Digital Health as a Tool to Support Health Equity

How to Include Every Patient in the Digital Health Era

Executive Summary

Digital health innovations can simultaneously improve health outcomes for some segments of patients and at the same time unintentionally exacerbate disparities for others. This phenomenon is known as the "digital divide." Over the last several years, nearly all facets of the healthcare industry have zeroed in on the importance of achieving health equity.

Today, many digital health companies are committed to achieving digital health equity. This term means that software and services are designed to both help those who are underserved by existing healthcare systems and reach patients who have been failed by current digital health solutions.

In this white paper, we review the factors that have renewed the industry's focus on health equity. We then describe four pillars that must be addressed for any solution to sufficiently account for digital health equity. Lastly, we describe Memora Health's analysis and design approach to health equity across age and engagement factors, accessibility challenges and literacy levels, and outcomes achieved for non-white patients in a postpartum support program.

PART I:
The Role of Digital Health in Improving Health Equity

A common adage of innovation is that "the future is already here — it's just not very evenly distributed." Nowhere is that more true than at the **intersection** of healthcare and technology (Makri, 2019). COVID-19 **catalyzed** the utilization of digital health applications that previously struggled to gain widespread adoption (Tseng, et al. 2021). Yet simultaneously COVID-19 brought attention to the structural inequities that are embedded in our healthcare system and society more broadly.

> "
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>
> **- William Gibson** "

Digital health, the nascent **industry** that combines 21st-century information technology with clinical objectives, is catalyzing improvements in healthcare (U.S. Food & Drug Administration, 2020).

However, this innovation has also **exacerbated** the barriers to technology that often exclude or inhibit equal access –i.e., **digital inequity**–which disproportionately affects people who are non-white, older adults, and of lower socioeconomic means (U.S. Food and Drug Administration, 2020; United Nations Conference on Trade and Development, 2020; World Economic Forum, 2020).

Digital inequity has prompted the **industry** to reexamine its aims to achieve health equity (Bathija, 2021).

According to the **World Health Organization**, health equity means that everyone should have fair opportunities to attain their full health potential and no individual or group of people should be disadvantaged (World Health Organization, 2011).

U.S. Policy Context

The U.S. federal government has been prompted to act in light of the COVID-19 pandemic and increased violence against people of color, especially at the hands of law enforcement. Policies to address health equity have become a national priority and various government strategies have been enacted to address the crisis.

The COVID-19 pandemic exposed health inequities caused or exacerbated by the pandemic. As explained **by the CDC**, "persistent health disparities combined with historic housing patterns, work circumstances, and other factors have put members of some racial and ethnic minority populations at higher risk for COVID-19 infection, severe illness, and death" (Centers for Disease Control and Prevention, 2022).

The COVID-19 Health Equity Task Force is charged to identify tactics to address pandemic-related inequities and prevent such inequities in the future (US Department of Health and Human Services Office of Minority Health, 2021). Their **recommendations** include investment in community-led solutions, adoption of a data ecosystem that promotes equity-driven decision making, and increased accountability for health outcomes (U.S. Department of Health and Human Services Office of Minority Health, 2021).

This last recommendation is consistent with the renewed focus health system leaders have placed on health equity. A **Deloitte study** found that 64% of healthcare finance leaders say health equity initiatives are a top priority (Shurland, Gerhardt, Shukla, & Astavans, 2021).

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Pursuant to **Executive Order 13985**, the U.S. federal government has a multi-pronged approach to address health equity (The White House, 2022). One charge is to expand health coverage and improve health outcomes via the Department of Health and Human Services (HHS).

A recent move by HHS in this space was the **announcement** by the Centers for Medicare and Medicaid Services (CMS) of the Accountable Care Organization (ACO) Realizing Equity, Access, and Community Health (REACH) Model (Centers for Medicare & Medicaid Services, 2022). The aim is to encourage health care providers to coordinate care to improve the care for Medicare beneficiaries, including those from underserved communities.

Health Equity Divides

Fundamentally, there are at least **two health equity divides:** 1) the longstanding inequities of our legacy approaches to care;, and 2) the new digital divide, which leaves many patients behind if they do not have the necessary digital access, digital literacy, or means to benefit from the ongoing digital health renaissance (Crawford et al., 2020).

Digital inclusion, or making sure that health tech innovations are accessible to all patients regardless of their circumstances, is **good for business**, improves **health outcomes**, and is a moral responsibility that all healthcare organizations share (Sieck et al., 2021; Aluko et al., 2021; Sheon et al., 2021). No single organization can mend all of our world's existing health inequities, and similarly, digital health alone cannot solve the persistent inequities of the U.S. healthcare system.

But digital health companies have an urgent and unique opportunity to serve those who have been disadvantaged by existing systems and to ensure that those patients are included in the next chapter of health tech innovation. Digital technology that relies on machine learning has **been found** to reflect human biases. In a recent Brookings study, "Natural language processing [NLP] applications' biased decisions not only perpetuate historical biases and injustices, but potentially amplify existing biases at an unprecedented scale and speed." This concern has been reinforced in another recent study from Rush University Medical Center. The researchers **conducted a study** using machine learning to determine bias within natural language processing (NLP) regarding opioid misuse classifiers. They found that "disparities across subgroups may be codified, perpetuated, and exacerbated if biases are not assessed, identified, mitigated, or eliminated. In healthcare settings, these biases and disparities can create multiple layers of harm" (Thompson et al., 2021).

With the mission to make care more accessible, actionable, and always-on, Memora Health strives to study and advocate for health equity. Health inequities come in many forms, and the focus of this paper will center on four of them. These are digital accessibility, language and literacy, age-related bias, and racial inequities in care delivery–collectively the four pillars of digital health equity.

Digital Accessibility **Language and Literacy** **Age and Engagement** **Racial Equity**
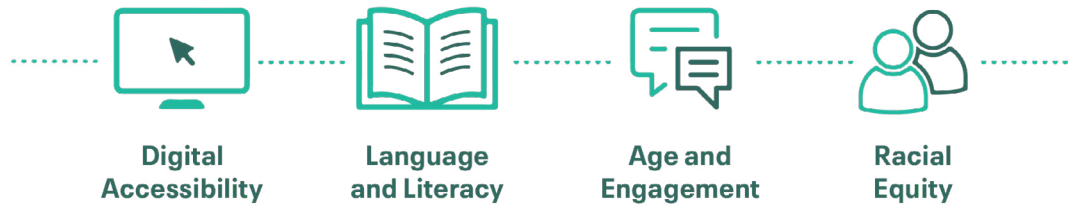
DIGITAL ACCESSIBILITY

Digital access is far from equitable among even the most developed nations. According to **Pew Research**, while 97% of people in the U.S. have a mobile phone as of 2021, only 85% have a smartphone and just 77% have **a broadband connection** at home (Pew Research Center, 2021). The same study found that 24% of the lowest-income people in the U.S. **do not have a smartphone**, mostly due to cost (Perrin, 2021).

People who have fewer resources, like limited access to broadband or smartphones, would stand to benefit significantly from digital health innovations by making access to resources and care easier and thereby improving patients' ability to achieve better health outcomes. However, innovations that require a web portal and app-based solutions widespread across health systems, leave these less resourced patients out. Even among those with internet access or smartphones, patient web portals and app-based solutions are used by less than 50% of patients.

According to the **Office of the National Coordinator for Health IT**, in 2020 about 60% of patients in the U.S. were provided access to a patient portal but less than 40% of patients ever accessed their portal–13% of patients did not have a way to access the internet while

24% had difficulty logging into patient portals in 2020 (HealthIT.gov, 2021; National Cancer Institute, 2020). The divide is significantly worse for already marginalized and disadvantaged populations. For example, 38% **of African Americans living in the Black rural South** (comprised of counties with an African American population of 35% or more) lack basic broadband access in their homes (Ferraro, 2021).

Digitization has provided novel solutions to today's patient and provider challenges, however, these solutions have failed to scale equitably. The digital boom has missed the imperative to reach the broader American population. Digital accessibility – or the means and skills to use digital solutions – also extends to the affordability of smartphones, computers, and subscription services.

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LANGUAGE AND LITERACY

Digital literacy is required to effectively use broadband services and smart devices, but certain marginalized groups are once again excluded (National Skills Coalition, 2020). Digital literacy is not only a challenge for older adults but also for people with disabilities who are unable to navigate the complexities of digital healthcare such as accessing patient portals or setting up accounts for telemedicine calls.

Digital literacy and access relate to all other domains of **social determinants of health**, including education and health literacy (Sieck et al., 2021). **The National Institutes of Health (NIH)** defines personal health literacy as "the degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others" via reading, writing, oral, and numerical skills (National Institutes of Health, 2021). Higher levels of health literacy empower patients to effectively engage with their providers and the healthcare system to achieve optimal health. Low levels of health literacy prevent patients from fully engaging with their care, and are directly associated with poorer health outcomes.

Low health literacy can manifest itself in a number of ways (Office of Disease Prevention and Health Promotion, 2020). For example, an individual with low levels of health literacy may have below-average reading skills that prevent them from reading healthcare instructions, or experience a language barrier that prevents them from communicating effectively with their physician in the language of the clinic, ultimately contributing to adverse health outcomes. Individuals with suboptimal

health literacy are more prone to lower self-reported health statuses, increased hospitalizations, and higher health **care costs**. (Jayasinghe et al., 2016).

Language barriers pose potentially dangerous obstacles to receive effective care for ethnic groups who come from culturally different backgrounds and whose first language is not English (Espinoza, 2021). Attempting to navigate an English-dominant system with Limited English Proficiency (LEP) further complicates **patient care** (Espinoza, 2021). These individuals have a considerably harder time communicating their needs to healthcare providers. As such, the providers' ability to understand relevant medical history and make an accurate diagnosis may be hindered, resulting in higher mortality rates. Patients with LEP are less equipped to effectively respond to health questionnaires and follow medication or post-discharge instructions, resulting in poor medical compliance (Espinoza, 2021). In this regard, Hispanic peoples face tremendous difficulty. Approximately **74% of patients of Hispanic descent** have low levels of health literacy compared to the national average of only 7% of Americans who have similarly low levels of health literacy (Office of Disease Prevention and Health Promotion, 2020).

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AGE AND ENGAGEMENT

Another demographic group affected by health inequity is older adults. Older patients experience poorer outcomes due in part to age-related biases and stigmas that healthcare workers may display in the clinical setting. **Physicians are less likely** to investigate certain symptoms that can be consistent with aging but are in fact separate disease manifestations. Healthcare providers are also less likely to recommend treatments to older individuals in order to allocate time and resources to younger patients (Ben-Harush et al., 2022). In these scenarios, age (rather than poor treatment plan outcomes) is the primary concern.

This age group is also regularly excluded from the benefits of digital care. Older adult populations are likely to be less familiar with the app-based and password-protected technologies that have been at the forefront of the digital health revolution (Heponiemi et al., 2022). While **research shows** that older patients have a lower likelihood of using online services for a variety of healthcare-related tasks, this is **likely** due to lower digital health literacy, smartphone ownership, and broadband access vs. the general population (Eruchalu, 2021). However, the percentage of people over 65 who own a cell phone exceeds 90%, while smartphone ownership among this population is still only **61% as of 2020** (Pew Research Center, 2021).

90%+
of people over 65 own a cell phone as of 2020

With support and technologies designed specifically for geriatric populations, the disparities in digital health utilization for older people can be mitigated. A **cross-sectional study** in Finland found that older adults are less likely to use online services to access their health information. However, the rate of use increased for patients 60-80 years old when providers trained these patients on the tools and made them easier to access (Heponiemi et al., 2022).

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RACIAL EQUITY

Race and ethnicity are inextricably tied to the discussion revolving around health equity, as health outcomes vary substantially across racial and ethnic groups. The U.S. healthcare system harbors significant health disparities based on race and ethnicity, as evidenced by higher than average rates of chronic disease and premature **death among nonwhite/Asian groups** (National Academies of Sciences, Engineering, and Medicine et al., 2019).

Digital access to a patient portal or app is inequitable for many African American and Hispanic populations compared to the white population in the U.S. because of limited broadband access and smartphone use (see Figure 1). **Data further demonstrates** that Asian, Latino, and Black or African American patients are 23%, 55%, and 62% less likely, respectively, than White patients to enroll in a patient portal (Garrido et al. 2015). In addition, African American and Hispanic adults are **less likely** than White patients to have either a traditional computer or a broadband connection at home (Atske, 2022).

Black and Hispanic adults in U.S. are less likely than White adults to have a traditional computer, home broadband
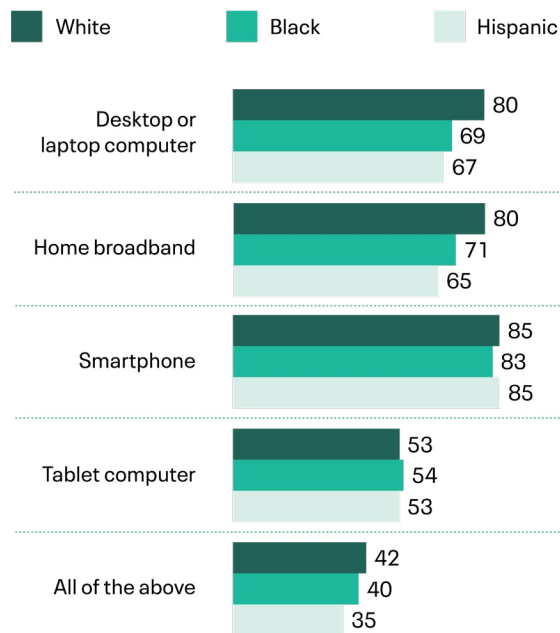% of U.S. adults who say they have the following

Legend: White | Black | Hispanic

Category	White	Black	Hispanic
Desktop or laptop computer	80	69	67
Home broadband	80	71	65
Smartphone	85	83	85
Tablet computer	53	54	53
All of the above	42	40	35

Figure 1. Source: (**Atske, 2022; Perrin, 2021**)

Black Maternal Care

Racial inequity in healthcare is particularly pronounced when considering care for pregnant women and their infants. The U.S. has the **highest maternal mortality rate** in the developed world, which is driven by poor health outcomes for patients of color. Importantly, **52% of these deaths** occurred postpartum (defined as up to 12 months after birth), most within 42 days of birth, and disproportionately among African American patients (Tikkanen, 2020). The data suggests that pregnancy-related mortality rates are 2 to 3 times higher among African American women and American Indian or Alaska Native (AI/AN) women than among white women (Centers for Disease Control and Prevention, 2022).

A previously unrecognized but important cause of postpartum mortality is **mental health and the data on racial disparities** in postpartum mental health further validate these findings (Tikkanen, 2020). While **1 in 7 women** suffer from postpartum depression (PPD) symptoms after giving birth, **patients of color** are twice as likely to have PPD symptoms than white patients but are **less likely** to report symptoms and **less likely** to start or continue treatment for PPD (Wisner, 2013; Howell et al., 2005; Sandoiu 2020; Kozhimannil et. al., 2011).

Postpartum support programs that solve for access and ease of use can help address the maternal health crisis. These types of solutions for racially diverse populations must enable parents to continue their care journey confidently at home from the time of delivery throughout the entire postpartum period. For example, the benefits of SMS-based approaches to digital health, can ensure higher levels of access while also being simple to use.

PART III:
Memora Health's Approach to Health Equity

Digital health innovations have the capacity to be transformative in healthcare delivery but health technology companies need to be intentional when implementing and scaling their solutions to actually impact and reduce disparities. Memora Health takes a patient-centric approach in supporting individuals along their care journeys. The technology and messaging take into consideration how people use and benefit from these messaging journeys. This approach ensures that all patients benefit from the service and stay closely connected with their care teams regardless of their age, financial resources, or racial identity.

Through internal research and in collaboration with our clients, Memora Health has analyzed our patient data to confirm our approach thoroughly accounts all four pillars of health equity. In our findings, we have assessed how usage, satisfaction rates, literacy levels, and accuracy of our natural language processing (NLP) algorithms compare across the age, literacy levels, and race of our patients.

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Age-Based Equity

Memora Health is used by a wide variety of patient populations across clinical use cases, and includes patients ranging from 14 years old to 83 years old. Our internal analyses investigated whether there are differences across this spectrum of age. We found no statistically significant differences in rates of usage nor accuracy of our NLP across age cohorts.

When evaluating the number of incoming messages from patients ($r = .021$, $p = .301$) and the number of outgoing messages to patients ($r = .037$, $p = .077$) based on their ages there is no significant difference.[1] However, when we analyze the oncology cohort separately, we find surprising results. This cohort of patients on average is over age 50 show a slightly positive trend between age and engagement ($r = .037$, $p = .077$). This stands in contrast to the common finding that older patients utilize digital health solutions less than younger patients.

We recognize that NLP accuracy is another common problem area for bias in digital health as mentioned previously. Our internal investigation of NLP accuracy against patient age found no significant discrepancies in accuracy when compared with younger patients ($r = -.008$, $p = .831$). As an additional measure of accuracy, we analyzed the number of questions that went unanswered by our NLP versus the age of patients and also found no statistically significant differences ($r = .014$, $p = .780$).

[1] These results exclude oncology use cases, where oral chemotherapy messages are requested from patients on a daily basis to track adherence–which would distort our analyses.

Lastly, we measured whether older adult patients required more manual messaging from their care teams than younger patients, even when accuracy and engagement were otherwise equivalent. Data suggests that there were no statistically significant differences in the number of manual messages from clinicians based on patients' age ($r = .03$, $p = .153$).

These results together support that the experience for older adult patients is broadly similar to that of younger patients and that SMS is an effective medium for patients of all ages. While the above data is derived from a heterogeneous set of use cases and these use cases tend to cluster around specific demographics (e.g., postpartum care has mostly younger patients, oncology care trends towards older patients), we will continue to monitor these results as we expand to other use cases and locations.

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Accessible Content

Memora Health's product overcomes the three typical barriers to accessing digital health solutions: connectivity, affordability, digital literacy, and health literacy. Our texting platform does not require a broadband connection, smartphone, or a high level of digital literacy. Rather, our solution is text-first which means that it is theoretically accessible to **97% of the U.S. population** (Pew Research Center, 2021). An SMS-based healthcare product is critical to developing an equity-focused solution and is a great equalizer to improve access and satisfaction for all patients.

Our content is written for at a 7th/8th grade reading level to ensure that all patients are able to easily interpret the messages we send them. The Flesch-Kincaid grading system is an industry standard that is applied to all content sent through our platform. Similarly, idiomatic language (phrases that are inherently metaphorical and/or whose meaning cannot be inferred from the individual words) is avoided to ensure messages are clear and understandable.

In addition, Memora has translated our content into a variety of languages to reach a greater number of patients. Recently, Memora introduced questionnaires for patients in Spanish at a Northeast U.S. medical center to monitor post-surgical recovery and saw high response rates in this group. We have also implemented successful programs in Vietnam and Peru to support follow-up after orthopedic surgery and perinatal care respectively. These programs represent scalable solutions could be available in any country in the world.

Race-Based Equity

To address the challenges of maternal mortality and digital health disparities, Memora Health partnered with Penn Medicine at the Hospital of the University of Pennsylvania (HUP) on a postpartum support program. After delivery, patients can ask questions via text message and receive answers as well as proactive advice from our artificial intelligence (AI). We provide timely reminders for appointments and follow-ups, proactive advice, screenings (e.g. for postpartum depression), and consultative support with answers around the clock. The AI allows patients to obtain and request resources they may not have previously known about or asked for.

This program allows outpatient clinical support services to be provided in the home environment virtually. This has resulted in a practical, effective, and viable support model - with exceptional outcomes for patients of all races and especially non-white patients, who make up more than 50% of new patients at the HUP. Our postpartum program at the HUP has enrolled more than 1,400 patients to date, with a 97% completion rate and an activation rate of more than 90%. Patients served are on average 29 years of age; 59% are Black or African American, 25% White, 5% Hispanic Latina, 4% Asian, and 7% of other races. More than half of the patients have public insurance (~54%).

Memora Health's postpartum program at the HUP has enrolled more than 1,400 patients to date with:

54%
On Public Insurance

90%+
Activation Rate

97%
Completion Rate

We have found data from our programs to be particularly encouraging for non-white patients in this postpartum support program. Our data shows that there is no difference in any measure of natural language processing (NLP) accuracy between patients by race ($F=.136$, $p=.873$). Additionally, non-white patients rate our program statistically significantly higher than white patients ($F=4.905$, $p=.008$). We believe these findings suggest that easily accessible SMS may indeed signal a channel for engagement that is effective because non-white patients have historically been disenfranchised and excluded from traditional care.

PART IV:
Key Takeaways

Existing barriers to digital health have only exacerbated problems inherent in our healthcare system, especially since the onset of the COVID-19 pandemic. Every healthcare organization has a role to play in our industry's collective efforts to identify, address, and eliminate health disparities. Four key areas to assess any digital health initiative against are its ability to be accessible regardless of patient resource level, and how well bias is mitigated when considering a patient's age, literacy level, and race.

Digital health innovators have a critical responsibility to ensure that impacted patients can benefit from their technologies, and not only the patients who already have the means to access patient portals, apps, or telehealth platforms. Memora Health has designed its platform and conducted analyses to address the four pillars of digital health equity in an effort to meet patients where they are and improve their clinical outcomes.

About Memora Health

Memora Health is the leading technology platform for virtual care delivery and complex care management. Memora partners with leading health systems, health plans, life science companies, and digital health companies to transform the care delivery process for patients and care teams.

The company's platform digitizes and automates complex care workflows, supercharging care teams by intelligently triaging patient-reported concerns and data to appropriate care team members and providing patients with proactive, two-way communication on their care journeys. To learn more about Memora's vision to make care more actionable, accessible and always-on, visit **memorahealth.com.**

PART V:
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