CHCF Issue Brief

FEBRUARY 2022

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Bridging the Digital Health Divide:
How Designers Can Create More Inclusive Digital Health Tools

Digital health tools and solutions are often built by and for users who are already comfortable accessing and using technology. But needs may be quite different among the broader public and specifically among marginalized individuals, such as people who speak a language other than English, people from racial and ethnic minority groups, those with low incomes, and older adults.

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Structural and social factors also create increased barriers to using existing digital health tools like telemedicine for many communities, such as older adults, Black, and Latinx individuals; those with public or no insurance; and respondents who face increased barriers to education.[2]

It's clear from these statistics that being more inclusive is necessary to reach a much larger population. Because the United States already invests substantially in digital health tools and services, focusing on equity and inclusivity will be essential to generate better health outcomes.[3]

Digital health tools and approaches that are relevant for different lived experiences — the information different groups need, how they like to receive information, and what appeals to them in a user interface — will ultimately offer something that is more appealing, useful, and engaging for everyone.

The goal of this two-part series, "**Bridging the Digital Health Divide**," is to provide key stakeholders in digital health with action-oriented recommendations to ensure that technology meets the needs of diverse patients. The other brief in the series focuses on how health care providers and health plans can reach patients where they are — whether at the doctor's office, at home, or on the go. This issue brief discusses the challenges for technology developers in ensuring inclusive digital health design and suggests design principles that can help developers overcome these challenges. The overall goal is health innovations that are relevant and usable for everyone.

Principles of Inclusive Design

Many developers already use practices like user-centered design to inform the creation of products and services. User-centered design actively involves the people who use online tools and services in their development to improve usability.[4]

However, mounting evidence suggests that these approaches do not always include a diverse array of people in the design process. Consequently, digital health solutions are less usable among groups that are socioeconomically disadvantaged and who face economic, racial, and language barriers in accessing health care. A lack of usability can widen the digital divide and fuel greater inequities.[5]

A foundational element of inclusive design is an inclusive team. Therefore, designers should recruit, hire, retain, and promote team members that share lived experiences, as well as language, with the communities they intend to serve. This is a critical area of improvement, as the current state of digital health development demonstrates underrepresentation of Black and Latinx individuals, as well as people from sexual/gender minority groups, people with disabilities, and those who have limited access to funding streams.[6] Barriers to inclusion are even more pronounced among individuals with intersecting identities spanning multiple groups that are historically and presently marginalized, which can cascade into inequities embedded into the design of the digital health tool itself.[7]

Beyond starting with building and maintaining an inclusive team, designers should integrate practices such as universal design and community co-design into their existing user-centered design principles. Universal design ensures that technology can work for everyone without significant adaptation or specialized design, and explicitly calls for developing training and support strategies that wrap around a product or service. The principles of universal design include:

- **Equitable use.** A technology performs similarly well across a wide spectrum of users. For example, special attention should be paid to the data used (or not used) to develop algorithms, such as those used in clinical decision support, to avoid encoding bias into technology.[8] Technology also should be accessible to those with disabilities and functional impairments. Products should be designed so that they can be used with screen readers for people with visual impairments, as one example.
- **Flexibility in use.** The product enables users to select their preferred format, such as receiving information via audio narration instead of written text or in a preferred language other than English.
- **Simple and intuitive.** The design is easy to understand regardless of a user's experience, knowledge, and current concentration level. This principle entails designing technology to provide necessary information while involving the lowest "cognitive load."
- **Perceptible information.** The technology is usable in a wide range of environments, such as varying levels of ambient noise, lighting, and motion.
- **Tolerance for error.** Accidental user actions are efficiently remedied. For example, a pop-up can ask users to confirm the information that they have entered.
- **Low physical effort.** Technology requires less dexterity so that individuals with a wide range of physical abilities can use it.
- **Size and space for approach and use.** Designers provide appropriate size and space for use regardless of a user's body size, posture, or mobility. An example of this is a wearable watch with an adjustable or customizable wristband.

The Center for Universal Design at North Carolina State University developed these principles and offers examples,[9] and the National Institute of Standards and Technology generates reports and recommendations about how these design standards can be employed, such as for online patient portals.[10]

In addition to using the principles of universal design, designers also should follow two core phases of community co-design: (1) community engagement and (2) end-user testing and iteration.[11] Community co-design intentionally involves people from the outset of the design process and across all stages of development, particularly those from underrepresented and marginalized groups, to ensure that technology aligns with their needs and preferences. This approach also can help designers anticipate and identify potential biases embedded in the technology.

1. **Community engagement to set priorities and direction.** This step requires a long-term view of partnerships and mutual collaboration, rather than transactional processes to design or iterate a single product. Long-standing relationships with consumer and patient advisory groups, as well as ongoing partnerships with community-based organizations, can help set the priorities and directions for digital health solutions. Innovators should be prepared to pay these partners for their time and expertise. Research demonstrates that co-design approaches help develop and implement solutions that are usable and valuable for individuals often excluded from the digital health design process, such as those facing literacy and economic barriers.[12]

2. **End-user testing and iteration.** In addition to setting priorities and direction, co-design applies to end-user testing and iteration. It is critical to be intentional and explicit about the diversity of stakeholders in this process, including those with different digital or literacy skills and knowledge; ages; genders; races, ethnicities, and cultures; income levels; and abilities. More specifically, innovators should employ culturally relevant and inclusive methods to allow target populations to engage with digital health tools when conducting user testing.

Translating Principles into Action

Related to these broad principles of universal design and co-design are three key considerations involved in bringing these principles to life in a product or service: (1) language access, (2) health literacy and readability, and (3) ease of use. When designers focus on these often-overlooked elements, they can unlock the potential for equitable design in health technology.

Language Access

Technology holds high potential to meet the language needs of individuals in the US, where nearly one-in-four households speak a language other than English at home.[13] However, most patient-facing digital health apps are offered only in English.[14] Additionally, technologies such as patient portals offer limited options for languages other than English. For instance, it is common for a portion of patient portal website content to be translated into another language (often only the navigation elements), while excluding translation of other important content, such as medical record information.

Two practices can improve the language accessibility of digital health products and services:

- **User engagement for linguistic and cultural relevance (transcreation).** These methods require gathering knowledge from a local population through user-centered design methods that provide information about enhancing the understanding of a product or service's content and increasing its relevance to people's lives, inclusive of but beyond language translation alone. For example, a text-messaging service to manage diabetes and

depression engaged with Spanish-speaking users to learn how to best motivate them to get out and exercise with culturally relevant messages, regular reminders, and prompts to meet up with friends (see sidebar).[15] While user engagement methods are more time- and resource-intensive, they are critically important to improve the inclusiveness of digital health tools and services.

- **Real-time translation.** Technology that immediately translates languages can be seamlessly integrated into many existing applications. Innovators can use basic tools such as **DeepL** or **Google Translate** to translate content into languages common among a target population. While this method is not as rich as full transcreation, it is a practical step that can immediately improve accessibility among people who speak a language other than English. Two-step processes of translated materials, such as English-to-Spanish translation followed by Spanish-to-English back translation conducted by bilingual and bicultural staff or contractors, also can enhance accuracy of content translation.

Co-Creating Tools with the Community

Researchers at UCSF partnered with Omada Health to adapt its existing diabetes prevention program with the goal of improving usability among publicly insured patients served in a safety-net health care setting.[16] The research team conducted focus groups with target patients to better understand their needs and preferences.

Overall, this design process resulted in changes, such as writing the curriculum at a less than sixth-grade reading level and recommending an enrollment process that provided ongoing technical assistance. For example, the following sentence was adapted from a ninth-grade to a fourth-grade reading level:

- **Ninth-grade level.** "Listening to music while you walk, waiting to read a favorite magazine or watch a guilty-pleasure TV show until you're on the stationary bike, or inviting your funniest friend to join you can turn exercise into something to look forward to."
- **Fourth-grade level.** "Listen to your favorite music while you walk or invite a friend to join you. This can make exercise something to look forward to."

As a second example, a research team at UC Berkeley and UCSF investigated the effect of text messaging on physical activity among English- and Spanish-speaking patients with diabetes and depression in a project called DIAMANTE. To assess the relevance and understanding of text message content, the research team hired bicultural and bilingual team members with shared lived experiences of the target community for the program.

This process helped the research team better understand the barriers to participate, such as the difficulty in accessing mobile apps and the need to address both social and medical needs within the content in both languages.[17] The design process resulted in improvements that addressed existing barriers, such as developing an onboarding protocol that assessed a patient's digital literacy skills and addressing chronic pain as it relates to physical activity. This resulted in a patient-centered approach that engaged more diverse participants.[18]

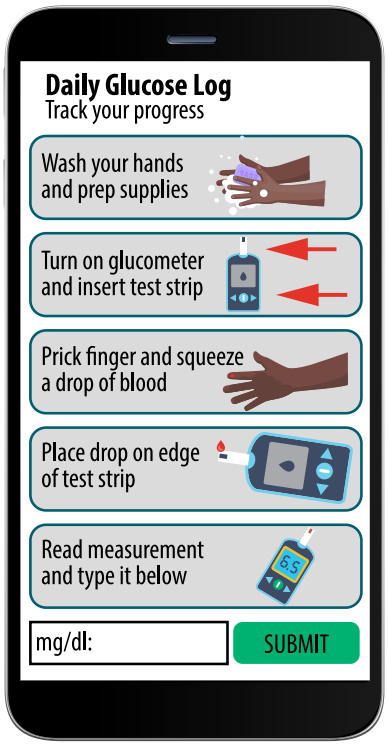
Health Literacy and Readability

Health literacy involves strategies that enable individuals to find, understand, and use health information and services to inform their decisions and actions.[19] Barriers to health literacy can span all forms of communication, not just written text. Equitable digital health design requires attention to literacy-appropriate communication. Fortunately, a wealth of evidence-based best practices for literacy-appropriate communication are highly applicable to digital health design.

- **Health literacy.** The *Health Literacy IT Guide* of the Agency for Healthcare Research and Quality (AHRQ) provides detailed information and a checklist to achieve the four domains for literacy-appropriate digital communication (see box):[20]
  - Use plain and clear language, with short words and sentences, active voice, and little jargon.
  - Include relevant content. Developers should assume little to no background knowledge to ensure all users receive the information that they need to successfully engage. Developers also should be cognizant that too much information can be a barrier to comprehension. Finally, it is important to use illustrations to clarify text and use numbers and percentages in ways that do not require calculation or mathematical understanding (e.g., saying "one in five" instead of "20%").
  - Ensure the format is conducive to comprehension. This is particularly critical to digital formats. Adequate white space, a large and familiar font, short line lengths, and bullets and groupings of similar information are among the formatting recommendations to support individuals with limited literacy.
  - Ensure the content appeals to users of different races, ethnicities, genders, and other backgrounds. Images of humans should include varying skin tones and genders and be respectful. Translation to non-English languages should be validated with native speakers not only for accuracy but also for sensitivity and appropriateness.

Improving Health Literacy of Digital Solutions

The illustration below provides an example of a Daily Glucose Log app with design features that follow the Agency for Healthcare Research and Quality's guidelines for health literacy. It uses plain language, only includes relevant content, uses a format conducive to comprehension, and includes images of varying skin tones.



Source: *Accessible Health Information Technology (IT) for Populations with Limited Literacy: A Guide for Developers and Purchasers of Health IT*, AHRQ, 2007.

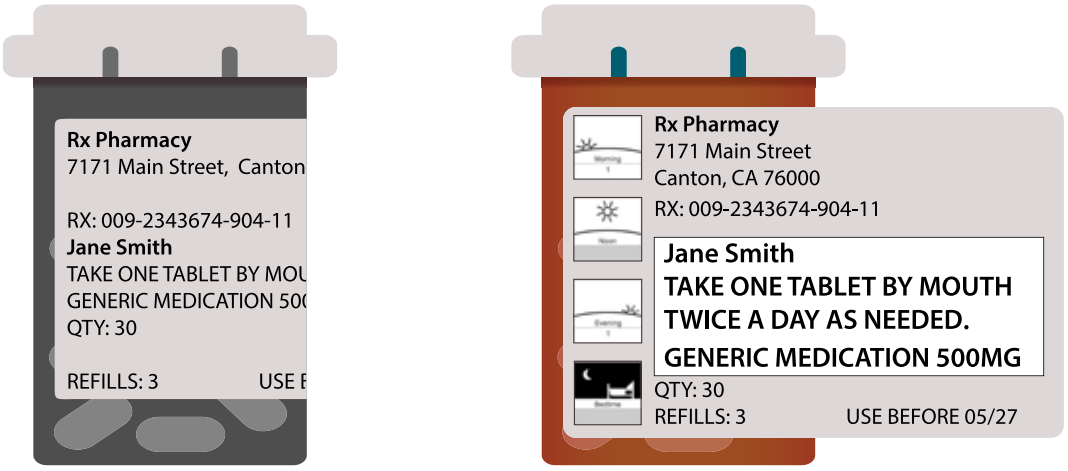
- **Readability.** Research conducted by AHRQ demonstrates that digital communication should be written at a sixth-grade reading level or lower.[21] Programs like Microsoft Word offer tools to assess readability. Testing content with diverse groups of users also can ensure that materials are literacy-appropriate (see box). The community-organized design consultancy Content Design London provides a useful **readability checklist** that innovators can use to implement these and other recommendations.[22]

Ease of Use

Digital health solutions also must be easily navigable, especially for users with differing levels of digital expertise.[23] Basic — and the most essential — features should be accessible by the widest range of users. Existing resources for improving the ease of use of digital solutions include the US government's **digital.gov website** and the **Bureau of Internet Accessibility**.[24] These resources provide designers with guidelines and checklists to ensure their products and services are easy for everyone to use.

Making a Medication Schedule Easier to Use

Researchers adapted traditional written prescription labels and instructions to a universal medication schedule to make them appropriate to lower levels of literacy. As illustrated below, several elements of a patient-centered label make it more comprehensible to those with limited health literacy.



The instructions are worded more simply, there are pictorial representations of information to support comprehension, there is more white space, and the font size is larger. These evidence-based strategies have been shown to improve medication comprehension and adherence in randomized controlled trials.

Sources: William H Shrank, Ruth Parker, Terry Davis et al. 2010, "**Rationale and Design of a Randomized Trial to Evaluate an Evidence-Based Prescription Drug Label on Actual Medication Use.**" *Contemp Clin Trials* 31 (6): 564-71; and Michael S Wolf, Terry C Davis, Laura M Curtis et al. 2016. "A Patient-Centered Prescription Drug Label to Promote Appropriate Medication Use and Adherence." *J Gen Intern Med* 31 (12): 1482–1489.

As key examples, products and services should be easy to use in the following contexts:

- **Across a range of devices.** This involves developing and testing the tools across different environments, such as desktop and laptop computers, tablets, mobile devices, and kiosks, as well as using various screen sizes and internet connection speeds.
- **Among people who do not have extensive digital expertise.** Many of the strategies that make technology more usable and accessible for older adults can be applied to make technology more usable and accessible for everyone. Strategies proven to help seniors access websites and apps include:[25]
  - Large displays and the removal of unnecessary interactive elements, such as dropdown menus and links that are difficult to click on or tap.
  - Elimination of scrolling so that users can see all of the relevant text on a single screen.
  - Guideposts for needed actions, such as clear buttons to signal how to navigate to additional content and numbered pages to show how many steps to expect.
  - Maximum flexibility for inputting information, such as removing data entry requirements like hyphens or parentheses within phone numbers.
  - Helpful error messages that do not contain technical language.
  - Ease of disabling unwanted features, such as ad pop-ups.

Conclusion

It is vital that everyone involved in developing and designing digital health innovations consider the foundational principles of inclusive digital health design covered in this issue brief. These elements should be incorporated during all phases of technology creation to ensure that digital health innovations are relevant and usable for everyone, including marginalized groups who face barriers accessing health care.

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Acknowledgments. The authors would like to thank Marika Dy and Sarah Lisker for their support with this issue brief.

About the Foundation

The **California Health Care Foundation** is dedicated to advancing meaningful, measurable improvements in the way the health care delivery system provides care to the people of California, particularly those with low incomes and those whose needs are not well served by the status quo. We work to ensure that people have access to the care they need, when they need it, at a price they can afford.

CHCF informs policymakers and industry leaders, invests in ideas and innovations, and connects with changemakers to create a more responsive, patient-centered health care system.

ADDITIONAL RESOURCES

The following resources were developed by companies, government entities, academia, nonprofits, foundations, and community groups to provide further guidance on inclusive design and accessibility for diverse communities.

Design Standards and Guidelines

- Xcertia: ***mHealth App Guidelines*** (PDF)
- Deloitte: **Digital Health Tools for Mobile Devices Can Help Advance Equity… If Designed Right**
- US Food and Drug Administration: **Applying Human Factors and Usability Engineering to Medical Devices**
- Agency for Healthcare Research and Quality: **Accessible Health Information Technology for Populations with Limited Literacy: A Guide for Developers and Purchasers of Health IT**
- The Commonwealth Fund: **Developing a Framework for Evaluating the Patient Engagement, Quality, and Safety of Mobile Health Applications**
- National Academy of Medicine: **Health Literacy Insights for Health Crises**
- Mark Wilson: **Ten New Rules of Design**
- UX Collective: **Frameworks for Measuring Product Inclusion and Product Equity**
- Anjana E. Sharma et al., *Journal of Community Health*: **Patient Engagement in Community Health Center Leadership: How Does it Happen?**

Guidebooks, Protocols, and Other Insights About Inclusive Design

- Usability.gov: **User-Centered Design Basics**
- Felix Chang, *Harvard Business Review*: **To Build More-Inclusive Technology, Change Your Design Process**
- Reboot: **Everyone Is Biased: How Reboot Builds Bias Checks into Design Research**
- Liberty, Life, and the Pursuit of Health Collective: **Health Equity Toolkit**
- Greater Good Studio with Lesley-Ann Noel, Sadie Red Wing, Jennifer Rittner, and moderated by George Aye: **Decentering Whiteness in Design webinar**
- Good Things Foundation Digital Health Lab: ***How to Co-Design Digital Inclusion in Health*** (PDF)
- Center for Care Innovations: **The Innovator's Guidebook**
- IDEO.org: **Field Guide to Human-Centered Design**
- Microsoft: ***In Pursuit of Inclusive AI*** (PDF)
- Microsoft: **Inclusive Design Toolkit and Toolkit Activities** (PDF)

Archives/Wikis

- **Community-Led Design Wiki**

Endnotes

1. "**QuickFacts, California**." US Census Bureau. Accessed December 14, 2021.
2. Charles M. Wray, Janet Tang, Sachin Shah et al. 2021. "Sociodemographics, Social Vulnerabilities, and Health Factors Associated with Telemedicine Unreadiness Among US Adults." *J Gen Intern Med* 1-3.
3. *Understanding Communication and Language Needs of Medicare Beneficiaries*. 2017. Rockville, MD: Centers for Medicare & Medicaid Services Office of Minority Health.
4. Ji-Ye Mao, Karel Vredenburg, Paul W. Smith, and Tom Carey. 2005. "The State of User-Centered Design Practice." *Communications of the ACM* 48 (3): 105–109; Rosa Hernandez-Ramos, Adrian Aguilera, Faviola Garcia et al. 2021. "Conducting Internet-Based Visits for Onboarding Populations with Limited Digital Literacy to an mHealth Intervention: Development of a Patient-Centered Approach." *JMIR Form Res* 5 (4): e25299; and Laura E. Pathak, Adrian Aguilera, Joseph J. Williams et al. 2021. "Developing Messaging Content for a Physical Activity Smartphone App Tailored to Low-Income Patients: User-Centered Design and Crowdsourcing Approach." *JMIR Mhealth Uhealth* 9 (5): e21177.
5. Urmimala Sarkar, Gato I. Gourley, Courtney R. Lyles et al. 2016. "Usability of Commercially Available Mobile Applications for Diverse Patients." *J Gen Intern Med* 31 (12): 1417–1426; Tiffany C. Veinot, Hannah Mitchell, and Jessica S Ancker. 2018. "Good Intentions Are Not Enough: How Informatics Interventions Can Worsen Inequality." *J Am Med Inform Assoc* 25 (8): 1080–1088; and Serena O. Blacklow, Sarah Lisker, Madelena Y. Ng et al. 2021. "Usability, Inclusivity, and Content Evaluation of COVID-19 Contact Tracing Apps in the United States." *J Am Med Inform Assoc* 28 (9): 1982–1989.
6. Ivor Horn and Megan Zweig. *Diversity in Digital Health: 2020 Annual Report*. San Francisco: Rock Health.
7. Caroline A. Figueroa, Tiffany Luo, Adrian Aguilera, and Courtney R. Lyles. 2021. "The Need for Feminist Intersectionality in Digital Health." *Lancet Dig Health* 3 (8): e526–533.
8. Milena A. Gianfrancesco, Suzanne Tamang, Jinoos Yazdany, and Gabriela Schmajuk. 2019. "Potential Biases in Machine Learning Algorithms Using Electronic Health Record Data." *JAMA Intern Med* 178 (11): 1544–1547.
9. Molly F. Story. 1998. "**Maximizing Usability: The Principles of Universal Design**." *Assist Technol* 10 (1): 4–12.
10. Michael C. Gibbons, Svetlana Z. Lowry, and Matthew T. Quinn. 2011. ***Human Factors Guidance to Prevent Healthcare Disparities with the Adoption of EHRs*** (PDF). Gaithersburg, MD: National Institute of Standards and Technology.
11. Nicol Turner Lee, Paul Resnick, and Genie Barton, *Algorithmic Bias Detection and Mitigation: Best Practices and Policies to Reduce Consumer Harms*. Brookings Institution. May 22, 2019.
12. Armen C. Arevian, Jennifer O'Hora, Felicia Jones et al. 2018. "Participatory Technology Development to Enhance Community Resilience." *Ethn Dis* 28 (Suppl 2): 493–502; Pathak et al., "Developing Messaging Content;" and Christina Cheng, Gerald R. Elsworth, and Richard H. Osborne. 2020. "Co-Designing eHealth and Equity Solutions: Application of the Ophelia (Optimizing Health Literacy and Access) Process." *Front Public Health* 8: 604401.
13. **Data.census.gov**. US Census Bureau. Accessed December 9, 2021.
14. *The Growing Value of Digital Health: Evidence and Impact on Human Health and the Healthcare System*. 2017. Durham, NC: IQVIA.
15. Patricia Avila-Garcia, Rosa Hernandez-Ramos, Sarah S. Nouri et al. 2019. "Engaging Users in the Design of an mHealth, Text Message-Based Intervention to Increase Physical Activity at a Safety-Net Health Care System." *JAMIA Open* 2 (4): 489–497.
16. Valy Fontil, Kelly McDermott, Lina Tieu et al. 2016. "Adaptation and Feasibility Study of a Digital Health Program to Prevent Diabetes Among Low-Income Patients: Results from a Partnership Between a Digital Health Company and an Academic Research Team." *J Diabetes Res*.
17. Avila-Garcia et al., "Engaging Users."
18. Rosa Hernandez-Ramos, Adrian Aguilera, Faviola Garcia et al. 2021. "Conducting Internet-Based Visits for Onboarding Populations with Limited Digital Literacy to an mHealth Intervention: Development of a Patient-Centered Approach." *JMIR Form Res* 5 (4): e25299.
19. "**What Is Health Literacy?**" Centers for Disease Control and Prevention. May 19, 2021.
20. June Eichner and Prashila Dullabh. 2007. ***Accessible Health Information Technology (IT) for Populations with Limited Literacy: A Guide for Developers and Purchasers of Health IT***. Rockville, MD: Agency for Healthcare Research and Quality.
21. Eichner and Dullabh, *Accessible Health Information Technology*.
22. **Readability Checklist**. Content Design London. December 20, 2019.
23. "**Introduction to Web Accessibility**." Web Accessibility Initiative. October 6, 2021.
24. **Digital.gov**. US General Services Administration. Accessed December 15, 2021; and **Digital Accessibility Resources**. Bureau of Internet Accessibility. Accessed December 15, 2021.
25. Lexie Kane, "**Usability for Seniors: Challenges and Changes**." Nielsen Norman Group. September 8, 2019. Accessed December 15, 2021.