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ORIGINAL RESEARCH

Building a Framework for a More Inclusive Healthcare System

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Abstract

Objective: With the explosion in the use of telehealth technologies, it is essential to address the challenges in global telehealth inequity in order to create a path to healthcare equality. To this end, this research paper focuses on investigating telehealth as it relates to the COVID-19 pandemic and its impact on healthcare inequality, telehealth inequity, and the continued vulnerabilities with increased demand in implementation.
Study design: A set of voluntary questions were e-mailed to active members of the IEEE-SA (Institute of Electrical and Electronics Engineers Standards Association) Transforming the Telehealth Paradigm: Sustainable Connectivity, Accessibility, Privacy, and Security for all. The interview answers were analyzed via deductive thematic analysis organized into higher themes and theme-specific codes.
Setting: The country of residence varied among individuals who are the IEEE-SA Telehealth program members. These continents included: North America, South America, Africa, Asia, and Europe.
Participants: Global healthcare leaders who are active members of the IEEE-SA Transforming the Telehealth Paradigm: Sustainable Connectivity, Accessibility, Privacy, and Security for all participated. The occupations of these individuals ranged from a variety of areas within the healthcare domain, such as physicians, scientists, and public health experts.
Main outcome measure: Qualitative data obtained voluntarily from global healthcare leaders participating in the IEEE-SA Transforming the Telehealth Paradigm: Sustainable Connectivity, Accessibility, Privacy, and Security for all.
Results: The major themes that emerged from the participants' responses included: telehealth infrastructure and access, digital literacy and user interface, government regulations, and telehealth legislation.
Conclusions: Telehealth has the power to decrease healthcare disparities, thus getting closer to achieving health equity. However, there are three significant common global barriers to the implementation of telehealth: infrastructure, digital literacy, and government regulations. Because the results were based on interviewer responses, the conclusions acknowledged how the background of respondents, including their career and education, influenced their experiences and, thus, the responses. Suggestions for change in reducing barriers to telehealth accessibility are detailed in this research. These suggestions were derived from respondents and focused on the global barriers to implementation. To reduce these barriers, changes in political health policy, patient health education, health provider telemedicine support, and in regulation for telemedicine are suggested. Limitations in our research project included a small sample size and the ensuing lack of representation from more geographical regions.

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Telehealth utilization within the clinical and medical realms has its roots stemming back to the mid-20th century. Early pioneers in medicine and technology recognized the potential benefits of telehealth as this novel technology was making its way into the 1960s as a legitimized form of healthcare delivery largely due to the needs of the National Aeronautics and Space Administration.[1] Since the early days of telehealth, a

rapid expansion in innovation and utilization has followed, expanding the meaning of telehealth for patients and providers worldwide. *The New England Journal of Medicine, Catalyst*, defines telehealth as "(the) delivery of healthcare, health education, and health information services via remote technologies…".[2]

Fast forward to the 21st century, and the promise of telehealth accelerated with the introduction of the COVID-19 global pandemic commanding the need for social distancing and keeping patients from hospital emergency rooms while trying to maintain some form of access to care for non-critical patients. By April 2020, 69% of health visits were virtual (in the USA), according to Epic Health Research Network—a 300-fold increase from pre-pandemic levels.[3] Although telehealth usage has stabilized, it is believed that the need for telehealth services will continue.[1]

This begs the question: if telehealth technology has been around for so long, why are we continuing to see delays in development in the critical areas of telehealth infrastructure, such as technical, regulatory, and financial? During COVID-19, we saw that quickly removing the regulatory and financial barriers of telehealth can lead to a spike in usage, fueled by patients with access to quality internet connections and reliable technological devices. Most importantly, technological literacy granted the knowledge on how to use these tools. COVID-19 exposed many inefficiencies and the consequence of unpreparedness for a global public health crisis. The pandemic shut down global supply chains, and international and domestic travel, stalled the global economy, and, more importantly, further exposed the magnitude of healthcare inequality and its downstream global impact.

Healthcare inequality continues to be a major cause of distress within marginalized communities across the globe. As there are no perfect definitions to describe this growing global epidemic amongst marginalized populations, the Agency for Healthcare Research and Quality (AHRQ) defines healthcare disparity as: "differences in access to or availability of medical facilities and services and variation in rates of disease occurrence and disabilities between population groups defined by socioeconomic characteristics such as age, ethnicity, economic resources, or gender and populations identified geographically."[4]

How can marginalized populations, such as those who are unhoused or have a low socioeconomic status, who already experience healthcare inequality, access reliable internet to participate in telehealth appointments?

Challenges to Telehealth Access for Marginalized Populations

Marginalized individuals and populations are more likely to encounter barriers to telemedicine due to low socioeconomic status or the limitation of technological infrastructure within their respective nations.[5] A staggering 3.6 billion people (i.e. around half of the world's population) remained offline as of 2019.[5] Meanwhile, 97% of the world population lives within reach of a cellular signal, though only 53% actually use the internet.[5] Low SES (socioeconomic status communities) and homeless individuals face financial barriers to the internet and the devices necessary to utilize the internet, such as smart devices.[6] When the world's urban and rural households are considered together, 43% of households do not have internet access at home.[5] These populations of offline individuals are primarily concentrated in Africa (71.8%) and Asia, and the Pacific (51.6%).[5] Even if patients have a device, they may not have access to high-quality internet, allowing them to conduct telemedicine through high-quality video streams. Increasingly, low-income and minority populations access the internet through only their smartphones.[7] This can be a significant problem as cellular data are often lower quality compared to a wired internet connection, not to mention how expensive it can become once you exceed your monthly internet data limit. The data can be, at times, staggering—nearly 1 in 4 low-income patients lack internet access or internet speeds necessary for a telehealth video call.[8] Likewise, 39% of people 65 years and older and 25% of those with a high school education or less do not own a video-enabled device such as a smartphone.[7]

These past few years forced world leaders in healthcare to reflect on the challenges in telehealth inequity—and with this knowledge, a promise to present innovative solutions in creating a path toward global healthcare equality.[9] The COVID-19 pandemic did not cause healthcare disparities; it only further exploited what was already present for decades within the realm of healthcare inequality. While many discuss preparation for the next pandemic, this research paper will survey and analyze the answers of global leaders in healthcare industries worldwide. This research focused on highlighting the immediate growing challenges of a global epidemic of healthcare inequality, telehealth inequity, and its continued vulnerabilities in the ever-changing landscape of global healthcare.

Setting

Institute of Electrical and Electronics Engineers Standard Association (IEEE SA)

The IEEE SA is a global organization that develops technical standards within a remarkably broad range of industries, including artificial intelligence, biomedical, healthcare, information technology, and telecommunications, to name a few.[10] Within the IEEE SA, an incubator program, *Transforming the Telehealth Paradigm Sustainable Connectivity, Accessibility, Privacy, and Security for All Industry Connections Program* brings together multidisciplinary volunteers from around the globe to identify

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and establish the necessary framework to enable security, accessibility, and privacy in telehealth technologies for all patients.[10] As an established multi-disciplinary program, contributors come from all corners of the globe representing an expansive list of entities that focus on healthcare, technology, research, academia, cybersecurity, and governmental regulations, amongst others.[10]

Background of Participants

The professionals participating in this activity have demonstrated an innovative knowledge of healthcare technologies working toward providing accessible and sustainable solutions in the telehealth paradigm worldwide. In this study of 11 international participants, five were physicians, three were global tech leaders, and three were other researchers and policy experts. Due to the expansive transdisciplinary experience the individuals interviewed for this paper have obtained throughout their careers, the interviewees' current occupations were noted for purposes of quantifying occupations. The e-interview questionnaire used in this study can be seen in Appendix A. These questionnaires were distributed through e-mail to potential interviewees, and answers were recorded and centralized using Google Drive. Individuals participating in this study are listed in Appendix B. E-Interviewee Profiles.

Methods

Participants chosen from the IEEE SA industry program were volunteers in the Transforming the Telehealth Paradigm industry connections initiative. All participants were identified as having a working knowledge of telehealth practices and having significant experience in the field both globally and within their respective nations. To understand the perspective of these global leaders in medicine and medical technologies, participants were contacted with the primary goal of attaining the highest responses from five continents. A total of 15 volunteers were contacted through email, with 11 responses received over 4 weeks (Table 1). Seven questions were asked of each participant, but it was optional for all questions to be answered. Participants were encouraged to answer questions about their experiences and observations that fell within their expertise.

Questions focused on the expertise of the professional within their respective nation, region, and organization. Questions were formulated to understand better the regional challenges experts have encountered in their line of work. The goal was to allow for a closer look into healthcare challenges from a physician's perspective, a patient's perspective on accessing healthcare, and a federal and global perspective.

The approach to analyzing these responses was largely inspired by deductive thematic analysis. The research team created codes based on e-interview responses documented via Google Drive and manually coded by three research team members. Research team members discussed and then reached a consensus on coding language. Codes were distributed into higher-level themes based on patterns identified in the codes listed in Table 2.

Table 1. Table of geographical regions

Location	Number of Interviews
USA	3
Ethiopia	1
Nigeria	1
Africa	1
Canada	1
Brazil	1
India	2
United Kingdom	1
Totals by continent	
North America	4
Africa	3
South America	1
Asia	2
Europe	1

Results

The majority of professionals envisioned a positive future in which telehealth technologies will be utilized to help further telemedicine and reduce telehealth inequities globally. Major differences in answers regarding telehealth and healthcare barriers can be appreciated by taking note of each professional's regional location. Throughout the analysis of e-interview answers, three major themes included: (i) telehealth infrastructure and access, (ii) digital literacy, and (iii) government regulations and telehealth legislation.

Theme 1: Telehealth Infrastructure and Access

Code(s): Socioeconomic Status

On many occasions, the professionals within the IEEE SA acknowledged the significant impact that socioeconomic status can have on healthcare and, subsequently, telehealth access. Globally, participants agreed that those of low socioeconomic status face obstacles to receiving quality healthcare, both in-person and via telehealth. These patients often do not have the means of traveling to their appointments, as they cannot afford transportation or they cannot afford to take time off of work. Similarly, others do not have the financial means to afford internet access, which precludes them from being able to have broadband and access the internet.

> Lower income families couldn't afford to travel to the larger hospitals for care, instructions to receive

Table 2. Interview theme and code guide

Theme	Code	Definition
Telehealth infrastructure and access	Socioeconomic Status (SES)	GTEs refers to SES as the financial standing/resources of patients that may help or hinder their ability to access healthcare and telehealth services.
	Access to Healthcare Services	GTEs discuss barriers that could preclude access to healthcare for patients, often exacerbated by low SES, geographic location and individual level of education.
	Region Specific Infrastructure	GTE commentary on local telehealth infrastructure stressed the importance of the difference and impact of local infrastructure (e.g. telephone access, Wi-Fi and data access).
Digital literacy and user interface	Ability to Navigate Telehealth Technologies	GTEs convey that having familiarity with devices used in telehealth technology can make it easier for patients to use telehealth tools.
	Individual and Community Education Level	GTE's commentary on education focused on the importance of educating persons and communities on telehealth service access and usage.
	Inclusivity of Innovation in Telehealth Technology	GTEs discuss making telehealth technology user-friendly/available to diverse patient populations in their communities through differences in backgrounds such as in age, language, abilities, etc.
Government regulations and telehealth legislation	Immediate Geographic Jurisdiction	GTEs express limitations in the implementation of improved telehealth measures given restricting legislation in many geographical locations.
	Healthcare Provider Compensation for Telehealth Services	GTEs demonstrate the inconsistency in monetary compensation provided for rendering telehealth services as a healthcare provider as services can often be denied for reimbursement.
	Political Support and Implementation of Policies	Many GTEs expressed the importance of support from governmental and political entities in implementing widespread and easily accessible telehealth infrastructure.

GTE: Global Telehealth Expert in this table refers to a person identified by the IEEE SA (Institute of Electrical and Electronics Engineers Standard Association) as an expert in their industries and who completed the questionnaire (Table 1). SES: socioeconomic status communities.

> care weren't available in all languages, and to receive Telehealth services required some basic technical literacy. (Michael Carter, MBA)

> Despite the effort to pursue these principles, for several reasons, there is still a long way to deliver them to the entire Brazilian population, especially to the most vulnerable. There are inequalities between regions and socioeconomic classes, with the poorest being most affected by the determinants of diseases, resulting in higher rates of mortality and morbidity. (Jefferson Gomes Fernandes, MD, PhD, MBA)

> In Africa…patients typically have access to only private healthcare, which means self-funding, which in turn means that the lower socioeconomic groups cannot afford treatment, ultimately leading to an under-diagnosed population of people. (Tina Barton, PhD, MBA)

Code(s): Access to Healthcare Services

Global experts stressed the importance of an individual's ability to access healthcare services within their communities. Geographic limitations can pose a significant barrier to patients being able to see a physician. This is especially seen in rural communities, where there are not many readily available healthcare resources, and patients are far from health centers. Additionally, there may be financial barriers to stable, long-distance transportation, if readily available, which can hinder the patient's potential to acquire adequate healthcare. Once established in communities like these, telehealth services have the capacity to rectify these issues.

> While telehealth and other digital solutions cannot address all obstacles to clinical trial participation, it can help mitigate certain barriers, including access to trial sites and financial and temporal constraints on participation. For many participants, distance from the trial site is a primary limiting factor. For would-be participants located in rural communities or in areas distant from clinical trial centers, travel to trial sites may be difficult or even infeasible. This limits the geographic range for participants and, depending on the patient population of trial sites, could also restrict diverse participation. These barriers constitute a sometimes insurmountable participant burden, which telehealth in combination with digital health tools has the potential to alleviate. (Sandhya Polu, PhD)

> The three delay's model has been used to describe the barriers to care in maternal health… and the possible points of intervention. One of those delays is the delay in accessing quality care at a healthcare facility. This is where telehealth can be utilized to

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curb the geographic barrier to receiving appropriate care throughout a woman's pregnancy, birth and the next crucial days of postnatal care. (Nebiyou Ermias Petros, MPH, MBA)

Code(s): Region-Specific Infrastructure

Though telehealth has the potential to reach marginalized populations in need of medical access, setting up the framework for these services is an essential first step. Establishing telehealth services in widespread regions requires building broadband infrastructure and ensuring that patients have the tools to get online using computers or smartphones. Many individuals do not have these resources, so they are unable to communicate with healthcare providers. Solutions proposed by global experts include utilizing popular technological tools and encouraging private and public entities to work together more efficiently in addressing the lack of regional infrastructure. Respondents detailed the immense barriers to telehealth resulting from the lack of telehealth infrastructure and the global impacts this can have.

Rather, private organizations and some individuals in government are making efforts to upgrade in the digital health space locally, regionally and globally. [There is no] clear evidence that the government or the private sector is doing enough to assist struggling people to access and/or learn how to utilize these services for healthcare needs in Nigeria. There has been a massive increase since 2001 in telephone access and digital access since the liberalization of telecommunication in Nigeria with the majority of the semi-urban areas now connected and accessible for data and telephony services, this is an advantage waiting to be explored. (Magnus Chinemerem Ogaraku, MD)

The challenges for quality access to telehealth/virtual care is based upon the quality of the broadband connections within communities. (Keith Thompson, MD, FCFP)

…there are three groups of people: Those with reasonable and consistent access to technology; those with intermittent and limited access and lastly those with no access at all. The best and most used communication tool in Africa is WhatsApp. Hence to make a significant difference, utilizing a tool with such a high level of penetration and reach can provide real impact. Telehealth inequality can therefore, in Africa, be defined as: the vast disparity by country, by social economic groups, different levels of education and local infrastructure all overshadowed by the inconsistency of power (i.e., electricity) with all countries experiencing varying levels of outage. (Tina Burton, PhD, MBA)

In our country [of India] the internet is definitely not available to everyone. Even the devices used to access telemedicine are not available with everyone. People in the rural areas especially might not have access to smartphones or other devices. (Haleema Yezdani, MBBS)

Theme 2: Digital Literacy and User Interface

Code(s): Ability to Navigate Telehealth Technologies

Digital literacy, user interface, and language barriers go hand in hand when it comes to global telehealth inequity. Global experts expressed the importance of educating marginalized communities on the functionality of technological devices. While operating these technological devices may come more naturally to some, the user interface might still act as an inhibitory factor in utilizing telehealth. User interfaces that are difficult to operate can pose major issues for individuals attempting to navigate the telehealth portals. This issue is further exacerbated when the patient's first language does not match that of the user interface. Ultimately, this serves to discourage them from utilizing these services to schedule appointments or communicate with their providers.

Digital illiteracy compounds issues of internet access. Without a minimum ability to navigate and use websites, patient portals, online scheduling, and digital health technologies effectively, the promise of telehealth will remain elusive for many, particularly for poor, rural, and elderly populations. (Sandhya Polu, PhD)

Low digital literacy and language barriers play an important role in its poor acceptance. Complex user interfaces and inattention to user experience are some of the probable reasons. Moreover, a large majority of these services are designed for an educated and English-speaking audience, leaving tele-health a luxury for the rural as well as urban uneducated Indian. (Prabhakaran Dorairaj, MBBS, MD, DM, MS)

Within our ambulatory virtual care services at Mass General Brigham, we observed patients from all ages and socio-economic segments participating over Telehealth throughout the pandemic, but there are many who weren't able to leverage Telehealth either due to the fact they didn't own a computer, or have a mobile data plan, or were not comfortable with the technology for a variety of reasons. This would point to digital literacy to be one of the

> biggest factors in my geographic area. However, the challenges…are not mutually exclusive. For instance, digital literacy and having the technology available in your native language could be related. (Michael Carter, MBA)

Code(s): Individual and Community Education Level

Education is a major pillar within the healthcare industry, specifically telehealth. Global experts have stated that there is a crucial need to educate not only individuals but more importantly healthcare systems, communities and regions on how to access telehealth and have proper resources in place to identify support systems. While taking a top-down approach to expanding telehealth technologies to all communities is great in theory, a more bottom-up approach will be needed to educate individuals on how to properly use and benefit from telehealth services.

> ...if the Telehealth industry could obtain high quality clinical services, and ensure there is access to all, that would be a great step forward. However, quality care and access are only part of the issue, we can't forget the "last inch" in this work and that is we need to educate people, health systems, and communities on how best to access these services and who to look to for support. (Michael Carter, MBA)

> Telehealth inequality can therefore, in Africa, be defined as: The vast disparity by country, by social economic groups, different levels of education and local infrastructure all overshadowed by the inconsistency of power (i.e., electricity) with all countries experiencing varying levels of outages. (Tina Burton, PhD, MBA)

Code(s): Inclusivity of Innovation in Telehealth Technology

Participants stressed the importance of increasing inclusivity in telehealth technological innovations so that broader, often marginalized, populations are able to successfully use these tools and access the quality care they need. Industry leaders must take a more aggressive approach to achieve this expansion in diversity. Experts referred to inclusivity in a wide range of capacities, including differences in abilities, language, age, housing status, and education.

> There is of course the risk that designing Telehealth solutions and policies without considering digital equity and inclusion in designs— various digitally vulnerable groups might be excluded from Telehealth services and the digital health and virtual care they provide access to. For example, age and disability are significant inequity exacerbation factors in low- or middle-income countries, both in terms of the population coverage on which evidence for health policy relies, as well as in terms of excluding these population groups from access to innovation and its broader (social value) validation. (Dimitrios Kalogeropoulos, PhD, MPhil, MSc)

> Telehealth or virtual care inequity is displayed among individuals challenged by physical or mental impairments that are barriers to access of virtual care health services. (Keith Thompson MD, FCFP)

> Neglecting affordability, language, digital literacy and technology barriers during design, deployment and delivery of telehealth services are key contributors to inequality in telehealth. The utilization of telehealth in India remains sub-par in rural as well as urban areas…Moreover, a large majority of these services are designed for an educated and English-speaking audience, leaving tele-health a luxury for the rural as well as urban uneducated Indian. (Prabhakaran Dorairaj, MBBS, MD, DM, MS)

Theme 3–Government Regulations and Telehealth Legislation

Code(s): Immediate Geographical Jurisdiction

Select global experts made note of their region-specific jurisdictions that impeded the expansion of telehealth use amongst their respective nations. Legislative limitations can have direct impacts on the extent to which telehealth programs can be implemented. If the implementation is restricted or prohibited due to legislation, the benefits of telehealth treatment options are vastly rendered moot. Telehealth impacts in one region can differ drastically from those in another due to the limitations of legal support for telehealth measures. Impacts made after the passing of pro-telehealth laws are documented and well-received amongst the expert's region of expertise. As noted by respondents, most regulations directed toward telehealth medicine to date have been rendered as an emergency response. This is seen clearly with the COVID-19 pandemic, as telehealth legislation was prioritized for virtual healthcare.

> With the Covid-19 pandemic the Brazilian Ministry of Health published an ordinance in March, which was followed by a new law by the National Congress in April 2020, both authorizing the use of telemedicine in all its modalities, including doctors' teleconsultations with patients. This brought a new era for digital health in the country with an exponential growth. Now there are thousands of teleconsultations daily provided by different health organizations, companies and by doctors themselves. The benefits are immense. (Jefferson Gomes Fernandes, MD, PhD, MBA)

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> From a patient perspective it is my opinion that the US state licensure laws for providers need to be broader after the public health emergency (PHE) is lifted by the [federal government] in the states. Otherwise, our sickest patients who need access to specialists won't be able to receive care if they live in a state where that specialist is not licensed. This is exacerbated by the fact that many patients in this category who were able to receive care under the PHE waivers may not be able to once the PHE is lifted. (Michael Carter, MBA)

Code(s): Healthcare Provider Compensation for Telehealth Services

Despite the benefits of telehealth services, physicians might remain limited in their options to implement telehealth care. Provider compensation extends beyond legislative support for the services. Monetary support can be limited and misaligned with insurance reimbursements due to poor reimbursement systems. This can lead to underfunding for many clinical practices and poor physician reimbursement in some regions. Billable telehealth costs in many regions face fiscal boundaries promoted by restricted telehealth funding in some regions. For instance, the limitations on reimbursements for virtual calls over in-person encounters and the subsidization of these services for healthcare providers can cause roadblocks. Billing regulations in certain jurisdictions can limit the reach of telehealth benefits and can curtail the progress of physician backing due to poor fiscal support. As stated by global experts, physician compensation and attitudes also play a role in the widespread adoption of telehealth practices. Government support of telehealth programs could help alleviate some of these issues while expanding healthcare access for patients.

> The last of these problems is Healthcare professionals' poor attitude to change including in Telehealth, [which] may be solved with clear reimbursement systems embedded in the services as well as advocacy. Australia made physical patient consultation almost at par with remote patient consultation. This led to almost 97% telehealth coverage of the large country with far-flung territories. This may be replicated in Nigeria and Africa. (Magnus Chinemerem Ogaraku, MD).

> Still in its [proof of concept] phase, the challenge in addressing the inequity of virtual care access for this population is the allowance of sustainable provincial health insurance funding to offset the costs of the technology and its infrastructure supports. The current government regulations for billing demand that house call fee codes (Currently $45.10 per patient encountered) are only eligible for face-to-face encounters and virtual is disallowed. (Keith Thomson, MD, FCFP)

> In November 2019, OTN [Ontario Telemedicine Network] announced the Evisit Program. This program allowed primary care physicians that were registered users for the OTN program, to send links to patients that would allow video links to encounter patients at home. The cost of the physician service was covered under the Provincial Health plan and so there was no additional cost to patients other than the cost of connectivity in their homes. (Keith Thomson, MD, FCFP)

Code(s): Political Support and Implementation of Policies

Support for telehealth services is largely limited to the health policies that reinforce them. Respondents emphasized how governmental and political processes can impact the implementation of new infrastructure, specifically televideo conference systems used in healthcare. The implementation of telehealth services is often limited to the legislation in site-specific regions. This extends to the regulation of telehealth practices, as some regions have extreme limitations placed on telehealth services. This is contrasted with underdeveloped nations that often have little to no regulation. The support for telehealth services must be supported by a region's health policies, but must also be well supported by those who have the opportunity to implement such services. As noted, the political support for telehealth has been well received as legislation was developed in India in anticipation of virtual healthcare needs during the COVID-19 pandemic. This was also seen in Brazilian political territories as the political sector surrounding telehealth has been catapulted to the forefront of health policy. To maintain the progress of telehealth use, continued political support must be aligned with the goals of telehealth practice.

> In an attempt to improve the utilization of telehealth in India and anticipating its increased need during the COVID19 pandemic, the Medical Council of India released the Telemedicine practice guidelines in March 2020. In addition to clearly stated directives for physicians, the document served as a symbolic acknowledgement of the legitimacy and need for telemedicine by the Indian policy makers. (Prabhakaran Dorairaj, MBBS, MD, DM, MS)

> The biggest challenge is still the issues of legislation and regulation of telemedicine. However, reimbursement, a culture of innovation and new models of healthcare are equally important. Political will, investments, strategic vision and management competences are also relevant, mainly in the public health sector. (Jefferson Gomes Fernandes, MD, PhD, MBA).

A "Parliamentary Front in Telehealth" was created at the Brazilian National Congress to discuss the elaboration of a bill to make the use of telemedicine definitive, mainly of direct teleconsultation to patients, throughout the national territory. (Jefferson Gomes Fernandes, MD, PhD, MBA).

[In India], there are reforms like National Health Mission and eSanjeevani, which are government portals for telemedicine. [There are also] many more private sector [entities] who offer Telemedicine services to the patients. (Haleema Yezdani, MBBS)

The overarching national digital development strategy and policy dimensions. In (low to middle income countries) telehealth and digital health development at large has traditionally relied less on the industry to develop such services but on centralized government provided services with the industry participating as implementation contractor. With such an arrangement, significant digital determinants of health (DDH) are overlooked and so are the needs of vulnerable population groups, including (i) older adults, (ii) migrants, (iii) mental health service users, (iv) high users of health services, and (v) the unemployed. This strategy is now changing, with international development partners adopting a new approach to telehealth as a global good and a new paradigm for ecosystem-building for sustainable digital development. (Dimitrios Kalogeropoulos, PhD, MPhil, MSc)

The best example of a sustainable and mature telehealth system within Canada is the Ontario Telehealth Network…This government funded program within the Province of Ontario was founded in 1998 as the Northern Ontario Remote Telehealth program to facilitate connecting patients in northern communities with specialty clinics…In some regions patients with limited access to internet or those that do not have connected devices, local health regions have funded access and cost of data using cell phone networks for tablets loaned to patients. The cost of funding these devices for patients faced with barriers of access or inequity of access, is offset by the savings for reduction in hospital admissions or ER transfers…The OTN system in Ontario is fully mature as a telehealth ecosystem, now supported by local, regional and Provincial Health authority. (Keith Thomson, MD, FCFP)

Discussion

The respondents in this study expressed largely positive opinions regarding the importance of telehealth and the implications it could have on reaching historically marginalized populations. They also detailed the many obstacles to the implementation of expanding healthcare in various regions across the globe, acknowledged barriers that currently exist in telehealth for patients and proposed possible solutions to consider for the future.

Respondents for this research were chosen with a global approach in mind. Geographic location was one of the largest segregation factors in global expert input on telehealth medicine. Focusing on the input from interviewees through a global perspective lens provides a unique and uncharted analysis of how telehealth perspectives can change due to geographic location. Less developed geographic locations, such as some regions in India and Africa, place a larger emphasis on access to connectivity in rural regions. These locations are likewise concerned with a wider digital literacy gap. Locations such as the United States and Brazil generally place a larger emphasis on the affordability of technology needed for telehealth innovations rather than access to such technologies. Though the participants consulted for this study came from five continents and seven countries, three major themes emerged from the interviews that were similar throughout: (i) telehealth infrastructure and access (ii) digital literacy and user interface, and (iii) government regulations and telehealth legislation. These themes were noted to share major similarities in barriers to healthcare equity throughout the world.

Telehealth infrastructure continues to be a major hurdle toward the goal of ending global health inequity. In some African countries, less than 10% of the annual GDP is allocated toward healthcare expenses.[11] This brings into question if the required resources are even present to support such efforts in telehealth at this time in these regions. Additionally, participants noted that the issue goes beyond simply providing individuals with a Wi-Fi-enabled device. The real challenge begins on a regional level—communities need electricity, Wi-Fi towers, and technologically sound infrastructure to facilitate care via telehealth.

While providing regions with telehealth-enabling infrastructure and individuals with telehealth-capable devices is a necessary start, there still remains a major hurdle—digital literacy. Digital literacy plays a large role in the inaccessibility of telehealth care. This might be because the technology is not available in the native language of the individual or because the patient does not have previous experience using this type of technology. This type of inequity is especially evident in more rural communities. This points to a global need for greater patient education and assimilation of telehealth technology so that widespread adoption and utilization can be made possible.

Legislation is another global barrier to making telehealth easily accessible. As legal regulations differ regionally, local and federal government support is crucial to

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implementing telehealth so more populations can obtain quality healthcare. Federal legislation is important to procuring the necessary financial and material support for implementing telehealth infrastructure. Overall, experts concurred that some government regulations would help alleviate rather than increase health inequity by way of telehealth. This is supported by Canada's Ontario Telemedicine Network, which was founded in 1998 and in the decades since, has expanded to providing care to patients in rural areas, as well as other under-resourced areas. And the cost for this program is supported by local and federal government programs and policies. In the US, experts mentioned that having broader physician licensure laws would allow providers to practice in more locations and thus care for more patients. Many countries, such as India and Brazil, passed legislation during the pandemic that enabled easy access to telehealth in this emergency situation. Experts contend that having similar laws in place post-pandemic would allow this same access to telehealth care for broader populations, and work could be done to make telehealth even more effective and accessible, not just in emergencies.

In addition, the occupation and professional background of respondents also play a key role in creating distinct trends in expert responses. Physician responses focus on barriers to implementation from the perspective of the healthcare provider, focusing on patient health education, barriers to care in telemedicine, and the regulation of compensation in telehealth care. However, those healthcare leaders with a position focused more on administration tend to focus on the implementation of telemedicine with the patient's access to technology at the forefront of concern. This extends to the medical institution's access to the necessary technologies and programs to implement telemedicine successfully.

To implement changes that will promote reducing barriers to accessing telehealth in the future, the challenges to telehealth use and barriers to implementation despite the growing demands of virtual healthcare must be understood. Although there are many challenges in making healthcare and telehealth more readily accessible to a wider population, especially marginalized or vulnerable populations, interviewers presented a clear direction forward through key recurring themes. Respondents detailed suggestions for change in reducing barriers to accessing telehealth in the future and moving toward a more inclusive and equitable telehealth infrastructure. These suggestions ranged from increasing health education to focusing on the sustainability of telehealth resources and the continuity of telehealth practices and policies.

Limitations

The study is limited by its small sample size, with 11 global experts used to represent issues experienced by patients and providers around the world. A future study would benefit in having interviews from experts from every continent, with representation from more countries and occupations. Similarly, the respondents were all volunteers of the IEEE, so the study focused on experts with that perspective. Future research studies might collaborate with other reputable organizations that have reach in similar industries.

One of the goals of this study was to understand global challenges to telehealth and healthcare inequality encompassing diverse stakeholders' perspectives. To obtain a more detailed breakdown of these challenges, future research studies could be conducted that include the patient's point of view. Patients could be directly contacted, perhaps by an anonymous survey, and asked about their experiences with telehealth and challenges to accessing healthcare. This would paint a complete picture of challenges in achieving equitable access to healthcare and could elucidate findings from this study, as well.

Further, all questions in the questionnaire were not answered by the respondents, as they were directed to answer only those reflecting their expertise.

Conclusions

This research examined the emerging issues surrounding telehealth medicine and the perpetuating inequity seen on a global scale in telehealth services. Telehealth medicine has the opportunity to play a large role in the future of personal and community healthcare but faces ever-present barriers in global implementation. As noted by one participant, telehealth medicine has clear benefits for the health of patients and communities, and "the delay in its implementation will bring unwanted harmful consequences for everyone." (Jefferson Gomes Fernandes, MD, PhD, MBA). These benefits can be masked by social and political determinants that span multiple geographical locations. The main barriers to the global implementation of telehealth medicine are seen in varying socioeconomic barriers, hindrance of access to technologies, and lack of political support for the varying aspects of telehealth care.

Healthcare is a rapidly changing field that requires innovative measures if it is to continue to provide the best care, and telehealth medicine needs a path forward to advocate for this innovation. This research has identified the implications of poor health equity in telemedicine and presents a generalized perspective on how the global telehealth community can move to increase the implementation of these services. Additional research is necessary to present a solution to the main issues presented throughout this research. The perspectives presented in this work are indicative of global experts in telehealth medicine and are representative of the issues in telehealth inequity today. How to best address these concerns can still be

addressed with additional input from experts in the field and additional input from the global regions sampled in these presented interviews.

Telehealth medicine is a critical tool in achieving widespread equitable care on a global scale and its implications within global healthcare cannot be understated. Achieving equitable access to telehealth services for global populations is essential for moving this technology forward and the continuous improvement of access to telehealth and equitable service is necessary.

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Appendix A. E-Interview Questionnaire

Global Telehealth Inequity Questionnaire

Expert Questions:

1. How have you witnessed or experienced (with your patient or fellow citizens) the impact of healthcare inequality? Based on your expertise and experience, do you find that quality access to telehealth services would mitigate some or most of these challenges?
2. How would you define Telehealth Inequality based on your experience and what you have witnessed in your geographic region (by country or continent)?
3. What have you identified as the greatest challenge impeding universal and quality access to telehealth within your geographic region?
4. How do you define quality and sustainable access to telehealth services? Do you find that quality and sustainable access to telehealth services will minimize the impact of healthcare inequality in the system?
5. Are there any new policies or discussions to advocate for or increase use and/or access to telehealth services "after" the pandemic?
6. Are there any government or private services to assist struggling populations to access and/or learn how to utilize these services for healthcare needs? If available, are patients aware of them, or are they underutilized? Are more needed?
5. Is there a statement or perspective you would like to include regarding this issue at either a global or regional level to bring attention as a challenge or opportunity in this area?
6. Are there any government or private services to assist struggling populations to access and/or learn how to utilize these services for healthcare needs? If available, are patients aware of them, or are they underutilized? Are more needed?
7. A statement or perspective you would like to include regarding this issue at either a global or regional level to bring attention as a challenge or opportunity in this area.

Important notes:

- Please respond to the questions above accordingly.
- When responding to the questions, please include any and all sources (author, entity, title of work, website URL, date of publication) to data references. If you are using an infographic or chart not created by you or someone in your organization, you will need permission from the author or creator of the graphic for us to repurpose into this article.
- The final article will be shared with all contributors before publishing for approval of how their content was integrated into the article.

Appendix B. E-Interviewee Profiles

Global Telehealth Expert Profiles

- Physicians: 5
- Scientists: 3
- Global tech leaders: 3

Michael Carter, MBA

- Expertise: Senior Manager, Virtual Care Platform Strategy
- Region: Massachusetts, North America

Jefferson Gomes Fernandes, MD, PhD, MBA

- Expertise: Vice-president, Brazilian Association of Telemedicine and Telehealth and Director of the Education program for the International Society of Telemedicine and eHealth
- Region: Brazil, South America

Tina Barton, PhD, MBA

- Expertise: COO of eMQT: Drug development specialist, clinical trials, start-up
- Region: Africa

Sandhya Polu, PhD

- Expertise: Global public health, biosecurity, federal and state governmental public health advisor, PhD in History covering infectious disease in India
- Region: Boston, USA

Nebiyou Ermias Petros, MPH, MBA

- Expertise: Health informatics, clinical data, and standards specialist
- Region: Ethiopia, Africa

Magnus Chinemerem Ogaraku, MD

- Expertise: AG Director of Health Services at Federal University Lokoja
- Region: Nigeria, Africa

Haleema Yezdani, MBBS

- Expertise: General Physician
- Region: India, Asia

Keith Thomson, MD, FCFP
- Expertise: Adjunct Faculty in the Department of Family Medicine
- Region: Canada, North America

Prabhakaran Dorairaj, MBBS, MD, DM, MS
- Expertise: Chronic health disease research, public health, epidemiology
- Region: India, Asia

Narendra Mangra, MS, MBA
- Expertise: Principal of Globenet LLC, Wireless telecommunications, public safety, telehealth
- Region: Washington DC, USA

Dimitrios Kalogeropoulos, PhD, MPhil, MSc
- Expertise: Senior Independent Advisor for Global Health Innovation
- Region: United Kingdom, Europe

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