

Assessing technology readiness and use to address women’s health needs during pandemics and other humanitarian crises

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Background

Globally, 810 women die each day due to complications of pregnancy and childbirth - mostly from preventable or treatable causes, such as infectious diseases and complications during or after pregnancy and childbirth.¹ Childbirth complications have been cited among the leading causes for hospital admissions in the U.S. Maternal deaths currently average around 700 per year and Severe Maternal Morbidity (SMM) related conditions impact upwards of 60,000 women annually.² The CDC defines SMM is defined as “unexpected outcomes of labor and delivery that result in significant short- or long-term consequences to a woman’s health” Certain demographics present a greater risk for SMM including older age (40+), insurance type and Black race/ethnicity. Black women are at greatest risk and three times more likely to die from a pregnancy-related cause than White women.

In developed countries like the United States, the COVID-19 pandemic highlighted health equity gaps and the inability of current public health interventions to address women’s needs. Technology-focused innovations such as the use of artificial intelligence (AI) have been adopted to predict factors associated with poor maternal health outcomes. While significant developments in engineering technology have been made such as Mobile Health (mHealth) and telemedicine, these solutions are often limited in features and affordability. There are several gaps in the current technology available including the lack of language capabilities, the lack of

¹ [Maternal mortality \(who.int\)](https://www.who.int/news-room/fact-sheets/detail/maternal-mortality)

² <https://www.cdc.gov/reproductivehealth/maternalinfanthealth/severematernalmorbidity.html>

offline options which require users to have high-cost internet data plans, and lack of or poor data privacy.³ Public health agencies will be tasked with identifying new ways to assess the readiness of current technology. Assessing tech readiness requires a three-fold process including the understanding that disparities in maternal health outcomes are not random, embracing the need and power of tech readiness data to address women's health needs, and stronger data privacy infrastructure. To the authors' knowledge, there are no or limited efforts to understand the role of technology in addressing maternal health needs, especially during pandemics and other humanitarian crises.

Methodology

Research Questions

Based on existing knowledge of maternal health disparities with regard to assessing the readiness of current technology, this paper asks:

1. What current technology is available for maternal health services during a public health emergency or humanitarian crisis?
2. What components support more equitable use of technology for maternal health services during a public health emergency or humanitarian crisis?
3. What policies/strategies strengthen technology available for maternal health services during a public health emergency or humanitarian crisis?

³ Beaunoyer, E., Dupéré, S., & Guitton, M. J. (2020). COVID-19 and digital inequalities: Reciprocal impacts and mitigation strategies. *Computers in human behavior*, 111, 106424. <https://doi.org/10.1016/j.chb.2020.106424>

Phase 1- Systematic review and interview with expert

This study employed a systematic literature review and an in-depth interview with an expert and front-line provider using technology for maternal health services. Following completion of the literature review, an in-depth interview was conducted with a maternal health care provider to ascertain more nuanced information on maternal health technology from an international perspective. An interview guide was prepared and focused on identifying technology components most critical to supporting effective maternity care, lessons learned from the COVID-19 pandemic regarding technology implementation for care continuity and current gaps and opportunities for improvement?

Findings from the interview suggest that technology played a critical role in streamlining care continuity, particularly for patients in quarantine due to COVID-19. Specifically, rapid testing helped ease the health care provider workload while communication technology such as WhatsApp enabled wide distribution of COVID-19 testing information. Comparatively, smaller countries such as Rwanda may have benefitted from the ability to circulate health information to patients faster than larger countries. However, patient data sharing remains a challenge which may be influenced by patient literacy challenges as well as differing knowledge, attitudes and cultural practices of community members. For example, patients who are uncomfortable in the clinical setting may opt to stay home and forgo care. Similarly, differences in patient health care knowledge could influence seeking care too late for effective treatment.

“Technology has to be adapted to local solutions. [Technology providers] have to become familiar with the community and its conditions.” - Dr. Erick Baganizi, MD, MPH

Lack of access to technology is a persistent burden, especially for rural populations and the lack of adaptability of some technologies to women and children presents difficulties for patients and providers.

Findings and themes from literature review, and in-depth interviews informed the development of a checklist. The checklist (Appendix A) was converted into an index and survey that was launched as a web-based application. The web-based application was developed using CommCare which is a mobile application and data collection platform. The technology may also be integrated with data visualization platforms such as Power BI for data analysis and reporting.

Developing a standardized tech readiness assessment/index

As a group we created a readiness index based on our literature reviews and compiled the factors that attributed to equitable health in healthcare facilities. Within our research we found that impediments to internet access and appropriate technological devices delay community responses to health crises. Commcare allows us to survey demographics regardless of connectivity due to an offline interface. As a result, the questions we compiled are able to be administered on cell phones or tablets with the app downloaded prior to arriving at a location. If said location does not have access to internet, the operator of the device can upload the responses once an internet connection is re-established. CommCare enables secure data collection for analysis in various ways.

Limitations

Despite a thorough and systematic literature review, this study was primarily exploratory in nature. As a result, we lacked quantitative results. Also, since research published on COVID-19, technology and maternal health is still emerging, it restricted the expansiveness of our

findings. Due to time constraints, our study did not include a thorough pre-testing of our assessment tool. Data from respondents would help inform the effectiveness of our application and any additional components that should be included. However, some health care workers are often not fully prepared to use assessment technology due to limited knowledge or IT skills. Some applications can also increase provider workload due to the need to input an excessive amount of data. Many health care institutions require additional funding to perform server maintenance and IT training for health care workers.⁴

Discussion

This project emanated from the knowledge that the available technology is incomplete in addressing women's maternal health care. Academic institutions and public health agencies should invest in innovative strategies to understand and address the gaps of modern technology to better meet women's health needs. Producing such data will enable public health institutions and agencies to make informed decisions and deploy bias-free solutions. These policy recommendations were published in an Op-Ed in July 2022 for *The New Times*, Rwanda's largest, leading news publication.

A second phase of this research study would enable the research team to conduct a meta-analysis of the literature. This process would provide a more exhaustive and comprehensive assessment and allow for quantitative analysis. In addition, a thorough pre-testing of the survey could be conducted to improve the effectiveness of the index. After a thorough review and implementation of any required changes identified in the pre-testing phase, the web and mobile application could be formally deployed to health care institutions. Additional funding would

⁴ Galle, A., Semaan, A., Huysmans, E., Audet, C., Asefa, A., Delvaux, T., Afolabi, B. B., El Ayadi, A. M., & Benova, L.. (2021). A double-edged sword—telemedicine for maternal care during COVID-19: findings from a global mixed-methods study of healthcare providers. *BMJ Global Health*, 6(2), e004575. <https://doi.org/10.1136/bmjgh-2020-004575>

support the hosting and maintenance of the interactive dashboard on a publicly available website and ensure secure data management. This website could potentially serve as a trusted resource for the public health community and a foundation for future research studies.

Appendix A

READINESS INDEX

Systems & Operations

Does the technology require any training/education prior to use?

If training required, who administers the training?

If yes, how long is the training?

Does the hospital directly manage the security of the data it collects from patients?

Does the technology or its operating system allow patients or clients to use it independently?

Do you conduct coding audits for racial or gender-bias?

Does the application automate incident-tracking and reporting?"

Is the technology accessible in the local language of your target population?

If yes, local language options available, are audio options available?

Is the technology accessible for users with literacy challenges?

Is the technology partially functional without internet connectivity?

Is the hardware required to operate your technology affordable to your health facility?

Is the software required to operate your technology affordable to your health facility?

Is the maintenance of the technology affordable to your health facility?

Is the deployment of the technology affordable to your individual users?

Does the technology comply with the local or national guidelines or protocol?

Do staff who use and manage the technology undergo cultural competency training?

Maintenance

Does the application automate incident-tracking and reporting?

Do you conduct coding audits for racial or gender-bias?

Can patients report accessibility challenges through the system?

Does the application undergo routine maintenance and updating?

Do you conduct a quarterly security assessment?

Do you conduct an annual security assessment?

Patient Treatment and Care Continuity

Does the technology support the delivery of culturally respectful and responsive maternal health services to all patients?

Is the technology inclusive to all patients (race/ethnicity, gender)?

Is the application acceptable by the community?

Is the application acceptable by community leadership?

Does the technology facilitate patient access to their health data?

Are language interpreters available for patients both online and offline?

Does your health facility partner with other organizations to support equal and affordable access to health care?

Is your health facility equipped with gender and age-appropriate equipment for maternal health screenings?

Does your health facility have adequate units of technology for labor and delivery services?

Do you offer follow-up consultations for maternal health services?

Are follow-up consultations for maternal health services subsidized or free for low-income patients?

Prevention

If applicable, do you provide technological equipment that patients can borrow?

Do you provide alternatives to technological equipment for patients with limited access to reliable electricity?

Does your hospital/facility offer patient transportation? (Public and/or Private)

Do you subsidize the cost of your technology-based health services for low-income patients?