Review Article:

Digital Health Literacy, Technology Services and Health Equity in Developing Economies - Concept, Challenges and Recommendations

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Abstract

In view of technological advances, the need for digital health literacy in today's society cannot be overstated. This is particularly the case in low-and-middle-income countries due to poor health resources and manpower. This paper aims to provide an overview of digital health literacy, its use, challenges and possible recommendations to promote health and ensure health equity in today's low- and middle-income countries. During the recent COVID-19 pandemic, people around the world experienced the impact of digital health technology by changing the way healthcare is delivered through telemedicine/telehealth and telerehabilitation to online teaching in schools. However, these are not uniform, as there are differences between countries, with low- and middle-income countries being at a disadvantage, and socio-economic and systemic factors playing an important role. Digital health technologies have been shown to have the potential to empower individuals and improve the efficiency and effectiveness of healthcare services. They were used in particular for the provision of mobile health services in the form of devices, short messages and mobile applications. In addition, these technologies can improve disease diagnosis, monitor patients, promote healthy lifestyles and support health research. Thus, access to digital health literacy has the potential to promote individuals' health behaviors and reduce the risks associated with the use of health services or poor health care. Therefore, low-and-middle-income countries must strive to identify, subsidize, and apply or freely make digital health/information accessible.

Keywords:

Digital health, technology, equity, low-and-middle-income countries

Introduction:

A state of health equity means avoiding inequalities in access to health services that make them unjust or unfair[1]. This includes a commitment to reducing or eliminating existing health inequalities or their determinants[2]. Ensuring health equity means seeking to achieve the highest possible standard of health for all, with particular attention to their needs, including access to digital health[3]. Digital health is a medical subspecialty that includes the use of technological applications to obtain health information and use or improve the delivery of health services[4]. Digital health uptake has the potential to improve the efficiency and effectiveness of medical services[3]. It also has the potential to empower health consumers to make better-informed decisions about their health and to support the early detection and prevention of diseases and other life-threatening conditions[3,4].

The World Bank divides the global economies into four categories based on gross national income (GNI) per capita in the 2024 fiscal year[5]. The first category is low-income economies, with countries in this category having a GNI per capita of 1,145 dollars or less[6]. The second category is low- to middle-income economies with a GNI per capita of between 1,146 and 4,515 dollars[6]. This is followed by upper middle-income countries, whose GNI per capita is between $4,516 and $14,005, while high-income countries have a GNI per capita of $14,006 or more[6].

The common premise and concern of this paper is low to middle income economies. To provide a brief overview of digital health literacy, challenges and the use of health technologies in today's low- and middle-income countries to promote health and ensure health equity, this paper is dedicated to promoting health and ensuring health equity in low- and middle-income countries.

State of inequality in low-and middle-income countries as compared to the high-income countries.

Global population was estimated at 8.2 billion people in mid-2024; and the population was projected to be 10.3 billion in mid-2080[7]. It has been proven that over a billion people live on < $1/day, while 2.7 billion people live on < $2/day[8]. To view it differently, the richest 10% of the world's population have 52% of the world's income, while the poorest half of the population earns 8.5% of the world's income[9]. The average income of a person belonging to the richest 10% of the world's population is US$122,100/year[9]. The individual from the poorest half of the category earns an average of 3,920 US$/year (Table 1)[9].

There are 6.9 (83.7% of the world population) people living in low- and middle-income countries, of whom 3.5 billion are men (50.3 %) and 3.4 billion are women (49.7 %)[10]. The total population growth rate of these regions was 0.97% for the year 2024, and the population will increase by 66.7 million people by 2025[10]. The popula-

tion of low- and middle-income countries was 1.8 billion in 1950, but rises to 6.9 by 2024, an increase of 282.7% in 73 years[10]. To be specific, in Africa the poor make up 60.8% of the population, but only have 36.5% of the total income; however, 4.8% of the population are said to have 18.8% of the total income[8]. This makes low- and middle-income countries, and Africa in particular, the second most unequal continent in the world[8]. This inequality could be due to higher tax revenues and income inequality, which are linked to and can exacerbate other forms of inequality (Table 1)[11].

The population of high-income countries reaches 1.3 billion people in 2024 (15.4% of the world population), with an equal gender distribution (50%), and an overall population growth rate of 0.25% for the year 2024[12]. Remember that in 1950, 692.7 million people lived in high-income countries; by 2024, this figure rose to 1.3 billion, which corresponds to an increase of 82.6% in just 73 years[12]. By 2025, the population of high-income countries is expected to grow by 3.2 million people[12]. The Gross Domestic Product (GDP) of these regions amounted to USD 68.3 trillion in 2023 and per capita income to USD 48.852.7[13].

Annual GDP growth in high-income countries was 1.8% with an unemployment rate of 4.3%[13]. In some of these countries, including Canada, the richest 10% of the population earn 36% of the national income, while the poorest 50% receive only 17%[14]. The richest 10% of New Zealanders receive 35% of the national income, while the poorest 50% receive 21%[14]. The wealthiest 10% of Americans receive 47% of the national income, followed by the middle 40% who receive 40% and the bottom 50% who receive 13%[14]. While in Australia the richest 10% receive 33% of the national income and the lowest 50% receive 17%, the richest 10% in Romania and Bulgaria receive 40% (Table 1)[14].

The estimated African population is 1.5 billion in 2024, with population growth of 100 million every three years; it has been predicted that the continent could account for half of global population growth[15]. This could be due to the fact that the continent is said to have had the highest fertility rates in the world 4.1[15].

It has been proven that Africa's share of the world's population was 9% in 1950 and 13% in 2000 and is expected to be 26% and 38% by 2050 and 2100 respectively[15]. This means that by 2050, one in five people in the world could come from Africa and that five of the eight countries are expected to account for half of global population growth in 2050, with Nigeria expected to be the third most populous country in the world (Table 1)[15].

Educational attainment has fallen worldwide, with international assessments showing a downward trend in reading literacy: 25% in science, 31% in math and 26% in reading[16]. This clearly shows that a large number of people are not meeting the required basic academic standards. In low-

and middle-income countries, 81% of boys in the richest quintile are likely to complete their education, compared to 26% in the poorest quintile in urban centers[17]. Particularly, the average level of education is very low in large parts of the Sahel region in sub-Saharan Africa[17].

Development aid accounts for 13% of total education funding, and the future of education in low-income countries is challenged by budget constraints and demographic changes[17]. Between 2020 and 2021, funding for education in these countries decreases by 7%[17]. In support of this evidence, the average education expenditure per student in low to middle-income countries is between USD 56 and USD 890, compared to USD 11,655 in high-income countries[17]. It can be deduced from this that the average education expenditure per student in high-income countries is two hundred times higher than the expenditure in low-income countries and thirteen times higher than the average expenditure per student in middle-income countries[17]. In sub-Saharan Africa, it has been demonstrated that 8% of secondary school-age children and 1 in 5 primary school-aged children do not attend school, and that 6 out of 10 young people do not attend school (Table 1)[18]. These point to the fact that the educational gap is glaring in most countries.

According to research, 81% of people living in urban areas worldwide have access to the Internet in 2023, compared to 50% of those living in rural areas, or a ratio of 1.6[19]. Specifically, in high-income nations, 95% of urban areas have internet connectivity, whereas only 88% of rural areas have[19]. In contrast, in low- and middle-income countries, 47%-85% of urban dwellers have access to the Internet, compared to 17%-72% of rural dwellers[19]. This suggests that internet usage is almost three times higher among urban inhabitants[19]. The ratio is 1.2 in the United States and the Commonwealth of Independent States (CIS), 1.5 in the Asia-Pacific area, and 1.6 in the Arab nations[19]. In Africa, the urban/rural ratio was 2.5, with 57% of people in urban areas and 23% in rural regions having internet access[19]. This can be a sign of how internet connectivity varies around the globe. Particularly, it's critical to acknowledge that the barrier has virtually vanished in Europe (Table 1)[19].

To sum it up, the current fragmentation of the healthcare system around the world may be caused by a number of factors, including the rural-urban divide, income discrepancies, educational inequities, and population demographic shifts. The disparities between and among people have not been sufficiently eradicated by international efforts. Therefore, this study aims to examine the state of inequality in low- and middle-income countries, issues related to digital health technology, its use, challenges and possible recommendations to promote health and ensure health equity in today's low- and middle-income countries.

Table 1: Factors influencing the use of digital health services in low- middle-and high-income countries.

Categories	Population	Levels of Education	Percentages of Individuals using the Internet	Income disparities
a. Globally	• Global population was estimated at 8.2 billion people in mid-2024. • The population was projected to be 10.3 billion in mid-2080[7].	• International assessments show a downward trend in reading literacy: 25% in science, 31% in math and 26% in reading. • This clearly shows that a large number of people are not meeting the required basic academic standards[16].	• 81% of urban-dwellers have access to internet; Urban-rural ratio 1.61. • 50% of rural dwellers have access to internet; rural ratio 1.61[19].	• Over one billion people live on < $1/day. • 2.7 billion people live on < $2/day[8]. • The richest 10% of the global population takes 52% of the world's income[9]. • The poorest half of the population earns 8.5% of the world's income[9]. • The average income of a person belonging to the richest 10% 10% of the world's population is US$122,100/year[9]. • The individual from the poorest half of the category earns an average of 3,920 US$/year[9].
b. Africa	• Total population is 1.5 billion in 2024. • Population growth rate is 100 million after every three years. • Half of the global population increase was in Africa. • Highest fertility rates in the world 4.1. • Share of the world population: 9% in 1950, 13 in 2000, by 2050 and 2100 it could be 26% and 38% respectively. • In 2050, one in five people in the world could come from Africa. • Africa has five of the eight countries are expected to account for half of global population growth in 2050, with Nigeria expected to be the third most populous country in the world[15].	• 58% of children of upper secondary school age do not attend school in sub-Saharan Africa. • One in five children of primary school age was not in school. • Six out of ten adolescents were not in school[18].	• 57% Urban; Urban-rural ratio 2.49. • 23% Rural; Urban-rural ratio 2.49[19].	• The gap between rich and poor in terms of health and education is glaring in most African countries. • The poor make up 60.8 % of the population, but only have 36.5 % of the total income. • 4.8% of the population are said to have 18.8% of the total income. • Considered the second most unequal continent in the world.[8]

c. Low-Middle-Income Countries	• Of the 6.9 billion people living in low- and middle-income nations, n = 3.5 billion are men (50.3%) and n = 3.4 billion are women (49.7%). • Total population growth rate of 0.97% for the year 2024. • In the low- and middle-income countries, the population will increase by 66.7 million people by 2025. • In the 73 years between 1950 and 2024, the population of low- and middle-income countries increases by 282.7%, from 1.7 to 6.9[5].	• 81% of boys in the richest quintile are likely to complete their education, compared to 26% in the poorest fifth in the urban centres. • The average level of education is very low in large parts of the Sahel region in sub-Saharan Africa. • Average spending on education per student in middle-income countries (USD 890). • Average spending on education per student in low-income countries (56 US dollars). • The future of education in low-income countries is threatened by demographic changes and budget constraints. • Funding source for education in low-income countries fell by 7% between 2020 and 2021. • Development aid accounts for 13% of total education funding[17].	• 73% Urban; Urban-rural ratio 1.74. • 42% Rural; Urban-rural ratio 1.74[19].	• Higher tax revenues could be responsible for an increase in income inequality. • Income inequalities are linked to other forms of inequality and can reinforce them[11].
d. High-Income Countries	• The population of high-income countries reached 1.3 billion, of which n = 632.8 million (50%) are male and n = 632.4 million (50%) are female in 2024. • With a total population growth rate of 0.251% for the year 2024. • The population of high-income countries amounted to 692.7 million people in 1950. • The population of high-income countries in 2024 was 1.3 billion. • An increase in population of 82.64% in 73 years. • High-income countries will increase their population by 3.2 million people by 2025[12].	• The average investment in education per student in the high-income countries was estimated at 11,655 US dollars. • Two hundred times higher than expenditure in low-income countries. • Thirteen times higher than the average spending per student in middle-income countries[17].	• 95% Urban; Urban-rural ratio 1.07. • 88% Rural; Urban-rural ratio 1.07[19].	• GDP is 68.28 trillion US$ in 2023. • GDP per capita was 48,752.7 in 2023. • GDP growth (annual %) in 2023 1.8%. • Unemployment, total (% of total labor force) 4.3 in 2023[13]. • Canada, top 10% earns 36%, with the bottom 50% earning 17% of the national income. • New Zealand, the top 10% earns 35%, with the bottom 50% earning 21% of the national income in 2023. • Australia, top 10% earns 33%, with the bottom 50% earning 17% of the national income. • Romania & Bulgaria, top 10% earns 40% of the national income. • In the United States, the bottom 50 % earn 13 % of the national income, the middle 40 % earn 40 % of the national income and the top 10 % earn 47 % of the national income[14].

An overview of Digital Health Literacy and its Applications:

Digital health literacy (or eHealth literacy) is the individual ability to seek, evaluate, and apply health information from electronic sources to treat or solve a health problem[20]. Digital health innovations have been identified as one of the approaches to strengthen the health system to improve disease surveillance, prevention and patient care[21]. As a result, sustainable, affordable and high-quality medicines/vaccines as well as medical devices and services could be more accessible in the future[22,23].

Recently, access to health information has been enhanced by digital technologies such as mobile devices, internet platforms and social media[24]. These digital technologies have been used to provide mobile health services through wearable devices (health trackers like Fitbit, SmarWeb-enabled glasses and Bluetooth headsets, Virtual reality headsets), short messages (e.g., reminders to take medications or follow-ups at the hospital) and other health applications on smartphones[25]. In addition, digital health technologies are also used in disease diagnosis (using digital biomakers), patient monitoring (e.g., pulse oximeter), counterfeit/narcotic drug detection (use of itemizer 3 machine), tracking physical activity level (e.g., pedometer), medical care (e.g., using freestyle Libre System for glucose monitoring) or hospital visits/maternity care (hospital navigation software), health research, storage of hospital records (e.g., electronic health record software), access to traffic reports/adverse weather conditions (PTV Optima/Baron Radar system), and financing of health services (e.g., Oracle NetSuite EBP)[20,26-29].

Interestingly, a palpable impact of digital health technology was witnessed during the recent COVID-19 pandemic through a global shift in the mode of healthcare delivery using telemedicine / telehealth and telerehabilitation[30-32]. In regions of the world where lockdowns have been implemented to contain the spread of the Severe Acute Respiratory Syndrome-Covid-2-Virus (SARS-Cov-2 virus), telemedicine, telehealth and tele-rehabilitation have been used to deliver healthcare services directly to the doorstep of patients and clients without the need to contact healthcare professionals or hospital facilities[33-34]. Services provided via telemedicine/telehealth and telerehabilitation during the pandemic include medication/exercise prescription, rehabilitation techniques and nutritional control measures[35-38]. Other services include follow-up care for patients, ergonomic support for home offices and general tips on preventive and curative medicine[39-41].

Issues Related to Digital Health Technology use in Low-and-Middle-Income Countries:

Digital technologies are being used by healthcare providers and stakeholders to improve the quality of and access to healthcare while reducing healthcare costs. Consumers in the healthcare industry can use digital technologies to manage and track their health-related behavior[42]. The digital learning gap has widened and extended throughout low-and-middle-income countries. However, there appears to be a gap between industrialized (high-income-countries) and low-and-middle-income countries in terms of access to and the utilization of digital health services. This could be the result of a complex interplay of factors ranging from people's literacy (educational inequalities) to a lack of quality education for marginalized groups, among other factors[43].

The recent Covid-19 pandemic has widened the existing gaps in low-and-middle-income countries health systems[44]. Before the pandemic, around a third of the population in these countries lived more than two hours away from the main medical facilities, and the proportion of medical personnel in the total population was generally far below the minimum number recommended by the World Health Organization (WHO)[45-46]. In addition, the impact of these problems has been exacerbated by the disruption of transport networks due to the lockdowns and the loss of health workers as a result of COVID-19[47-48]. Global health problems and inequality are exacerbated by inadequate public health spending in low- and middle-income countries and an ineffective regulatory environment for the digitalization of health services[49].

One benefit of the recent pandemic is the increase in digital tools; the use of this technology has reportedly accelerated by several years[50]. Digital technologies, in particular, could hold great promise for improving primary healthcare and strengthening the response of low- and middle-income countries to infectious disease threats[51]. Improving the use of digital health tools in low-and-middle-income countries and achieving the goal of a national health ecosystem through a methodical approach could benefit both individual and population health. Therefore, governments in low- and middle-income countries could prioritize the urgent need for digital education for the general public and professionals and find a solution to promote digital growth and help many people lead a healthier lifestyle. However, it has been shown that certain elements can hinder the efficient use of digital health technology in low- and middle-income countries.

Challenges for the use of Digital Health Technologies in Low- and Middle-Income Countries :

There is no doubt that the technological penetration of low- and middle-income countries, driven by internet connectivity, has advantages and disadvantages. Factors that hinder the effective use of digital health technologies in low- and middle-income countries include the urban-rural divide, income disparities and other forms of inequality, as well as cultural, religious, legal and linguistic barriers.

The urban-rural divide:

The urban-rural bias is probably a factor due to the unbalanced distribution of Information Communication Technology (ICT) and the financialization/control of biotechnology alongside the concentration of technology ownership among urban dwellers[52]. One study found that 22.4% of Americans in rural areas have no (high-speed) internet access, compared to only 1.5% of city dwellers[53].

The inequality in internet access between urban and rural areas varies greatly depending on the income group. In high-income countries in particular, the gap is almost closed with a ratio of 1.1[19]. In contrast, the gap is still significant in low-income countries, where less than one in five (17%) rural residents have access to the internet[19]. The difference in internet usage between urban high- and low-income groups is 48% compared to rural high- and low-income groups at 71%. This shows that the digital divide between income groups is very large[19].

This inequality is not just a problem of numbers, but reflects more fundamental problems of accessibility, gaps in legislation and social inequalities[53]. The observed discrepancy could represent both a difficulty and an untapped potential that might hinder the expansion of the use of digital health in low-and-middle-income countries. Nevertheless, there is a positive trend in the introduction and use of digital healthcare in these regions[53]. It is possible that digital healthcare in rural areas will attract a large number of potential clients, especially those who are unable to seek treatment at traditional facilities due to transportation, cost, and a lack of easily accessible information in their communities[54]. Training in rural areas is therefore needed to close this gap in digital health literacy.

There are some fundamental infrastructure problems that could hinder the spread of information and communication technology (ICT) in low- and middle-income countries, and internet usage in rural and urban areas is known to differ[55-57]. It is worth noting that the gap between urban and rural internet use has remained remarkably constant[56-57]. Although the overall proportion of Internet users has in-

creased, there has been a 6-9% gap between rural and urban users since 1998[57]. Another problem could be the geographical concentration of socio-economic activities and facilities in some places where others do not have access, e.g. in rural areas that are difficult to access. There is evidence that Africa lags behind in the availability, affordability and use of ICTs; it was also the region with the lowest ICT development index in the world[55-56]. It could be that the service is not affordable or that access is beyond their reach[43-44].

Other factors that could exacerbate the problem are the lack of a reliable electricity supply, the fact that a significant proportion of the population is illiterate, prejudices based on language, ethnicity and discrimination, as well as ill-conceived government policies and topographical problems in some countries[43-44].

Income disparities and other forms of inequality:

Income disparities due to differences in people's socioeconomic status are likely to be a limiting factor for the effective use of digital health services in low- and middle-income countries[58]. For social and equity implication, this could mean that not everyone can afford or has access to the internet, which is essential for navigating the digital shift[59]. This could be compounded by other factors such as the gender gap as a result of increasing domestic violence, rising unemployment and unpaid care for family members, which deny women in particular access to medical information[60].

In addition, the cost of internet services or their unavailability in certain areas, e.g., rural areas, is also likely to play a role[60]. Because of the role the internet plays in health outcomes and its impact on the social determinants of health such as access to healthcare, employment and education, it is referred to as a super determinant of health[60-61.] However, it is important to recognize that digital health literacy and the ability of individuals to use it can be uneven; therefore, there is a possibility that it will not contribute to better population health, but will be a new source of inequality[62]. This is possibly because a certain subgroup of people benefits most from the digital transformation in healthcare and excludes others[62].

The rapid adoption of digital healthcare in our health systems with the goal of improving access may lead to inequities, such as differences in health status or unequal distribution of resources[58]. Sociopolitical instability, poor governance, and poverty factors, combined with relationships between capital development and unemployment, gross domestic product (GDP), and social trust might equally affect digital health utilization[63-64]. However, these relationships might not reflect actual structur-

al changes in disadvantaged areas, among others, which could impact digital health.

Other factors are likely to be the significant shortage of health workers and facilities, which in most low- and middle-income countries is below WHO recommendations, and the lack of accessibility to health services, to which ≥ 400 million people in South Asia and Africa have no access[65].

Another troubling trend is increasing income inequality, which makes it harder for families to access education. It is an undeniable fact that among all demographic factors, family income might be the most significant determinant of educational attainment. Again, the outbreak of the pandemic and the measures taken to combat it make it difficult for schools in developing countries to access classes, while schools in developed countries have access to online courses, highlighting the extent of inequality in access to education worldwide. When considered together, technological progress, income inequality and educational disparities can have a negative impact on low- and middle-income countries[66-67]. Equally important are the socioeconomic factors that characterize the vast majority of inhabitants of low- and middle-income countries. With the majority of people living in rural areas, the poverty rate is quite high, with most people living on less than $2.2 a day,[68] while others use subsistence farming to meet local needs. Therefore, any additional burden associated with cost may pose a significant challenge.

The case of the COVID-19 pandemic is a perfect example of how socioeconomic status affects people's ability to comply with health guidelines. It is known that a number of countries restricted movement to minimize transmission of COVID-19, which in turn affected people's earnings, especially low-income workers, resulting in massive food insecurity[57]. In countries such as South Africa, it has been shown that low-income traders have had to defy restrictions and continue their daily routines to meet their needs, regardless of the risk of becoming infected[69].

Inequality not only affects health and well-being, but also contributes to other negative behaviors such as aggression, poor lifestyle choices, and other issues related to social gradient[70]. The cost of living and low incomes have made it impossible for individuals to meet basic needs, let alone afford other necessities such as internet access, although increasing industrialization and globalization have led to more and more people migrating from the rural areas to the cities. This may be related to the low or no use of technological services such as the Internet in many low-income countries.

The lack of national health hotlines, inadequate or ineffective media coverage of health-related activities, outdated ed-

ucational materials, the lack of a sustainable electricity supply, the cost of internet services and the promotion of education without adequate infrastructure support (e.g., digital libraries) are other potential influencing factors. These concerns are exacerbated by the sharp rise in inequality and the resulting socio-political and economic repercussions. Therefore, low- and middle-income countries may not have the resources to provide efficient digital health services if wealth disparities and other forms of inequality are not addressed.

Cultural, religious, legal and linguistic barriers:

Digital healthcare has also been hampered by cultural barriers, possibly due to a lack of consistent inclusion of linguistic perspectives in the design and implementation of the -income countries — sometimes referred to as developing countries — the interplay of these factors can influence the availability and use of digital health services. Therefore, it technology, and possibly due to a lack of consideration of religious, legal and ethical factors[71-72]. There seems to be a lack of information on the above aspects; Badr et al.[73] note that while most studies analyze inequalities in digital health technologies in terms of individual characteristics, they hardly examine the cultural factors that might influence the differences. In low- and middleis likely that access to digital health literacy promotes individuals' health behaviors and reduces the risks associated with the use of health services[74]. Therefore, digital health literacy could help to promote access to and utilization of health services/interventions in low- and middle-income countries.

We now live in an age of technological wizardry,[75] but not everyone benefits. Several cultural factors have now been identified that could limit digital health literacy in low- and middle-income countries. In particular, many people in sub-Saharan Africa reject digital technologies and limit their use in their families because they are afraid of losing their cultural identity and adapting to Western lifestyles (cultural imperialism)[65,66,70]. There is a possibility that this is true because Western nations dominate the media, which indirectly influences the cultures of low-and-middle-income countries through western values imposed upon them, thus destroying their own cultures[67]. It is for this reason that African value systems are gradually being influenced by western culture[67]. To make matters worse, in most countries there are no regulations governing the media, which allow them to operate unchecked and provide a breeding ground for the development of bad attitudes, especially for future generations. It's possible that this is a cause of many people's reluctance to adopt and use new technologies, or to allow their families to do so.

To summarize, many low- and middle-income countries face significant challenges due to the interplay of socioeconomic status, various types of inequality, cultural norms and other elements, including inadequate education and system preparation. Addressing these challenges therefore requires not only improving incentives, but also developing measures to reduce income inequality and promote prosperity and the possibility of sustainability.

How can the effectiveness of digital health be improved in low- and middle-income countries?

Bridging the education gap through investment in information and communication technology (ICT)

To close the education gap, we need to improve access to technological resources and implement a one-to-one policy that provides every student with a smartphone in low-and-middle-income countries. In addition, digital health should be promoted through the provision of free internet services for students to enhance learning at all times (where possible), as well as highly subsidized import tariffs for smartphones, tablets, and other ICT-related gadgets, which may encourage access and participation in digital health interventions (Figure 1)[56,65-66]. These measures are essential to ensure equal opportunities at a time when students' education depends on screens, especially in the presence of a pandemic.

Clinical endorsements, advice and direct support to promote digital health should be provided, together with free internet services where possible. Furthermore, creating awareness, understanding and motivation, and by allowing individuals to pick their digital agencies, low-and-middle-income countries could potentially promote the use of digital health[65].

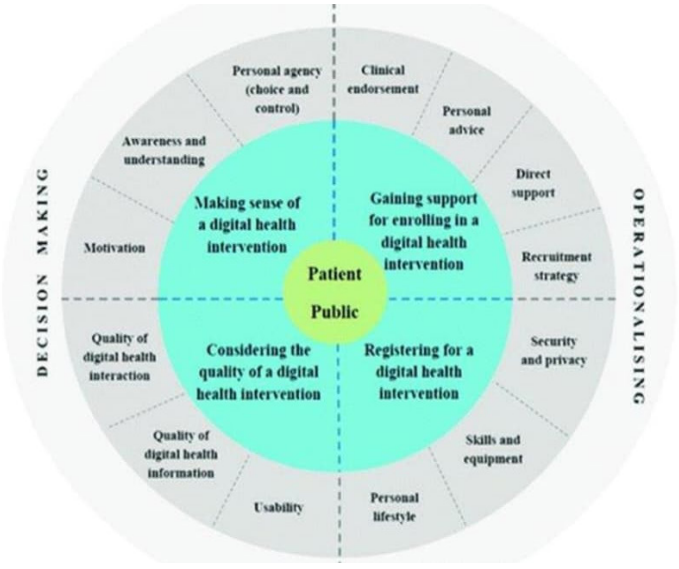


Figure1: Digital Health Engagement Model.

It is important to recognize that low- and middle-income countries may struggle to use technology services effectively due to a variety of factors. However, it was assumed that investment in ICT would enable the achievement of the ninth goal of the Sustainable Development Goals (SDGs), namely the provision of universally affordable broadband access in both high-income and low- and middle-income countries[76]. Unfortunately, the political will and ability of governments to support such an approach remains uncertain. Thus, for low- and middle-income countries to meet the above challenges, the health system framework needs to be redesigned to improve outcomes and quality.

Allocating Resources to Digital Health:

Governments in low-and-middle-income countries should allocate resources to digital health rather than individual/cyclical initiatives as this will enable them to address issues of access to healthcare, high quality and cost-effectiveness[64]. This could be achieved by enhancing the security and privacy of the users as well as the provision of the necessary training and equipment's so that people might improve their skills as well as promote their lifestyle (Figure 1)[65].

Creating a comprehensive digital health model that eliminates existing fragmentation also requires collaboration between public and private entities in the healthcare ecosystem[64]. As a result of this collaboration, resources and risks can be shared between stakeholders. An important aspect of healthcare is data sharing, the integration of which can help build trust between patients and healthcare professionals.

The development of a sustainable economic approach may require improved access to technological health services in low- and middle-income countries. This could be achieved by allocating at least 0.5% of national budgets to the digital economy, as it has been proven that Facebook alone as a digital platform could account for this proportion of a country's GDP per year[77-78].

Digital health has been shown to improve the efficiency and effectiveness of medical care[3]. Accordingly, it has been recommended that governments at all levels in low-and-middle-income countries to invest in improving the delivery of digital health services. To do this, we should take into account the quality of the available interventions, the types of digital health information that might be disseminated, and how they might be used[65].

By combining the aforementioned strategies, low-and-middle-income countries can increase digital health services access and use. Again, there are quite a number of digital health/wearable and smart health technologies around the world, but it is quite unclear whether low-and-middle-

income countries can afford to buy them or whether the technologies can stand the test of time in their terrain. Therefore, future research should focus on integrating new technologies into our hospitals, where data, digitization and artificial intelligence can be used to drive service delivery.

Policy Recommendations:

A specific policy framework that provides free education and subsidized internet access for both urban and rural populations could be essential. Financing mechanisms through public-private partnerships that could provide universal income to people in low- and middle-income countries are also needed.

Conclusion:

Finally, this paper discusses digital health technologies as a potential means to improve the quality of healthcare in developing economies by identifying potential challenging conditions and recommended appropriate preventive and curative measures. Specifically, the effective use of digital health technologies in low- and middle-income countries could be influenced by the urban-rural divide in internet access/use, income disparities between and within people/countries, changes in population demographics, disparities and access to education and related financial resources and other forms of inequality, as well as cultural, religious, legal and language barriers. Addressing these issues requires bridging the education gap, investing in information and communication technology (ICT), providing resources for digital health and promoting internet access). To explore whether digital devices are feasible, acceptable, and applicable in low-and-middle-income countries, more studies are needed.

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