OPINION EDITORIAL

Medical delivery drones as a tool to improve health equity in Sub-Saharan Africa

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INTRODUCTION

Inaccessibility to healthcare and systemic health inequities continue to adversely affect a large proportion of populations across Sub-Saharan Africa (SSA) [1,2,3]. In this paper, we will be focusing on the application of medical delivery drones within low-income and low-resource public health systems in SSA for the transportation of medical supplies, medications, biological samples, and other health-related products. Limited human and financial public health resources, rapidly rising populations, and recent infectious disease outbreaks place continuously increasing pressure on health systems. Additionally, isolated and remote communities face compounded barriers to even basic healthcare and medical supplies [1]. For example, in the Democratic Republic of the Congo (DRC), 38% of the population (approximately 30 million people) reside over two hours away from the nearest hospital facility [1]. Similarly, in Ethiopia and Sudan, approximately 30% and 31% of the population lives more than two hours from the closest hospital, respectively [1]. This is an especially critical barrier for rural communities with poor road accessibility, infrastructure, and maintenance [1], which is further impacted during the prolonged rainy seasons experienced by many countries in SSA [4].

The SARS-CoV-2 (COVID-19) pandemic has further exacerbated the already significant healthcare-related inequalities between high- and low-income countries [2,3,5].

In terms of both direct COVID-19 mortality rates as well as the collateral effects of the pandemic on global resource supply chains, health system capacity, and economic downturn, low-income and low-resource communities are those most adversely affected [3]. In sub-Saharan Africa (SSA) specifically, public health systems that were struggling pre-pandemic under the weight of communicable disease epidemics, such as tuberculosis and human immunodeficiency virus, must now take on the additional burden of COVID-19. Additionally, the COVID-19 pandemic has caused wide-ranging disruptions to communicable and non-communicable disease services in many SSA countries, leaving many people without access to treatments or care [6].

Benefits of Medical Delivery Drones

Over the last decade, drones are becoming an increasingly reliable and adaptable tool within the field of humanitarian development [7,8]. Drones, also known as unmanned aerial vehicles, are autonomous or remotely piloted aircraft without onboard pilots or passengers [9]. Drone technology is highly versatile and is currently used within the humanitarian field for purposes such as urban planning, mapping, disaster relief, environmental monitoring, and cargo delivery [7]. Drones have the potential to be a quicker and more cost-effective option for healthcare supply delivery, depending on the local context [10].

Supply chain logistics make up approximately 60-80% of humanitarian expenditures, and drones offer a significantly reduced cost compared to typical ground transportation [11]. Additionally, the ability of drones to fly the straight-line distance between two locations means they do not need to navigate poorly maintained roads or other geographic barriers [12]. While delivery drones have been integrated into public health supply chains in other low-, middle-, and high-income settings over recent years, SSA has thus far led the way in the successful implementation and deployment of drones for health-related purposes [8].

Success Stories from SSA

An ongoing drone delivery project in the East African country, Rwanda, is perhaps the most promising example of the successful implementation of drones into a public health system. The project, led by Zipline, a San Francisco drone organisation, in collaboration with the Republic of Rwanda Ministry of Health, began in 2016 and has since completed over 55 thousand successful flights [13,14]. The drones are primarily used to transport blood and blood products, emergency and routine medications, as well as emergency and routine vaccines [14]. The growing drone network in Rwanda currently serves approximately 450 individual health facilities and a population of about 8 million people [14]. Along with significantly improving access to healthcare within the country, the use of drones reduces transportation-related carbon dioxide emissions by 98% compared to the use of vans or cars [15].

Similarly, in the DRC, a collaboration between the Seattle-based non-profit organisation, VillageReach, a drone logistics company called Swoop Aero, and the DRC Ministry of Health, have been using drones for medical deliveries since 2020 [15]. As previously mentioned, 38% of the population in the DRC lives more than two hours away from the nearest hospital [4]. Along with this, the large geographic land area, armed conflicts and political instability, increasing levels of poverty, continued tuberculosis and Ebola epidemics, as well as one of the highest population growth rates in the world, have collectively stretched the DRC's healthcare system thin and created significant barriers to accessing healthcare for the country's population [17,18]. Since 2020, VillageReach and their partners have implemented a drone delivery network that serves 70 hard-to-reach health facilities and a population of over 500 thousand people in DRC's Equateur province, mainly transporting immunisation products and medical supplies [14]. Due to the success of this project, drone services will be expanded to 75 more health facilities in the Kinshasa and Kongo Central provinces of the DRC [19].

Challenges

Despite these positive use cases, it is important to note the many challenges impacting the long-term efficacy and sustainability of drone projects within SSA. While drones offer promising opportunities to increase the efficiency of health systems in low- and middle- income countries (LMICs), they are not a one-size-fits-all solution. For example, there are many common concerns regarding privacy and safety from community members in LMICs prior to the implementation of a medical drone project [20]. Such concerns include fear that drones are being used to spy on locals, worries about physical safety in the event of a crash, and overall distrust in the use of drones for health [20]. For these reasons, conducting community education and sensitivity training, as well as ensuring drones are a contextually appropriate tool are critical pre-intervention steps. There is a need for more context-specific research demonstrating ethically-centred approaches for drone project implementation in LMICs. Finally, one of the most significant barriers within the drone industry in low- and middle-income settings such as SSA, is a lack of funding, infrastructure, and general resources [21]. Without consistent financial input from local governments or external donors, it is very challenging to effectively and sustainably scale-up drone delivery services.

While significant research has been conducted on scalability from a general global health perspective [23,24], no studies to date explore processes and challenges to scalability for drone-centred public health initiatives. This should be a top priority moving forward.

CONCLUSION

Medical drone delivery, despite its challenges, is emerging as one of the most efficient ways to streamline supply delivery in LMICs in SSA. The economic benefits paired with the ability to provide rural regions, where healthcare delivery is often inconsistent and fragmented, with more access to healthcare and supplies, can improve health outcomes in the region and increase overall wellbeing. While lack of funding and infrastructure has been an issue in recent years, the emergence of the COVID-19 virus has increased the urgency for collaboration with bilateral and multilateral partners in SSA in order to optimise their healthcare system against current and future pandemics [25,26]. The use of drone deliveries may be an integral component to this response.

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