

Leveraging Digital Health Tools to Advance Health Equity

**Digital Health Tools Study found that Adoption
and Use are Widespread,
but Health Equity Remains Elusive**

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EXECUTIVE SUMMARY

Efforts to advance health equity and eliminate longstanding health inequities are receiving unprecedented attention. Digital Health Tools (DHTs) have the power to improve health and advance health equity by enhancing healthcare accessibility and improving quality of care for underserved populations, including individuals who are economically disadvantaged, seniors, racially and ethnically minoritized communities, people with disabilities, and rural communities. For more than a decade, federal programs and quality improvement (QI) initiatives have promoted, incentivized, and even mandated DHT use in healthcare settings, resulting in rapid growth in the use of DHTs. In addition, in 2020, the COVID-19 pandemic catalyzed policy changes to allow for more extensive use of telehealth in the U.S., creating opportunities to improve access to care during the pandemic. Even so, many individuals and communities still experience inequitable access to DHTs, due to many factors, including limited broadband access, challenges related to health and technology literacy, and lack of culturally and linguistically appropriate design and implementation. Primary care—serving as a trusted source of information and resources for patients and often the first point of entry into the healthcare system—has a unique role to play in using DHTs to advance health equity.

In partnership with the United Health Foundation, researchers from the National Center for Primary Care (NCPC) at Morehouse School of Medicine (MSM) conducted the Digital Health Tools Study (DHTS) to assess adoption and use of DHTs and barriers and opportunities for leveraging DHTs to advance health equity. From October 2019 to July 2021, the DHTS assessed adoption and use of DHTs by more than 1,200 primary care clinicians working primarily in four states: Georgia, Kentucky, North Carolina, and Tennessee.

“The timing of the DHTS is invaluable in demonstrating the impact that the pandemic has had on the increased access to health care services for underserved through the use of telemedicine. As the national healthcare system moves forward with population health through value based care, the identified barriers of broadband and smartphone access, lack of integration into clinical workflows and interoperability need to be prioritized to prevent further inequalities in healthcare.”

Adrienne Mims, MD, MPH, FAAFP, AGSF
Chief Medical Officer, Rainmakers Strategic Solutions

“Health technologies like remote patient monitoring, telehealth, and digital therapeutics improve healthcare quality, accessibility, and efficiency, but their benefits are not equally distributed across all patient populations. This report offers a window into the economic, social, and geographic divides that can be bridged to drive the adoption of health technology at scale. The substantial equity gap in our health system reflects an urgent need for greater technology adoption. We are proud to support the Morehouse School of Medicine to advance research that paves the way for a more equitable future in U.S. health.”

René Quashie

Vice President, Digital Health at the Consumer Technology Association

Through surveys, focus groups, and leadership roundtable discussions, the study found:

- ▶ Almost all clinicians in the sample (99.4%) had used at least one DHT in the past five years.
 - ▷ Electronic health records, health information exchanges, and telemedicine had the highest utilization rates.
- ▶ Over half (52%) of primary care clinicians used telehealth for the first time during the pandemic.
- ▶ Easing workflow integration, meeting patient need, and improving patient health were the most important factors for clinicians' DHT adoption.
- ▶ Time and cost were clinicians' top barriers for adopting DHTs.
- ▶ Clinicians participating in quality reporting programs were more likely to use telemedicine, health information exchanges, and electronic health records than other DHTs.

Policy and practice changes could support and expand use of DHTs by primary care clinicians and are needed to maximize the potential for DHTs to promote health equity for patients receiving services in primary care settings. These changes include:

- 1) prioritizing equity in healthcare transformation efforts;
- 2) improving the interoperability of digital health tools;
- 3) improving access to telehealth;
- 4) increasing accessibility to culturally and linguistically tailored patient centered DHTs; and
- 5) increasing support for both patients and healthcare professionals in the use of DHTs.

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“The National Center for Primary Care report, *Leveraging Digital Health Tools to Advance Health Equity*, is a valuable addition to the Digital Health Recommendation to Design information technology that serves the patient, family, and the interprofessional care team. This is an important objective of the NASEM report on Implementing High-Quality Primary Care and the one that remains without a national data source for assessing and monitoring change. Digital health tools have had an intense focus as a source of frustration and burnout, but their use and usefulness are rarely tested with rigor. This report should inform policy options, not only for HIT but for equity, as well.”

Robert L. Phillips, Jr., MD, MSPH

Founding Executive Director, The Center for Professionalism and Value in Health Care, ABFM Foundation

INTRODUCTION

Health inequities are prevalent and pervasive in the United States (U.S.). Underserved populations—people who are economically disadvantaged, seniors and older adults, racial and ethnic minoritized communities, people with disabilities, and/or people living in rural communities—experience worse health outcomes and have lower life expectancy than people living in communities with more resources.^{1,2,3,4,5} Digital health tools (DHTs) can increase access to health care, improve coordination among clinicians and healthcare settings, and better monitor patient activity.⁶ All these advantages have the potential to improve equity by increasing healthcare access for underserved populations, addressing unmet needs, and personalizing patient care. So far, however, disparities exist in the uptake of these tools, and healthcare professionals face ongoing challenges with their adoption and sustained use—particularly clinicians who treat underserved populations.⁶

To examine existing barriers and opportunities to leverage DHTs to advance health equity, Morehouse School of Medicine (MSM) conducted the Digital Health Tools Study (DHTS). Funded in partnership with the United Health Foundation, researchers at MSM's National Center for Primary Care (NCPC) launched this comprehensive research study focused on primary care clinicians in urban and rural small practices, federally qualified health centers (FQHCs), and hospitals in four states: Georgia (GA), Kentucky (KY), North Carolina (NC), Tennessee (TN).⁷ Data collection began in October 2019 and continued during the onset of the COVID-19 pandemic through July 2021. Therefore, this study reflects clinician utilization and perspectives on approaches to advance DHTs prior to and during the COVID-19 pandemic. The DHTS builds on prior NCPC research on equitable access to DHTs.^{8,9,10}



The project assessed:

- ▶ **Access and use** of DHTs by clinicians working in small practices^a, FQHCs, and hospitals, to better understand current capabilities and barriers to adoption (i.e., what DHTs are primary care clinicians using and/or not using and why?)
- ▶ **Types** of digital tools that clinicians in rural and underserved communities leverage in order to care for their patients
- ▶ **Effectiveness** of DHT use in the prevention, diagnosis, and treatment of prevalent chronic diseases in rural and underserved communities
- ▶ **Policy and infrastructure** of state and federal health information technology (health IT) enabling adoption of DHTs among providers who serve in medically underserved areas or communities in the Southeastern U.S.

The study identified innovative practices and places that have successfully integrated DHTs into their work. It also identified recommendations that could address barriers to equitable DHT use in underserved communities.

a. Small practices are practices with less than five providers. Large practices are practices with more than five providers.

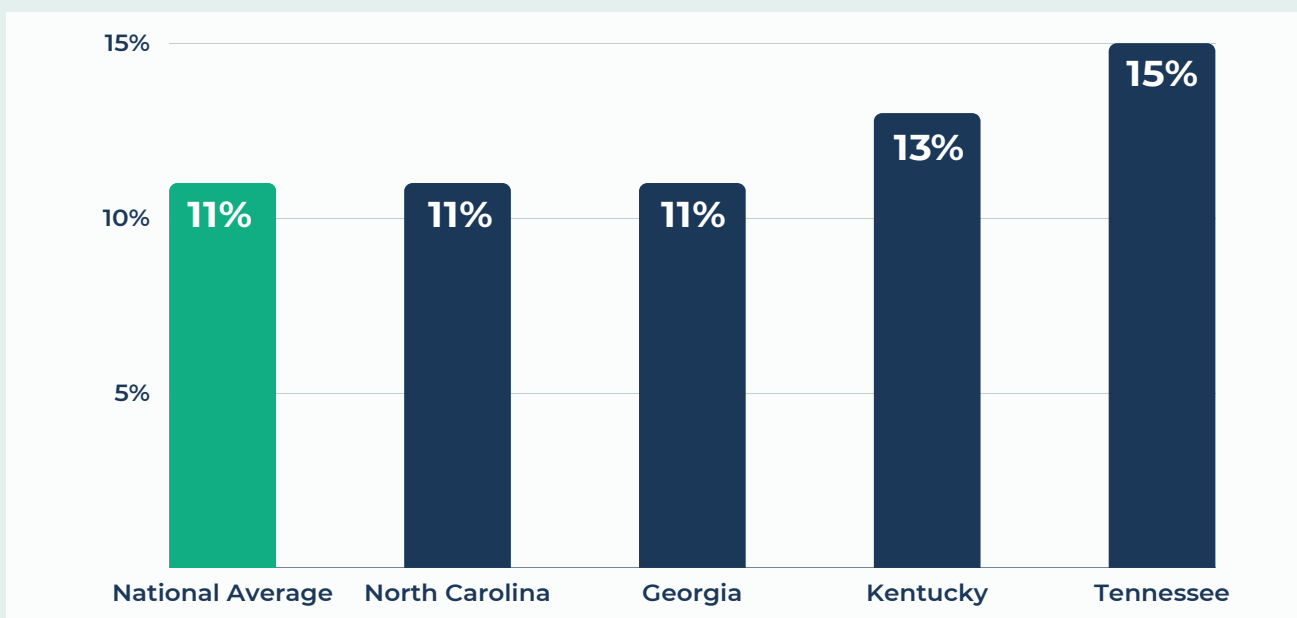
BACKGROUND

Health equity is defined as attainment of the highest level of health for all people. Health equity requires valuing everyone equally and addressing avoidable inequalities, historical and contemporary injustices, and social determinants of health, and the elimination of health inequities.¹¹

Both national and regional health inequities exist in the U.S. Nationally, people who identify as Black and American Indian/Alaska Native (AIAN) live fewer years, on average, than White people.¹² People who identify as Black or AIAN are also more likely to die from treatable conditions; suffer serious pregnancy-related complications and/or die during or after pregnancy; and lose children in infancy.^{3,4,12,13} In addition, the COVID-19 pandemic has exacerbated inequity—with average life expectancies for Blacks and Hispanics/Latinx shrinking at a faster rate compared to Whites.¹⁴ Blacks, Hispanics, and Asians also have substantially higher rates of infection, hospitalization, and death related to COVID-19 compared to Whites.¹⁵

Regionally, the rates of diabetes, for example, are much higher in the Southeast U.S. than elsewhere in the country.¹⁶ As shown in the figure below, diabetes affects 10.5 percent of adults nationally. In North Carolina and Georgia, the prevalence of diabetes is 11.4 percent. In Kentucky and Tennessee, the rates are 12.9 percent and 13.1 percent, respectively.¹⁶ According to the 2019 Health of Women and Children Report by the United Health Foundation, Georgia, Kentucky, North Carolina, and Tennessee all ranked within the bottom 20 states for maternal mortality outcomes, and within the bottom 16 states for child mortality outcomes. In the words of the report, “stark disparities exist in key measures of health across states and by race/ethnicity, gender, and education.”¹⁷

FIGURE 1:
DIABETES PREVALANCE IN DHTS STATES COMPARED TO NATIONAL AVERAGE



In terms of access to health care, 10 percent of the population in these states live without health insurance.¹⁸ While Kentucky expanded its Medicaid program in 2019, North Carolina, Georgia, and Tennessee did not, leaving hundreds of thousands of adults without health insurance coverage.^{19,20} According to the 2022 Scorecard on State Health System Performance, the Southeast U.S. health systems performed below average.²¹ Additionally, per the County Health Rankings, Georgia, Tennessee, and North Carolina have higher years of potential life lost before age 75 per 100,000 population, and a higher percentage of people (under 65) without health insurance, compared to the national measures.²²⁻²⁴

HEALTH EQUITY AND DHTs

The U.S. Food & Drug Administration (FDA) defines DHTs as mobile health (mHealth), health IT, wearable devices, telehealth and telemedicine, and electronic health records (EHRs).^{25,26,27} DHTs support clinicians' access to patients and their data, improve coordination of care across clinicians and settings, and can also help patients make more informed decisions and better manage their health conditions and needs outside of clinical settings.²⁵ DHTs play an important role in efforts to advance health equity by improving access to healthcare services and health information, supporting population health analytics to identify and address health inequities, and reducing health system inefficiencies and barriers to care.²⁵

Identifying and addressing health inequities within the healthcare system is increasingly reliant on the use of DHTs. However, significant disparities in the access to and use of DHTs across sociodemographic groups potentially exacerbates existing health inequities.^{28,28} For example, people with higher levels of education, higher income, and non-Hispanic White individuals report using DHTs more than older, uninsured, and economically disadvantaged people.^{29,30}

DHTs have the potential to improve health equity by providing patients with access to a wider range of specialized care that they may not otherwise have access to while living in a rural or underserved area. They may also be used to integrate information on social determinants of health with other clinical data in EHRs so that clinicians can take a more holistic approach to health care.

WAYS DHTs CAN PROMOTE HEALTH EQUITY:

- ▶ Convenience and improved access for patients
- ▶ Reducing need to take time off work, secure child and elder care, and find transportation
- ▶ Improved patient engagement through patient portal use
- ▶ New models for low-acuity care and chronic disease management
- ▶ Improved reporting capabilities
- ▶ Using standardized, systematic data collection for health surveillance and interventions

1. Shah SD, Alkuresishi L, Lee WW. Seizing The Moment For Telehealth Policy And Equity. Health Affairs Forefront.
2. How can electronic health records improve public and population health outcomes? (<https://www.healthit.gov/faq/how-can-electronic-health-records-improve-public-and-population-health-outcomes>)

Current healthcare transformation efforts focus on achieving the quintuple aim of enhancing the patient experience, improving health outcomes, reducing costs, improving the work life of healthcare clinicians, and achieving health equity.³¹ To support this transformation, quality improvement, value-based payment, and other reporting programs are being adopted across public and private payers, health systems, and settings.^{32,33,34} Although these efforts focus on quality, efficiency, and costs, DHTs are becoming increasingly necessary to support transformation activities by standardizing collection of clinical and patient data, improving clinician workflow, automating clinical decisions, providing patients with timelier access to care, and reducing costs.³⁵ Currently, however, disparities in implementation and use of DHTs among healthcare professionals, as well as varying levels of participation and readiness to participate in sophisticated delivery system reforms have delayed progress in equitable adoption and use of DHTs, especially in primary care and other underserved clinical settings.³⁶

POLICY DRIVERS OF DHT ADOPTION AND USE

Following decades of slow and steady growth in the use of health information technology, passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009 triggered rapid adoption.³⁷ The HITECH Act statutorily authorized the Office of the National Coordinator for Health Information Technology (ONC) to create standards for health IT and provided financial incentives for EHR adoption.³⁸ The HITECH Act funded Regional Extension Centers (RECs), which provided much-needed technical support to primary care practices and led to EHRs becoming an integral component of primary care outpatient practices.^{39,40,41} Despite the major advancements initiated by the Act, gaps remained. For example, the Act did not promote EHR use for behavioral health services, which resulted in a lag in the adoption of EHRs in that field, which continues to exist today.^{42,43} Over time, incentives tied to EHR adoption have evolved to focus on interoperability, quality measurement, population health analytics, and are increasingly tied to payment. EHRs have become necessary tools to support healthcare transformation, especially as healthcare payment and delivery policies focus on value over volume.⁴⁴

Telehealth is another DHT that has gained traction for its potential to improve access to healthcare. Medicare began paying for telemedicine services in 1999, but with major limitations, resulting in 20 years of low utilization of telehealth in Medicare. One major limitation was that telehealth services were restricted to Medicare recipients living in rural areas. In 2019, CMS increased plan choices and benefits and increased telehealth benefits allowed in Medicare Advantage plans. This change eliminated the rural restriction and made patient access to telehealth services universal.⁴⁵ In 2020, the COVID-19 pandemic amplified the value of telemedicine, necessitating expansive federal and state policy changes that rendered it easier to administer services via telemedicine.⁴⁶ These changes included removing in-person requirements for certain services and allowing the same payment and reimbursement models for in-person visits as for audio and video visits.⁴⁷ The Coronavirus Aid, Relieve, and Economic Security ACT (CARES Act) allowed FQHCs to receive reimbursement for distant site telehealth services to Medicare beneficiaries. Subsequently, FQHCs were able to receive payment for telehealth mental health visits starting in 2022.⁴⁸ In addition, as of November 2021, CMS forecast that it would pay for mental health visits made by Rural Health Clinics and Federally Qualified Health Centers (FQHCs), irrespective of the status of COVID-19.⁴⁹ See Appendix A for the changes Georgia, Tennessee, North Carolina, and Kentucky made to their telehealth policies since the beginning of the COVID-19 pandemic.

In the midst of these policy changes, NCPC's DHTS helped identify successes and gaps in the adoption of DHTs among primary care clinicians in four Southern states—with the goal of identifying ways in which DHT use can lead to potential equity improvements in people's access to health care.

METHODOLOGY

The DHTS employed a mixed-methods approach to identify barriers and facilitators to DHT adoption and use in the Southeastern U.S. NCPC surveyed 1,215 primary care clinicians and conducted seven focus groups (with a total of 25 primary care clinicians) between October 2019 and July 2021. NCPC also convened four leadership roundtables (with a total of 28 participants)—including clinicians, healthcare leaders, and policymakers. Many clinicians specialized in family and internal medicine, pediatrics, geriatrics (collectively referred to as primary care), and obstetrics/gynecologists. They included physicians, nurse practitioners, physician assistants, and certified nurse midwives.

The DHTS focused on clinicians' adoption and utilization of the following tools:

- ▶ Telemedicine
- ▶ Home/remote monitoring
- ▶ Patient portals
- ▶ Health information exchange (HIE)
- ▶ Electronic health records (EHR)
- ▶ Prescription drug monitoring programs (PDMP)
- ▶ Wearable devices
- ▶ Mobile applications
- ▶ Other technologies used in healthcare settings

(See Appendix B for descriptions of these tools.)

The DHTS also included questions about clinicians' participation in the following government-sponsored QI programs:

- ▶ Quality Payment Program (QPP) - APM / MIPS track
- ▶ Inpatient Quality Reporting
- ▶ Chronic Care Management
- ▶ Medicare EHR Incentive Program (Meaningful Use/Promoting Interoperability)
- ▶ Medicaid EHR Incentive Program (Meaningful Use/Promoting Interoperability)
- ▶ Patient-Centered Medical Home (PCMH)
- ▶ Accountable Care Organization

(See Appendix C for information about these programs.)

MSM began participant recruitment for the survey and the focus groups in September 2019 at in-person state and regional primary care meetings and conferences. When the COVID-19 pandemic prevented in-person engagement, the research team pivoted to virtual recruitment strategies, including marketing via e-newsletters, email listservs, social media, and website ads. To help in recruitment, the study team leveraged partnerships with state and local primary care clinician organizations, hospital/health systems, rural health associations, state agencies, and other community organizations and clinician groups.

The DHTS survey was conducted using the secure online database system Research Electronic Data Capture (REDCap).⁵⁰ The survey included 23 questions, and a combination of open-ended/Likert scale/ranking and branching logic to identify:

1. prior/current use of DHTs;
2. reasons for adopting/using DHTs;
3. adoption/use barriers and facilitators; and
4. clinician demographic and practice characteristics.

The survey also asked clinicians which specific DHTs they used, and a series of questions related to each DHT selected. Detailed socio-demographic information (including state of practice, primary care discipline, practice setting, age, race, and years in practice) was collected. Responses were anonymous and not linked to identifying information.

MSM conducted focus groups using a semi-structured interview guide focused on three topic areas:

1. adoption and sustainability of DHTs;
2. how DHTs have impacted patient health and practice workflow; and
3. facilitators and barriers related to the adoption and implementation of DHTs in primary care practice.

Clinicians were recruited using internal and external listservs, signing up through the DHTS survey, and social media. Focus groups were facilitated by members of the qualitative research team, all of whom have experience conducting focus groups/qualitative research with clinicians. All focus groups were conducted in English, recorded via Zoom, and transcribed verbatim using NVivo transcriptions. The transcripts included no identifying information.

MSM also conducted four leadership roundtables, one in each of the four Southeastern U.S. states of primary interest. Moderators asked experts in the fields of policymaking, medicine, management, equity, and technology three over-arching questions: 1) What have been your biggest challenges to invest in, implement, sustain, or expand DHTs in your state or in your health system?; 2) What policy and/or practice issues may be impacting/affecting uptake and utilization of DHTs to address health equity among underserved communities?; and 3) What are the catalysts and policy levers to promote DHT development, implementation, and sustainability in your community or state? The roundtable questions and discussion captured information across seven domains: DHTs, attitudes toward adoption, workforce shortages and labor issues, cost, patient literacy, patient access, and law and policy.

Finally, we performed a literature search while writing this report, using search terms such as “digital health tools”, “health equity”, “value-based care”, “primary care”, “COVID-19”, “incentives”, and “payment models”. This literature informed the background and discussion sections for this report, and provided context for the overall findings, presented below.

The Morehouse School of Medicine Institutional Review Board approved the study protocol.

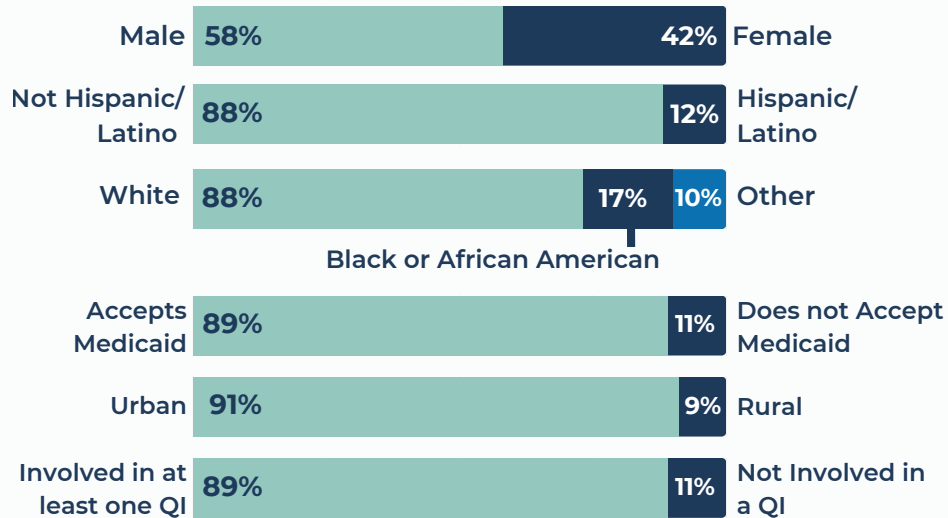
FINDINGS

This section presents findings from the survey, focus groups, and leadership roundtables regarding clinicians' DHT utilization, barriers to and reasons for adoption, and COVID-19's impact on DHT utilization.

Of the 1,215 surveyed clinicians, 36 percent were located in Georgia, 27 percent in North Carolina, 17 percent in Kentucky, and 14 percent in Tennessee. As shown in Figure 2:

- ▶ More than half the clinicians were male (58%).
- ▶ 17 percent identified as Black/African American, 10 percent as another race, and the remaining 73 percent as White.
- ▶ 12 percent identified as Hispanic/Latinx.
- ▶ Most clinicians (91%) were located in urban settings, and most (90%) accepted Medicaid.
- ▶ 89 percent of clinicians participated in at least one QI program.

FIGURE 2:
DHT USE BY CLINICIAN DEMOGRAPHICS



Compared to national rates, the study population had higher rates of representation by Black and Hispanic/Latinx clinicians, including two times as many clinicians who identified as Hispanic/Latinx (12% compared to 6% nationally) and three times as many clinicians who identified as Black (17% compared to 5% nationally).⁵¹ (See Appendix D for more information on participant demographics.)

DHT USE

At the time of the survey, almost all clinicians (99.4%) reported using DHTs in the past five years. Clinicians in general medicine, pediatrics, geriatrics, and preventive healthcare had higher utilization rates among almost all the tools, compared to clinicians in other specialties. But clinicians in all areas reported telemedicine, HIEs, EHRs, and patient portals as the tools they used most.

Clinicians were more likely to have used all the tools except for telemedicine for more than a year than for less than a year (Exhibit 1). EHRs were the only DHT most clinicians used for more than one year. Rates of use for more than one year for all other tools was less than 40 percent, with tools such as remote/home monitoring as low as 8 percent for more than one year's use. Most clinicians were satisfied/very satisfied with the different tools, particularly for prescription drug monitoring program (PDMP) and EHR.

**EXHIBIT 1:
DHT USE OVERALL, DURATION, AND SATISFACTION**

	Total Use	Using for >1 year	Using for <1 year	Will use within next year	Satisfied or Very Satisfied
Telemedicine	66%	31%	33%	2%	65%
EHR	65%	53%	11%	1%	72%
HIE	53%	41%	11%	2%	65%
Patient Portal	49%	35%	12%	2%	58%
PDMP	39%	31%	7%	1%	74%
Mobile App	26%	16%	8%	2%	67%
Wearable Devices	24%	16%	7%	2%	59%
Home Monitoring	10%	8%	2%	1%	66%

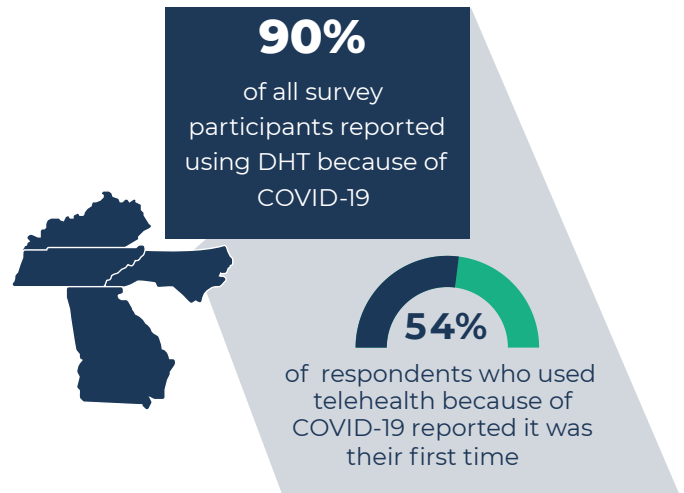
The tools had different utilization rates by type of healthcare service. Clinicians reported using all the tools most frequently for chronic disease management, followed by care coordination. Many clinicians reported using EHR for chronic disease management (45%), care coordination among health professionals (43%); referrals to specialists (42%); and post-hospitalization care (41%). Similarly, 45 percent reported using telemedicine for chronic disease management; and 38 percent reported using it for care coordination. EHR was the most frequently used of the tools across conditions, except for behavioral health services (psychiatry, psychology, and substance use treatment), for which focus group clinicians reported using predominantly telemedicine compared to any other DHT.

Clinician age, race, credentials, and technology enthusiasm were all statistically significant indicators of their DHT utilization. Younger clinicians reported being slightly less likely than older clinicians to use the patient portal and slightly more likely to use remote monitoring. **Hispanic/Latinx clinicians were only a third as likely to use telehealth as clinicians who did not so identify.** Nurses reported being twice as likely to use EHR as physicians. Finally, clinicians who identified as eager/early DHT adopters reported being more likely to use telemedicine, EHRs, and patient portals than those who identified as neutral or hesitant to use DHTs.

DHT USE DURING COVID-19

Overall, about half (52%) of clinicians reported using telehealth for the first time during the COVID-19 pandemic. Clinician gender, credentials, practice setting, and involvement in quality reporting programs were all statistically significant predictors of first-time telehealth use during the pandemic (Figure 3):

- ▶ Female clinicians were almost twice as likely as male clinicians.
- ▶ Clinicians who identified as a race other than Black or White were twice as likely as White clinicians.
- ▶ Nurse practitioners were almost three times as likely as physicians.
- ▶ Clinicians participating in a PCMH were 1.5 times more likely than those participating in other QI programs.
- ▶ Clinicians working in FQHCs and Rural Health Centers were twice as likely as those in practices with fewer than five clinicians, and 21 times as likely as clinicians in Veteran Affairs and other government settings.
- ▶ Clinicians in smaller practices (with less than 5 clinicians) were more likely than clinicians in larger settings such as hospitals, Veterans' Affairs, and government facilities.
- ▶ Clinicians in healthcare settings accepting Medicaid were 1.6 times more likely than those in settings not accepting Medicaid.²

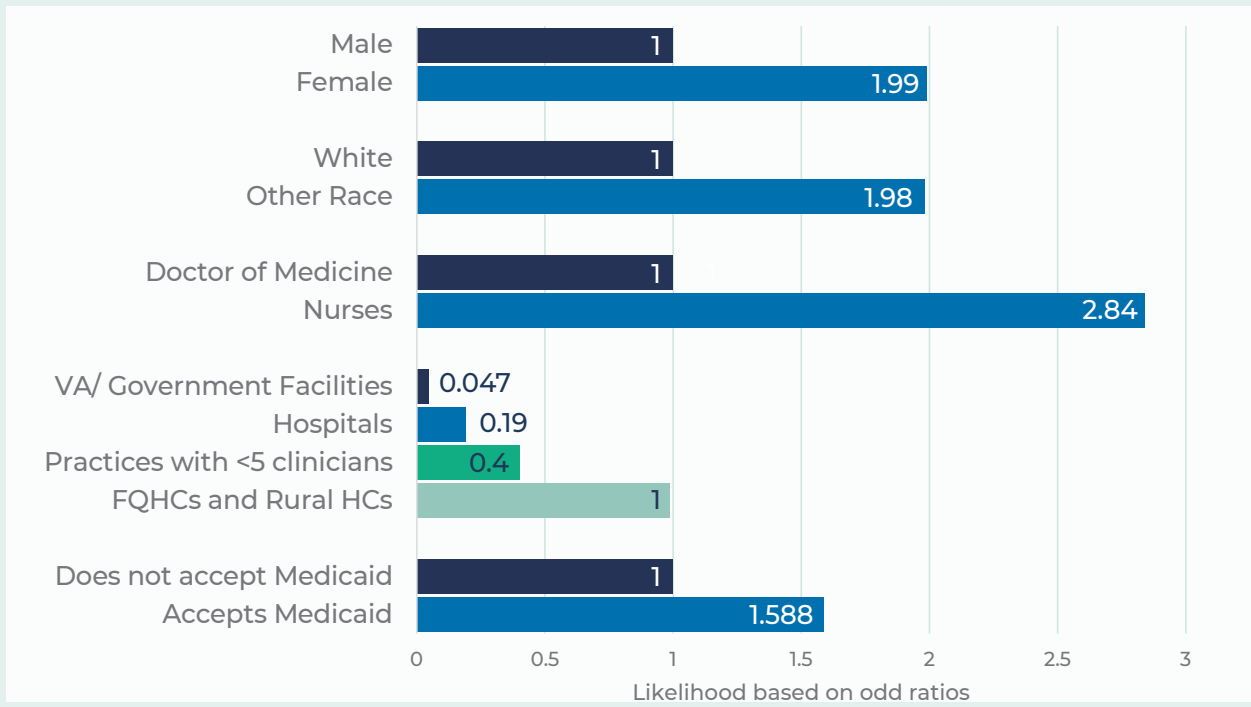


Some focus group and leadership roundtable participants mentioned that telemedicine helped them increase their access to patients during COVID-19, which also helped them conserve their financial resources. As quoted by one participant:

“For me, especially during COVID, [telemedicine] helped get [me to] a lot of the hospitals when all this a couple of months ago, have been kind of on diversion. And so, if I didn’t have telemedicine, these patients were only basically being seen by me. And some of these cases, you know, I’m not comfortable handling, but it’s like either I handle or the patient dies because we have no other hospital to send him to. So, it’s definitely telemedicine. it’s definitely come in handy with this COVID surge because it’s saved my butt on plenty of occasions...”

Focus Group Participant

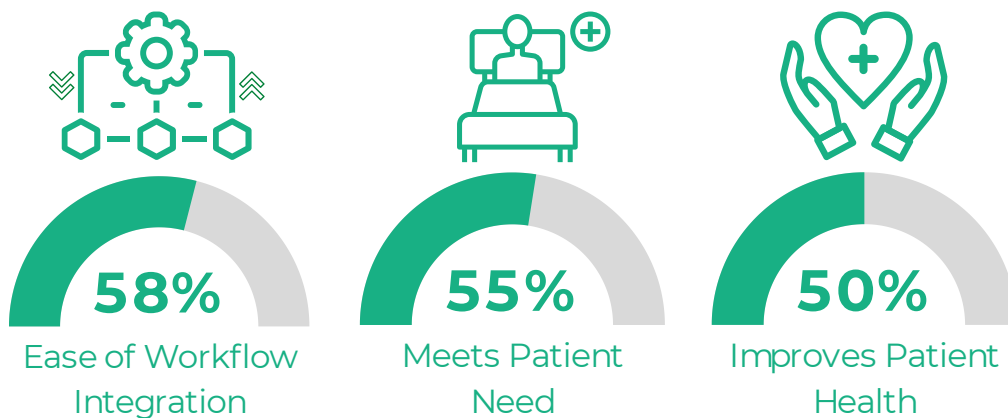
**FIGURE 3:
CLINICIANS' LIKELIHOOD OF USING TELEHEALTH FOR THE FIRST TIME IN
COVID-19 PANDEMIC BY CHARACTERISTICS**



REASONS FOR ADOPTION

Clinicians reported ease of workflow integration, meeting patient needs, and improving patient health as the top factors for adoption of DHTs.

TOP FACTORS FOR SUPPORTING DIGITAL HEALTH TOOL ADOPTION



Leadership roundtable and focus group participants mentioned that telehealth helped reduce no-shows among patients, and was useful for follow-up appointments and post-operation check-ins. Further, they indicated that streamlining their EHR and HIE technology has led to greater utilization among clinicians.

Clinicians in hospitals were less likely to believe DHTs meet patient need and improve patient health than those in other practice settings. Clinicians in an outpatient group practice with more than five clinicians were almost twice as likely to cite time as a barrier to adoption, and only half as likely to believe digital health tools can be integrated easily into the workflow as clinicians in all other practice settings. Lastly, Hispanic/Latinx clinicians were also half as likely to believe DHTs can be integrated easily, yet almost twice as likely to believe they meet patient need and improve patient health.

BARRIERS TO ADOPTION

The most frequently cited barriers to clinicians' adoption of DHTs were time (53%), cost (51%), and limited workflow integration (40%).

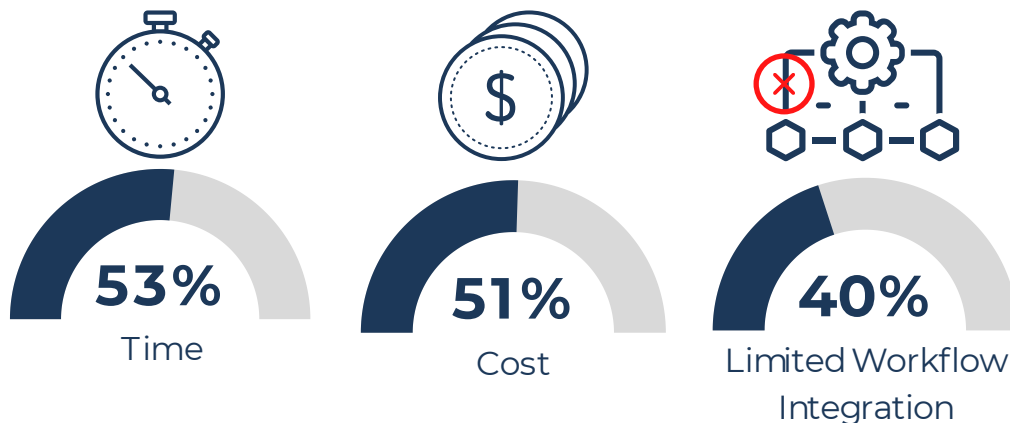
Additional barriers included limited patient access to technology; patient literacy and language difficulties; and challenges with patients' technology literacy, particularly among older patients and those with diverse cultural backgrounds and language needs.

These clinicians also mentioned experiencing issues with integrating new DHTs with already existing systems, and smaller clinics' lack of financial resources needed to implement DHTs.

“...connectivity has been an issue, the broadband issue with poor service in a lot of our areas here. That’s a limiting factor you may be able to get on if they cut out. And we can’t finish the entire visit and them on the phone just to kind of wrap it up, even though I can’t do the actual visual portion of it.”

Focus Group Participant

TOP BARRIERS TO ADOPTING DIGITAL HEALTH TOOLS



“...the other big issue outside of patient demographics in terms of older versus younger in adopting to the changes virtually is really that digital divide in those that have the availability and the capability to utilize different networks, cellular services, having both video and audio capabilities. I think that’s been one of the biggest barriers that we’ve seen in our rural community.”

Focus Group Participant

INVOLVEMENT IN QUALITY REPORTING PROGRAMS AND DHTS USE AND ADOPTION

The majority of clinicians (89%) reported participating in at least one quality reporting program. Clinicians’ involvement in the different quality reporting programs was a statistically significant indicator of their adoption and use of DHTs:



- ▶ Telemedicine utilization was more likely among clinicians involved in the Medicare EHR Incentive program or in an ACO.



- ▶ HIE utilization was more likely among QPP and CCM clinicians.



- ▶ EHR utilization was more likely among CCM and PCMH clinicians.

Clinicians involved in the Medicaid EHR Incentive Program were less likely to believe cost was a barrier to adoption, and almost two times more likely to adopt DHTs because they meet patient needs, than clinicians in other quality reporting programs. Clinicians in ACOs and Inpatient Quality Reporting programs were more likely to believe adopting DHTs improves patient health than clinicians in other quality reporting programs. In the context of the COVID-19 pandemic, clinicians who participated in QPP were about half as likely to be first-time users, and PCMH clinicians were 1.5 times as likely to be first-time users, as clinicians in other quality reporting programs.

DISCUSSION

The DHTS found widespread use of EHRs, HIEs, patient portals, and telemedicine to treat underserved patients among clinicians in the Southeast. However, limited use of more patient-centric tools (such as remote monitoring, mobile apps, and wearable devices) among the DHTS participants suggests challenges related to patient access—and therefore health equity—especially as use of these tools increases in specialty and higher resourced settings. According to a 2019 American Medical Association (AMA) study,⁵² the largest increases in DHT utilization immediately prior to the COVID-19 pandemic (2016–2019) were in two types of remote care tools: telehealth use by physicians doubled and remote monitoring increased by nearly 70 percent. In the same study, 68 percent of physicians cited the ability to provide remote care to their patients as very important/somewhat important when considering whether to incorporate DHTs into their practice.⁵³ Specifically, the study found that increasing numbers of physicians—especially in primary care—recognize the value of tools that allow them to provide care remotely. Similar to the DHTS findings, respondents in the AMA study cited DHTs' ability to improve efficiency, increase patient safety, and provide greater convenience as top motivators for adoption.⁵³

Widespread use of DHTs reported by DHTS participants reflects recent national trends, suggesting that early gaps in adoption of EHRs and telemedicine among clinicians serving underserved communities are closing. Since 2019, DHT use by smaller/mid-sized practices and medical schools increased compared to larger multi-specialty, hospital, single-specialty, and solo practice settings. Improved clinical outcomes, patient privacy protection, and improved work efficiency were among the top motivators physicians cite for using DHTs.⁵⁴ In 2022, ONC reported that nearly four in five office-based physicians (78%) and nearly all non-federal acute care hospitals (96%) had adopted a certified EHR as of 2021—a substantial increase since 2011, when 28 percent of hospitals and 34 percent of physicians had adopted an EHR.⁵⁵

COVID-19

The DHTS captured the dramatic increase in DHT use during the pandemic and highlighted opportunities to leverage DHTs to advance health equity. Clinicians in FQHCs and Rural Health Centers were between two to 21 times more likely to use telehealth for the first time during the pandemic than other practice settings. Such clinicians also serve higher rates of racially and ethnically minoritized populations, older adults, and Medicaid patients than other healthcare settings.⁵⁶ Policy changes in telehealth usage eligibility and sudden necessity due to the COVID-19 PHE likely influenced smaller practices to use telehealth for the first time compared to larger settings, which were more likely to be already using DHTs. In addition, increased HIE and EHR use during the pandemic were likely due to the tools' ability to collect COVID-19 data, conduct contact tracing, and share COVID-19 data among multiple healthcare facilities.^{57, 58, 59} Given that underserved populations experienced COVID-19 at disproportionately high rates, use of these tools to manage the disease's spread is particularly salient for promoting health equity.⁶⁰

Another factor that likely increased access to care for racially and ethnically minority communities in urban areas was that Medicare allowed telehealth payments for originating sites beyond those designated as rural before the COVID-19 pandemic.⁶¹ Medicare enrollees' use of telehealth was higher in urban areas compared to rural areas in 2020, for example, which highlights the importance of expanding telehealth across geographic locations.⁶¹ The continued waiver of the telehealth payment requirements for originating sites, alongside the continuation of other policy changes made during the COVID-19 pandemic, could further advance health equity by improving access to preventive services for structurally vulnerable populations.

CONTINUING BARRIERS TO DHT ADOPTION

Cost and time were clinicians' top barriers to DHT adoption, according to DHTS findings. Costs to upgrade or buy new technologies; hire needed workforce; and pay for training, liability insurance, and other resources needed to implement DHTs can be expensive and deplete finances needed for direct service delivery.^{8,62,63,64} Adoption of technology also requires time investments to learn how to use the new tools, including clinician time.⁶⁵ Moreover, the technological knowledge required to implement these systems, as well as lack of interoperability with other systems, are further disincentives for practices—especially smaller ones—from allocating financial resources to integrate DHT systems.⁶⁶ Clinicians expressed lower satisfaction with the patient portal and wearable devices than for other DHTs, which is likely attributable to these tools' limited integration with other DHTs, as well as both clinician and patient challenges with understanding how to operate the software involved in patient portals and wearable devices.^{67,68}

Limited workflow integration was another barrier to DHT adoption. Practices often have to redesign their care models to incorporate new DHTs and make them available to all healthcare clinicians on a care team.⁶³ This type of redesign requires significant IT resources for both implementing the tools and ongoing troubleshooting among patient and clinician users.⁶⁹ Moreover, many tools have their own structures for capturing and storing data, restricting the ability to transfer knowledge learned about one tool to the use of other tools.⁷⁰ Patients' barriers to access (e.g., language, literacy, internet, time, health, or technological limitations) make it even more challenging to operationalize tools for patient use.⁷¹

Finally, reimbursement uncertainty and low reimbursement rates deter some clinicians from adopting DHTs, especially clinicians in a private practice.⁷² Some primary care clinicians in the DHTS noted that lack of reimbursement by public and private payers was a barrier to DHT adoption. Though policies promoting payment parity between in-person and virtual visits were more widespread during the COVID-19 pandemic than before, the future of these policies post-pandemic remain uncertain. Over half of physicians reported in one survey that they would be less likely to offer telehealth if reimbursement for virtual visits were 15 percent lower than in-person visits.⁶⁶ Moreover, clinicians are often not reimbursed for the time needed to review and respond to patient data and inquiries related to patients' use of the varying DHTs.⁶⁵

DHTs, VALUE-BASED CARE, AND HEALTH EQUITY

DHTs are becoming increasingly necessary for functions such as population health analytics, clinical decision support, and quality reporting. Furthermore, the quantity, sophistication, and resources needed to implement DHTs continue to grow. Such tools provide clinicians with detailed information they would not see without frequent in-person visits.⁷³ Clinicians and practices that are resistant, hesitant, or lack resources to integrate DHTs into their workflows may fall behind, and may even experience financial penalties.⁷⁴

With the expected expansion of value-based care (VBC) reforms,⁷⁵ DHTs (particularly EHRs and HIEs) offer clinicians value through: 1) improved monitoring of patients' conditions, and 2) provision of more comprehensive and accurate information to all members of a care team.⁷⁶ However, both DHTs and VBC models are not always implemented equitably. DHTs are often provided in languages and at literacy levels inaccessible to many patient populations and require stable internet connection in areas where secure broadband connections are still limited. These barriers prevent under-resourced populations from accessing needed primary care, which exacerbates health inequities.⁷⁷ VBC programs themselves face

equity issues. For example, safety net hospitals' participation in the Hospital Value-Based Purchasing (HVBP) program and Hospital-Acquired Condition Reduction Program (HACRP) were not found to have improved healthcare outcomes.⁷⁸ This result may well be tied to the overall clinical and social risk profile of safety net hospitals compared to other participating programs. Given that HVBP and HACRP penalize lower-performing hospitals in their programs by up to two percent of the total inpatient payments, lack of improvement in safety-net hospital quality measures could threaten a hospital's financial stability.⁷⁸ Additionally, VBC models can exacerbate health disparities for certain groups if their healthcare algorithms are not explicitly assessed for bias.^{79,80}

As noted, EHR utilization by DHTS survey participants delivering psychiatry, psychology, and substance use treatment services was lower than for other service areas. A plausible reason for this could be the HITECH Act's lack of incentives for EHR adoption among behavioral health providers.⁴² Conversely, clinicians in psychiatry /psychology had the highest use rate of PDMP, given its crucial role in monitoring medication intake for certain behavioral health conditions, also potentially driven by state PDMP mandates.⁸¹

POLICY IMPLICATIONS AND RECOMMENDATIONS

Primary care is an essential component of strategies to improve health equity. If efforts to leverage primary care in underserved communities to improve health equity are to be successful through increased DHT adoption and use, they must start from the current level of DHT usage and recognize the existing motivators for, and barriers to, DHT adoption. Policy and practice changes needed to sustain and maximize DHTs' equity-improving impact on under-resourced populations moving forward include the following:

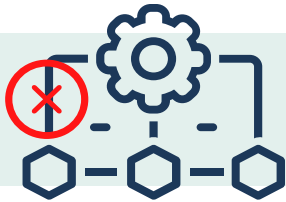
The DHTs found that, compared to those in other quality reporting programs:

- ▶ Clinicians in ACOs were more likely to use telehealth.
- ▶ Clinicians in the chronic care management program were more likely to use HIEs and EHRs.
- ▶ Clinicians in PCMHs were also more likely to use EHRs.

Prioritize equity in healthcare transformation efforts. Early healthcare transformation efforts tied to improving quality and increasing value-based care failed to explicitly prioritize health equity. To promote health equity, DHTs can aid healthcare organizations transforming to VBC by gathering data on patient perspectives and experiences as well as patients' social determinants of health (SDOH), and enhancing care coordination through increasing data availability and interoperability.⁸² Other opportunities also exist to further leverage DHTs to improve patient outcomes and reduce health disparities. Clinicians can gather more information on patients' health disparities by stratifying patient data by race, ethnicity, sex, preferred language, sexual orientation and gender identity, disability status, and geography.⁸³ Subsequent integration and sharing of these data among health plans, clinicians, and community health organizations will allow healthcare practices to better identify the needed community-based and clinical services to holistically support each patient.⁸⁴ Clinicians need an integrated patient record—which must include their clinical history and needs—to develop comprehensive, coordinated, and patient-centered care plans.⁸⁵ Going beyond an EHR towards a more holistic and comprehensive health record will be essential.

Recent healthcare transformation efforts have begun to prioritize health equity. CMS' Accountable Care Organizations Realizing Equity, Access, and Community Health (ACO REACH) model—which has an explicit goal to “advance health equity to bring the benefits of accountable care to underserved communities”—requires all model participants to “develop and implement a robust health equity plan to identify underserved communities and implement initiatives to measurably reduce health disparities within their beneficiary populations.”⁸⁶ While the requirement emphasizes that health equity is a priority for CMS, the program itself is voluntary and further research is needed regarding its effectiveness and impact on equity. More generally, given the different ACO programs in existence, there is a need to evaluate their effectiveness (overall and by component) to understand how the components found most effective can be integrated into ACO models more broadly. In particular, incentive schemes should ensure that safety-net hospitals have adequate support to provide appropriate healthcare care for the disadvantaged population that they serve.⁸⁷

Given the potential for EHRs to collect and quickly share richer information on SDOH, advanced data collection and analytics should be encouraged across all healthcare settings.⁷⁶ One study on FQHCs found that only 71 percent collect social risk data.⁸⁸ Increasing SDOH data collection and use to address patients' social needs may lead to improved health outcomes. In many states, Medicaid agencies require that ACOs and Managed Care Organizations (MCOs) screen for social risk factors.⁸⁸ This type of requirement could facilitate the adoption of social risk screening tools⁸⁸—including DHTs—which can, in turn, promote health equity. Making data sharing a condition in value-based contracts improves data quality and interoperability.⁸⁹



The DHTS found that clinicians cited limited workflow as a top barrier to DHTS adoption.

Improve the interoperability of digital health tools. Almost half of clinicians in the DHTS cited limited workflow integration as a barrier to DHT adoption. Furthermore, despite widespread adoption of HIEs, DHTS participants cited lower frequencies of sharing meaningful clinical data. The tools' difficulty with integrating into existing healthcare systems, as well as limited interoperability with other clinicians and settings, make it challenging to operationalize DHTs across healthcare settings. Healthcare organizations should create a common data architecture and nomenclature across their digital health systems and tools, to ensure smooth transference and interpretation of data.⁷⁰ Through government support, development of a common health information database available to all healthcare clinicians nationwide would enable even greater information sharing.⁷⁰ Improving data sharing will ultimately enable better coordination among care teams, which can improve patient outcomes, particularly for underserved patients.⁷⁰ The Agency for Healthcare Research and Quality's evidence-based Care Transformation Support (ACTS) provides guidance on how to make digital platforms more interoperable, and in doing so, enhance the patient experience and improve the work life of healthcare clinicians while reducing costs. This roadmap should be used by organizations to improve their digital health systems in ways that ultimately improve health equity.³¹



Over half of the clinicians in the DHTS used telemedicine for the first time during the PHE, likely due to new policies focused on promoting the tool's use.

Improve access to telehealth. A significant proportion of DHTS clinicians reported using telehealth for the first time during the pandemic. Clinicians in FQHCs and practices accepting Medicaid had higher likelihoods of being first-time users. Given these practices serve historically underserved populations and that the pandemic-era policies' expanded access for them,⁹⁰ these policies should be adopted permanently to further health equity. The Consolidated Appropriations Act of 2021 (CAA) expanded flexibilities to cover mental health and substance use audio-only visits permanently.⁹¹ Maintaining access to audio-only telehealth services can be a lever for advancing equity.⁶³ Policies should consider flexibilities for populations who may not have a reliable internet source, who must depend on telephone and audio-only services. Beginning in 2020, people enrolled in Medicare living in urban areas became able to receive telehealth services, which were originally restricted to those living in rural areas.⁹²

Overall, urban enrollees with Medicare coverage had a 140-fold increase in telehealth use for Part B fee-for-service (FFS) visits. While overall telehealth visits in urban and rural areas were higher across all racial and ethnic groups in 2020 compared to 2019, there is still evidence of racial and ethnic disparities in the uptake of telehealth in 2020.⁹² Hispanic and AIAN Medicare enrollees had higher telehealth use than White individuals in both urban and rural areas. However, Black individuals had lower telehealth use than White individuals in both urban and rural areas.

Some minority populations, low-income populations, and patients living in rural areas lack access to smartphones, broadband, or computers.^{93,94,62} Sizable portions of DHTS patient populations live in rural areas and lack internet access, which highlights the importance of supporting broadband and telecommunications infrastructure if expanded telehealth policies are to be effective. In addition, investments in telecommunications infrastructure for smaller and lower-resourced practices are needed.⁶³ Physicians in larger practices, as well as practices not owned by physicians, had higher telehealth use.^{95,96} These practices are likely better able to make the investments necessary to support telehealth, which can be a financial burden for smaller clinics.⁹⁵

**THE DHTS FOUND THE FOLLOWING ABOUT
CLINICIANS' LIKELIHOOD OF USING TELEMEDICINE
FOR THE FIRST TIME DURING THE PHE:**



- ▶ Clinicians working in FQHCs and Rural Health Centers were five times as likely than those in hospitals, and 21 times as likely as those in Veteran Affairs and other government settings.



- ▶ Clinicians in health care settings that accept Medicaid were 1.6 times more likely than those in settings that do not accept Medicaid.



- ▶ Clinicians in practices with less than five clinicians were two times as likely as clinicians in hospitals and eight times as likely as those in Veterans' Affairs and government facilities.

The DHTS found that:

- ▶ Low use of patient-centered DHTs such as PDMP, remote monitoring, mobile apps, and wearable devices among participating clinicians.
- ▶ Non-Hispanic/Latino clinicians were three times more likely to use telehealth than Hispanic/Latino clinicians.
- ▶ Clinicians who identified as a race other than Black or White were twice as likely to be first-time telehealth users during the pandemic than White clinicians.

Increase accessibility to patient centered DHTs through culturally relevant outreach and software availability in public facilities.

Outreach tailored to community members should be leveraged to educate and engage them with the different DHTs.^{97,70} Engagement of diverse populations should occur at all stages (design, implementation, and evaluation) of telehealth technology, mobile apps, and patient portals, to include their cultural, literacy, and linguistic needs.^{98,99,100} The resulting DHT language needs to be easy to interpret and self-explanatory, to engage users of different literacy and accessibility levels.^{98,100} The DHTS findings that Hispanic/Latinx clinicians are significantly less likely to use telehealth than their non-Hispanic/Latinx counterparts and that clinicians who identified as a race other than Black or White were more likely to be first time telehealth users indicates possible language and/or cultural barriers to the utilization of this tool. Thus, clinicians should also be engaged in the development of digital health tools, to provide input on the information that is most helpful to collect, and the best ways to design tools that can streamline the data collection and sharing processes.^{101,102}

Community institutions such as public libraries and schools can serve as secure, accessible sites for training and access to digital health services.⁷¹ This type of access enables people who may not otherwise have the technological access and/or privacy to speak to their healthcare professionals the opportunity to do so in a secure location. Students can access telehealth services publicly at school-based health centers, which have been found to expand youth access to healthcare nationwide, including in underserved communities.¹⁰³ Government policies supporting and expanding these programs can be an important lever to promote health equity. Provision of telehealth by school-based health centers has resulted in reduced student absences, as students do not have to miss class to attend an in-person office visit.¹⁰⁴



Clinicians in the DHTS cited time and costs as the top barriers for DHT's adoption.

Increase support for both patients and healthcare professionals on DHT use. Training clinicians on how to use new DHTs, as well as the time required for ongoing troubleshooting while using the tools, are often not reimbursable. To support clinicians using EHRs, reimbursement models should build in the time clinicians need to learn how to interpret electronic records, review patient records, and message patients through patient portals.^{65,105} Federal funding to support technical assistance programs, as was effectively done through the Regional Extension Center (REC) program of the HITECH Act, could provide more clinicians with technical support.¹⁰⁶ Underserved populations should be provided with training and ongoing support in using DHTs, which should be easy to find, quickly available, and provided through channels familiar to the populations accessing the tools. School systems should adopt public education and training programs to ensure students have a minimum level of digital literacy.^{99,107}

CONCLUSION

Widespread use of DHTs among primary care clinicians across the Southeastern U.S. is a promising finding that highlights opportunities to leverage DHTs to advance health equity. The COVID-19 pandemic amplified the need for DHTs, especially to improve access to care in underserved communities. To maximize use of DHTs to advance health equity, healthcare transformation efforts should prioritize health equity and policies should account for challenges and barriers facing clinicians and patients, especially those that have important implications for health equity.

“The US health system continues to be a global leader for implementing innovative health technology, but access remains inequitable. Health inequities are well known but under-studied in the realm of digital health. This research is a glance into underserved communities across the Southeast and the corresponding practices that serve this population. “Leveraging Digital Health Tools to Advance Health Equity” gives us detailed evidence and suggested solutions that can bridge disparate barriers to digital health utilization.”

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APPENDIX A: TELEHEALTH POLICY BY STATE, PRE AND DURING THE COVID-19 PHE

State	State Telehealth Policies	
	Pre-COVID-19 PHE	During COVID-19 PHE
Georgia ^{108,109}	<ul style="list-style-type: none"> ▶ Reimbursed for live video telemedicine, as long as service was medically necessary and appropriate ▶ Both patient and clinicians needed to be at one of eligible sites during visit (not including home) 	<ul style="list-style-type: none"> ▶ Authorized health care clinicians to provide telehealth services and patients to receive health services from home ▶ Approved audio-only care in certain circumstances ▶ Prohibited the need for in-person consultation before receiving telehealth services ▶ Banned separate deductibles for telehealth services
Tennessee ^{110,111}	<ul style="list-style-type: none"> ▶ Coverage was guaranteed for live video telehealth for crisis-related services ▶ Did not specify the type of healthcare clinician allowed to practice telemedicine 	<ul style="list-style-type: none"> ▶ Amended its telehealth laws to authorize the practice of physical therapy and occupational therapy via telehealth ▶ Redefined store-and-forward technology, allowing patients and clinicians to engage in services even if they are not available at the same time ▶ Authorized certain out-of-state clinicians to provide telehealth services on a volunteer basis through a free clinic in the state.
North Carolina ^{112,113}	<ul style="list-style-type: none"> ▶ Reimbursed for medically necessary services delivered via live video telemedicine, with some restrictions and conditions on care, including prior approvals ▶ Required that telehealth clinicians obtain a full license specifically required for telemedicine in the state of North Carolina 	<ul style="list-style-type: none"> ▶ Expanded its telehealth services during the COVID-19 PHE by waiving the requirement that healthcare and behavioral healthcare personnel be licensed in North Carolina to provide healthcare services to individuals within the state. ▶ The North Carolina Medical Board adopted and implemented several emergency procedures and orders and the North Carolina Nursing Board loosening of existing licensure requirements.
Kentucky ^{114,115}	<ul style="list-style-type: none"> ▶ Medicaid did not reimburse for store-and-forward (asynchronous visits) 	<ul style="list-style-type: none"> ▶ Started creating new telehealth laws in 2018, and significantly expanded telehealth services during the COVID-19 PHE by issuing guidance to have telehealth services include remote patient monitoring, wellness visits, nutrition counseling, mental health counseling, among others

APPENDIX B: DIGITAL HEALTH TOOLS

Health Information Exchange and Electronic Health Records

Health Information Exchange (HIE) allows doctors, nurses, pharmacists, other healthcare clinicians and patients to appropriately access and securely share a patient's vital medical information electronically, thereby improving the speed, quality, safety, and cost of patient care.¹¹⁶

The electronic health record (EHR), according to the U.S. Department of Health and Human Services, is "an electronic version of a patient's medical history, that is maintained by the clinician over time, and may include all of the key administrative clinical data relevant to that person's care under a particular clinician, including demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports."¹¹⁷ In the U.S., there were no standards regarding EHR adoption and no unified approach to the measurement of EHR adoption prior to 2009.¹¹⁸

Telehealth and Telemedicine

According to the ONC, telemedicine is the administration of remote clinical services as well as the administration of non-clinical services such as clinician training, meetings, and continued medical education.¹¹⁹ Telehealth refers to the broader scope of remote healthcare services, such as long-distance clinical health care, health-related education, and public health and health administration. The technologies covered under telehealth include videoconferencing, the internet, store-and-forward imaging, streaming media, and wireless communications.¹¹⁹ Telemedicine can improve healthcare access, is well suited for caring for many medical conditions, and enhances patient care in a variety of ways.¹²⁰ One 2021 study researching primary care physicians' experiences with telemedicine during COVID-19 showed that physicians expressed positive views about telemedicine and cited opportunities to leverage telemedicine to improve patient care.¹²⁰ According to one 2022 study analyzing the changing nature of telehealth use by primary care physicians in the U.S., the proportion of primary care physicians using telehealth typically increased by over 670 percent.¹²¹ This supplements findings from the 2019 AMA study on digital health tools, which found that televisits/virtual visits increased by 100 percent.⁵²

Federal, state, and local telemedicine policy changes during the pandemic enabled the aforementioned tremendous increases in utilization.⁴⁶ The Georgia, Tennessee, North Carolina, and Kentucky changes to their telehealth policies since the beginning of the COVID-19 pandemic are shown in Appendix A. Broadly, states expanded originating site laws to allow for more flexibility in locations, allowed more types of healthcare clinicians to use telehealth, and modified payments.

Patient Portals

According to the ONC, a patient portal is a "secure online website that gives patients convenient, 24-hour access to personal health information from anywhere with an internet connection."¹²² According to a study published in 2016, clinic personnel viewed patient portals as a tool that had potential to improve communication and enhance information sharing.¹²³ However, there was concern over increased workload, confusion for patients, alienation of non-users, and a potential increase in health disparities. Therefore, their uptake and impact on care were expected to be limited.¹²³ Another 2017 study found that having access to patient portals could improve access to clinicians and health data that lead to improvements in patients' functional status and reduce high-cost healthcare utilization, but would likely not improve patients' self-efficacy, perception of health state, or experience with primary care practices.¹²⁴ One paper suggested that the portal could be a "gateway" to the use of other digital health interventions, prompting patients to use other digital tools.¹²⁵ Research on patient portal use during COVID-19 is limited.

Prescription Drug Monitoring Programs

Prescription Drug Monitoring Programs (PDMPs) are state-operated databases that collect information on dispensed medications. The first PDMPs, which were paper based, did not provide reports to healthcare providers for use during individual patient care; however, today's electronic databases have a variety of features that make them practical for such care.⁸¹

Home/Remote Monitoring

Remote monitoring devices and patient-generated data that could lead to faster, more personalized care for millions of people nationwide.³⁶ According to research conducted by the American Medical Association, smart versions of common clinical devices such as thermometers, blood pressure cuffs, and scales that automatically record readings in the patient record increased workflow efficiency for clinicians.⁵⁴

Wearable Devices and Mobile Applications

Wearable devices create new health knowledge and more effective prevention and treatment techniques by integrating vital-sign data, health-related behavioral data, and environmental-exposure data with clinical and genetic data.¹²⁶ Within the past several years, medical professionals and engineers have started integrating wearable technology in diagnosis and care processes, validating their effectiveness with patients in observational studies¹²⁷ and randomized controlled trials.¹²⁸ One 2021 systematic review study on wearable devices and their rise during the COVID-19 pandemic found that, between 2020–2021, wearable devices had provided good results in terms of high accuracy in diagnosing patients for COVID-19 after the initial onset of symptoms and monitoring patient symptoms.¹²⁹

APPENDIX C: QUALITY IMPROVEMENT PROGRAMS

Value-Based Care, Quality Improvement Programs, and Digital Health

Value-based care (VBC) is “a healthcare delivery model under which clinicians are paid based on the health outcomes of their patients and the quality of services rendered.”¹³⁰ Healthcare practices’ transformation from fee-for-service (FFS) to VBC relies partially on digital health tools to assist with patient data collection and care management to improve patient outcomes while reducing costs.¹³¹ Certain organizations are recognizing the importance of incentivizing digital health tool use for both FFS and VBC delivery and payment models.³⁶ VBC is promoted through innovative models supported by state and federal government agencies as well as the private sector.¹³² Between 2014 and 2019, there was a seven-fold growth in the number of states and territories implementing value-based reimbursement programs, with a total of 48 implementing VBC nationwide (including the District of Columbia and Puerto Rico).¹³³ Only four states—West Virginia, Indiana, Mississippi, and Georgia—had little or no value-based payment activity. CMS has a priority to shift towards value-based programs to support better care for individuals at a lower cost³² and is also one of the primary federal agencies encouraging data collection and the use of the social determinants of health in clinical settings through EHRs. CMS administers the Medicare QPP, which includes options for Alternative Payment Models (APMs) such as ACOs, described below.⁴⁴

Currently, public state programs and private programs are also incentivizing VBC and DHT use in innovative ways. Each state has its own laws and reimbursement policies for telehealth.³³ For example, New Mexico’s Medicaid contract requires contractor participation in the state’s Project ECHO program, which “provides telehealth specialty consultation services to underserved communities and healthcare clinicians working in remote areas.”³³ Kansas requires contractors to cover “telementoring” services, which extends specialist services to both patients and clinicians in underserved communities.³³ As part of the COVID-19 pandemic, Medicaid agreed to pay for adapting and using telehealth services across all states.¹³⁴ Private payers also adopting VBC by investing in ACOs.^{34,135,136}

There are currently six major types of quality improvement programs:

▶ **Quality Payment Program (QPP) – APM/MIPS track**

CMS administers the Medicare Quality Payment Program (QPP), which is used to reward quality and value—rather than volume—and ensure patients experience better care and improved health outcomes.¹³⁷

- ▶ An alternative payment model (APM) gives added incentive payments to provide high-quality and cost-efficient care,¹³⁸ and apply to a specific condition, care episode, or population.¹³⁸ CMS, for example, increases payments to Medicare clinicians that provide high-value, high-quality care, while also reducing payments to clinicians not meeting performance standards.¹³⁹
- ▶ The Merit-based Incentive Payment System (MIPS) determines Medicare payment adjustments. Depending on a composite performance score, clinicians may receive a payment bonus, a payment penalty, or no payment adjustment.¹⁴⁰ The categories that determine the payment adjustment are quality, improvement activities, promoting interoperability, and cost.¹⁴⁰

▶ **Inpatient Quality Reporting**

- ▶ Under this program, CMS aims to drive quality improvement via measurement and transparency, by publicly displaying data to help consumers make more informed decisions about health care.¹⁴¹ Data for certain measures are used to pay a portion of hospitals based on the quality and efficiency of care.¹⁴¹

▶ **Chronic Care Management**

- ▶ This program usually involves non-in person services provided to Medicare enrollees who have two or more chronic conditions expected to last at least 12 months or for the rest of the patient's lifetime.¹⁴² This allows healthcare professionals to be reimbursed for time and resources between Medicare enrollees' appointments.¹⁴³

▶ **Medicare EHR Incentive Program (Meaningful Use/Promoting Interoperability)/Medicaid EHR Incentive Program (Meaningful Use/Promoting Interoperability)**

- ▶ This program provides financial incentives to "eligible professionals and hospitals as they adopt, implement, upgrade, or demonstrate 'meaningful use' of certified EHR technology."¹⁴⁴ Those who participate in the program must use certified EHR technology to collect, store, and report quality measures.¹⁴⁴

▶ **Patient Centered Medical Home (PCMH)**

- ▶ The PCMH model is designed to coordinate care across the health system.¹⁴⁵ The PCMH model allows patients to engage directly with a clinician that coordinates a team of healthcare professionals, takes responsibility for comprehensive and integrated care for the patient, and advocates and arranges care with other clinicians and community resources as needed.¹⁴⁵ This model aims to improve safety, efficiency, and quality in patient care¹⁴⁵ while allowing comprehensive care to take place inside a patient's home. According to the Agency for Healthcare Research and Quality (AHRQ), a medical home can be "a model of the organization of primary care that delivers the core functions of primary health care."¹⁴⁶ According to AHRQ, the medical home has five functions and attributes: comprehensive care, patient-centeredness, coordinated care, accessible services, and quality and safety.¹⁴⁶

▶ **Accountable Care Organizations (ACOs)**

- ▶ ACOs are groups of doctors, hospitals, and healthcare clinicians who choose to coordinate high-quality care for their patients.¹⁴⁷ When the ACO succeeds in delivering high-quality care while accruing savings, it shares in the savings it generates.¹⁴⁸ Some ACOs are recognized as in CMS's QPP as APMs. There are several different types of Medicare ACO programs:
 - ◆ Medicare Shared Savings Program (MSSP): Allows clinicians, hospitals, and others involved in patient care the opportunity to create an ACO while lowering expenditure growth.¹⁴⁹
 - ◆ ACO Investment Model: This is a pre-paid shared savings model, which aims to encourage new ACOs to form in rural and underserved areas. It is structured to encourage those participating in the MSSP to participate in arrangements with greater financial risk.¹⁵⁰

- ◆ Next Generation ACO Model: Provides higher levels of financial risk and reward than the MSSP.¹⁵¹
- ◆ Medicare-Medicaid ACO Model: This model is focused on improving care and reducing costs for dually eligible Medicare and Medicaid enrollees. Allows interested states to offer ACOs and assume accountability for Medicare and Medicaid costs and quality.¹⁵²
- ◆ Advance Payment ACO Model: Designed for physician-based and rural clinicians. Select clinicians in this model can receive upfront, monthly payments, which can allow clinicians to invest in their care coordination infrastructure.¹⁵³
- ◆ Comprehensive ESRD Care Model: Designed to “identify, test, and evaluate new ways to improve care for Medicare [enrollees] with End-Stage Renal Disease (ESRD).”¹⁵⁴ This model tests ACOs for ESRD enrollees. The model uses a shared savings and losses model, under which those providing coordinated care will share savings, and in some instances be accountable for losses.¹⁵⁵
- ◆ Pioneer ACO Model: This model is “designed for healthcare organizations and clinicians that were already experienced in coordinating care for patients across care settings.”¹⁵⁶ Using this model, clinician groups can move more rapidly from an MSSP model to a population-based payment model. This model is also designed to align clinician incentives, aimed to improve quality and health outcomes while achieving cost savings.

APPENDIX D: DHTS PARTICIPANT DEMOGRAPHICS

Overall (n=1160)	n	%
Sex		
Male	670	57.76
Female	490	42.24
Age		
21-29	62	5.34
30-39	443	38.19
40-49	406	35.00
50-59	175	15.09
60+	74	6.38
Ethnicity		
Hispanic/Latino	136	11.72
Not Hispanic/Latino	1024	88.28
Race		
White	843	72.67
Black or African American	198	17.07
Other	119	10.26
Credentials		
MD/DO	712	61.38
NP/PA/CNM	253	21.81
PhD	39	3.36
Other/Multi	156	13.45
Specialty		
Family Medicine	486	41.90
Internal Medicine	205	17.67
Obstetrics and Gynecology	91	7.84
Geriatrics	71	6.12
Pediatrics	113	9.74
Mental/Behavioral Health	77	6.64
Other/Muti	117	10.09
Years in Practice		
Up to 10	495	42.67
11 to 20	461	39.74
21+	204	17.59
Tech Enthusiasm		
Skeptical/Hesitant	204	17.59
Neutral	357	30.78
Eager/Early Adopter	599	51.64

Overall (n=1160)	n	%
Practice Setting		
Solo Practice	83	7.16
Single/Multi specialty outpatient group practice	97	8.36
Single/Multi specialty outpatient group practice	362	31.21
Hospital and Outpatient Primary Care	199	17.16
Hospital	159	13.71
Medical School/Academic Medical Center	55	4.74
FQHC/Rural Health Center	195	16.81
VA/Government	10	0.86
Ownership		
Full Owner	115	9.91
Part Owner	86	7.41
Employee	959	82.67
Medicaid Acceptance		
Yes	1038	89.48
No	122	10.52
Number of Quality Reporting Programs Enrolled (0-7)*		
Quality Payment Program (QPP) - APM / MIPS track	642	55.34
Inpatient Quality Reporting	405	34.91
Chronic Care Management	521	44.91
Medicare EHR Incentive Program (Meaningful Use/Promoting Interoperability)	450	38.79
Medicaid EHR Incentive Program (Meaningful Use/Promoting Interoperability)	410	35.34
Patient Centered Medical Home (PCMH)	427	36.81
Accountable Care Organization	280	24.14
Current/Past DHT Use		
Yes	1153	99.40
No	7	0.60
Urban/Rural		
Urban	1055	90.95
Rural	405	9.05
Number of Program Enrolled (0-7)		
0	123	10.60
1	151	13.02
2	221	19.05
3 and more	665	57.33

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