Personalized Digital Health Beyond the Pandemic

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ABSTRACT

The effectiveness of telehealth and personalized digital health became evident during the coronavirus disease 2019 pandemic. This article defines what personalized digital health is and provides selected examples of the various personalized digital health devices patients may be using. The article also delves into how to implement and incorporate these personalized digital health devices in practice and presents suggestions on political actions that nurse practitioners need to advocate for with regard to telehealth and personalized digital health policy.

The translation and application of technology in health care is not new, but the coronavirus disease 2019 pandemic served as a catalyst, propelling digital health to the forefront. Digital health is an all-encompassing term that includes telehealth and can be personalized in the form of mobile health (mHealth) and wearable devices.[1] As the largest profession in health care, nursing needs to be involved in the expansion and solidification of telehealth and personalized digital health (PDH). Having nurses and nurse practitioners (NPs) who are telehealth and PDH competent is key for the implementation and effectiveness of telehealth and PDH in practice. During the pandemic, telehealth use increased overall by 78% from February 2020 to April 2020.[2] Telehealth saw a 63-fold increase for Medicare-insured patients.[3] As of 2021, telehealth use increased to 38% from its prepandemic baseline.[2] This article provides NPs with relevant and up-to-date information on new ways to lead the integration of telehealth and PDH into patient care. The positive trajectory and effectiveness of telehealth calls for practitioners to be prepared and ready to fully engage in the use of telehealth and PDH and utilize its benefits.

What Is Personalized Digital Health?

PDH is harnessing digital health in a way that tailors health care to the individual, thereby playing a critical role in increasing equity in health care and strengthening health systems universally. The World Health Organization announced a global digital health strategy for 2020 to 2025 describing digital health as a broad umbrella term encompassing mHealth; e-health; and developing areas such as the use of advanced computing sciences in machine learning, big data, genomics, and artificial intelligence.[4,5] Moreover, 1 of the goals of Healthy People 2030 is to broaden health information technology access to enable patients and providers to

exchange health information efficiently.[6] To effectively integrate PDH into practice, NPs need to first be aware of what PDH is and the scope of PDH in clinical practice.

PDH can generally be categorized into 3 nonmutually exclusive categories that use portable electronic devices. These include remote patient monitoring, mHealth, and the Internet of things (IoT) (Table 1).[7,8]

Overview of PDH Devices

NPs using PDH can help transition health care from a reactive to a proactive focus. For example, the NP can visualize patterns and trends in patient data on PDH devices that can measure and collect the user's heart rate, body temperature, respirations, steps, and sleep habits. Tables 2 and 3 highlight a selection of currently available and in development PDH devices.

All these IoTs are made to send PDH data to smartphones or providers' electronic health record. These devices are helping to move health care beyond telehealth to digitally enabled care where in-person and virtual care are seamlessly integrated into the care of a patient.[61] In this way, PDH is a powerful tool to encourage patients to be partners in their own care.

Application of Telehealth and PDH

If we are able to help our patients bridge the technology gap by providing Internet service smartphone-like devices for telehealth visits, then we can remove 1 of the barriers or hassle factors of using technology.[62] An example of trying to bridge the gap is seen with a primary care organization called ChenMed, that serves predominantly elderly patients. They took data showing that 41% of Medicare beneficiaries do not own a smartphone or tablet while

Table 1
Nonmutually Exclusive Categories of Personalized Digital Health[7,8]

Category	Definition
Remote patient monitoring (RPM)	RPM is the use of digital technologies in a home or care facility to monitor, collect, store, evaluate, and transmit medical and health data to health care providers.[9,10] These providers can then assess, recommend, and instruct patients with both acute and chronic illnesses. This level of patient involvement allows patients to take more control of their health and monitor their individual health status.
Mobile health (mHealth)	mHealth is the use of smart devices and health-based apps to continually monitor health.[8] These electronic devices have become part of everyday life for many patients. For example, as of 2020, 97% of Americans own a cell phone of some type, and, of those, 85% are smart phones.[11] Utilization of mHealth has the capability and capacity to encourage participation in one's own health care and can even integrate with a patient's personal health record if designed to do so.
Internet of things (IoT)	IoT is a system of interconnection among various computing devices embedded into everyday objects equipped with unique identifiers having the capacity and features to collect and transfer data via the Internet through corresponding interfaces.[12,13] These devices are the Internet of medical things when used specifically for health care.[14] There are numerous companies making IoTs available for direct-to-consumer use in the form of watches, glasses, jewelry, clothing, drinkware, shoes, and more. Various researchers are designing prototypes of wearable health care devices.[15] One example would be a wearable device embedded with inertial sensors and algorithms classifying functional movement for stroke patients.[15] The personalized digital health data collected from IoT and wearable devices have the potential to benefit the patient and the nurse practitioner caring for them.

Table 2
Currently Available Personalized Digital Health Devices

Personalized Digital Health Device	Type of Device	How it Works
Oura Ring	Ring (Finger)	The Oura Ring (Oura) measures heart rate and body temperature, allowing users to track menstrual cycles and even identify when they may be getting sick.[16-18] For example, the Oura Ring has the capacity to detect comorbidities like sleep apnea or acute illnesses like severe acute respiratory syndrome coronavirus 2 because it measures continuous oxygen saturation. Guided imagery and sleep analysis are added individualized benefits of the Oura Ring, and studies have shown that it can also help with predicting symptoms of anxiety and depression with participants reporting lower anxiety and improved moods.[19,20]
Apple 7 Series Watch	Watch	The Apple 7 series watch provides fall alerts, oxygen saturation, electrocardiographic (ECG) readings, and arrhythmia notifications.[21] This device includes a sleep app and wellness options ranging from mindfulness to tai chi and pilates.[21] Studies report the accuracy of the watch in detecting both atrial fibrillation (AF) and heart rate.[22,23] For example, a 2019 study reported the use of the watch to detect for irregular pulse in participants, mailing out ECG patches for those who received irregular pulse detections.[24] Of the 450 who returned their ECG patches, over a third were found to have AF.[24] Currently, Apple along with Johnson and Johnson are actively recruiting for the first randomized clinical trial testing the iECG app on the watch. The goal is to accurately diagnosis AF and potentially decrease stroke and cardiovascular mortality.[25]
HeartMath	Sensors (Bluetooth and wired) for smartphone and desktop	HeartMath technology (HeartMath, Inc) uses tools, products, and techniques to improve emotional well-being by training the heart's activity to positively affect the brain's function.[26] HeartMath measures heart rate variability (HRV), which is a marker of biological aging, because abnormally low HRV within a specified age group can indicate premature mortality or an increased risk of future health issues. Studies suggest that HeartMath techniques are effective in reducing stress and increasing resiliency, which could be helpful in managing pain, anxiety, and sleeplessness.[27] HeartMath can even aid in improving blood sugar levels and some markers of cardiovascular inflammation.[28] However, users need to be able to make time to learn and practice these techniques because integrating HeartMath techniques can be seen as an extra burden.[29]
Apollo Neuro	Wrist or ankle banded device	Apollo Neuro (Apollo Neuroscience, Inc) is a wearable wrist or ankle device that uses touch therapy to rebalance the autonomic nervous system, thereby decreasing stress levels and facilitating better sleep.[30] Apollo Neuro boasts of 7 different vibration modes adjustable to activities throughout the day. However, it is important to note that no rigorous, large-scale study of this device has been accomplished, and findings from a few small studies are not yet published in peer-reviewed journals. Even so, there is both a clinical trial and a large sleep study currently underway, and if proven to work, this device can be revolutionary for health care.[31,32]
KardiaMobile	Wallet card (single-lead electrocardiogram), single-lead or 6-lead ECG devices	The KardiaMobile (AliveCor) is a Food and Drug Administration–cleared single lead ECG device that can help detect 6 of the most common arrhythmias.[33] The company has now expanded its products to include the KardiaMobile Card, which fits into a wallet, and the KardiaMobile 6L, a 6-lead version of the original. The accuracy of Kardia's algorithm for AF was tested in a group of 100 patients undergoing cardioversion (93% sensitivity and 84% specificity).[34] A prospective randomized trial using the single-lead ECG device in a high-risk population led to an AF diagnosis in 3.8% of participants compared with 1% in the usual care group.[35]
Omron Blood Pressure Monitor	Blood pressure monitor	Omron makes a few different wireless smart blood pressure (BP) cuffs that can be connected to a mobile app. Readings can be synced and organized to map personal BP trends.[36] The device has been validated in multiple studies and has been used in various randomized controlled trials.[37-40]

Table 2 (*continued*)

Personalized Digital Health Device	Type of Device	How it Works
QardioArm	Blood pressure monitor	The QardioArm (Qardio, Inc) is another smart BP monitor that also has its own app where it is easy to toggle on data sharing with the user's primary care team. The device does triple measurements for the most accurate readings and also displays BP results on a color-coded World Health Organization chart for more accurate interpretations.[41] Use of the device has been validated in various patient populations from those with diabetes to obesity; it is comparable with the Omron Evolve.[42-45]
Dexcom	Continuous glucose monitoring (sensor and transmitter) with adhesive backing & needle	The Dexcom G6 is a continuous glucose monitoring device that can transmit data to smartphones and other electronics, which then communicates with the user's provider.[46] The device is a very convenient way to manage diabetes; users who frequently engage with the device and app were more likely to have stable glycemic profiles.[47] The Dexcom G6 has proven to be cost-effective long-term, with improved glycemic control and better quality of life outcomes compared with fingerstick testing.[48-50]
TytoCare	Medical kit (camera, thermometer, otoscope, stethoscope, tongue depressor)	TytoCare (TytoCare Ltd) is a smart medical kit that brings the primary care office into the home setting, falling into the remote patient monitoring category. The kit comes equipped with the TytoCare Device that has a camera and thermometer. This device also has adapters for attachment to an otoscope, stethoscope, and tongue depressor. If a virtual visit is needed, the TytoApp can be accessed for guided examinations with a health care provider.[51] Although this virtual medical kit was initially made with pediatrics in mind, it has expanded to all of primary care because many providers are realizing a hybrid primary care model postpandemic.[52-54]

another 41% lack computers with sufficient Wi-Fi; they then either provided smart devices to these patients or made available pre-programmed and connected devices for those without effective broadband access.[63,64]

Leading PDH implementation requires NPs to have knowledge and awareness of the patient populations being served. For example, during the coronavirus disease 2019 pandemic, older Black patients were more likely to use audio health (telephone calls) instead of live videoconferencing, whereas Hispanic and Asian patients used telehealth less than their White peers.[65,66] To help facilitate the use of telehealth and PDH, NPs can partner with digitally forward organizations in the community to overcome digital disparities. Two of these organizations include the Digital Health Connectivity Project and PCs for People, which provide devices as well as hot spots and affordable Internet services.[67,68] On the other end of the spectrum, for digital natives (ie, millennials and Gen Z) who use IoT frequently, they expect convenience and instant gratification, even in health care, with 70% saying they prefer telehealth and 44% considering switching providers if telehealth is not offered.[69-71] For these populations, NPs may find it easier to incorporate PDH into client-owned IoT devices.

When clients are equipped with these digital health devices and become PDH literate, then truly effective lifestyle changes can happen. Users gain a powerful sense of control when they use a fitness watch that tracks their heart rate and respirations in real time or a continuous glucose monitor device that alerts glucose level changes. The goal is for clients to be comfortable using technology for health care so that they can be more inclined to participate in their own health care using the technological devices or IoT that they own. Having health data connected directly to patients' mobile devices and other IoT provides access for evaluation, education, and development of an actionable plan of care. Therefore, becoming educated on these various IoTs and direct-to-consumer digital products is crucial if NPs want to properly implement telehealth and PDH in clinical practice and, ultimately, to influence health care policy and advocacy.

Importance of Telehealth Policy

As nurse leaders, NPs are involved in health policy and advocacy. Centers for Medicare and Medicaid Services extended

Table 3
Personalized Digital Health Devices in Development and Testing

Personalized Digital Health Device	Type of Device	How It Works
K'Watch Glucose	Watch with adhesive backing	Instead of using needles, the K'Watch Glucose has a fitted adhesive glucose-reading patch that adheres to the back of the watch and makes contact with skin.[55] This patch consists of an array of micropoints and biosensors programmed for continuous glucose monitoring. The results are displayed on the watch and can be sent to family, friends, and providers alike. A prospective clinical trial study in the United States is currently underway, which is expected to be completed by the end of June 2022.[56]
Lily Bra	Clothing with sensors	A product marketed toward women's cardiac health is the Lily Bra from Bloomer Tech—a smart bra that is able to capture critical cardiac data from sensors embedded into clothing.[57] The goal is to make clothing into lifestyle medical and health care devices to increase health care accessibility for all.
Contact lens	Contact lens	This is an app-connected smart contact lens that can read vitreous fluid to detect glucose levels in people with diabetes.[58] This specific device was also shown to trigger a release of diabetic retinopathy drugs depending on its vitreous fluid readings. Because diabetes is another major chronic health issue in primary care, the ever-evolving continuous glucose monitoring technologies are welcomed.
Fall sensors	Sensors	A good example of combining or modifying existing technology is the use of the Microsoft Kinect Sensors (originally used for gaming) to monitor older adults at home who are at risk for falls.[59] This study showed that a cumulative change in gait speed over time is associated with an increased risk of falling. Because falls in older adults are another by-product and cause of comorbidities, using telehealth and PDH to predict and prevent them is a brilliant idea.
Water bottle	Bottle with sensors	There are water bottles being developed with sensing technologies that can measure data on a person's fluid intake.[60] The bottle is fitted with noninvasive physiological sensors. When a person picks it up to drink and makes contact with the bottle, it can measure anything from heart rate to water intake. This type of information would be very helpful in managing patients with heart failure.

certain telehealth services, including remote patient monitoring, to be in place until the end of 2023, but these past few years have proven that federal telehealth and PDH expansion deserves a permanent place in health care policy.[72,73] Both the American Nurses Association and the American Association of Nurse Practitioners have position statements supporting the use of telehealth and PDH. They state that telehealth and PDH practices need to have continually updated policies, regulations, and reimbursement criteria on parity with in-person health visits.[74,75] It may be beneficial to join 1 of the aforementioned or 1 of the many other professional special interest groups that have their own teams of health policy advocates brainstorming current pertinent and pressing health policy priorities.

For example, a letter sent to Congress on January 31, 2022, by more than 360 organizations (including Healthcare Information and Management Systems Society and the American Telemedicine Association) urged leadership to facilitate a pathway in creating permanent comprehensive telehealth reform.[76] The letter provided a detailed timeline for Congress to follow that would extend current telehealth waivers through the end of 2024 while giving them enough time to pass permanent, evidence-based telehealth legislation that would be effective starting 2024. Following that letter, bipartisan senators introduced the Telehealth Extension and Evaluation Act on February 7, 2022, aiming to extend current telehealth emergency waivers for another 2 years.[77] This law reflects the positive direction that telehealth-related legislation is taking. In 2021 alone, 47 states passed 201 telehealth-related bills, almost double the amount from 2020.[78] Specifically targeting PDH, the Food and Drug Administration recently established the Digital Health Software Precertification Program to better regulate direct-to-consumer digital health care products.[79]

The current health care policy trend indicates the need for appropriate and effective telehealth and PDH laws. Now is the time for NPs to advocate for PDH regulations that aim to improve a user-centered approach in privacy, accessibility, accuracy, and usability. With the knowledge NPs possess, we have an obligation to advocate for federal, state, and local telehealth and PDH laws in order to benefit both the patient and the practitioner.

A Final Word

NPs are on the front lines of American health care. Our knowledge, training, and experience qualify us to lead in digital health care implementation. This takes place in the form of recognizing various PDH devices to realizing the need for specific PDH laws. We are capable of politically advocating not only for ourselves but also for those we serve. It is when we are intentionally proactive in learning new technology that we can effectively tailor care for best outcomes. In this current climate, there is a pressing need for permanent expansion of telehealth services along with PDH application and use. Although this is a multisystem issue, NPs should be assertive and use our voice when it comes to making these digital health care decisions that not only affect our patients, but ultimately affect us all.

Acknowledgement

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