (Kruskal-Wallis test, $p = 0.87$).

Table 2. Institutional maturity for delivery of telemedicine services.

Category	Maturity level (median (IQR)) $n = 24$
Overall maturity level	2.0 (1.75)
Organizational readiness	2.0 (2.0)
Processes	1.0 (1.0)
Digital environment	2.0 (1.3)
Human resources	2.0 (1.0)
Regulatory issues	1.5 (1.0)
Expertise	2.0 (2.0)

adult hospital attendees was approximately 1:4, and about one-fifth (18%) of all patients seen were above 60 years of age.

A little over a third (37.5%) of all institutions used electronic health records for consultation; less than a fifth (16.7%) had a specific budget line for TM. All but one participating institution offered residency training programmes (Table 1).

TM maturity of tertiary institutions

The summary data for the major thematic areas of the PAHO tool for assessing the maturity level of health institutions to implement TM (Organizational readiness, Processes, Digital environment, Human resources, Regulatory issues and Expertise) are presented in Table 2 and Figure 1 (regional data). Supplemental Tables 1 to 6 display the maturity level for all domains and each parameter and the distribution of the different scores among the institutions.

Overall, the median maturity level was 2.0 (1.75) indicating beginner level. The median maturity levels in the

six geo-political zones of the country ranged from 1–2 (no initiative in place – beginner level) without a statistically significant inter-regional difference in median maturity overall (Figure 1, Kruskal-Wallis test, $p = 0.87$). Additional details are provided regarding the digital environment (internet connection and connectivity, software for managing medical records and patient portals, administrative software for billing, payments, monitoring hours and technical equipment such as hardware and other equipment) in Table 3 and Supplemental Table 3. Maturity and level of preparedness in terms of human resource capacity (health workers and IT staff) are depicted in Figure 2 and Supplemental Table 4. There was no regional difference in the maturity level for any of the domains (non-parametric test; organizational readiness $p = 0.37$, processes $p = 0.52$, digital environment $p = 0.86$, human resources $p = 0.88$, regulatory issues $p = 0.28$, expertise $p = 0.10$).

Discussion

This is the first nationally representative exploratory survey documenting the maturity and level of preparedness of FFTHIs in Nigeria to deploy and integrate TM services in healthcare provision. The objectives of our survey align with the WHO's recommendations that evaluation is vital for the scalability, transferability, and continuing quality improvement of TM.[13] The main findings indicate a beginner level of TM maturity nationwide, without an inter-regional difference, widely varied organizational readiness, predominantly beginner level with respect to the processes required for successful deployment of TM services, the digital environment, human resources and expertise, and the lowest level of preparedness with respect to regulations.

Organizational readiness

This examines the foundational issues that need to be resolved before an institution goes ahead to implement TM services. In this study, the median maturity level for organizational readiness indicates that participating institutions are primarily at the beginner level to deploy TM services, although considerably varied. The PAHO tool for assessing institutional maturity recommends delaying the implementation of TM services if the institutional score is less than a maturity level of 3 for related items. Each institution in this category will need to formulate an action plan geared towards taking their institutional readiness to a higher level in the areas identified as lacking (such as availability of IT staff, reliable internet, infrastructure for providing TM services etc.), before proceeding with TM service provision. The main reason would be to avoid the frustration and failure that could result from launching TM without adequate capacity. In this study, less than 20% of institutions had a budget line for TM services, exposing a potential weakness that should be addressed as an area of priority. Not surprisingly, given the relative lack of funding, approximately one-third of participating institutions had commenced any TM services at the time of the survey. Improving institutional readiness would understandably involve a policy shift and the appropriate political will to divert financial resources to build capacity. In line with the general principles of quality improvement, it is recommended that facilities roll out services in phases, recognizing areas of critical or urgent need, where the impact would be most felt.[14,15] This would also help to build the confidence of both providers and users in TM and increase buy-in to the concept of e-health, allowing for a period of transition in deploying and up-scaling the technology and user capabilities required for TM service provision.[14,16]

Table 3. The overall maturity of the digital environment for the delivery of telemedicine services.

Digital environment	Maturity level (median (IQR)) $n = 24$
Internet connection and connectivity	2.0 (1.9)
Software (managing medical records, patient portals)	1.5 (1.0)
Administrative software (billing, payments, monitoring)	2.0 (1.8)
Technical equipment (e.g. hardware, others)	2.25 (1.0)

Processes

The median maturity score reflecting the set of operations and functions required to commence TM services implied there were no initiatives in place. Key considerations in this area include the assignment of duties to clinical and administrative staff, security, procedures for referrals, adverse events and emergency support. Without the recommended processes in place, TM services are not likely to be sustainable or would quickly encounter clinical, technical or legal operational challenges capable of eroding confidence and user acceptability. We recommend that institutions include training and reasonable timelines for developing and rolling out actions related to relevant processes, and tasking specified working groups with sufficient expertise to midwife the processes. Staff training has been identified as one of the prerequisite measures for the sustainability of any successful e-health system, and the fundamental role of collaboration for capacity building to ensure success and sustainability is a key lesson reiterated by the findings from previous global surveys.[13,16]

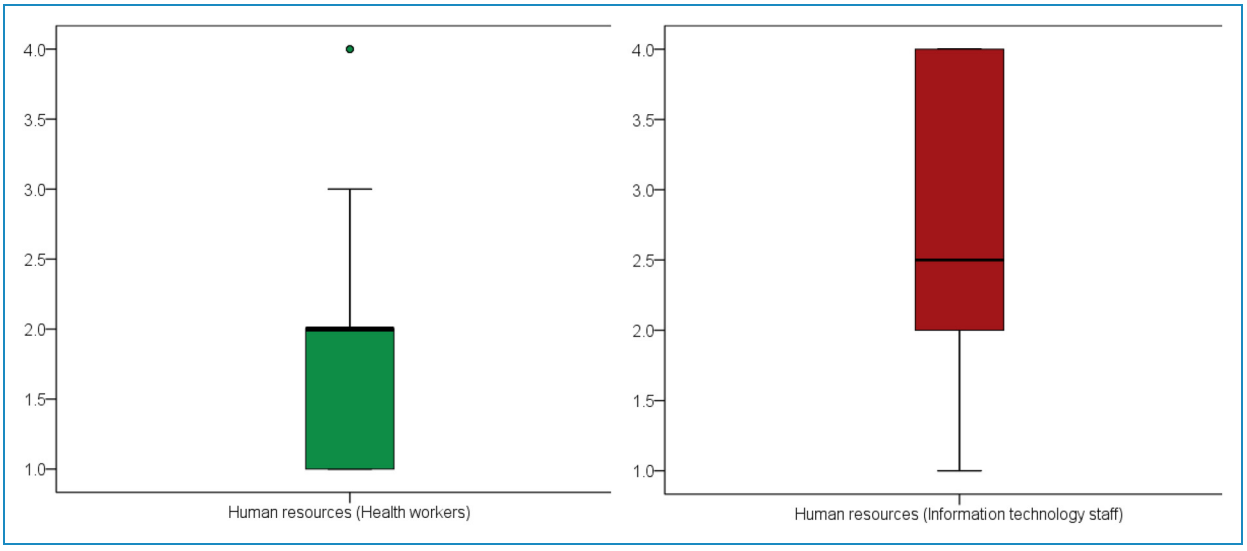

Figure 2. The maturity level of human resources (health workers and information technology staff) for telemedicine delivery.
Footnote: Boxplots illustrating the median maturity level and interquartile range. The human resources boxplot includes three outlier institutions (green dot) with a median of 4.0. Health workers (green boxplot) (median 2.0 (1.0), range (1–4), mean (95% CI) (1.9 (1.5–2.4)); information technology staff (wine boxplot) (median 2.5 (2.0), range (1–4), mean (95% CI) (2.7 (2.3–3.2)).

Digital environment

Digitalization of processes and robust information and communications technology (ICT) infrastructure are fundamental requirements for efficient TM services, although these should be relatively adaptable to the level of technological advancement, cognizant of the appropriateness of solutions to the local context, optimize cost-effectiveness and minimize complexity.[10,13,16] The digital environment (technology infrastructure) to support the deployment of TM was assessed in this study to be at a median beginner level across participating institutions, ranging from less than beginner level for patient records software (median 1.5) to slightly above beginner level for technical equipment. This observation is practically actionable and can be addressed with budgetary allocations and manpower development specifically targeted at installing robust health information management systems (incorporating administrative applications, clinical software and hardware) integrating a platform for TM. Although Nigeria is considered to have increased its telecommunications coverage in the last several years,[17] other related infrastructures such as challenges of interruptions in power supply, limited internet bandwidth and data costs are cogent barriers to the implementation of TM on a larger scale, including migration to real-time synchronous access rather than store-and-forward asynchronous interfaces.[15,16,18,19] This challenge is similar across less developed countries and impacts providers and users, as active mobile broadband subscriptions, the proportion of individuals using the internet, and mobile cellular telephone subscriptions are approximately 33%, 19% and 75% (compared to corresponding rates of 122%, 87% and 129%, respectively, in high-income countries).[20] According to the 2020 report of the International Telecommunications Unit (ITU), about a quarter of less developed countries lack access to a mobile-broadband network (more so in the rural than urban settings), coming short of the sustainable development goal (SDG) (9.c) to significantly increase access to ICT and strive to provide universal and affordable access to the Internet in the least developed countries by 2020.[20] For TM services to achieve full potential in Nigeria, the overall national status of ICT development has to improve.

Human resources

The human resources requirement for implementing and sustaining telehealth services include IT, administrative and health workforce and long-term commitment to developing this component is an important investment for achieving sustainable TM services.[13,16] Committing resources to and implementing well-coordinated e-health training derived from evidence-based conceptual frameworks recognizes the importance of human capacity in telehealth and also avoids the frustration of unstructured and random strategies at capacity building with a high likelihood of being unsustainable.[21,22] In our survey, most institutions self-reported being at a beginner level in this regard although all reported having taken some steps to provide qualified IT personnel for TM. It is entirely conceivable that without any concerted and proactive intervention, the current out-migration of the specialized health workforce and IT personnel being experienced as part of the current wave of 'brain-drain' potentially will further jeopardize institutional capacity to advance in this domain.

Regulation

The institutional maturity vis-à-vis regulatory requirements for TM was the least mature, with the majority indicating being least ready. This observation was a common thread even in other segments of the survey where a few questions bordering on legal or regulatory issues were encountered. For example, less than 20% of institutions were at advanced levels of maturity with regard to knowledge/clarity of all the legal issues pertaining to TM, as well as issues relating to what constitutes malpractice. Other studies report a lack of a legal framework to cover TM service delivery in their facility/locality within Nigeria,[18] and a number of studies report staff concerns about medico-legal implications of TM, issues of data privacy, impersonation and quackery.[23] A well-structured regulatory framework is crucial for a successful and sustainable TM service. The 2010 WHO report on the second global survey on eHealth noted that lower-middle and low-income countries (LMICs) had the lowest percentage of countries with policies or legislation to define medical jurisdiction, liability, reimbursement, patient safety and quality of care, and protection of privacy of personally identifiable information and privacy of individual's electronic health data. Moreover, policy-related considerations constituted the third-highest barrier to TM in LMICs (compared to being the seventh highest for high-income counties).[13]

Expertise

Under this domain, the median level of maturity was 2.0 (IQR = 2.0). This category summarizes the political will required to sustain TM after implementation. It is the drive that the institutions require for the TM services to run successfully, and incorporates tools that pertain more to the overall effect of TM services on public health. A global survey on TM utilization for movement disorders during the COVID-19 pandemic observed an increase in the utilization of different forms of TM, including in Nigeria, in a bid to reduce the spread of the virus whilst still providing some degree of care to patients; a scenario that cut across almost all fields of medicine.[18,24,25] Prior to this, in 2010, approximately 25% of LMICs cited expertise as a barrier to TM (in contrast to about 5% of HICs).[13] This demonstrates that expertise is rapidly up-scalable where an urgent need is recognized, and barriers cited as anchors for not using TM are surmountable.

Any TM service design should not just focus on the 'technology' but should employ a holistic approach that will, in addition to the technological capabilities, encompass changes in clinical processes, clinical governance, change management, clinician and patient expectations and operational sustainability.[26] A recent systematic review on TM use in sub-Saharan Africa concluded that while the policy remains the same across the region, policy makers need to develop implementation strategies in tune with the needs of the individual countries.[9] The authors recommended the establishment of relevant policies, legislations and ethical standards to govern TM use in healthcare in the region.[9] This is particularly relevant for Nigeria as there is currently no regulatory agency for TM-related matters.[27,28] From the legal perspective, there has been a call for the enactment of legislation for TM in Nigeria and a need for advocacy for a legal framework for TM.[28]

In conclusion, our survey demonstrates the current status of TM maturity (i.e. none (1) or steps taken but far from able to implement services (2)) of the federally funded tertiary health institutions that are at the fore of healthcare delivery and manpower (basic and specialist) training in Nigeria. With this level of maturity, the recommendation from PAHO is to delay implementation of TM services till a maturity level of 3 is achieved by carrying out the following interventions – setting up a task-force, ensuring a reliable internet access, specifying which healthcare services will be offered through TM, identifying IT staff specialized in complex information technologies or TM and also carry out specific legal consultation bearing in mind the regulatory issues in section V of the PAHO tool.

It is likely that the scenario in other LMICs is similar to this, especially within sub-Saharan Africa, and in some instances would certainly be a worst-case scenario. However, as systems vary in their strengths, weaknesses, and opportunities, it would be important for each system to undertake its own needs assessment using the same or similar tool to understand specific challenges that require to be addressed.

We recommend that policy makers in Nigeria re-evaluate the commitment to implementing the tripartite strategic objectives of the Global Strategy on Digital Health (2020–2025) including promoting global collaboration and advancing the transfer of knowledge on digital health, advancing the implementation of national digital health strategies and strengthening the governance of digital health at the national level.[29] These strategies promote the pillars of sustainable telehealth delivery: infrastructure and appropriate technology, policy and governance, manpower and capacity development.[13,29] Such a comprehensive approach will assure the sustainability of any existing and future TM programmes in the country.

Our world is increasingly being faced with disruptions, be it from pandemics, migration, population displacement, natural disasters or wars. Post-COVID, TM can be used to provide health services in areas affected by natural or man-made calamities, rural areas worldwide, most especially in sub-Saharan Africa and is an invaluable tool in low- and middle-income countries currently experiencing a dearth of healthcare workers.

Limitations

We acknowledge the main limitation of the study regarding the self-report nature of the data provided as we did not

conduct an actual facility inspection to verify the responses. However, we sourced responses from the administrative leadership at each institution to improve the veracity and credibility of the information. Our data are largely representative of the scenario across the nation, with the understanding that specific institutional status would vary within the sample studied, and as expected, at specific institutions not included in the survey. Notwithstanding, the geographic spread and the similarity of the profile of institutions included to other federally funded tertiary institutions across the country justifies the relevance of the findings and recommendations emanating thereof.

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