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Commentary

The barriers to global eye care equity and the role of digital innovations

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1. Introduction

Ophthalmology has benefited from a myriad of digital innovations ranging from simple virtual clinics to complex deep-learning imaging analysis.[1] With an increasingly ageing global population, the need for population eye health planning is paramount and should be recognised as an essential aspect of overall health.[2] However, high-quality eye health services are often not universally delivered. This is especially the case in low middle-income countries (LMICs), whose populations suffer far more in blindness and visual impairment compared to wealthier countries.[3] Numerous social determinants, including low education levels, poverty, physical distance, and socio-cultural situations, can all contribute towards inequitable access to eye care services.[4] New modes of healthcare delivery proposed by digital innovations have the potential to reduce inequity.

The COVID-19 pandemic has also disproportionally affected poorer and more vulnerable populations.[5] Whilst the pandemic certainly accelerated the implementation of digital health innovations in eye care, many digital health solutions have not been built with sufficient attention to health equity and it may be that these rapid developments may have had unintended consequences on exacerbating health inequity.[6]

In this commentary, we examine the current inequities in eye care access, the impact of COVID-19 on service provision and technology implementation, and the outlook for providing new models of care on a global scale.

2. Barriers to digital solutions implementation and the impact of COVID-19

Following the rapid changes to healthcare systems during COVID-19, there has been an acceleration of the adoption of new models of healthcare delivery. This places a greater emphasis on prevention, remote care, and technological dependence.[7] It is foreseeable that many of these new digital modalities of consultation are here to stay as healthcare systems shift into the "new normal". It is therefore pertinent to examine the ramifications of the current disparities in inequity of care across different subgroups of the population in accessing eye care services. Tanahashi[8] described in 1978 the evaluation of health service coverage on the factors that determine its ability to serve the target population (See Fig. 1), At each stage, a portion of the target population is lost due to the bottlenecks in service provision.

The COVID-19 pandemic undoubtedly had an immense impact on healthcare delivery globally. As a specialty heavily structured upon delivering outpatient services, ophthalmology practices were particularly affected. The pandemic resulted in the cancellation of thousands of ophthalmology clinic visits due to the need to reduce risks of virus transmission from face-to-face appointments. The adoption of telemedicine in ophthalmology practices during the pandemic was a significant development, with significant potential to increase the accessibility of eye care coverage.[9] Substituting in-person appointments for online video consultations or telephone calls helped to screen and triage patients with high-risk conditions who needed to be seen urgently and those who could be managed at home or by other ophthalmology services.

However, implementation of the digital solution in eye care has been limited. For example, teleconsultations in ophthalmology have only been widely implemented in the US, UK, India, Hong Kong, and Singapore and are limited to subspecialties of the medical retina, neuro-ophthalmology, and paediatric ophthalmology.[10] On a global scale, 91.75% of those who are blind and 87.68% of those with moderate and severe vision impairment live in LMICs.[11] There are several barriers faced in the widespread implementation of teleophthalmology. Access to most tele-ophthalmology services requires an active internet connection, a

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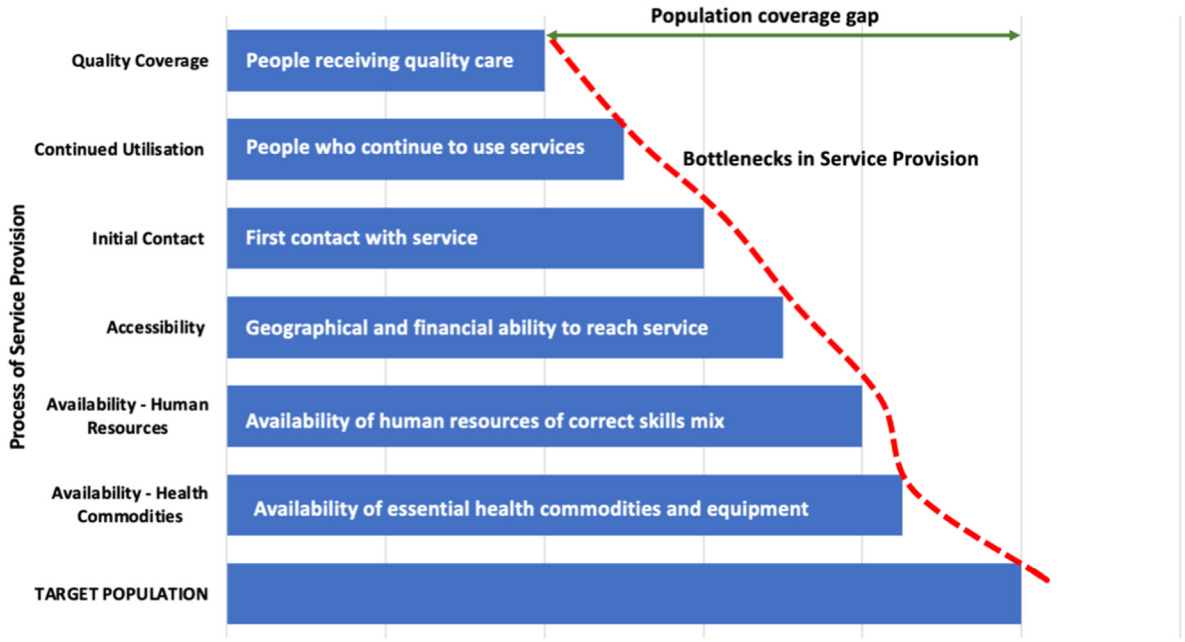

Fig. 1. A modified Tanahashi[8] framework detailing the successive health system challenges that result in loss of performance, measuring aspects including the availability of resources, geographical accessibility, quality of provision, and demand for services.

smartphone or computer, and an understanding of how to use the technology.[12] Especially in LMICs, the development and deployment of teleophthalmology are largely dependent on the telecommunication infrastructure.[13] There is also the unfamiliarity with the logistical aspects of telemedicine requiring formal staff training and sceptical patient attitudes.[14] Whilst accessibility may be improved, it is evident there are still significant barriers in the availably of human resources with the right skills mix and health commodities.

Additional concerns existed regarding the accuracy or reliability of virtual consultations over in-person appointments as well as privacy and security concerns about data sharing. Uptake and receptiveness are also influenced by various factors such as age, level of education and cultural differences. The younger generation of patients are more likely to be comfortable with phone or video interactions due to their increased digital literacy.[15] This could result in the older populations, who are likely to have greater eye care needs, being left out from access to ophthalmology services. It is not enough to develop teleophthalmology in isolation. Rather, these innovations must fit into the existing health system infrastructure to ensure equitable access.

3. Outlook for global digital implementation

Digital solutions present huge potential to provide equitable and sustainable access to eye care for all. While the benefits of digital health are evident in high-income countries (HICs), there remains a significant disparity in LMICs where resources are in short supply. Technological barriers and socio-economic-cultural factors create inequities between countries, and even between different regions within the same country.[16] The disparity in digital inclusion, influenced by the social factors listed above, is known as the digital divide. With the rest of the world moving forward and reaping the benefits of a digitalised age, the inequities faced by marginalised communities and the digitally illiterate will only increase.

Evidence has emerged of the influence social determinants have on patient engagement with digital services in healthcare.[17] It is important to note the root causes of eye health inequity are largely the same social determinants that cause digital exclusion. Building equitable digital systems in eye care means we must consider the implementation process across all levels of the healthcare system, from the patient and the care team to the overall organisation infrastructure and regulatory frameworks. A key process involves building digital health literacy, which can be defined as the degree to which individuals can obtain, understand, and process basic healthcare information and services to make the appropriate decision in the context of technology.[17]

Until new innovative technologies are introduced, the role of teleophthalmology is in providing care alongside in-person clinical examination, rather than as a replacement. Furthermore, both current and future technologies must be designed to be implementable even in lower-income countries with fewer resources. The high initial costs of teleophthalmology, such as costs of fundus cameras, as well as the availability of robust IT infrastructure and accessibility to computers and smartphones, are further challenges that must be considered in the context of the creation of a digital divide across both countries in individual population subgroups.

Therefore, to increase digital health outreach and improve eye health outcomes globally, policy reforms must aim to address the existing social inequality and improve social mobility (See Fig. 2). Reducing wealth, education, and gender inequalities will promote greater digital uptake and literacy, leading to better outcomes in eye health. Moreover, international cooperation with HICs and between LMICs countries may help to promote connectivity in isolated regions and help to deliver digital health services in regions with limited resources. For digital health solutions to be successfully implemented, personnel must be equipped and adequately trained to operate the required technology.

4. Conclusions

Eye care services have undergone considerable digital transformation globally. Although progression to an ever more digitised eye care service

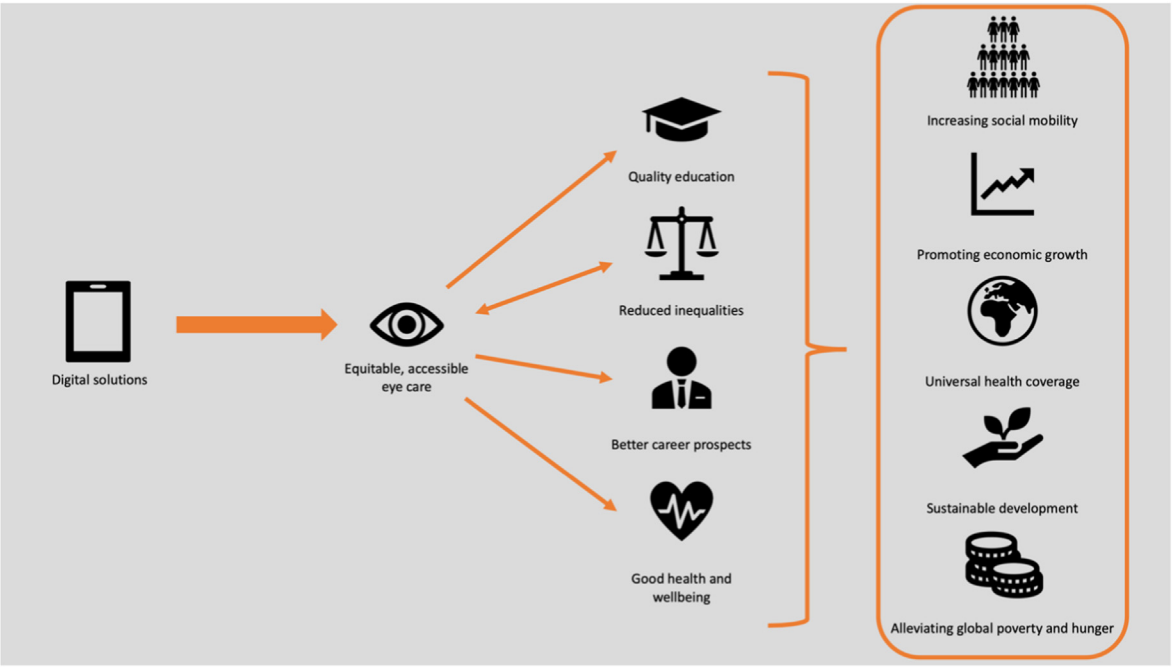

Fig. 2. Flow diagram adapted from the Lancet Global Health Commission on Global Eye Health: vision beyond 2020[18] illustrating the effects of successful digital eye care solution implementation. Equitable eye care leads to quality education, better career prospects, and good health and wellbeing. Good eye care also leads to reduced inequalities, and in turn, policy reforms aimed at reducing inequalities leads to more equitable eye care. Collectively, these factors contribute to achieving the UN's SDGs.

provision seems likely, it is paramount that new digital systems are built concerning health equity frameworks and the provision of services to marginalised communities. Once in place, however, digital eye care services have the potential to vastly benefit those, especially from lower socioeconomic statuses, by increasing access to care and removing barriers of time, expense, and distance.

Study Approval

Not Applicable.

Author Contributions

The authors confirm contribution to the paper as follows: Drafting the manuscript: SZ, JC, JC, SJ; All authors contributed to editing the manuscript; All authors reviewed the results and approved the final version of the manuscript. Authorship All authors attest that they meet the current ICMJE criteria for authorship

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Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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