

Evidence- and Consensus-Based **Digital Healthcare Equity Framework**



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Executive Summary

PURPOSE, AUDIENCE, AND SCOPE

This document presents the Digital Healthcare Equity Framework (the Framework), an evidence- and consensus-based framework that guides users in intentionally considering equity in healthcare solutions that involve digital technologies. The Framework is accompanied by an [Implementation Guide](#) (the Guide) that contains best practice examples and relevant resources to help users implement the Framework. The intended users of this framework include digital healthcare developers and vendors, health systems, health plans, and clinical providers. The Framework serves as a tool to help users and other stakeholders assess whether their healthcare solutions that involve digital technologies are equitable at every phase of the digital healthcare lifecycle, including planning, development, acquisition, implementation, and monitoring. The Framework and Guide apply to both patient-facing and clinician-facing healthcare solutions and address the accessibility, purpose, security and privacy, usability, and safety concerns of those digital solutions.

METHODS

The first step in developing the Framework and Guide was conducting an environmental scan to understand the current state of related frameworks and best practices for designing equitable healthcare solutions that involve digital technologies. The environmental scan included two components: 1) a scoping review of the literature and 2) key informant interviews with health equity and digital healthcare technology thought leaders. Next, a 31-person technical expert panel (TEP) was convened to ascertain their perspectives on digital healthcare and health equity during the development of the Framework and Guide.

EVIDENCE SUPPORTING THE FRAMEWORK

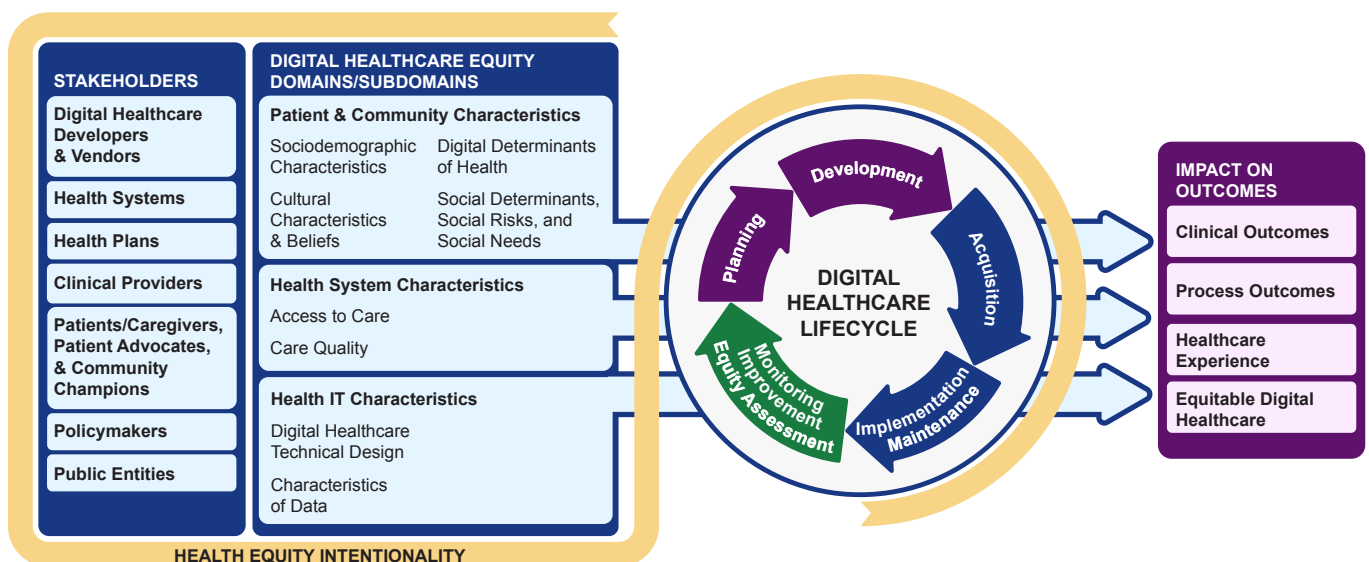
In the scoping review, a limited set of frameworks was identified that focused specifically on digital healthcare equity.^{1,2} Most of the examined literature focused on frameworks that either addressed concepts and aspects of healthcare solutions that involve digital technologies or frameworks related to health equity. However, only a few frameworks addressed both.

Similar concepts from the scoping review of the literature were grouped together and synthesized into several primary domains and subdomains. The review of the health equity and digital healthcare literature resulted in a similar number of primary domains (7 each) and subdomains (3-7 per domain). Further, from concepts discussed in key informant interviews, four additional primary domains were identified. While different terminologies were used in the scoping review and key informant interviews, many concepts overlapped. The composite list of domains and subdomains was presented to the TEP. The TEP members supported the need for the Framework

and the overall content. They also offered numerous suggestions for improving the clarity and usefulness of the Framework.

THE FRAMEWORK

The Framework domains and subsequent subdomains were derived from the synthesized concepts identified in the scoping review, key informant interviews, and feedback received from the TEP. Ultimately, three overarching domains resulted for intentionally considering equity in digital healthcare solutions: 1) Patient and Community Characteristics, 2) Health System Characteristics, and 3) Health Information Technology Characteristics (refer to Figure 2 in the main text for a depiction of how the synthesized domains from the environmental scan and additional TEP input resulted in the Framework’s three overarching domains and corresponding subdomains).



The Framework is structured around the digital healthcare lifecycle. The lifecycle is aligned with quality improvement approaches, such as the “Deming Wheel” and the Institute for Healthcare Improvement’s model of “Plan, Do, Study, Act,”^{3,4} and includes the following phases:

- Planning
- Development
- Acquisition
- Implementation/Maintenance
- Monitoring/Improvement/Equity Assessment of healthcare solutions that involve digital technologies

The TEP recommended that a digital healthcare equity framework needed to reflect engagement with multiple stakeholder groups, including a) digital healthcare developers and vendors; b) health systems; c) health plans; d) clinical providers; e) patients/caregivers, patient advocates, and community champions; f) policymakers; and g) public entities. It is these stakeholders who will need to intentionally consider the Framework domains and subdomains and their interaction throughout the digital healthcare lifecycle to achieve desired outcomes.

IMPLEMENTATION GUIDE

To accompany the Framework, an implementation guide was developed to help users apply the Framework in a variety of different scenarios. The Guide is structured around the primary users of the Framework (i.e., digital healthcare developers and vendors, health systems, health plans, and clinical providers). Each section of the Guide identifies the primary user(s), the main phase(s) of the digital healthcare lifecycle where the user(s) play key roles, and key recommendations of how users can address the most relevant domains and subdomains in that phase of the lifecycle, including how to engage other stakeholders.

Key Definitions

To ensure that users of the Framework and Guide have a full understanding of the concepts presented in this document, definitions of key terms used in this document based on established sources and subject matter experts are offered:

HEALTH EQUITY

The attainment of the highest level of health for all people. Achieving health equity requires valuing everyone equally with focused and ongoing societal efforts to address avoidable inequalities, historical and contemporary injustices, and the elimination of health and healthcare disparities.³

HEALTH DISPARITIES

A particular type of difference in health is closely linked with social, economic or environmental disadvantage. Health disparities adversely affect groups of people who have systematically experienced greater obstacles to health based on their racial or ethnic group; religion; socioeconomic status; age; mental health; cognitive, sensory, or physical disability; sexual orientation, gender and gender identity; geographic location; or other characteristics historically linked to discrimination or exclusion.³

EQUITY INTENTIONALITY

An approach that is intentional in who is engaged, how they are engaged, and to what end they are engaged to achieve the end goal of healthcare equity.

DIGITAL HEALTHCARE

The field of knowledge and practice associated with the development and use of digital technologies to improve healthcare.

DIGITAL REDLINING

Discrimination by internet service providers in the deployment, maintenance, or upgrade of infrastructure or delivery of services. The denial of services has disparate impacts on people in certain areas of cities or regions, most frequently on the basis of income, race, and ethnicity.⁵

DIGITAL DIVIDE

The gap between those who have affordable access, skills, and support to effectively engage online and those who do not.⁵

DIGITAL DETERMINANTS OF HEALTH

Factors such as literacy in information and communication technologies and ability to access equipment, broadband, and the internet.⁶

DIGITAL HEALTHCARE LIFECYCLE

The process used in technology development that includes planning, development, acquisition, implementation/maintenance, and monitoring/ improvement/equity assessment. This process is aligned with quality improvement approaches such as the “Deming Wheel” and the Institute for Healthcare Improvement’s model of “Plan, Do, Study, Act.”^{3,4,7}

DIGITAL HEALTHCARE EQUITY

Intentional consideration of equity in the planning, development, acquisition, implementation/ monitoring, and monitoring/improvement/equity assessment of healthcare solutions involving digital technologies.

DIGITAL HEALTHCARE SOLUTIONS

Any patient-facing or clinician-facing healthcare solution that involves digital technologies, wholly or in part. Examples include mHealth applications, patient portals, telehealth platforms, hospital websites, Federal and State health programs’ enrollment websites, clinical decision support tools, and risk prediction algorithms.

Introduction

PURPOSE

The purpose of this document is to present the Digital Healthcare Equity Framework (the Framework), an evidence- and consensus-based framework that guides users in intentionally considering equity in healthcare solutions that involve digital technologies. The Framework is accompanied by a separate implementation guide (the Guide) that contains best practice examples to help users implement the Framework.

INTENDED AUDIENCE

The intended users of this document include digital healthcare developers and vendors, health systems, health plans, and clinical providers. While those stakeholder groups are considered the primary users of this framework, other stakeholders are important collaborators in improving health equity (e.g., patients, caregivers, community champions). Users of the Framework are encouraged to include other stakeholders in opportunities to contribute throughout the digital healthcare lifecycle.

SCOPE

The Framework is designed as a tool to help users and other stakeholders intentionally consider equity during each phase of the digital healthcare lifecycle: 1) the planning and development phases (e.g., for digital healthcare developers and vendors), 2) the acquisition phase (e.g., for a health plan), and 3) the implementation/maintenance and monitoring/improvement/equity assessment phases (e.g., for health systems or provider practices). The Framework is intended to apply to both patient-facing and clinician-facing digital healthcare solutions and address the accessibility, purpose, security, privacy features, usability, and safety concerns applying to those digital solutions.

RATIONALE

Digital technologies are an increasingly important means of gaining access to employment, housing, education, and social networks.⁸ Their role in healthcare delivery is growing and includes both patient-facing solutions and clinician-facing solutions. In particular, individuals in disadvantaged communities who lack timely access to high-quality healthcare might benefit more from digital healthcare technologies, as they suffer a potentially lower quality of life and shorter life expectancy.^{9,10}

Despite the considerable opportunities that digital healthcare technologies provide, substantial disparities due to race, ethnicity, and socioeconomic status still exist in access to and utilization of healthcare services.¹¹⁻¹³ The positive impact of digital technologies on individual and population

health will be limited if the unique characteristics, needs, and capabilities of *all* patient groups are not considered at each phase of the digital healthcare lifecycle.

Considerations ranging from lack of patient digital literacy to lack of broadband access—which are collectively referred to as the digital divide—may impact the viability (e.g., implementation and successful use across different communities) of healthcare solutions that involve digital technologies and tools.¹⁴⁻¹⁶ Growing concerns over the digital divide and its impact on the application of healthcare technologies in the United States and across the world have created a demand for a digital healthcare equity approach. Addressing the digital divide and its impact on the health of individuals and communities requires such an approach to intentionally consider equity throughout the lifecycle of digital healthcare solutions. This systematic approach is essential to achieve digital healthcare equity and to consider the unique needs and capabilities (e.g., patient's digital literacy) of all applicable patient groups, as well as social determinants, social risks, and social needs in the built environment, where they live, work, or socialize (e.g., patient's broadband access).

A digital healthcare equity approach helps to move from a superficial description of factors to an ecologically comprehensive approach that considers the multitude of sociodemographic, cultural, and economic factors and their interactions that impact health and well-being.^{1,2} This comprehensive approach bridges two well-developed concepts: 1) digital healthcare and 2) health equity. This approach links social determinants, needs, and risk factors in health equity and creates a structure through which digital healthcare equity can be measured, planned, and achieved at every level, from healthcare providers to institutions, insurers, health regulators, and the government.¹ This approach also recognizes health equity as an essential domain of the quality of digital healthcare, in tandem with the domains of person-centeredness, safety, timeliness, effectiveness, and efficiency.^{17,18}

For example, the quality of digital healthcare will suffer and digital healthcare equity will be impacted if consideration is not given to the culture, physical environment (e.g., home or workplaces), and social context (e.g., communities) of users. The effectiveness of a given digital healthcare solution will also be diminished if developers are not mindful of these factors in creating institutional digital healthcare strategies or in providing funding and remuneration models for providers.¹ Moreover, this approach acknowledges that to ensure equity intentionality, certain populations may necessitate creating a non-digital way of implementing the healthcare solution. For instance, in the context of COVID-19 vaccination, many initial technologies used for vaccination signups relied on internet access and familiarity with digital forms, which was a disadvantage for those who lacked those capabilities. Further, if a digital healthcare solution is designed explicitly for a portion of the patient population needing the solution, it should be labeled accordingly. Entities implementing such a solution can consider best practice alternatives when creating an overarching solution to fit the needs of their entire patient population. Health

systems, for example, shouldn't eliminate vaccination signups through patient portals, but should offer viable alternatives for patients needing them.

Thus, digital healthcare equity should be monitored by providers, institutions, insurers, health regulators, and government leaders and should be a key focus of their respective quality efforts. The quality improvement approaches for addressing equity gaps build on existing approaches for addressing other quality gaps: incorporating tools and methods such as Plan, Do, Study, Act cycles, feedback loops, patient engagement, checklists, and physician and nurse champions.¹⁸⁻²⁰ The digital healthcare equity framework proposed here has been designed to specify the aspects that need to be considered in this systematic and intentional approach to digital healthcare equity.

Methods

The development of the Framework and Guide was informed by an environmental scan, which included a scoping review and key informant interviews, engagement of the technical expert panel (TEP) in various forms, and reviews by internal and external advisors. The development process took place over a 2-year period (**Figure 1**).

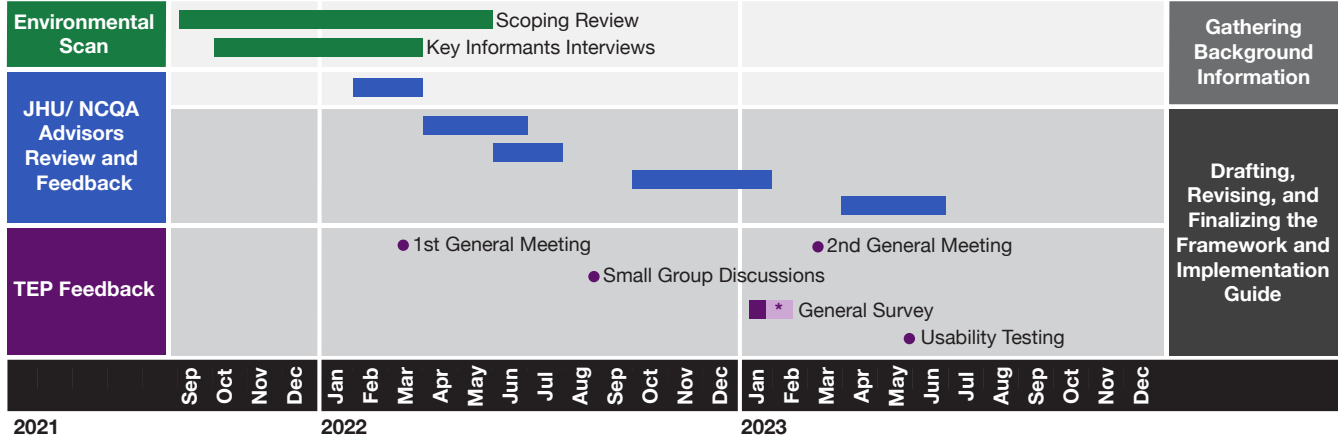


Figure 1. Timeline of Development of Digital Healthcare Equity Framework and Implementation Guide.

ENVIRONMENTAL SCAN – SCOPING REVIEW

As a first step in developing the Framework, an environmental scan was conducted to understand the current state of related frameworks and best practices for designing equitable healthcare solutions that involve digital technologies. The scan included two components: 1) a scoping literature review and 2) interviews with key informants. The scoping review aimed to identify existing digital healthcare equity frameworks and literature reporting on the development or implementation of the frameworks (please refer to **Appendix A** in the [environmental scan report](#)

for details on the search strategy). Articles that both described a framework and those that offered recommendations on developing a framework or implementing it in different settings were identified. Thus, PubMed, CINAHL, and PsycINFO database searches were conducted, as well as a hand search of reference lists of included articles and relevant systematic reviews, selected health informatics journals, and grey literature on relevant websites. Two reviewers independently screened each abstract. Articles promoted to round two screening underwent full-text review by two independent reviewers. The selected literature was organized according to frameworks addressing either digital healthcare solutions or those addressing healthcare equity.

ENVIRONMENTAL SCAN – KEY INFORMANT INTERVIEWS

The key informant interview component of the scoping review included discussions with health equity and digital technology thought leaders about their experiences and perspectives on intentionally integrating healthcare equity into healthcare solutions involving digital technologies and products. Nine thought leaders and experts in health equity or digital healthcare with an array of experiences in researching, planning, and implementing health equity initiatives or digital healthcare technologies were interviewed. A semistructured interview guide was used to facilitate individual, hour-long interviews. Questions focused on developing both an understanding of the key informant's specific experiences and background related to digital healthcare or health equity and on soliciting input on best practices that could inform our framework.

TECHNICAL EXPERT PANEL REVIEW AND SURVEY

A 31-member TEP comprised of digital healthcare and health equity experts was convened to ascertain their perspectives on the development of the evidence- and consensus-based digital healthcare equity framework and accompanying guide (please see **Appendix B** for the list of TEP members and their organizations). The TEP members included thought leaders representing health plans, healthcare delivery systems, digital healthcare or health equity researchers, public health experts, digital healthcare developers and vendors, and patient advocates. Through different expert panel engagements, their feedback was sought on how to best address equity issues in healthcare solutions that involve digital technologies (two meetings with all panel members, two small group discussion sessions with a subset of panel members, and a survey to all panel members). The feedback from the TEP members focused on reviewing the Framework and the proposed list of domains and subdomains that were drafted. The TEP also provided feedback on the outline of the implementation guide and shared use cases and real-world examples of how to best address equity issues in digital healthcare solutions.

Results Informing Framework Development

EXISTING FRAMEWORKS FOR DIGITAL HEALTHCARE AND HEALTH EQUITY

General findings from the scoping review and limitations of the current evidence

As part of the scoping review, 124 articles that met the inclusion criteria were identified, of which 60 targeted health equity, 51 targeted digital healthcare, and 13 targeted both digital healthcare and health equity (refer to the project's [environmental scan report](#) for more details). The majority of the proposed frameworks were developed by independent researchers/experts, and in only a few instances were frameworks developed by a national (e.g., National Academy of Medicine,²¹ Diabetes Wellness and Prevention Coalition)²² or international organization (e.g., Dutch Center for Consumer Experiences in Healthcare,²³ World Health Organization's (WHO's) regional and Country office in Ghana).²⁴ Other approaches for framework development included engaging key informants, performing a literature review, using surveys and focus groups, and participatory research.

The scarcity of frameworks from national or international organizations limits the generalizability of digital healthcare equity concepts because most frameworks developed by independent researchers do not spread beyond their organization and only reach a limited readership if published. In terms of the development process for a framework, only a few reported a consensus-based approach.

About one-third of the articles identified health systems as their target audience. Therefore, their proposed frameworks could potentially be implemented in health systems during the acquisition, design, or implementation of healthcare solutions that involve digital technologies. Furthermore, most frameworks did not specify an applicable patient population and very few proposed concepts were specifically applicable to elderly patients or the medically underserved. Specifying patient populations is helpful in determining the needs to address when proposing concepts for a framework.

Limitations of available frameworks in the digital healthcare space

Our scoping review identified only a few frameworks that focused specifically on digital healthcare equity, despite a wealth of frameworks that focused on social determinants, needs, and risk factors.^{1,2} Only a few frameworks covered the concepts applicable to both health equity and digital technologies. In the digital healthcare space, frameworks have been proposed to understand how evolving digital technologies are applied in healthcare. Most of the proposed frameworks for the design of healthcare solutions that involve digital technologies lack equity intentionality in their recommendations, guidelines, and best practices. For example, while the WHO's Global Strategy on Digital Health⁶ report presented several health equity-related

approaches throughout, there was no formulated and explicit plan to address digital healthcare equity within the WHO implementation plan.¹

Another example is the Evidence Standards Framework for Digital Health Technologies by the UK's National Institute for Health and Care Excellence (NICE).²¹ The document describes “an evidence standards framework for digital health technologies...that should be available, or developed, for digital health technologies to demonstrate their value in the UK health and care system.”²⁵ The framework proposed a very limited and focused equity analysis as one component of an economic analysis and recommended including subgroup analyses to show the relevant economic impact if there were good clinical data to show that the effects differed by demographic factors.

In the United States, Mathews et al.²⁶ proposed a pragmatic framework for an objective, transparent, and standards-based evaluation of digital healthcare products across technical, clinical, usability, and cost domains. Although the framework aimed to address the current limitations in the marketplace and to bring greater clarity to the market, it failed to address digital healthcare equity.

Key features of exemplar frameworks addressing digital healthcare equity

Only a few articles proposed frameworks that addressed both healthcare solutions that involve digital technologies and equity concepts. For example, the Digital Health Equity Framework (DHEF)¹ identified the digital determinants of health and their interaction with other intermediate health factors, such as psychosocial stressors, preexisting health conditions, health-related beliefs, and behaviors, etc. (please see **Appendix C** for full listing). The DHEF was one of the few examples available in the literature addressing factors relevant to health equity and digital healthcare. However, it was developed by independent researchers and was not consensus-based, which may have limited the generalizability of the proposed concepts.

Hughes et al.²⁷ used the Health Equity Impact Assessment (HEIA),²⁸ a flexible and practical assessment tool capable of identifying potential unintended positive or negative impacts of a policy, program, or initiative on disadvantaged or marginalized groups. They proposed the Telehealth Equity Impact Assessment (TEIA) Tool as an overarching framework to assess digital healthcare equity in the context of the rapid telehealth expansion due to the COVID-19 pandemic (**Appendix C**). TEIA Tool concepts may apply to other settings where healthcare solutions involving digital technologies are considered. However, the tool was developed with the plan to be implemented in real-world settings to address telehealth equity. Thus, the framework may be limited to a specific digital healthcare solution but still provides practical approaches for implementation in similar settings. Moreover, Were et al.²⁹ adapted the HEIA framework to the digital healthcare landscape and recommended a framework with five steps addressing (1) scope, (2) impacts, (3) mitigation, (4) monitoring, and (5) dissemination strategies for digital healthcare equity assessments. Other notable efforts include the recommendations by Rodriguez et al.³⁰ to

bring equity to patient-facing digital healthcare tools including recommendations for government agencies, vendors, healthcare institutions, clinical providers, and patients.

DOMAINS IDENTIFIED IN SCOPING REVIEW

After reviewing concepts related to digital healthcare equity from articles within the scoping review, similar concepts were grouped together and categorized into several primary domains and subdomains.

For articles that addressed health equity, seven primary domains with three to seven subdomains for each domain were identified. For example, some articles presented concepts such as a lack of health insurance coverage or inadequate internet access as potential barriers to the equitable use of healthcare solutions involving digital technologies. Such concepts were synthesized under the domain of *Access to Care* and the subdomain of *Access to Services*.

From articles addressing either digital healthcare alone or a combination of digital healthcare and health equity, seven primary domains with four to seven subdomains for each domain were identified. For example, some articles presented concepts such as the potential to build in automatic interpretation and active recognition, as well as addressing the barriers to using technology as important factors related to equitable access to digital healthcare solutions involving digital technologies. Such concepts were synthesized under the domain of *General Characteristics of Digital Healthcare Solutions* and the subdomain of *Equitable Access*.

For health equity frameworks, the most referenced concepts were related to *Access to Care*. This finding was to be expected as the main focus of many equity frameworks is the challenge of access to care for marginalized patient populations, including digital barriers, health literacy, and access to insurance. In frameworks related to either digital healthcare alone or combined digital healthcare–health equity, the most referenced concepts were *Patient/Caregiver Characteristics* and *Technical Characteristics of Healthcare Solutions that involve digital technologies*. The focus on patient/caregiver characteristics is promising and highlights a trend to integrate patient-centered approaches in frameworks addressing the design, development, and implementation of healthcare solutions that involve digital technologies (please refer to Tables 3 and 4 in the [environmental scan report](#) for more details on the domains, subdomains, and examples of the identified concepts).

Reviewing the organizational aspects of frameworks revealed a lack of frameworks that provided a process for intentionally addressing equity in the context of healthcare solutions that involve digital technologies. Further, the available frameworks did not acknowledge that there is a process involved in the technology development⁷ and use, which includes different phases such as planning, development, acquisition, implementation/maintenance, and monitoring/improvement/equity assessment. Additionally, the frameworks did not address that health equity should be considered as a critical part of each phase.

CONTRIBUTIONS FROM KEY INFORMANT INTERVIEWS

From the concepts that arose from the key informant interviews, four primary domains were identified: *Digital Determinants of Health*, *Inclusive and Diverse Product Development*, *Digital Healthcare Technology*, and *Implementing and Monitoring Digital Healthcare Technologies* (refer to Table 7 in the project's [environmental scan report](#) for more details on the domains and subdomains identified from the key informant interviews). The identified domains highlighted several barriers and facilitators to health equity. These interrelated structural (e.g., policy), environmental, and individual factors may each be relevant to specific phases or multiple phases of the digital healthcare technology lifecycle. For instance, some key informants highlighted the importance of participatory design, community engagement, and considerations related to end-users' experiences as major factors to be considered for equitable healthcare solutions that involve digital technologies. These concepts were categorized under the *Inclusive and Diverse Product Development* domain. These factors may be more critical to be considered during the planning and development of such solutions. Thus, a technology lifecycle approach would help to identify critical factors and where they would have the most impact.

DOMAIN AND SUBDOMAIN SYNTHESIS

The domains and subdomains identified in the scoping review and key informant interviews were synthesized. While different terminologies were used to describe the different domains and subdomains, there were several conceptual overlaps. To better understand how these domains and subdomains compared to each other, a side-by-side comparison of the different domains and subdomains was performed.

Our comparison showed many areas of congruence between domains and subdomains identified in health equity frameworks, digital healthcare or combined frameworks, and key informant interviews (please see **Figure 2** and **Appendix D**). The alignment of domains and subdomains was guided by the specific examples identified in the environmental scan. For example, the subdomain *Care Continuity* included examples such as “cultural misunderstandings” and “identification of decision options and their implications” derived from health equity framework concepts. These examples matched closely with the *Approachability and Appropriateness* subdomain which included examples such as “culturally sensitive services” and “access to care resources” found in digital healthcare frameworks.

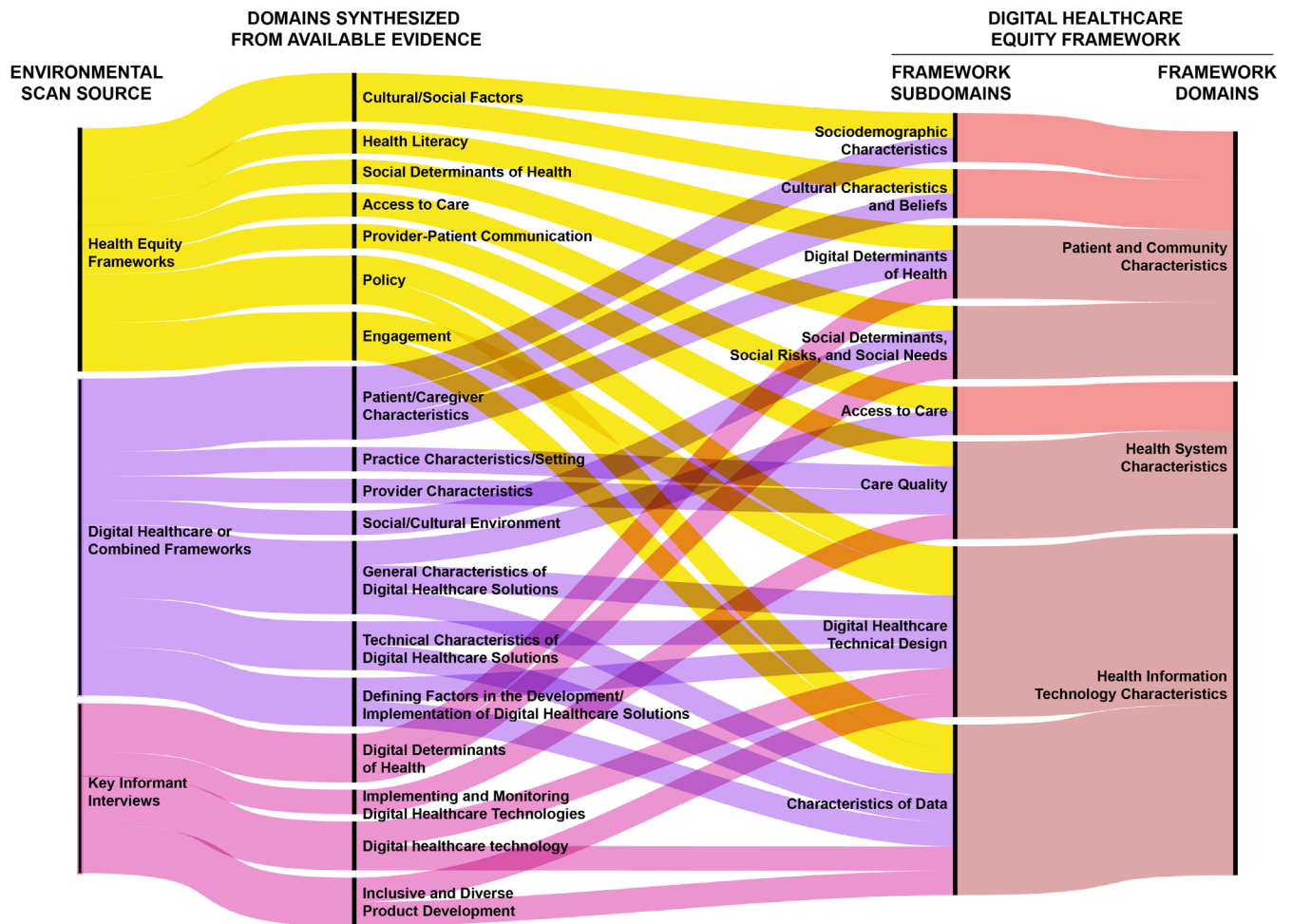


Figure 2. Comparison of Synthesized Domains and Subdomains from Environmental Scan.

Several domains and subdomains from the health equity frameworks and digital healthcare frameworks overlapped. For example, the *Access to Care* domain from health equity frameworks and the *General Characteristics of Digital Healthcare Solutions* domain from digital healthcare frameworks had overlaps across several subdomains. Some overlapping domains and subdomains between the key informant interviews and the health equity and digital healthcare frameworks were also found. Notable overlaps in subdomains included: adapting technology to stakeholders' needs, community engagement, co-creating health solutions with patients, health literacy, and digital determinants of health. A small number of subdomains were unique to one component of the environmental scan. These primarily related to the digital healthcare frameworks and included: user-friendliness, adaptation to other health technologies, interoperability, scalability, and rigorous evaluation and assessment. Accordingly, blank spaces in side-by-side comparisons in the table in Appendix D present the lack of evidence on some subdomains in one or more components of the environmental scan.

The environmental scan highlighted an absence of formal guidelines or common approaches that can inform how healthcare solutions that involve digital technologies can better serve patient populations who have historically been excluded from access to technologies that may improve their health. A set of domains and subdomains was identified from the scoping review that informed this framework of how digital healthcare equity should be planned, structured, and implemented. Information from the key informant interviews complemented the review findings and provided insights into how the Framework might be structured and implemented.

FRAMEWORK CONTRIBUTIONS FROM TECHNICAL EXPERT PANEL

Panel members supported the need for a framework and lauded the extensive content gathered during the environmental scan. They had numerous suggestions for improving the clarity and usefulness of the Framework and indicated strong interest in working with the team to address these opportunities to improve the Framework. The resulting recommendations from the different TEP engagements are detailed in Appendix A and reflect the following recommendations:

Clarify the proposed framework domains and subdomains

Panelists noted that the proposed domains and subdomains of the Framework should be clearly defined with distinct boundaries. For example, digital literacy is a multifactorial concept defined differently across different contexts. Digital and health literacy are byproducts of distinct factors, such as structural racism, and all these factors should be fully considered in the proposed set of domains. Panelists noted the importance of simplifying terminology to assure readability and implementation by broad audiences.

Include additional domains and subdomains

Panelists recommended creating a *Data* domain, separating this concept from the *Technical Aspects* domain. Panelists suggested that the *Data* domain addresses governance, production, data collection and processing, use, privacy/security, justice, and accuracy/quality. Panelists suggested that the *Technical Aspects* domain focus on design and implementation.

Panelists discussed the organization of the *Data* domain's subdomains. Several panelists supported the idea of separating subdomains related to *Data Use* from subdomains that reflect 1) *Data Production*, with the *Data Production* subdomains containing concepts such as collection, processing, and data quality and accuracy; and 2) the *Data Use* subdomains containing concepts such as data justice, data sovereignty, and privacy and security.

Improve conceptualization of Framework

Panelists recommended the development of a set of guiding principles, a clear purpose for the Framework, mindfulness of intended audience, and a development of its domains before discussing how to implement the Framework.

Incorporate key aspects into the implementation guide

Panelists emphasized the importance of incorporating diverse perspectives from a range of stakeholders for developing the Guide and also focusing on applicable domains and subdomains based on the end-user and target population/audience. Further, comments reiterated a focus on patient-centeredness and community engagement.

Panelists highlighted several considerations for implementing the Framework, such as providing use cases and real-world examples, a checklist of actionable steps, identifying means of measuring successful implementation (e.g., impact on outcomes), and acknowledging available human and financial resources, among others. Moreover, panelists provided ideas on how to encourage implementation of the Framework, including integration with interoperability standards to facilitate usability and establishing mandates for uniform adoption across States. Further, panelists provided several existing resources to assist with designing the visual for the Framework, incorporating a participatory design approach, and engaging key community stakeholders, among others.

Approach to the Framework

PRINCIPLES GUIDING THE FRAMEWORK

Six principles guided the development of the Framework to ensure equity intentionality across the digital healthcare lifecycle (**Figure 3**). These principles are based on TEP recommendations as well as the synthesis of the evidence from the environmental scan.

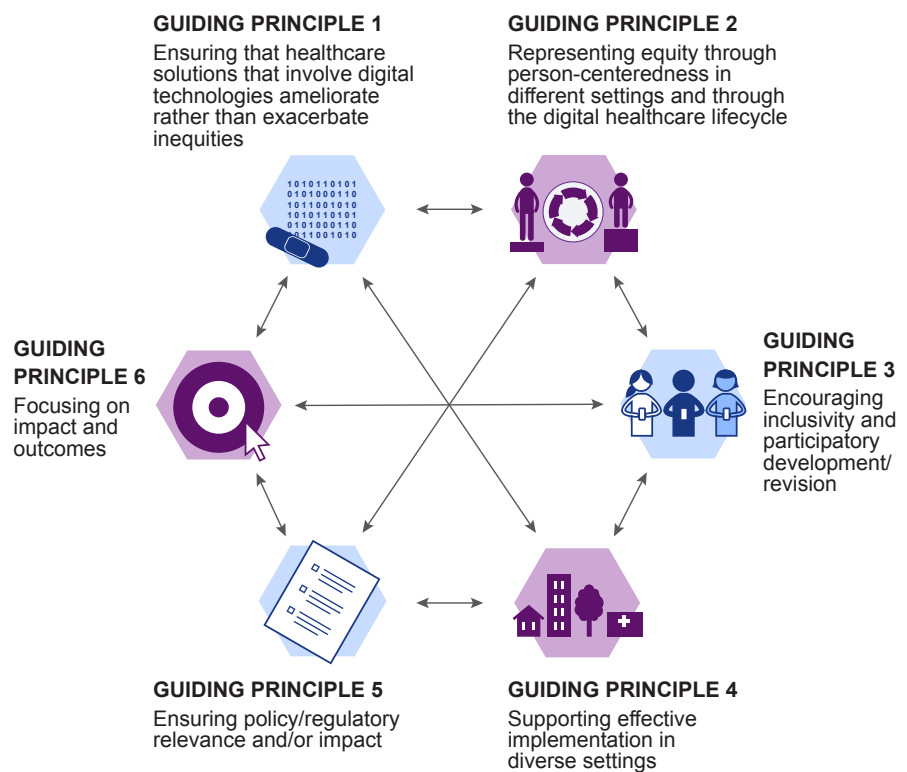


Figure 3. Guiding Principles to Ensure Equity Intentionality Across Digital Healthcare Lifecycle



Guiding Principle 1: Ensure digital healthcare solutions that involve digital technologies ameliorate, not exacerbate, inequities.

Digital healthcare technologies should be utilized to address health inequities and to close any gaps in the quality of care. To ensure that digital healthcare solutions do not exacerbate inequities and to avoid worsening any existing disparities, different strategies should be considered across the lifecycle of digital healthcare solutions.



Guiding Principle 2: Represent equity through person-centeredness.

Digital healthcare equity needs to be achieved through a person-centered approach, which considers the needs of the patient and caregiver, provider, and healthcare system in different settings and throughout the digital healthcare lifecycle.



Guiding Principle 3: Encourage inclusivity and participatory creation of digital healthcare solutions.

The inclusive and participatory creation of healthcare solutions that involve digital technologies can be achieved through the co-creation and engagement of diverse groups and representatives of different stakeholders' subpopulations such as patients, users, providers, and vendors. An example would be training digital healthcare developers and vendors to work with different populations to assess and address health equity literacy among digital healthcare developers and vendors. It also requires strategic and organizational focus on patient and community engagement throughout the digital healthcare lifecycle. Moreover, user experiences should be a guiding principle to ensure healthcare solutions that involve digital technologies properly address all users' needs and desires.



Guiding Principle 4: Supporting effective implementation in diverse settings.

Achieving digital healthcare equity requires considerations of the different settings in which digital healthcare solutions are implemented. Being mindful of the context of implementation ensures that the tailoring of digital healthcare solutions will be accessible by diverse groups.



Guiding Principle 5: Ensure specific attention to policy/regulatory relevance or impact of the proposed solutions.

Achieving digital healthcare equity requires special attention to the influence of regulatory and legislative actions on improving patient health. Relevant policy/regulatory efforts can ensure equity intentionality across the digital healthcare lifecycle. An example of such policies would be that sexual orientation and gender identity be documented in electronic health records, which

is a requirement of the Office of the National Coordinator for Health Information Technology.³¹ This policy impacted the collection of sexual orientation and gender identity data across different patient populations. Moreover, different policies and regulatory constraints, such as those related to interoperability or confidentiality of data may impose benefits and harms for digital healthcare solutions and present the impact of policy and regulatory factors on achieving digital healthcare equity.



Guiding Principle 6: Focus on impact and outcomes for patients, health systems, and communities.

The digital healthcare equity framework should focus on paths for impacting care delivery and health outcomes and help stakeholders achieve equitable health outcomes for different patient populations.

FULL FRAMEWORK

Overview

Figure 4 presents an overview of the digital healthcare equity framework. The Framework is intended to guide equity assessment across the digital healthcare lifecycle. While the users of the Framework reflect a smaller subgroup, the Framework specifically calls for the engagement of multiple stakeholders. The Framework is designed with the aims 1) to improve patient outcomes and 2) to advance equity. Accordingly, the Framework has definitions of both the specific domains and subdomains and their interactions that users will need to intentionally consider throughout the digital healthcare lifecycle to achieve the desired outcomes.

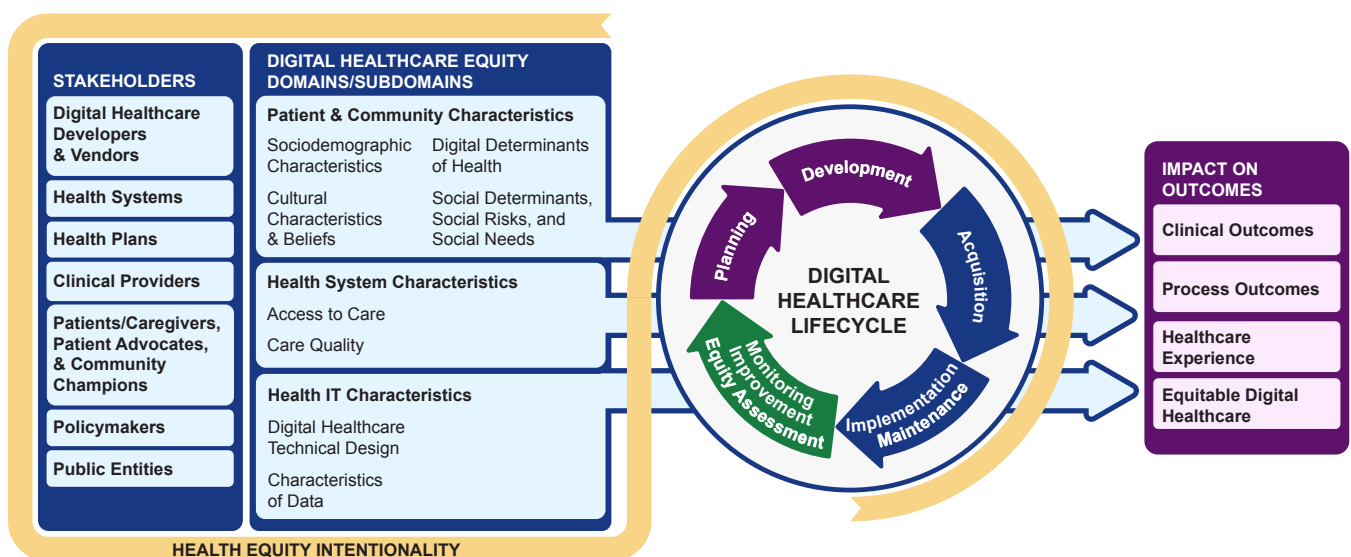


Figure 4. Framework for Assessing and Advancing Equity for Healthcare Solutions that Involve Digital Technologies.

Domains and Subdomains

The proposed domains and subdomains are synthesized from the concepts identified in the scoping review, the key informant interviews, and feedback from the TEP members. Three overarching domains were identified for intentionally considering equity in digital healthcare solutions, including *Patient and Community Characteristics*, *Health System Characteristics*, and *Health Information Technology Characteristics*, with several relevant subdomains for each domain (Figure 5). Below each subdomain, several illustrative examples of the subdomain are provided.

Digital Healthcare Equity Domains and Subdomains




Domains	Subdomains
 <p>Patient and Community Characteristics Including patient-level characteristics, community-based characteristics, and factors representing the interactions between the two.</p>	<ul style="list-style-type: none"> • Sociodemographic Characteristics (e.g. race and ethnicity, primary language, sexual orientation, disability, age, and gender identity) • Cultural Characteristics and Beliefs (e.g. cultural rituals that inform care, historical experiences, and use of cultural language) • Digital Determinants of Health (e.g. broadband access, urban/rural divide, and digital redlining) • Social Determinants, Social Risks, and Social Needs (e.g. chronic poverty, the physical environment, environmental exposures, and racism)
 <p>Health System Characteristics Including factors related to access to and quality, continuity, and affordability of care.</p>	<ul style="list-style-type: none"> • Access to Care (e.g. health insurance coverage, transportation for medical appointments, and supply of providers) • Care Quality (e.g. culturally competent care, provider training in culturally and structurally competent and concordant care)
 <p>Health Information Technology Characteristics Referring to the technical characteristics of a digital healthcare solution and characteristics of the data being used and generated by the solution.</p>	<ul style="list-style-type: none"> • Digital Healthcare Technical Design (e.g. timeliness of healthcare solutions that involve digital technologies, user-friendliness and experience, data privacy, data security, and interoperability) • Characteristics of Data (e.g. data accuracy, data transparency, data justice, and ethical concerns)

Figure 5. Domains and Subdomains of the Digital Healthcare Equity Framework.



Patient and Community Characteristics

Patient and community characteristics present a wide spectrum of factors that need to be considered to intentionally address equity in digital healthcare. Explicit feedback was sought from TEP members on whether patient and community characteristics would best be reflected as a single domain or two different domains. The primary rationale for potentially splitting these into two different domains was that the interventions needed to address each are largely distinct. The main argument given for maintaining a single domain was that patients and their life experiences are geographically and culturally linked to the communities they are part of and that it is difficult to tease apart individual patients' life experiences from experiences as a part of their community. The two patient advocates included in the TEP voiced support for keeping them as one domain. Given strong arguments in both directions, the patient and community characteristics are presented as a single domain, as expressed by the patient's voice.

Some factors listed below are more patient-level characteristics whereas others are more community-based or an amalgam of interactions between patient- and community-level factors. Interventions aiming to address patient and community characteristics may be implementable at the patient or community scale, but most address intersections of patient risk factors, expectations, and needs with the characteristics of their community. Thus, assessing and addressing patient and community characteristics in tandem provides an opportunity to consider the synergistic effects that such features have on the health and well-being of patients and communities.

- a. **Sociodemographic Characteristics** refers to factors that shape a patient's current and historical experience in society and the healthcare system. Factors such as age, race and ethnicity, primary language, sexual orientation, gender and gender identity, disability status, and socioeconomic status impact patient beliefs and attitudes toward digital healthcare solutions and ultimately impact their experience with such solutions.

This subdomain draws from examples that were included in the *Cultural/Social Factors* domain (from the Health Equity Frameworks) and the *Patient/Caregiver Characteristics* domain (from the Digital Healthcare or Combined Frameworks) of the scoping review.

- b. **Cultural Characteristics and Beliefs** refers to the systemic, community, and individual influences that are potential facilitators and barriers to patients accessing and using healthcare solutions involving digital technologies and achieving optimal health. Such characteristics include different cultural rituals that inform care, historical experiences, and use of cultural language (e.g., fear of discrimination in the healthcare system among racial and ethnic minorities, trust and lived experience in the healthcare system for patients and their caregivers).

This subdomain also draws from the *Cultural/Social Factors* domain (from the Health Equity Frameworks) and the *Patient/Caregiver Characteristics* domain (from the Digital Healthcare or Combined Frameworks) of the scoping review. The TEP recommended a separate domain to highlight the importance of cultural context.

- c. **Digital Determinants of Health** refers to digital factors such as broadband access (e.g., cellular and internet connectivity), urban/rural divide, the role of internet service providers and digital redlining, access to digital devices and hardware, digital literacy (e.g., education level, patient preferences, and comfort levels related to using digital tools) that can influence patient access to and the use of healthcare solutions that involve digital technologies and eventually impact their health and well-being.

This subdomain combines items from the *Health Literacy* domain (from the Health Equity Frameworks) and the *Patient/Caregiver Characteristics* domain (from the Digital Healthcare or Combined Frameworks) of the scoping review, as well as the *Digital Determinants of Health* domain of the key informant interviews. It incorporates both examples that are both community characteristics (e.g., broadband access) and items that are patient characteristics (e.g., an individual's comfort level with digital tools).

- d. **Social Determinants, Social Risks, and Social Needs** refers to the conditions in which people are born, grow, and work. These conditions influence individual and group differences in health status (e.g., chronic poverty, the physical environment, environmental exposures, and racism). Factors such as having caregiver support or having special needs also impact individual and group access to healthcare solutions that involve digital technologies (e.g., persons with disabilities and functional needs). Moreover, functional disability status should be considered as a voluntary, self-identified demographic factor, including when or how the disability occurred. Just like other demographic factors, the duration and the type of disability can affect beliefs and attitudes toward healthcare solutions that involve digital technologies. This subdomain also includes patient and community assets and capabilities, in addition to risks, needs, and deficits.

This subdomain groups individual-level and community-level characteristics related to social factors from different domains in the scoping review, the *Social Determinants of Health* domain (from the Health Equity Frameworks) and the *Social/Cultural Environment* domain (from the Digital Healthcare or Combined Frameworks), as well as the *Digital Determinants of Health* domain of the key informant interviews.

Health System Characteristics

- a. *Access to Care* refers to the patient-level and system-level factors that contribute to ongoing patient access to healthcare services, including access to healthcare



solutions that involve digital technologies and care continuity in the transition from digital to in-person. This subdomain addresses factors in the healthcare system at national, regional or local scales and factors specific to a given health system. Factors such as health insurance, transportation for medical appointments, and adequate supply of providers all impact the availability of services for different patient populations. Moreover, digital healthcare access, affordability, and sustainability of healthcare solutions at both the healthcare system at large or specific health systems can ensure that technology serves as a facilitator rather than a barrier to accessing and receiving care.

This subdomain draws from examples in the *Access to Care* domain (from the Health Equity Frameworks) and the *General Characteristics of Digital Healthcare Solutions* domain (from the Digital Healthcare or Combined Frameworks) of the scoping review.

- b. **Care Quality** refers to the degree to which a health system delivers physical and digital healthcare services that increase the likelihood of desired health outcomes and better patient experiences for all patients, and that are consistent with professional knowledge. Factors such as an inclusive culture in the health system, providers' cultural competency, humility, provider training in culturally and structurally competent and concordant care, offering patients support when using healthcare solutions that involve digital technologies, tracking possible disparities in the care of patient populations, and following evidence-based guidelines by providers impact the care quality for healthcare solutions that involve digital technologies. Further, the level of integration of healthcare solutions that involve digital technologies into care and existing workflows, as well as whether providers view such technology as a burden or an amplifier, all impact care quality. Moreover, factors such as where the health system is located, who it serves, how it operates, its culture, and wealth are highly relevant to the quality of all healthcare services.

This subdomain draws from examples in the *Patient-Provider Communication* domain (from the Health Equity Frameworks) and the *Practice Characteristics/ Setting* and *Provider Characteristics* domains (from the Digital Healthcare or Combined Frameworks) of the scoping review, as well as the *Implementing and Monitoring Digital Healthcare Technologies* domain of the key informant interviews.

Health Information Technology Characteristics

- a. **Digital Healthcare Technical Design** refers to the technical characteristics of a digital healthcare solution that are important for supporting equitable use. Factors such as the timeliness of healthcare solutions that involve digital technologies reflect the current needs of the patients in the health system, such as telehealth technology at the time of the COVID-19 pandemic. Other factors such as user-friendliness and user experience, interoperability across providers and between medical providers and community/



social/public health agencies, and technology integration with each other and within the workflows assure the equitable use of healthcare solutions that involve digital technologies. For instance, the integration of healthcare solutions that involve digital technologies with the Federal interoperability standards and ensuring such solutions adhere to the standards could facilitate the usability of healthcare solutions that involve digital technologies. Moreover, factors impacting the accessibility and adaptability of healthcare solutions that involve digital technologies subsequently impact how those solutions can be used by people with different needs (e.g., people with disabilities).

This subdomain draws from examples in the *Policy* domain (from the Health Equity Frameworks) and the *General and Technical Characteristics of Digital Healthcare Solutions* domains (from the Digital Healthcare or Combined Frameworks) of the scoping review, as well as the *Digital Healthcare Technology* domain of the key informant interviews.

- b. ***Characteristics of Data*** refers to how data are used to inform the creation of healthcare solutions that involve digital technologies and how data generated by the solutions are used. This subdomain includes: factors related to data curation, such as data accuracy, including research and evaluation of data and who is in charge of ensuring the accuracy of data (e.g., health systems, patient advocacy groups); equitable data collection, including a clear definition of different variables (e.g., how different categories of race are defined and who is left out of these definitions) and methods of data collection (e.g., self-reported); assessment of data context and sources; data bias review, assessing and handling missing data (e.g., through imputation), model performance assessment, evaluation, quality assessment, and ongoing training should be considered. Also, data transparency in *dataset* creation and visibility/transparency in the development of data *models*, such as AI algorithms, as well as patient privacy and data security (e.g., patient privacy in virtual visits and data sharing with third parties) may impact the equitable use of healthcare technology. Other factors related to data governance including, ownership of data, data sovereignty, and data sharing/confidentially are critical factors impacting equitable use. Lastly, factors related to data justice and ethical concerns such as the need to prevent and mitigate harm (e.g., ensuring that AI algorithms do not misrepresent the risk threatening a sub-population of patients), diversity of representation in data sets (e.g., data sets used for the development of risk-predictive models are representative of the populations that such models are used for), equitable data collection (e.g., data on different healthcare risks, needs, and outcomes are properly collected across different sub-populations of patients), and patient privacy and data security (e.g., patient privacy in virtual visits) are critical factors to consider for equitable use.

This subdomain draws from examples in the *Policy* domain (from the Health Equity Frameworks) and the *General and Technical Characteristics of Digital Healthcare Solutions* domains (from the Digital Healthcare or Combined Frameworks) of the scoping review, as well as the *Digital Healthcare Technology* domain of the key informant interviews.

ADDRESSING EQUITY ACROSS THE DIGITAL HEALTHCARE LIFECYCLE

Equity intentionality in the context of digital healthcare solutions requires the involvement of different stakeholders at different stages of the development and utilization of such solutions. Thus, the Framework is organized around the digital healthcare lifecycle, which is based on the process used in technology development.⁷ The lifecycle includes the following phases:

- Planning.
- Development.
- Acquisition.
- Implementation/Maintenance.
- Monitoring/Improvement/Equity Assessment of healthcare solutions that involve digital technologies.

The lifecycle is aligned with quality improvement approaches such as the “Deming Wheel” and the Institute for Healthcare Improvement’s (IHI’s) model of “Plan, Do, Study, Act.”^{3,4}

The planning and development phases of the lifecycle are aligned with the “Plan” phase of the IHI model, the acquisition and implementation/maintenance phase is aligned with the “Do” phase, and the monitoring/improvement/equity assessment phase is aligned with the “Study and Act” phases of the IHI model. The lifecycle acknowledges that different stakeholders may enter this process at different points and each phase of the lifecycle offers opportunities for stakeholders to intentionally consider equity (e.g., a stakeholder might enter the Implementation phase of the lifecycle). To ensure equity intentionality during this process, an equity assessment should be completed at each phase of the lifecycle. This equity assessment at each phase of the lifecycle helps identify whether equity can be achieved through a digital healthcare solution alone and when certain populations may need a nondigital alternative solution to address their needs.

ENGAGEMENT WITH STAKEHOLDERS

Stakeholders and their roles in the digital healthcare lifecycle should be considered in developing healthcare solutions that intentionally consider equity. While the users of the Framework are most likely to be digital healthcare developers and vendors, health systems, health plans, and clinical providers, other key stakeholders (e.g., patients/caregivers) are important collaborators in improving health equity. The users of the Framework should provide different opportunities for their contributions in the process.

- Likely Users of the Framework
 - Digital Healthcare Developers and Vendors
 - Health Systems

- Health Plans
- Clinical Providers (e.g., doctors, pharmacists)
- Other Key Stakeholders Involved in Improving Equity
 - Patients/ Caregivers, Patient Advocates, and Community Champions
 - Policymakers
 - Public Entities (e.g., public health departments)

IMPACT ON OUTCOMES

An intentional approach to considering equity throughout the digital healthcare lifecycle aims to promote improvement in clinical outcomes (e.g., mortality, morbidity, and health/quality of life), process outcomes (e.g., care continuity, care coordination, and care quality), and healthcare experiences (e.g., patient satisfaction/engagement and provider satisfaction/engagement). It also seeks to achieve equitable access to and equity in the quality of healthcare solutions involving digital technologies.

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Appendix A. Technical Expert Panel Recommendations on the Framework and Implementation Guide

Johns Hopkins University and the National Committee for Quality Assurance (NCQA) convened a technical expert panel (TEP) to ascertain the perspectives of digital healthcare and/or health equity experts on the development of an evidence- and consensus-based digital healthcare equity framework and accompanying guide that considers equity in the creation, planning, implementation, and assessment of digital technologies. The expert panel provided a venue to discuss innovative solutions among thought leaders representing health plans, healthcare delivery systems, digital health and/or health equity researchers, public health experts, digital health developers, vendors, and patient advocates on how equity issues are integrated into the process. The resultant recommendations from the TEP are detailed in this report and reflect extensive panelist feedback to do the following:

- I. Clarify the proposed domains/subdomains
- II Consider including additional domains/subdomains
- III. Improve the Framework’s conceptualization including audience, purpose, and principles
- IV. Incorporate key aspects into the implementation guide

These recommendations serve to build upon prior research conducted by Johns Hopkins University (JHU) and NCQA to inform the development of a digital healthcare equity framework and accompanying guide.

APPROACH

The JHU and NCQA team identified approximately 30 TEP candidates representing health plans, health systems, digital health and/or health equity researchers, public health experts, digital health developers and vendors, and patient advocates. Candidates comprised diverse expertise in research, planning, and implementation of health equity initiatives and/or digital health technologies. Additionally, candidates were targeted if they possessed a leadership role within an organization or department accountable for promoting health equity or supporting digital healthcare tool development.

The team provided TEP panelists with materials prior to the TEP meeting, including an agenda, a description of meeting objectives and expectations, the list of TEP members, and the report summarizing the environmental scan (i.e., a scoping review and key informant interviews), including a list of proposed framework domains. The 3-hour meeting took place on March 30, 2022, from 2:00 pm-5:00 pm ET via the Zoom platform. The agenda included a brief description of the environmental scan and a presentation of proposed domains and subdomains for the

Framework. TEP panelists shared their perspectives in a large group setting and small group/breakout sessions.

KEY FINDINGS

In general, panel members supported the need for a framework, complimented the team on the extensive review, and supported the content. They had numerous suggestions for improving the clarity and usefulness of the Framework and indicated strong interest in working with the team to address these opportunities to improve the Framework. In the following summary, the key points raised by the TEP members in both the large and small discussion groups are presented.

Feedback on proposed domains

The first breakout session was structured to specifically focus on 1) whether the domains were on track, 2) if any domains should be excluded or were missing, and 3) whether domains and subdomains should be subject to reorganization. Responses were organized by existing domains.

- **Social and Digital Determinants of Health (Community-Level).** Panelists emphasized the importance of a patient's social networks in facilitating their engagement with technology and addressing digital divide barriers. Panelists noted that important community stakeholders were missing from the domain description, including faith leaders, community political and nonprofit leaders, and family matriarchs and patriarchs.
- **Patient's Cultural/Social Factors and Characteristics (Individual-Level).** Panelists noted the domain description is missing sociodemographic factors, such as geographic location (e.g., ZIP code), education level, disability, functional status, sexual orientation, gender identity, and having a caregiver as a proxy status. Additionally, panelists noted the lack of emphasis on patient comfort levels and preferences related to using digital tools. Many panelists reiterated the importance of caregivers as a key stakeholder perspective.
- **Engagement.** A few panelists noted that while patient-centeredness is critical, participatory design and engagement should also include the clinician's perspective since end users are also end users of care delivery technology. The clinician can often be left out of the design and implementation of technology; however, clinician perspectives can inform how technologies are integrated within existing workflows.
- **Organization of Care.** Panelists noted that this domain should be more clearly defined, especially when it comes to the care continuity and transition between in-person and digital (or virtual) care. One panelist also noted, with other panelists' support, that the clinician stakeholder group should be expanded to include other team members and allied health professionals.

- **Technical Aspects of Digital Health.** The main takeaway from panelists for this domain was to separate the data-related subdomains into an independent *Data* domain. Other recommendations include consideration of how separate technologies are integrated within workflows. Panelists advised that researchers consider how health information exchange affects health equity in communities and systems.

Recommendations for new domains/subdomains and related discussion

During the first breakout session, panelists were also asked to provide input on any new domains to add to the Framework. Overall, panelists recommended creating a *Data* domain, separating this concept from the proposed *Technical Aspects* domain. Panelists suggested that the *Data* domain address governance, production, data collection and processing, use, privacy/security, justice, and accuracy/quality. Panelists suggested that the *Technical Aspects* domain could then focus on design and implementation.

Panelists discussed the organization of the *Data* domain's subdomains. Several panelists supported the idea of separating subdomains related to *Data Use* from subdomains that reflect *Data Production*, with the *Data Production* subdomain containing concepts such as data governance, collection, processing, data accuracy, and quality, data justice, and data privacy and security. The panelists also discussed adding other subdomains such as *Research and Evaluation* and *Quality Improvement*. It was unclear from the discussion how the subdomains of the *Data* domain should be organized or grouped.

Additionally, there was a rich discussion on how data quality is a pervasive problem for digital health equity. One issue raised by many panelists is that the underlying data used for machine learning (artificial intelligence), predictive, and risk-adjustment models are often of poor quality and perpetuate gaps in care and outcomes. For example, prior research found that excluding clinical text notes in racial identification underestimates the percentage of patients who identify as Black and Hispanic if solely using structured electronic health record (EHR) data. Additionally, incomplete race and ethnicity structured data may underestimate Black and Hispanic age, disease burden, and poverty levels.

Recommendations for conceptual approaches to developing the Framework

In addition to domain-specific recommendations, panelists also advised relying on evidence-informed conceptual approaches to prioritize, organize, and gain more consensus on proposed domains. This includes providing context and evidence on the proposed domains/subdomains from the scoping review. Specifically, the following recommendations were supported by multiple small groups and/or the large group discussions.

- **Domain Clarity and Overlap.** Panelists generally noted that the domains did not have clear and distinct boundaries. For example, one panelist noted that digital literacy is a multifactorial concept defined differently across contexts. Further, panelists shared that digital and health literacy are byproducts of structural racism and other factors not fully considered in the proposed set of domains. Panelists noted the importance of simplifying terminology to improve readability and implementation by broad audiences.
- **Evaluate domains for policy/regulatory relevance and impact.** Panelists said that policy, regulatory, and ethical considerations were absent in the domains and subdomains. For example, the absence of these considerations overlooks differential benefits and harms created by States with different policies and regulatory constraints. Other examples shared by the panelists include interoperability and confidentiality concerns that are within the purview of governments and oversight organizations.
- **Develop guiding principles for the Framework.** Overall, panelists recommended taking a few steps back to develop a set of guiding principles and a clear purpose for the Framework and development of its domains prior to discussing how to implement the Framework.
- **Incorporate a patient-centered lens across domains.** A broadly discussed deficiency in the domains was the absence of patient-centeredness. Panelists generally supported the idea that domains be reoriented to account for patient centeredness and other levels of the healthcare system (i.e., community, organization). This might include linking patient outcomes to each domain.
- **Identify relevant stakeholders for each domain.** Panelists recommended that domains and subdomains be better aligned with stakeholders who are either affected or whose related domain/subdomains serve their interests to improve outcomes. Additionally, other stakeholders, like internet service providers were excluded but are important entities that play a key role in reducing structural challenges to improving digital health equity.
- **Engage the panelists further.** The panelists indicated their desire to participate in future work to refine the Framework and inform the implementation guide. Specifically, they recommended holding an additional TEP meeting and providing TEP members opportunities to rate the domains and subdomains (potentially using a Modified Delphi process).

Recommendations for the implementation guide

During the second breakout session, panelists were asked for feedback on implementing the digital healthcare equity framework, considerations that potential implementers would need to consider, and potential resources to which they could refer. Panelists noted important aspects of implementation that should be considered in the Guide, which can be subdivided into four categories below.

- **Stakeholder engagement for developing the Guide.** Panelists emphasized the importance of incorporating diverse perspectives from a range of stakeholders for developing the Guide and focusing on applicable domains and subdomains based on the end-user and target population/audience. Comments reiterated a focus on patient-centeredness and community engagement.
- **Considerations for implementing the Framework.** Panelists highlighted several considerations for implementing the Framework, including the use of case examples and a checklist of actionable steps, identifying a means of measuring successful implementation (e.g., impact on outcomes), and acknowledging available human and financial resources, among others.
- **Incentives and policy levers to support implementation.** Panelists provided ideas on how to encourage implementation of the Framework, including integration with interoperability standards to facilitate usability and establishing mandates for uniform adoption across States.
- **Examples of resources.** Panelists also provided several existing resources to assist with designing the visual for the Framework, incorporating a participatory design approach, and engaging different stakeholders.

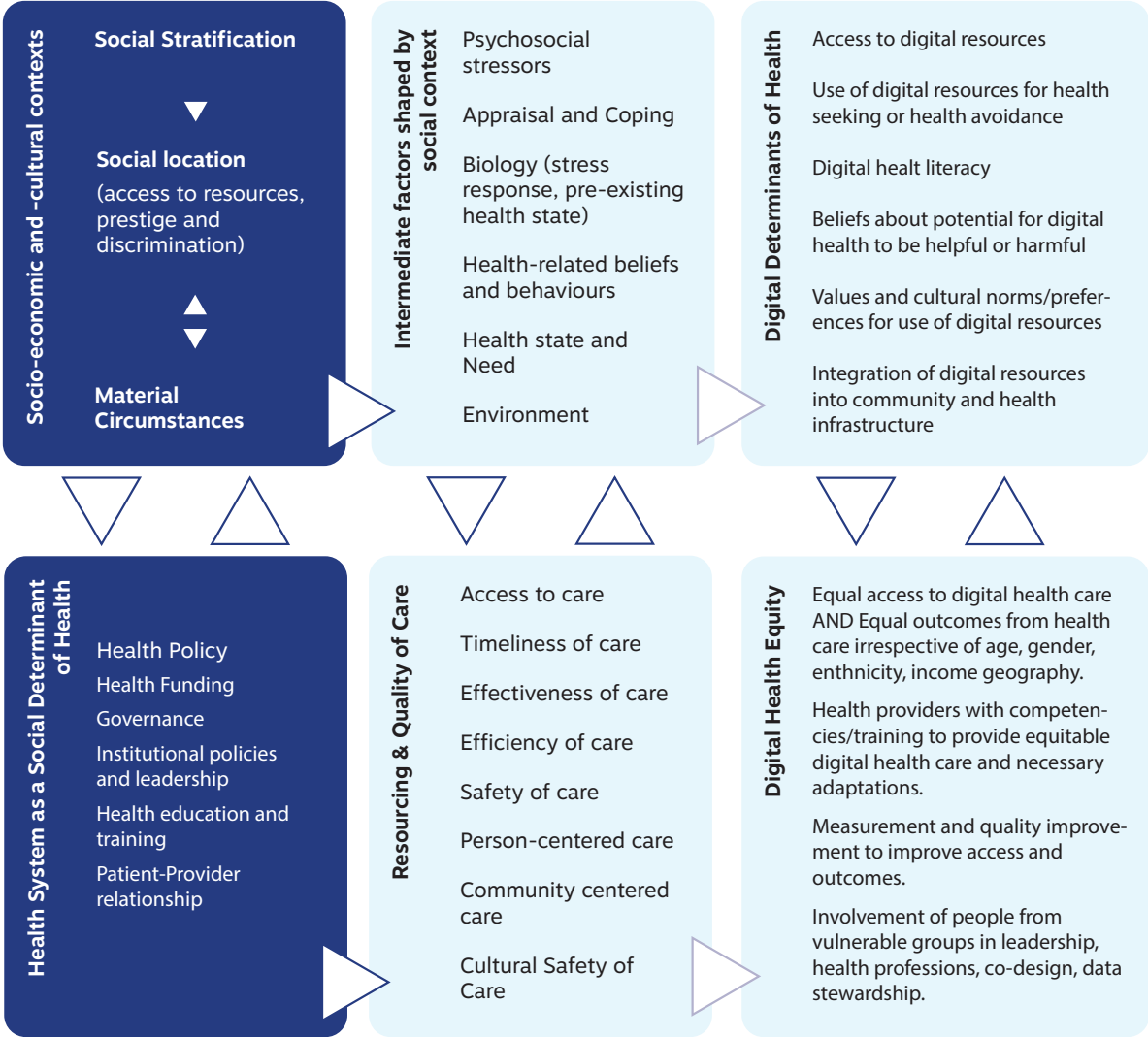
Appendix B. List of Technical Expert Panel Members

Expert Panelist	Position and Affiliated Organization
Adrian Aguilera, PhD	Associate Professor School of Social Welfare University of California - Berkeley
Shireen Atabaki, MD, MPH, FAAP, FACEP	Associate Medical Director, Telemedicine, Children's National Hospital, Professor, Pediatrics & Emergency Medicine, George Washington University School of Medicine and Health Sciences
Bettina M. Beech, DrPH, MPH	Chief Population Health Officer, Clinical Professor of Population Health, College of Medicine University of Houston
Ethan Booker, MD, FACEP	Medical Director, MedStar Telehealth Innovation Center MedStar Washington Hospital Center
Helen Burstin, MD, MPH	Chief Executive Officer, Council of Medical Specialty Societies
Shonta Chambers, MSW	Executive Vice President, Health Equity Initiative and Community Engagement, Patient Advocate Foundation
Theresa Cullen, MD, MS	Public Health Director, Pima County Health Department
Sarah DeSilvey, DNP, MSN	Director of Clinical Informatics The Gravity Project
Bradford Diephuis, MD, MBA, MS	Senior Advisor, Centers for Medicare and Medicaid Innovation, US Department of Health and Human Services
Rachel Dolin, PhD,	Professional Staff, Committee on Ways and Means, US House of Representatives
Kadija Ferryman, PhD	Core Faculty, Berman Institute of Bioethics, Assistant Professor, Department of Health Policy and Management Johns Hopkins Bloomberg School of Public Health
Chris Grasso, MPH	Chief Information Officer, Fenway Community Health
Ája Hardy, MPH, MBA, PRINCE2	US Food and Drug Administration (FDA)
Ivor Horn, MD, MPH	Director, Health Equity and Product Inclusion Google
William Hung, MD, MPH	Associate Director of Clinical Programs, Geriatric Research Education and Clinical Center (CRECC), James J. Peters VA Medical Center, Professor of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai

Expert Panelist	Position and Affiliated Organization
Bridget Hurd, MBA	Vice President and Chief Diversity Officer, Inclusion and Diversity Blue Cross Blue Shield of Michigan
Julia Iyasere, MD, MBA	Executive Director, Dalio Center for Health Justice at New York Presbyterian Hospital
Doug Jacobs, MD, MPH	Senior Advisor to the Director of Medicare Centers for Medicare & Medicaid Services
Edward Juhn, MD, MBA, MPH	Chief Quality Officer, Inland Empire Health Plan
Sai Ma, PhD, MPA	Director of Business Intelligence, Clinical Transformation, Humana
Thomas Mason, MD	Chief Medical Officer, Office of the National Coordinator for Health IT, US Department of Health and Human Services
David McSwain, MD, MPH	Chief Medical Information Officer, University of North Carolina Health System
Orriel Richardson, JD, MPH	Vice President, Morgan Health
Jorge Alberto Rodriguez, MD	Hospitalist and Instructor of Medicine Brigham and Women’s Hospital, Brigham and Women’s Hospital
Anindita (Annie) Saha, BS	US Food and Drug Administration (FDA)
Dorothy Siemon, Esq.	Senior Vice President, Office of Policy Development and Integration (OPDI), AARP
Julia Skapik, MD, MPH	Chief Medical Information Officer, National Association of Community Health Centers
Leith States, MD, MPH, MBA, FACPM	Chief Medical Officer, Office of the Assistant Secretary for Health (OASH), US Department of Health and Human Services
Walter Suarez, MD, MPH	Executive Director, HIT Strategy and Policy, Kaiser Permanente
Rebecca Winokur, MD, MPH	Senior Physician Executive, Health Equity Service Line Leader, Cerner Corporation
Silvia Yee, JD	Senior Staff Attorney, Disability Rights Education and Defense Fund

Appendix C. Digital Health Equity Frameworks Identified in the Literature

The following are two examples of proposed frameworks that address both healthcare solutions that involve digital technologies and equity concepts. The Digital Health Equity Framework (DHEF)¹ (the first example) identified the digital determinants of health and their interaction with other intermediate health factors, such as psychosocial stressors, preexisting health conditions, health-related beliefs, behaviors, etc. Hughes et al.²⁷ (the second example) used the Health Equity Impact Assessment (HEIA),²⁸ a flexible and practical assessment tool capable of identifying potential unintended positive or negative impacts of a policy, program, or initiative on disadvantaged or marginalized groups. They proposed the Telehealth Equity Impact Assessment (TEIA) Tool as an overarching framework to assess digital healthcare equity in the context of the rapid telehealth expansion due to the COVID-19 pandemic.



The Digital Health Equity Framework by Crawford and Serhal (2020)¹

Step 1. SCOPING		Step 2. POTENTIAL IMPACTS			Step 3. MITIGATION	Step 4. MONITORING	Step 3. DISSEMINATION
a) Populations*	b) Determinants of Health: Identify determinants of telehealth disparities	Unintended Positive Impacts	Unintended Negative Impacts	More Information Needed	Identify ways to reduce potential negative impacts and amplify the positive impacts	Identify ways to measure success for each mitigation strategy identified	Identify ways to share results and recommendations to address telehealth equity
Age related groups (e.g., children, youth, seniors, etc.)							
Disability (e.g., physical, hearing, visual)							
Ethnic minority groups (e.g., Hispanic/Latino)							
Ethno-racial communities (e.g., racial/racialized or cultural minorities, immigrants and refugees)							
Immigrant communities (U.S.-born vs. foreign-born)							
Inner-urban populations (e.g., socio-economically deprived neighborhoods)							

The Telehealth Equity Impact Assessment Tool by Hughes et al. (2021)²⁷

Appendix D. Comparison of Synthesized Domains and Subdomains from Environmental Scan

Health Equity Frameworks	Digital Healthcare or Combined Frameworks	Key Informant Interviews
Domain: Access to Care	Domain: General Characteristics of Digital Healthcare Solutions	
<ul style="list-style-type: none"> • Access to services 	<ul style="list-style-type: none"> • Accessibility • Equitable Access 	
<ul style="list-style-type: none"> • Care Continuity (e.g., cultural misunderstandings, identification of decision options and their implications) 	<ul style="list-style-type: none"> • Approachability (e.g., culturally sensitive services) • Appropriateness (e.g., access to care resources) 	
<ul style="list-style-type: none"> • Cost 	<ul style="list-style-type: none"> • Affordability 	
<ul style="list-style-type: none"> • Resources and Sustainability 	<ul style="list-style-type: none"> • Sustainability 	
Domain: Policy	Domain: Technical Characteristics of Digital Healthcare Solutions	
	<ul style="list-style-type: none"> • Compatibility with and Adaptability to Stakeholder Needs and Desires 	Domain: Digital healthcare technology <ul style="list-style-type: none"> • Technological simplification and agility • Translating processes from in-person design
	<ul style="list-style-type: none"> • Data Processing and Management (e.g., data bias review) 	Domain: Digital healthcare technology <ul style="list-style-type: none"> • Impact of Health Technology on Care Delivery and Outcomes (e.g., algorithm bias) • Equitable data collection, quality, and use
	<ul style="list-style-type: none"> • Timeliness 	
	<ul style="list-style-type: none"> • User Friendliness 	

Health Equity Frameworks	Digital Healthcare or Combined Frameworks	Key Informant Interviews
<ul style="list-style-type: none"> Healthcare Integration Regulations 	<ul style="list-style-type: none"> Policies and Regulations 	
<ul style="list-style-type: none"> Patient Privacy 	<ul style="list-style-type: none"> Privacy and Security 	<p>Domain: Digital healthcare technology</p> <ul style="list-style-type: none"> Impact of Health Technology on Care Delivery and Outcomes (e.g., patient privacy in virtual visits)
<p>Domain: Engagement</p>	<p>Domain: Defining Factors in the Development/ Implementation of Digital Healthcare Solutions</p>	
	<ul style="list-style-type: none"> Adaptability with Current Digital Healthcare Solutions 	
<ul style="list-style-type: none"> Community Engagement AND Patient/Community Participation AND Partnerships 	<ul style="list-style-type: none"> Co-creating with Stakeholders 	<p>Domain: Inclusive and Diverse Product Development</p> <ul style="list-style-type: none"> Participatory Design AND Community Engagement End-user Experience
<ul style="list-style-type: none"> Social Support Networks (e.g., leveraging resources and sustainability) 	<ul style="list-style-type: none"> Feasibility and Sustainability 	
	<ul style="list-style-type: none"> Interoperability and Scalability 	
	<ul style="list-style-type: none"> Rigorous Evaluation/ Assessment, Support, and Improvement 	
<p>Domain: Cultural/Social Factors</p>	<p>Domain: Patient/Caregiver Characteristics</p>	
	<ul style="list-style-type: none"> Behavioral and Lifestyle 	
	<ul style="list-style-type: none"> Needs and Desires 	
<ul style="list-style-type: none"> Sociodemographic 	<ul style="list-style-type: none"> Demographics 	
<ul style="list-style-type: none"> Culture and Beliefs 	<ul style="list-style-type: none"> Perception 	
<ul style="list-style-type: none"> Equity/Equality 		

Health Equity Frameworks	Digital Healthcare or Combined Frameworks	Key Informant Interviews
<ul style="list-style-type: none"> Knowledge/Awareness of Services (e.g., health information and education) 	<ul style="list-style-type: none"> Health and eHealth Literacy 	
<ul style="list-style-type: none"> Social Support 	<ul style="list-style-type: none"> Socio-economic Characteristics 	
Domain: Health Literacy		
<ul style="list-style-type: none"> Health Knowledge 	<ul style="list-style-type: none"> Health and eHealth Literacy 	Domain: Digital Determinants of Health <ul style="list-style-type: none"> Skills and literacy related to digital use
<ul style="list-style-type: none"> Patient Awareness Patient Health Education 	<ul style="list-style-type: none"> Perception 	
<ul style="list-style-type: none"> Self-care 	<ul style="list-style-type: none"> Health Status and Quality of Life 	
Domain: Provider-Patient Communication		
<ul style="list-style-type: none"> Motivation/Opportunity 	Domain: Practice Characteristics/ Setting <ul style="list-style-type: none"> Care Coordination AND Care Quality 	Domain: Implementing and Monitoring Digital Healthcare Technologies <ul style="list-style-type: none"> Collaborative action and workforce engagement
	<ul style="list-style-type: none"> Finances 	
	<ul style="list-style-type: none"> Practice Priorities and Context 	Domain: Implementing and Monitoring Digital Healthcare Technologies <ul style="list-style-type: none"> Collaborative action and workforce engagement
Domain: Provider Characteristics		
	<ul style="list-style-type: none"> Communications with Other Providers 	
<ul style="list-style-type: none"> Education Provision (e.g., engaging professional medical societies) 		

Health Equity Frameworks	Digital Healthcare or Combined Frameworks	Key Informant Interviews
	<ul style="list-style-type: none"> • Efficiency (e.g., increased collaboration among physicians through digital technologies) 	
<ul style="list-style-type: none"> • Provider Awareness AND Provider Skills 	<ul style="list-style-type: none"> • Expertise AND Clinician Perception 	
	<ul style="list-style-type: none"> • Legal Requirements 	
<ul style="list-style-type: none"> • Messaging/ Engagement • Trust 	<ul style="list-style-type: none"> • Patient Communication 	
	<ul style="list-style-type: none"> • Quality of Care 	
Domain: Social Determinants of Health	Domain: Social/Cultural Environment	
<ul style="list-style-type: none"> • Access to Health and Health Information 	<ul style="list-style-type: none"> • Public Health AND Digital Determinants of Health 	Domain: Digital Determinants of Health <ul style="list-style-type: none"> • Internet and cellular connectivity
<ul style="list-style-type: none"> • Sociodemographic • Chronic Poverty 	<ul style="list-style-type: none"> • Environmental Context/ Resources 	
<ul style="list-style-type: none"> • Physical Environment and Environmental Exposures 	<ul style="list-style-type: none"> • Built Environment 	
<ul style="list-style-type: none"> • Racism • Social Support • Substance Abuse 	<ul style="list-style-type: none"> • Social Context 	

