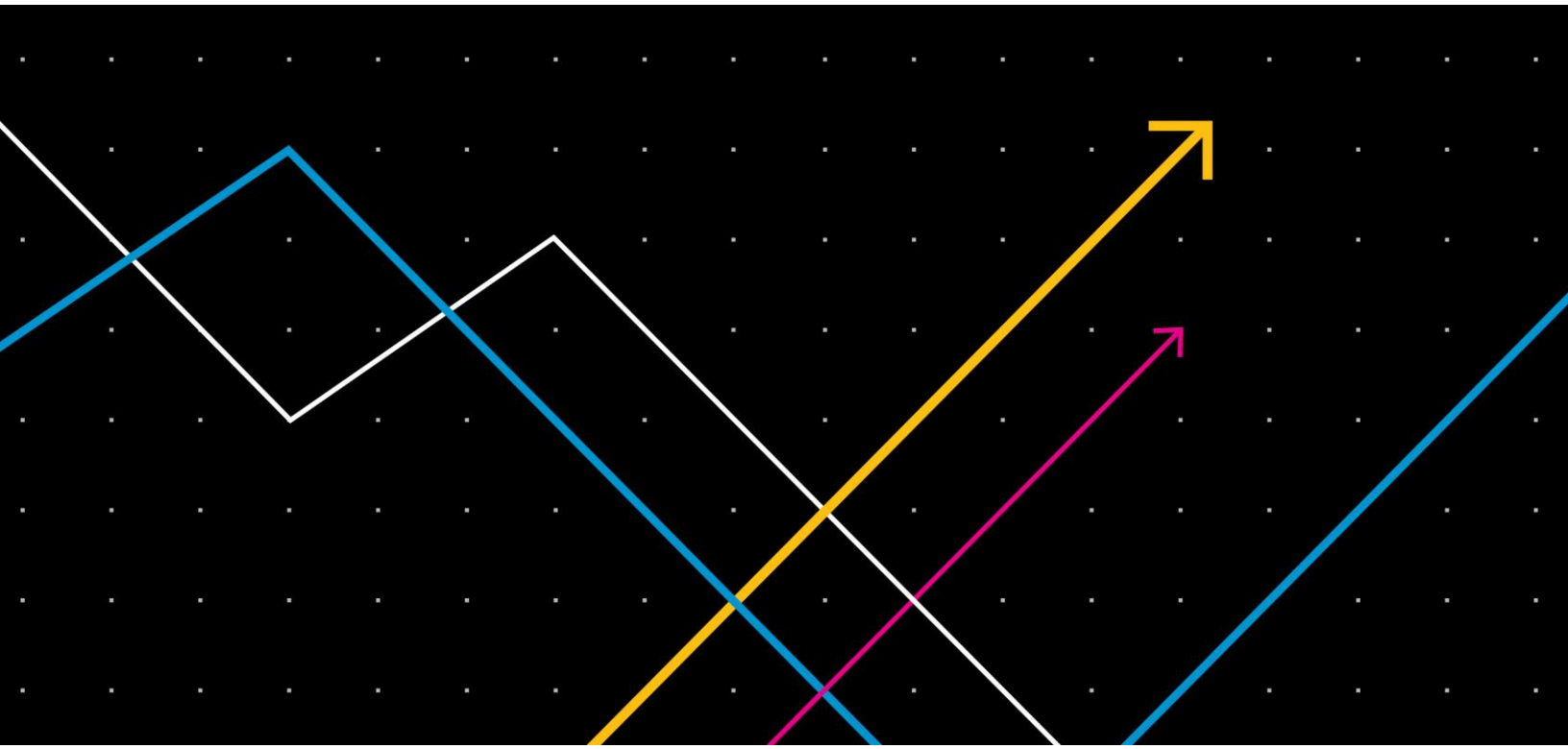

RESEARCH REPORT

Expanding Digital Opportunity

A Framework and Road Map for Strengthening Digital Inclusion

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Contents

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Executive Summary

In an increasingly interconnected world, digital opportunity and inclusion are essential for bridging gaps between people and places and promoting advancements in education, health, housing, and economic prosperity. However, the digital divide—the gap between those who have affordable access, skills, and support to effectively engage online and those who do not[1]—threatens to leave some individuals and communities out. Expanding digital opportunity to all requires a comprehensive, evidence-based framework connecting the pathways to greater digital inclusion that lead to positive outcomes for individuals, families, communities, and society. Policymakers, internet service providers, advocates, and those who provide critical training, services, and funding can leverage this framework and emerging solutions to narrow the digital divide.

A Framework for Digital Opportunity and Inclusion

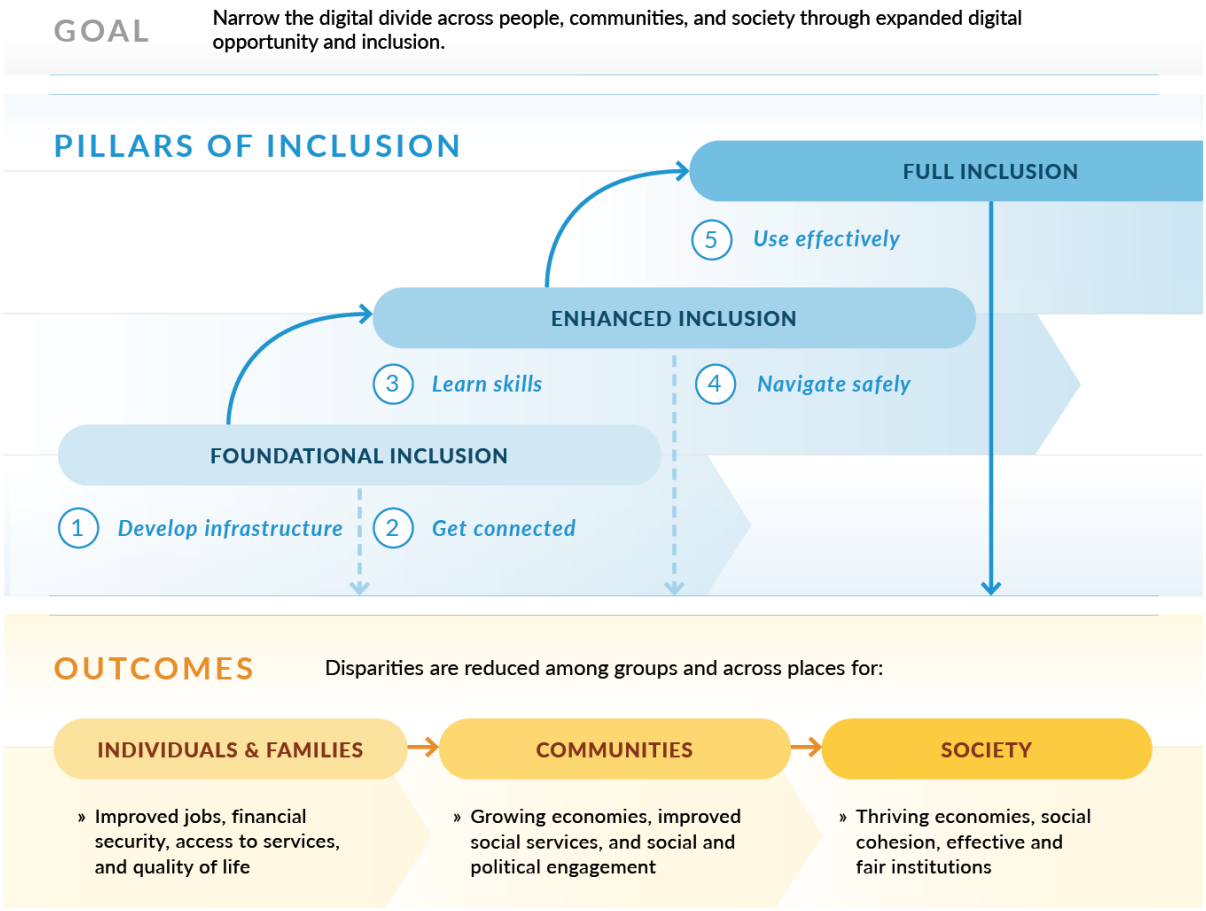
This framework for digital opportunity and inclusion lays out the evidence base across five pillars, focusing on what the pillars are, who is adversely affected by persisting digital divides, and what emerging solutions—including policies, programs, and practices—promote digital opportunity and inclusion (figure ES1). The five pillars fall within three categories of inclusion: foundational inclusion, enhanced inclusion, and full inclusion. We list the categories and the pillars below and in figure ES1. See page 7 for the full framework for digital opportunity and inclusion.

- Foundational inclusion
  - » **Develop infrastructure**: access, speed, and reliability of physical infrastructure
  - » **Get connected**: adoption of available and affordable internet services and devices
- Enhanced inclusion
  - » **Learn skills**: digital literacy, basic skills, and advanced certifications to exercise digital autonomy
  - » **Navigate safely:** privacy and security to control and protect personal information online
- Full inclusion

» **Use effectively:** inclusive devices, applications, and human and technical supports to empower self-determined use and achieve goals

FIGURE ES1

Components of Digital Opportunity and Inclusion



Source: Abridged framework developed by the authors.

What Are the Benefits of Expanded Digital Opportunity and Inclusion?

This framework characterizes digital opportunity as the many individual, community, and societal benefits that come from expanding digital inclusion by narrowing the digital divide and promoting digital equity. Examples span many dimensions of individual and community well-being, including improving individual confidence and self-efficacy; improving educational outcomes; improving health,

health information access, and health management; improving financial outcomes; improving economic, workforce, and labor market outcomes; improving social cohesion and reduced social isolation; reducing recidivism rates among people reentering society after incarceration; and improving overall quality of life.

Who Benefits from Expanded Digital Opportunity and Inclusion?

The evidence in this report shows that some people and communities are more affected by the digital divide than others. Populations that would benefit from investments and resources to expand digital opportunity and inclusion include many populations of color, tribal communities, people with lower incomes, women, people living in rural areas, older adults, justice-impacted populations, many people with disabilities, people experiencing homelessness, and immigrant and refugee populations.

What Is the State of the Evidence on Digital Opportunity and Inclusion?

As technology advances, research and evidence about expanding digital opportunity and inclusion continue to grow. Our review of the literature examined bodies of evidence related to the five framework pillars and different populations. We summarize that evidence here, grouped by prevalence.

Established Evidence

The conclusions below are widely accepted, as there are consistent and clear findings from numerous sources.

- **Many rural and Native American communities experience the largest digital divide in access to high-speed infrastructure.** Nationally, Native American populations have access to less digital infrastructure than any other group. Although deployment is expanding, many rural regions have less access to reliable, affordable high-speed internet than suburban and urban areas.
- **Race, ethnicity, and income are significant predictors of in-home broadband internet subscription.** Many populations of color—including Black and Hispanic/Latine populations—

and people with lower incomes are less likely than other groups to have in-home broadband internet subscriptions.

- **High-speed internet at home is associated with improved economic and workforce outcomes.** People with high-speed internet connections at home tend to have better economic and workforce outcomes, including higher incomes and lower rates of unemployment. Home internet also supports economic and workforce outcomes by supporting job searching, employment mobility, and business recruitment.
- **High-speed internet at home is associated with improved educational outcomes.** Children living in homes with high-speed internet have better educational outcomes, including improved access to information, better digital literacy, and higher grades.
- **Access to and meaningful use of internet technologies supports improved health outcomes.** Expanding high-speed internet access, device availability and affordability, and meaningful use of the internet can enable greater access to health information and health care services, improve early detection, and improve health management for individuals.
- **High-speed internet supports rural economic productivity, employment, and job creation.** Without high-speed internet infrastructure, industry and business productivity in rural areas lags. Increasing access and adoption of high-speed internet in rural areas supports employment growth and diversity, increases wages, and supports business ownership and entrepreneurialism, especially for women.
- **Digital literacy supports that are culturally competent and promote self-efficacy are most effective.** Education programs, training programs, digital navigator programs, and other interventions and strategies to improve digital literacy are most effective if they are socially and culturally relevant to participants and they increase participants' sense of confidence and belief that they can learn and apply digital skills in their lives. This is particularly true for older adults, women, English-language learners, incarcerated and formerly incarcerated people, and children.

Emerging Evidence

For the findings below, there is a growing body of evidence that is beginning to develop, indicating the possibility for new trends that could potentially grow stronger with further investigation.

- **Community-wide and public-private programs, partnerships, and support networks are effective in helping build digital skills.** In many communities, community-based and nonprofit technical support networks, digital navigator programs, and providers have been shown to help individuals and households learn and apply digital skills. Partnerships between educational institutions and correctional facilities to provide digital-skills training have resulted in greater participation in skill building, education, and related digital programs.
- **Device issues and device quality, including low quality or limited devices, are barriers to connectivity, and some groups may be more affected than others.** Researchers have found that problems with devices and challenges resulting from low-quality devices are key barriers to using the internet effectively, especially for some Hispanic/Latine households, Black households, Native American households, and people experiencing homelessness.
- **Justice-impacted people face unique barriers to digital inclusion, and investments in digital literacy and training associate with reduced recidivism among formerly incarcerated people.** Many justice-impacted populations have access to poor digital infrastructure, excessive fees for digital services in prisons, and challenges adapting to new technology and seeking and securing employment, especially in careers requiring digital expertise, after long periods of incarceration. Some studies have shown that digital literacy and training programs tailored to the context and needs of incarcerated and formerly incarcerated people can support reduced recidivism and increase job retention when they reenter society.
- **The availability of high-speed internet is associated with higher crop yields and higher property values in some rural areas.** Some research has found that agricultural productivity may receive a boost from the installation of high-speed internet infrastructure, and that the expansion of high-speed internet access in rural residential properties increases property values.

Limited Evidence

There is not enough evidence to support strong conclusions at this time and more research on these topics is needed.

- **Effective strategies to encourage internet adoption for nonadopters.** Evidence consistently shows that a durable share of people who do not use home internet say they simply do not need it or are not interested in using it, with the majority of adults without home broadband reporting that they are not interested in having it in the future. To close the adoption gap, more

evidence is needed about the contexts and motivations of nonadopters and about effective strategies to support internet adoption among this population.

- **Opportunities to expand digital opportunity and inclusion for some military and veteran populations.** More research is needed about the needs and possibilities of expanding digital opportunity and inclusion for specific military and veteran groups, including military spouses and older veterans—such as accessing social and health services, accessing and retaining employment, and engaging in business development and entrepreneurial activity.
- **Effective digital strategies to support people experiencing homelessness.** People experiencing homelessness rely on unreliable public Wi-Fi, outdated devices, and spotty mobile hotspots. Device theft, lack of charging infrastructure, and limited digital literacy can further restrict their internet use and make it difficult for them to maintain connections with people and institutions that can provide critical resources to support pathways out of homelessness. More research is needed about effective digital investments, approaches, and strategies to support people experiencing homelessness.

Charting a Road Map for Fuller Digital Opportunity and Inclusion

This report summarizes evidence-based strategies to strengthen pathways toward greater digital inclusion across and between the framework pillars, including the following:

- targeting place-based subsidies to narrow the infrastructure gap and expand in-home connections
- supporting individual connectivity through subscription subsidies, low-cost or free devices, and free public Wi-Fi and mobile hotspots for people who struggle to connect to in-home broadband infrastructure or are housing insecure
- protecting digital privacy and strengthening civil rights protections and enforcement online
- providing clear digital training and navigation, as well as properly equipping and supporting those who train others in these skills
- making digital platforms, devices, and supports easy to use, relevant, and accessible for all, regardless of income, race and ethnicity, social and cultural background, language, and ability
- issuing quality devices and supporting troubleshooting and maintenance for device users

The report ends with a learning agenda to drive future research across the pillars of digital inclusion, including a series of specific opportunities and potential research questions:

- Support the development of more research and evidence around solutions to the digital divide.
- Conduct research that is more inclusive of marginalized populations.
- Fill important knowledge gaps related to what it takes to help people get and stay connected to high-speed internet.
- Focus on outcomes for individual, family, and societal thriving.

Expanding Digital Opportunity

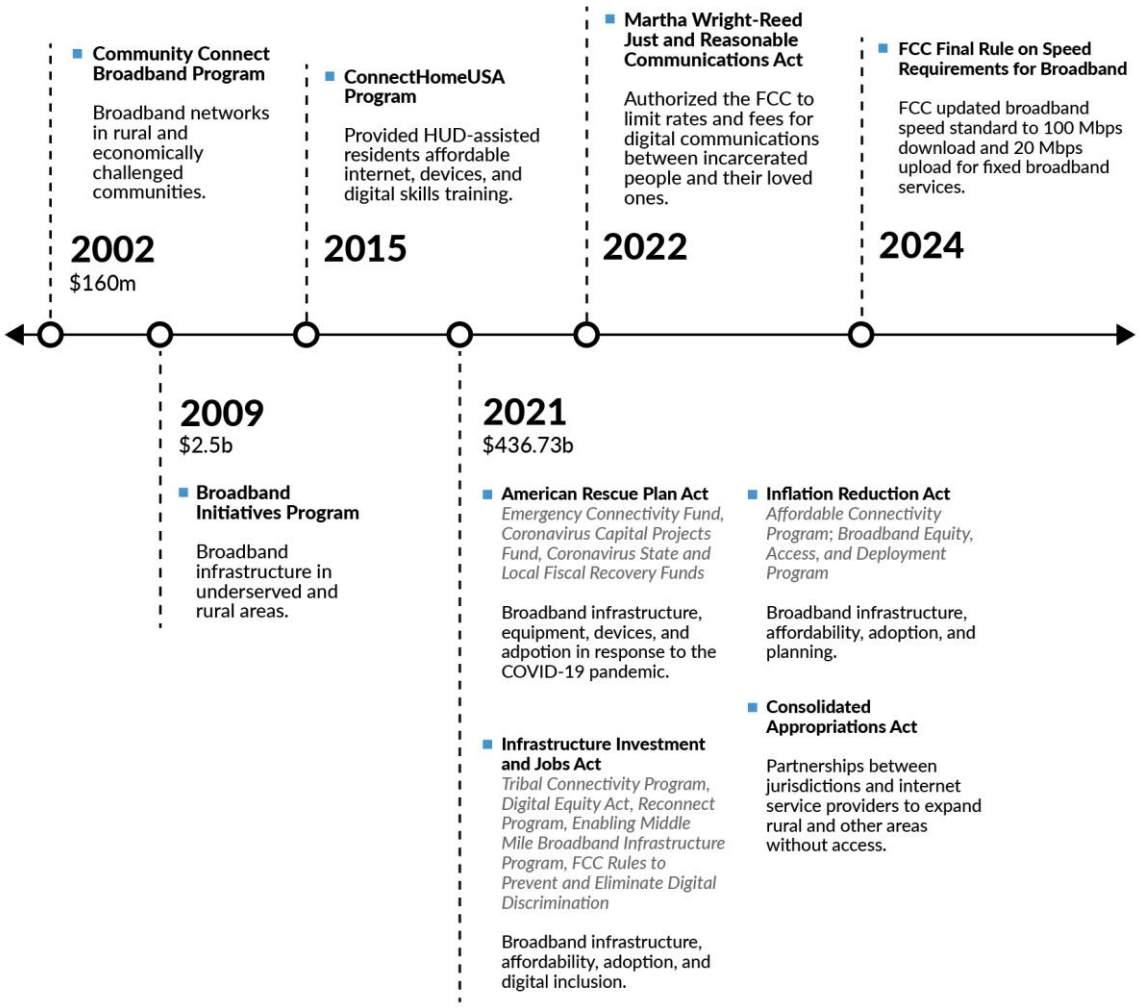
Across the US, unprecedented investments are occurring in infrastructure, connectivity, and skill development to equip society for a digital world. Congress has made over $439 billion in federal government funding available to expand digital opportunity since 2002 (figure 1), with most coming since the COVID-19 pandemic laid bare critical gaps in digital infrastructure and connectivity in communities across the country. In particular, the American Rescue Plan Act, Infrastructure Investment and Jobs Act, and Inflation Reduction Act allocated significant funding to deploy high-speed infrastructure to unserved and underserved locations, make quality devices and connections more accessible, and support skills training so that all can leverage digital technology to meet their needs and support their goals.

Introduction

The vast majority of American households now have access to the internet at home, meaning that a technology, service, or facility that provides internet connectivity is available for a computer or smart device at their address. The growth in internet access in recent years is attributable to the expansion of affordable high-speed internet options. Nationwide, cable remains one of the most widely available broadband internet sources, but recently there has been significant growth in fiber optic and satellite technologies (figure 2). With these expansions, the number of households reporting that they have not adopted home internet has steadily declined, with internet access now nearly universal. However, a relatively small but durable share of nonadopters persists, with the share of those who report not using the internet plateauing in recent years (figure 3).

FIGURE 1

Federal Investments in Digital Opportunity, 2002–24



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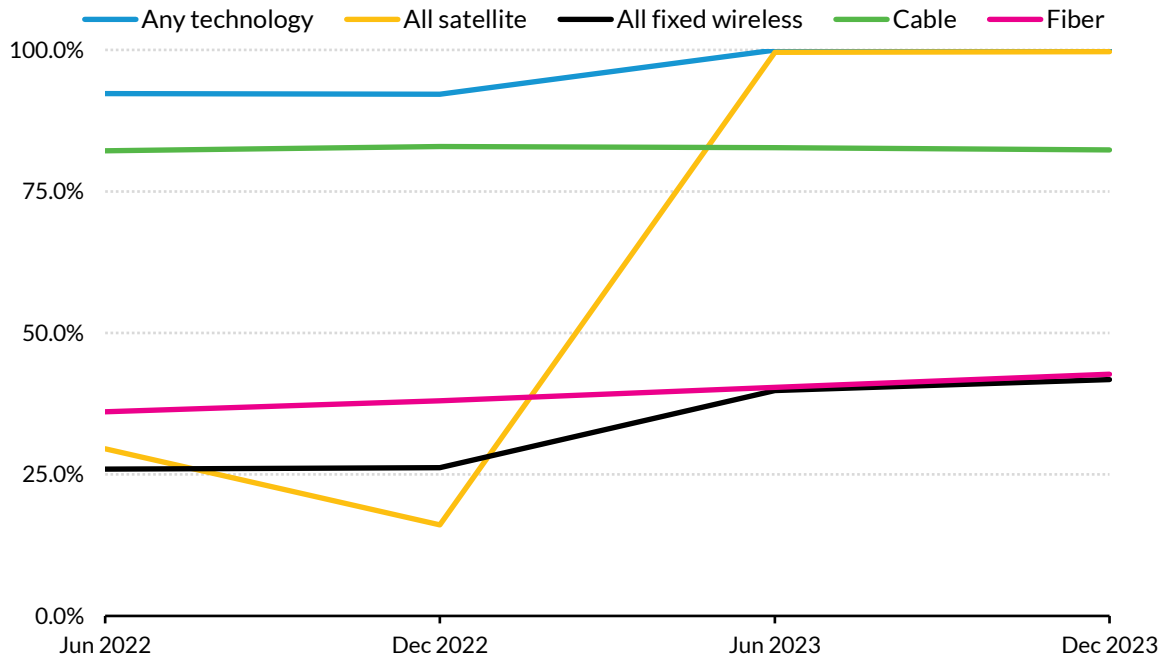
Source: Timeline developed by the authors.

FIGURE 2

US Households with Broadband Internet Access by Major Infrastructure Type, 2022–23



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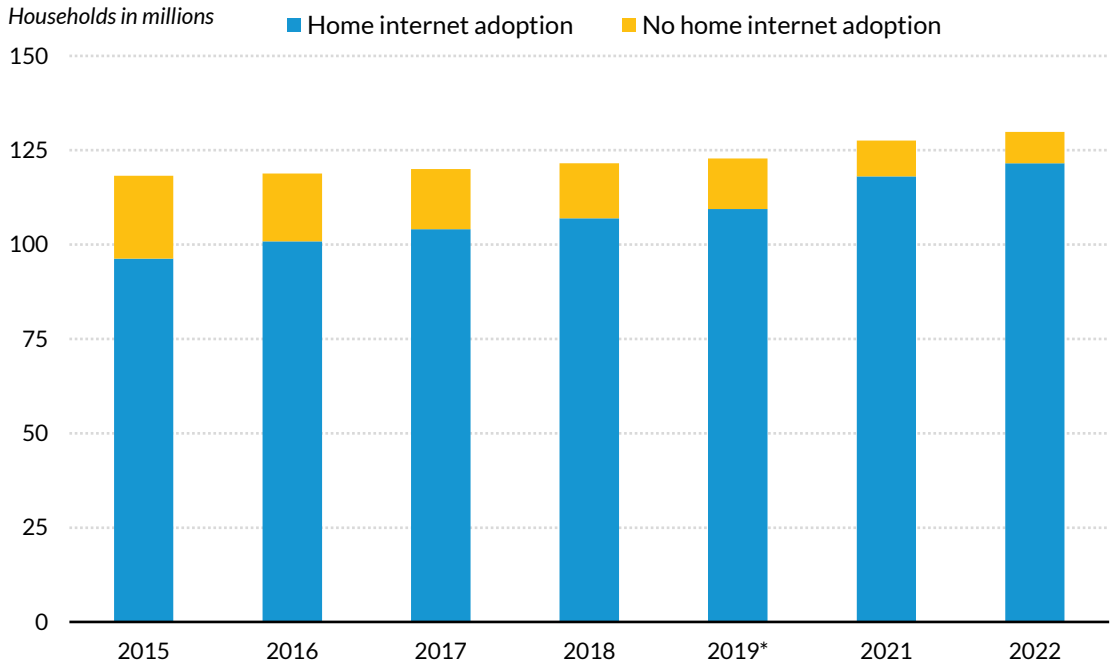
Source: Author's calculations using December 2023 Federal Communications Commission national broadband data.
Notes: The substantial growth in satellite infrastructure between December 2022 and June 2023 coincides with significant growth in Starlink internet service, including rapid expansion of its user base, the introduction of their upgraded "V2 mini" satellite, increased number of satellite launches, and improved user terminal availability.

FIGURE 3

US Households Reporting Home Internet Adoption, 2015–22



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Source: Author's calculations using American Community Survey one-year estimates.
Note: *Estimates for 2020 are omitted because the US Census Bureau did not publish American Community Survey one-year estimates in 2020 due to data-collection challenges during the COVID-19 pandemic.

A Framework for Digital Opportunity and Inclusion

As technology advances, digital participation is increasingly necessary for people to access essential services; seek, secure, and retain employment; meet basic needs; engage in lifelong learning; and participate in cultural and civic life.[2] Because of this, the National Digital Inclusion Alliance (NDIA), a national nonprofit organization that advocates for broadband access, defines digital equity as achieved when people and communities have the information and technological capacity to participate in society, democracy, and the economy (box 1).[3] NDIA's definition is widely cited as the standard across state broadband offices,[4] public-private broadband partnership organizations, education and literacy organizations,[5] and digital and community advocacy groups.[6]

This framework conceptualizes digital opportunity as the many individual, community, and societal benefits that come from expanding digital inclusion by narrowing the digital divide and promoting

digital equity (box 1). Many other definitions of digital opportunity also refer to participation in society, democracy, and the economy, even if they do not directly reference the NDIA definition. Other definitions for digital opportunity commonly focus on concrete or technological requirements for digital participation. For example, AARP describes three key criteria for equitable digital opportunity: internet access, a suitable device, and digital literacy and training.[7]

BOX 1

Definitions

This framework uses the following definitions:

- **digital divide**: The gap between those who have affordable access, skills, and support to effectively engage online and those who do not.[a]
- **digital inclusion**: The activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of information and communication technologies, including (1) affordable, robust broadband internet service; (2) internet-enabled devices that meet the needs of the user; (3) access to digital literacy training; (4) quality technical support; and (5) application and online content designed to enable and encourage self-sufficiency, participation, and collaboration.[b]
- **digital equity**: The condition in which all individuals and communities have the information-technology resources and capacity needed for full participation in our society, democracy, and economy.[c]
- **digital opportunity**: Digital opportunity means that everyone can access the life-changing benefits that digital inclusion unlocks. It extends the goal of closing the digital divide beyond simply increasing the number of connected households or devices to ensuring that people can effectively use digital technology to improve their lives. When everyone has the digital connections, affordable and appropriate devices, and skills to navigate the digital world safely and effectively, their opportunities to improve employment, education, housing, health, and other quality of life outcomes expand, and they can more fully participate in the economy, democracy, and society.[d]

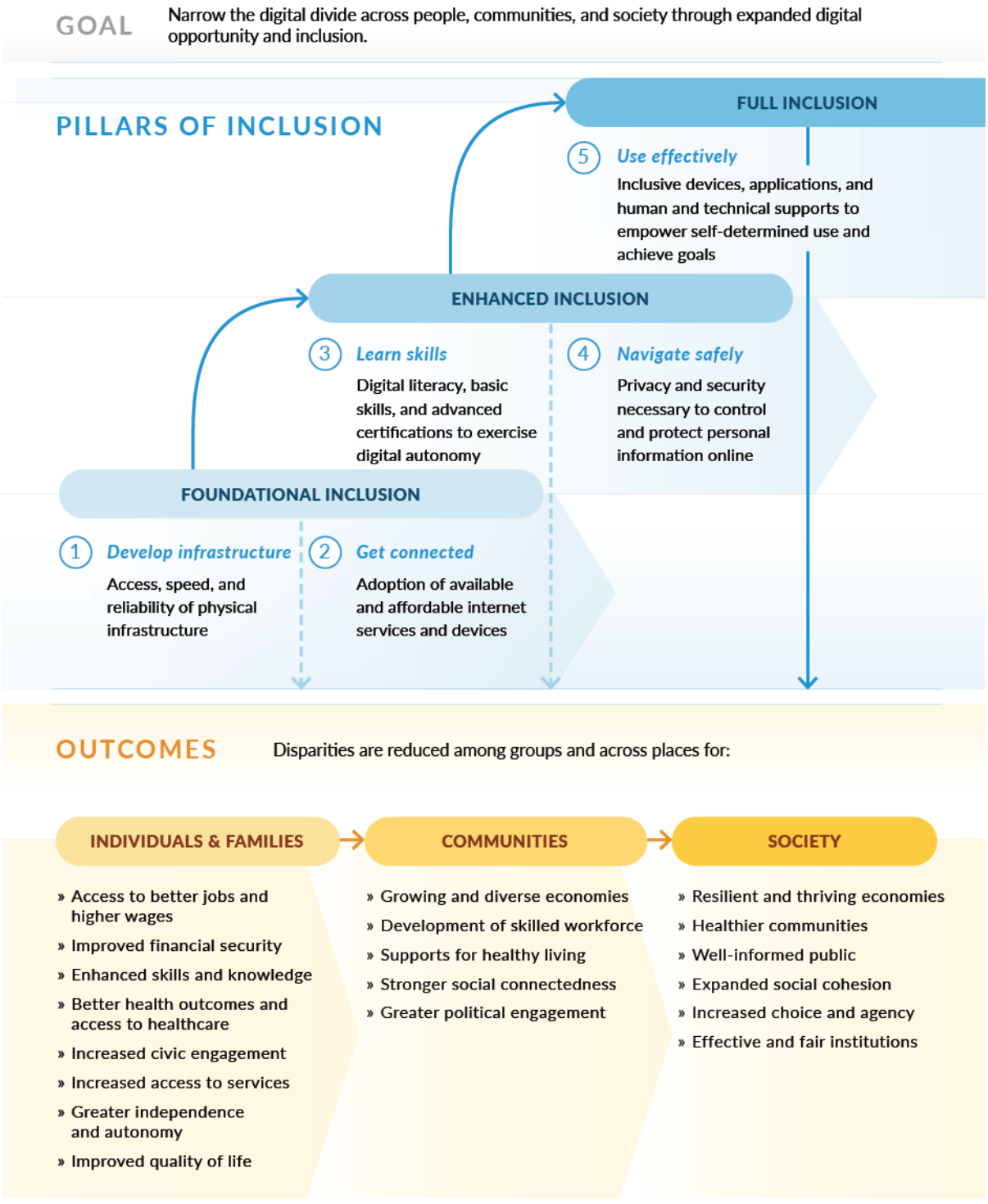
Sources: [a, b, c] National Digital Inclusion Alliance, "Definitions," accessed December 17, 2024, https://www.digitalinclusion.org/definitions/
[d] Definition developed by the authors.

Because of historic and ongoing gaps in digital investments and participation, many people and regions face persistent barriers to achieving both the technological and participatory benefits of digital

opportunity. This report's framework synthesizes existing definitions and positions digital opportunity as the outcome along a spectrum of three ascending categories of digital inclusion: foundational inclusion, enhanced inclusion, and full inclusion, with the goals of (1) narrowing the digital divide between those who can effectively engage online and those who cannot and (2) improving outcomes for people and communities (figure 4).

FIGURE 4

Framework for Digital Opportunity and Inclusion



Source: Framework developed by the authors.

Foundational Inclusion

Foundational inclusion is the baseline for digital participation. It includes the development and deployment of the physical infrastructure needed for digital participation and the ability of people to connect to it. There are two pillars in this category:

- **Develop infrastructure**: This includes the access, speed, and reliability of fixed and mobile digital infrastructure. Fixed connections include fiber internet, cable internet, Digital Subscriber Line (DSL) technology, satellite internet, and fixed wireless internet infrastructure. Mobile connections include cellular towers, smart devices, public Wi-Fi, and mobile Wi-Fi hotspot technology.
- **Get connected:** This includes the adoption, affordability, and take-up of available internet service connections and devices. Getting connected is dependent on the physical infrastructure being deployed or available to a service area, community, residence, and/or building.

Enhanced Inclusion

Enhanced inclusion is possible when the infrastructure and connection criteria for foundational inclusion are satisfied. It includes the skills that people need to use the internet safely and effectively. There are two pillars in this category:

- **Learn skills**: The basic digital skills, digital literacy, and digital certifications or credentialing necessary to exercise digital autonomy.
- **Navigate safely**: The knowledge, ability, and resources to control and protect personal or sensitive information online.

Full Inclusion

Full inclusion is possible when foundational inclusion and enhanced inclusion criteria are satisfied with available and reliable infrastructure, affordable connections and adoption, with needed skills and safety protections so that people can meaningfully and effectively use and benefit from the internet. There is one pillar in this category:

- **Use effectively**: This includes the inclusivity and effectiveness of digital devices, applications, and human and technical supports to empower self-determined use and to support people in using the internet to achieve their goals.

SHORT-TERM OUTCOMES OF GREATER DIGITAL INCLUSION

Our review of the evidence shows that full inclusion can yield positive outcomes for individuals, households, communities, and society as a whole in both the short and long term.

- **In the housing sector**, evidence shows that expanding digital inclusion can support in-home broadband access and connectivity, increase home values, reduce discrimination in online housing transactions, support renters and buyers in finding housing at reasonable costs in communities of choice, improve home security systems, reduce home energy use and related utility costs, and improve in-home assistive technologies.
- **In the health sector**, expanded digital inclusion can improve access to digital health services, such as appointment scheduling, participation in telehealth, and prescription ordering. It can also support greater access to health care providers, caregivers, and medical records access, which together strengthen preventive care services.
- **In the educational fields**, greater digital inclusion is associated with improved grades and test scores for learners at all ages, as well as increased rates of homework completion, higher graduation rates, and increased enrollment in higher education.
- **In the economic sector**, greater digital inclusion supports easier navigation of public financial services; increased rates of entrepreneurship, and improved labor market outcomes through enhanced job searching, job matching, and access to job information. Digital inclusion is also associated with higher incomes through lowering unemployment rates and supporting higher labor force participation.

LONG-TERM OUTCOMES OF GREATER DIGITAL INCLUSION

As short-term benefits accrue, greater digital inclusion can make longer-term, transformative outcomes possible.

- **In the housing sector**, expanded digital inclusion can support increased housing wealth for homeowners, increase access to high amenity communities for both homeowners and renters, and support community safety.
- **In the health sector**, greater digital inclusion can improve health behaviors and health management for individuals, reduce the use and strain on emergency services, reduce health complications and negative health outcomes across a variety of ailments and illnesses, and improve overall health and well-being.

- **In the educational fields**, greater digital inclusion can help strengthen students' understanding of class content and support the development of digital literacy skills and improve access to digital services of all kinds, such as government services, banking, and community information.
- **In the economic sector,** expanded inclusion can also strengthen economic outcomes and reduce economic disparities, such as by improving access to jobs that require basic or advanced digital skills, increasing local business activity, and improving productivity and raising incomes.

Who Could Benefit from Stronger Digital Inclusion?

As opportunity expands, it is important to ensure that everyone benefits fairly. Yet some people and communities face historic and persistent gaps in digital access, connections, and use, diminishing their ability to fully participate in the digital era and reducing their chances to thrive. Multiple populations and communities face compounded or long-standing challenges and will benefit significantly from targeted and expanded digital opportunity investments:

- Rural communities have less infrastructure deployed and often depend on less-reliable wireless and more expensive satellite connections (Wolf and Irwin 2024; Garnett, Jeffrey, and Johnson 2024).
- Nationally, Native American populations have less access to digital infrastructure than any other group (Garnett, Jeffrey, and Johnson 2024; Fenner et al. 2024), and researchers have found that Black and Hispanic/Latine populations in some areas have less provider choice and less fiber availability compared with other groups (Galperin, Le and Wyatt 2021). Compared with white people, people of color are also more likely to cancel internet subscriptions because of financial strain (Early and Hernandez 2021; Vogels et al. 2020). Historically-redlined neighborhoods have also been found to have lower broadband adoption rates (Skinner, Levy, and Burtch 2024).
- Nationally, people with lower incomes have similar access to broadband infrastructure as other groups. However, researchers have found that lower-income populations in some municipalities and regions still face significant challenges. For example, although not all service providers deploy less infrastructure in lower income areas, some do. Nationally, fiber is less available than cable broadband in communities with high rates of people living below the federal poverty line (Garnett, Jeffrey, and Johnson, 2024). Other challenges include lower internet usage rates among adults, more pronounced disparities in technology adoption, and frequent difficulties accessing public benefits through digital means (Garnett, Jeffrey, and

Johnson 2024; Czaja et al. 2018; Singh et al. 2020; Marston, Shore, and White 2020; Lee et al. 2024).

- Women face unique barriers to digital access due to precarious housing, financial instability, privacy concerns, and lower self-efficacy, while women of color, especially mothers and justice-impacted women, face additional economic and social challenges (Seo et al. 2020; Faber and Mercier 2022; Blomburg et al. 2021; Seo et al. 2021).
- Older adults, especially those with low incomes and those who are justice-impacted, often have low confidence and fewer skills to use new and evolving digital technology (Czaja et al. 2018; Hecker, Spaulding, and Kuehn 2021; Singh et al. 2020; Marston, Shore, and White 2020).[8]
- Many people with disabilities face accessibility barriers to effectively use digital services and devices. They need investments in digital equity to access essential income support programs, benefit from assistive technologies that enhance independent living, and fully participate in telemedicine, education, and daily life (Zuo and Powell 2023; Khanlou et al. 2021; Chidambaram et al. 2024; Ding et al. 2023; Jamwal et al. 2022).
- Immigrants and refugees, particularly those with limited English proficiency, face language and accessibility barriers to effectively use digital services and devices. They need culturally responsive resources and support to expand access to digital information, health care, education, and legal services and institutions as they settle into a new country (Bastick and Mallet-Garcia 2022; Buiquy 2022; Suh and Hsieh 2019; Connell 2019).
- Many military families and some veteran populations move frequently and face barriers to efficiently access health care and social services (Wray et al. 2022; Reentry Coordination Council 2022).
- Justice-impacted populations face poor infrastructure, excessive fees for digital services in prisons, and challenges adapting to new technology and seeking and securing employment, especially in careers requiring digital expertise, after long periods of incarceration (Badejo, Chakraborty, and Forbes 2024; Brown 2020).[9]
- People experiencing homelessness rely on unreliable public Wi-Fi, outdated devices, and spotty mobile hotspots. Device theft, lack of charging infrastructure, and limited digital literacy further restrict their internet use and make it difficult for them to maintain connections with people and institutions who can provide critical resources to support pathways out of homelessness (Galperin, Bar, and Nguyen 2021; Rhinesmith 2024; Polson et al. 2024).

Digital inclusion, or the lack thereof, has important consequences for people, communities, and society across multiple dimensions of policy and practice. In this report, we focus on the intersections of digital inclusion and education, health, housing, and economic prosperity, which are relatively underexamined in the context of digital opportunity but have transformative influence on individual and community well-being and overall quality of life. As the evidence in this report shows, expanded digital opportunity across each of these domains contributes to improved outcomes at the individual, community, and societal levels.

Develop Infrastructure

The presence of physical infrastructure is the foundational pillar of digital opportunity and inclusion. Recent federal, state, private, and collaborative investments have catalyzed the expansion of high-speed internet infrastructure and technology, but some people and places face persistent gaps in access as well as disproportionate barriers to internet infrastructure, speed, and reliability.

What Does Current Infrastructure Look Like?

Digital infrastructure can vary by internet speed, reliability, and the costs of and barriers to construction. Broadband speed—a standard measure of internet speed defined by the Federal Communications Commission (FCC) as a threshold for download and upload speed—is independent of infrastructure type. As of April 2024, the definition of broadband is a download threshold of 100 megabits per second (Mbps) and an upload threshold of 20 Mbps.[10] Any service provider offering lower speeds than the FCC standard is not considered broadband (box 2). Before the 2024 update, the standard of 25 Mbps download/3 Mbps upload had been in place since 2015.

FIXED AND SATELLITE INTERNET CONNECTIONS

Fixed connections refer to a physical network or connective infrastructure used to deliver internet access to a fixed location, such as a residence or business. The primary types of fixed infrastructure are fiber, cable, DSL, and fixed wireless internet technology.

- **Fiber:** A type of high-speed broadband technology that uses fiber-optic cables to transmit data using light waves. Fiber internet can be very fast, with speeds up to 100 gigabits per second (Gbps) or more.[11]

- **Cable**: Uses fiber to the node or home, coaxial cable from the node to the home and inside the home, and a cable modem to provide internet access, with typical speeds between 50 to 1000 megabits per second or more. [12]
- **DSL:** A "Digital Subscriber Line" internet connection includes multiple technologies that use existing copper telephone lines to transmit data via high-speed internet. Services can be delivered on the same telephone line simultaneously with wired telephone service (Garnett and Johnson 2022). DSL internet is declining in usage with the rise of faster technologies like fiber.[13]
- **Fixed wireless internet:** Uses radio waves transmitted from a cellular tower to a fixed receiver that stays in one place, providing internet access without physical cables. It can be more reliable than mobile wireless, but less flexible. It is often used in areas where wired infrastructure is limited, such as rural areas.[14]

Satellite connections provide broadband access wirelessly through communication satellites. Satellite is not considered a "fixed" connection because the signals travel through space, not a fixed network.

- **Satellite**: In recent years, internet access via satellite has become available virtually everywhere in the United States (figure 3) and can offer download speeds of 200 Mbps or slightly higher as of August 2024.[15] Subscribers can install a satellite dish to receive broadband services at their location from a satellite broadband service provider (Garnett and Johnson 2022). As of 2024, approximately 6.7 percent of Americans use satellite for internet services (FCC 2024a). Satellite services can have a higher lag time in transmitting data than wired infrastructure and can be more costly, but reductions in costs in recent years are projected to continue.[16]

For more about reliability and speed of different connections, see Appendix B.

MOBILE INFRASTRUCTURE

Mobile infrastructure refers to the network of physical and software components that enable portable devices like smartphones and smart devices to connect to the internet. Mobile infrastructure supports internet connection without wired infrastructure, such as during transit or when there is no access to a fixed connection. Mobile infrastructure includes cellular towers, public Wi-Fi, and mobile hotspots.

- **Cellular towers:** Structures equipped with antennas and electronic communication equipment that transmit and receive radio signals and facilitate wireless communication between mobile

devices. Fifth generation, or "5G," towers are the latest advancement in wireless communication technology, providing faster data speeds, increased capacity, and lower latency than older 4G towers. The fastest 5G internet could reach download speeds of 1-10 Gbps, which is as fast as download speeds for fiber internet.[17] However, 5G has a limited coverage area and is still susceptible to interference from obstacles such as buildings, trees, and glass. As of August 2024, approximately 206.4 million people—or 62 percent of Americans—could receive high-speed 5G coverage at home.[18]

- **Wi-Fi:** Wireless networking technology that allows devices such as computers, smart phones and smart devices, and other equipment to connect with the internet.
  - » **Public Wi-Fi** are wireless networks that are available in many public places, such as coffee shops, hotels, airports, libraries, colleges and universities, and public transportation.
  - » **Mobile hotspots** are portable devices that serve as access points for users to connect smart devices to the internet using Wi-Fi. These networks enable convenient connections while on the move. Some mobile hotspots are provided for free through available providers and sometimes include modest amounts of free data.

BOX 2

Who Provides Infrastructure?

- **Internet service providers:** An Internet Service Provider (ISP) is an entity that offers customers the capability of accessing, retrieving, using, storing, managing, or otherwise processing websites and other information on the internet. ISPs can be organized in various forms, such as commercial, community-owned, nonprofit, or otherwise privately owned. They may or may not own the physical digital infrastructure they deploy and maintain.
- **Mobile network operators**: Mobile network operators, also known as mobile network providers, provide wireless communication services to customers. Larger providers own and maintain their own towers and associated equipment and smaller operators often rent access.
- **Private and public Wi-Fi providers and hotspot lenders**: Private businesses and public institutions (e.g., municipalities, libraries, schools) that subscribe to internet services and make free connections available to users to connect in specific, fixed locations or portably via mobile hotspots.

Who Has Less Access to Infrastructure and What Are the Consequences?

Not all people have equal access to digital infrastructure. Notably, although access varies across and within individual communities, recent national-level analysis of broadband infrastructure deployment that meets the 100/20 FCC thresholds found no significant difference in the deployment of high-speed broadband by race or ethnicity of communities (census block groups), except for Native American communities. Overall, fewer than half of Native Americans living on reservations nationwide have access to any broadband technology (Garnett, Jeffrey, and Johnson 2024, Galperin, Le, and Wyatt 2021; Skinner, Levy, and Burtch 2024; Early and Hernandez 2021; Fenner et al. 2024).

Among different infrastructure types, cable broadband is widely accessible, while fiber-based broadband is less available in some lower-income communities and those with majority-Black and Hispanic/Latine residents (Garnett, Jeffrey, and Johnson 2024). These findings are consistent with another, earlier study of census blocks in Los Angeles. Authors analyzed data from 2014–2018 and found both internet service provider competition and fiber access were less common in low-income areas and in communities of color, especially Black communities (Galperin, Le, and Wyatt 2021).

Many rural and Native American communities experience the largest geographical digital divide in access to high-speed infrastructure, and some urban communities also still struggle. For example, under the FCC's new broadband threshold, not including satellite technology, just 65 percent of people living in rural areas have access to 100/20 Mbps internet technology—far fewer than 97 percent of people living in urban areas (Garnett, Jeffrey, and Johnson 2024). Among different infrastructure types, cable broadband infrastructure is most common in urban areas, with nearly 94 percent of urban residents having access, compared with only one out of every three (36.7 percent) rural residents. Similarly, fiber optic internet is available to approximately one out of every two urban residents, but just one out of every four rural residents have access. Fixed wireless internet is the least available to both groups, but by less than half the rate for rural residents compared with urban residents (36.8 percent for urban populations and 18 percent of rural populations; Garnett, Jeffrey, and Johnson 2024).

Other researchers have found that residents in low-income rural communities tend to have the least choice in broadband internet service providers, with many having access to just one provider. Among Native American households in low-income and rural areas, more than two out of three (68.3 percent) have no access at all (Garnett, Jeffrey, and Johnson 2024). Even without considering rurality or income, Native American communities nationwide still have the least access, with most (55 percent) having no access to a broadband provider (Garnett, Jeffrey, and Johnson 2024).

Tribal communities often face unique challenges to developing digital infrastructure, including inadequate resources and funding, geographical barriers, and higher costs associated with lower-density community settlement patterns that are more common to rural tribal communities (Korostelina and Barrett 2023). Deploying middle-mile infrastructure (which includes broadband infrastructure that does not connect directly to an end-user location)—such as buried fiber and copper cables, utility poles, and cellular towers —is particularly challenging in rugged, isolated geographies, including many tribal lands (Buiquy 2022). Complex terrains can also have important cultural, spiritual, or other sacred value (Korostelina and Barrett 2023). These challenges contribute to findings that tribal households are nearly twice as likely to access the internet exclusively through cellular data plans, and five times likelier than other groups to access the internet exclusively through satellite internet, which often have slower speeds and can be less reliable compared with wired technologies (Bauer, Feir, and Gregg 2022).

Researchers have also found that people living on tribal lands that are restricted to cellular access can experience problems completing online forms and processes and enrolling in public benefits such as Social Security and Supplemental Security Income for those with disabilities (Butrica, Mudrazija, and Schwabish 2023).

What Supports Infrastructure Development?

The most common strategies to support infrastructure development involve siting new or improving existing broadband infrastructure. Numerous federal programs have made historic investments in recent years (figure 1; box 3).

BOX 3

The Broadband Equity Access and Deployment Program

Authorized through the Infrastructure Investment and Jobs Act of 2021 and administered through the National Telecommunications and Information Administration (NTIA), the Broadband Equity, Access, and Deployment Program (BEAD) provides $42.45 billion in block grants to states and territories to fund planning, infrastructure deployment, and adoption. BEAD marks the first time in history that the US government has provided funding to states for these specific purposes.[19] Funding can support infrastructure deployment and upgrades, broadband data collection and planning, device provision to promote broadband adoption, digital equity program and investments, and reduced-cost internet access to multifamily housing units.

As of the first quarter of 2025, the program is in the mid to late stages of implementation as states and eligible grantees process their multistage application packages. Initial proposals outline how each

applicant entity will invest awarded resources. NTIA has approved all of the initial proposals, which has provided states access to at least 20 percent of their allocated funds to begin competitive bidding activities. Applicants' final proposals must detail information about the proposed investment outcomes, their subgrantee selection process, and how the applicant will ensure universal coverage. As of the first quarter of 2025, 55 eligible entities, including all 50 states, have completed all application phases.[20]

A key innovation of the BEAD program is its emphasis on community engagement. BEAD prioritizes investments in projects and plans that feature public-private collaborations, that actively involve local partnerships, and that prioritize community-driven projects. BEAD projects identify needs in different communities and regions and tailor solutions to ensure that the broadband infrastructure and connectivity plans effectively address local challenges and needs. Key to this process are deep outreach efforts to understand digital literacy needs and investments in training to empower people to use the internet effectively.

STATE AND LOCAL PROGRAMS

State and local programs as well as cooperative and public-private partnership initiatives are also effective in supporting investments to expand digital infrastructure. For example, since 2013, the Wisconsin Broadband Office has invested over $74 million in expanding high-speed internet access, funded primarily through the Universal Service Fund. The Universal Service Fund is a federal fund that helps people and communities across the United States access telecommunications services at reasonable rates and is paid into by telecommunications service providers. One study assessed the impact of expanded fiber internet on home values in Wisconsin between 2013 and 2017, finding that subsidized fiber internet expansion increased a home's value between 1.02 percent and 5.25 percent (Wolf and Irwin 2024). Researchers found that this translates into a price premium between $1,924 and $9,956 for the average Wisconsin homeowner and that across the state, this represented more than $250 million in home value growth (Wolf and Irwin 2024).

Other states and municipalities invest through different incentive, partnership, and financing pathways. Some states offer priority points to developers that include high-speed internet infrastructure in their plans when applying to develop affordable rental housing through the federal low-income housing tax program.[21] In California, collaboratives between school districts, municipal governments, and private entities incentivize broadband access. For example, in Imperial County, the Imperial Valley Telecommunications Authority—a collaborative of 35 agencies including K–12 school districts, city governments, the Imperial County Office of Education, Imperial Community College, and San Diego State University—established a fiber optic network to provide network and internet services to over 120 educational and public agencies throughout the county. In 2017, the county launched a

pilot program to create a 4G network to bring high-speed wireless internet to students across local school districts (Hayes, Gao, and Hsieh 2021).

In Fresno, California, the school district leveraged its fiber internet backhaul—the network infrastructure that connects smaller local networks, such as cellular towers or Wi-Fi access points, to a larger core network—as platforms to deploy a private high-speed internet service to students. During early stages of implementation, the district deployed high-speed internet at 15 "school-facilities-as-towers," covering approximately 20 square miles and supporting more than 6,500 student connections (Hayes, Gao, and Hsieh 2021).

MOBILE WI-FI LENDING PROGRAMS

For individuals and households that are underserved by infrastructure or who cannot connect in their homes for other reasons, mobile Wi-Fi lending programs can help support internet connections. These programs are particularly beneficial for students, rural residents, and people experiencing homelessness. For example, participating college students in Montana State University's hotspot lending program—which was created to help expand internet connections for students who lacked access because of cost, availability, or other reasons—reported that the program supported them in coursework and program success (Salsbury and Hansen 2022).

Mobile hotspots for people experiencing homelessness and vulnerable clients of nonprofit social service providers can also support social connections, enhance safety, and increase access to basic needs and services (Rhinesmith 2024). For example, researchers found that mobile Wi-Fi hotspots helped to reduce stress and anxiety for people experiencing homelessness. Study participants reported concerns that without the connective devices, they were worried they could not otherwise be located by providers and loved ones. They also reported that the hotspots helped them feel more connected, and as a result, safer, in unhoused conditions despite other challenges such as poor weather or lack of electricity (Rhinesmith 2024).

COMMUNITY-LED PLANNING

Community-led planning can ensure that infrastructure investments are tailored and responsive to local needs (box 3). Researchers note that policies are most effective when they take local contexts into consideration and align resources with needs (Hecker, Spaulding, and Kuehn 2021). For example, the Digital Equity Act of 2021 supports state digital equity plans focused on helping meet specific community equity gaps based on local contexts and needs. Other programs, such as the Indiana Broadband Ready Communities Program, prioritized and amplified local input, meeting the goals of

tailoring broadband implementation to local priorities and needs. The program gave rural and low-income communities $50,000 toward broadband development and supported community stakeholders to coproduce a vision of the future of broadband in their communities, including determining different locally relevant and appropriate pathways for how that vision could be achieved (Zoccola and Borissov 2022).

Get Connected

Once digital infrastructure is in place, getting connected to the internet and digital networks through computers, phones, and smart devices is the next pillar of digital opportunity and inclusion. Getting connected requires that digital infrastructure exists; that stable, reliable internet connections are available; and that internet services and devices are affordable or otherwise accessible for potential users.

Getting connected is not a binary status, such that individuals have either achieved or nor achieved it. Rather, some researchers conceptualize "getting connected" as a spectrum of access, understanding that even if subscriptions, services, and devices are available, disruption via technology breakdowns, maintenance issues, quality gaps, affordability barriers, and service and connectivity delays or challenges can result in worse connectivity and uneven outcomes for the people and communities most affected (Gonzales, Calarco, and Lynch, 2018).

What Does It Mean to Be Digitally Connected?

"Digital adoption" refers to processes of gaining access to and actively using the internet by individuals, businesses, and other subscriber entities and integrating the internet into their operations and lives.

Adoption is not solely a matter of access. Internet connections may be present and available, but whether and the extent to which users opt in can vary by intensity—for example, frequency of use—as well as by subscription and device characteristics (see Appendix C). For example, researchers cite related factors that make digital access less affordable and drive the digital divide beyond whether physical infrastructure is deployed, including socioeconomic factors. They also find that geographical disparities and technology deployment costs can influence access, such that providers make decisions on where to fund deployments based on profit and cost calculations, which can result in areas where it is more costly to deploy having less access to service (Reddick et al. 2020).

The NTIA internet use survey collects annual data to report on related trends in internet usage and identify areas where use is limited to inform policy decisions aimed at closing the digital divide (Appendix C). Data show that many people report using the internet at home through residential subscriptions, while others only use the internet through public access connections such as public Wi-Fi. For those that use the internet at home, household subscription characteristics can also vary, including in-home service subscriptions to fixed infrastructure, or household cellular service plans to connect to mobile infrastructure. People living in apartments or public housing may also subscribe to building-level or community-level subscription options, which can be provided through wired or wireless infrastructure.

Device characteristics also play a role. For example, the quality of devices—such as desktop computers, laptops, tablets, smartphones, smart home devices, wearables, etc.—can significantly impact people's ability to use the internet by affecting factors such as processing speed, screen clarity, battery life, and connectivity. This can directly influence how efficiently and comfortably users can access the internet and interact online, especially for tasks requiring high performance or extended usage periods.[22]

What are the Barriers to Getting Connected and Why?

There are numerous barriers to establishing adequate digital connections, including lack of available services, unaffordable subscriptions and devices, lack of choice or control over internet connections, and lack of interest—and some populations face greater barriers than others. Many people can face precarious connectivity and digital access instability, including people of color, people with low incomes, people who are limited to smartphone connections because they lack high-speed internet at home, people living in rural areas, people without digital connections and devices they can control, people experiencing homelessness, and many justice-impacted populations. We explore some of the factors associated with digital connectivity below.

RACE AND ETHNICITY

Race and ethnicity are significant predictors of in-home broadband internet subscription. Data from Pew Research's 2023 internet use poll show that fewer Black (68 percent) and Hispanic/Latine (75 percent) adults reported in-home subscriptions than Asian (84 percent) or white adults (83 percent).[23] According to 2024 Census reporting, only 71 percent of households who identify as American Indian or Alaska Native and live on tribal lands have an internet subscription of any kind other than dial-up, including fiber, cable, cellular, and satellite.[24]

INCOME AND OTHER ECONOMIC CHARACTERISTICS

Income and other economic characteristics are also associated with connectivity. Income also tracks with in-home subscription rates nationally. In 2023, just 57 percent of adults with annual household incomes less than $30,000 reported in-home subscriptions, whereas the significant majority of adults (95 percent) earning over $100,000 did.[25] These gaps have persisted across time, and although affordability has increased, it remains a barrier for some households. For example, Black and Hispanic/Latine adults surveyed by the Pew Research Center were twice as likely to have canceled or cut their internet service subscriptions because of financial strain than those identifying as white (Vogels et al. 2020; Early and Hernandez 2021). Similarly, among a small group of Native American postsecondary students in North Dakota, researchers found that the cost of internet access at home was too high relative to other needs (Fenner et al. 2024).

Economic outcomes more broadly are also associated with digital connectivity. For example, industry and business productivity in rural communities can lag without high-speed infrastructure. As technology advances, broadband is part of the necessary infrastructure rural communities need to participate in the global tech economy, and essential to tech-based economic development. Without it, rural communities will struggle to achieve local wealth creation and quality tech employment.[26] Researchers used internal data that broadband providers submitted to the FCC detailing internet connections by subscription speed to examine farm production expenses and crop yields from USDA's Census of Agriculture. They found that farm productivity may receive a boost from the installation of broadband infrastructure (LoPiccalo 2022).

SMARTPHONE DEPENDENCY

Smartphone dependency is a barrier to adequate digital connection. Approximately 15 percent of US adults are smartphone dependent, meaning they do not have a high-speed home broadband service at home and rely on a mobile phone to access the internet.[27] This can present multiple challenges to effectively using the internet. For example, smartphone screens have limited screen space for more complex online tasks; smartphone data-usage caps can limit users' online activity; older and more limited smartphones may have slower processing speeds and difficulty with file uploads and downloads; and smartphones offer a limited typing experience and limited access to certain features that are better suited for larger screens. Smartphone dependency can indicate greater challenges in reliably using the internet for different populations. For example, a higher proportion of Black (21 percent) and Hispanic (20 percent) adults were smartphone dependent in 2023, as were approximately one out of every four adults earning less than $30,000 annual household income. Adults living in rural (18 percent) and urban

(17 percent) communities also had higher rates of smartphone dependency than their suburban counterparts (11 percent).[28]

A study of patrons, internet users, and staff at libraries in the midwestern US found that people without internet access at home can experience figurative "digital home-lessness" (Comi et al. 2022), meaning that are often excluded from accessing the internet and digital technology, and experience barriers to participating in the online world. People who experience literal homelessness also commonly rely on public Wi-Fi locations such as libraries, mobile hotspots, and older devices to access the internet, leaving many of them vulnerable and disconnected when access and charging points are closed or they experience technical difficulties (Galperin, Bar, and Nguyen, 2021; Rhinesmith 2024).

Issues related to smartphone dependency can be particularly burdensome for people experiencing homelessness. For example, despite programs to disseminate smartphones, issues relating to phone quality, data availability and affordability, charging infrastructure, device theft, and digital literacy (especially among older adults) may limit the connectivity benefits of smartphone use (Polson et al. 2024; Galperin, Bar, and Nguyen 2021).

SETTLEMENT PATTERNS AND GEOGRAPHY

Spatial settlement patterns and geography are key predictors of connectivity. For example, in-home fixed internet subscriptions tend to be highest in the suburbs (86 percent) and substantially lower in urban areas (77 percent) and rural communities (73 percent).[29] Rural households also depend more on less-reliable connections than people living in urban and suburban areas: they are more likely to rely on wireless internet and satellite connections (Wilmoth 2019; Boik 2017) and are more likely to be smartphone dependent (Pew 2024). An earlier study preceding the new 2024 broadband speed update used 2014–2018 US Census Bureau American Community Survey data to more deeply examine rural subscription disparities by race and ethnicity. Researchers found that rural census tracts with high percentages of Black residents tended to have lower rates of high-speed wired internet adoption, particularly in isolated rural tracts. The rural tracts with lowest high-speed internet adoption rates tended to be spatially clustered in the Southeast, Southwest, and northern plains (Zahnd, Bell, and Larson 2022).

Researchers have found that gaps in infrastructure access likely explain some, but not all, of the divide in adoption between rural and nonrural areas (Mills and Whitacre 2003; LaRose et al. 2007). Other factors that are linked to lower adoption rates include income and age, with low-income households and older people less likely to subscribe to available internet services (Zahnd, Bell, and

Larson 2022).[30] These populations account for a relatively higher share of the population in rural areas, which may also partially explain why adoption rates in rural areas tend to be lower.

DEVICE ISSUES AND QUALITY

Device issues and device quality, including low-quality or limited devices, are barriers to getting connected. For example, in a study of families engaging in remote learning during the COVID-19 pandemic, researchers found that among Hispanic/Latine households, 32 percent did not have enough computers for their children to use, and 35 percent faced technical problems connecting to the internet. They also found that 17 percent of Black households did not own a computer at all (Cruz 2022). Similarly, in a study of Native American postsecondary students, researchers found that even when internet access at home was available, most students still did not have adequate devices or related supports to effectively service or use them (Fenner et al. 2024). Among people experiencing homelessness, lack of access to safe and reliable device charging has been found to disrupt their "reachability," and thereby diminish options to transition out of homelessness by limiting their ability to gain and sustain employment, connect with health care providers, and maintain personal support networks (Galperin, Bar, and Nguyen 2021).

PROVIDER CHOICE

Provider choice can be a key factor associated with adoption of home internet subscriptions (Silva et al. 2018). However, the number of choices can vary with area population characteristics. For example, in a study of home subscription adoption, researchers found that where high-speed internet was available, census tracts with more educated, wealthy, and older people had more choices of internet providers and higher fixed broadband subscription rates compared to tracts with less educated, lower-income, and younger people (Silva et al. 2018). Provider choice has improved in recent years with the expansion of satellite internet technology (figure 3). Although satellite costs are declining, in many rural areas—especially geographically remote regions where only expensive satellite or mobile plans are available—the expense of a connection can still be prohibitive. Rural areas and high-poverty areas also commonly have fewer ISPs for subscribers to choose from because it is less profitable to build and maintain infrastructure across large distances with a lower population density (Garnett et al. 2024). This results in fewer companies willing to service rural areas and reduced consumer choice.[31]

OTHER BARRIERS

Persistent challenges and lack of interest are durable barriers to getting connected for some populations. Some groups face abiding barriers that can depress interest in or ability to get connected. In many urban

areas, numerous affordability programs—which help low-income households pay for internet services and connective devices—help households to get connected at reduced rates. Yet NTIA survey data shows that a durable share of people who do not use home internet say they simply do not need it or are not interested. Indeed, approximately 71 percent of adults without home broadband report that they are not interested in having it in the future (Perrin 2021). Other recent analyses show that as home internet adoption rates rise, the share of nonadopters with lack of need or interest rises, and the share citing affordability challenges falls. This may make it challenging to close the adoption gap and underscores the need to address complex adoption barriers beyond affordability.[32]

Other adoption barriers may be related to feelings of limited self-efficacy, comfort, other psycho-social barriers, as well as yet unestablished explanations. For example, transient, housing insecure, and digitally disconnected people may lack the means or motivation to get connected, including students that move frequently with their families, people experiencing homelessness, and justice-impacted populations. In New York, as many as 114,000 unhoused and highly mobile students are unable to access consistent broadband internet because they lack a permanent address (Chandra et al. 2020). Many people who have been incarcerated for long periods—especially since before widespread internet access or the development of smart devices, as well as older people who are incarcerated—can be hesitant or lack motivation to use digital and connectivity services that may be available. This can present reentry challenges and exacerbate social exclusion and isolation (Badejo, Chakraborty, and Forbes, 2024).

Onerous or complicated internet program applications and requirements can be cumbersome and inaccessible, contributing to depressed internet adoption for some people. This is particularly true for people without existing internet access, with low digital literacy skills, or with low English proficiency. For example, researchers found that limited enrollment in some subsidized internet and device programs by eligible participants was largely due to factors such as skepticism about the quality of free internet, the complexity of the subsidy programs, and structural challenges such as language barriers (Goodchild et al. 2021).

In carceral settings, internet service models, poor infrastructure, and device quality are common barriers to accessing the internet. In US prisons and jails, every aspect of digital infrastructure and access—including broadband fiber, network wiring, and telecommunication hardware and software—is usually owned by single, private vendors. Bundling infrastructure and related services enables vendors to create artificial barriers for competitors, separate price from cost, and provide low-quality service.[33] In prisons and jails, the contracting corrections agency—not the end user—is the customer, and many internet providers and digital technology vendors are encouraged or allowed by corrections agencies to levy onerous pay-

per-use or pay-per-access fees that disproportionately burden low-income people who are incarcerated (for example, charges for sending and receiving text messages, charges for sending email, charges for sending email attachments, charges for using internet time, as well as tuition fees for online learning programs). The preferred or exclusive provider and technology vendors also often provide simplistic or throttled devices that restrict users' ability to meaningfully navigate the internet, find information, or use online digital services and resources.[34] This often results in excessive rates and egregious fees to access and use digital services, which are paid for by justice-impacted populations and their loved ones.[35]

What Helps People Get Connected?

Effective strategies for increasing connectivity include subsidies, policies, and regulations to lower costs of connections and expand access to underconnected places and populations, such as low-income families, residents of federally subsidized housing, people experiencing homelessness, and justice-impacted populations. Other strategies include expanding connectivity within communities to help people get connected beyond the home, often through existing institutions, providers, and partnerships—as well as culturally responsive community and social supports to help people get connected.

FEDERAL AND STATE PROGRAMS AND POLICIES

Numerous federal and state programs and policies have made substantial investments to help unconnected and underconnected people and communities get connected (figure 1). Although comprehensive evaluations of outcomes and impacts have not been conducted for most programs and policies, evidence from some programs and investments point to impacts.

- **ConnectHomeUSA Program (2015).** The ConnectHome program was launched as a pilot program in 2015 by the US Department of Housing and Urban Development (HUD) to reduce the digital divide for HUD-assisted residents by funding public housing agencies and corporate and nonprofit partners to provide affordable internet, devices, and digital-skills training services. By early 2017, the program reported a 25 percent reduction in unconnected public housing households with children in grades K–12 (US Department of Housing and Urban Development and EnergyOn, n.d.). A study of ConnectHome participants also found that school-age children used the internet and tablets provided by the ConnectHome program to meet their educational needs and that having internet access in the home enabled parents to keep better track of their children's school activities and monitor academic progress (US

Department of Housing and Urban Development 2018). Since its inception, HUD reports that the program has deployed more than 30,000 devices, established more than 72,500 in-home internet connections, and convened hundreds of digital literacy trainings.[36]

- **Affordable Connectivity Program (2021)**. The $14.2 billion Affordable Connectivity Program (ACP) was the largest internet affordability investment in US history, authorized through the 2021 Inflation Reduction Act to support eligible low-income households struggling to afford monthly internet service.[37] The program offered subscription discounts of up to $30 per month for internet service and up to $75 per month for people on tribal lands, as well as a one-time $100 discount for connective device purchases. The program could also be used to provide free or greatly reduced mobile voice and data plans to individuals experiencing homelessness. Participants received monthly subsidy payments for their internet bills through their service providers. The program expired May 2024 because Congress did not provide additional funding, resulting in 23 million households losing benefits. Research suggests the ACP had a positive impact on both broadband and device adoption among low-income households (Galperin and Bar 2024).

With the end of ACP, many of its program benefits likely will not be sustained; however, there are a growing number of state efforts to continue connectivity subsidy programs (box 4).

BOX 4

State Strategies to Subsidize Connectivity Losses after the Affordable Connectivity Program Ended

In 2024, some state lawmakers began to strategize opportunities to resolve emergent funding gaps and redefine eligibility for subscribers who would be affected by the end of the Affordable Connectivity Program. For example, lawmakers in New York, North Carolina, and Pennsylvania, are considering establishing new broadband subsidies. Other states, such as California and Oregon, are investigating ways to increase funding for their state-operated Lifeline subsidy programs in order to supplement the $9.25 monthly discount offered by the federally operated Lifeline program. Lawmakers elsewhere are considering ways to replicate the BEAD low-cost option provision and require ISPs under contract with their state to provide plans at a state-determined affordable price.

PRIVATE SECTOR PROGRAMS

Multiple private sector programs have expanded connectivity by subsidizing or supporting internet subscriptions and devices, including the following.

- **Comcast Internet Essentials** (IE). The Comcast IE program was established in 2011 as a voluntary three-year commitment by Comcast before its merger with NBC Universal. The program has continued past the initial commitment and is available to anyone living in an area with Comcast's Xfinity Internet service who qualifies for federal low-income programs like Medicaid, the Supplemental Nutrition Assistance Program, housing assistance, or the National School Lunch Program. IE has two tiers, $14.95 per month for 75/10 Mbps internet service and $29.95 per month for 100/20 Mbps internet service, both with no activation fees, and no equipment rental fees.
- **Spectrum Internet Assist**. The Internet Assist program is Spectrum's broadband access program for eligible low-income households. The program was introduced by Charter Communications, the parent company of Spectrum, in 2016. The program costs $14.99 per month for qualifying households. To qualify, a member of the household must receive benefits from at least one of the following programs: the National School Lunch Program, the Community Eligibility Provision of the NSLP, or the Supplemental Security Income (SSI) program (age 65 and over only). The program provides a Wi-Fi connection with a router, a modem, parental control functionality, and security services.
- **Cox Connect2Compete**. Cox's Connect2Compete broadband internet access program has been providing low-cost internet and Wi-Fi service to families with K-12 students since 2012. The program is intended to help families afford internet access to support homework, email, social networking, and monitoring web activity. The program costs $9.95 per month for qualifying customers, with speeds up to 100 Mbps download. One Wi-Fi modem rental is included, but equipment must be returned when service is canceled. Eligible households must have at least one child in grades K–12 who is enrolled in a qualifying government assistance program, such as the National School Lunch Program or Supplemental Nutrition Assistance Program.
- **Mediacom Connect2Compete**. Since 2017, Mediacom has provided low-cost internet services for qualifying households through their Connect2Compete program. Subscriptions cost $9.95 per month plus tax, and are available to low-income families with at least one K-12 student who qualifies for the National School Lunch Program. Subscriptions include Wi-Fi connections and provide up to 25 Mbps download speeds at home. There are no upfront deposits or equipment rental fees required.
- **Midco Lifeline Assistance Program**. Midco's Lifeline Assistance program provides a discount on internet and home phone services for eligible low-income households in Midwestern states

in Midco's service area. Eligibility and rates are based on income. The program provides a monthly discount of up to $9.25 for qualifying households, and households on tribal lands may receive up to $34.25 per month.

Some scholarly analyses of the Comcast Internet Essentials program—launched in 2011 and among the first of these programs—have found evidence of substantive program impact. Many of the other private-sector programs are newer, or their impacts have not been independently evaluated. Rosston and Wallsten (2020) estimated that approximately 66 percent of Comcast's IE program subscribers represent true increases in adoption by low-income households as a result of the program, with the remaining subscribers being from households that switched from a competitor or that would have subscribed as part of a general upward trend in adoption. Other researchers found significant effects for IE impacts on the labor market, such that the employment effect of enrolling in IE was approximately 8.1 percentage points, with a lower bound of 2.1 percentage points (Zuo 2021). These researchers also found that IE program availability increases household incomes by $147 and that the program benefit to enrolled households is approximately $2,202—or more than four times the estimated cost to provide the service (Zuo 2021). Evidence also shows that IE has helped people with disabilities access critical social services. Researchers found that participation in Social Security Disability Insurance and Social Security Insurance programs increased in areas where the Comcast IE program was available, especially in communities with fewer Social Security Administration offices that could support in-person program applicants. Researchers found that participation in IE significantly increased Social Security Disability Insurance participation by approximately 1.7 percentage points in areas where it was available (Zuo and Powell 2023).

LOW- OR NO-COST DEVICE PROGRAMS

Other strategies to support connectivity center around providing devices at low or no cost. These strategies can be particularly beneficial for underconnected populations such as some veterans, people experiencing homelessness, and justice-impacted populations. For example, among over 5,000 veterans living in HUD Veterans Affairs Supportive Housing who received a video-enabled tablet or cell phone during the COVID-19 pandemic, in-person and video engagement with health care providers at the US Department of Veteran's Affairs increased by an average of 1.4 in-person visits and 3.4 video visits approximately six months after receiving the devices (Wray et al. 2022).

Another example is the Lifeline Assistance program, which provided free smartphones beginning in 2008 to people experiencing poverty. Through the program, unhoused people could pick up a smart phone at retail locations by showing some form of personal identification (Polson, Botta, and Van

Houweling 2024). In carceral settings, competitive bidding processes paired with bidding incentives for prisons and jails can be used as a public policy instrument to regulate competition for both internet infrastructure, services, and devices, especially in the context of prison technology (Arguelles and Ortiz-Luis 2021).

COMMUNITY-LEVEL PROGRAMS

Sponsored service agreements allow a single financial sponsor—such as a school district, county, or other entity—to sponsor and process internet payments for multiple low-income households. Certain sponsored service offerings have specific eligibility requirements. The most common criterion is that families must qualify for at least one public assistance program, which may include programs like the National School Lunch Program, housing assistance, Medicaid, Supplemental Nutrition Assistance Program (SNAP), or the Social Security Income (SSI) program.[38] Since the COVID-19 pandemic, the model has become more prevalent across school districts to ensure that low-income students have reliable access to remote learning.[39]

Leveraging existing digital infrastructure to expand connectivity through community institutions such as libraries, schools, and multifamily buildings can help increase individual connections. Evidence suggests that both strengthening community-level connections, such as providing Wi-Fi in community rooms of affordable rental housing communities, and establishing connections at personal residences can strengthen connectivity (Harris, Judge, and Burger 2022). These investments can be particularly beneficial for students, affordable housing residents, and people experiencing homelessness.

For example, schools can increase student connectivity and success by allowing students on campus before and after school, extending the reach of school-provided Wi-Fi to school parking lots, and installing Wi-Fi hotspots on school buses. These investments will both expand the physical footprint of digital access for students as well as help reduce the amount of time needed to complete online homework, which in turn helps promote student success in homes with limited or lacking in-home connectivity (Evans 2019). Libraries can also play a critical role in bridging digital gaps and fostering digital literacy by providing or extending the reach of their digital connections (Wang and Si 2024). And for affordable housing residents, evidence suggests building-wide internet and internet hotspots are promising approaches to help alleviate the lack of connectivity in many affordable multifamily buildings (Ellison-Barnes et al. 2021).

Culturally and socially relevant community supports can help increase digital connectivity for individuals and households. Evidence shows that having others around who are using the internet helps people use the internet more frequently themselves, which can in turn help drive adoption by increasing self-

efficacy and comfort with technology. Multilingual and linguistically accessible information about how to get connected and obtain devices can also help those with limited English proficiencies. For example, health care organizations can expand screening and referral processes that provide patients who are less proficient in English with accessible information in their preferred language on how to obtain access to the internet or devices (Rodriguez et al. 2021).

Learn Skills

Once digital infrastructure is deployed and people are able to get connected, digital skill-building is the next pillar of digital opportunity and inclusion (Sheon and Khoong 2024). Even if broadband infrastructure is present and users are able to establish connections, lack of digital literacy may prevent people from using and benefiting from digital technology (Li et al. 2023). Education, learning, and training opportunities are often necessary to acquire both foundational and advanced skills (Sheon and Khoong 2024).

What Does It Mean to Learn Digital Skills?

Learning and applying digital skills involves learning to use digital devices, applications, and networks to access, manage, create, and share information online. According to the Digital Literacy Taskforce, a person with digital literacy skills:

- possesses the variety of skills—technical and cognitive—required to find, understand, evaluate, create, and communicate digital information in a wide variety of formats;
- is able to use diverse technologies appropriately and effectively to retrieve information, interpret results, and judge the quality of that information;
- understands the relationship between technology, lifelong learning, personal privacy, and stewardship of information;
- uses these skills and the appropriate technology to communicate and collaborate with peers, colleagues, family, and on occasion, the general public; and,
- uses these skills to actively participate in civic society and contribute to a vibrant, informed, and engaged community.[40]

BASIC AND ADVANCED DIGITAL SKILLS

Basic digital skills include using digital devices, finding information online, and communicating using digital tools. For example, examples of basic skills include turning on a device, keyboarding, mousing, navigating a computer desktop, typing, and word processing. Basic skills related to finding information online involve using a digital device to connect to the internet, open a browser, and execute search queries. Basic communication using digital tools involves using a cellular phone for calling and text messaging, using smartphones or tablets, and using email, messaging applications, and social media. Other skills such as using assistive technology to make devices easier to use are foundational to effective use of digital devices and services for people with accessibility and/or mobility challenges. Basic skills may present varied levels of difficulty for people with different literacy and numeracy levels.

Advanced digital skills include skills and knowledge that allow people to use advanced tools and strategies to take on more complex digital tasks and challenges. They can be useful in many technical and nontechnical career paths, including marketing, design, information technology, project management, and data science. Examples include creating digital content and data visualizations, video editing, and creating websites and digital applications, including creating advanced website navigation to allow users to make purchases or conduct business. Advanced digital skills are also used to track and manage projects, to do bookkeeping, and to manage proprietary industry or financial information. Coding (e.g., using HTML, CSS, JavaScript, jQuery, Bootstrap, Python, or R) and robotics are also advanced digital skills.

METHODS OF LEARNING DIGITAL SKILLS

There are multiple ways to learn digital skills, such as through digital navigator programs. Digital navigators help people learn how to use technology, access the internet, and develop related digital skills. They are often affiliated with local or regional organizations such as educational institutions, nonprofits, or government agencies. For example, The ExCITe Center at Drexel University, designed to help address Philadelphia's digital divides across racial and economic lines, works with other nonprofit organizations to collect, refurbish, and distribute computers to community members at no cost. Digital navigators can provide information about low-cost internet plans and hotspots and offer training and support for using computers (Gonzalez and Sharma 2021). Similarly, in Minnesota, Literacy Minnesota deploys digital navigators to help learners with basic digital literacy skills, such as using electronic devices, accessing the internet, using Zoom, and finding resources and supports online to help meet their needs.

Digital-skills training classes and certification programs are another avenue to learn digital skills. Both basic and advanced digital skills can be learned through hands-on training, whether on the job, through apprenticeships, or through some other form of exposure. They can also be learned through formal instruction and technical coursework. Digital-skills training programs teach people how to use technology and develop a digital mindset to learn and adapt to new technologies. These programs can be offered to individuals, youth, employees, or the general public and can include a variety of activities and modalities, such as online courses, workshops, certifications, project-based learning, and school or educational-based learning. Many advanced digital skills credentialing can be taught through specialized training and certification programs such as Microsoft Certified Fundamentals, Microsoft Office Specialist, and IT specialist.

Examples of digital-skills training programs are vast. The National Digital Inclusion Alliance (NDIA), for example, is a nonprofit with over 600 affiliated organizations advocating for digital inclusion in the United States. NDIA identifies, creates, and shares resources and tools for digital inclusion programs and supports digital inclusion practitioners and advocates on the ground. They also conduct, support, and promote research that informs public understanding and policy related to digital inclusion. NDIA's Digital Inclusion Trailblazers program sets a national standard for digital inclusion work, including an honor roll for local governments that achieve Trailblazer status.

Some programs combine both digital navigation and digital training support. The Rural LISC pilot Digital Navigator program, for example, helps people in rural communities access technology and develop digital skills to participate in the economy, society, and their communities through digital means. The program provides individualized support to help people access affordable internet subscriptions and devices, learn how to use digital services, build digital skills, and access resources for online courses and other opportunities. Rural LISC's Digital Navigator program is also optimized to complement (rather than duplicate) training services that other organizations already provide, including Community Action Agencies, Financial Opportunity Centers, Affordable housing organizations, and Human services agencies.

Programs may also be tailored for specific groups or learners. For example, The Digital Skills Youth Academy (DSYA) helps underserved youth develop the technical skills they need to succeed in the digital economy. For example, DSYA's Earn-While-You-Learn program prepares students for college, internships, or apprenticeships while still in high school. Their curriculum combines coding, computational literacy, digital media skills, and job skills. DSYA students work on real-world projects that teach them problem-solving and critical thinking skills. The program builds career pathways to economic mobility by closing skills gaps.

Similarly, the Fortune Society offers a variety of digital-skills training programs for formerly incarcerated people. Their Grow with Google Career Readiness for Reentry program is a partnership between Google and five nonprofit organizations that provides free digital skills and job readiness training. The program organizes content and training by key learning paths, including Getting Started with the Basics, Job Search, Online Safety, and others. The program also offers one-on-one coaching to help prepare for job interviews and develop resumes.

The Fortune Society's Digital Equity Program also offers technical support and training sessions to help participants develop digital skills, promote digital safety, and gain agency over their digital identities. Some of the classes offered include an introduction to computers, PowerPoint, Word, Excel, and Outlook. They also offer a six-week bootcamp to teach social media, digital literacy, and how to create and curate a LinkedIn profile.

Other programs are designed to "train the trainers." The Goodwill Career Coach and Navigator Professional Certificate program is a four-course program that teaches people how to help others navigate their careers. The certificate is offered by Goodwill Industries International and Coursera. The program provides training for people who would like to become a career coach or navigator by improving their ability to support people in building skills and advancing careers, and prepares them for jobs in career coaching, career navigation, and career counseling.

Who Might Face Challenges Learning Skills and Why?

Not all people have equal access to resources, supports, or training to learn and practice digital skills. Some people may face complex barriers that affect their ability to learn these skills. For example, older adults and people disconnected from regularly using digital technologies, such as those experiencing incarceration or homelessness, are less likely to have confidence about learning new skills and may experience technology anxiety. Barriers may also differ by gender, race and ethnicity, and language.

OLDER ADULTS AND SOME YOUTH

Older adults face unique challenges when it comes to learning digital skills, and some youth do as well. A 2022 AARP survey of 3,000 older adults found that most would like to use technology more but many felt it was not easy to figure out what technology to use and it was too complex and difficult to learn.[41] Disparities in technology adoption and use are particularly pronounced among older adults compared with other age groups and are even greater among low-income older adults (Singh et al. 2020; Marston, Shore, and White 2020). Some evidence suggests that internet use among low-income older adults may

be as low as 17 percent (Czaja et al. 2018). For older adults still in the workforce, low confidence can hinder the use of technology for developing critical workforce skills and ageism in the workplace can deepen doubts that they can learn new skills (Hecker, Spaulding, and Kuehn 2021).

Youth who are disconnected from education and work tend to have lower digital skills. This "disconnected status" is negatively correlated with digital skill levels for all youth and across all racial and ethnic groups (Hecker and Briggs 2021).

PEOPLE EXPERIENCING HOMELESSNESS AND INCARCERATION

Barriers to learning digital skills are high for people experiencing homelessness and incarceration. People experiencing homelessness may not have the digital skills needed to navigate basic tools developed to support them. For example, in a study of the efficacy of digital resources to support people experiencing homelessness, researchers found that a water, sanitation, and hygiene map published to Google Maps was too complicated for many target beneficiaries to navigate because using it required having a Gmail account, navigating the map application, and understanding how to view and read the information provided (Polson, Botta, and Van Houweling, 2024). Similarly, people who have been incarcerated for long periods—especially since before widespread internet access or the development of smart devices—and older people who are incarcerated can be reluctant to participate in digital skills, education, and employment programs that are available (box 5). This can present reentry challenges and exacerbate social exclusion and isolation for these groups (Badejo, Chakraborty, and Forbes 2024).

BOX 5

Challenges People Experiencing Incarceration Face When Learning New Skills

Multiple studies illuminate challenges that people experiencing incarceration face, including unique contexts for different age and gender groups.

- For incarcerated people, desire and interest in the subject matter are mediating factors for participation and success in digital training programs and improved employment prospects after incarceration. This is especially true for people who have been incarcerated for long periods, and points to the need to make direct, personal connections between program opportunities, topics, and potential economic and workforce benefits for participants to meaningfully engage (Robinson 2024).
- Educational programs targeted to incarcerated women are fewer and more limited than those offered to incarcerated men, despite female inmates having a greater need for unique services on reentry compared with their male counterparts (Emerson 2018; Seo et al. 2020). For previously incarcerated women in particular, confluences of barriers and other life

circumstances and challenges—such as precarious housing situations, child care demands, concerns about ex-partners, privacy concerns, or mental health issues—can disrupt digital-skills training program participation, which may limit other quality-of-life and employment outcomes (Seo et al. 2020).

PEOPLE WITH LOW LITERACY AND NUMERACY SKILLS

Basic literacy and numeracy gaps can be a barrier to digital learning and skill development. This is especially true for English-language learners, people with learning challenges and disabilities, some people of color, and disconnected youth. Gaps in basic literacy and numeracy based on race, ethnicity, and socioeconomic status and educational attainment are well documented (Tate and Warschauer 2022). For English-language-learner students, digital access and literacy challenges are often compounded by language barriers. In many cases, these obstacles associate with negative educational outcomes including knowledge gaps, lower grades, chronic absenteeism, and disenrollment (Workie et al. 2022).

What Helps People Learn Skills?

People learning digital skills benefit from culturally relevant and accessible programs that focus on building confidence using technology. Learning can effectively take place in one-on-one settings, through cohorts, community-wide programs, or online.

CULTURALLY RELEVANT PROGRAMS

Culturally relevant and tailored programs and supports help ensure digital skills are accessible. For example, training programs based on adult learning principles and community supports can motivate skills learning and increase internet use for older adults and residents of affordable housing communities. Onsite digital literacy programs within affordable housing communities that let residents set their own goals, provide accessible and appropriate learning materials, include self-paced learning options, and have human supports available on demand have been found to help residents get connected and build basic digital, financial, and health management skills (Harris, Judge, and Burger 2022). Other, similar pilot programs and studies show promise in increasing digital use among older adults (Ellison-Barnes et al. 2021).

In health care settings, providers and health systems have been successful in supporting patients' digital efficacy by incorporating digital assessments and tailoring services in response to patients' digital literacy levels. This may involve inquiring if patients know how to use smart devices to schedule a doctor's visit; request, access, review, and interpret test results; or communicate virtually with their provider. Handouts, videos, and other resources that walk patients through the steps of using digital devices are also helpful (McCall et al. 2022).

Individuals' contexts and unique life experiences should be considered when designing and delivering digital training, education, and skills programs for incarcerated people and people on community supervision (e.g., probation and parole; Hwang et al. 2024). Especially in the context of reentry programs, targeted and culturally relevant services, training, and supports have been shown to improve participation rates and experiences for justice-impacted veterans, resulting in reduced homelessness and improved reentry outcomes such as employment, housing, and generally navigating the digital world (GSMA 2020).

CONFIDENCE-BUILDING PROGRAMS

Programs that focus on building self-efficacy, confidence, and interest are most effective for those learning digital skills. For example, integrating digital technologies into correctional processes can offer greater autonomy and strengthen self-efficacy for incarcerated people, which can be instrumental in developing digital skills and improving reentry outcomes (Hofinger and Pflegerl, 2024; Knight and Van De Steene 2020). Self-efficacy helps improve training success and, in the longer-term, workforce and employment success for incarcerated people and people on probation and parole (Brown 2020; Nisser et al. 2024; Hwang et al. 2024). And empowering people in prison with choice and self-determination via digital platforms and programs can allow them to engage in educational, training, and therapeutic interventions (United Nations Interregional Crime and Justice Institute, 2024). In broader contexts of workforce development and skills training, teaching job-related digital skills in task-level modules reduces intimidation among participants by making the technology feel less abstract (Hecker, Spaulding, and Kuehn 2021).

ACCESSIBLE DEVICES AND PROGRAMS

Accessible devices and platforms are key to learning and using digital technologies. Accessibility is important for everyone, but older adults, children, people with disabilities, immigrants and refugees, and English-language learners can have specialized needs. For example, supporting learning and adoption of digital technologies for people with disabilities requires specialized design, availability, and affordability accommodations, plus targeted interventions for people at different life stages (Khanlou et

al. 2021). In the educational sector, educators' knowledge and expertise has been found to be a key factor in providing accessible and inclusive digital learning materials and environments to students. Effective trainings can focus on topics on disability and awareness, legislation, and methods of producing accessible digital materials and providing inclusive digital learning environments. Similarly, in the health care sector, health service providers can screen for patients' digital literacy needs and produce educational materials to ensure they can effectively use service provider's digital platforms.

PROGRAMS FOR EDUCATORS

Train the trainer programs and supports build skills and knowledge among educators. Effective supports for teachers to incorporate technology in the classroom include, for example: online professional development classes, in-school coaching on technology usage, "just in time" tech support, information on classroom strategies for technology use, and curated sets of resources for their subject areas and grade levels (Evans 2019). Higher-education faculty rate learning management systems highest in terms of importance and competence, but also highly value other digital technology that benefits student learning. Institutions may be able to motivate faculty to integrate digital technology if they support its use and provide instructors with time and resources to learn to use digital technologies (Martin et al. 2020).

SMALL, COHORT-BASED, AND PEER-LEARNING PROGRAMS

Cohort-based and one-on-one approaches are effective for older adults learning job-related digital skills. Opportunities for peer learning and support and cohort-based approaches, such as job clubs, can help older adults learn digital skills faster because seeing and learning with peers can make older adults feel more comfortable (Hecker, Spaulding, and Kuehn 2021). Relatedly, surveys of older adult participants in a digital literacy program in San Francisco suggest that the most effective approaches comprehensively combine opportunities for connection with supportive resources, ongoing support, and opportunities for continuous learning (Park 2024). In addition, one-on-one supportive training for older adults can help them connect to the internet and use basic tablet functions (Gleason and Suen 2021). Providing adequate time for questions is particularly effective among older workers (Hecker, Spaulding, and Kuehn 2021). One-on-one support also helps learners of all ages, including older adults, use collaboration and productivity tools such as those offered by Google (Powers, Musgrove, and Nichols 2020).

COMMUNITY PROGRAMS

Community-wide programs, partnerships, and support networks help build digital skills. Digital navigators in communities help people develop digital skills (McCall et al. 2022). Core technical support networks and direct support providers can help households in public housing better learn digital skills. For example, a survey of public housing residents in Austin, TX found that larger core technical support networks were associated with higher self-reported levels of digital skills among residents (Li 2018).

Partnerships between educational institutions and correctional facilities to provide digital-skills training to incarcerated individuals can also result in greater participation in skill building, education, and related digital-program participation during and after incarceration (Badejo, Chakraborty, and Forbes 2024). For example, the Vermont Center for Correctional Post-Secondary Education provides tuition-free community college education and career training at all six of Vermont's correctional facilities for both incarcerated individuals and correctional officers. It is in the early stages of implementation but could be a model for other states.

Navigate Safely

As many processes and interactions of daily life move online, there exist growing risks to individual safety, privacy, and security. Even after digital infrastructure and digital connectivity are established and people have developed the skills to use digital technology, they still need education and resources to navigate the digital world safely. Evidence from our review highlights particular risks for specific populations as well as domain-specific challenges and solutions.

What Risks to Privacy and Security Can People Face Online and Who Is Most at Risk?

Everyone who uses the internet is susceptible to both common and serious risks, but some people are more vulnerable. Common digital risks are associated with using legitimate websites and online platforms that collect information from users without their knowledge or permission. Grande and colleagues (2020) summarize five general threats to digital consumer privacy that they apply to health contexts but that reflect universal challenges:

1. **Invisibility**: People are unaware of how their data are tracked, used, and sold, and have little opportunity to opt out of these data uses. They may have false sense of security in the face of increased surveillance.

2. **Inaccuracy**: Data on an individual can be inaccurate or based on wrong assumptions about digital behaviors.
3. **Immortality**: Data have no expiration date and are aggregated and transferred over time, muddying control and ownership.
4. **Marketability**: Data have commercial value and are frequently bought and sold, without compensation to those generating the digital data.
5. **Identifiability**: Individuals can be readily reidentified, for example, based on several location points such as home address, office address, and children's school address.

Other digital risks include explicit criminal acts, such as online scams from bad actors that aim to steal money, personal information, or identities. For example, email and other online communication and data platforms can be used to leverage fake identities and commit fraud (Poster 2022). These techniques trick people into revealing information under false and misleading pretenses. Common compromised platforms include social media accounts such as YouTube, Instagram, and TikTok; job-listing platforms like Indeed.com; gig economy and rideshare applications such as Uber, Uber Eats, and Lyft; and cryptocurrency and financial management platforms (Poster 2022). Anyone who uses the internet is at risk for this type of victimization, and learning how to avoid such scamming and hack attempts are essential digital literacy skills.[42] However, certain populations may be at greater risk because of language barriers (e.g., English-language learners), lack of digital literacy (both adolescents and older adults), and other vulnerable groups such as people in carceral settings, some people of color, and some military personnel and veteran populations (Irvin-Erickson 2024). See Appendix D for more examples of digital risks.

How Can People Navigate Safely?

Supporting digital literacy can mitigate against the collection and tracking of personal information and avoid online victimization by scams. Beyond this, expanded legal protections could improve users' safety online, strengthen education and communication about specific risks, and improve individual outcomes related to online activities.

In recent years, both international and domestic legislation have been used to allow consumers to access their collected data, to opt out of having their data sold, and to make choices about the storage, use, and destruction of personally identifiable and private information. An international example is the General Data Protection Regulation adopted by the European Union in 2016 that governs not just the

right to control one's data, but also the "right to be forgotten" or the "right of erasure."[43] The regulation enshrines seven principles of consumer data protection and privacy for organizations that collect data, including fair, lawful, and transparent data collection; limiting the reasons why data are collected; limiting collected data to only what is absolutely necessary; requiring organizations to keep accurate and up to date personal data; limiting data storage for only as long as necessary; using encryption for secure and confidential data processing; and requiring data collectors to be accountable and comply with the law.

Use Effectively

Using the internet effectively is the final pillar of the Digital Opportunity Framework and necessary for full digital inclusion. It is only possible if foundational inclusion and enhanced inclusion pillar criteria are satisfied through greater access to infrastructure and connections, skills development, and online safety and security.

What Does It Mean to Use Digital Resources Effectively?

Effective use means using the internet meaningfully and effectively to improve overall quality of life and to support thriving. Full digital inclusion means everyone has the access, subscriptions, skills, safety, resources, and supports needed to use the internet to live their lives, achieve their goals, and support their desired outcomes.

Who Has Trouble Using Digital Resources Effectively, and Why?

In addition to the extensive challenges outlined above that can limit digital inclusion and opportunity, some digital platforms and resources present unique difficulties for many populations, including people with low incomes, patients, disabled individuals, many people of color, renters, educators, students, and justice-impacted populations (box 6).

Poorly functioning and inaccessible platforms limit access to critical social, health, and financial services for people with low incomes and people with disabilities. Some digital applications meant to help connect low-income households with resources and benefits work poorly. One study of over 13 million screenshots from low- and high-income people using the internet for financial services found over one-third (34.5 percent) of public benefits screenshots for low-income users revealed problems

with government websites or platforms, with the most common problem being slow-loading websites. Meanwhile, higher-income users experienced far fewer challenges accessing commercial financial services such as online banking credit card services (Lee et al. 2024).

People with disabilities also face challenges in accessing online health platforms and devices based on their type of disability. Many telemedicine platforms are not well-designed for patients with hearing, visual, or cognitive impairments, and electronic communication can be challenging for people with intellectual disabilities and neurologic or speech disorders (Chidambaram et al. 2024). Some patients require access to in-person consultations and exams to receive adequate health care, including patients with physical disabilities, mental health issues, and behavioral problems (Chidambaram et al. 2024). Finally, digital platforms and user interfaces can prove challenging or inoperable for users with visual disabilities or impairments when they fail to include adequate accessibility in their design and functioning, such as screen readers, captions, magnification, color, contrast, among other accessibility features (Chidambaram et al. 2024).

Inadequate human supports can thwart the effective use of digital technology. In an analysis of the US Office of Disease Prevention and Health Promotion 2020 Health and Information National Trends survey, only half of respondents with access to a patient portal used it, and those less likely to use it were typically male, Hispanic, had less than a college degree, were insured by Medicaid, lacked a regular medical provider, or had no internet access (Nishii et al. 2022). Reasons for nonuse included a preference for direct communication with providers, lack of an online record, privacy concerns, and low digital literacy. Inadequate human support can also stymie the use of digital technology in educational sectors, such as when educators lack sufficient instruction on using technology to support meaningful online learning (Tate and Warschauer 2022).

What Is the Impact of Using Digital Resources Effectively?

Ensuring digital technology is accessible, multilingual, and comes with appropriate resources and human supports can help users navigate applications and devices. Digital technologies can be used to improve employment and workforce development, educational opportunities, health management and outcomes, and housing choices and stability.

EMPLOYMENT AND WORKFORCE DEVELOPMENT

Connecting people with jobs requires reliable high-speed internet connections for businesses and workers, supporting the development of occupational digital literacy and related skills, and innovative

funding. Programs focused on occupational digital literacy and skills help workers develop the "cognitive and technical skills that equip individuals to use information and community technologies effectively within a specific occupation" (Bashay 2020, 2).

Partnerships between industry and education providers can target employer needs, scale employer-based upskilling best practices, and better address worker and employer labor market needs at local and regional levels (Bergson-Shilcock 2020b; Bashay 2020). Reskilling programs can provide educational pathways to high-skill careers for adults without bachelor's degrees. For example, Merit America, a nonprofit organization that helps low-wage workers transition into well-paying tech careers, partners with top employers to understand their specific skill requirements, secures priority hiring commitments for graduates of their program, and locates programming in regions where vacant jobs exist (Escobari, Seyal, and Meaney 2019). The programs require 20 hours of coursework per week for 13 to 22 weeks and provide resources to offset transportation and child care costs for participants.

To support digital training opportunities, innovations in and additional funding for government workforce programs can also help. For example, the Digital Equity Act allocated approximately $2.75 billion for a Federal Digital Literacy Upskilling grant program, which may help build capacity within states to pursue digital inclusion. The program will invest in digital-skills training for specific industries, support the professional development of digital trainers, and cover the costs of training new and existing workers (Bashay 2020). Plans submitted by states under the Workforce Innovation and Opportunity Act could also expand their activities to promote digital skills in ways that align with the Digital Equity Act (Coolberth 2024). For example, Washington state's Workforce Innovation and Opportunity Act plan sets a specific strategic goal for digital literacy and inclusion in state workforce training programs by integrating digital skills investments across all levels of workforce education activities.

Another way to boost digital entrepreneurship and employment is to increase connectivity to high-speed internet for small businesses and entrepreneurs in underconnected or marginalized places, such as rural areas. Online labor platforms that connect buyers and sellers of digital services remotely in industries like graphic design, software development, and data entry can increase rates of entrepreneurship and small business creation, particularly for skilled workers in rural areas, according to a national study of US counties (Braesemann, Lehdonvirta, and Kässi 2022). Another national study of nonmetropolitan counties found that while high-speed internet access generally enhances start-up activity in rural counties, the impact of broadband access was highest in the most remote, rural counties, driven primarily by women-led start-ups (Conroy and Low 2022).

EDUCATION

In the educational sector, both secondary and postsecondary students can take advantage of digital platforms to strengthen specific digital skills, increase employability, and enhance their overall learning. Google for Education is a digital suite of tools and features for teachers and learners that facilitates learner collaboration and class management and can be integrated with Chromebook tablets and laptops, which are the technologies of choice across many school districts. A recent Google-commissioned study found that in addition to saving money on hardware and software, the Google platform and user experience improved students' and teachers' time on tasks and resulted in a 229 percent return on investment (Forrester 2024). Microsoft Teams also offers a comprehensive platform for education but it has not been evaluated.

A variety of online courses and trainings enhance adult learning through nontraditional postsecondary opportunities and employment-based courses. In postsecondary settings, digital learning skills sessions can introduce students to basic digital and education management skills to help support independent learning in a higher education environment in a quick, cost-effective manner compared with in-person trainings (Bernacki, Vosicka, and Utz 2020). Massive open online courses (MOOCs) provide free or low-cost, open, online education on a variety of topics and subjects, increasing access to postsecondary and continued education by allowing more students into a course, limiting tuition costs, and allowing students to participate virtually.

Advanced degrees can also be made more affordable for midcareer learners. For example, Georgia Tech's online Master of Science degree program in computer science is offered at $510 per course, which was projected to boost new master's degrees in the field by 7 percent (Goodman, Melkers, and Pallais 2019). Once employed, digital training and education programs for employees can assess individuals' "digital fitness" using applications that enable people to customize and coordinate learning assets and courses within a single "digital hub" (Fenlon and Fitzgerald 2019). Applications can include interactive features such as podcasts, gamification, skill-building experiences, and quizzes. Digital Accelerator Programs, which help organizations rapidly adopt and implement new digital technologies, can also help adults pursue reskilling in areas such as data analytics, visualization, automation, artificial intelligence, and digital storytelling (Fenlon and Fitzgerald 2019).

HOUSING

Today, most housing searches and many real estate–related transactions occur online. Real estate platforms shape and control access to information sharing on available housing and can reduce information asymmetries for homebuyers and renters, but they can also increase discrimination against

potential tenants and homebuyers. Researchers have found that using digital technologies can "lower transaction costs, reduce search frictions, and provide more frequent information, all of which will help improve the match between supply and demand" (Shamsuddin and Srinivasan 2021, 127).

Many home sellers and buyers, renters and landlords, and associated stakeholders such as mortgage lenders, real estate appraisers, and real estate agents, have benefited from the "democratization" of housing searches on real estate platforms like Zillow, Redfin, Apartments.com, Craigslist, and others (Boeing, Harten, and Sanchez-Moyano, 2023). From the landlord perspective, real estate platforms can help screen tenants and minimize management risks while property management platforms can reduce delinquent payments and generate operating efficiencies by automating rent collection and maintenance requests, among other benefits (Ferreri and Sanyal 2022; Fields 2022. For home sellers, real estate platforms can improve marketing and reduce time on market, among other benefits. Both homebuyers and renters can access real-time, detailed information on available residences or units in many areas. This can expand housing options to places the homeseeker would not otherwise be familiar with and provide opportunities for upward residential mobility for households of color and those earning low incomes (Boeing, Harten and Sanchez-Moyano 2023).

Increasing enforcement of existing laws such as the Fair Housing Act and expanding interpretation to cover the full range of digital transactions can help reduce illegal discrimination in housing transactions online. HUD recently issued guidance around applying fair housing law to online tenant screening tools and using digital platforms for advertising and algorithmic systems in order to reign in online discrimination in housing transactions (US Department of Housing and Urban Development 2024a, 2024b). Leveraging devices to help people find homes, stay stably housed, and age in place while connecting with people and services can also promote positive outcomes.

Smart home devices also can assist homeowners and renters in securing their homes, maintaining comfort, controlling energy use, and monitoring home users (e.g., pets, kids, older family members) (Li et al. 2021). They can also help older adults access health services and build and maintain social connections, and they can serve as assistive technology in a variety of ways for people with disabilities (Ding et al. 2023; Jamwal et al. 2022).

For people experiencing homelessness, providing adults with quality devices, ways to recharge them (e.g., mobile charging carts), and useful, accessible applications to connect with local health care, housing, food, and training and employment opportunities could help improve stability and help more people transition out of homelessness (Galperin, Bar, and Nguyen 2020).

HEALTH AND HEALTH CARE

Partnering people and communities with resources to design and manage tailored and relevant health interventions can improve health efficacy and health outcomes. For example, researchers have found that engaging communities in shaping digital health applications and interventions within the context of their social and physical environments can often lead to more effective and sustainable solutions than expert-driven ones (Brewer et al. 2020). Tech companies can partner with underrepresented communities from the beginning of the design process for mobile health apps that help people manage their health (Lee et al. 2023). Recent examples include the FAITH! app—a culturally relevant and tailored mobile intervention created with community input. Developers included peer- and technology-supported self-management training to help users manage mental and chronic health conditions (Brewer et al. 2022). A scan of 40 studies found that participants involved in human-centered design of digital health interventions reported increased agency, improved digital and health literacy, better illness management, greater knowledge in making health care decisions, more assertiveness when interacting with providers, and increased personal responsibility for their health (Evans et al. 2023).

Boosting patients' overall technical skills can also help patients engage in digital health care. Individuals with better technological skills are better equipped to use digital apps, equipment, platforms, and telemedicine, which are all positively associated with better health-seeking and health-promoting behaviors, health knowledge, and attitudes. (Chidambaram et al. 2024).

Promoting patient engagement, digital portals, and reporting can also improve health outcomes. Patient portals are increasingly used to introduce patients to digital health information and management, and medical provider endorsements appear to influence patient engagement (Price-Haywood et al. 2023). Patients use the portals to better manage their health, but there is also evidence that portals can increase provider workload because of increased patient requests outside of visits. Workflow redesign that captures the entire lifecycle of a patient's visit could help make the process easier for patients, providers, and staff (Price-Haywood et al. 2023). A related type of platform for collecting patient-reported health information for tracking purposes is electronic patient-reported outcomes, which direct patients to use digital devices to electronically record and submit their health information such as symptoms, quality of life, and treatment effects. Studies have found increased positive health outcomes, including survival rates, among patients with cancer who used this technology to monitor and provide critical health data (Pritchett et al. 2023; Basch et al. 2017).

Telehealth and telemedicine services use electronic communication technologies to provide health care services remotely. A nurse-managed telemonitoring intervention that includes digital transmission of blood pressure measurements, nurse interventions, and counseling to Black patients with

hypertension showed reduction in systolic blood pressure at 12 months compared with usual care (Hernandez and Rodriguez 2023). Another study found positive patient and provider experiences with "telelactation," a program that provided video calls with international board-certified lactation consultants for rural mothers (Kapinos et al. 2019). Ensuring such services are provided in the patient's preferred language and including clear and accessible instructions for setting up telehealth visits and built-in translation services can further reduce health care disparities for patients who prefer to communicate in a language other than English (Eberly et al. 2020a).

BOX 6

Increasing Digital Use for Positive Outcomes for Justice-Impacted Populations

Expanding access, training, and technology through integrated programs that support social connectivity, develop skills, and provide training that is tailored to the contexts and needs of people who are incarcerated will support greater integration, job readiness and attainment, and reduced recidivism when justice-impacted people reenter society.

- The tech nonprofit Ameelio supports successful reentry by providing a free video calling platform for prisons; allowing participation in online classes with virtual guidance counselors and office hours with professors; and supporting a policy lab on digital equity solutions for incarcerated people across communications, education, and reentry services.
- The nonprofit The Last Mile provides technical education and training that builds educational and workforce reentry skills, focusing on web development and audio/video production. They have partnered with GoDaddy through Empower by GoDaddy, a program focused on digital and social entrepreneurship development. GoDaddy leads webinars on social media advertising, search engine optimization, generative artificial intelligence, and how to build websites with GoDaddy's website and marketing tools.
- The Brave Behind Bars curriculum is a 12-week, college-accredited introductory computer science and career-readiness pilot program for incarcerated people taught both online and in-person. Researchers evaluating the program found both qualitative and quantitative evidence for increased self-efficacy among a sample of 34 participants (Nisser et al. 2024).

Charting a Road Map for Fuller Inclusion

Expanding positive outcomes for greater digital inclusion requires ensuring that all people, no matter who they are or where they live, can use the internet effectively to meet their needs, achieve their goals, and live their lives. That will require strengthening and expanding each pillar of inclusion so that individuals and households can benefit from foundational inclusion through greater access to infrastructure and connections. It will also require that everyone can reap the benefits of enhanced inclusion by supporting skill development and protecting users' privacy and security. When these conditions are satisfied, digital opportunity is possible for people and communities to leverage the benefits of the internet to meaningfully and effectively improve overall quality of life and support thriving.

Recommendations to Strengthen Pathways to Positive Outcomes

Based on the evidence reviewed in this report, we outline a series of broad recommendations to strengthen digital inclusion across each pillar of the digital opportunity framework.

Target place-based subsidies to narrow the infrastructure gap and expand in-home connections. There is clear evidence that certain places and people are underserved by existing infrastructure and some evidence directly connecting expanded infrastructure and connections to positive outcomes. Rural communities and many places that Native Americans, Black, and Hispanic/Latine people call home are underserved by one or more types of high-speed internet infrastructure.

When broadband infrastructure expands, there is evidence of positive outcomes. For example, there is some evidence of employment growth in neighborhoods that receive government investments in broadband deployment through programs such as the Broadband Initiatives Program (BIP) under the American Recovery and Reinvestment Act of 2009 (Rupasingha et al. 2023). And telehealth use has improved among Black and Latine patients through the provision of devices equipped with data plans and through reliable home internet services in vulnerable ZIP codes (Eberly et al. 2020b).

In agricultural communities, broadband expansion is associated with increased farmland values, farm productivity, more business starts, and increased home values. For example, one study found that farmland sale prices rose by 0.281 percent and county-level cash rents by 0.071 percent for every one megabit per second (Mbps) increase in available download speed; and that an increase in download speed growth rates leads to increases in county-level cash rents growth rates (Qu et al. 2022). In addition, a study using the pre-2024 broadband definition found that increased internet penetration

rates improved crop yields, such that a 3.79 percent increase in corn yields was found to result from doubling the number of 25+/3+ connections per 1,000 households. Some cost savings were also associated with improvements in download and upload speeds (LoPiccalo 2022).

Internet access has also been shown to associate with an increase in the number of rural small businesses and women-owned businesses in rural areas (Conroy and Low 2022). In the rural housing space, pre-2024 broadband access has been associated with a premium on housing values (Deller and Whitacre 2019). In fact, one study found that the value of single-family homes with access to a 25 Mbps connection was nearly three percent higher than similar homes in neighborhoods with a one Mbps connection (Molnar, Savage, and Sicker 2019).

Support individual connectivity through subscription subsidies, low-cost or free devices, and free public Wi-Fi and mobile hotspots for people who struggle to connect to in-home broadband infrastructure or who are transient or housing insecure. There is evidence of a variety of barriers that people face in connecting to the internet and accessing in-home infrastructure. Although these include some nuanced reasons—such as lack of digital skills, concerns about privacy, and simply not wanting to use the internet—some people face basic challenges around the cost of subscriptions and devices and need reliable public infrastructure options.

We found some evidence of notable programs launched during COVID-19 to expand digital connectivity to vulnerable populations during the public health crisis that remain relevant to bridging the digital divide postpandemic. Reauthorizing and funding state and local broadband subsidies, for example, is a straightforward way to keep households online. During the pandemic, subsidizing in-home connections and mobile connections for low-income people first through the Emergency Broadband Benefit and then through the Affordable Connectivity Program expanded connectivity for 23 million households. In some cities, public institutions increased public Wi-Fi access spots for those who struggled with reliable in-home connections or were experiencing homelessness. And libraries and schools launched hotspot lending programs so community members and students could take connections with them. Providing affordable devices to students, people with low incomes, and people experiencing homelessness has also been successful in boosting connectivity, and closing the "homework gap"—the disparity between students who have access to reliable internet at home to complete schoolwork and those who do not. Expanding mobile connections and issuing personal devices (usually a laptop) to each student can be particularly helpful in rural and low-income areas (Powers, Musgrove, and Nichols 2020). For people experiencing homelessness, obtaining high-quality devices and connectivity with the ability to charge them can strengthen access to services, employment,

and safety (Galperin, Bar, and Nguyen 2021; Polson, Botta, and Van Houweling 2024; Rhinesmith 2024).

Protect digital privacy and strengthen civil rights protections and enforcement online. Some people choose not to use the internet or specific digital platforms or technologies because of security risks. Others may not be aware of the challenges associated with sharing personal data online. Evidence shows that these risks remain high for certain digital uses (e.g., applications and screenings, surveillance) and that some populations are at risk for civil rights discrimination. Strengthening digital protections could involve adopting a national digital data privacy framework that includes a stronger legal framework for using and controlling data exchanged online and "right to be forgotten" online measures. In the housing sector, strengthening existing legal protections against civil rights discrimination, like the Fair Housing Act, for online transactions and auditing online platforms such as "proptech"—or property technology used in the real estate and housing sector—and automated valuation models could further ensure legal compliance.

Provide clear digital training and navigation and properly equip and support those who train others. Digital navigation is effective for expanding an individual's digital literacy and improving effective internet use for a variety of purposes, including connecting to services, connecting to loved ones, and gaining employment. Skill-development training is also critical to retrain job seekers and help people use the internet effectively to connect with employment and perform digital jobs (Gonzalez, Garcia, and Dominguez Villegas 2020).

Training can be used to span the language divide for English-language learners and the digital divide at the same time. For example, pairing language education for English-language learners with digital skills can support job competitiveness. Hybrid courses with in-person training components may be even more effective, and such courses should measure success in digital skills in flexible ways (Bergson-Shilcock 2020a).

Justice-impacted populations can also be better supported through additional and targeted training opportunities. Establishing dedicated digital learning centers and public-private partnership models to offer online education and training can be effective as long as security concerns are addressed and appropriate monitoring systems are implemented to maintain facility safety. For example, Veterans Justice Programs staff greatly increased their use of virtual outreach tools, including video and telehealth technology for justice-impacted veterans. Including families in virtual engagements through digital programs and social work engagements during the COVID-19 pandemic was beneficial to keeping clients engaged (Reentry Coordination Council, 2022).

Lastly, it is critical to invest in adequate training for those who support digital use, such as teachers, service coordinators, and caseworkers, which will also increase their own comfort with and ongoing use of technology. For example, in rural areas, teachers' perceived usefulness and ease of use of providing one-on-one computing device training were significant predictors of how well students perceived training benefits and how individual instructions were received (Powers, Musgrove, and Nichols 2020).

Make digital platforms, devices, and supports easy to use, relevant, and accessible. Community engagement and partnership is crucial for understanding specific digital barriers and creating culturally relevant and accessible technologies. Technology companies can partner with communities during the design process to ensure that applications and devices are appropriate and useful (Brewer et al. 2020; Hernandez and Rodriguez 2023). It's also important to provide targeted, culturally relevant, and tailored early-stage and pilot services for subgroups at high risk of homelessness, including formerly incarcerated people and veterans, both in the prison system and during reentry periods (Reentry Coordination Council 2022).

Beyond this, smart home devices can serve as assistive technologies for people with disabilities to support independent living, strengthen social connections, safety, and boost quality of life (Ding et al. 2023; Jamwal et al. 2022). And multilingual platforms remove linguistic barriers that can be discriminatory (Rodriguez et al. 2021). More accessible digital platforms can lead to increased adoption and use of digital technologies that result in positive outcomes for disabled users, older adults, justice-impacted individuals, individuals experiencing homelessness, and users with varying English proficiencies.

Issue quality devices and support long-term troubleshooting and maintenance. Any device-focused program should provide high-quality devices and ongoing maintenance and support. This support can particularly help older adults, people with disabilities, students, veterans, and people experiencing homelessness, all of whom face barriers to effective use. Pairing device-ownership programs with digital training and technical supports is particularly effective.

A promising example of this comes from rural Mississippi, where school districts with one-to-one computing programs also implemented a device-maintenance program. This involved assigning a technology department technician to the school and drawing on emerging expertise of students studying Career and Technical Education to assist technicians while gaining hands-on experience. Another possibility that will also support student learning is to allow students to volunteer to provide IT help desk support under the supervision of a district technician (Williams 2022).

Setting a Learning Agenda

Much of the evidence on what works to expand digital opportunity and inclusion is scattered and unevenly distributed across the populations and pillars of focus in this report. Amid historic investments to narrow the digital divide, we know more about the negative outcomes of digital exclusion than we know about policies, programs, and practices that support positive outcomes for individuals, households, communities, and society.

More evidence is needed to assess and evaluate individual programs and strategies to increase the general knowledge of what works to expand digital opportunity at scale to the people and places that need it most. We present the below learning agenda to drive research forward across the pillars of digital inclusion and potential outcomes, including a series of specific opportunities and potential research questions.

Support more and deeper evidence-building around solutions. Although the evidence reviewed in this report is rigorous and thorough, additional research is needed to evaluate effects of the digital divide and specific solutions focused on narrowing the gaps between people and places. Many studies we reviewed identified negative consequences or barriers rather than outcomes of policies and practices meant to result in benefits for individuals and communities. A spate of recent federal, state, and local plans and investments across the spectrum of digital inclusion provide a critical opportunity to evaluate the strategies and processes that are most effective for advancing full digital inclusion (see, for example, box 7). This type of evidence-building is needed to identify promising solutions that can be replicated and scaled to improve outcomes at both the individual and societal level.

BOX 7

Evaluating the Broadband Equity, Access, and Deployment Program

The $42.45 billion in Broadband Equity, Access, and Deployment (BEAD) program investments will primarily tackle digital infrastructure gaps, with additional resources supporting digital skills. Given this unprecedented investment, we may expect to see the digital divide narrow for some populations and places. This may be contingent on a variety of local factors, including the stakeholders involved, planning process employed, and the infrastructure deployment conditions. The most successful strategies and contexts will help identify programs and practices to replicate and scale, while those with more limited success will highlight additional barriers that need to be overcome. Important research questions to ask in BEAD evaluations include:

- How do state plans affect BEAD implementation and outcomes? How do interventions vary with community engagement levels and strategies?

- Which digital strategies are most effective in narrowing the digital divide for people and places being served, and who and what groups are involved?
- How does increased access to broadband infrastructure affect connectivity and use? How does it affect outcomes and opportunities for individuals and communities?

Conduct inclusive research. Although some populations have been the focus of numerous studies on digital equity and related issues, others lack the same rigorous attention. Some groups were missing almost completely from our scan of recent studies, including immigrants and those with refugee status, particularly those who speak languages other than English, and groups marginalized because of their sexual orientation and/or gender identity

Although some recent research is available on households with low incomes, older adults, individuals and communities of color, disabled people (box 8), justice-impacted populations, and people experiencing homelessness, there is still more work to be done to explain and narrow the digital divide for these groups, especially given the flood of new federal and state investments across the spectrum of digital inclusion (figure 1). Without close evaluation, these populations could be exposed to widening disparities and increased digital harm, and effective practices and approaches could be lost.

BOX 8

Expanding Digital Opportunity for People with Disabilities

There is little recent research on what works best for expanding digital opportunities for disabled students, working adults, and older adults, including technology accessibility policies for schools and opportunities to leverage smart home devices as in-home assistive technologies (Shaheen 2022; Ding et al. 2023; Jamwal et al. 2022). There is also scant research investigating the relationship between broadband access and adoption and employment outcomes for people with disabilities. Answering the following research questions in future scholarly research and policy and program evaluations would deepen knowledge of what works to expand digital opportunities for people with disabilities:

- What types of digital platforms, devices, and accessibility features work best to promote digital learning and communications for students with disabilities? What should qualify as assistive technology in the digital era under the Individuals with Disabilities Education Act of 1975?
- How do smart home devices used as assistive technologies help people with disabilities live independently and older adults age in place?

- How does expanded broadband infrastructure and connectivity affect the quality of life of disabled people in terms of health, employment, and social connections?

Fill important gaps in knowledge about what it takes to help people get and stay connected to high-speed internet. There are some groups that face persistent barriers connecting to the internet. These include people who struggle with the availability and affordability of in-home connections, whether they rent or own their homes; those experiencing homelessness; and those who are incarcerated. Scattered policies exist to help cover the costs of connections, but some have been temporary, and others still fail to offer robust, high-quality, high-speed internet connections to highly remote, mobile, or incarcerated populations (box 9). In addition, most unconnected households report that they do not have an internet connection because they do not want one. More research could help understand these rationales and the consequences of such disconnection in the face of an increasing digital society. Failure to connect to and use the internet could widen existing gaps between frequent internet users and infrequent and nonusers, so assessing what can motivate and promote connectivity is important.

BOX 9

Improve Connectivity for Justice-Impacted Populations

Justice-impacted populations can encounter restricted, high-cost, low-quality internet connections while incarcerated in federal, state and county prison and jail systems. Improving connectivity can improve prisoner safety, provide secure health tracking and management, give access to workforce development programs, and provide communication technology that boosts legal defense and family connections (Hofinger and Pflegerl, 2024; Novisky et al. 2022). Exploring answers to the following research questions could help narrow the digital divide for justice-impacted populations and expand positive outcomes both inside and outside prison walls:

- How can internet connectivity be expanded for people incarcerated in prisons and jails while maintaining security and privacy and protecting against bad actors and criminal activity?
- What strategies for expanding digital connectivity and use for prisoners yield the most positive outcomes?

Focus on outcomes that help individuals, families, and societies thrive. Future research can do more to explore outcomes resulting from increased digital inclusion, particularly as it relates to how and why people choose to use the internet to meet their needs. Without evaluating what may help or harm people as they navigate online with various applications and devices, it is challenging to know how to most effectively advance full digital inclusion in a way that maximizes positive outcomes while minimizing negative ones.

Some areas of policy and practice have stronger evidence bases around outcomes from digital inclusion than others, including health, education, and workforce. However, the evidence often focuses on the individual and family level and on immediate or intermediate outcomes rather than longer-term, societal, or more transformational outcomes. Housing is one area of policy highlighted in this report with weak recent evidence on what works to advance digital inclusion for homeowners and renters, with research mostly pointing to risks and harms.

Finally, our framework suggests other aspirational outcomes that have not been well researched. Little is known about how digital inclusion strengthens individuals' financial security, civic participation, independence and autonomy, and overall quality of life. For communities, research is lacking on how increasing digital inclusion contributes to economic diversification beyond telework jobs, and how it supports community health, social connections, and political engagement. Societal outcomes are the most challenging to measure and demonstrate. Future studies that explore outcomes such as a better-informed public, greater social cohesion, and effective and fair intuitions could highlight the potential for social good that can come from a more globally connected society.

Appendix A. Methodology

There is an established and growing body of research about the negative impacts of the digital divide. Yet, much of the evidence concerning the benefits of and strategies for expanding digital opportunity and inclusion are siloed among disparate scholarly journals and discipline- or industry-specific studies. To synthesize this research and identify areas where the evidence is strong and where more research is needed, we reviewed the current literature on the digital divide and the impacts and benefits of expanding digital opportunity and inclusion.

From this foundation, we developed an actionable, policy-relevant framework and road map for expanding digital opportunity and inclusion for policymakers and stakeholders to help narrow the digital divide by understanding, supporting, and strengthening positive outcomes for individuals, families, communities, and society.

First, we conducted a preliminary scan and review of seminal and widely cited research reports and studies from scholarly, policy, gray literature, and industry sources. From this sample, we reviewed and categorized the various definitions, characterizations, and scopes of digital opportunity and inclusion; identified common or relevant related key terms; compiled inputs or criteria that are found to expand digital opportunity and inclusion; and identified various social, economic, geographic, and policy topics and issues where research is focused.

Next, we developed a systematic search protocol and coding framework to collect and analyze the broader literature related to key domains that emerged from the preliminary review: health and health care, education, economic mobility, housing, and geography (rural, suburban, urban). We also investigated evidence relating to specific populations that emerged from the preliminary review, including older adults, people with disabilities, people of color, and justice-impacted people. Based on input from experts and technical advisors, we also investigated the evidence for other populations that may benefit from expanded inclusion, including veteran populations, English-language learners, immigrants and refugees, and LGTBQIA+ people.

We conducted online searches of scholarly, policy, gray literature, and industry sources to identify research and evidence across these domains and populations. We reviewed each identified document for relevance and recency before including it in our sample. Because digital and internet technologies are rapidly evolving, we prioritized research and evidence that was published since 2020. We also prioritized evidence that was specific to the United States, but did retain select international research publications with methodologies or findings that were relevant or applicable to the United States

context. In total, we retained 254 research reports, studies, and publications for deeper analysis. We read and coded each document based the following criteria:

- Characterization or definition of digital opportunity, digital inclusion, and/or related terms
- Domain and/or population focus
- Digital topic focus (digital infrastructure, digital adoption or subscription, digital skills, digital privacy and security, effective digital use)
- Methodology (if a scientific study)
- Identified inputs or criteria that support digital opportunity, digital inclusion, and/or related terms
- Identified impacts or outcomes from expanding digital opportunity, digital inclusion, and/or related terms
- Scale of identified impacts or outcomes (individual, household, community, society)

Next, we analyzed the coded data to identify domains and topics where evidence is established, emerging, and limited. We also characterized the breadth and depth of evidence across and between key domains, populations, and topical areas to identify key topics and issues where evidence is unique or where knowledge and evidence gaps persist.

From this analysis, we developed the framework for digital opportunity and inclusion, which organizes the evidence about successful strategies and outcomes across five key pillars. We also developed a road map with broad recommendations and opportunities to strengthen digital opportunity and inclusion across each pillar of the framework.

Literature Review

The 254 sources included in our review include the following plus the sources in our reference list, which are cited throughout this report.

Arias López, Maria Del Pilar, Bradley A. Ong, Xavier Borrat Frigola, Ariel L. Fernández, Rachel S. Hicklent, Arianne J. T. Obeles, Aubrey M. Rocimo, and Leo A. Celi. 2023. "Digital Literacy as a New Determinant of Health: A Scoping Review." *PLOS Digital Health* 2 (10): e0000279. https://doi.org/10.1371/journal.pdig.0000279.

Arum, Richard, and Mitchell L. Stevens. 2020. "Building Tomorrow's Workforce Today: Twin Proposals for the Future of Learning, Opportunity, and Work. Policy Proposal 2020-15." Hamilton Project.

Baim-Lance, Abigail, Matthew Angulo, Mary Ann Chiasson, Helen-Maria Lekas, Rachel Schenkel, Jason Villarreal, Anyelina Cantos, et al. 2022. "Challenges and Opportunities of Telehealth Digital Equity to Manage HIV and Comorbidities for Older Persons Living with HIV in New York State." *BMC Health Services Research* 22 (1): 609. https://doi.org/10.1186/s12913-022-08010-5.

Baluk, Kaitlin Wynia, Ali Solhi, and James Gillett. 2023. "Partnering for Social Infrastructure: Investigating the Co-Location of a Public Library in an Affordable Housing Building." In *How Public Libraries Build Sustainable Communities in the 21st Century*, edited by Kaurri C. Williams-Cockfield and Bharat Mehra, 53:229–42. Advances in Librarianship. Emerald Publishing Limited. https://doi.org/10.1108/S0065-283020230000053021.

Barron, Kyle, Edward Kung, and Davide Proserpio. 2020. "The Effect of Home-Sharing on House Prices and Rents: Evidence from Airbnb." *Marketing Science* 40 (1): 23–47. https://doi.org/10.1287/mksc.2020.1227.

Bergson-Shilcock, Amanda, and Roderick Taylor. 2023. "Closing the Digital 'Skill' Divide: The Payoff for Workers, Business, and the Economy." National Skills Coalition. https://eric.ed.gov/?id=ED626621.

Berkley, Kate, Joseph Castro, and Shadman Uddin. 2024. "Device Ownership, Digital Equity, and Postsecondary Student Success," June. https://escholarship.org/uc/item/7xp747jb.

Blomberg, Matt, Darcey Altschwager, Hyunjin Seo, Ellie Booton, and Maxine Nwachukwu. 2021. "Digital Divide and Marginalized Women during COVID-19: A Study of Women Recently Released from Prison." *Information, Communication & Society* 24 (14): 2113–32. https://doi.org/10.1080/1369118X.2021.1963462.

Carhill-Poza, Avary, and Timothy P. Williams. 2020. "Learning 'Anytime, Anywhere'? The Imperfect Alignment of Immigrant Students' Experiences and School-Based Technologies in an Urban US High School." *Comparative Education Review* 64 (3): 428–50. https://doi.org/10.1086/709430.

Chase, Ashley Krenelka. 2021. "Exploiting Prisoners: Precedent, Technology, and the Promise of Access to Justice." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3904859.

Conley, Kelsey L., and Brian E. Whitacre. 2020. "Home Is Where the Internet Is? High-Speed Internet's Impact on Rural Housing Values." *International Regional Science Review* 43 (5): 501–30. https://doi.org/10.1177/0160017620918652.

Crawford, Allison, and Eva Serhal. 2020. "Digital Health Equity and COVID-19: The Innovation Curve Cannot Reinforce the Social Gradient of Health." *Journal of Medical Internet Research* 22 (6): e19361. https://doi.org/10.2196/19361.

Dahl, Andrew J., James W. Peltier, and George R. Milne. 2018. "Development of a Value Co-Creation Wellness Model: The Role of Physicians and Digital Information Seeking on Health Behaviors and Health Outcomes." *Journal of Consumer Affairs* 52 (3): 562–94.

Deller, Steven, Brian Whitacre, and Tessa Conroy. 2022. "Rural Broadband Speeds and Business Startup Rates." *American Journal of Agricultural Economics* 104 (3): 999–1025. https://doi.org/10.1111/ajae.12259.

DeRenzis, Brooke, Jeannine Laprad, Nakeisha Ricks-Pettyjohn, and Roderick Taylor. 2023. "Creating an Equitable, Resilient Workforce System." National Skills Coalition.

Dickes, Lori, Elizabeth Crouch, and Thomas Walker. 2019. "Socioeconomic Determinants of Broadband Non-Adoption among Consumer Households in South Carolina, USA." *Ager. Revista de Estudios Sobre Despoblación y Desarrollo Rural*, no. 26 (April), 103–27. https://doi.org/10.4422/ager.2018.17.

Eason, John M. 2017. *Big House on the Prairie: Rise of the Rural Ghetto and Prison Proliferation*. Chicago, IL: University of Chicago Press. https://press.uchicago.edu/ucp/books/book/chicago/B/bo25227153.html.

Faelens, Lien, Kristof Hoorelbeke, Ruben Cambier, Jill van Put, Rudi De Raedt, and Ernest H.W. Koster. 2021. "The Relationship between Instagram Use and Indicators of Mental Health: A Systematic Review." *Computers in Human Behavior Reports* 4 (August-December): 100121. https://doi.org/10.1016/j.chbr.2021.100121.

Fields, Desiree. 2022. "Automated Landlord: Digital Technologies and Post-Crisis Financial Accumulation." *Environment and Planning A: Economy and Space* 54 (1): 160–81. https://doi.org/10.1177/0308518X19846514.

Fields, Desiree, and Dallas Rogers. 2021. "Towards a Critical Housing Studies Research Agenda on Platform Real Estate." *Housing, Theory and Society* 38 (1): 72–94. https://doi.org/10.1080/14036096.2019.1670724.

Francis, Dania V., and Christian E. Weller. 2022. "Economic Inequality, the Digital Divide, and Remote Learning During COVID-19." *The Review of Black Political Economy* 49 (1): 41–60. https://doi.org/10.1177/00346446211017797.

Friedline, Terri, and Zibei Chen. 2021. "Digital Redlining and the Fintech Marketplace: Evidence from US Zip Codes." *Journal of Consumer Affairs* 55 (2): 366–88. https://doi.org/10.1111/joca.12297.

George, Caroline, and Adie Tomer. 2022. "Delivering to Deserts: New Data Reveals the Geography of Digital Access to Food in the U.S." Brookings. May 11, 2022. https://www.brookings.edu/articles/delivering-to-deserts-new-data-reveals-the-geography-of-digital-access-to-food-in-the-us/.

Gilman, Michele E. 2020. "Five Privacy Principles (from the GDPR) the United States Should Adopt to Advance Economic Justice." *Arizona State Law Journal* 52:368.

Graves, Janessa M., Demetrius A. Abshire, Solmaz DDes Amiri, and Jessica L. Mackelprang. 2021. "Disparities in Technology and Broadband Internet Access Across Rurality: Implications for Health and Education." *Family & Community Health* 44 (4): 257–65. https://doi.org/10.1097/FCH.0000000000000306.

Hampton, Keith N., Craig T. Robertson, Laleah Fernandez, Inyoung Shin, and Johannes M. Bauer. 2021. "How Variation in Internet Access, Digital Skills, and Media Use Are Related to Rural Student Outcomes: GPA, SAT, and Educational Aspirations." *Telematics and Informatics* 63 (October):101666. https://doi.org/10.1016/j.tele.2021.101666.

Harpur, Paul, and Peter Blanck. 2020. "Gig Workers with Disabilities: Opportunities, Challenges, and Regulatory Response." *Journal of Occupational Rehabilitation* 30 (4): 511–20. https://doi.org/10.1007/s10926-020-09937-4.

Hegde, Saket S., and Jessica Van Parys. 2024. "The Impact of Municipal Broadband Restrictions on COVID-19 Labor Market Outcomes." Working Paper. Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w32257.

Hernandez, Shannon. n.d. "Implementing Educational Courses on Social Media Within Prisons to Decrease Unemployment Rates Among Ex-Prisoners and Reduce Recidivism in the United States."

Hess, Chris, Rebecca J. Walter, Ian Kennedy, Arthur Acolin, Alex Ramiller, and Kyle Crowder. 2023. "Segmented Information, Segregated Outcomes: Housing Affordability and Neighborhood Representation on a Voucher-Focused Online Housing Platform and Three Mainstream Alternatives." *Housing Policy Debate* 33 (6): 1511–35. https://doi.org/10.1080/10511482.2022.2133548.

Horan, Tyler, and Haijing Tu. 2023. *Digital Literacy, Ability and Vulnerability: Education and Income Variations in the Platform Economy*. https://doi.org/10.31235/osf.io/m98kz.

Humphry, Justine. 2022. *Homelessness and Mobile Communication: Precariously Connected*. New York, NY: Palgrave Macmillan.

Insight Policy Research. 2018. "ConnectHome Initiative: Final Report." Office of Policy Development and Research, U.S. Department of Housing and Urban Development.

Isley, Catherine, and Sarah A. Low. 2022. "Broadband Adoption and Availability: Impacts on Rural Employment during COVID-19." *Telecommunications Policy* 46 (7): 102310. https://doi.org/10.1016/j.telpol.2022.102310.

Johnson, Kathryn R., and Claudia Persico. 2024. "Broadband Internet Access, Economic Growth, and Wellbeing." Working Paper. Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w32517.

Johnson, Melissa, Molly Bashay, Amanda Bergson-Shilcock, Michael Richardson, and Brooke DeRenzis. 2019. "The Roadmap for Racial Equity: An Imperative for Workforce Development Advocates." National Skills Coalition. https://nationalskillscoalition.org/resource/publications/the-roadmap-for-racial-equity/.

Kabel, Matthew, Jiyung Hwang, and Jiwon Hwang. 2021. "Lessons Learned From a Rural Classroom Study: Transitioning From Concrete to Virtual Manipulatives to Teach Math Fact Fluency to Students With Learning Disabilities." *Journal of Curriculum Studies Research* 3 (1): 42–68. https://doi.org/10.46303/jcsr.2021.7.

Kreski, Noah T., Qixan Chen, Mark Olfson, Magdalena Cerda, Deborah Hasin, Silvia S. Martins, Pia M. Mauro, and Katherine M. Keyes. 2021. "Trends in Adolescent Online and Offline Victimization and Suicide Risk Factors." *Pediatrics* 148 (3): e2020049585. https://doi.org/10.1542/peds.2020-049585.

Kyung, Nakyung, and Byungtae Lee. 2019. "The Effect of Broadband Adoption on the Labor-Market Inclusion of the Disabled: An Empirical Analysis." In . Munich, Germany. https://web.archive.org/web/20220915062511id_/https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1210&context=icis2019.

Levander, Ximena A., Hans VanDerSchaaf, Vanessa Guerrero Barragán, Hetal Choxi, Amber Hoffman, Emily Morgan, Eva Wong, Raghav Wusirika, and Anthony Cheng. 2024. "The Role of Human-Centered Design in Healthcare Innovation: A Digital Health Equity Case Study." *Journal of General Internal Medicine* 39 (4): 690–95. https://doi.org/10.1007/s11606-023-08500-0.

Lobo, Bento, Md Rafayet Alam, and Brian Whitacre. 2019. "Broadband Speed and Unemployment Rates: Data and Measurement Issues." *Telecommunications Policy* 44 (April). https://doi.org/10.1016/j.telpol.2019.101829.

Lustgarten, Samuel D, Yunkyoung L Garrison, Morgan T Sinnard, and Anthony WP Flynn. 2020. "Digital Privacy in Mental Healthcare: Current Issues and Recommendations for Technology Use." *Current Opinion in Psychology*, Cyberpsychology, 36 (December):25–31. https://doi.org/10.1016/j.copsyc.2020.03.012.

Mack, Elizabeth A., Scott Loveridge, Thomas Keene, and John Mann. 2024. "A Review of the Literature About Broadband Internet Connections and Rural Development (1995-2022)." *International Regional Science Review* 47 (3): 231–92. https://doi.org/10.1177/01600176231202457.

Maresova, P., O. Krejcar, S. Barakovic, J. Barakovic Husic, P. Lameski, E. Zdravevski, I. Chorbev, and V. Trajkovik. 2020. "Health–Related ICT Solutions of Smart Environments for Elderly–Systematic Review." *IEEE Access* 8:54574–600. https://doi.org/10.1109/ACCESS.2020.2981315.

McArthur, David Philip, and Jinhyun Hong. 2023. "Are Slow Internet Connections Limiting Home Working Opportunities?" *Travel Behaviour and Society* 33 (October):100629. https://doi.org/10.1016/j.tbs.2023.100629.

McClure, Jared, and Jodi Pilgrim. 2022. "Implementing a 1:1 Technology Program in a Rural, Public School: A Study of Perceptions of Technology Integration." *Journal of Research on Technology in Education* 54 (2): 302–16. https://doi.org/10.1080/15391523.2020.1852455.

McHenry, Giulia, Rafi M. Goldberg, Maureen Lewis, Edward Carlson, and Ishan Mehta. 2017. "Digital and Economic Inclusion: How Internet Adoption Impacts Banking Status." SSRN Scholarly Paper. Rochester, NY. https://doi.org/10.2139/ssrn.2944394.

McKnight, Lee W., Danielle Taana Smith, Wednaud J. Ronelus, Ryan Ondocin, and Prasanta K. Ghosh. 2021. "Enhancing Education in Underserved Schools: 2021 IEEE International Conference on Cognitive and Computational Aspects of Situation Management, CogSIMA 2021." Edited by Nicolette McGeorge, Alicia Ruvinsky, Mare Teichmann, Leo Motus, and Mary Freiman. *Proceedings - 2021 IEEE International Conference on Cognitive and Computational Aspects of Situation Management, CogSIMA 2021*, Proceedings - 2021 IEEE International Conference on Cognitive and Computational Aspects of Situation Management, CogSIMA 2021, , May, 32–38. https://doi.org/10.1109/CogSIMA51574.2021.9475946.

Merid, Beza, and Vanessa Volpe. 2023. "Race Correction and Algorithmic Bias in Atrial Fibrillation Wearable Technologies." *Health Equity* 7 (1): 817–24. https://doi.org/10.1089/heq.2023.0034.

National Center for Education Statistics. 2023a. "Digest of Education Statistics." National Center for Education Statistics. January 1, 2023. https://nces.ed.gov/programs/digest/d22/tables/dt22_702.40.asp.

———. 2023b. "School Pulse Panel: Responses to the Pandemic and Efforts toward Recovery." National Center for Education Statistics. August 1, 2023. https://nces.ed.gov/surveys/spp/results.asp.

Nazareno, Luísa, and Justina Jose. 2021. "The Effects of Broadband Deployment in Rural Areas: Evaluating the Connect America Fund Program." SSRN Scholarly Paper. Rochester, NY. https://doi.org/10.2139/ssrn.3897867.

Neal, Michael, Sarah Strochak, Linna Zhu, and Caitlin Young. 2020. "How Automated Valuation Models Can Disproportionately Affect Majority Black Neighborhoods." Washington, DC: Urban Institute.

Neginskiy, Katerine Callahan. 2022. "Building Career Pathways for Resettled Refugees in the United States." *Refugee Law Initiative*, September. https://sas-space.sas.ac.uk/9706/1/RLI%20WPS%20No.%2065.pdf.

Nembhard, Susan, Travis Reginal, and John M. Eason. 2024. "Curbing Rural Prison Demand and Responsibly Closing Prisons." *Urban Institute*, April. https://www.urban.org/urban-wire/curbing-rural-prison-demand-and-responsibly-closing-prisons.

Nyce, Ashley. 2022. "Children, Disability, and the Digital Classroom: Rethinking Access and Assistive Technology for Low-Income Children with Disabilities in the Digital Age." *Connecticut Law Review*, January. https://digitalcommons.lib.uconn.edu/law_review/557.

Pandit, Ambrish A, Ruchira V Mahashabde, Clare C Brown, Mahip Acharya, Catherine C Shoults, Hari Eswaran, and Corey J Hayes. 2023. "Association between Broadband Capacity and Telehealth Utilization among Medicare Fee-for-Service Beneficiaries during the COVID-19 Pandemic." *Journal of Telemedicine and Telecare*, April, 1357633X231166026. https://doi.org/10.1177/1357633X231166026.

Pender, John, Joshua Goldstein, and Devika Mahoney-Nair. 2022. "Impacts of the Broadband Initiatives Program on Broadband Adoption and Home Telework." *Telecommunications Policy* 46 (8): 102365. https://doi.org/10.1016/j.telpol.2022.102365.

Rauh, Jonathan. 2021. "Does Increasing Access to Technology Provide Benefits to Students? Considering Socioeconomics, Broadband and One-to-One Computing." Trident United Way. https://www.tuw.org/sites/tuw/files/School%20%26%20Broadband.pdf.

Readiness and Emergency Management for Schools Technical Assistance Center. 2024. "Cyber Safety for K-12 Schools and School Districts." Readiness and Emergency Management for Schools Technical Assistance Center. September 10, 2024. https://rems.ed.gov/cybersafety.

Reisdorf, Bianca C. 2023. "Locked In and Locked Out: How COVID-19 Is Making the Case for Digital Inclusion of Incarcerated Populations." *The American Behavioral Scientist*, February, 00027642231155369. https://doi.org/10.1177/00027642231155369.

Ryan, Mia. 2020. "Accelerating Digital Inclusion for People Experiencing Homelessness: A Spotlight on San Francisco." London, United Kingdom: GSMA Digital Equity Initiative. https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2020/03/Digital-Equity-Accelerating-Digital-Inclusion-for-People-Experiencing-Homelessness-A-spotlight-on-San-Francisco_SINGLE.pdf.

Schulz, Peter J., Sara Rubinelli, Maria Caiata Zufferey, and Uwe Hartung. 2010. "Coping with Chronic Lower Back Pain: Designing and Testing the Online Tool ONESELF." *Journal of Computer-Mediated Communication* 15 (4): 625–45. https://doi.org/10.1111/j.1083-6101.2009.01509.x.

Schur, Lisa A., Mason Ameri, and Douglas Kruse. 2020. "Telework After COVID: A 'Silver Lining' for Workers with Disabilities?" *Journal of Occupational Rehabilitation* 30 (4): 521–36. https://doi.org/10.1007/s10926-020-09936-5.

Staff, T. C. R. 2018. "Access Denied: The Digital Crisis in Prisons." *The Crime Report* (blog). August 6, 2018. https://thecrimereport.org/2018/08/06/access-denied-the-digital-crisis-in-prisons/.

US Department of Commerce, and National Telecommunications and Information Administration. 2022. "Internet for All: Frequently Asked Questions and Answers Draft Version 2.0." U.S. Department of Commerce, National Telecommunications and Information Administration. https://broadbandusa.ntia.doc.gov/sites/default/files/2022-09/BEAD-Frequently-Asked-Questions-%28FAQs%29_Version-2.0.pdf.

Varsick, S., and L. Vosberg. 2024. "The Potential Impact of Artificial Intelligence on Equity and Inclusion in Education." 23. OECD Artificial Intelligence Papers. https://doi.org/10.1787/15df715b-en.

Verma, Aradhana, Amytis Towfighi, Arleen Brown, Anshu Abhat, and Alejandra Casillas. 2022. "Moving Towards Equity With Digital Health Innovations for Stroke Care." *Stroke* 53 (3): 689–97. https://doi.org/10.1161/STROKEAHA.121.035307.

Wagner, Gary A., and Hyun Ji Lee. 2024. "Does Broadband Affect Local Economic Outcomes Less than We Thought? Micro Evidence from Louisiana." *Contemporary Economic Policy* 42 (1): 68–93. https://doi.org/10.1111/coep.12628.

Wang, Peter. 2020. "The Causal Effect of Mobile Broadband on Earnings Inequality and Employment." SSRN Scholarly Paper. Rochester, NY. https://doi.org/10.2139/ssrn.3725699.

Wang, Yi, Geng Niu, Yang Zhou, and Weijie Lu. 2023. "Broadband Internet and Stock Market Participation." *International Review of Financial Analysis* 85 (January):102473. https://doi.org/10.1016/j.irfa.2022.102473.

Wedlake, Stacey, Yvette Iribe Ramirez, Kathleen Carson, Chris Jowaisas, David Keyes, and Matthew Houghton. 2021. "Creating a Digital Bridge: Lessons and Policy Implications from a Technology Access and Distribution Program for Low-Income Job Seekers." SSRN Scholarly Paper. Rochester, NY. https://doi.org/10.2139/ssrn.3898330.

Wheelahan, Leesa, and Gavin Moodie. 2022. "Gig Qualifications for the Gig Economy: Micro-Credentials and the 'Hungry Mile.'" *Higher Education* 83 (June). https://doi.org/10.1007/s10734-021-00742-3.

Whitacre, Brian, and Roberto Gallardo. 2022. "Broadband Availability vs. Adoption: Which Matters More for Economic Development?" Southern Rural Development Center. https://scholarsjunction.msstate.edu/cgi/viewcontent.cgi?article=1000&context=srdctopics-digitalaccess.

Whitacre, Brian, Roberto Gallardo, and Sharon Strover. 2014. "Does Rural Broadband Impact Jobs and Income? Evidence from Spatial and First-Differenced Regressions." *The Annals of Regional Science* 53 (3): 649–70. https://doi.org/10.1007/s00168-014-0637-x.

Yang, Tian, Julia Ticona, and Yphtach Lelkes. 2021. "Policing the Digital Divide: Institutional Gate-Keeping & Criminalizing Digital Inclusion." *Journal of Communication* 71 (4): 572–97. https://doi.org/10.1093/joc/jqab019.

Zaber, Melanie, Lynn Karoly, and Katie Whipkey. 2019. *Reimagining the Workforce Development and Employment System for the 21st Century and Beyond*. https://doi.org/10.7249/RR2768.

Zivanai, Eugenia, and Gilbert Mahlangu. 2022. "Digital Prison Rehabilitation and Successful Re-Entry into a Digital Society: A Systematic Literature Review on the New Reality on Prison Rehabilitation." *Cogent Social Sciences* 8 (1): 2116809. https://doi.org/10.1080/23311886.2022.2116809.

Appendix B. Internet Speed and Reliability

The FCC reports twice every year about the coverage of broadband internet nationwide, and rates by technology type are rapidly changing as fiber expands into more areas and new technologies, such as satellite and 5G (figure 3). Including all technologies, broadband is available to 99.97 percent of US households, according to analyses of the most recent FCC data.[44] However, when satellite is not included, broadband internet via other fixed terrestrial connections is only available to approximately 93 percent of US households as of December 2023. Narrowing the scope further to include only cable and fiber service—the fastest speeds among all infrastructure types—broadband coverage further drops to 89 percent of US households.[45]

There are three domains of internet reliability: reliability of the internet connection, reliability of the internet speed, and reliability based on the user setting or context. The reliability of internet connections can vary based on weather conditions, provider infrastructure, and geographical barriers. Reliability of internet speeds can vary from what ISPs advertise versus what they deliver because of network congestion from high usage, distance from the nearest network tower, internet service provider infrastructure, quality of routers and cables, number of devices connected to a network, and individual device capabilities.

User context also plays a role. The construction quality and characteristics of residences and other buildings—including age, number of floors, and construction materials such as concrete, glass, or wood—can play a significant role in the quality and reliability of connections. Internal and external physical obstructions like walls and large buildings can interfere with Wi-Fi signals.

Fixed Infrastructure

Topography, cost, and reliability are key challenges with fixed infrastructure. For example, fiber installation is labor-intensive, often requiring excavation equipment, sophisticated engineering, and substantial human labor to dig and bury cables. Reliability can be an issue for satellite internet, which may be unable to support video conferencing, with implications for remote workers and many people in rural areas that do not have other internet options. The FCC communicated "serious doubts" about the competitiveness of low earth satellite technology in 2020 for its rural subsidy program,[46] but recent

increases in the number of deployed satellites as the technology advances may improve reliability (Shayea et al. 2024).[47]

Mobile Infrastructure

Service reliability and security can make mobile infrastructure less desirable for internet uses requiring consistently high speeds or secure platforms for data transmission. To receive the fastest 5G service, a consumer needs to be very close to a tower, which makes deployment unlikely to be profitable in low-density rural areas.[48] Public Wi-Fi and mobile hotspot connections may also not be secure, and information sent over shared networks could be intercepted by bad actors (James 2021). Workarounds exist to strengthen security, such as connecting via a virtual private network (VPN) and using secure web practices. However, research suggests not all consumers have knowledge of secure web practices, or if they do, may be unlikely to use them.[49] Moreover, network access and speed can be influenced by how many people are using a network at the same time, the user's distance from the connection point, and other physical obstructions that can impede a reliable connection.

Appendix C. Common Digital Inclusion Data Sources and Measures

TABLE C1

Common Digital Data Sources and Measures

Dataset	Data publisher or owner	Pillars	Level of geography	Data collection type	Data collection release cadence	Most recent year available	Measures
FCC National Broadband Map	Federal Communications Commission	Access	State, county, congressional district, place, tribal area, MSA	Service provider data	Twice yearly	2023	Coverage of fixed and mobile internet service
FCC Form 477 Fixed Broadband Deployment Data	Federal Communications Commission	Access	Census block	Service provider data	Twice yearly	2021	Coverage of fixed and mobile internet service
American Community Survey	Census Bureau	Access, adoption	State, county, city	Survey	Yearly	2023	Household computer and internet use
NTIA Internet Use Survey	National Telecommunications and Information Administration	Access, adoption, skills, safety, use	State	Survey	Every two years	2023	Device and internet access and use

Dataset	Data publisher or owner	Pillars	Level of geography	Data collection type	Data collection release cadence	Most recent year available	Measures
NTIA Local Estimates of Internet Adoption	National Telecommunications and Information Administration	Adoption	County	Survey, auxiliary data, estimation modeling	Yearly	2022	Internet adoption
Internet and Broadband survey	Pew Research Center	Adoption	National	Survey	Yearly	2023	Internet and broadband use

Source: Urban Institute data scan.

Note: [a]Pew Research Center changed its methodology for this survey in 2023. FCC = Federal Communications Commission; NTIA = National Telecommunications and Information Administration.

National Telecommunications and Information Administration Internet Use Survey

The NTIA conducts an annual survey on internet use, connections by infrastructure type, and connections by type of device. The most recently available data available are from November 2023.[50] The NTIA Data Explorer[51] enables tracking and visualization of the survey data. In partnership with the US Census Bureau, NTIA gathers data on internet usage across the United States, providing insights into who uses the internet, what technologies they use, and the challenges preventing people from full internet access. NTIA data cover information about device use, internet use and nonuse, types of internet services, and online activities.

- **Device use**: Use of desktop computers, laptops, tablets, smartphones, smart TVs, other smart connected devices, and wearable devices.
- **Internet use**: Use of the internet at home, work, school, coffee shop, or other business; while traveling between places, in public places, and at someone else's home; use of home internet by anyone in the household; and no home internet use.
- **Reasons for nonuse of the internet at home**: Nonuse because it is not needed or respondents are not interested; subscriptions are too expensive; lack of or inadequate computer; ability to use the internet elsewhere; privacy or security concerns; or the internet is not available in the area.
- **Types of internet services**: Types of services including wired high-speed internet at home, satellite used at home, dial-up used at home, and mobile data plan at any location; home internet plan bought from a company; home internet plan brought by an agency, co-op, or nonprofit; home internet provided for a building, condominium, or apartment; home internet provided via publicly available service at no charge; and home cable TV subscription.
- **Online activities**: Types of activities including email, text messaging, instant messaging, social networks, publishing content, online video and voice calls, watching videos online, streaming videos and music, working remotely, searching for a job, taking a class or job training, using financial services, shopping, making reservations, using customer service, selling goods, requesting services, offering services, and interacting with household equipment.

Appendix D. Additional Digital Risks

Everyone that uses the internet experiences common risks associated with using legitimate websites and online platforms that collect information without their knowledge or permission (see p. 38). Numerous other digital risks are associated with specific sectors or technologies. This section details risks associated with health data and technologies, housing data and housing technologies, and risks related to digital surveillance.

Health Data Vulnerabilities

Health data vulnerabilities are a threat to privacy and can be a barrier to meeting health needs. In the health arena, individuals create a digital health footprint as they interact online that exposes them to privacy risks. Information shared during these digital interactions and activities—such as internet searches, mobile applications, wearable devices, and social media conversations—can generate health-relevant information about, for example, physical activity, fertility, and chronic disease and depression risks (Grande et al. 2020). Yet many health-related apps and devices are not covered under privacy protection laws such as the Health Insurance Portability and Accountability Act of 1996 (Rockwern et al. 2021). This lack of privacy and security online may unduly affect populations that have historically experienced the worst health disparities and increase reluctance to leverage technology to meet their health needs (Richardson et al. 2022).

Insecure Housing Data

Insecure housing data can lead to or exacerbate housing discrimination. In the housing sector, many prospective and current homeowners and renters regularly use real estate-related platforms to find a residence to rent or purchase. Private consumer data is often collected and stored, and data from digital platform communications over the course of leasing, management, or selling processes can be sold. These data can include race and ethnicity information, often via proxy (such as name), family status (e.g., number of bedrooms), disability status (e.g., requests for accessible accommodations to view or live in a home). Data can also include income, source of income (including use of a federal housing voucher), employer information, credit information, rent history, and even criminal background checks (Boeing, Harten, and Sanchez-Moyano 2023). Other data are compiled, sold, and used to score and screen prospective tenants and used in landlord decisions to rent (Ferreri and Sanyal 2022). Collected data

may reveal protected class status under the Fair Housing Act, which prohibits discrimination in housing transactions for protected classes, but online transactions can obfuscate more covert discrimination, such as simple failure to reply to an online inquiry after someone has revealed their protected class status (Faber and Mercier 2022). Nationally, there is little regulation governing how securely these data are kept, how these data can be used by those who own or receive it, and how and when these data are destroyed or expunged.

Digital Surveillance Risk

Audio and video technologies increase the risk of digital surveillance. Beyond consumer use of digital real estate platforms, technologies capable of audio or video surveillance pose additional risks to renters and homeowners. Increased surveillance of renters by landlords—from closed-circuit television (CCTV) cameras to facial recognition systems—can be used in attempts to catch lease violations and justify tenant evictions (McElroy and Vergerio 2022). Tenants may not be asked for consent or given information about where surveillance data is stored, how it is used, and whether it is destroyed. The technology is also systematically worse at identifying people with darker skin tones, which has resulted in false accusations of crimes or failure to recognize lawful residents (McElroy and Vergerio 2022).

Consumers can also adopt technology in their own homes that open them up to unwanted surveillance, such as smart home devices. Smart home devices can help residents feel more secure and comfortable and can provide convenience and supports for aging or younger family members, but many come with security risks that are underexplored by the industry and poorly understood by consumers (Hammi et al. 2022). Risks include the vulnerability of devices to hacking to monitor in-home activities or to cause devices to malfunction and physically destroy property. These unresolved data-privacy issues can lead to distrust and low adoption rates of smart home technologies that could otherwise lead to positive outcomes such as increasing personal safety, supporting home energy savings, and improving social connections, particularly for older adults who wish to age independently in their own homes (Chhetri and Genaro Motti 2022).

Finally, internet users relying on unsecured public Wi-Fi instead of a secure, reliable in-home connection can be more vulnerable to data privacy breaches and digital surveillance. Public Wi-Fi is often unsecured and users can be vulnerable to malware, data interception, identity theft, session hijacking, and other attacks.[52] Some researchers have raised additional concerns that overreliance on mobile connectivity without proper privacy protections can expose users to data aggregation used to screen for employment, access higher education, and predict policing (Madden et al. 2017).

Notes

[1] National Digital Inclusion Alliance "NDIA Definitions," accessed February 7, 2025, https://www.digitalinclusion.org/definitions/

[2] National Digital Inclusion Alliance. "NDIA Definitions."

[3] National Digital Inclusion Alliance. "NDIA Definitions."

[4] New Jersey Office of Broadband Connectivity, "Digital Opportunity and Resources," accessed September 17, 2024, https://www.nj.gov/connect/resources/digital-opportunities/.

[5] New York City Coalition for Adult Literacy, "New York City Alliance for Digital Equity," accessed July 9, 2024, https://www.nyccaliteracy.org/nycade.html.

[6] Community Tech Network. "Broadband Equity and the Digital Divide," December 13, 2021, https://communitytechnetwork.org/blog/broadband-equity-and-the-digital-divide/

[7] AARP. "Digital Equity," accessed June 23, 2024, https://oats.org/digital-equity/.

[8] Brittne Kakulla, "2023 Tech Trends: No End in Sight for Age 50+ Market Growth. AARP Research," AARP, January 5, 2023, https://www.aarp.org/pri/topics/technology/internet-media-devices/2023-technology-trends-older-adults/

[9] Dan Feng, "An Open Letter to State Broadband Leaders on Digital Equity for Incarcerated Persons," Benton Institute for Broadband & Society, December 11, 2023, https://www.benton.org/blog/open-letter-state-broadband-leaders-digital-equity-incarcerated-people.

[10] Federal Communications Commission, "FCC Fact Sheet: Inquiry Concerning Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion," February 22, 2024, 2024 Section 706 Report, GN Docket No. 22-270, https://docs.fcc.gov/public/attachments/DOC-400675A1.pdf

[11] Fiber Broadband Association, "US Fiber Rollouts Reach Tipping Point but Are Still Far Behind HFC" Light Reading, March 12, 2024, https://www.lightreading.com/fttx/us-fiber-rollouts-reach-tipping-point-but-are-still-far-behind-hfc.

[12] CableLabs, "DOCSIS 3.1 Technology," accessed November 11, 2024, https://www.cablelabs.com/technologies/docsis-3-1.

[13] Tyler Cooper, "The End of an Era: Is DSL Internet Still Available?" BroadbandNow, November 1, 2023, https://broadbandnow.com/report/the-end-of-dsl.

[14] Verizon, "What is Fixed Wireless Internet Technology?" accessed July 9, 2024, https://www.verizon.com/about/blog/fixed-wireless-access.

[15] PC Mag, "2024 Starlink Tests: SpaceX's Satellite Internet Keeps Getting Better," March 6, 2024, https://www.pcmag.com/articles/2024-starlink-speed-tests-spacex-satellite-internet.

[16] BCG, "Regulating the Next Generation of Satellites," March 14, 2024, https://www.bcg.com/publications/2024/regulating-the-next-generation-of-satellites.

[17] Center on Rural Innovation, "Solving Rural Connectivity Issues," July 8, 2020, https://ruralinnovation.us/blog/solving-rural-connectivity-issues/.

[18] BroadbandNow, "The True State of High-Speed 5G Coverage in the United States: 5G Map," accessed August 30, 2024, https://broadbandnow.com/national-5g-coverage-map.

[19] Pew Research Center, " What States Need to Know About Federal BEAD Funding for High-Speed Internet Expansion," January 9, 2023, https://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2023/01/what-states-need-to-know-about-federal-bead-funding-for-high-speed-internet-expansion.

[20] Internet for All, "BEAD Initial Proposal Progress Dashboard," October 17, 2024, https://www.internetforall.gov/bead-initial-proposal-progress-dashboard.

[21] Pew Research Center, "How to Make Broadband a Priority in Affordable Rental Housing Development," November 3, 2022, https://www.pewtrusts.org/en/research-and-analysis/articles/2022/11/03/how-to-make-broadband-a-priority-in-affordable-rental-housing-development.

[22] Pew Research Center, "Navigating Technological Challenges," September 1, 2021, https://www.pewresearch.org/internet/2021/09/01/navigating-technological-challenges/.

[23] Pew Research Center, "Internet, Broadband Fact Sheet," November 13, 2024, https://www.pewresearch.org/internet/fact-sheet/internet-broadband/?tabItem=89fe9877-d6d0-42c5-bca0-8e6034e300aa.

[24] United States Census Bureau, "Broadband Access in Tribal Areas Lags Rest of the Nation," June 18, 2024, https://www.census.gov/library/stories/2024/06/broadband-access-tribal-areas.html.

[25] Pew Research Center, "Internet, Broadband Fact Sheet."

[26] Center on Rural Innovation, "Why Fiber Broadband Networks Matter," accessed August 30, 2024, https://ruralinnovation.us/our-work/broadband/.

[27] Pew Research Center, "Americans' Use of Mobile Technology and Home Broadband," January 31, 2024, https://www.pewresearch.org/internet/2024/01/31/americans-use-of-mobile-technology-and-home-broadband/.

[28] Pew Research Center, "Americans' Use of Mobile Technology."

[29] Pew Research Center. "Internet, Broadband Fact Sheet."

[30] Pew, "Broadband Access Still a Challenge in Rural Affordable Housing." December 8, 2022, https://www.pewtrusts.org/en/research-and-analysis/articles/2022/12/08/broadband-access-still-a-challenge-in-rural-affordable-housing.

[31] NTIA, "The Economics of Broadband Networks," accessed November 13, 2024, https://broadbandusa.ntia.doc.gov/sites/default/files/2022-03/Economics%20of%20Broadband%20Networks%20PDF.pdf.

[32] George S Ford, "Challenges to Universal Adoption: A Look at NTIA's New Data," Perspectives: Phoenix Center for Advanced Legal and Economic Public Policy Studies, June 9, 2022, https://www.phoenix-center.org/perspectives/Perspective22-03Final.pdf.

[33] Dan Feng, "An Open Letter to State Broadband Leaders on Digital Equity for Incarcerated Persons," Benton Institute for Broadband & Society, December 11, 2023, https://www.benton.org/blog/open-letter-state-broadband-leaders-digital-equity-incarcerated-people.

[34] Dan Feng, "An Open Letter to State Broadband Leaders on Digital Equity for Incarcerated Persons."

[35] Dan Feng, "An Open Letter to State Broadband Leaders on Digital Equity for Incarcerated Persons."

[36] HUD, "Our Impact: ConnectHomeUSA Program," accessed July 9, 2024, https://www.hud.gov/program_offices/public_indian_housing/connecthomeusa/our-impact.

[37] The White House, "Affordable Connectivity Program Enrollment Fact Sheets," accessed July 9, 2024, https://www.whitehouse.gov/build/resources/affordable-connectivity-program-enrollment-fact-sheets/.

[38] Digital Bridge K–12, "A Guide to Sponsored Service," accessed November 3, 2024, https://digitalbridgek12.org/toolkit/procure/sponsored-service/

[39] Digital Bridge K–12, "A Guide to Sponsored Service."

[40] Digital Literacy Taskforce, " What Is Digital Literacy?" American Library Association, 2011, https://alair.ala.org/handle/11213/16260.

[41] Brittne Kakulla, "2023 Tech Trends: No End in Sight for Age 50+ Market Growth. AARP Research."

[42] "Scams," Cybercrime Support Network, accessed October 9, 2024, https://fightcybercrime.org/scams/.

[43] "What is GDPR, the EU'a New Data Protection Law?," European Union General Data Protection Regulation, accessed September 9, 2024, https://gdpr.eu/what-is-gdpr/.

[44] David Anders, "New Broadband Maps Are Out. Did the FCC Get Your Area Right?", May 30, 2024, https://www.cnet.com/home/internet/new-broadband-maps-are-out-did-the-fcc-get-your-area-right/.

[45] David Anders, "New Broadband Maps Are Out. Did the FCC Get Your Area Right?"

[46] Federal Communications Commission. 2020. "Rural Digital Opportunity Fund Phase I Auction: Notice and Filing Requirements and other Procedures for Auction 904" accessed February 11, 2025, https://docs.fcc.gov/public/attachments/FCC-20-77A1.pdf.

[47] Thibault Werlé, Faisal Hamady, and Hamza Najmi, "Regulating the Next Generation of Satellites," BCG, March 14 2024, https://www.bcg.com/publications/2024/regulating-the-next-generation-of-satellites.

[48] Broadbandnow, "The True State of High-Speed 5G Coverage in the United States: 5G Map," accessed August 30, 2024, https://broadbandnow.com/national-5g-coverage-map.

[49] Federal Trade Commission Consumer Advice, "Are Public Wi-Fi Networks Safe? What You Need to Know," accessed July 9, 2024, https://consumer.ftc.gov/articles/are-public-wi-fi-networks-safe-what-you-need-know; Forbes Advisor "The Real Risks of Public Wi-Fi: Key Statistics and Usage Data," February 9, 2023, https://www.forbes.com/advisor/business/public-wifi-risks/.

[50] National Telecommunications and Information Administration Internet Use Survey, November 2023, https://www.ntia.gov/data/explorer#sel=internetUser&disp=map.

[51] National Telecommunications and Information Administration Data Explorer, accessed February 11, 2025. https://ntia.gov/data/explorer.

[52] Norton. "Public Wi-Fi: A Guide to the Risks and How to Stay Safe," September 16, 2024, https://us.norton.com/blog/privacy/public-wifi.

References

Arguelles, Paolo, and Isabelle Ortiz-Luis. 2021. "Bars Behind Bars: Digital Technology in the Prison System." Rochester, NY: Social Science Research Network. https://doi.org/10.2139/ssrn.3812046.

Badejo, Johannes, Joyram Chakraborty, and Mia Forbes. 2024. "A Digital Inclusion and Technological Barriers: Investigating the Challenges Faced by Formerly Incarcerated Populations in Adopting and Accessing Technology:" In *Proceedings of the 19th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications*, 464–70. Rome, Italy: SCITEPRESS - Science and Technology Publications. https://doi.org/10.5220/0012360800003660.

Basch, Ethan, Allison M. Deal, Amylou C. Dueck, Howard I. Scher, Mark G. Kris, Clifford Hudis, and Deborah Schrag. 2017. "Overall Survival Results of a Trial Assessing Patient-Reported Outcomes for Symptom Monitoring During Routine Cancer Treatment." *Journal of the American Medical Association* 318 (2): 197–98. https://doi.org/10.1001/jama.2017.7156.

Bashay, Molly. 2020. "Digital Skills for an Equitable Recovery: Policy Recommendations to Address the Digital Skill Needs of Workers Most Vulnerable to Displacement." National Skills Coalition. https://eric.ed.gov/?id=ED607390.

Bastick, Zach, and Marie Mallet-Garcia. 2022. "Double Lockdown: The Effects of Digital Exclusion on Undocumented Immigrants during the COVID-19 Pandemic." *New Media & Society* 24 (2): 365–83. https://doi.org/10.1177/14614448211063185.

Bauer, Anahid, Donn. L. Feir, and Matthew T. Gregg. 2022. "The Tribal Digital Divide: Extent and Explanations." *Telecommunications Policy* 46 (9): 102401. https://doi.org/10.1016/j.telpol.2022.102401.

Bergson-Shilcock, Amanda. 2020a. "Amplifying Impact: How Policies That Combine Investment in English Language Skills with Digital Learning Pay off for Workers and Businesses." National Skills Coalition. https://eric.ed.gov/?id=ED607433.

———. 2020b. "The New Landscape of Digital Literacy: How Workers' Uneven Digital Skills Affect Economic Mobility and Business Competitiveness, and What Policymakers Can Do about It." National Skills Coalition. https://eric.ed.gov/?id=ED607391.

Bernacki, Matthew L., Lucie Vosicka, and Jenifer C. Utz. 2020. "Can a Brief, Digital Skill Training Intervention Help Undergraduates 'Learn to Learn' and Improve Their STEM Achievement?" *Journal of Educational Psychology* 112 (4): 765–81. https://doi.org/10.1037/edu0000405.

Boeing, Geoff, Julia Harten, and Rocio Sanchez-Moyano. 2023. "Digitalization of the Housing Search: Homeseekers, Gatekeepers, and Market Legibility." Joint Center for Housing Studies of Harvard University. https://www.jchs.harvard.edu/research-areas/working-papers/digitalization-housing-search-homeseekers-gatekeepers-and-market.

Boik, Andre. 2017. The economics of universal service: An analysis of entry subsidies for high speed broadband. *Information Economics Policy*. 40. 13-20. https://doi.org/10.1016/j.infoecopol.2017.04.004

Braesemann, Fabian, Vili Lehdonvirta, and Otto Kässi. 2022. "ICTs and the Urban-Rural Divide: Can Online Labour Platforms Bridge the Gap?" *Information, Communication & Society* 25 (1): 34–54. https://doi.org/10.1080/1369118X.2020.1761857.

Brewer, LaPrincess C, Karen L Fortuna, Clarence Jones, Robert Walker, Sharonne N Hayes, Christi A Patten, and Lisa A Cooper. 2020. "Back to the Future: Achieving Health Equity Through Health Informatics and Digital Health." *JMIR mHealth and uHealth* 8 (1): e14512. https://doi.org/10.2196/14512.

Brewer, LaPrincess C., Sarah Jenkins, Sharonne N. Hayes, Ashok Kumbamu, Clarence Jones, Lora E. Burke, Lisa A. Cooper, and Christi A. Patten. 2022. "Community-Based, Cluster-Randomized Pilot Trial of a Cardiovascular

Mobile Health Intervention: Preliminary Findings of the FAITH! Trial." *Circulation* 146 (3): 175–90. https://doi.org/10.1161/CIRCULATIONAHA.122.059046.

Brown, Kelsey. 2020. "How Twenty-First Century Technology Affects Inmates' Access to Prison Law Libraries in the United States Prison System" 21.

Buiquy, Myranda. 2022. "The Digital Isolation of Indigenous Communities." *American Indian Law Journal* 11 (1). https://digitalcommons.law.seattleu.edu/ailj/vol11/iss1/3.

Butrica, Barbara A., Stipica Mudrazija, and Jonathan Schwabish. 2023. "Understanding the Characteristics and Needs of Tribal Community Members for Social Security Delivery." CRR WP 2023-26. Chestnut Hill, MA: Center for Retirement Research at Boston College. https://crr.bc.edu/wp-content/uploads/2023/12/wp_2023-26.pdf.

Chandra, Sumit, Amy Chang, Lauren Day, Amina Fazlullah, Jack Liu, Lane McBride, Thisal Mudalige, and Danny Weiss. 2020. "Closing the K–12 Digital Divide in The Age of Distance Learning." Common Sense Media. November 20, 2020. https://www.commonsensemedia.org/sites/default/files/research/report/common_sense_media_report_final_7_1_3pm_web.pdf.

Chhetri, Chola, and Vivian Genaro Motti. 2022. "Privacy Concerns about Smart Home Devices: A Comparative Analysis between Non-Users and Users." In . https://doi.org/10.54941/ahfe1002207.

Chidambaram, Swathikan, Bhav Jain, Urvish Jain, Mwavu, Rogers, Rama Baru, Beena Thomas, Felix Greaves, et al. 2024. "An Introduction to Digital Determinants of Health." *PLOS Digital Health* 3 (1): e0000346. https://doi.org/10.1371/journal.pdig.0000346.

Comi, Matt, Sarah Smith, Walter A Goettlich, Perry Alexander, Drew Davidson, and William G Staples. 2022. "Digital Home-Lessness: Exploring the Links between Public Internet Access, Technological Capital, and Social Inequality." *Current Sociology* 72 (1): 65–82. https://doi.org/10.1177/00113921221111819.

Connell, Megan Rose. 2019. "Mind the Gap: An Analysis of the Landscape of the Policies of the United States and Germany, and NGOs on Improving Digital Integration for Refugee Populations." University of North Carolina at Chapel Hill. https://cdr.lib.unc.edu/concern/dissertations/5t34sq09g.

Conroy, Tessa, and Sarah A. Low. 2022. "Entrepreneurship, Broadband, and Gender: Evidence from Establishment Births in Rural America." *International Regional Science Review* 45 (1): 3–35. https://doi.org/10.1177/01600176211018749.

Coolberth, Nicky Lauricella. 2024. "How States Are Implementing New Funds to Support Adult Learners and Workers." National Skills Coalition. July 10, 2024. https://nationalskillscoalition.org/blog/future-of-work/how-states-are-implementing-new-funds-to-support-adult-learners-and-workers/.

Cruz, Christopher. 2022. "From Digital Disparity to Educational Excellence: Closing the Opportunity and Achievement Gaps for Low- Income, Black, and Latinx Students." Harvard Latin American Law Review. https://www.mto.com/Templates/media/images/PDFs/24_Cruz.pdf.

Czaja, Sara J, Walter R Boot, Neil Charness, Wendy A Rogers, and Joseph Sharit. 2018. "Improving Social Support for Older Adults Through Technology: Findings From the PRISM Randomized Controlled Trial." *The Gerontologist* 58 (3): 467–77. https://doi.org/10.1093/geront/gnw249.

Deller, Steven, and Brian Whitacre. 2019. "Broadband's Relationship to Rural Housing Values." *Papers in Regional Science* 98 (5): 2135–57. https://doi.org/10.1111/pirs.12450.

Ding, Dan, Lindsey Morris, Kristin Messina, and Andrea Fairman. 2023. "Providing Mainstream Smart Home Technology as Assistive Technology for Persons with Disabilities: A Qualitative Study with Professionals." *Disability and Rehabilitation: Assistive Technology* 18 (7): 1192–99. https://doi.org/10.1080/17483107.2021.1998673.

Early, Jody, and Alyssa Hernandez. 2021. "Digital Disenfranchisement and COVID-19: Broadband Internet Access as a Social Determinant of Health." *Health Promotion Practice* 22 (5): 605–10. https://doi.org/10.1177/15248399211014490.

Eberly, Lauren A., Michael J. Kallan, Howard M. Julien, Norrisa Haynes, Sameed Ahmed M. Khatana, Ashwin S. Nathan, Christopher Snider, et al. 2020a. "Patient Characteristics Associated With Telemedicine Access for Primary and Specialty Ambulatory Care During the COVID-19 Pandemic." *JAMA Network Open* 3 (12): e2031640. https://doi.org/10.1001/jamanetworkopen.2020.31640.

Eberly, Lauren A., Sameed Ahmed M. Khatana, Ashwin S. Nathan, Christopher Snider, Howard M. Julien, Mary Elizabeth Deleener, and Srinath Adusumalli. 2020b. "Telemedicine Outpatient Cardiovascular Care During the COVID-19 Pandemic." *Circulation* 142 (5): 510–12. https://doi.org/10.1161/CIRCULATIONAHA.120.048185.

Ellison-Barnes, Alejandra, Alyssa Moran, Sabriya Linton, Manotri Chaubal, Michelle Missler, and Craig Evan Pollack. 2021. "Limited Technology Access Among Residents of Affordable Senior Housing During the COVID-19 Pandemic." *Journal of Applied Gerontology* 40 (9): 958–62. https://doi.org/10.1177/07334648211013634.

Emerson, Amanda Marie. 2018. "Narrative Inquiry into Shelter-Seeking by Women with a History of Repeated Incarceration: Research and Nursing Practice Implications." *ANS. Advances in Nursing Science* 41 (3): 260. https://doi.org/10.1097/ANS.0000000000000216.

Escobari, Marcela, Ian Seyal, and Michael Meaney. 2019. "Realism about Reskilling: Upgrading the Career Prospects of America's Low-Wage Workers. Workforce of the Future Initiative." Center for Universal Education at The Brookings Institution. https://eric.ed.gov/?id=ED602976.

Evans, Julie A. 2019. "Digital Learning: Peril or Promise for Our K-12 Students. National Briefing Paper -- Speak Up 2018/19." Project Tomorrow. https://eric.ed.gov/?id=ED605281.

Evans, Laura, Jay Evans, Claudia Pagliari, and Karin Källander. 2023. "Scoping Review: Exploring the Equity Impact of Current Digital Health Design Practices." *Oxford Open Digital Health* 1 (January):oqad006. https://doi.org/10.1093/oodh/oqad006.

Faber, Jacob William, and Marie-Dumesle Mercier. 2022. "Multidimensional Discrimination in the Online Rental Housing Market: Implications for Families With Young Children." *Housing Policy Debate*, 1–24. https://doi.org/10.1080/10511482.2021.2010118.

FCC (Federal Communications Commission). 2024a. "Children's Internet Protection Act (CIPA)." July 5, 2024. https://www.fcc.gov/consumers/guides/childrens-internet-protection-act.

———. 2024b. "E-Rate: Universal Service Program for Schools and Libraries." February 27, 2024. https://www.fcc.gov/consumers/guides/universal-service-program-schools-and-libraries-e-rate.

Fenlon, Michael J., and Brian K. Fitzgerald. 2019. "Reskilling – A Solution for the Digital Skills Gap." *Business-Higher Education Forum*.

Fenner, Chad, Cherie Noteboom, and Omar El-Gayer. 2024. "Digital Divide in Rural Native American Homes: A Student Perspective." In *Proceedings of the 57th Hawaii International Conference on System Sciences*, 6989–98. https://hdl.handle.net/10125/107224.

Ferreri, Mara, and Romola Sanyal. 2022. "Digital Informalisation: Rental Housing, Platforms, and the Management of Risk." *Housing Studies* 37 (6): 1035–53. https://doi.org/10.1080/02673037.2021.2009779.

Forrester. 2024. "The Total Economic Impact™ Of Chromebooks In Education: Cost Savings And Business Benefits Enabled By Chromebooks In Education." Forrester. https://tei.forrester.com/go/google/chromebookEDU/?lang=en-us.

Galperin, Hernan, and François Bar. 2024. "Evaluating the Impact of the Affordable Connectivity Program." Los Angeles, California: USC Annenberg School for Communication. https://arnicusc.org/wp-content/uploads/2024/05/Deliverable-2-final.pdf.

Galperin, Hernan, François Bar, and Hoan Nguyen. 2021. "The Power Divide: Mobile Communication in Los Angeles' Skid Row." *Mobile Media & Communication* 9 (1): 30–50. https://doi.org/10.1177/2050157920932608.

Galperin, Hernan, Thai V. Le, and Kurt Wyatt. 2021. "Who Gets Access to Fast Broadband? Evidence from Los Angeles County." *Government Information Quarterly* 38 (3): 101594. https://doi.org/10.1016/j.giq.2021.101594.

Garnett, Paul, Alexander Jeffrey, and Johnson, David. 2024. "Achieving Internet for All: Socioeconomics and Fixed Broadband Availability in the U.S." Vernonburg Group. https://static1.squarespace.com/static/5f5282b71117310d16e654d3/t/6615bccacf4ca24a093d7d49/1712700619550/AchievingInternetForAllPaper_SinglePgs.pdf.

Garnett, Paul. and David Johnson. 2022. "Toward Effective Administration of State and Local Fixed Broadband Programs." Vernonburg Group .https://static1.squarespace.com/static/5f5282b71117310d16e654d3/t/637c0828c164e464e07e5a34/1669072937014/Toward+Effective+Administration+of+State+and+Local+Fixed+Broadband+Programs+%28Nov+2022%29.pdf

Gleason, Kelly, and Jonathon J. Suen. 2021. "Going beyond Affordability for Digital Equity: Closing the 'Digital Divide' through Outreach and Training Programs for Older Adults." *Journal of the American Geriatrics Society*, October. https://doi.org/10.1111/jgs.17511.

Gonzales, Amy L., Jessica McCrory Calcaro, and Teresa K. Lynch. 2018. "Technology Problems and Student Achievement Gaps: A Validation and Extension of the Technology Maintenance Construct." *Communication Research* 47 (5). https://doi.org/10.1177%2F0093650218796366.

Gonzalez, Catalina, and Priyanka Sharma. 2021. "Program Profiles." Digital US. 2021. https://digitalus.org/digital-navigator-playbook/program-profiles/.

Gonzalez, Nick, Diana Garcia, and Rodrigo Dominguez Villegas. 2020. "Latino Workers and Digitalization: An Analysis and Policy Roadmap to Building an Inclusive 21st Century Digital Economy." UCLA Latino Policy & Politics Initiative. https://escholarship.org/content/qt07s1919d/qt07s1919d.pdf.

Goodchild, Chris, Hannah Hill, Matt Kalmus, Jean Lee, and David Webb. 2021. "Boosting Broadband Adoption and Remote K–12 Education in Low-Income Households." *BCG Global* (blog). May 12, 2021. https://www.bcg.com/publications/2021/accelerating-broadband-adoption-for-remote-education-low-income-households.

Goodman, Joshua, Julia Melkers, and Amanda Pallais. 2019. "Can Online Delivery Increase Access to Education?" *Journal of Labor Economics* 37 (1): 1–34. https://doi.org/10.1086/698895.

Grande, David, Xochitl Luna Marti, Rachel Feuerstein-Simon, Raina M. Merchant, David A. Asch, Ashley Lewson, and Carolyn C. Cannuscio. 2020. "Health Policy and Privacy Challenges Associated With Digital Technology." *JAMA Network Open* 3 (7): e208285. https://doi.org/10.1001/jamanetworkopen.2020.8285.

GSMA, 2020. Accelerating Digital Inclusion for People Experiencing Homelessness: A Spotlight on San Francisco. https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-for-development/wp-content/uploads/2020/03/Digital-Equity-Accelerating-Digital-Inclusion-for-People-Experiencing-Homelessness-A-spotlight-on-San-Francisco_SINGLE.pdf.

Hammi, Badis, Sherali Zeadally, Rida Khatoun, and Jamel Nebhen. 2022. "Survey on Smart Homes: Vulnerabilities, Risks, and Countermeasures." *Computers & Security* 117 (June):102677. https://doi.org/10.1016/j.cose.2022.102677.

Harris, Kathy, Naila Judge, and Chris Burger. 2022. "Learning from Each Other: A Partnership Between an Affordable Housing Organization and a Digital Literacy Research Organization." *Adult Literacy Education* Fall:28–33. https://doi.org/10.35847/KHarris.NJudge.CBurger.4.3.27.

Hayes, Joseph, Niu Gao, and Vicki Hsieh. 2021. "Policy Brief: Achieving Digital Equity for California's Students." Public Policy Institute of California. https://www.ppic.org/publication/policy-brief-achieving-digital-equity-for-californias-students/.

Hecker, Ian, and Amanda Briggs. 2021. "Overlooked and Under-Connected: Exploring Disparities in Digital Skill Levels Among Older Youth of Color in the US." https://www.urban.org/research/publication/overlooked-and-under-connected-exploring-disparities-digital-skill-levels-among-older-youth-color-us.

Hecker, Ian, Shayne Spaulding, and Daniel Kuehn. 2021. "Digital Skills and Older Workers: Supporting Success in Training and Employment in a Digital World." Urban Institute. https://eric.ed.gov/?id=ED616367.

Hernandez, Mario Funes, and Fatima Rodriguez. 2023. "Health Techequity: Opportunities for Digital Health Innovations to Improve Equity and Diversity in Cardiovascular Care." *Current Cardiovascular Risk Reports* 17 (1): 1–20. https://doi.org/10.1007/s12170-022-00711-0.

Hofinger, Veronika, and Philipp Pflegerl. 2024. "A Reality Check on the Digitalisation of Prisons: Assessing the Opportunities and Risks of Providing Digital Technologies for Prisoners." *Punishment & Society*, March, 14624745241237190. https://doi.org/10.1177/14624745241237190.

Hwang, Ye In (Jane), Amanuel Hagos, Adrienne Withall, Stephen Hampton, Phillip Snoyman, and Tony Butler. 2024. "Population Ageing, Incarceration and the Growing Digital Divide: Understanding the Effects of Digital Literacy Inequity Experienced by Older People Leaving Prison." *PLOS ONE* 19 (4): e0297482. https://doi.org/10.1371/journal.pone.0297482.

James, Jason E. 2021. "Analysis of Security Features and Vulnerabilities in Public/Open Wi-Fi." *Journal of Information Systems Applied Research* 14 (3): 4–13.

Jamwal, Rebecca, Hannah K. Jarman, Eve Roseingrave, Jacinta Douglas, and Dianne Winkler. 2022. "Smart Home and Communication Technology for People with Disability: A Scoping Review." *Disability and Rehabilitation: Assistive Technology* 17 (6): 624–44. https://doi.org/10.1080/17483107.2020.1818138.

Kapinos, Kandice, Virginia Kotzias, Debra Bogen, Kristin Ray, Jill Demirci, Mary Ann Rigas, and Lori Uscher-Pines. 2019. "The Use of and Experiences With Telelactation Among Rural Breastfeeding Mothers: Secondary Analysis of a Randomized Controlled Trial." *Journal of Medical Internet Research* 21 (9): e13967. https://doi.org/10.2196/13967.

Knight, Victoria, and Steven Van De Steene. 2020. "The Digital Prison: Towards an Ethics of Technology." In *Prisons and Community Corrections*. Routledge.

Korostelina, Karina V., and Jocelyn Barrett. 2023. "Bridging the Digital Divide for Native American Tribes: Roadblocks to Broadband and Community Resilience." *Policy and Internet* 15 (3): 306–26. https://doi.org/10.1002/poi3.339.

LaRose, Robert, Jennifer Gregg, Sharon Strover, Joseph Straubhaar, and Serena Carpenter. 2007. Closing the Rural Broadband Gap: Promoting Adoption of the Internet in Rural America. *Telecommunications Policy* 31(6–7):359–373.

Lee, Hee Yun, Lauren Kois, Kun Wang, Cho Rong Won, Areum Han, and Rebecca S. Allen. 2023. "Correlations between Social Determinants of Health and Technology Access among Rural African American Alabamians." *Journal of Health Care for the Poor and Underserved* 34 (1): 21–34.

Lee, Jihye, James Hamilton, Nilam Ram, Thomas N. Robinson, and Byron Reeves. 2024. "Digital Inequality in Online Access to Public Benefits: A Computational Appraisal of Challenges Experienced by Low-Income Individuals in Accessing Public Benefits Via Smartphones." http://dx.doi.org/10.2139/ssrn.4814133.

Li, Wenda, Tan Yigitcanlar, Isil Erol, and Aaron Liu. 2021. "Motivations, Barriers and Risks of Smart Home Adoption: From Systematic Literature Review to Conceptual Framework." *Energy Research & Social Science* 80 (October):102211. https://doi.org/10.1016/j.erss.2021.102211.

Li, Xiaoqian. 2018. "Core Technical Support Networks in Public Housing Communities: A New Perspective on Digital Inequalities." Unpublished dissertation, Austin, TX: University of Texas, Austin.

Li, Y., B.R. Spoer, T.M. Lampe, P.Y. Hsieh, I.S. Nelson, A. Vierse, L.E. Thorpe, and M.N. Gourevitch. 2023. "Racial/Ethnic and Income Disparities in Neighborhood-Level Broadband Access in 905 US Cities, 2017–2021." *Public Health* 217 (April):205–11. https://doi.org/10.1016/j.puhe.2023.02.001.

LoPiccalo, Katherine. 2022. "Impact of Broadband Penetration on U.S. Farm Productivity: A Panel Approach." *Telecommunications Policy* 46 (9): 102396. https://doi.org/10.1016/j.telpol.2022.102396.

Madden, Mary, Michele Gilman, Karen Levy, and Alice Marwick. 2017. "Privacy, Poverty, and Big Data: A Matrix of Vulnerabilities for Poor Americans." *Washington University Law Review* 95:53.

Marston, Hannah Ramsden, Linda Shore, and P. J. White. 2020. "How Does a (Smart) Age-Friendly Ecosystem Look in a Post-Pandemic Society?" *International Journal of Environmental Research and Public Health* 17 (21): 8276. https://doi.org/10.3390/ijerph17218276.

Martin, Florence, Drew Polly, Shanna Coles, and Chuang Wang, 2020. "Examining Higher Education Faculty Use of Current Digital Technologies: Importance, Competence, and Motivation." *International Journal of Teaching and Learning in Higher Education*. 32 (1):73–86.

McCall, Terika, Kammarauche Asuzu, Carol R. Oladele, Tiffany I. Leung, and Karen H. Wang. 2022. "A Socio-Ecological Approach to Addressing Digital Redlining in the United States: A Call to Action for Health Equity." *Frontiers in Digital Health* 4 (July). https://doi.org/10.3389/fdgth.2022.897250.

McElroy, Erin, and Manon Vergerio. 2022. "Automating Gentrification: Landlord Technologies and Housing Justice Organizing in New York City Homes." *Environment and Planning D: Society and Space* 40 (4): 607–26. https://doi.org/10.1177/02637758221088868.

Mills, Bradford and Brian Whitacre. 2023. "Understanding the Non-Metropolitan—Metropolitan Digital Divide." *Growth and Change* 34 (2):219–243. https://doi.org/10.1111/1468-2257.00215

Molnar, Gabor, Scott J. Savage, and Douglas C. Sicker. 2019. "High-Speed Internet Access and Housing Values." *Applied Economics* 51 (55): 5923–36. https://doi.org/10.1080/00036846.2019.1631443.

Nishii, Akira, Celeste Campos-Castillo, and Denise Anthony. 2022. "Disparities in Patient Portal Access by US Adults before and during the COVID-19 Pandemic." *JAMIA Open* 5 (4): ooac104. https://doi.org/10.1093/jamiaopen/ooac104.

Nisser, Martin, Marisa Gaetz, Andrew Fishberg, Raechel N. Soicher, Faraz Faruqi, and Joshua Long. 2024. "From Prisons to Programming: Fostering Self-Efficacy via Virtual Web Design Curricula in Prisons and Jails." In *Proceedings of the CHI Conference on Human Factors in Computing Systems*, 1–13. CHI '24. New York, NY, USA: Association for Computing Machinery. https://doi.org/10.1145/3613904.3642717.

Novisky, Meghan A., Rusty P. Schnellinger, Richard E. Adams, and Brie Williams. 2022. "Health Information Seeking Behaviors in Prison: Results From the U.S. PIAAC Survey." *Journal of Correctional Health Care: The Official Journal of the National Commission on Correctional Health Care* 28 (2): 90–99. https://doi.org/10.1089/jchc.20.04.0024.

Park, Hyewon. 2024. "Bridging the Digital Divide by Addressing Barriers with Digital Literacy Strategies for Older Adults. Community Technical Network." San Francisco: Community Tech Network. https://communitytechnetwork.org/wp-content/uploads/2024/04/AAACE-WhitePaper.pdf-1.pdf

Perrin, Andrew. 2021. *Mobile Technology and Home Broadband 2021*. Pew Research Center. https://www.pewresearch.org/internet/wp-content/uploads/sites/9/2021/06/PI_2021.06.03_Mobile-Broadband_FINAL.pdf

Polson, Erika, Renée A. Botta, and Emily Van Houweling. 2024. "Where's the Bathroom in This 'Mobile Home'? Adding Water, Sanitation & Hygiene (WaSH) Infrastructure to Agendas on Homelessness and Digital Media." *Mobile Media & Communication* 12 (2): 368–85. https://doi.org/10.1177/20501579231191929.

Poster, Winifred R. 2022. "Introduction to Special Issue on Scams, Fakes, and Frauds." *New Media & Society* 24 (7): 1535–47. https://doi.org/10.1177/14614448221099232.

Powers, Jillian, Ann Musgrove, and Bryan Nichols. 2020. "Teachers Bridging the Digital Divide in Rural Schools with 1:1 Computing." *The Rural Educator* 41 (April):61–76. https://doi.org/10.35608/ruraled.v41i1.576.

Price-Haywood, Eboni G., Connie Arnold, Jewel Harden-Barrios, and Terry Davis. 2023. "Stop the Divide: Facilitators and Barriers to Uptake of Digital Health Interventions Among Socially Disadvantaged Populations." *Ochsner Journal* 23 (1): 34–42. https://doi.org/10.31486/toj.22.0101.

Pritchett, Joshua C., Debra Patt, Gita Thanarajasingam, Anne Schuster, and Claire Snyder. 2023. "Patient-Reported Outcomes, Digital Health, and the Quest to Improve Health Equity." *American Society of Clinical Oncology Educational Book*, June. https://doi.org/10.1200/EDBK_390678.

Qu, Xiaorui, Qinan Lu, Minghao Li, and Wendong Zhang. 2022. "Broadband Internet Speed Upgrades and the Farmland Market: A Shift-Share Instrumental Variable Approach." SSRN Scholarly Paper. Rochester, NY. https://doi.org/10.2139/ssrn.4869538.

Reddick, Christopher G., Roger Enriquez, Richard J. Harris, and Bonita Sharma. 2020. "Determinants of Broadband Access and Affordability: An Analysis of a Community Survey on the Digital Divide." *Cities* 106 (November):102904. https://doi.org/10.1016/j.cities.2020.102904.

Reentry Coordination Council. 2022. "Coordination to Reduce Barriers to Reentry: Lessons Learned from COVID-19 and Beyond." https://www.justice.gov/opa/press-release/file/1497911/dl.

Rhinesmith, Colin. 2024. "'It's One of the Most Important Things We Carry for Us': How Mobile Hotspots Support People Experiencing Homelessness." *Mobile Media & Communication* 12 (2): 274–92. https://doi.org/10.1177/20501579231212061.

Richardson, Safiya, Katharine Lawrence, Antoinette M. Schoenthaler, and Devin Mann. 2022. "A Framework for Digital Health Equity." *Npj Digital Medicine* 5 (1): 1–6. https://doi.org/10.1038/s41746-022-00663-0.

Robinson, Tenesha. 2024. "Digital Divide Experienced by Formerly Incarcerated Individuals and Its Effect on Their Reintegration into Society." *Open Journal of Social Sciences* 12 (7): 258–78. https://doi.org/10.4236/jss.2024.127018.

Rockwern, Brooke, Dejaih Johnson, Lois Snyder Sulmasy, and Medical Informatics Committee and Ethics, Professionalism and Human Rights Committee of the American College of Physicians. 2021. "Health Information Privacy, Protection, and Use in the Expanding Digital Health Ecosystem: A Position Paper of the American College of Physicians." *Annals of Internal Medicine* 174 (7): 994–98. https://doi.org/10.7326/M20-7639.

Rodriguez, Jorge A., Alejandra Casillas, Benjamin L. Cook, and Robert P. Marlin. 2021. "The Language of Equity in Digital Health: Prioritizing the Needs of Limited English Proficient Communities in the Patient Portal 2.0." *Journal of Health Care for the Poor and Underserved* 32 (2): 211–19.

Rosston, Gregory, and Scott Wallsten. 2020. Increasing low-income broadband adoption through private incentives. Telecommunications Policy. 44(9).

Rupasingha, Anil, John Pender, Ryan Williams, Joshua Goldstein, and Devika Nair. 2023. "Place-based Subsidies and Employment Growth in Rural America: Evidence from the Broadband Initiatives Programme." *Papers in Regional Science* 102 (4): 677–709. https://doi.org/10.1111/pirs.12740.

Salsbury, Meghan, and Mary Anne Hansen. 2022. "Bridging the Digital Divide: Wi-Fi Hot Spots as a Means of Digital Equity." *Portal: Libraries and the Academy* 22 (1): 199–219.

Seo, Hyunjin, Darcey Altschwager, Baek-young Choi, Sejun Song, Hannah Britton, Megha Ramaswamy, Bernard Schuster, et al. 2021. "Informal Technology Education for Women Transitioning from Incarceration." *ACM Transactions on Computing Education* 21 (2): 1–16. https://doi.org/10.1145/3425711.

Seo, Hyunjin, Hannah Britton, Megha Ramaswamy, Darcey Altschwager, Mathew Blomberg, Shola Aromona, Bernard Schuster, Ellie Booton, Marilyn Ault, and Joi Wickliffe. 2020. "Returning to the Digital World: Digital Technology Use and Privacy Management of Women Transitioning from Incarceration." *New Media & Society* 24 (3): 641–66. https://doi.org/10.1177/1461444820966993.

Shaheen, Natalie L. 2022. "Technology Accessibility: How U.S. K-12 Schools Are Enacting Policy and Addressing the Equity Imperative." *Computers & Education* 179, 104414. https://doi.org/10.1016/j.compedu.2021.104414/

Shamsuddin, Shomon, and Sumeeta Srinivasan. 2021. "Just Smart or Just and Smart Cities? Assessing the Literature on Housing and Information and Communication Technology." *Housing Policy Debate* 31 (1): 127–50. https://doi.org/10.1080/10511482.2020.1719181.

Shayea, Ibraheem, Ayman A. El-Saleh, Mustafa Ergen, Bilal Saoud, Riad Hartani, Derya Turan, and Adnan Kabbani. 2024. "Integration of 5G, 6G and IoT with Low Earth Orbit (LEO) Networks: Opportunity, Challenges and Future Trends." *Results in Engineering* 23 (September):102409. https://doi.org/10.1016/j.rineng.2024.102409.

Sheon, Amy, and Elaine Khoong. 2024. "Pillars, Policies, And Plausible Pathways Linking Digital Inclusion And Health Equity." Health Affairs. https://www.healthaffairs.org/do/10.1377/hpb20240327.505/full/

Silva, Simone, Narine Badasyan, and Michael Busby. 2018. Diversity and Digital Divide: Using the National Broadband Map to Identify the Non-Adopters of Broadband. *Telecommunications Policy* 42 (5):361–373. https://doi.org/10.1016/j.telpol.2018.02.008.

Singh, Gopal K., Mehrete Girmay, Michelle Allender, and Christine T. Ramey. 2020. "Digital Divide: Marked Disparities in Computer and Broadband Internet Use and Associated Health Inequalities in the United States." *International Journal of Translational Medical Research and Public Health* 4 (June):1–16. https://doi.org/10.21106/ijtmrph.148.

Skinner, Benjamin T., Hazel Levy, and Taylor Burtch. 2024. "Digital Redlining: The Relevance of 20th Century Housing Policy to 21st Century Broadband Access and Education." *Educational Policy* 38 (5): 1007–43. https://doi.org/10.1177/08959048231174882.

Suh, Minhyang (Mia), and Gary Hsieh. 2019. "The 'Had Mores': Exploring Korean Immigrants' Information Behavior and ICT Usage When Settling in the United States." *Journal of the Association for Information Science and Technology* 70 (1): 38–48. https://doi.org/10.1002/asi.24078.

Tarver, Will L., and David A. Haggstrom. 2019. "The Use of Cancer-Specific Patient-Centered Technologies Among Underserved Populations in the United States: Systematic Review." *Journal of Medical Internet Research* 21 (4): e10256. https://doi.org/10.2196/10256.

Tate, Tamara, and Mark Warschauer. 2022. "Equity in Online Learning." *Educational Psychologist* 57 (3): 192–206. https://doi.org/10.1080/00461520.2022.2062597.

United Nations Interregional Crime and Justice Institute. 2024. "Digital Rehabilitation in Prisons." United Nations Interregional Crime and Justice Institute. https://unicri.it/sites/default/files/2024-03/Digital%20Rehabilitation%20in%20Prisons_0.pdf.

US Department of Housing and Urban Development. 2024a. "Guidance on Application of Fair Housing Act to the Advertising of Housing, Credit, and Other Real Estate-Related Transactions through Digital Platforms." Washington, DC: US Department of Housing and Urban Development, Office of Fair Housing and Equal Opportunity. https://www.hud.gov/sites/dfiles/FHEO/documents/FHEO_Guidance_on_Advertising_through_Digital_Platforms.pdf.

———. 2024b. "Guidance on Application of Fair Housing Act to the Screening of Applicants for Rental Housing." Washington, DC: US Department of Housing and Urban Development, Office of Fair Housing and Equal Opportunity.

https://www.hud.gov/sites/dfiles/FHEO/documents/FHEO_Guidance_on_Screening_of_Applicants_for_Rental_Housing.pdf.

US Department of Housing and Urban Development, and EnergyOn. n.d. "ConnectHome Playbook: How to Build Partnerships and Narrow the Digital Divide in HUD-Assisted Communities Nationwide." Washington, DC: US Department of Housing and Urban Development. https://www.hud.gov/sites/dfiles/PIH/documents/ConnectHome%20Playbook.Original.pdf.

Vogels, E. A. Perrin, L. Raine, and M. Anderson. 2020. 53% of Americans say the Internet has been Essential During the COVID-19 Outbreak. Pew Research Center.

Wang, Cheng, and Li Si. 2024. "The Intersection of Public Policy and Public Access: Digital Inclusion, Digital Literacy Education, and Libraries." *Sustainability* 16 (5): 1878.

Williams, Demetric. 2022. "Digital Equity: Difficulties of Implementing the 1:1 Computing Initiative in Low-Income Areas." *Dissertations*, May. https://aquila.usm.edu/dissertations/1978.

Wilmoth, Daniel. 2019. "Accessing the Internet in Rural America." Issue Brief Number 15. U.S. Small Business Administration Office of Advocacy. https://advocacy.sba.gov/wp-content/uploads/2019/11/Rural-Internet-Accesss.pdf

Wolf, David, and Nicholas Irwin. 2024. "Is It Really Bridging the Gap? Fiber Internet's Impact on Housing Values and Homebuyer Demographics." *Journal of Regional Science* 64 (1): 238–71. https://doi.org/10.1111/jors.12670.

Workie, Essey, Lillie Hinkle, Anna deDufour, and Valerie Lacarte. 2022. "Advancing Digital Equity among Immigrant-Origin Youth." Migration Policy Institute.

Wray, Charlie M, James Van Campen, Jiaqi Hu, Cindie Slightam, Leonie Heyworth, and Donna M Zulman. 2022. "Crossing the Digital Divide: A Veteran Affairs Program to Distribute Video-Enabled Devices to Patients in a Supportive Housing Program." *JAMIA Open* 5 (2): ooac027. https://doi.org/10.1093/jamiaopen/ooac027.

Zahnd, Whitney, Nathaniel Bell, and Annie Larson. 2022. Geographic, Racial/Ethnic, and Socioeconomic Inequities in Broadband Access. *The Journal of Rural Health* 38(3):519-526. https://doi.org/10.1111/jrh.12635.

Zoccola, Robyn, and Erin Borissov. 2022. "Digital Divide - Disparate Impact? The Impact of Modern Recruiting and Workplace Practices That Rely on Broadband." *Indiana Law Review* 56:543.

Zuo, George W. 2021. "Wired and Hired: Employment Effects of Subsidized Broadband Internet for Low-Income Americans." *American Economic Journal: Economic Policy* 13 (3): 447–82. https://doi.org/10.1257/pol.20190648.

Zuo, George W., and David Powell. 2023. "The Impact of Affordable and Accessible Broadband on SSDI and SSI Participation." Working Paper MRDRC WP 2023-467. Ann Arbor, MI: University of Michigan Retirement and Disability Research Center. https://mrdrc.isr.umich.edu/publications/papers/pdf/wp467.pdf.

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