Deploying a Mobile Health Unit with Telehealth in Rural and Under-Resourced Communities

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Abstract

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The healthcare needs in the Mississippi River Delta Region (Delta Region) of the United States consist of primary care and mental healthcare provider shortages (Health Resources and Services Administration [HRSA], 2023) and medically under-resourced areas (HRSA, 2021). These healthcare needs lead to poorer health status (Gennuso et al., 2016). Rural health needs in the Delta Region are even more compared to urban areas in Delta Region (Cross et al., 2021). Rural residents have challenges accessing healthcare services, particularly primary care (Rural Health Information Hub 2021a; Rural Health Information Hub, 2021b), obstetrical care, (Kozhimannil et al., 2017; American College of Nurse Midwives, 2015), and mental health care (Morales et al., 2020). The definition for "rural" as related to this work is defined by the HRSA (n.d.), "all non-metro counties, all metro-census tracks with RUCA codes 4-10, and large area Metro census tracts of at least 400 sq. miles in area with population density of 35 or less per sq. mile with RUCA codes 2-3" (para. 11).

Mobile health units have successfully connected rural patients to urban specialty providers via telehealth before, during, and after the COVID-19 pandemic (Geisler et al., 2019; Rousseau et al., 2021). Following the declaration of a public health emergency due to the COVID-19 pandemic in March 2020, telehealth use increased to facilitate care for patients when outpatient offices were closed (Cortez et al., 2021; Demeke et al., 2020; Koonin et al., 2020). Due to the rapid implementation of telehealth in these clinical settings, many students who had practicum rotations in these settings were not given training or education regarding telehealth best practices (Usher et

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al., 1999). Insufficient telehealth education for healthcare students limits their ability to provide comprehensive health care to isolated populations and leaves the students less equipped to educate patients in feeling confident with virtual visits.

Prior to the COVID-19 pandemic, some nursing programs provided telehealth education and training, such as telehealth etiquette and best practices (Rutledge et al., 2021). In addition, some colleges of nursing also used telehealth prior to the pandemic to conduct virtual faculty site visits to assess clinical performance to supplement in-person faculty site visits (Harris et al., 2020). Since the 1990s, telehealth education and technical assistance have been provided to health systems, providers, academic institutions, and other stakeholders by the HRSA-funded Telehealth Resource Centers (Skillman et al., 2015). The support has been instrumental in promoting the acceptance and integration of telehealth across various healthcare settings.

Oftentimes rural areas have difficulty recruiting health care providers and are identified as health care provider shortage areas (HRSA, 2023; HRSA, 2021). In the Delta Region, many rural residents travel 100-150 miles to receive specialty care in the Memphis area due to health care provider shortages in the rural areas. One way to assist with the healthcare provider shortage is training students in rural and under-resourced areas. Nursing students who have rural clinical experiences are more likely to practice in a rural setting after graduation (Skillman et al., 2015; Brommelsiek & Peterson, 2020). Placing nurse practitioners and nursing students in rural settings facilitates a readiness to practice in rural communities by improving rural cultural competence, increasing knowledge of social drivers of health, gaining a better understanding of health literacy needs, learning how to be a better patient advocate, enhancing communication skills, honing assessment and other practical skills, and gaining insight into one's own need to self-reflect and practice self-care (Lefler et al., 2018).

The MHU provides care four days a week in these rural counties. One day each week, it is parked beside a community mental health center to facilitate primary care services for these patients. Another example of where the MHU provides care is in a low-income housing complex. Many of these patients need assistance with specialty provider appointments, specifically by telehealth. The MHU team uses the Assessing Meaningful Community Engagement conceptual model to work with communities to improve health outcomes and health equity (Aguilar-Gaxiola et al., 2022).

Equipping Mobile Health Unit with Telehealth

In 2023, the University of Tennessee Health Science Center College of Nursing (CON) launched a nurse-led Mobile Health Unit (MHU) funded by the HRSA Nurse Education, Practice, Quality and Retention grant. The MHU is 24 feet long and 8 feet wide with 117 square feet of workspace consisting of one exam room and one intake area with telehealth services and a phlebotomy station. The CON collaborated with the university's Information Technology Systems (ITS) team and the MHU vendor to design two telehealth stations with industry-required security, a commercial Tier I network package that includes a Cradle point IBR900 gigabit-class long-term evolution (LTE) router with 940 Mbps firewall throughout, and dual-band concurrent Wi-Fi 5 that is a 5G-ready and can be field upgraded. Prior to selecting a cellular carrier, the MHU and ITS team assessed which one would provide the greatest coverage in rural areas. Due to budgetary constraints and contractual agreements, the MHU team selected one carrier therefore not using the full capacity and functionality of the Cradle point device. An extension antenna was placed on the MHU's rooftop to allow a better connection with the LTE network and ensure the greatest coverage in rural areas. A router and networking hardware system was designed, installed, and configured with multiple virtual local area networks (vLANs) to use up to 10 concurrent virtual

private network (VPN) tunnels and 15 non-VPN users. This device, which is called a Pepwave router, is commonly used to provide secure and reliable network solutions for remote clinics, where connectivity is critical. The unit is equipped with firewall/security analytics, fleet management/GPS location, and a cellular connectivity tracking map, allowing identification of areas on the GPS with low/bad signals.

Electronic Health Record with Telehealth Capabilities

Careful consideration was given to ensuring our team chose an electronic health record (EHR) system that met the unique challenges and constraints of a mobile setting. The MHU team followed several methodical steps to ensure we were choosing a reliable program. Our team worked with an organizational ITS expert and performed a modified needs assessment to ensure the proper regulatory requirements would be met with the EHR system and that the system would adapt to the evolving needs of our growing MHU program. The various EHR features, functionalities, pricing, and possible customizable solutions were carefully analyzed to ensure a suitable fit for our MHU program. A hands-on demonstration of each system by the EHR vendors helped the team evaluate the ease of use and compatibility with our MHU program. After careful consideration, our team deployed the NextGen (Pradeepa, Rajalakshmi, & Mohan, 2019) EHR since it was used in other clinics within our organization and allowed efficient management of patient health records, appointments, prescriptions, and billing.

During the EHR implementation phase, Uniform Data System (UDS) reporting became a requirement of grant-funded programs. An annual reporting system, UDS reporting tracks program performance and patient outcomes in health care services provided to under-resourced communities and vulnerable populations. Fortunately, UDS reporting was a customizable option in the NextGen EHR system. Also, during implementation, NextGen announced the company was

joining forces with Luma Health (Rush et al., 2022) to equip ambulatory organizations with enhanced solutions for patient intake and telehealth visits. The Luma Health features will enable patients to self-schedule and access their personal health information. Integrating features like self-scheduling and offering patients access to personal health information is increasingly recognized as a key component of quality health delivery (Rhoads, 2022).

Telehealth Assessment

Rural areas often experience disrupted internet and cellular services, restricting where patients can access a telehealth appointment (Lefler et al., 2018; Lopez et al., 2021; Pradeepa et al., 2019; Rush, et al., 2021). Therefore, testing our telehealth services and connectivity prior to launching care was essential. In June 2023, the MHU team traveled to Lake and Lauderdale Counties to test cellular connectivity in three distinct areas within each county where services would be provided. Download and upload speeds during a two-way audio and video test were assessed at each site. Of the six sites assessed, none had lag time or decreased connectivity when testing three simultaneous virtual visits. As a part of our ongoing continuous quality improvement plan, the MHU will track the quality of the telehealth services provided, such as patient satisfaction, the length of time to schedule an appointment with a specialty provider, quality of the connection, and provider and student telehealth etiquette. In addition to assessing the quality of telehealth services, the MHU will track number of telehealth visits conducted, patient outcomes, and other metrics such as, patient demographics, and quality of care indicators.

Telehealth Training

All faculty, staff, and nursing students who rotate on the MHU must complete a two-part training program consisting of didactic and experiential learning. First, all learners complete the *Introduction to Virtual Care for Health Care Providers and Students* (Rhoads, 2022) online

program, which includes three modules: Introduction to Telehealth, Telehealth Etiquette, and Telehealth Legal and Ethical Issues. These modules were developed as part of another HRSA-funded project that provided telehealth training for students, faculty, and preceptors (Rhoads, 2022). Nurses and nurse practitioners who complete the modules are awarded Nursing Continuing Professional Development contact hours; staff, students, and non-nurses are awarded a certificate of completion. To date, 85 faculty, staff, and students have completed the *Introduction to Virtual Care for Health Care Providers and Students* training. Eighty-eight percent of learners reported that they would change their practice, and 90% reported the training program as good or excellent. One learner stated, "These modules reinforced checking and understanding state policies regarding telehealth." Another learner stated, "I would like to implement some sort of telehealth home bridge for discharged NICU patients."

In the second part of the program, learners receive hands-on training in the CON Telehealth Training Center, a Satellite Training Center of the HRSA-funded South Central Telehealth Training Center (South Central Telehealth Resource Center, 2024) or on-site in the MHU. This experiential training includes simulated experiences often led by telehealth experts in their specialty. For example, nurse midwifery student training includes a guest lecturer who is an advanced practice nurse who routinely conducts high-risk pregnancy visits via telehealth. The training provides faculty, students, and staff the opportunity to practice and apply these new skills in a safe and supportive learning environment, preparing for real patient interaction with confidence.

Telehealth Services on the MHU

The CON is pioneering a transformative approach to delivering essential healthcare services in rural and under-resourced communities. By leveraging innovative telemedicine

technologies, the MHU is breaking down the barriers of distance and accessibility that often prevent individuals from accessing essential specialty care. The experience also teaches the future healthcare generation to consistently brainstorm ways to use innovative technologies to solve patient accessibility issues.

With an initial focus on primary care, mental health, and obstetrical care services, the MHU ensures that patients receive timely, high-quality care regardless of location. Patients can connect with experienced healthcare providers remotely through telemedicine consultations and receive diagnosis, treatment, and support without extensive travel or long wait times.

As healthcare demands shift or new challenges arise in these communities, the MHU stands ready to integrate additional specialty services, ensuring that residents in these rural and under-resourced areas have access to comprehensive healthcare options.

Conclusion

In collaboration with community healthcare partners, we are implementing specialty care services via telehealth to better meet the needs of geographically isolated individuals and provide needed services and education. In 2024, the MHU will begin billing for services to facilitate sustainability. Additionally, we are providing enhanced educational opportunities in rural communities and under-resourced populations for graduate and undergraduate students who rotate on the MHU. One of the goals of the MHU is to leverage innovative telemedicine technologies to decrease the barriers of distance and accessibility that often hinder individuals from accessing vital specialty care.

The flexibility of offering primary and specialty care via a MHU allows for the adaptation and expansion of services based on the evolving needs of the community. As healthcare demands shift or new challenges arise, the MHU can revise locations or specialty services we provide. The

MHU team screens every patient on their social drivers of health and socioeconomic needs. The MHU team uses continuous quality improvement methods to track socioeconomic and health outcomes of our patients.

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Author Contributions Statement

Author 1: Methodology, Investigation, Formal analysis, funding, Writing – Original Draft, Review & Editing. Author 2: Methodology, Investigation, Formal analysis, funding, Writing – Original Draft, Review & Editing. Author 3: Writing – Original Draft, Review & Editing. Author 4: Data curation, Writing – Review & Editing. Author 5: Data curation, Writing - Reviewing and Editing. Author 6: Methodology, Writing – Reviewing and Editing.

Conflict of Interest

Sarah Rhoads receives royalties for the development of Angel Eye Webcamera System.

Data Access Statement

Following the Transparency and Openness Promotion (TOP) guidelines, deidentified data from this study are available upon request to the corresponding author upon a reasonable request. This study was not pre-registered.

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