



How Telehealth Can be Used to Improve Maternal and Child Health Outcomes: A Population Approach

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Abstract: Mobile applications and telehealth services are being used to unprecedented degrees in maternal and child care, with uncertain impact on population health outcomes. In this article, we will review the role of the COVID-19 pandemic in accelerating large scale implementation of telehealth services, known and anticipated impacts on maternal and child health and related inequities, and potential strategies to optimize outcomes at the population level.

Key words: telehealth, virtual health, maternal telehealth, pediatric telehealth, structural racism, COVID-19

Introduction

Over the last few decades, telehealth has allowed for innovations in provider medical care and education. “Telehealth” refers broadly to the use of electronic

information and telecommunication to support long-distance clinical care,¹ whereas “telemedicine” refers specifically to remote clinical services. “Telehealth” therefore includes 2-way, synchronous video or audio visits, asynchronous “store and forward” communication, nonclinical services and case management, remote patient monitoring of vital signs, mobile health applications or mHealth, use of wearable devices, messaging services, and provider training and communication.²

Population health is defined as the health outcomes of a group of individuals, including the distribution of such outcomes within the group. While technology-enabled approaches lend themselves toward larger scale intervention, the specific impacts of telehealth integration on population health in the United States are poorly understood.

Maternal and child population outcomes in the United States lag behind

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those of other high-income countries, and have been shaped by historical legacies of racial inequity stemming from structural racism impacting Native and Black birthing people. This manifests in inequities in maternal outcomes (eg, maternal mortality and severe maternal morbidity), perinatal outcomes (preterm birth, low birthweight), and early childhood outcomes (infant mortality, morbidity, and chronic health issues during the first 5 years of life). For instance, Black women are 3 to 4 times more likely to die from pregnancy-related causes and have more than a twofold greater risk of severe maternal morbidity than white women. Black women also experience higher rates of postpartum hemorrhage, puerperal infection, and thromboembolism.³ Similarly adverse perinatal outcomes such as preterm birth and infant mortality occur more frequently in Black women than their white counterparts.³

Inequitable maternal and early childhood outcomes are influenced by differences in access to and quality of clinical care as well as by social and structural determinants of health. Social determinants of health (SDOH) are defined as the social and environmental context where a person lives, works and plays, and include factors such as access to housing, food, the presence of violence, and environmental barriers.⁴ For example, as a result of geographic barriers to accessing basic and subspecialty obstetric care, birthing people who live in underserved rural communities are at a higher risk for preterm birth, maternal mortality, and maternal morbidity.⁵ These SDOH are impacted by structural determinants of health further upstream—the “cultural norms, institutions, policies, and practices that define the distribution (or maldistribution) of SDOH,” ranging from histories of enslavement to redlining and Jim Crow, to housing policy.⁶ A recent report on the integration of social and medical care and current trends in the field suggest that health technology interventions could help address “awareness” of

health-related social needs most relevant to an individual’s health, and “adjustment,” or tailoring of health services to fill gaps regarding negative determinants, and support positive determinants.⁷ However, while existing efforts are promising, there are significantly fewer telehealth efforts described and evaluated in the literature relating to “assistance” with making and completing referrals to fulfill social needs, “alignment” of services addressing social needs and medical care, in part because of challenges in data specification and sharing, and “advocacy” to further systems-level and policy change to create new social assets in communities.

As reliance on telehealth accelerates as a result of the COVID-19 pandemic, it is necessary to think through clear frameworks for understanding the ways in which the incorporation of telehealth may support improved perinatal outcomes, versus perpetuate or worsen inequitable outcomes. We present a summary of trends and findings relevant to clinical, policy, and payer stakeholders seeking to integrate technology to impact population outcomes in perinatal health. Given that telehealth programs currently measure impact through short term process and utilization outcomes (eg, client engagement, visit adherence, and emergency department or inpatient utilization), efforts to scale and evaluate telehealth interventions through payment innovation and community partnerships will be vital to understanding true impact of telehealth interventions on the perinatal health outcomes we value most: preterm birth, infant morbidity and mortality, and maternal morbidity and mortality.⁸

HISTORICAL GAPS IN TELEHEALTH CARE: REGULATION AND DEMOGRAPHICS

Advances in Telehealth Impact on Population Health

Historically, payer and system telehealth implementations have targeted the reduction

of emergency room and urgent care utilization in adult populations, given the significant financial incentives in the commercial and Medicare spaces, with less investment in fields directly impacting maternal and child health outcomes. Findings in various demonstrations suggest that allowing nonpregnant adults to virtually connect with providers for what they believed were emergent issues positively impact low-value emergency utilization, with a 6.7% absolute reduction in potentially medically unnecessary emergency department visits compared with controls, a 44-minute reduction in total ambulance back-in-service times, and \$2468 cost savings per ER visit averted, in one study.⁹ A systematic review found that telehealth may assist in reducing unnecessary patient transfer and secondary emergency department overtriage, increasing the capacity of emergency departments to diagnose and manage patients locally.¹⁰ Previous studies have also demonstrated that telehealth assists with patient assessment, resulted in improved patient care, increased the capacity of rural staff to manage patients locally, minimized time away from support networks and reduced unnecessary retrievals.¹⁰ However, there is less programmatic experience in the space of maternal and child health.

Telehealth: Infrastructure and Regulation

Before the global COVID-19 pandemic, wide scale use of telehealth was limited by payment, provider and organizational constraints.¹¹ Barriers included lack of reimbursement, barriers to interstate and medical licensure, and requirements for hospital credentialing at the location of the patient in order to provide telehealth services.¹² Researchers have found the leading barriers contributing to the use of pediatric telehealth services were: reimbursements for care, lack of provider time, provider interest in originating site, state regulations, and poor business model sustainability.¹³ There are also issues

from the patient perspective, the most common being connectivity.¹³

Assessment of the population impact of telehealth has been limited since Medicaid reimbursement policies have varied by state, with uneven uptake across health systems and provider organizations, and Center of Medicare and Medicaid Services (CMS) restrictions on Medicare reimbursement.¹² Before the pandemic, laws governing medical practice and health insurance were enacted at a state level and as a result, certain states were more conducive to growth from a regulatory and financial perspective.¹⁴ Some states require that insurers cover a wide variety of telehealth services while others leave it up to the payer.¹⁴ Further research on the population health impacts of telehealth parity laws would allow for a better understanding of positive health outcomes associated with telehealth usage.

The COVID-19 pandemic has pushed health care providers to rely more heavily on telehealth to prevent disease transmission, encouraging regulatory authorities to relax guidelines in order to ensure access to essential care and services.¹² Over the past year, the CMS recommended extended coverage for telehealth services and telehealth regulatory requirements, supporting rapid policy change among states, who retain ultimate control over what specific telehealth services are covered and reimbursed by Medicaid (eg, some states provide for Medicaid reimbursement for remote patient monitoring and others do not).¹²

Recommended CMS changes support provider billing for the following telehealth services¹⁵:

- Initial and subsequent observation and observation discharge day management.
- Audio-only telephone services for certain services.
- Initial hospital care and hospital discharge day management.
- Initial nursing facility visits, all levels (low, moderate, and high complexity)

and nursing facility discharge day management.

- Critical care services.
- Domiciliary, rest home, or custodial care services, new and established patients.
- Home visits, new and established patient, all levels.
- Inpatient neonatal and pediatric critical care, initial and subsequent.
- Initial and continuing intensive care services.
- Care planning for patients with cognitive impairment.
- Psychological and neuropsychological testing.
- Therapy services, physical and occupational therapy, all levels.
- Radiation management services.
- Licensed clinical social worker services, clinical psychologist services, physical therapy services, occupational therapist services, and speech-language pathology services can be paid for as Medicare telehealth services.

Many states have subsequently changed Medicaid policy to support reimbursement of telehealth visits at the same level as standard in-person visits (telehealth parity); as of October 2020, 22% of states have telehealth parity laws.¹⁶ Reimbursement policies by private insurers remain heterogeneous and also vary state to state.

Telehealth: Geographic and Racial Inequities

While telehealth programs present opportunities for addressing geographic barriers to in-person care, access to telehealth is variable within populations.¹¹ These intersectional issues highlight racial inequities and structural racism as contributors to health care disparities despite the availability of health technology as a tool. Structural racism, or the totality of ways in which societies foster racial discrimination, through inequitable systems that in turn

reinforce discriminatory beliefs, values, and distribution of resources, drives adverse health outcomes, and is as relevant to telehealth implementation as it is to other modalities of care.¹⁷

Before the COVID-19 pandemic, a study found that highest utilizers of telehealth services were used and had received a post high school education.¹¹ A COVID-19 and telehealth uptake study found phone visits, rather than video visits, more frequent with older patients, Black patients and those on Medicaid, Medicare and self-pay status.¹¹ Fischer et al¹⁸ conducted a survey study and found that elderly adults (individuals over the age of 65) and those who identified as African-American were less likely to utilize telehealth services and televideo conferencing tools to connect with their providers. In this same study, Black individuals and respondents living below or near the federal poverty level were less likely to report willingness to use videoconferencing. Compared with other racial/ethnic groups, 33.6% of Black respondents reported willingness to use videoconferencing compared with 51.5% of respondents from other races.¹⁸ In addition, 69.1% of respondents with incomes of over \$200,000 reported willingness to use videoconferencing versus 29.9% (118) with incomes of <\$20,000 and 44.4% (309) with incomes between \$20,000 and \$50,000.¹⁸ This data suggests the use of telehealth tools such as videoconferencing were primarily used by wealthier, white individuals.

A study conducted by Jain et al¹⁹ found that internet use among Black patients with comorbidities such as hypertension and diabetes was less than their white counterparts. Lorence et al²⁰ similarly conducted a study on the effects of digital and technological disparities and found that the difference in technology use in different communities is impacted by both income and race. White individuals are more likely than those of Hispanic and African-American descent to utilize internet services in order to seek out health care information.²⁰ Language is also an

important determinant of computer ownership and Internet use even after controlling for education, family income, and immigrant status.²⁰

A literature review spanning 2012 to 2017 found that pregnancy apps were less utilized by lower-income and non-English speaking women. Preliminary evidence showed that a combination of technological, health literacy, and language issues may result in lower uptake of pregnancy apps by these groups and further investigation is required.²¹

Van Winkle et al²² found there were three major buckets that continue to reinforce the digital divide:

- (1) Poor internet connectivity and lower e-literacy.
- (2) Technology solutions tend to overlook vulnerable populations because those designing them come from more affluent and privileged backgrounds.
- (3) Limited incentives to focus on innovations targeting low-income patients. Many private provider practices have financial incentives to explore new technology that will differentiate them from competitors, while safety net providers rarely have the means or incentives to explore innovative health technologies.

Although telehealth can help in addressing gaps in access to care for those who might not be able to make it to a physical appointment, it is important to analyze the potential gaps in this service model, how these gaps can disproportionately impact communities that have already been structurally marginalized, and what ethical role physicians and practices have to play in minimizing disparities by intentionally designing telehealth interventions for and with communities most impacted by gaps in access to high quality care.

TELEHEALTH AND MATERNAL HEALTH

Telehealth is increasingly being used in every aspect of obstetrics and gynecology,

with more than 2000 mobile applications relating to the field of obstetrics alone, as of 2014.²³ Applications most relevant to population outcomes include those that support perinatal smoking cessation, breastfeeding, access to medical abortion services, and high-risk obstetrics.²⁴

Mobile Applications

In 2015, applications in the field of women's health and pregnancy accounted for 7% of all health applications.²⁴ A number of maternal health applications and monitoring tools provide resources directly to expecting parents through blogs, daily updates that track a baby's growth, forums and symptom trackers with the goal to positively impact prenatal and postnatal health outcomes.

Remote Monitoring and Management of High-risk Pregnancies

Remote patient monitoring has been incorporated as a tool in our health care system for a number of reasons, among them monitoring patients with chronic illnesses, patients with disabilities, neonates and elderly patients.

Marko and colleagues studied the impact of a prenatal care application in reducing in-person visits scheduled for low-risk pregnancies, while maintaining patient and provider satisfaction. In this study, 88 patients were enrolled, 47 in the experimental group and 41 in the control group. For patients in the experimental group the average number of in-person visits were 7.8 during pregnancy versus 10.2 for the control group. There was no statistical difference in patient or provider satisfaction.

Another study included 21 patients all > 17-year old at their first obstetric visit.²⁵ Patients were asked to participate in a remote monitoring and bidirectional messaging intervention at their first obstetrical visit and were monitored until 6 weeks after delivery. This study found that 87.5% of scheduled appointments were

attended or rescheduled. The average number of routine prenatal appointments attended was 7.4, compared with the practice average of 3.2 appointments.²⁵ On average, 277 messages were sent between each patient and care coordinator and 18.7% originated from patients. Thirty-nine modifiable, socioeconomic factors were identified and triaged to clinical staff (15), social work staff (7), state assistance services (8), local non-profits (6), and transportation services (3).²⁵ The implications of this study may be meaningful in the age of COVID-19 as our health system works to limit in-person health care visits as much as possible, though further work to understand impact on patient experience and perinatal outcomes at larger scale is urgently warranted.

Hoppe et al²⁶ conducted a prospective single-cohort feasibility study of a remote monitoring program where women with hypertension in pregnancy participated in a postpartum telehealth intervention for blood pressure management after discharge. The primary feasibility outcome measures were recruitment and retention through 6 weeks postpartum.²⁶ Secondary outcomes included the incidence of severe postpartum hypertension and/or need for blood pressure treatment after discharge, participant satisfaction, and 6-week hospital readmission. Participants received a tablet and equipment to transmit vital signs to a central monitoring site daily, and participated in telehealth or telephone visits with a nurse at 48 hours and as needed.

Ultimately, among 1413 deliveries, 263 (19%) women had hypertension in pregnancy, and (47%) of women approached were consented. The retention rate was 95%. Among study participants, the incidence of severe hypertension after discharge was 9 (16%). Twenty-nine (53%) of participants required treatment because of exacerbations in blood pressure after discharge, in which 9 (16%) were severe.

There were no hospital readmissions. Overall, 39 (86%) participants were satisfied with the remote monitoring.²⁶ In another study, a postpartum text-based remote monitoring program for those with preeclampsia reduced racial disparities in postpartum blood pressure ascertainment. Given that >5% of maternal deaths occur postpartum, and hypertensive and cardiac disease are leading causes of pregnancy-related deaths in the United States, such findings suggest promising impacts on maternal mortality and morbidity if such interventions are further developed and implemented.²⁷

Maternal and Infant Health: Case Management and Population Health

Some regionalized maternal and perinatal health care programs are attempting larger telehealth integrations in order to improve the quality of care for all pregnant women and newborns. A state collaborative program in Arkansas created a statewide telemedicine and clinic network consisting of an education and support program for obstetric providers, case management services, a 24-hour call center, and a distribution network for development and distribution of evidence-based guidelines.²⁸ Improvements in technology have allowed the state's only group of board-certified maternal-fetal medicine specialists, located centrally in Little Rock, to provide real-time clinical support to physicians, as well as consultation or direct care to patients statewide.²⁸ Further analysis of this program's health outcomes data would be needed in order to examine impacts on cost and outcomes, though such models are promising as states move toward perinatal regionalization in accordance with recommendations around levels of care designation.

Georgia has created a state collaborative model where the Georgia Department of Public Health's Office of Telehealth and Telemedicine (GDPH) partnered with county health departments

to implement a telehealth network in all 159 counties in the state because of concerns that counties with the highest infant mortality rates correlated with lack of access to obstetricians.²⁹ Nurses in Georgia's county health departments use GDPH-provided telemedicine "carts" in order to facilitate video conferences between pregnant residents and specialty providers for a variety of health care services, resulting in uptake of visits. Similarly, the Massachusetts, Child Psychiatry Access Program for Moms connects local obstetricians, primary care physicians, and pediatricians to subspecialty expertise to optimize behavioral health outcomes during and following pregnancy.⁵ Impacts on population health outcomes must be further evaluated to determine long-term health efficacy of such programs.

NEWBORN AND EARLY CHILDHOOD CARE

Meaningful impact on perinatal outcomes also requires intervention supporting newborn and early childhood health. A survey study assessing the use of telehealth for pediatric care, at-large, found that neonatology is a top telehealth service line within the field of pediatrics.¹³ Given that for Medicaid-insured children, asthma and mental health conditions have been identified as the highest cost expenditures, telehealth efforts have focused on these needs³⁰; with studies suggesting that telehealth services allow for improved coordination between pediatricians and school-based clinics, improved self-monitoring and reduced emergency department utilization for children with asthma.^{31,32}

Published experience regarding impact of telehealth on neonatal outcomes is most robust in the field of lactation, where telehealth visits have been shown to improve adherence to exclusive breastfeeding, where benefits extend to high-risk and preterm infants, and where direct-to-

consumer models are outpacing payer and medical home integration of telehealth services.

POPULATION HEALTH AND VALUE-BASED PAYMENT CONSIDERATIONS

In all, telehealth can be leveraged as a tool to improve quality of care for maternal and pediatric care, with promising early findings limited to direct-to-consumer models and islands of innovation. Significant further investment is needed to assess potential impact at the population level. Such investments may be enabled in a cost-effective manner by more flexible payment models that move beyond fee-for-service reimbursement structures. Incremental policy changes have supported this shift in recent years; the National Committee for Quality Assurance has made changes to the healthcare effectiveness data and information set that has allowed for telehealth to be used as a quality measurement for providers. Since healthcare effectiveness data and information set is one of health care's major tools to assess provider performance, it is critical for providers to adopt telehealth care in their practice for large scale valued based payment outcomes.³³

Lessons From the COVID-19 Pandemic and Looking Forward

Such incremental changes have been outpaced with the dramatic uptake of telehealth services during the 2020 COVID-19 pandemic. Obstetric providers around the country have begun to create protocols for more flexible and efficient prenatal care, delivered using telehealth, with unclear impact on patient experience and perinatal outcome to date. Researchers flag that the current model of delivering prenatal care needs to be redesigned and highlight the guiding principles to develop robust prenatal virtual care as: (1) use in-person care for services that cannot be delivered remotely and offer video visits for other essential services and (2) allow

patients to tailor their support to meet their needs through opt-in programs.³⁴ Aziz and colleagues found that patient satisfaction was not negatively impacted by virtual visits among mothers who utilized telehealth for prenatal care. This study emphasizes that telehealth services can be tailored with high-risk pregnancies in mind.³⁵

Telehealth services can improve a provider's reach, enable partnerships with community-based entities, schools, government programs and payers, help screen for SDOH, support case management and serve as a critical resource for disadvantaged communities. However, there is limited experience in the United States with large scale implementations that incorporate users regardless of socioeconomic background, and engage long-standing racial inequities that are the hallmark of our nation's maternal outcomes. Overlapping disparities in technology access may further exacerbate such inequities if telehealth implementations are seen as solutions to issues of quality and access in a vacuum. Taking advantage of the reduction of regulatory restrictions for telehealth use, particularly among Medicaid and Medicare populations, providers, payers and other stakeholders must work in partnership with impacted communities to mitigate maternal morbidity and mortality and preterm birth, improve infant birth outcomes, patient experience, and long-term pediatric health. In order to continue to improve telehealth access and equity:

- Design: telehealth designers must create co-designed solutions with underserved communities in mind, in order to generate measurable impact on historically inequitable outcomes.
- Care delivery system: payers and health systems must continue to expand telehealth coverage and increase the provision of technology education.
- Regulations and policy: government leaders and providers can continue to push for telehealth parity laws and

increased funding of telehealth services but must assess whole and segmented impact in real-time.

- Quality: providers can continue to integrate telehealth as a mechanism for achieving value-based care and positively impact a patient's quality of care.

Given the relevance of maternal and child health outcomes to population health overall, providers of obstetric and pediatric care and other stakeholders can center their patients, communities and outcomes of interest in the shifting and dynamic context posed by greater available technology. COVID-19 and the availability of new payment mechanisms that enable more flexible, community-based and technology-enabled care provide timely opportunities to answer the questions posed by experience and findings to date.

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