

The Digital Revolution in Behavioral Health

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Michael J Hasselberg¹ 

Abstract

BACKGROUND: Technology is disrupting every modern industry, from supermarkets to car manufacturing, and is now entering the health care space. Technological innovations in psychiatry include the opportunity for conducting therapy via two-way video conferencing, providing electronic consultations, and telementoring and education of community health care providers. Use of mobile health applications is also an expanding area of interest and promise. **OBJECTIVE:** The purpose of this article is to review the evolution and pros and cons of technology-enabled health care since the digital movement in psychiatry began more than 50 years ago as well as describe the University of Rochester's innovative digital behavioral health care model. **METHODS:** A review of the literature and recent reports on innovations in digital behavioral health care was conducted, along with a review of the University of Rochester's model to describe the current state of digital behavioral health care. **RESULTS:** Given the lack of access to care and mental health professional shortages in many parts of the United States, particularly rural areas, digital behavioral health care will be an increasingly important strategy for managing mental health care needs. However, there are numerous hurdles to be overcome in adopting digital health care, including provider resistance and knowledge gaps, lack of reimbursement parity, restrictive credentialing and privileging, and overregulation at both the state and federal levels. **CONCLUSIONS:** Digital health innovations are transforming the delivery of mental health care services and psychiatric mental health nurses can be on the forefront of this important digital revolution.

Keywords

telepsychiatry, telemedicine, digital health, health care technology, behavioral health, psychiatric mental health nursing

Technological innovations in psychiatry are revolutionizing health care and are an important strategy for managing mental health care needs in the United States, particularly, in rural and underserved areas. To improve access to care, the University of Rochester (UR) has developed a digital behavioral health model of care. This article describes that program and reviews the evolution of digital health care in psychiatry and the pros and cons of this form of delivery of services.

Mental Health Care Background

Data from the National Institute of Mental Health and the Substance Abuse and Mental Health Services Administration (SAMHSA) indicate that 44.7 million people in the United States had a mental illness in 2016, and a quarter of that population had a severe mental illness (National Institute of Mental Health, 2015; SAMHSA, 2017). One quarter of people with mental illness have more than one mental health condition (Karg et al., 2014), and many have comorbid mental health and medical disorders. Unfortunately, access to treatment is lacking, particularly in rural areas.

According to SAMHSA, in 2016 only 43.1% of the 44.7 million Americans with any type of mental illness age older than 12 years had used mental health services (SAMHSA, 2017), in part due to mental health professional shortages (Health Resources and Services Administration [HRSA], 2015).

Few can argue that the United States has excessive health care costs, especially in comparison to other wealthy countries. A Kaiser Family Foundation analysis of data from the Organisation for Economic Co-operation and Development found that the United States spends twice as much per person on health care (\$10,348) annually as most other countries (average \$5,280; see Figure 1; Sawyer & Cox, 2018). What's more, that gap has been widening since 1980 (Sawyer & Cox, 2018).

¹Michael J Hasselberg, PhD, RN, PMHNP-BC, University of Rochester Medical Center, Rochester, NY, USA

Corresponding Author:

Michael J Hasselberg, University of Rochester Medical Center, 315 Science Parkway, Suite 400, Rochester, NY 14620, USA.
Email: michael_hasselberg@urmc.rochester.edu

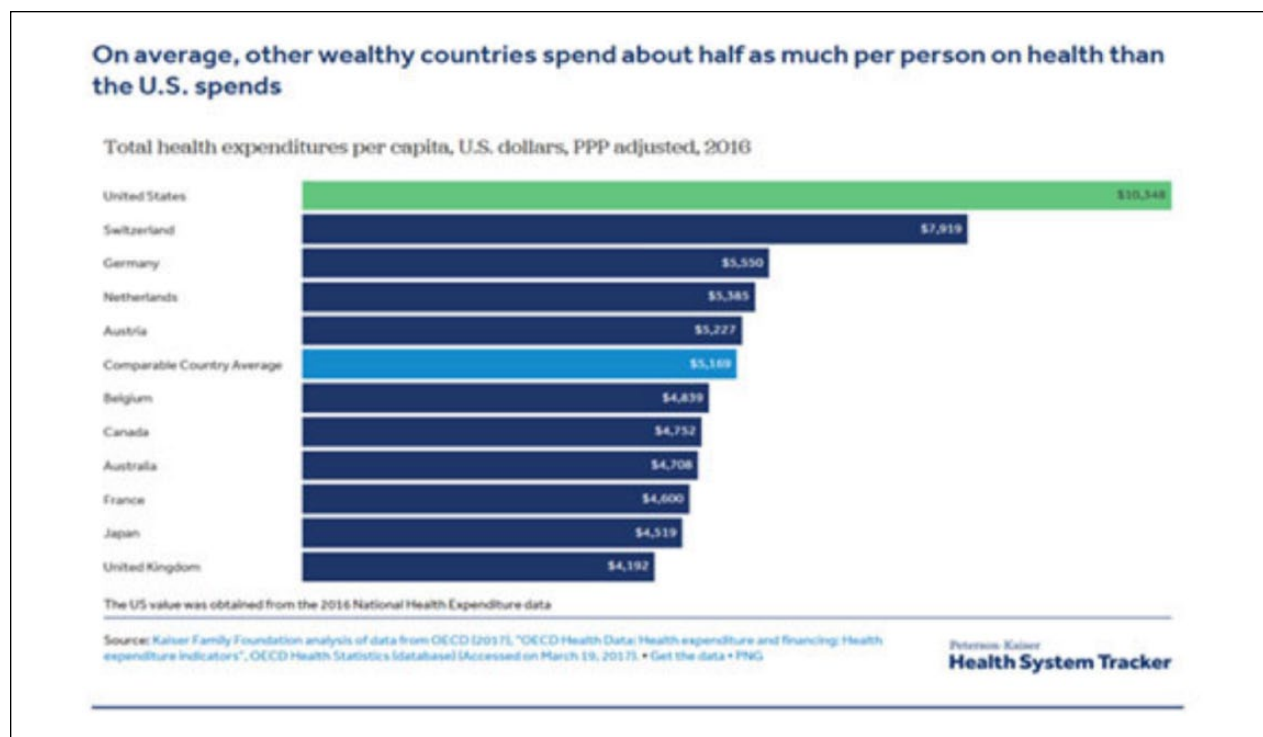


Figure 1. The broken health care system.

Data compiled by the National Institute for Health Care Management show that 5% of the U.S. population accounts for half (49%) of health care spending (\$43,212 average expenditure per person per year), and 50% of the U.S. population accounts for only 3% of health care spending (\$253 average expenditure per person per year; National Institute for Health Care Management, 2014). The 5% are known as “superutilizers”—a shorthand term for people with complex physical and behavioral health and social issues who have high rates of utilization for emergency department and hospital services (Robert Wood Johnson Foundation, 2014). Eighty percent of superutilizers have a mental illness (Cohen, 2014).

Currently, there are too few psychiatric nurses and nurse practitioners and psychiatrists available to meet the needs of the superutilizer population or, indeed, the overall population with mental health disorders. Although efforts are being made to increase the number of providers, training, and employment of psychiatric mental health professionals is not going to happen overnight. Therefore, it is essential that providers think outside the box in addressing these care gaps, and adoption of technology-enabled care is one way to meet these needs.

Technology Disruption

Technology is disrupting every modern industry, from supermarkets (Amazon’s purchase of Whole Foods) to

car manufacturing (Tesla). In 2008, the top five publicly traded companies by market cap were Exxon, Petro-China, Walmart, China Mobile, and P&G. By 2013, the top five were Apple, Exxon, Microsoft, Google, and Berkshire Hathaway. Today, the top 5 are all technology companies—namely Apple, Amazon, Alphabet (the parent company of Google), Microsoft, and Facebook (Statista, 2019).

Big technology is also entering the health care space (Figure 2): Apple has developed a health care platform that can be utilized by hospitals to deliver more efficient, personalized care with software that can be used with ease by both providers and patients. Apple has also created a health records system that integrates with the Apple Health Mobile application (app) for smartphones, where users can read and store their health records securely and aggregate their health data from multiple institutions. Another innovation is the Apple watch, which has features that can detect heart rate, irregular heart rhythms, and falls; in addition, if users download a special electrocardiogram app, they can perform an ECG on themselves in their home. ResearchKit is an Apple innovation that allows health care professionals to create apps that streamline research tasks, while CareKit allows them to develop customized apps for their patient population (Apple, 2019).

Amazon is entering the health care space by selling medical supplies and equipment, acquiring the online

Apple	Amazon	Google	Microsoft	Facebook
<ul style="list-style-type: none"> • Apple Health Mobile App • Apple Watch • Apple Health Records • ResearchKit & CareKit 	<ul style="list-style-type: none"> • Medical supplies & equipment • Employee health with J.P. Morgan and Berkshire Hathaway • Voice technologies (Alexa) 	<ul style="list-style-type: none"> • Over 190 healthcare patents filed • Google Glass • Body sensors and monitors • HIPAA cloud platform • \$375 million investment in Oscar Health 	<ul style="list-style-type: none"> • Healthcare NExT • Azure for health data • Microsoft Genomics • AI Network Project • Empower MD with UPMC • Project InnerEye 	<ul style="list-style-type: none"> • Data share with top hospitals (on hold) • AI for suicide predictions and drug addiction • Healthcare marketing

Figure 2. Big tech in health care.

Note. AI = artificial intelligence; HIPAA = Health Insurance Portability and Accountability Act; UPMC = University of Pittsburgh Medical Center.

pharmacy company PillPack, and developing voice technologies using its artificial intelligence (AI) Alexa device (Paavola, 2018). In the latter case, the device is able to detect when a person is sick (e.g., coughing or sneezing) and provide diagnostic and self-care/first-aid advice; it can also be used to provide information about drugs and diseases (Vath, 2018). The company has applied for numerous patents and was looking for a Health Insurance Portability and Accountability Act (HIPAA) compliance expert in 2018 (Paavola, 2018). Amazon also partnered with J. P. Morgan Chase and Berkshire Hathaway in 2018 to offer an independent employee health care plan (Paavola, 2018; Wingfield, Thomas, & Abelson, 2018).

Alphabet, the parent company of Google, has filed more than 190 health care patents and is marketing Google Glass—a headset that fits over the eye and contains both a computer and a video camera—to record and live stream surgical interventions for archiving, educational, and consultation purposes (O'Connor, 2014). The company has also developed body sensors and monitors and a HIPAA cloud platform and made a \$375 million investment in the insurance startup company Oscar Health (D'Onfro, 2018; Gandolf, 2018).

Microsoft officially launched a health care division last year and created Healthcare NExT, an initiative that seeks to partner the tech company with current players in the health care field (McGrane, 2018). Other projects include Azure, an integrated cloud-based service to manage health data and perform other functions, Microsoft Genomics to assist with genetic sequencing, analysis, and

storage (Microsoft, 2019), AI network projects, joint projects to empower clinicians and consumers using AI with the University of Pittsburgh Medical Center (Zellner, 2017), and the InnerEye Project to automatically analyze medical images (Microsoft, 2012).

Facebook had been developing a data share program with top hospitals, but the program is currently on hold due to concerns about how the company is protecting its users' private information (Condon, 2018). It has also developed AI tools for suicide prediction (e.g., to detect suicidal posts on the platform) and drug addiction (Novet, 2018), and is entering the health care marketing field.

"The Amazon Effect" has changed the way American consumers perceive service industries: They are looking for convenience (e.g., easy accessibility), a positive experience (e.g., transparency as to where their order is in the delivery process), and value (e.g., the ability to make comparisons regarding shipping options and cost). As service providers, health care professionals now need to change the way they offer services to address consumer expectations in line with lessons learned from the tech industry.

Start of the Digital Movement

The digital movement in medicine began more than 50 years ago in 1955 when psychiatrists Dr. Reba Benschoter and Dr. Cecil Wittson developed a telemedicine studio with cooperation from Bell Telephone Company at the University of Nebraska (UNMC Archives, n.d.). University

of Nebraska was able to transmit grand rounds to rural hospitals via this technology. From there, between 1956 and 1961, the first two-way, closed-circuit television system was launched in the United States. This development led to group telepsychiatry visits and eventually to individual, direct consultations using two-way video/audio links. For instance, between 1963 and 1966, synchronous video consultations were initiated between Nebraska Psychiatric Institute and the Norfolk State Mental Hospital, which was located 112 miles away.

Fast-forwarding 60 years, American telemedicine has evolved, albeit it slowly, with research data suggesting it can be highly effective for mental health care (Archibald et al., 2018). However, the full adoption of telemedicine in behavioral health care is hobbled by lack of full reimbursement parity comparable to in-person provision of services. The primary factor affecting telemedicine reimbursement is legal policy. Under the Medicare program, telemedicine reimbursement is only provided to beneficiaries who are physically located in a county outside of a Metropolitan Statistical Area or in a licensed health facility within a geographic Health Professional Shortage Area (Centers for Medicare & Medicaid Services, 2019). Medicare also limits the types of health care providers and procedures that can be reimbursed. Reimbursement for non-Medicare patients depends on the state jurisdiction where the patient is located while receiving services. Likewise, while many states have telehealth parity laws that mandate that Medicaid and commercial payers pay for telemedicine, these laws vary considerably in their requirements for full reimbursement of providers by insurers (American Telemedicine Association, 2019). In the state of New York, for example, commercial payers are required to pay for telemedicine services under the state's parity law, but the law does not require parity in respect to reimbursement. Many commercial insurers in New York State have elected to reimburse providers of telemedicine services at well below the rate that would have been paid if the service was provided to a patient in person. Given that the pay schedule for providers is already poor, it is difficult to persuade mental health professionals and organizations to adopt telemedicine when they will be paid substantially less than their normal fees.

UR's Digital Behavioral Health Care Model

In an attempt to overcome barriers to provision of telemedicine, UR has developed a digital behavioral health care model to serve the large, underserved rural areas in New York State. This model incorporates telepsychiatry, telementoring using a protocol known as Project ECHO (Extension for Community Healthcare Outcomes), and onsite psychiatric engagement with the goals of improving

patient/provider satisfaction and population health and reducing costs (Figure 3).

Telementoring

Telementoring is a concept within digital health that involves the use of videoconferencing technology to provide real-time guidance and support between two or more clinicians in different geographic locations. Project ECHO is a method of telementoring that was started at the University of New Mexico for hepatitis C care in the early 2000s to disseminate information from academic medical centers to community-based clinicians (Arora et al., 2011; Hager et al., 2018). At UR, the Project ECHO paradigm is used to deliver geriatric and general psychiatry services. During telementoring sessions, a multidisciplinary team of academic medical center specialists such as psychiatrists, social workers, psychiatric nurse practitioners, psychiatric physician assistants, psychologists, and pharmacists videoconference with community-based providers and long-term-care clinicians. These providers present cases to the specialists for their input on management. The specialists also provide 10 to 15 minutes of evidence-based didactic presentations. The clinics are held weekly or biweekly for approximately 1 hour.

Telepsychiatry

At UR, patient-facing telepsychiatry services have been layered on top of Project ECHO, making UR staff members available to consult to skilled nursing facilities and rural hospitals. In this digital health model, UR has broadly defined telepsychiatry as the synchronous (i.e., real-time video and audio) and asynchronous (i.e., electronic communication) exchange of medical information between a behavioral health clinician and patient. Currently, UR is performing approximately 2,000 synchronous telepsychiatry consultations per year. The service is available Monday through Friday from 8:30 a.m. to 5:00 p.m., excluding university holidays. Behavioral health clinicians on the service include psychiatric nurse practitioners, psychiatrists, and psychologists. The technological demands to offer synchronous telepsychiatry services in the UR model are minimal; the required equipment consists of an iPad on a rolling stand for providers and a high-definition video camera on the patient side (Figure 4).

Asynchronous telepsychiatry consultations within the model are provided through e-consultations. The procedure for e-consultations, performed through computers, is also simple: A request or question comes in from a provider and is answered by a UR specialist. With asynchronous telepsychiatry, facilities have the added ability to transmit recorded video of patients in an agitated state to

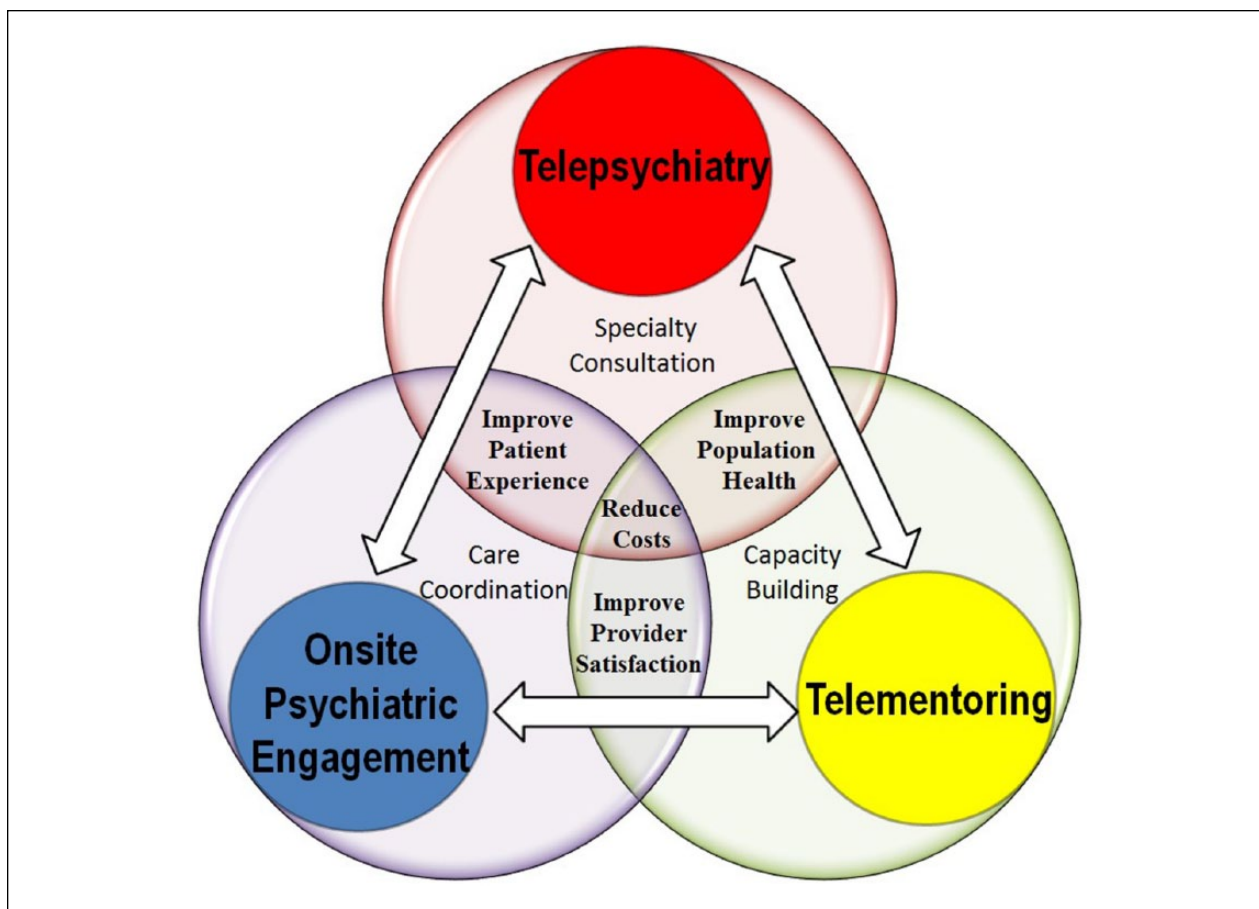


Figure 3. University of Rochester's digital behavioral health care model.

UR specialists, who can consult the patient's medical record and the video before making a recommendation for management.

Psychiatric Nurse Engagement Specialists

All of UR's digital health efforts have an in-person component to establish therapeutic rapport that is driven by psychiatric nurse engagement specialists. For instance, for nursing facilities in rural areas, psychiatric nurse engagement specialists visit the facilities at least once a month to perform training and provide support to staff members for complex cases, review patient registries, and assist in the development of behavioral care plans and triaging referrals to Project ECHO and telepsychiatry. In turn, psychiatric assessment officers are assigned to rural hospitals to provide behavioral health evaluations, crisis intervention, and milieu management. These officers also collect patient-reported outcomes data, act as patient advocates in the emergency department, and assist with coordinating emergency care and disposition. Last, psychiatric care managers for primary care

provide support to triage referrals to Project ECHO and telepsychiatry.

Comparing Telepsychiatry With Face-to-Face Care

As a clinician who has spent most of my 20-year career treating patients in person, I was concerned that my quality of care might suffer when I began seeing patients through a telepsychiatry service. However, I have been pleasantly surprised by how efficient and effective telepsychiatry is in the behavioral health space, and I now exclusively see patients via telemedicine.

Advantages. Telepsychiatry offers a number of distinct advantages over in-person care. Certainly, it reduces barriers to care for patients living in rural and other underserved areas, those with phobias, anxieties, or physical limitations that inhibit their ability to leave their homes, and those who find it difficult to keep appointments due to work or family demands. It also improves the ability of clinicians to provide coverage for peers who are on



Figure 4. An iPad on a rolling stand is all that is required to deliver telepsychiatry services.

vacation, ill, or otherwise unavailable, and to offer services from a home office. Research also demonstrates that use of telepsychiatry can decrease the stigma for people with mental health disorders to seek care (Aboujaoude, Salame, & Naim, 2015). Many patients do not want to be seen going to a provider's office and can be treated discreetly by two-way videoconferencing from their homes via an iPad.

It should be noted that delivery of telepsychiatry does not mean that the provider sees more patients: A 1-hour appointment remains a 1-hour appointment, so there are the same limitations on the provider's calendar as with in-person delivery of care. However, there is less chance that patients will skip appointments.

In response to rising total health expenditure costs, health care systems and insurers are now being incentivized to develop new innovative approaches to the delivery and financing of care. These approaches include development of organizational structures in which reimbursement will increasingly be based on the quality and outcomes of care delivered (i.e., value-based purchasing). Examples include shared savings contracts between payers and providers in which savings realized in the delivery of care are returned to the provider if indicators of quality are met. At UR, the

digital behavioral health model has reduced costs by decreasing the number of avoidable emergency department presentations and rehospitalizations for patients with behavioral health comorbidities. For UR's nursing home partners, the program has improved their reportable quality metrics of antipsychotic utilization and depression symptoms, both deemed as priority metrics in the New York State Long-Term Care Value Based Payment Recommendation Report (New York State Department of Health Managed Long-term Care Clinical Advisory Group, 2016).

Disadvantages. The potential loss of some nonverbal communication during provider-to-patient interactions (e.g., the ability to smell alcohol on a patient's breath) is a disadvantage of this form of treatment. Some patients and providers may also perceive telepsychiatry interactions to be of less value than in-person visits due to a loss of patient-provider rapport; anecdotally, this does not appear to be the case. It appears that patients may feel safer engaging in therapy from their home than in person because the technology offers a natural barrier and protection. Certainly, however, telepsychiatry visits are not appropriate when a patient's safety is compromised or self-harm may be imminent. In addition, there is a risk of confidentiality and privacy breaches with telepsychiatry both in terms of data and interactions.

Ethical Considerations

To provide HIPAA-compliant care on a digital health platform, it is essential to obtain informed consent from patients for use of this form of care. Providers must be proficient in the technology and know its limitations. They must be prudent in carrying out a full diagnostic evaluation, although it is possible to perform a full head-to-toe evaluation, including a cognitive examination, via telepsychiatry. Steps must also be taken to promote continuity of care. Professionalism must be maintained and patient privacy ensured—telepsychiatry visits should be conducted utilizing the same standards for seeing patients in an office. If the telepsychiatry session is being conducted in a home office environment, for instance, no dogs or children should be running around in the background or distracting the provider, and the platform used must be secure and private.

Growth Going Forward

Although telepsychiatry has been around for more than 50 years, growth going forward is proceeding slowly. One of the greatest obstacles is the need to both recruit and train personnel to perform digital health care. This is difficult particularly because the incentive to offer telepsychiatry

can be lacking due to parity issues with reimbursement in comparison to in-person care. In addition, it has been difficult to establish the true benefits and risks of telepsychiatry because data are not being systematically collected and research on the benefits and risks of telepsychiatry is lagging behind implementation.

In addition, credentialing and privileging is burdensome; for instance, telepsychiatry cannot be utilized across state lines unless one is working within the Veterans Affairs system. Telepsychiatry is also overregulated both at the federal level and in some states. By way of example, in New York State, several groups have established their own regulations, which do not always align with one another.

Opportunities to Innovate

Despite the slow growth, there are numerous opportunities to capture new data streams, develop analytic tools and translate data to knowledge, and create novel interventions utilizing technological innovations. These opportunities begin with the acquisition of data, but unfortunately, most psychiatric nurses are not trained to quantify the services they deliver. For instance, they might simply note in the chart that a “patient feels better.” Instead, nurses need to begin to systematically quantify what they do across all the patients they serve to generate data that can be analyzed to show where they can intervene earlier and better and develop both in-person and telemedicine approaches to improve care.

An example of where this type of quantified data might lead is in the realm of patient-reported outcomes. The National Institutes of Health has developed a program called PROMIS, a patient-reported outcomes system that incorporates a variety of validated psychometric scales and applies computer-adapted technology to these items (National Institutes of Health, 2019). As a patient answers each question on an instrument, the computer recalibrates to become more sensitive and specific in comparing the patient’s score to that of the general population. UR is utilizing the PROMIS system in behavioral health and has incorporated it into the electronic health record system. Patient data are captured via iPad. With the gathering of data, the computer can begin to predict how patients move through the health system, leading to greater efficiency and better patient care. Applications of this type of program in behavioral health can include computer-generated proactive screening of patients for mental health disorders, risk stratification of patient populations, development of care decision algorithms based on patients’ own reported data, integration of behavioral health data with physical health data, and increased provider production.

Direct-to-Consumer Technology

Mobile phone apps are another area of innovation. A Pew Research Center survey conducted in 2015 reveals that 92% of the U.S. population has a cell phone, including smartphones (Pew Research Center, 2015a, 2015b). Low-socioeconomic individuals are the most rapidly growing group of smartphone adopters (Pew Research Center, 2016), which offers mental health care providers an opportunity to reach patients they previously could not reach. Other research suggests that 92% of consumer activity on smartphones is driven by apps (Khalaf, 2017).

Over 10,000 mental health apps are already on the market through the Apple App Store and Google Play and could be leveraged and customized for use by health care systems. These apps are designed to track symptoms, offer access to education, deliver adjunctive therapy treatments, and provide mindfulness and meditation exercises.

While potential benefits abound, mobile apps can also cause harm. They are minimally regulated by the Food and Drug Administration and can offer inaccurate or misleading information. They may also claim to offer therapeutic interventions or services but actually be ineffective. They may not be secure regarding personal health data and would need to be built into the EPIC electronic medical record system to prevent hacking of data. App developers may also sell patient-collected data but not disclose this fact to users.

The American Psychiatric Association has developed an evaluation model for clinicians to vet mobile apps before recommending them to patients (American Psychiatric Association, 2019). First, the app should be evaluated for privacy and safety considerations. If the initial evaluation is unsatisfactory, there is no need to continue with the assessment of that particular app, and it should not be recommended. If the evaluation is satisfactory, evidence of effectiveness, ease of use, and interoperability should be considered.

Research suggests that mobile apps can be effective in treating a variety of mental health conditions. For delivery of cognitive behavioral therapy (CBT), for instance, research indicates that if users go through all modules on an app, outcomes are comparable to in-person treatment and sometimes better (Rathbone, Clarry, & Prescott, 2017).

Unfortunately, current mobile apps are limited by a variety of factors, including poor usability (meaning they are not personalized to the patient), patient distrust, the potential for a disconnect from the therapist, and lack of a user-centric design. There is also often a lack of reminders to maintain user engagement, leading many people to download an app, do one module, and then give up on the program.

UR has secured a number of grants to develop mobile apps, including a CBT virtual reality (VR) mobile app, in an effort to overcome some of these limitations. This app, which is ready for testing in UR-affiliated primary care practices, is prescribed through providers. Once prescribed, patients download the app in their provider's office, enhancing trust in the validity of the intervention. The app is linked to the medical record and the provider is able to monitor how the patient is faring while moving through the app's modules. The app also includes an individualized care aspect utilizing the PROMIS instrument: As patients answer questions within the app, their experience can be customized. UR has also incorporated VR technology into the app by filming a psychologist performing a CBT intervention, which allows patients to use their phones to see the therapist's office without the need for a VR headset and to feel like they are in the office with the therapist. To further enhance immersion in the experience, music and two-dimensional pictures of natural environments have been added. Early on in the app, patients are asked to rate whether specific music and photos are calming or not calming to them; patient-selected pictures and music are then utilized to end the app's session, along with a guided meditation.

The Big Picture: The UR Digital Web

Ultimately, UR's goal is to create digitally integrated behavioral health services comprising telepsychiatry, telermentoring, mobile apps, and other technologies to reach patients in the many large, underserved, rural areas in New York State. UR patients are technology-savvy and most own a smartphone, tablet, and/or computer, while nurses represent the largest technology-user group in most health care organizations. Successful implementation of technology-enabled care will require a strong nursing foundation, and psychiatric mental health nurses are well-positioned to be on the forefront of this important technological revolution. To establish this foundation, UR is incorporating telemedicine education into all its nursing programs from undergraduates through to psychiatric nurse practitioners, clinical nurse leaders, and doctoral candidates.

Conclusions

Digital innovations are slowly but successfully expanding access to mental health care services for Americans by providing service to rural areas and circumventing the stigma of seeking care at a psychiatric office or emergency department. There is some resistance to adopting digital health due to lower reimbursement fees in comparison to in-person visits, lack of qualified providers, and lack of data on its benefits. However, psychiatric

mental health nurses are ideal practitioners to be on the forefront of this important technological revolution.

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Author Roles

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ORCID iD

Michael Hasselberg  <https://orcid.org/0000-0001-8646-5068>

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