

STATE OF THE ART AND SCIENCE

Why Aren't Our Digital Solutions Working for Everyone?

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Abstract

The article explores a digital injustice that is occurring across the country: that digital solutions intended to increase health care access and quality often neglect those that need them most. It further shows that when it comes to digital innovation, health care professionals and technology companies rarely have any incentives to focus on underserved populations. Nevertheless, we argue that the technologies that are leaving these communities behind are the same ones that can best support them. The key is in leveraging these technologies with: (a) design features that accommodate various levels of technological proficiency (e-literacy), (b) tech-enabled community health workers and navigators who can function as liaisons between patients and clinicians, and (c) analytics and customer relationship management tools that enable health care professionals and support networks to provide the right interventions to the right patients. Finally, we argue that community health care workers will need to be incentivized to play a larger role in building and adopting innovations targeting the underserved.

Narrative: Heart Failure and the Failure of Remote Monitoring

Jeremy lives in a small subsidized housing development with his mother and three sisters. At 52, he struggles with heart failure with reduced ejection fraction. This year alone, he has visited the emergency department four separate times. Luckily, a nearby hospital has recently been focusing on reducing readmission rates for heart failure in response to increasing incentives related to value-based care. The hospital is exploring promising technologies that might help Jeremy: inexpensive remote monitoring devices that are connected wirelessly to a broadband router through Bluetooth®. The solutions require Jeremy to use a scale and arm blood pressure cuff to record daily metrics that are sent wirelessly to his cardiologist. The idea is that, if clinicians can monitor Jeremy on a real-time basis, they can evaluate his health to see if he is deteriorating or stable. They can then use this information to proactively schedule an appointment or to make a medication adjustment. The solution, like many designed to prevent costly emergency visits or readmissions postdischarge, is considered to be integral in bending the cost curve and improving health. The problem is that none of these solutions are working. Jeremy is only becoming sicker and more frustrated. He lives in a home where wireless

internet connection is spotty. The connection is not dependable enough to download search engines, let alone to routinely send signals from his arm cuff to his clinician. Jeremy also repeatedly forgets to take his medication. In short, our “promising” digital technologies are not helping Jeremy at all.

Barriers to Digital Health Solutions

Digital health solutions are increasingly being touted as the key to solving the two great health care problems of our time—cost and access [1]. While the quantitative impact of these digital solutions is still yet to be determined [2], their potential for driving the next generation of care is indisputable [3, 4]. But, as with other historical transformations, the solutions and associated shifts risk leaving certain groups or individuals behind [5, 6]. The transition to digital health and the opportunities it provides are causing a widening gap between those who are “connected”—that is, those who can access *and* use technology services and tools that rely on internet or wireless connectivity—and those who are not. We highlight three barriers to leveraging digital solutions to address underserved patients like Jeremy:

1. *Poor internet connectivity and low e-literacy.* Many disadvantaged communities have [poor broadband access](#), part of a growing digital injustice that has been well documented [7-9]. These same communities suffer from associated low technological proficiency, or low e-literacy, that renders most emerging digital health solutions ineffective [10].
2. *Those who design technological solutions tend to overlook those most in need.* Those who design technological solutions are almost exclusively well-educated and wealthy [11]. Meanwhile, high-cost and high-need patients tend to be older, more diverse, and less educated [12].
3. *Limited incentives to focus on innovations targeting low-income patients.* Many physician practices have financial incentives to explore new technologies as a way to differentiate themselves from competitors [13], but they are often focused on attracting commercially insured patients. Meanwhile, safety net health care professionals rarely have the means or incentives to explore innovative technologies [14].

These issues pose ethical questions for health professionals. What responsibilities do facilities and their clinicians have to explore low-tech innovations targeting underserved communities? Are health professionals violating ethical guardrails by introducing technologies in communities of the primarily well-to-do? What obligation does the profession have to create an entrepreneurial environment for solutions to be designed for patients who actually need them? These questions have historically been answered (or left unanswered) according to health professionals’ own ethical inclinations. But as value-based incentives grow around at-risk patients, clinicians will increasingly look for strategies and tactics on how to better manage patients like Jeremy.

What Can Be Done to Rectify Digital Injustice?

The technologies that are leaving disadvantaged communities behind are the same technologies that can best support them. The key is in leveraging them with (a) design features that accommodate various e-literacy levels; (b) tech-enabled community health workers, who can function as liaisons between patients and professionals; and (c) analytics that enable health professionals to push the right technologies to the right patients. Finally, the industry will need to (d) incentivize health care professionals to play a larger role in building and adopting innovations targeting the underserved. Before any of these changes can happen, however, communities will need to be provided with internet access and electronic health (e-health) education programs. Each of these innovations can solve at least one recognized problem (see table 1).

Table 1. Mapping tech-related solutions to issues

Solution	Issue		
	Poor connectivity or low e-literacy	Tech not designed for those in need	Limited physician incentives
Expand coverage and provide e-health education	√		
Design tech for underserved communities	√	√	
Use tech-enabled community workers	√	√	
Connect patients with the right resources	√	√	
Develop programs to incentivize clinicians		√	√

Expand internet coverage and support e-health literacy training programs. Investments in broadband to optimize the use of digital health resources are beginning to target digital inclusion issues [15, 16]. These investments are steps in the right direction, but access will need to be paired with education and support programs to be effective. In her paper on novel approaches to technology adoption, Amy Sheon and colleagues lay out several well-supported suggestions for internet access programs, free digital skills training, and commercial partnerships to equip, educate, and connect low-income residents [8]. They

call for engaging community health workers to screen health system patients for digital skills and connectivity. They also refer them to networks of community organizations that developed under the \$4B Broadband Technology Opportunities Program to access low-cost internet and free digital skills training [16]. The community health workers would then provide specific training in using digital health tools [5]. In Jeremy's case, instead of relying on the clinician to educate Jeremy on the technology, the hospital could have partnered with local education programs to set up and support the use of digital technologies in Jeremy's home. Jeremy could have been enrolled in free digital skills training to help him monitor his condition with low-tech equipment. Sheon and colleagues' recommendations constitute a critical starting block on which our subsequent suggestions build.

Design technologies for underserved patients. Few health applications are adapted for patients with low e-literacy rates [17]. To be effective, technologies need to be designed for people with different levels of digital competency and needs for assistance in using these tools. Rather than potentially ill-equipped health care professionals being tasked with training their patients, specialists with expertise in digital skill acquisition could help ensure patients' proficiency with digital solutions [5]. Caretakers should be able to leverage various types of remote monitoring technologies for the same disease, understanding that each person responds to, and uses, technology very differently. The Network of Digital Evidence in Health (NODE Health), a nonprofit consortium of health care systems (including the authors' organization, LifeBridge Health) that serves "to promote evidence based digital medicine" [18], is beginning to adopt a tool and simple questionnaire to understand the "digital fingerprint" of patients. The tool, RxUniverse, developed by Sinai App Lab, aggregates the most effective evidence-based apps, care plans, and health education materials available onto a single platform, which then allows clinicians to prescribe *simple* digital medicine solutions directly to patients based on the assessment of the patient's digital skills and digital engagement [19]. Jeremy, for example, could have been screened by a community health worker to understand the type of internet or wireless coverage he had or the types of phone reminders that best suit his digital abilities. If he had a cell phone, text messages could have been sent to his phone reminding him of medication guidelines, and, if he had a smartphone, he could have been provided free access to a [home monitoring](#) system via cellular networks rather than broadband. With this in mind, questions like "What kind of applications do you use and how often?" could become one of the most important questions a nurse practitioner can ask in the transition of care.

Integrate tech-enabled community health workers into community programs. Rather than inject technologies into communities, we would be better served by providing community health workers with digital tools that can respond to or supplement low-tech monitoring or simple messaging devices. For example, Jeremy could have been provided with community-based home visits, which have been shown to enhance compliance

with medications and to reduce readmissions of patients with chronic diseases [20]. The routine home visit by a community health worker with a mobile monitor could have facilitated a virtual visit with a remote clinician. Responses to the Ebola crisis may be one of the best examples of empowering [digitally-equipped health workers](#) in remote, disconnected areas. During the crisis, several low-tech solutions were developed to provide health workers in Guinea with basic surveillance and communication tools, supported by low-tech, flip-phone telehealth solutions. These solutions were a far cry from the more advanced user experience platforms on today's smartphones, but in resource-constrained environments, they were utterly transformational [21].

Connect patients with the right resources. In some ways, the ultimate promise of digital technology is not the ability to deliver or manage care remotely but the ability to better customize the entire interaction between the patient and the health care system. Such customization could facilitate leaps forward in our ability to improve health, to enhance the patient experience, and to reduce cost [22, 23]. Table 2 gives examples for each of these goals and how analytics can help patients like Jeremy.

Table 2. Managing disadvantaged patients now and in the future

Managing low e-literacy patients	
The present	The future
Improving health	
A patient with chronic heart failure (CHF) might see any cardiology specialist, if the patient sees any at all	CHF patients are matched with a clinician based on patient specifics (history, level of acuity, other needs) and a providing team's experience and past performance with CHF patients
Patient experience	
With limited preference information, systems do not know how, when, and where to reach patients in the most effective manner	Based on both preset and learned preferences, patients indicate their preferences for alerts and notifications
Reducing cost per capita	
Health systems routinely route high-need patients to high-touch, high-cost programmatic interventions based on their clinical condition	Generic clinical populations are divided into more specific, actionable subpopulations and matched with intervention programs based on their likelihood of success for patients with similar characteristics

Incentivize community providers to play a greater role in community innovations. Until there are more opportunities for underserved patients to play a greater role in the design of digital technologies, community health facilities and their clinicians will have to represent their patients and ensure the integration of digital solutions into their care. To facilitate this endeavor, medical associations could consider a fellowship fund for physicians to work with technology firms to focus exclusively on at-risk communities. Patients from underserved communities could collaborate with these firms and physicians in order to ensure that the newly designed digital technology meets the population's needs [24]. Medical associations could also collaborate with organizations like NODE Health and payers, social services, tech startups, venture capitalists, and safety net health care professionals to develop and share a common business case for accelerating innovative technologies targeting the underserved.

Conclusion

Digital health tools have the potential to change how we provide care [25]. To fully realize this potential, communities will need to have connectivity, digital educational programs, and tech-enabled community health facilities and professionals to support them. Programs will also need to be created to incentivize health professionals and tech companies to focus on disadvantaged communities. Until this happens, those left on the wrong side of the digital divide will experience widening health disparities.

Four months after Jeremy was provided with the keys to solving the health crisis, he made one last visit to the emergency department, having collapsed in his apartment after a sudden cardiac arrest. For the four months preceding this event, Jeremy was equipped with what many would have considered to be the latest digital technologies needed to manage his disease, but, sadly, he was unable to manage the technologies. Despite all the promising digital innovations emerging in health care these days, Jeremy died the old-fashioned way.

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