



The state of California gives extra points for projects that offer in-unit broadband when awarding low-income housing tax credits. Edén Housing's Cottonwood Place, in Fremont, provides wired access and a modem to each of its 98 units.

Jeff Peters, Vantage Point Photography, Inc.

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## Community Development and the Digital Divide

Internet access, specifically high-speed broadband Internet access, spurs innovation and collaboration, fosters economic activity and growth, and facilitates access to information and services. Increasingly, people need Internet access to secure and sustain employment opportunities, pursue and succeed in education, and obtain healthcare; as President Obama has said, “today, high-speed broadband is not a luxury, it’s a necessity.”<sup>1</sup> Since

2000, public and private investments have led to dramatic advances in the infrastructure, availability, and usage of in-home broadband, but some disparities remain, creating a digital divide between those who have access to a high-speed Internet connection and those who do not. Further, even as broadband availability nears universality, differences in adoption, digital literacy, and outcomes associated with Internet usage result in ongoing disparities that

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## Message from the Assistant Secretary

This issue of *Evidence Matters* discusses digital inequality and efforts to promote digital inclusion, especially as they relate to housing and community development. In recent years, substantial public and private investment in broadband infrastructure has largely closed gaps in the *availability* of high-speed Internet among U.S. households, although divides in infrastructure still exist between urban and rural areas. The most significant divides are in adoption — primarily because of a lack of affordability, inadequate connection speed and quality, and inequalities in digital literacy. Gaps in Internet use by age, race, educational attainment, and income persist, although they are shrinking. Analysis of American Community Survey and HUD administrative data reveals that HUD-assisted renters are particularly likely to

be on the wrong side of digital divides. HUD-assisted households are less likely to have in-home Internet access than unassisted renters (43% and 69%, respectively), and HUD-assisted households in public housing and multifamily housing have lower connection rates than HUD-assisted households as a whole. These divides continue even as the Internet becomes increasingly necessary for an expansive range of tasks, from completing homework to applying for a job. The costs of these disadvantages are borne by individuals and families in the form of lost educational and employment opportunities and limited access to information as well as by society in the form of unrealized economic productivity.

HUD has taken steps to reduce digital disparities for assisted households, particularly recently. In 2015, HUD launched the ConnectHome initiative, a collaborative public-private effort to make free or low-cost broadband services and digital literacy supports available to families with school-aged children living in HUD-subsidized housing. ConnectHome started in 27 cities and 1 Tribal nation and could be scaled up to serve HUD-subsidized housing communities nationwide and possibly extended to HUD-assisted households using housing choice vouchers.

The Office of Policy Development and Research (PD&R) is responsible for evaluating the progress of the ConnectHome initiative. Early efforts have focused on establishing a baseline estimate of the in-home connectivity of households with school-aged children and identifying barriers for unconnected households through a survey of residents in ConnectHome communities. A second survey asks ConnectHome subscribers about issues related to digital literacy. Information about households' ability and comfort in using the Internet for education, employment searches, and health care can inform efforts to educate households on using the Internet more effectively. Finally, focus group discussions with residents, public housing agency (PHA) staff, and local leaders in ConnectHome communities will yield a better understanding of whether the initiative is achieving its goals. Key research questions for residents include what barriers remain that might keep households from subscribing to broadband service and whether and how subscribing households benefit from connectivity. Discussions with PHA staff and local leaders will focus on lessons learned regarding the structuring of public-private partnerships and implementation that can inform efforts in future ConnectHome sites.

In an increasingly Internet-dependent society, full digital inclusion for HUD-assisted households, and low-income households generally, is essential for ensuring access to opportunity and improved quality of life.

— Katherine M. O'Regan, *Assistant Secretary for Policy Development and Research*

# Editor's Note

Digital inclusion, the focus of this edition of *Evidence Matters*, is increasingly essential for individuals, families, and communities to reach their full potential. Although advances in infrastructure and technology have made the Internet almost universally available, issues such as the affordability of broadband subscriptions and devices and differences in digital literacy continue to pose barriers to full and equal access. Throughout this issue, you will see evidence of digital disparities and associated costs as well as ways in which policymakers at various levels are working with nonprofit and private-sector partners to close the remaining gaps.

The lead article, “Community Development and the Digital Divide,” reviews the causes and costs of digital inequality and programs and strategies to close remaining disparities. The Research Spotlight article, “Digital Inequality and Low-Income Households,” discusses frameworks for understanding digital inequality, statistics on the connectivity of U.S. households with an emphasis on HUD-assisted households, and HUD’s ConnectHome initiative. Finally, the In Practice article, “Working to Bridge the Digital Divide,” describes three innovative programs that promote digital inclusion.

We hope this edition of *Evidence Matters* provides a helpful overview of this critical topic. Our next issue will focus on creative placemaking. Please provide feedback on any of our issues at [www.huduser.gov/forums](http://www.huduser.gov/forums).

— Rachele Levitt, *Director of Research Utilization Division*

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## Highlights

- Infrastructure gains have increased the availability of high-speed broadband, but disparities remain, especially between urban and rural areas. Gaps also persist in Internet use, which varies by race, income, and educational attainment.
- Lack of high-speed Internet access can negatively impact economic growth, household income, educational performance, healthcare access, and employment searches.
- Several federal, state, and local programs — including HUD’s ConnectHome initiative — aim to close the digital divide through investments in infrastructure, affordable broadband connections and devices, and digital literacy training.

persist even as the disadvantages of not having broadband increase. A host of federal, state, and local initiatives aim to close the remaining gaps and achieve digital inclusion for all. Broadband access is a central concern of housing and community development because of its physical infrastructure as well as its implications for social and economic activity in communities throughout the nation.

### Connecting to the Internet

Individuals can access the Internet through a growing variety of connection types and devices and at various speeds. For high-speed access to the Internet, users must connect through broadband, “a method of transmitting information using many different frequencies, or bandwidths, allowing a network to carry more data.”<sup>2</sup> As content and technology, such as streaming

videos, have evolved, the minimum speed required to optimize Internet use has increased. In 2015, the Federal Communications Commission (FCC) revised the standard for high-speed broadband sufficient to support “advanced telecommunications capability,” setting the new mark at 25 megabits per second (Mbps) downstream (information downloaded from the Internet to the user’s device) and 3 Mbps upstream (information uploaded from the user’s device to the Internet).<sup>3</sup>

Residential Internet connections rely on an extensive infrastructure that often uses existing utility poles, conduits, and rights of way. In recent years, broadband providers have made significant investments to expand this infrastructure, reportedly tens of billions of dollars annually. Substantial public investment supplements these efforts. Federal funding has supported upgrades to more than 111,500 miles of network infrastructure since 2009.<sup>4</sup> Such infrastructure is critical for getting higher speeds to end users, but the users’ speed is often limited by the maximum



capacity of last-mile connections — the final connection between the Internet and the device. In other words, even if enhanced infrastructure makes a high-speed connection possible, that connection will be only as fast as the slowest link in the network, which often is the one within the home. As of June 30, 2015, there were around 342 million Internet connections (100 million fixed and 242 million mobile) of at least 200 kilobits per second (Kbps) in at least one direction (download or upload) in the United States, according to the FCC.<sup>5</sup> Of the fixed connections, 24.4 million were slower than 10 Mbps.<sup>6</sup> Various technologies transmit broadband signals with a range of speed capacities:

- Digital subscriber line (DSL). DSL offers faster speeds than phone lines, from several hundred Kbps and higher.
- Cable. Coaxial cable with a modem can provide speeds of 1.5 Mbps or more. The National Cable and Telecommunications Association estimates that 93 percent of U.S. households have the wiring

necessary to make high-speed Internet service available to them using cable.<sup>7</sup>

- Fiber. Fiber-optic technology can achieve speeds tens or hundreds of Mbps faster than DSL or cable, but this speed varies considerably depending on how close the fiber gets to the user's device.
- Wireless. A radio link between the end user and the service provider offers speeds that are comparable to those of DSL or cable connections but that can be less expensive to provide in sparsely populated areas.
- Satellite. Satellite technology produces a wireless signal with a download speed of 500 Kbps that is faster than dial-up connections but slower than DSL or cable. Satellite connections can reach remote areas but are vulnerable to weather interference.
- Power lines. An emerging technology with speeds comparable to cable that has the advantage of using facilities that now exist nearly everywhere in the country.<sup>8</sup>

As of June 2015, residential fixed connections with downstream speeds of at least 10 Mbps were overwhelmingly (73%) cable modem connections, followed by smaller shares using DSL (13%) and fiber (12%).<sup>9</sup>

## The Digital Divide(s)

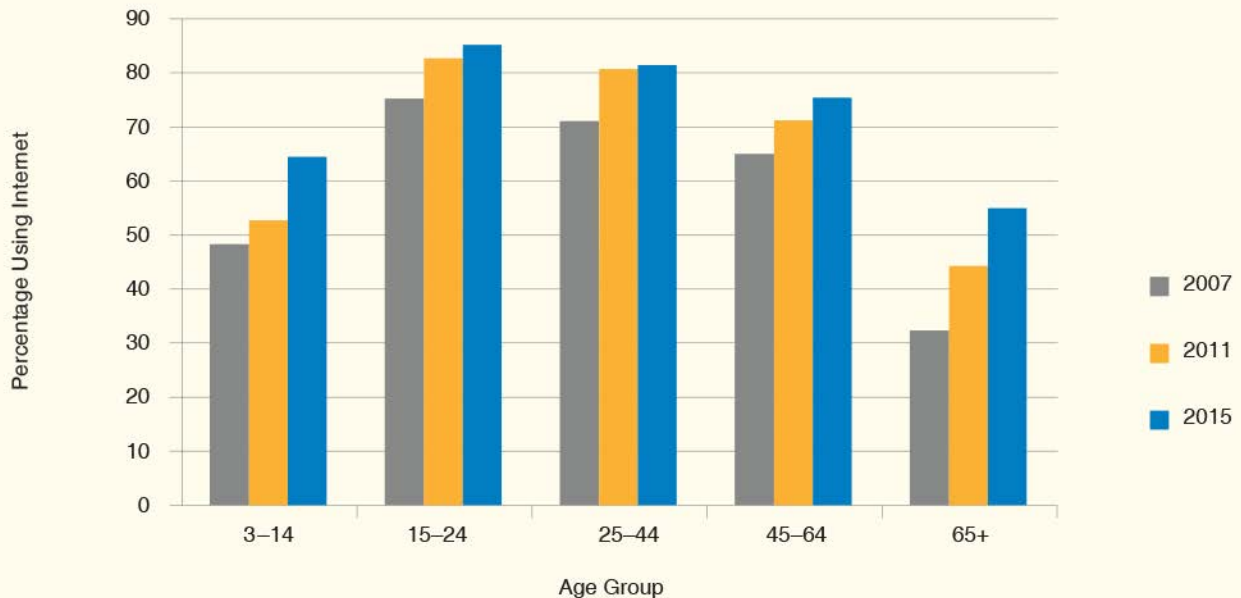
Although millions of people have in-home broadband connections, many remain unconnected or have connections that are slow or unreliable. The so-called digital divide, the gap between the broadband haves and have-nots, primarily concerns the *availability* of broadband — that is, the option to purchase broadband service if one can afford it. This “first-level” divide falls largely along urban and rural lines and becomes more pronounced at higher speed standards. At the FCC’s minimum broadband speed standard of 25 Mbps downstream and 3 Mbps upstream, 39 percent of residents in rural areas, 41 percent in Tribal lands, and 66 percent in U.S. territories lacked access to fixed broadband in 2014 compared with 10 percent of the U.S. population as a whole. Even though this disparity lessens at lower speed standards, it still persists: 25 percent of rural residents lack access to 10 Mbps downstream and 1 Mbps upstream broadband connections, and 19 percent lack access to speeds of 4 Mbps downstream and 1 Mbps upstream.<sup>10</sup> However, the availability gap between urban and rural areas has closed somewhat since 2012.<sup>11</sup> The urban/rural disparity also applies to mobile broadband. Fifty-three percent of the overall U.S. population lacks access to speeds of 10 Mbps downstream and 1 Mbps upstream compared with 87 percent of those living in rural areas.<sup>12</sup> The FCC finds that individuals without access to broadband typically live in areas with a lower average population density, lower average per capita income, lower median household income, and a higher percentage of households in poverty than do individuals who do have access.<sup>13</sup> These differences in speed matter for getting the most out of applications and content, which have grown increasingly



Comcast Corporation

Comcast, a partner in HUD’s Connect Home initiative, has expanded eligibility for its low-cost, high-speed Internet Essentials program to an estimated 2 million HUD-assisted households.

**Figure 1. Percentage of Americans Using Internet at Any Location by Age Group**



Source: National Telecommunications and Information Administration. “Digital Nation Data Explorer” ([www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer](http://www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer)). Accessed 28 September 2016.

sophisticated. Michael Limmatta, former manager of HUD’s ConnectHome program and cofounder of Connecting for Good, says that “being underconnected can be as limiting as being unconnected.” Similarly, accessing the Internet through smartphones rather than computers can limit what users can do with the Internet.<sup>14</sup>

Even in areas where high-speed Internet is available, various barriers may still prevent people from using the service. Nationally, residential Internet use among households in 2015 was 73 percent (compared with 74% in 2013).<sup>15</sup> Internet use from any location among individuals ages 3 and older in 2015 was 75 percent. Yet, for the most part, this usage is at speeds slower than the FCC broadband standard; only 29 percent of households in the United States had adopted broadband at rates of 25 Mbps downstream and 3 Mbps upstream in 2013.<sup>16</sup> Data collected by the National Telecommunications and Information Administration (NTIA) on Internet use — accessing the Internet at any speed,

from any location, through any device — show that the digital divides are shrinking in terms of age, educational attainment, and race, although significant gaps persist (figs. 1, 2, and 3).

Internet use also varies considerably by income. According to calculations by the Council of Economic Advisers, only 49 percent of households in the lowest income quintile (those earning less than \$21,700) use the Internet at home compared with 95 percent of households in the highest income quintile.<sup>17</sup> Finally, limited evidence suggests a divide by residential tenure. A California survey found that 81 percent of homeowners and 77 percent of renters had high-speed Internet at home, although those numbers drop to 78 percent of homeowners and 66 percent of renters when those with smartphones only are excluded.<sup>18</sup> Significantly, the Pew Research Center reports that over the past 15 years, there has been at most a modest gap in Internet use between men and women, and that gap is now negligible.<sup>19</sup>

After availability and adoption, differences in levels of digital literacy — the ability to use digital technologies to find, create, and use information — divide those who benefit from broadband Internet.<sup>20</sup> For example, to assess digital readiness for online learning — qualities such as confidence in using computers, facility with new technology, use of digital tools for learning, and the ability to determine the trustworthiness of information — the Pew Research Center surveyed American adults and concluded that 52 percent were relatively hesitant to pursue online learning and 48 percent were relatively more prepared. Among the relatively hesitant, researchers identified a subgroup representing 14 percent of the total that they labeled “the unprepared.” This group had low confidence in their computer skills, needed help using technology, and was unsure about how to find trustworthy information online. Adults most likely to fall into this category were women, those aged 50 and older, those in lower-income households, and those with lower levels

of education.<sup>21</sup> Similarly, another Pew Research Center survey found that a minority of respondents were not comfortable or confident in their digital job-seeking skills. Excluding those who are disabled or retired, 17 percent reported that it would not be easy to create a résumé, 12 percent said that it would not be easy to find a job, and 12 percent said that it would not be easy to fill out an online job application.<sup>22</sup>

Van Deursen and Helsper have argued that even if disparities in availability, adoption, and digital literacy did not exist, some populations may still derive fewer benefits from Internet use than others because outcomes are linked to other types of advantage and disadvantage. As they put it, “[e]ven when two users have high-quality autonomous access and adequate skills, they may not obtain the same returns on their Internet use.”<sup>23</sup> Consequently, strategies that focus on individual literacy or skills may have only a limited ability to achieve full digital inclusion or level social and economic playing fields.<sup>24</sup> Glasmeier et

al. add that the nature of the content also matters; to truly close the digital divide, there must be “content that meets the needs of disenfranchised groups and that is created by those groups.”<sup>25</sup>

### Costs of the Divide

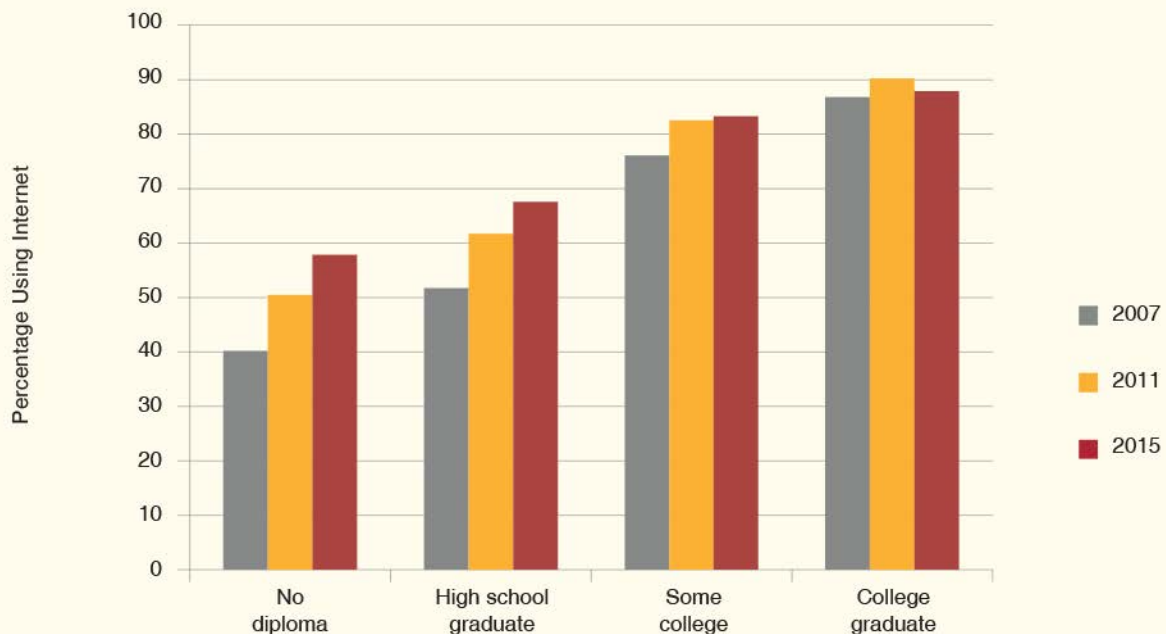
As daily activities across nearly all aspects of life become increasingly dependent on the Internet, the costs of being on the wrong side of the digital divide also increase. Those costs are borne by both individuals and society at large.

*Economic growth and income.* Closing digital gaps promises to expand individual opportunities and increase economic productivity.<sup>26</sup> One study estimated that expenditures for Internet access in 2006 (before the proliferation of streaming audio and video) accounted for \$28 billion in U.S. gross domestic product.<sup>27</sup> The Obama administration argues that “[o]ver the longer term, broadband adoption also fuels a virtuous cycle of Internet innovation.”<sup>28</sup> New applications foster demand for greater broadband capacity, which, in turn,

encourages more innovative applications. The administration cites industry studies estimating that between 2007 and 2011, mobile applications development grew from nothing to a \$20 billion industry that created more than 300,000 new jobs.<sup>29</sup> Studies have also found that in some cases, broadband expansion is associated with higher incomes.<sup>30</sup> One study reports that in Organisation for Economic Co-operation and Development member countries, a speed increase of 4 Mbps was associated with a \$2,100 gain in household income.<sup>31</sup> Based on these findings, it appears likely that a persistent digital divide restricts household income and economic growth.

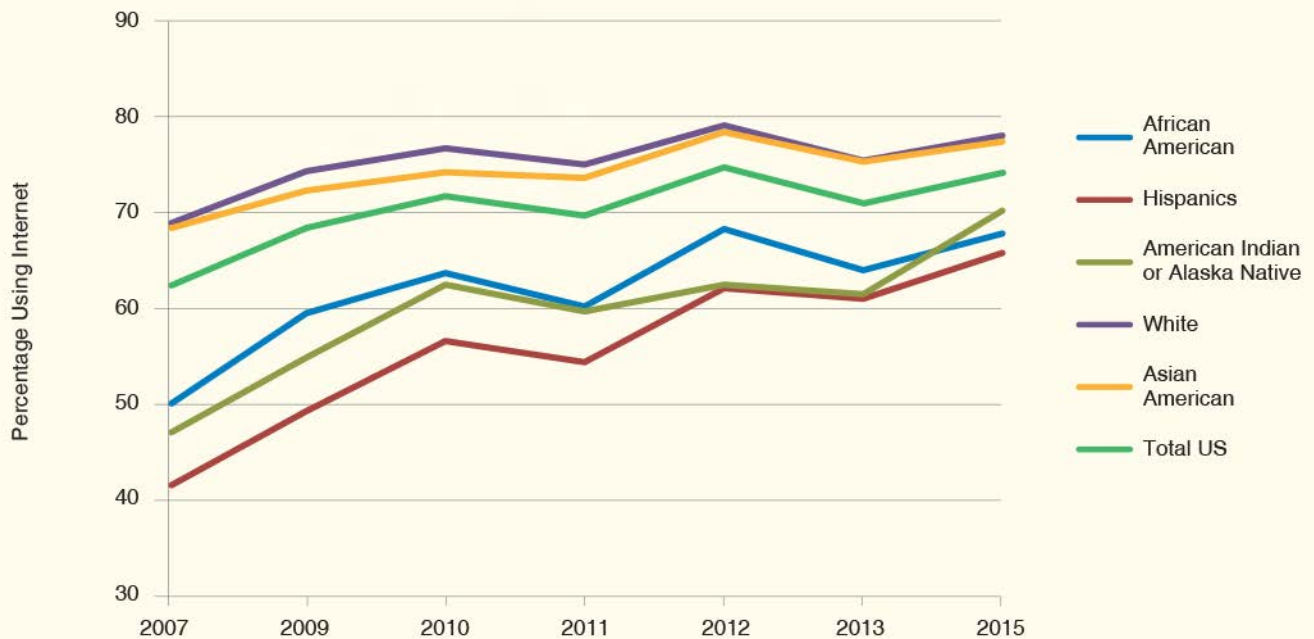
*Health and healthcare.* People with high-speed Internet have ready access to medical information and telemedicine, but those without Internet access cannot get answers to basic medical questions at home and therefore must go to a doctor or hospital and incur associated costs.<sup>32</sup> Low-income households may also struggle to shop for

Figure 2. Internet Use by Educational Attainment



Source: National Telecommunications and Information Administration. “Digital Nation Data Explorer” ([www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer](http://www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer)). Accessed 28 September 2016.

**Figure 3. Internet Use by Race or Ethnicity, 2007–2015**



Source: National Telecommunications and Information Administration. “Digital Nation Data Explorer” ([www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer](http://www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer)). Accessed 28 September 2016.

health insurance or use the Affordable Care Act health insurance exchanges, and they may not be able to take advantage of virtual healthcare, which can be cheaper than traditional in-person visits.<sup>33</sup>

*Education: The “homework gap.”* Increasingly, schoolwork and homework require Internet access to complete, leaving those without broadband access at a disadvantage.<sup>34</sup> An estimated 5 million households with school-aged children do not have in-home broadband access. African American and Hispanic households are disproportionately represented among this population; African American and Hispanic households lack broadband access at home at a rate 10 percent higher than white households earning comparable incomes. Among households with school-aged children and an annual income of less than \$50,000, 31.4 percent lack in-home broadband.<sup>35</sup> Yet an estimated 70 percent of teachers assign homework that requires Internet access.<sup>36</sup> Educators seeking to make the most of innovative

online learning tools and prepare students to thrive in an increasingly Internet-dependent society face an impossible challenge. If they assign homework that requires the Internet, they risk placing students without in-home broadband connections at a disadvantage, but if they avoid such assignments, they risk depriving all students of the opportunity to acquire valuable digital skills. Fifty-six percent of educators who teach the lowest-income students say that limited student access to technology is a “major challenge” for incorporating digital tools in their teaching.<sup>37</sup> Research shows that broadband access contributes to positive educational outcomes. Dettling et al. find that access to high-speed Internet in one’s junior year of high school is associated with better performance on the SAT and application to a higher number of (and a more expansive selection of) colleges. The effects, however, are concentrated among students of higher socioeconomic status, indicating that broadband access may also exacerbate existing inequalities.<sup>38</sup>

*Employment.* A 2015 Pew Research Center survey found that 54 percent of U.S. adults have gone online to look for job information, and 45 percent have applied for a job online.<sup>39</sup> Many job-related tasks are difficult to complete using a mobile device, but 28 percent of Americans have used a smartphone to search for jobs. Half of these people have filled out an application with their smartphone, and 23 percent have created a résumé or cover letter. Of people using their smartphones as part of a job search, nearly half have encountered some type of difficulty doing so, underscoring the continuing importance of fixed connections and computers.<sup>40</sup>

*Civic Participation.* People can use the Internet to learn about and connect with local organizations and other residents as well as for various forms of civic engagement.<sup>41</sup> A 2013 Pew Research Center survey found that 39 percent of adults had recently contacted a government official or participated in a public forum offline, and 34 percent had done so online.<sup>42</sup>



Those with broadband access generally have more options and more information to complete daily tasks, including but not limited to searching for housing, shopping for goods and services, banking, and developing social connections.

exists, especially at higher speeds. Only 38 percent of the U.S. population has access to more than one provider of fixed connections at 25 Mbps downstream and 3 Mbps upstream, and only 13 percent of the rural population has more than one available option.<sup>46</sup>

even if they can afford it. Parents who are unconvinced that home Internet access is needed or who believe that handheld devices are sufficient may exacerbate the homework gap, according to Liimatta.<sup>51</sup> Seniors make up part of the adoption divide through a lack of interest. A study of seniors in Switzerland finds that the encouragement of family and friends has a strong influence on adoption rates.<sup>52</sup>

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## The persistence of multiple digital divides — in availability, affordability, digital literacy, and connecting devices — means that multiple strategies are necessary to close the gaps.

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### Causes of the Divide

The divide in broadband availability, which, as noted above, falls largely along rural and urban lines, results primarily from the absence of adequate infrastructure in rural areas. In many cases, the remote locations and low population densities of rural areas make the extension of infrastructure unprofitable. Although satellite and wireless alternatives offer some promise for expanding broadband access to rural populations, more needs to be done to fully close the availability divide.<sup>43</sup>

Although in some areas the adoption divide results from a lack of availability, the issue generally is a lack of affordability. Unaffordability of broadband, particularly at higher speeds, is affected by both demand-side factors — the ability of a consumer to pay — and supply-side factors — the price at which providers offer service. On the demand side, Internet adoption or use is strongly correlated with income.<sup>44</sup> A 2015 Pew Research Center survey found that 33 percent of households without a home broadband connection cited monthly subscription costs as the main reason. Another 10 percent said that the cost of a computer was the main reason they did not have an in-home broadband connection.<sup>45</sup> On the supply side, the degree of competition among providers in a market affects price and quality. In some areas little to no competition

Disparities in device ownership also contribute to a digital divide. Those who do not have computers, who have computers that are not capable of connecting to the Internet, or who have computers with low capacity are limited in their ability to take advantage of the Internet. The U.S. Census Bureau found that 83.8 percent of households owned computers in 2013. Computer ownership is lower in the South and in nonmetropolitan areas.<sup>47</sup> Some observers consider mobile broadband an avenue for broader inclusion — a way to access the Internet independent of any type of landline infrastructure.<sup>48</sup> Others worry that accessing the Internet only through a smartphone limits what users can gain, particularly in important areas such as job seeking or online learning. The Pew Research Center finds that people who are smartphone dependent are more likely to have monthly data limits (or incur extra charges for exceeding limits) and more frequently must cancel or suspend service for financial reasons than do those with landline connections.<sup>49</sup> Low-income individuals and minorities are more likely than others to have a handheld device as their only connection to the Internet.<sup>50</sup>

Finally, some individuals may believe that there are no advantages to using the Internet, or they may be intimidated by technology and simply lack the motivation to adopt broadband service

### Programs and Strategies To Close the Gap

The persistence of multiple digital divides — in availability, affordability, digital literacy, and connecting devices — means that multiple strategies are necessary to close the gaps. Writing for the Benton Foundation, Colin Rhine-smith proposes a four-part strategy to promote what he calls “meaningful broadband adoption,” which consists of providing low-cost broadband service, connecting digital literacy training with relevant content and services, making low-cost computers available, and operating public-access computing centers.<sup>53</sup> Strategies to achieve these steps include promoting competition among providers to improve quality and speed as well as lower prices, educating nonusers about the value of connecting through outreach efforts, and offering subsidies for devices and service, among others.

At the federal level, policymakers have pushed for investment in infrastructure and are seeking ways to promote competition among broadband service providers, removing existing barriers to competition. Speed and price are correlated with the level of competition in an area, and a statistically significant relationship exists between the number of broadband choices and the share of households using the Internet at home. For example, when Google Fiber announced service in Kansas City, existing network speeds increased 86 percent. Municipal providers have been an important source of competition in areas that would otherwise have severely limited options — in some cases, only one provider. As recently as the beginning of



2015, legal barriers prevented community broadband providers from competing against existing providers in 19 states.<sup>54</sup> In February of that year, the FCC ruled to preempt state laws in Tennessee and North Carolina that prevented a community broadband provider and the city of Wilson, respectively, from competing with private providers.<sup>55</sup>

In addition to promoting competition to improve the affordability and quality of broadband options throughout the country, the federal government has invested in several programs designed to expand broadband access, often with a special emphasis on underserved populations and areas.

- National Telecommunications and Information Administration's (NTIA) Broadband Technology Opportunities Program distributed a total of \$4.7 billion over two rounds of grant funding in 2009 and 2010 supporting the development of broadband

infrastructure, enhanced capacity at public computer stations, and the sustainable adoption of broadband service.<sup>56</sup> The Navajo Tribal Utility Authority, which received program funding, has constructed 570 miles of fiber-optic network lines and 59 microwave towers that have made broadband connections available to an estimated 30,000 households in the Navajo Nation.<sup>57</sup>

- NTIA's BroadbandUSA is a program offering online and in-person technical assistance, workshops, and best practices guides for communities seeking to improve their broadband capacity. The Community Connectivity Initiative component of the program will establish a set of connectivity indicators that will help communities assess existing capacity and plan for enhancements. In September 2016, NTIA hosted a broadband workshop in Missoula, Montana, to bring together stakeholders and discuss

strategies and best practices; these are now packaged in a toolkit for effective outreach and engagement.<sup>58</sup>

- The U.S. Department of Agriculture's Rural Utilities Service Broadband Initiative Program has awarded \$3.5 billion in loans and grants for 320 projects to deploy broadband infrastructure in rural areas; 297 of these projects provided service directly to end users. The projects resulted in an estimated 61,047 miles of fiber installed, 1,391 wireless access points installed, and 728,733 subscribers receiving new or improved service.<sup>59</sup> Program loans supported Peoples Rural Telephone Cooperative's Fiber to the Home expansion, which enhanced broadband service to residents in rural Kentucky.<sup>60</sup>
- The U.S. Department of Education's ConnectED is an Obama administration initiative announced in 2013 with the goal of connecting 99



Marsha Robinson, resident of Forest Houses, received her college degree using the Digital Van computers.





Tech Goes Home Chattanooga

Tech Goes Home Chattanooga is a digital inclusion program that offers digital literacy classes at schools, libraries, churches, and youth and family development centers across Hamilton County, Tennessee. Participants who graduate from the classes can purchase a new Chromebook for \$50.

percent of students with high-speed Internet access (at least 100 Mbps) in classrooms by 2018; the initiative also invests in training for teachers to use technology in classrooms and encourages students and educators to make use of private-sector innovations in educational devices and software.<sup>61</sup>

An associated initiative, the ConnectED Library Challenge, creates partnerships among schools, libraries, and local governments to ensure that every child enrolled in school has a library card with access to the library's broadband and wireless service as well as digital resources such as ebooks.<sup>62</sup> As of June 2015, public- and private-sector partners had provided or pledged more than \$10 billion in funding and in-kind commitments for the program, and more than 1,900 school superintendents had committed to investing in digital education in their districts.<sup>63</sup>

- FCC's ConnectALL is a proposed repurposing of the Lifeline phone subsidy program to subsidize broadband

services for low-income individuals. The effort seeks to connect 20 million individuals to broadband by 2020. In addition, the Computers for Learning program will make surplus government computer equipment available to low-income individuals.<sup>64</sup>

For its part, HUD has worked to close the digital divide through the ConnectHome program, a public-private collaboration to bring free or low-cost broadband service to families with school-aged children living in HUD-assisted housing. Announced in 2015, ConnectHome has launched in 27 cities and 1 Tribal nation, with the intention of eventually scaling up to HUD-assisted housing communities nationwide.<sup>65</sup> Local stakeholders work out the precise details of implementation in each locality, tailoring the arrangement to local circumstances. AT&T, Comcast, Cox Communications, and Google Fiber are among the providers who have participated in local partnerships. Former ConnectHome manager Michael Liimatta says that private providers have

come to see that offering low-income plans in public housing communities is both good publicity and good business, helping to build brand loyalty. He notes that some areas that just a few years ago had no low-income plans or just one now have multiple providers offering affordable plans.<sup>66</sup>

To measure progress, the ConnectHome initiative tracks the numbers of households that have gained high-speed Internet, including those with school-aged children, digital literacy programs, and devices donated. ConnectHome initiative director Rei Onishi says that while there can be challenges getting the word out to residents about low-cost offers available in their communities, adoption rates have been highest where public housing agencies (PHAs) have been most proactive. Outreach activities, such as community sign-up events and providing free devices to households that sign up for broadband, have been effective. Onishi notes that another promising outreach practice, as exemplified by the

Rockford (Illinois) Housing Authority, is to integrate broadband into the conversations that residential services coordinators have with residents about other services.<sup>67</sup>

Thus far, ConnectHome has worked with PHAs and residents of public housing communities but is looking for ways to reach HUD-assisted households using rental vouchers. One of the ConnectHome partners, Comcast, has recently expanded its Internet Essentials low-cost, high-speed Internet service for low-income households, working with HUD to make the program available to an estimated 2 million HUD-assisted homes, including housing choice voucher recipients. Internet Essentials offers service at \$9.95 per month, an option to purchase a low-cost computer, and free digital literacy training through various formats.<sup>68</sup>

HUD has also proposed a rule that would require installing broadband infrastructure in newly constructed or substantially rehabilitated multifamily rental housing that is funded or supported by HUD programs. The rule would not apply to multifamily rental housing that has a mortgage guaranteed by the Federal Housing Administration but no funding from another HUD program. The rule defines broadband infrastructure as cable, fiber optic, wiring, wireless, or other permanent infrastructure that provides a connection to each residential unit at the FCC minimum standard of 25 Mbps downstream and 3 Mbps upstream. Most private-market multifamily developers include landline wiring and jacks at the standards required by the rule; this regulation would simply make that practice standard in HUD-assisted housing as well. Developers are responsible only for the infrastructure, not for connecting residences with an Internet service provider.<sup>69</sup>

At the state level, California offers points for in-unit broadband when awarding low-income housing tax credits (LIHTCs). For example, Cottonwood

Place in Fremont, California, a development funded by LIHTCs as well as HUD's Section 202 Supportive Housing for the Elderly Program, provides each of its 98 units with wired broadband access and a modem.<sup>70</sup> The developer, Eden Housing, offers low-cost options for those interested in buying a device through its Communities Wired! initiative. Residents may purchase a laptop for \$120 and a tablet for \$75 and receive tutorials on how to access their Internet connection.<sup>71</sup> Digital literacy courses help low-income seniors build the confidence to use the technology.<sup>72</sup> Despite these gains in bridging the digital divide for low-

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Substantial progress has been made to close these divides, but the gaps that remain may be especially stubborn and difficult to erase.

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income seniors, two challenges remain for residents of Cottonwood Place. First, seniors must continue to update their devices and software to keep pace with rapid technological advances. Second, the free bandwidth that Eden Housing provides does not support streaming media.<sup>73</sup>

Finally, at the local level, many municipalities, nonprofits, and foundations as well as private entities are working to expand broadband access, often in cross-sector partnerships and with state and federal governments. Municipal broadband providers in Cedar Falls, Iowa; Chattanooga, Tennessee; and other locations have expanded access and have also added competition to improve price and quality among private-sector providers in their cities.

Local nonprofits such as PCs for People in St. Paul, Minnesota, tackle the digital divide through various strategies. PCs for People recycles computers — refurbishing them and making them available to low-income households — and offers low-cost, high-speed Internet to eligible households.<sup>74</sup> Three additional examples of local efforts are featured in “Working to Bridge the Digital Divide,” p. 22.

## Conclusion

Divides in broadband availability, broadband adoption, digital literacy, outcomes associated with Internet use, and the creation of digital content remain, even as digital access and proficiency become essential for competitiveness in nearly every aspect of life. Substantial progress has been made to close these divides, but the gaps that remain may be especially stubborn and difficult to erase. Liimatta says that progress is likely to be slow and will take considerable resources in the form of money (both public and private) and “boots on the ground” — people reaching out to and working directly with nonusers, convincing them of the value of connecting, walking them through every step of the connection process, and then teaching these newly connected users how to make the most of their Internet access.<sup>75</sup> Continuing progress will depend on the work of many partners: Internet service providers, municipal governments, libraries, schools, and nonprofits. As the experience of ConnectHome has shown, PHAs will also play an important role in expanding access to low-income households. Closing the remaining digital divides promises to open up new opportunities for individuals and promote economic growth for society at large. **EM**

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<sup>1</sup> The White House. 2015. “Remarks by the President on Promoting Community Broadband.”

<sup>2</sup> Executive Office of the President. 2015. “Community-Based Broadband Solutions: The Benefits of Competition and Choice for Community Development and Highspeed Internet Access,” 5.

<sup>3</sup> United States Federal Communications Commission. 2015. “Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment,” 3.

<sup>4</sup> Council of Economic Advisers. 2016. “The Digital Divide and Economic Benefits of Broadband Access,”



- Council of Economic Advisers Issue Brief, 1.
- <sup>5</sup> Based on Form 477 filings. U.S. Federal Communications Commission. 2016. "Internet Access Services Status as of June 30, 2015," 2.
- <sup>6</sup> *Ibid.*, 3.
- <sup>7</sup> National Telecommunications and Information Administration. "Industry Data" ([www.ncta.com/industry-data](http://www.ncta.com/industry-data)). Accessed 31 August 2016.
- <sup>8</sup> U.S. Federal Communications Commission. "Types of Broadband Connections" ([www.fcc.gov/general/types-broadband-connections](http://www.fcc.gov/general/types-broadband-connections)). Accessed 31 August 2016.
- <sup>9</sup> U.S. Federal Communications Commission 2016, 23.
- <sup>10</sup> U.S. Federal Communications Commission. 2016. "Broadband Progress Report," 34.
- <sup>11</sup> *Ibid.*, 39.
- <sup>12</sup> *Ibid.*, 36–7.
- <sup>13</sup> *Ibid.*, 40.
- <sup>14</sup> Interview with Michael Liimatta, 23 September 2016.
- <sup>15</sup> John B. Morris, Jr. 2016. "First Look: Internet Use in 2015," National Telecommunications and Information Administration, 21 March blog post.
- <sup>16</sup> National Telecommunications and Information Administration. "Digital Nation Data Explorer" ([www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer](http://www.ntia.doc.gov/other-publication/2016/digital-nation-data-explorer)). Accessed 16 November 2016; U.S. Federal Communications Commission. 2015. "Broadband Availability in America: With Rural Americans Looking for High-Speed Services, Adequate Broadband Speeds Remain Out of Reach for Many."
- <sup>17</sup> Council of Economic Advisers, 3.
- <sup>18</sup> Field Research Corporation. 2015. "Wide Differences in Broadband Connectivity Across California Households," California Emerging Technology Fund, 5.
- <sup>19</sup> Andrew Perrin and Maeve Duggan. 2015. *Americans' Internet Access: 2000-2015: As internet use nears saturation for some groups, a look at patterns of adoption*, Pew Research Center, 10.
- <sup>20</sup> American Library Association. "Digital Literacy Definition" ([connect.ala.org/node/181197](http://connect.ala.org/node/181197)). Accessed 29 September 2016.
- <sup>21</sup> John B. Horrigan. 2016. "Digital Readiness Gaps: Americans fall along a spectrum of preparedness when it comes to using tech tools to pursue learning online, and many are not eager or ready to take the plunge," Pew Research Center, 3.
- <sup>22</sup> Aaron Smith. 2015. "Searching for Work in the Digital Era," Pew Research Center.
- <sup>23</sup> Alexander J.A.M. Van Deursen and Ellen J. Helsper. 2015. "The Third-Level Digital Divide: Who Benefits Most from Being Online?" *Communication and Information Technologies Annual* 10, 32.
- <sup>24</sup> I. Mariën and J.A. Prodnik. 2014. "Digital inclusion and user (dis)empowerment: A critical perspective," *info: The Journal of Policy, Regulation and Strategy for Telecommunications, Information and Media* 16:6, 35.
- <sup>25</sup> Amy K. Glasmeier, Chris Benner, Chandrani Ohdekar, and Lee Carpenter. 2007. "Beyond the Digital Divide: Broadband Internet Use and Rural Development in Pennsylvania," Center for Rural Pennsylvania, 6.
- <sup>26</sup> Council of Economic Advisers, 1; 5.
- <sup>27</sup> Shane Greenstein and Ryan C. McDevitt. 2009. "The Broadband Bonus: Accounting for Broadband Internet's Impact on U.S. GDP," NBER Working Paper No. 14758. Cited in Executive Office of the President. 2015. "Community-Based Broadband Solutions: The Benefits of Competition and Choice for Community Development and Highspeed Internet Access," 5.
- <sup>28</sup> Executive Office of the President, 6.
- <sup>29</sup> Michael Mandel. 2012. "Where the Jobs Are: The App Economy," February 2. Cited in Executive Office of the President. 2015. "Community-Based Broadband Solutions: The Benefits of Competition and Choice for Community Development and Highspeed Internet Access," 6.
- <sup>30</sup> Paul DiMaggio and Bart Bonikowski. 2008. "Make Money Surfing the Web? The Impact of Internet Use on the Earnings of US Workers," *American Sociological Review* 73:2; Jed Kolko. 2012. "Broadband and Local Growth," *Journal of Urban Economics* 7:1; Brian Whitacre, Roberto Gallardo, and Sharon Strover. 2014. "Broadband's Contribution to Economic Growth in Rural Areas: Moving Towards a Causal Relationship," *Telecommunications Policy* 38:11; Chris Forman, Avi Goldfarb, and Shane Greenstein. 2012. "The Internet and Local Wages: A Puzzle," *American Economic Review* 102:1.
- <sup>31</sup> Ericsson. 2013. "Measuring the Impact of Broadband on Income"; Forman et al., 556–7.
- <sup>32</sup> Steven Haderlie and Danny Weiss. 2015. "The Benefits of Broadband Expansion to America's Economy, Education, and Health," A Policy Brief by Common Sense Kids Action, 4–5.
- <sup>33</sup> *Ibid.*
- <sup>34</sup> John B. Horrigan. 2015. "The Numbers Behind the Broadband 'Homework Gap.'"
- <sup>35</sup> *Ibid.*
- <sup>36</sup> Haderlie and Weiss, 3–4.
- <sup>37</sup> Kristen Purcell, Alan Heaps, Judy Buchanan, and Linda Friedrich. 2013. "How Teachers Are Using Technology at Home and in Their Classrooms," Pew Research Center, 4.
- <sup>38</sup> Lisa J Dettling, Sarena F. Goodman, and Jonathan Smith. 2015. "Every Little Bit Counts: The Impact of High-speed Internet on the Transition to College," Finance and Economics Discussion Series 2015-108. Washington: Board of Governors of the Federal Reserve System, 1.
- <sup>39</sup> Smith, 2.
- <sup>40</sup> Smith, 3–4.
- <sup>41</sup> Michael J. Stern and Alison E. Adams. 2010. "Do Rural Residents Really Use the Internet to Build Social Capital? An Empirical Investigation," *American Behavioral Scientist* 53:9, 1389–90.
- <sup>42</sup> Aaron Smith. 2013. "Civic Engagement in the Digital Age," Pew Research Center.
- <sup>43</sup> Executive Office of the President, 9.
- <sup>44</sup> *Ibid.*
- <sup>45</sup> John B. Horrigan and Maeve Duggan. 2015. "Home Broadband 2015: The share of Americans with broadband at home has plateaued, and more rely only on their smartphones for online access," Pew Research Center, 4.
- <sup>46</sup> U.S. Federal Communications Commission. 2016. "Broadband Progress Report," 38.
- <sup>47</sup> Thom File and Camille Ryan. 2014. "Computer and Internet Use in the United States: 2013," American Community Survey Reports, United States Census Bureau, 1–2.
- <sup>48</sup> James Prieger. 2013. "The Broadband Digital Divide and the Benefits of Mobile Broadband for Minorities," Pepperdine University, School of Public Policy Working Papers, Paper 45.
- <sup>49</sup> Horrigan and Duggan, 3.
- <sup>50</sup> File and Ryan, 7.
- <sup>51</sup> Michael Liimatta. 2016. "Bridging The Digital Divide: Not Every Low Income Family Is The Same," National Digital Inclusion Alliance.
- <sup>52</sup> Thomas N. Friemel. 2014. "The digital divide has grown old: Determinants of a digital divide among seniors," *New Media & Society*, 1.
- <sup>53</sup> Colin Rhinesmith. "Digital Inclusion and Meaningful Broadband Adoption Initiatives," Evanston, IL: Benton Foundation, January 2016.
- <sup>54</sup> Council of Economic Advisers, 5; Executive Office of the President.
- <sup>55</sup> U.S. Federal Communications Commission. 2015. "FCC Grants Petitions to Preempt State Laws Restricting Community Broadband in North Carolina, Tennessee."
- <sup>56</sup> National Telecommunications and Information Administration. 2010. "Broadband Technology Opportunities Program: Notice of Funds Availability for Second Round — Fact Sheet."
- <sup>57</sup> National Telecommunications and Information Administration. 2011. "Navajo Tribal Utility Authority."
- <sup>58</sup> Doug Kinkoph. 2016. "New NTIA Guide Outlines Strategies, Best Practices for Effective Broadband Stakeholder Outreach," National Telecommunications and Information Administration.
- <sup>59</sup> Colin Rhinesmith. "Digital Inclusion and Meaningful Broadband Adoption Initiatives," Evanston, IL: Benton Foundation, January 2016.
- <sup>60</sup> Brian Lazenby. 2014. "PRTC's Fiber to the Home (FTTH) Update"; Lisa Mensah. 2015. "Keeping our Promise in Kentucky."
- <sup>61</sup> White House. n.d. "ConnectED: President Obama's Plan for Connecting All Schools to the Digital Age."
- <sup>62</sup> "ConnectED Initiative," The White House website ([www.whitehouse.gov/issues/education/k-12/connect-ed](http://www.whitehouse.gov/issues/education/k-12/connect-ed)). Accessed 26 September 2016.
- <sup>63</sup> The White House. 2015. "Fact Sheet: ConnectEd: Two Years of Delivering Opportunity to K-12 Schools & Libraries," 25 June press release. Accessed 26 September 2016.
- <sup>64</sup> White House. 2016. "Fact Sheet: President Obama Announces ConnectAll Initiative," 9 March press release.
- <sup>65</sup> U.S. Department of Housing and Urban Development. 2016. "ConnectHome."
- <sup>66</sup> Interview with Michael Liimatta.
- <sup>67</sup> Interview with Rei Onishi, 28 September 2016.
- <sup>68</sup> U.S. Department of Housing and Urban Development. 2016. "Comcast and The U.S. Department of Housing and Urban Development Collaborate to Close the Digital Divide for Up to 2 Million HUD-Assisted Households in Major Internet Essentials Program Expansion."
- <sup>69</sup> U.S. Department of Housing and Urban Development. "Narrowing the Digital Divide Through Installation of Broadband Infrastructure in HUD-Funded New Construction and Substantial Rehabilitation of Multifamily Rental Housing," *Federal Register* 81:96, 31181–3.
- <sup>70</sup> Mindy Ault. 2015. "Eden Housing's Cottonwood Place," National Housing Conference.
- <sup>71</sup> *Ibid.*
- <sup>72</sup> *Ibid.*
- <sup>73</sup> *Ibid.*
- <sup>74</sup> PCs for People. "What We Do" ([www.pcsforpeople.com/about-us/what-we-do](http://www.pcsforpeople.com/about-us/what-we-do)). Accessed 29 September 2016.
- <sup>75</sup> Interview with Michael Liimatta.

## Digital Inequality and Low-Income Households

As information, services, and resources increasingly move online, digital inequality has come to both reflect and contribute to other persistent forms of social inequality.<sup>1</sup> Disparate access to the Internet and digital devices corresponds closely with longstanding inequalities in income, education, race and ethnicity, age, immigration status, and geography (see “Community Development and the Digital Divide,” p. 1).<sup>2</sup> At the same time, the negative consequences of being underconnected are growing, and researchers and policymakers are increasingly concerned that underconnection is fueling other socioeconomic disparities.<sup>3</sup> Indeed, Internet access, and particularly broadband Internet access, has become an important tool for taking full advantage of opportunities in education, employment, health, social services, and the production and dissemination of knowledge and digital content.<sup>4</sup> Yet those who are most in need of social services are often least able to get online to access those services,<sup>5</sup> and low-income children — who are four times less likely to have access to broadband at home than their middle- and upper-income counterparts<sup>6</sup> — are particularly vulnerable to the long-term detrimental effects of constrained access to technology-enriched education.<sup>7</sup> These trends suggest that digital access will play an increasingly central role in socioeconomic inclusion.

Building on the idea that digital inclusion is an important part of broader efforts to create strong, inclusive communities and improve opportunities and quality of life for all Americans, this article offers a series of frameworks, points of reference, and data for developing strategies to address current

- Research on digital inequality has shifted toward frameworks that consider multiple dimensions and levels, including social supports and other neighborhood-level factors.
- Low-income households have lower rates of in-home Internet connectivity compared with higher-income groups. Connectivity rates are particularly low among HUD-assisted renter households, who are also more likely to depend exclusively on smartphones and other handheld devices to access the Internet in the home.
- Low-income households are most likely to cite affordability constraints as a substantial barrier to in-home broadband adoption. Eighty percent of respondents to the 2015–2016 ConnectHome baseline survey who lacked Internet access at home cited Internet costs as one reason they lacked in-home Internet access, and 37 percent cited device costs.

relationships between low-income housing and digital inequality.

### Digital Inequality Frameworks

Dominant approaches to thinking about and measuring digital inequality have evolved since the commercialization of the Internet in the mid-1990s. Early concerns about digital inclusion highlighted a “digital divide” between those who did and did not have access to new forms of information technology. Studies rooted in this framework sought to identify gaps in access to the Internet and computers by income, geography, age, education, and other types of inequality,<sup>8</sup> both within and between countries.<sup>9</sup> As digital penetration in the United States has increased, however — growing from 1 in 4 U.S. families having Internet service at home around 2000 to nearly 3 in 4 by 2012<sup>10</sup> — additional relevant dimensions of digital inequality have emerged.<sup>11</sup> Although the presence or absence of Internet access remains an important dimension of digital inequality, the concept of a binary digital divide, which highlights absolute inequalities between the included and excluded, does not account for the fact that many technological inequalities are relative, continually shifting as new technologies emerge.<sup>12</sup> As a result, the concept of digital inequality has evolved in two key directions over recent years to focus

on the complex ways in which digital access varies.

#### *Multidimensional Digital Inequality.*

One key way in which digital inequality frameworks shifted was by focusing on the multiple dimensions of digital inequality, highlighting how access to, and the use of, digital technologies varies even among people with formal access to the Internet. This multidimensional approach draws attention to five key aspects of digital inequality, each of which shapes Internet use as well as returns to use.<sup>13</sup>

First, multidimensional approaches to digital inequality focus on variations in equipment, or the technology people use to access the Internet. This aspect of digital inequality includes the extent to which households have computers, software, and connections that allow them to effectively engage with online content.<sup>14</sup> The advent of always-on broadband connections has given rise to qualitatively different kinds of Internet use that involve more time online, a greater variety of activities, and the creation of new content.<sup>15</sup> Similarly, smartphones and desktop and laptop computers offer different kinds of mobility and ease in accessing educational, employment, health, and social service opportunities.<sup>16</sup> As a result, procuring household access to Internet connections with acceptable speed and

reliability, as well as to devices capable of handling a variety of computing activities, is an important component of addressing digital inequality.

Multidimensional approaches also emphasize variations in the autonomy of Internet use. Autonomy includes whether users access the Internet from work or home, whether their use is monitored, their frequency of use, whether they must compete with others for time and access, and the extent to which their use is circumscribed by filters or other constraints.<sup>17</sup> Attention to how autonomy shapes digital experiences underscores the relevance of in-home Internet access; the heightened control over the environment and usage frequency associated with in-home access tends to provide the greatest opportunities for learning, increasing earnings, and participating in the production of digital content.<sup>18</sup> Having Internet at home also allows families to access Internet from a private — and therefore safe — space, particularly in contexts where safety is a concern.<sup>19</sup>

Multidimensional perspectives of digital inequality also address variations in the level of skill that people bring to their Internet use. Skill encompasses users' digital literacy, "their capacity to respond pragmatically and intuitively to online challenges and opportunities," and their ability to master new technologies and mobilize information resources to meet everyday goals and concerns.<sup>20,21</sup> Those with higher levels of digital skill typically incorporate more technology into their learning, exhibit more confidence in online engagements, are less hesitant about finding trusted information online, and are better able to take advantage of emerging technologies.<sup>22</sup> Studies have suggested that inequalities in skill levels are larger than inequalities in physical access to the Internet, that skill gaps have grown even as gaps in physical access have closed,<sup>23</sup> and that most newcomers to the Internet would need assistance to go online.<sup>24</sup>

Variation in the level of social support on which Internet users can draw constitutes a fourth dimension of digital inequality. Such support can include formal technical assistance, technical assistance from friends and family, and emotional reinforcement from friends and family.<sup>25</sup> This dimension involves fostering institutional and social networks that can support effective digital connectivity.

Finally, a multidimensional perspective emphasizes variations in the purposes for which people use technology. This dimension involves the ways in which people use the Internet to increase their economic productivity and their political and social capital.<sup>26</sup> This realm can also include inequalities in the creation of digital content; although the Internet has the potential to be an egalitarian public sphere, differences in control over digital tools and usage of online information can contribute to digital production gaps.<sup>27</sup>

*Multilevel Digital Inequalities.* In addition to highlighting multiple dimensions of digital inequality, digital inequality frameworks have also paid increasing attention to how social dynamics at different levels of society influence Internet access and use. This multilevel perspective builds on earlier digital inequality literature that focused on individual-level characteristics, behaviors, and outcomes, to also consider how family, community, neighborhood, and network factors contribute to digital inequalities.<sup>28</sup> Studies of the influence of local environments on people's willingness to adopt the Internet and related technologies<sup>29</sup> have highlighted two key approaches to thinking about the multilevel dynamics of digital inequality.

The first approach focuses on place-based influences, including neighborhood-level effects on digital access and the roles that communities play in shaping digital behaviors.<sup>30</sup> Local digital and social infrastructures can influence how residents engage with digital resources, including through affecting: the local

cost, speed, and availability of Internet connectivity and devices; the available opportunities for training and support that facilitate meaningful digital connectivity; and the involvement of community partners and digital-inclusion organizations as part of broader citywide and regional digital initiatives.<sup>31</sup> Spaces such as libraries and community organizations can provide access to in-person support, classes and workshops, and social contexts that encourage the development of hands-on digital skills.<sup>32</sup> Factors such as segregation and concentrated poverty can also create disparities in Internet access and use even in areas where broadband networks are available.<sup>33</sup> Ultimately, examining these place-based influences can help clarify the ways in which community-based organizations and support structures help people gain meaningful access to technology.<sup>34</sup>

A second approach to thinking about multilevel digital inequality focuses on the effects of social networks on digital access. This approach emphasizes the role that human-to-human interactions play in shaping digital adoption, situating broadband use within broader communications networks and social resources.<sup>35</sup> This social networks framework suggests that people's social relationships influence the value they place on Internet adoption. For example, the price that people are willing to pay for Internet access tends to rise as more people in one's social network start using it. These dynamics, particularly within networks consisting of people of similar status, can increase inequality by significantly reducing adoption rates in less privileged groups.<sup>36</sup> The concept of network dynamics encourages new thinking about how coordinated efforts to bring social networks online might foster heightened digital engagement among disadvantaged populations over time.

In short, research on digital inequalities has shifted over the past several decades from frameworks focused on capturing inequalities between the connected and



unconnected to more nuanced frameworks that consider digital inequalities along multiple dimensions and at multiple levels of society. These new frameworks call for strategies that address multiple aspects of digital inequality, including affordable devices and broadband access, digital literacy training, and publicly accessible computing centers with helpful staff and support.<sup>37</sup>

### Digital Inequality and Low-Income Housing Trends

HUD-assisted households include populations that tend to face digital disadvantages, such as families earning less than \$25,000 per year, individuals without a high school degree, and minorities.<sup>38</sup> HUD-assisted housing also serves both urban and rural populations; school-aged youth and the elderly; people with disabilities; and households facing a range of institutional, organizational, and social contexts. Although assisted housing providers are well positioned to address many of the central challenges that shape

digital inequality today, relatively little research has examined specific associations between low-income housing and Internet access. This section reviews recent data detailing the relationship between low-income housing and digital inequality.

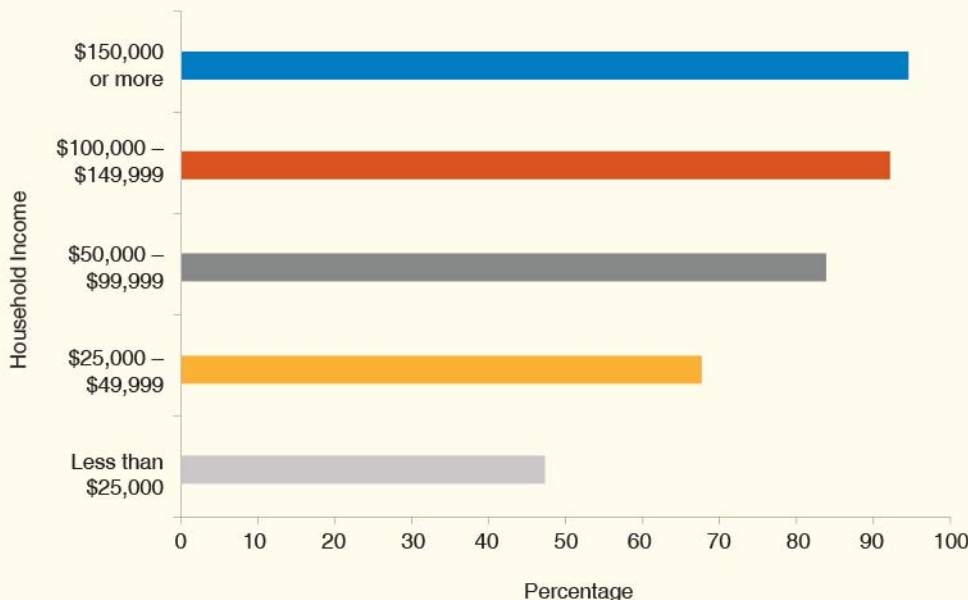
*Internet Connectivity Trends.* One dimension of digital inequality focuses on Internet connectivity, defined here as in-home adoption of high-speed Internet. Connectivity disparities — by both income and geography — align in important ways with low-income housing patterns.

Household income is strongly associated with in-home Internet connectivity levels, with low-income households being less connected than higher-income households.<sup>39</sup> Although 67 percent of all U.S. adults aged 18 and older had broadband Internet access at home in 2015, this rate was 41 percent among adults with a household income below \$20,000 and 90 percent among adults

with a household income of more than \$100,000. Evidence also suggests that the gap between low- and high-income households with a broadband connection at home may have increased slightly in recent years; while the rate of households with at-home broadband who earn less than \$20,000 per year dropped by 5 percent (from 46% to 41%) between 2013 and 2015, the rate for households earning more than \$100,000 dropped by only 3 percent (from 93% to 90%) during the same period. As a result, modest declines in broadband adoption from 2013 to 2015 were concentrated among low- to middle-income households.<sup>40</sup> Highlighting the relevance of income for digital inequality, even after accounting for age, a 90-year-old in the top quartile of income was more likely to have an in-home Internet connection in 2013 than a person of any age in the bottom quartile of the income distribution.<sup>41</sup>

Place-based characteristics are also associated with disparities in rates of in-home Internet connectivity. Broadband continues to be less available in rural areas than in urban areas, particularly at higher speeds. Although most areas have Internet service at speeds of at least 10 Mbps today, and almost all areas offer dial-up Internet access, the presence of infrastructure capable of supporting broadband speeds of more than 25 Mbps, including fiber-optic technology, is still divided along urban/rural lines. Many rural areas have only one Internet service provider, and some rural areas have access to only satellite and cellular modem service or have no broadband availability at all.<sup>42</sup> Other place-based dynamics complicate the urban/rural divide; broadband availability is associated not only with population density but with a community's proximity to a major urban area. As a result, small-town residents tend to have less broadband availability than ex-urbanites despite living in much more densely populated areas.<sup>43</sup> At the same time, disparities in urban and rural broadband access are less severe than they once were;<sup>44</sup> recent investments in

**Figure 1. U.S. Households With High-Speed Internet Subscription at Home by Income, 2013**



Source: Thom File and Camille Ryan. 2014. "Computer and Internet Use in the United States: 2013," American Community Survey Reports, U.S. Census Bureau, 3.

**Table 1. In-Home High-Speed Internet Subscription and Device Ownership Among U.S. Households by HUD Subsidy, 2014**

Housing Characteristics	Percentage with high-speed Internet subscription <sup>1</sup>	Percentage with desktop or laptop computer <sup>2</sup>	Percentage with handheld computer only <sup>3</sup>
Total Households	75.1	78.1	6.5
HUD-Assisted Renters	43.1	44.2	14.1
Public Housing	40.8	41.0	14.4
Voucher	49.1	51.0	15.1
Multifamily	35.6	36.3	12.4
Unassisted Renters	69.0	71.7	10.6
Owners	80.2	83.6	3.9

<sup>1</sup> Does not include those who use the Internet without a paid subscription. High-speed Internet indicates that a household has Internet service other than dial-up.

<sup>2</sup> Includes households that own or use a desktop, laptop, netbook, or notebook computer at their home.

<sup>3</sup> Includes households that own or use only a handheld computer, smart mobile phone, or other handheld wireless computer at their home.

Source: U.S. Census Bureau and U.S. Department of Housing and Urban Development. "2014 American Community Survey and HUD Administrative Data (PIC, TRACS, HUD-951)."

broadband infrastructure have made fast 4G wireless broadband available to more than 98 percent of Americans.<sup>45</sup>

Although broadband *availability* may be higher than before, evidence of disparities in place-based broadband *adoption* persists, and broad urban/rural divides are less instructive in understanding these dynamics. Substantial variation in adoption rates, Internet quality, and connection speeds exists within cities and is correlated with household income.<sup>46</sup> Examples from several cities suggest that income can be more important than population density in explaining Internet adoption rates in certain areas.<sup>47</sup> An analysis of Chicago found that neighborhood-level factors such as segregation and concentrated poverty influenced access to in-home Internet connections,<sup>48</sup> and qualitative work has suggested that Internet adoption may be more limited for residents of low-income urban areas: Internet service providers may not offer strong coverage of some low-income housing areas or may charge high installation fees to initiate service in unserved buildings or neighborhoods.<sup>49</sup> Figure 1 draws on 2013 American Community Survey (ACS) data to show how home high-speed Internet service in the United States varies by household income.

Examining merged 2014 ACS and HUD administrative data offers insight into the relationship between housing and in-home Internet access. These data indicate that connectivity rates among HUD-assisted households are very low; only 43 percent of HUD-assisted renters subscribed to high-speed Internet service at home compared with 69 percent of unassisted renters and 80 percent of owners (table 1). The connectivity rate for HUD-assisted renters is even lower than the rate for all U.S. households earning less than \$25,000 per year (43% and 47%, respectively), a finding that suggests that HUD-assisted renters are among the nation's most disconnected households.<sup>50</sup>

Another source of insight into connectivity in low-income housing is baseline survey data from the ConnectHome pilot program, HUD's initiative to extend affordable broadband access, technical training, digital literacy programs, and devices to HUD-assisted households in 28 ConnectHome pilot communities across the nation. The survey collected data on in-home Internet access in 22 of these communities in 2015 and 2016.<sup>51</sup> These data include information about levels of Internet access, the types of Internet connections available,

the types of devices used to connect to the Internet, the reasons for any lack of Internet access, the existence of previous Internet access, awareness of the ConnectHome program, and the receipt of free or low-cost Internet through ConnectHome.<sup>52</sup> These data found that 34 percent of surveyed households have a high-speed Internet subscription in addition to a desktop computer, laptop computer, or tablet at home. Another 35 percent of surveyed households are underconnected; these households may have access to the Internet only through a smartphone device and with a smartphone data plan, or they may rely on another combination of devices and connection types, such as a tablet with a data plan only, or a high-speed Internet connection with only a smartphone device. Finally, 31 percent of households have no Internet access at home.<sup>53</sup>

*Device Trends.* Another dimension of digital inequality focuses on access to Internet-enabled devices at home, as households can only take full advantage of Internet access if they have devices that enable them to effectively connect to the Internet and its content. Although desktop and laptop computers offer households important access to

tools, information, and skill-building opportunities,<sup>54</sup> they can be prohibitively expensive for many families. On the other hand, smartphones offer advantages such as mobile connectivity,<sup>55</sup> but being limited to smartphone-only Internet access is associated with data cap limits, risk of service cancellations or suspensions due to financial constraints, and difficulty performing essential tasks such as applying for jobs or writing papers on a smartphone's small screen.<sup>56</sup>

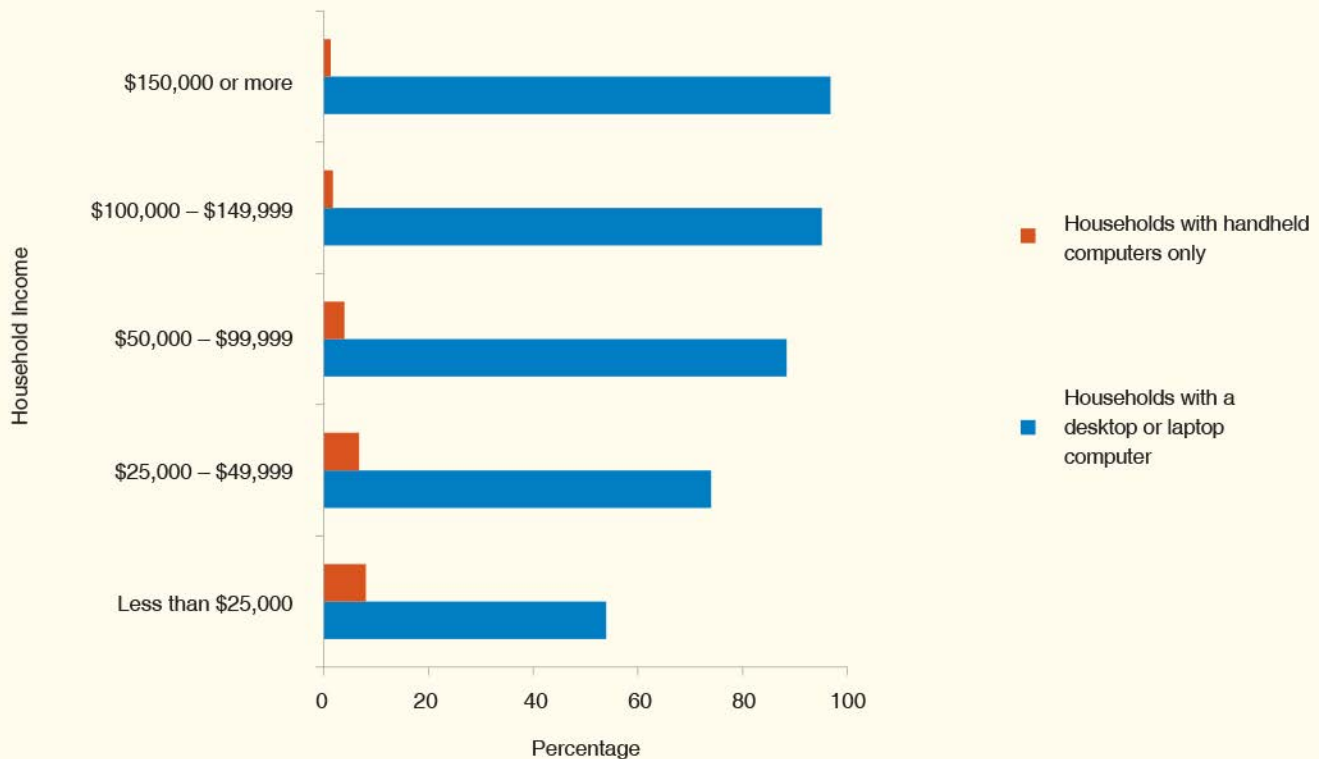
Device access is a substantial barrier to in-home Internet use for many low-income households. People from higher-income households are more likely to own a computer than those from lower-income households.<sup>57</sup> At the same time, a much higher percentage of lower-income households rely solely on smartphones for Internet access compared with more

affluent households (fig. 2).<sup>58</sup> In 2015, 21 percent of adults with an annual household income below \$20,000 had a smartphone but no broadband at home, compared with 6 percent of adults with a household income above \$100,000.<sup>59</sup> Evidence also suggests that the gap between low- and high-income households with smartphone-only access may have increased slightly in recent years; between 2013 and 2015, the percentage of adults with smartphone-only access in households with annual incomes below \$20,000 increased from 13 percent to 21 percent, while the percentage of adults with smartphone-only access in households with incomes above \$100,000 grew only from 4 percent to 6 percent.<sup>60</sup>

Device ownership also presents a substantial barrier to in-home Internet use for HUD-assisted households (table 1). Only 44 percent of HUD-assisted

renters own a desktop, laptop, netbook, or notebook computer.<sup>61</sup> This rate is much lower than the national average of more than 78 percent and lower than even the 54 percent of households earning less than \$25,000 per year that own a desktop, laptop, netbook, or notebook computer.<sup>62</sup> Among HUD-assisted renters, computer access is particularly limited for public housing and multifamily households, with only 36 percent of HUD-assisted multifamily households owning a desktop, laptop, netbook, or notebook computer. HUD-assisted households are also more likely to be smartphone-only users; 14.1 percent of HUD-assisted households access the Internet only through smartphones or other handheld computers compared to 6.5 percent of total U.S. households.<sup>63</sup> High rates of dependence on smartphones are found across voucher, public housing, and multifamily households. Together, these trends

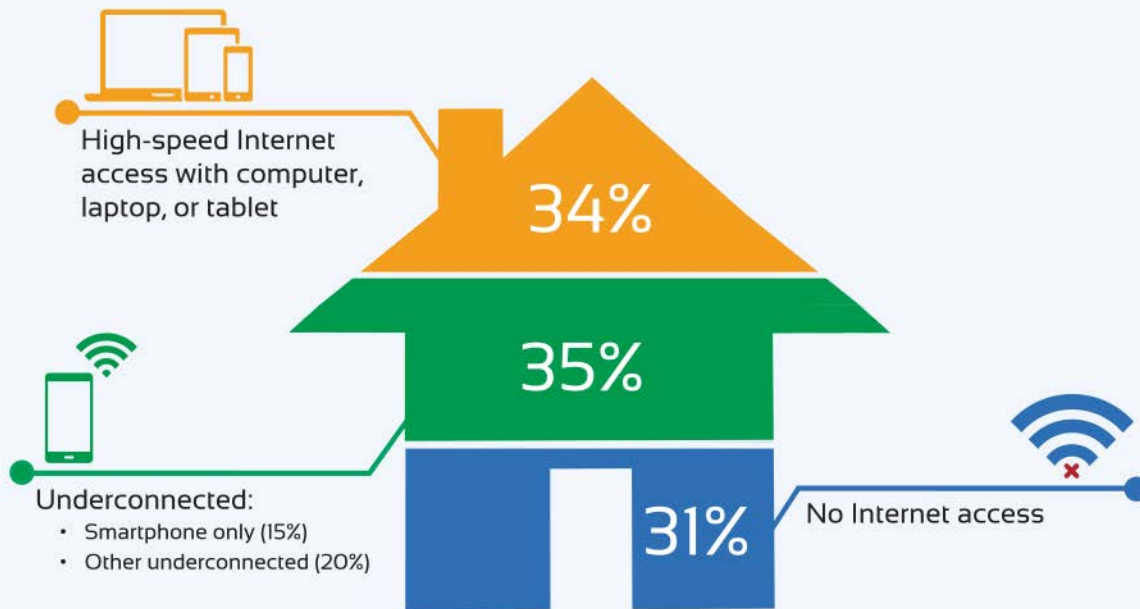
**Figure 2. Device Ownership Among U.S. Households by Income, 2013**



Source: Thom File and Camille Ryan. 2014. "Computer and Internet Use in the United States: 2013," American Community Survey Reports, U.S. Census Bureau, 3, 9.



## Baseline Internet Access Among ConnectHome Households



Source: ConnectHome Baseline Internet Access Survey; conducted November 2015–June 2016.

Graphic reprinted with permission from: U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities: Results From the National Evaluation of ConnectHome," 2.

further suggest that HUD-assisted renters are among the most disconnected households in the country.<sup>64</sup>

Data from the 2015–2016 ConnectHome baseline survey indicate that, of the 69 percent of HUD-assisted ConnectHome households with some Internet access in the home (including by smartphone), only 65 percent have a desktop or laptop computer or a tablet in their home, meaning that 35 percent of the ConnectHome households that have some Internet access in the home lack access to a device that can fully take advantage of connectivity. At the same time, about three-quarters of HUD-assisted ConnectHome households with some Internet access at home use a smartphone to access the Internet.<sup>65</sup>

*Barriers to Obtaining Home Broadband Internet Service.* According to a 2015 Pew Research Center survey, 43 percent of all U.S. adults age 18 and older cited cost as the most important reason for not having home broadband service; 33 percent cited the monthly subscription cost as the main barrier, and 10 percent

stated that a computer was too expensive. Additionally, 12 percent of nonadopters stated that their smartphone was sufficient, 10 percent responded that they had other options to get online outside the home, and 5 percent stated that Internet service was either unavailable or insufficient.<sup>66</sup> Other studies of households without home broadband access have cited similar rationales, including lack of relevance, usability obstacles, limited availability, device access, and price.<sup>67</sup>

The population of nonadopters can be categorized into two groups: those who do not use the Internet at all and those who use the Internet away from home; in 2013, these groups consisted of 15 percent and 9 percent of U.S. adults, respectively.<sup>68</sup> Among those who do not use Internet at all, only 19 percent cited device or Internet connection cost as the reason. However, among those who use the Internet away from home — a population that tends, on average, to earn lower incomes — 44 percent cited financial reasons as the main limiting factor.<sup>69</sup>

Nonadopters can also be classified into two additional groups: never-adopters, who have never had in-home Internet access, and unadopters, who once had in-home Internet access but no longer do.<sup>70</sup> In 2013, unadopters accounted for 12 percent of all nonadopting households and were significantly more likely than their never-adopter counterparts to cite cost, the availability of Internet access outside the home, and computer shortcomings as reasons for discontinuing service.<sup>71</sup> In the end, price sensitivity is “most prominent among those who have had service in the past, and/or are interested in getting it in the future.”<sup>72</sup>

Perhaps unsurprisingly, those with the lowest incomes are most likely to cite cost as the main barrier to having broadband access at home.<sup>73</sup> A series of studies shows that low-income households tend to recognize the value and relevance of connectivity, and their ability to pay, rather than their willingness to pay, is the main reason for not having home broadband service.<sup>74</sup> Among this population, affordability barriers include not only monthly subscription

costs but also devices and hidden fees; access to low-cost computers was often just as important to these households as access to low-cost Internet options.<sup>75</sup>

Cost is also a substantial connectivity obstacle for HUD-assisted households that do not have in-home Internet access. Eighty percent of respondents to the 2015–2016 ConnectHome baseline survey who lacked Internet access at home cited Internet costs as one reason they lacked in-home Internet access, and 37 percent cited device costs. Other reasons cited for lacking in-home Internet access were the ability to use the Internet away from home, lack of interest in using the Internet, being uncomfortable with using computers or the Internet, having difficulty obtaining service, and living in housing that is not wired for service. At the same time, HUD-assisted households have a high incidence of being unadopters; the ConnectHome baseline survey revealed that 35 percent of surveyed households without home Internet access had such access in the past<sup>76</sup> compared with 12 percent of all nonadopting households.<sup>77</sup>

## ConnectHome: Confronting Digital Inequality in Low-Income Housing

Because HUD-assisted households have low connectivity rates, limited device access, and other specific barriers to Internet access, HUD-assisted housing offers a promising platform to significantly increase digital inclusion rates and improve residents' quality of life. HUD's ConnectHome initiative offers affordable broadband access, devices, technical training, digital literacy programs, educational and workforce related content, and organizational support to families living in HUD-assisted housing.<sup>78</sup> ConnectHome is a public-private collaboration that creates a platform for community leaders, local governments, nonprofit organizations, and private-sector stakeholders to produce locally tailored solutions for reducing digital inequality.<sup>79</sup> The initiative has already made progress toward distributing devices, establishing Internet connections,

and providing digital-literacy training in its 28 pilot communities.<sup>80</sup> As ConnectHome communities advance their digital inclusion efforts, HUD is evaluating progress, learning about the benefits of expanded in-home Internet access for HUD-assisted residents, and gathering information about what Internet penetration looks like in these low-income households.<sup>81</sup>

ConnectHome advances digital inclusion in ways that align with current frameworks for thinking about digital inequality. By incorporating connectivity, device access, and digital literacy, as well as opportunities for communities to build coalitions among local organizations, foster social networks, and integrate Internet access with job training and other social programs,<sup>82</sup> ConnectHome offers a platform to address digital inequality as a challenge that is both multidimensional and multilevel. Indeed, many of the efforts advanced as part of ConnectHome address inequalities in equipment, autonomy, skill, purpose of use, and support, and provide opportunities to engage with family, community, neighborhood, and network dynamics that can shape digital inclusion.

To address equipment inequalities, and because affordability is a significant barrier to access for HUD-assisted residents,<sup>83</sup> ConnectHome helps bring free and low-cost Internet and computing devices to HUD-assisted families.<sup>84</sup> ConnectHome prioritizes broadband Internet options as well as in-home access to devices that are powerful enough to accommodate a variety of computing and online activities.<sup>85</sup> By bringing Internet access directly to the homes of HUD-assisted residents,<sup>86</sup> ConnectHome also limits the extent to which long commutes, usage restrictions and monitoring, wait times, and limited hours constrain the learning opportunities associated with autonomous use.<sup>87</sup>

ConnectHome addresses inequalities in digital skills by promoting affordable digital literacy resources.<sup>88</sup> Individual

ConnectHome pilot communities have already begun establishing digital literacy trainings, ranging from basic classes on how to set up a computer, create an email address, and browse the Internet safely and securely, to more advanced courses on how to build a computer, code, and provide technical assistance to others.<sup>89</sup> These digital literacy trainings also speak to inequalities in purpose of use, or the extent to which digital activities are able to increase economic productivity and political and social capital.<sup>90</sup> Specifically, these digital literacy trainings have covered topics such as employment, health, education, social services, and home safety, and several ConnectHome communities have engaged HUD-assisted residents in advanced digital literacy training, including through the Jobs Plus and Section 3 programs, to provide job training for technology careers, refurbish devices for HUD-assisted households, and develop technical assistance teams for their communities.<sup>91</sup>

ConnectHome also encourages building regional and local partnerships and engaging local stakeholders,<sup>92</sup> which can build social supports for residents. These efforts include developing local collaborations between housing authorities, computing centers, schools, libraries, and nonprofits.<sup>93</sup> Various ConnectHome pilot communities have fostered social supports within HUD-assisted housing communities as well, by engaging resident councils in digital inclusion efforts and establishing Internet cafes, technical assistance teams, and social-support spaces for digital participation.<sup>94</sup>

Finally, ConnectHome supports the development of community-specific implementation plans that account for local needs, stakeholders, and interests.<sup>95</sup> The program provides communities with strategies to coordinate with government programs such as Choice Neighborhoods and Family Self-Sufficiency initiatives in ways that support local efforts to advance digital access and expand economic, political,

and social opportunities for low-income households.<sup>96</sup> By encouraging housing authorities to partner with libraries, nonprofits, and local schools to create community-based support networks,<sup>97</sup> and by bringing communities and families online together, ConnectHome efforts can also harness the power of social networks to reinforce the value of being online.<sup>98</sup>

## Directions for Future Research

In addition to researching the practical applications of digital inequality frameworks through ConnectHome, opportunities exist for further research into the complex relationships between low-income housing and Internet access. First, researchers should continue analyzing the causal mechanisms through which wide-ranging social inequalities shape digital inequalities, and through which digital inequalities,

in turn, affect other kinds of inequality. This area of research involves examining the causes and consequences of digital inequality and the kinds of models that might disrupt cyclical and mutually reinforcing inequalities. Second, more research is needed into how the infrastructure supporting digital access, as well as the market dynamics and processes through which digital resources are developed and disseminated, affect inequality, and how these digital infrastructures could be built in ways that are increasingly inclusive.<sup>99</sup> Third, researchers need to consider innovative ways to study and mitigate digital inequality in a world where technologies and patterns of use are constantly changing.<sup>100</sup> Finally, researchers should continue examining how different low-income housing contexts — including rural and urban geographies, different kinds of housing stock, and varied resident needs — affect digital inequality.

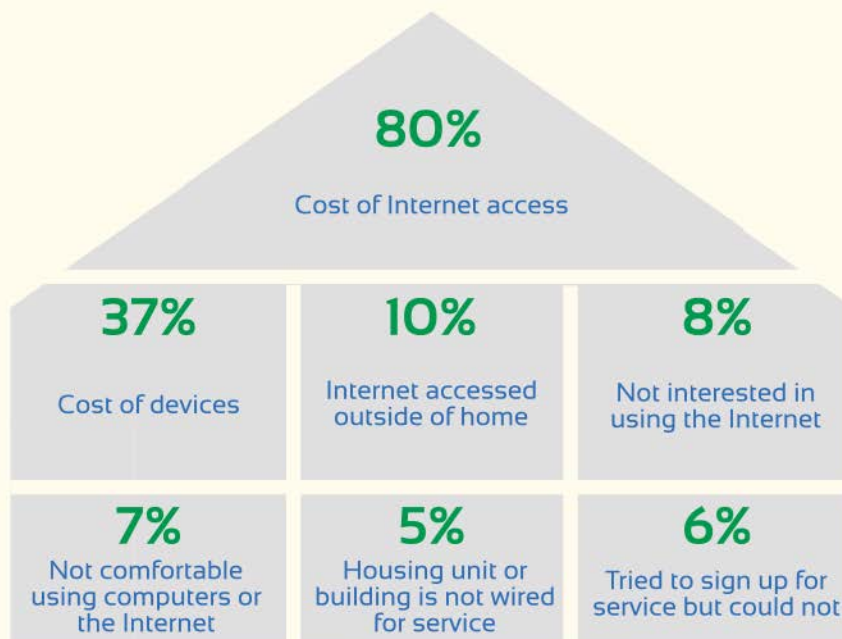
The ConnectHome effort itself is well-positioned to continue assessing how the initiative’s strategies expand high-speed Internet access; reduce digital inequalities; and create new educational, employment, health, and social-service opportunities.

Continued research on these fronts can guide ongoing efforts to build a digital infrastructure and provide Internet access in ways that are increasingly inclusive. To the extent that digital inequality is both a cause and consequence of other socioeconomic disparities, efforts to increase Internet connectivity, device access, and digital literacy play an important role in stemming cycles of inequality over time. **EM**

— Megan Peppel, *Former HUD Intern*

<sup>1</sup> Council of Economic Advisors. 2015. “Mapping the Digital Divide: Issue Brief,” 1; Eszter Hargittai. 2008. “Digital Reproduction of Inequality,” in *Social Stratification*:

## Reasons for Lack of In-Home Internet Access Among ConnectHome Households Not Connected



**Source:** ConnectHome Baseline Internet Access Survey; conducted November 2015–June 2016.

**Note:** Respondents could check more than one category.

Graphic reprinted with permission from: U.S. Department of Housing and Urban Development. 2016. “Baseline Internet Access Among ConnectHome Communities: Results From the National Evaluation of ConnectHome,” 4.



- Class, Race, and Gender in Sociological Perspective*, David Grusky, ed. Boulder, CO: Westview Press, 936.
- 2 Council of Economic Advisors; Kathryn Zickuhr. 2013. "Who's Not Online and Why," Pew Research Center; The White House. 2015. "Fact Sheet: ConnectHome: Coming Together to Ensure Digital Opportunity for All Americans"; Vikki S. Katz and Carmen Gonzalez. 2015. "Community Variations in Low-Income Latino Families' Technology Adoption and Integration," *American Behavioral Scientist* 60:1, 59–80; Vikki S. Katz and Carmen Gonzalez. 2016. "Toward Meaningful Connectivity: Using Multilevel Communication Research to Reframe Digital Inequality," *Journal of Communication* 66:2, 236–49; John B. Horrigan. 2010. "Broadband Adoption and Use in America," U.S. Federal Communications Commission; Hargittai.
  - 3 Katz and Gonzalez 2016, 59–60.
  - 4 Colin Rhinesmith. 2016. "Digital Inclusion and Meaningful Broadband Adoption Initiatives," Benton Foundation, 7; Paul DiMaggio and Eszter Hargittai. 2001. "From the 'Digital Divide' to 'Digital Inequality': Studying Internet Use as Penetration Increases," Princeton University Center for Arts and Cultural Policy Studies Working Paper; Dharma Dailey et al. 2010. "Broadband Adoption in Low-Income Communities," Social Science Research Council; Jen Schradie. 2011. "The Digital Production Gap: The Digital Divide and Web 2.0 Collide," *Poetics* 39:2, 145–68.
  - 5 Dailey et al., 23.
  - 6 John B. Horrigan. 2015. "The Numbers Behind the Broadband 'Homework Gap,'" Pew Research Center.
  - 7 The White House.
  - 8 Katz and Gonzalez 2016; DiMaggio and Hargittai; Jan A. V. G. M van Dijk. 2006. "Digital Divide Research, Achievements, and Shortcomings," *Poetics* 34: 4–5, 221–35; Hargittai.
  - 9 Wenhong Chen and Barry Wellman. 2004. "The Global Digital Divide Within and Between Countries," *IT & Society* 1:7, 39–45; Van Dijk.
  - 10 Paul DiMaggio and Filiz Garip. 2014. "When Do Social Networks Increase Inequality?" in *Social Stratification: Class, Race, and Gender in Sociological Perspective*, David B. Grusky, ed. Boulder, CO: Westview Press, 673.
  - 11 DiMaggio and Hargittai.
  - 12 Van Dijk.
  - 13 Dimaggio and Hargittai, 2.
  - 14 DiMaggio and Hargittai, 9–10; Hargittai; Shane Greenstein. 2004. "The Economic Geography of Internet Infrastructure in the United States," in *The Handbook of Telecommunications Economics, Volume II*, Martin Cave, Sumit Majumdar, and Ingo Vogelsang, eds.
  - 15 Pew Research Center. 2016. "Three Technology Revolutions."
  - 16 John B. Horrigan and Maeve Duggan. 2015. "Home Broadband 2015," Pew Research Center.
  - 17 DiMaggio and Hargittai, 9–10.
  - 18 DiMaggio and Garip, 679; Schradie, 148; 161.
  - 19 Katz and Gonzalez 2015, 242–3.
  - 20 DiMaggio and Hargittai, 8–11; Van Dijk; Hargittai.
  - 21 Katz and Gonzalez 2016.
  - 22 John B. Horrigan. 2016. "Digital Readiness Gap," Pew Research Center, 2–6.
  - 23 Van Dijk, 29.
  - 24 Lee Rainie. 2016. "Digital Divides 2016," Keynote Address at the Internet Governance Forum.
  - 25 DiMaggio and Hargittai, 12–3; Hargittai.
  - 26 DiMaggio and Hargittai; Hargittai; Eszter Hargittai and Amanda Hinnant. 2008. "Digital Inequality: Differences in Young Adults' Use of the Internet," *Communication Research* 35:5, 602–21.
  - 27 Schradie.
  - 28 Katz and Gonzalez 2015, 63; Schradie.
  - 29 Katz and Gonzalez 2015; DiMaggio and Garip.
  - 30 Karen Mossberger et al. 2012. "Unraveling Different Barriers to Internet Use: Urban Residents and Neighborhood Effects," *Urban Affairs Review* 48:6, 773; Katz and Gonzalez 2015.
  - 31 Katz and Gonzalez 2015; Katz and Gonzalez 2016; Dailey et al 2010; Rhinesmith 2016.
  - 32 Dailey et al.
  - 33 Mossberger et al.
  - 34 Rhinesmith.
  - 35 Rhinesmith; Dailey et al.
  - 36 DiMaggio and Garip.
  - 37 Rhinesmith; J.C. Araque et al. 2013. "Computer Usage and Access in Low-Income Urban Communities," *Computers in Urban Behavior* 29:4, 1393–401.
  - 38 The White House.
  - 39 The White House; Council of Economic Advisors; Horrigan 2010.
  - 40 Rainie; Horrigan and Duggan.
  - 41 Council of Economic Advisors.
  - 42 Greenstein; Council of Economic Advisors; David Beede and Anne Neville. 2013. "Broadband Availability Beyond the Rural/Urban Divide: Broadband Brief No. 2," NTIA and Economics and Statistics Administration; Dailey et al.
  - 43 Beede and Neville.
  - 44 Greenstein.
  - 45 The White House.
  - 46 Council of Economic Advisors.
  - 47 Ibid.
  - 48 Mossberger et al.
  - 49 Dailey et al.
  - 50 Thom File and Camille Ryan. 2014. "Computer and Internet Use in the United States: 2013 American Community Survey Reports," U.S. Census Bureau; Calvin Johnson. 2016. "ConnectHome: Demonstrating How to Close the Digital Divide," U.S. Department of Housing and Urban Development PD&R *Edge* Message From PD&R Senior Leadership, March 2016.
  - 51 Johnson; Insight Policy Research. 2016. "Baseline Memorandum: August 4, 2016."
  - 52 Insight Policy Research 2016.
  - 53 U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities: Results from the National Evaluation of ConnectHome."
  - 54 Rhinesmith.
  - 55 Pew Research Center.
  - 56 Horrigan and Duggan; Rhinesmith.
  - 57 Anderson.
  - 58 File and Ryan.
  - 59 Horrigan and Duggan; Rainie.
  - 60 Horrigan and Duggan.
  - 61 U. S. Census Bureau. "2013 American Community Survey," U.S. Census Bureau's American Community Survey Office; U.S. Department of Housing and Urban Development. "HUD Administrative Data (PIC, TRACS, HUD-951)."
  - 62 File and Ryan.
  - 63 2014 American Community Survey and HUD Administrative Data.
  - 64 Johnson; The White House.
  - 65 Insight Policy Research 2016; U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities."
  - 66 Horrigan and Duggan; Rainie.
  - 67 Van Dijk; Zickuhr.
  - 68 Zickuhr.
  - 69 Ibid.
  - 70 Dailey et al.; Brian Whitacre and Colin Rhinesmith. 2016. "Broadband Un-Adopters," *Telecommunications Policy* 40:1, 1–13.
  - 71 Whitacre and Rhinesmith.
  - 72 Horrigan and Duggan, 7.
  - 73 Horrigan 2010; Rhinesmith.
  - 74 Dailey et al; Rhinesmith; Horrigan 2010.
  - 75 Dailey et al; Rhinesmith.
  - 76 Insight Policy Research 2016; U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities."
  - 77 Whitacre and Rhinesmith.
  - 78 U.S. Department of Housing and Urban Development. 2016. "Comcast and the U.S. Department of Housing and Urban Development (HUD) Announce Pilot Program to Close the Digital Divide for Public Housing Residents in Miami, Nashville, Philadelphia, and Seattle," 24 March press release.
  - 79 The White House.
  - 80 U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities."
  - 81 Johnson; U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities."
  - 82 The White House; U.S. Department of Housing and Urban Development 2016; U.S. Department of Housing and Urban Development. 2015. "The National ConnectHome Summit: PD&R Expert Convenings Summary Report," Office of Policy Development and Research, October 2015.
  - 83 Insight Research Partners 2016; U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities."
  - 84 The White House.
  - 85 U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities."
  - 86 U.S. Department of Housing and Urban Development 2015; Johnson.
  - 87 Hargittai, 940; Dailey et al.
  - 88 U.S. Department of Housing and Urban Development. 2016. "Baseline Internet Access Among ConnectHome Communities"; Johnson; The White House.
  - 89 Interviews with ConnectHome pilot communities.
  - 90 DiMaggio and Hargittai; Hargittai; Hargittai and Hinnant.
  - 91 Interviews with ConnectHome pilot communities.
  - 92 The White House.
  - 93 U.S. Department of Housing and Urban Development 2015.
  - 94 Interviews with ConnectHome pilot communities.
  - 95 U.S. Department of Housing and Urban Development 2015.
  - 96 Ibid.
  - 97 Ibid.
  - 98 DiMaggio and Garip.
  - 99 DiMaggio and Hargittai; Greenstein.
  - 100 Van Dijk.

# Working To Bridge the Digital Divide

Over the past few decades, the Internet has become a key tool in many parts of daily life, including searching and applying for jobs, doing homework, paying bills, accessing news, interacting with government, watching television and movies, and even talking with friends and family.<sup>1</sup> Low-income households in the United States, however, are less likely than wealthier households to use the Internet; they are also less likely to have broadband connections at home, which means that they can miss out on the opportunities that access to high-speed Internet affords.<sup>2</sup> This digital divide manifests in various ways: through a lack of home Internet connections, low rates of computer ownership, and uneven skills and training in digital technologies (see “Community Development and the Digital Divide,” p. 1).

Three innovative and effective programs are working to bridge these gaps by leveraging nonprofit, public, and private resources to provide free or low-cost devices, Internet connectivity,

## Highlights

- Austin’s Unlocking the Connection program promotes digital inclusion among the city’s public housing residents by providing free high-speed home Internet connections, training in digital literacy, and free refurbished computers.
- Digital education programs focused on training participants to use online public and social services, teaching parents to engage with their children’s education, and promoting career advancement are central to Connecting for Good’s mission in Kansas City.
- Tech Goes Home Chattanooga partners with more than 60 organizations to offer digital literacy courses throughout Tennessee’s Hamilton County.

and classes in digital literacy: Austin’s Unlocking the Connection, a public-private partnership focused on public housing residents; Connecting for Good in Kansas City, a nonprofit that serves low-income residents; and Tech Goes Home Chattanooga, which works with underserved groups in Tennessee’s Hamilton County.

### Unlocking the Connection in Austin

Although 92 percent of the one million residents of Austin, Texas, have an Internet connection at home, a rate higher than the national average, the city still faces a digital divide based on age, income, and gender.<sup>3</sup> According to a 2015 study conducted by the University of Texas at Austin, about

50,000 Austin residents do not use the Internet.<sup>4</sup> Compared with Internet users, these nonusers are more likely to be older, female, and less educated. Nonusers are also disproportionately African American — the home connectivity rate among African Americans is 80 percent compared with 91.9 percent for Hispanics and 94.5 percent for whites.<sup>5</sup> A significant portion of Austin residents who do not have a home Internet connection cite cost as the chief impediment.<sup>6</sup>

Some 4,300 people, or 1,838 families in the city, live in the Housing Authority of the City of Austin’s (HACA) 18 developments. Nearly half of HACA residents (48%) are children, 12 percent are elderly, and 31 percent are disabled. Women outnumber men, making up 58 percent of the residents.<sup>7</sup> According to a 2013 survey of HACA households in East Austin, fewer than one-third of residents reported owning a desktop, laptop, or tablet computer. And among those who did own one of those devices, 28 percent did not have Internet access at home.<sup>8</sup>

To eliminate the digital divide for its residents, HACA, in partnership with the city of Austin, Google Fiber, and other philanthropic and corporate partners, launched Unlocking the Connection in 2014. Led by nonprofit Austin Pathways, a HACA subsidiary that works with low-income families to achieve self-sufficiency, the program



Patrick Wong

Meadowbrook Apartments, a 100-unit HACA housing development in Austin, offers gigabit-speed Internet connections to residents.

provides HACA residents with training in digital literacy, free refurbished computer devices, and free home Internet service at either 5 megabits per second (Mbps) or gigabit speed from Google Fiber.<sup>9</sup>

Unlocking the Connection began taking shape in 2013, when Sylvia Blanco, executive vice president of Austin Pathways, sought to make digital inclusion for public housing residents a part of HACA's strategic plan. In 2014, Google Fiber made Austin the country's second city to receive gigabit broadband service, an extremely fast fiber-optic connection available in only seven other cities nationwide. At the time, Google Fiber launched a competition to award free broadband connections to 100 nonprofits in the city. Some 350 organizations applied, and although most of the 100 winning sites were anchor institutions such as libraries, schools, and hospitals, the community computer lab at HACA's Booker T. Washington Terraces was among them.<sup>10</sup> This successful outcome gave Blanco the opportunity to open a dialogue with Google Fiber and the city of Austin about bringing broadband connections into the homes of public housing residents. Internet access and digital literacy "have become a necessity to function and compete in today's market," says Blanco, who argues that digital inclusion is critical to supporting individuals' journey to self-sufficiency.<sup>11</sup> Ultimately, the partnership with Google Fiber will offer HACA residents free gigabit-speed Internet connections, but until the fiber-optic cables are installed, the city's many Internet service providers offer low-cost connections to these households.

## Digital Literacy

In addition to Internet access, Unlocking the Connection provides digital literacy training to HACA households. In designing the training classes, the program benefited from the support and expertise of Austin's vibrant technology community, which includes companies such as cloud computing firm Rackspace;



The digital literacy training that Unlocking the Connection's partner organizations provide is meant, in part, to prepare HACA residents for local jobs.

Unlocking the Connection

strategic planning and support from IBM, which provided consultants at no cost; and Dropbox, which developed a curriculum called LifeHacks that provides smartphones prepopulated with apps used to pay utility bills, connect to public schools' web portals (to access data on children's homework and grades), and research employment opportunities.<sup>12</sup>

Unlocking the Connection partners with organizations such as the United Way and the Boys and Girls Club to deliver the digital literacy classes. The courses range from 32 to 60 class hours, and residents who complete 80 percent of the classes in their course earn a certificate redeemable for a refurbished computer or tablet at no cost. Each family can earn up to two devices per household each year, although families with more than three children can earn an additional device. The organization then schedules a "computer deployment," which includes computer installation and a comprehensive orientation, so that residents can confidently apply their digital literacy to their new computer.<sup>13</sup>

In addition to the support that Unlocking the Connection has had from the nonprofit and private sectors, the city of Austin has also backed the program's

development. The city's Grant for Technology Opportunities Program, which provides matching grants to organizations that work toward digital inclusion, funds Unlocking the Connection's Digital Ambassadors and Lab Apprentices programs. These programs pay public housing residents to teach other HACA tenants how to use digital tools, from computers to programmable thermostats.<sup>14</sup>

Since its November 2014 launch, the program has been rolled out to six HACA properties, five of which are in South Austin, the area of the city with the lowest rates of home Internet access. Some 580 households have completed digital literacy training; about 500 have already earned a device, with 150 more households slated to earn a device this fall. Google Fiber is now installed and available to residents in four HACA properties, and another property offers free 100 Mbps connections through a contract with Austin-based nonprofit USFon. In all, 12 of HACA's 18 developments will have free gigabit-speed connections, and the remaining 6 will have free 5 Mbps connections.<sup>15</sup> The program has been recognized with a 2015 Digital Inclusion Leadership Award by the National League of Cities and Next Century Cities in the Most Promising New Plan or Program category.<sup>16</sup>



## Increased Opportunities

About 40 percent of Austin's economy is based in digital technology, a sector that includes software and semiconductor companies as well as the film industry, which relies on digital tools. The local workforce, however, is largely unprepared for these jobs. Recent estimates put the number of unfilled technology jobs in the city at 60,000. Catherine Crago, head of strategic initiatives and resource development for HACA and Austin Pathways, points out that Unlocking the Connection staff are "very attuned" to the fact that companies throughout the city need more technically skilled workers and that they "need to look more in our backyard to find them."<sup>17</sup> To some degree, the program is preparing HACA residents for these jobs; three tenants are now working in information technology fields in roles that, according to Crago, were "completely inaccessible to them" before their training.<sup>18</sup>

Residents' children are also benefiting from the program. Many can now do homework at home, says Crago, because

of the devices their families have earned and the Internet connectivity they have at home. Moreover, the computers are preloaded with educational content, including textbooks, typing tutors, STEM educational games, and MedlinePlus in Spanish and English, so that even without Internet access, students can use the devices for homework and learning. Crago also points to the increased quality of life made possible through the computers, Internet connectivity, and digital training, which residents draw on to connect with loved ones. The federally supported Lifeline, which offers low-cost landline or cell phone service, provides for a finite number of minutes; once those are reached, service is cut off. In contrast, Unlocking the Connection surveys show that participants consider the Internet to be a much more consistent way to connect with friends and relatives.<sup>19</sup>

## Learning Along the Way

With a budget of about \$40,000 to put toward devices, Unlocking the Connection staff knew they would have to find other sources for supplying residents with

computers. Crago notes that although donations of older computers were an option, many institutions destroy these computers' hard drives when they get rid of them to comply with privacy requirements. Destroying hard drives may be an efficient, low-cost way to ensure that a hard drive is fully "scrubbed" of personal information, but doing so renders the computers useless.<sup>20</sup>

Austin Community College (ACC), which refreshes its computer labs biannually, donated 600 desktops, keyboards, and mice to Unlocking the Connection in 2015. Rather than destroy the hard drives, Unlocking the Connection staff devised a way to wipe the drives in accord with strict privacy standards, using a CD with free software and a USB stick. "We can refurbish as many at a time as we have USB sticks," says Crago, stressing that this easy, low-budget process is not very time intensive. HACA refurbishes the computers and installs the Linux operating system and 32 gigabytes of educational content on each.<sup>21</sup>



Kansas City Public Schools

Connecting for Good is piloting a new program that examines whether providing parents with digital literacy training enables them to be more involved with their children's schooling.



Residents inevitably experience technical problems with their devices, but providing technical support can tax a housing agency's resources, says Blanco. The program's partnership with ACC has tackled this challenge as well. The college created a new internship focused on providing technical support for HACA residents. In addition to troubleshooting technical issues and meeting a need that HACA could not adequately address, the interns serve as role models for the residents, particularly youth, "who may have never even imagined that this is a job they can pursue," says Blanco. "It opens up a whole new world of possibilities [for them]."<sup>22</sup>

Reaching large numbers of residents at each property is also a challenge. The first wave of participants often seeks out the program, says Crago, but the second and third waves of potential participants are harder to engage. Some of Unlocking the Connection's partner organizations attempt to do so by going door to door, but families' often-hectic schedules, among other factors, can make such canvassing difficult. About 25 percent of parents, for example, are not home when the organizations do this face-to-face recruitment. Moreover, recruiting residents is not a one-size-fits-all task. "Every property, every neighborhood, every cul-de-sac has a slightly different culture and feel," says Crago. As a result, at each property, service providers must develop different strategies for recruiting and retaining participants, for finding out where the "opinion leaders" live, and for earning potential participants' trust. This tailored approach makes the difference between programming that succeeds and programming that fails to attract tenants.<sup>23</sup>

Trust between residents and HACA is another barrier that Unlocking the Connection has overcome. Residents express concerns about the degree to which HACA can and will monitor what they do on their computers. Although the organization does not monitor residents' Internet use, Crago says that concerns about whether Internet use is

related to the tenants' lease agreement are among the most frequent questions that program staff receive.<sup>24</sup>

The age of HACA's buildings has proved challenging because installing Google Fiber requires penetrating building walls, some of which were constructed when asbestos was used in building materials. Consequently, HACA has had to perform asbestos abatement in some units to ensure installation crews' safety. HACA is also rehabilitating its buildings through HUD's Rental Assistance Demonstration program, which addresses asbestos abatement. As a result, the installation of Google Fiber has taken longer than anticipated.<sup>25</sup> Google's work to install Google Fiber throughout the city has also been a time- and labor-intensive process. The construction difficulties that Google encounters — such as navigating around and sometimes puncturing sewer and water pipes — inevitably slow the rollout of Google Fiber for Unlocking the Connection.<sup>26</sup>

## Evaluation and Mentoring

To assess the program's efficacy, Unlocking the Connection has partnered with the Moody College of Communication at the University of Texas at Austin. Researchers are measuring broadband usage and computer literacy penetration as well as how residents use digital tools — whether to do their work, improve their quality of life, or connect with social services. The evaluation also examines the role that social learning plays in finding out about and adopting different apps and technologies.<sup>27</sup>

In addition to this formal evaluation, the program also communicates regularly with residents through focus groups and other informal opportunities for feedback. Blanco and Crago both point to the necessity of creating curricula and programs that are based around residents' interests and needs.<sup>28</sup> "So many times we create a program for the benefit of the families we serve, but we don't always get the input from the residents," says Blanco. She stresses that this input is key to Unlocking

the Connection's success, from creating meaningful curricula to inspiring participation.<sup>29</sup>

As a mentor city for the national ConnectHome initiative (see "Community Development and the Digital Divide," p. 1), a role it assumed in November 2015, Austin has prioritized sharing both implementation challenges and best practices with other cities. Unlocking the Connection has also shared what it has learned about the nuts and bolts of cable agreements and how to take on new digital literacy providers. Other initiatives have also benefited from the program's cost- and time-effective method of refurbishing computers. Crago regularly fields questions from the 28 ConnectHome communities about how to proceed with their digital inclusion efforts.<sup>30</sup>

## Connecting for Good in Kansas City

In 2012, Kansas City, Missouri, became the country's first city to receive Google Fiber. Yet a quarter of the metropolitan area's 2 million residents lack access to a broadband connection at home, including more than two-thirds (70%) of the 15,000 students in Kansas City's public schools.<sup>31</sup> Connecting for Good addresses its core mission of digital inclusion by offering education and training in digital tools; selling refurbished, low-cost computers; and providing free or low-cost broadband connections to low-income families and nonprofits. In the areas where the organization focuses its work — north-east Wyandotte County in Kansas and the communities east of Troost Avenue in Kansas City, Missouri — up to 80 percent of residents do not have computers or broadband access at home.<sup>32</sup>

Digital education and training are central to the organization's mission, which it realizes through free classes in technology, the Internet, and computers. Its curricula fit into three main categories. The Connected Life curriculum encompasses digital life skills such as using the web to learn

about transportation options; housing options, including resources to help older adults age in place; and financial literacy. The Connected Life curriculum also trains participants to use online public and social services as well as broadband and computer technologies that foster social connections. Connected Education programming focuses on teaching parents how to engage with their children's education digitally. Courses focus on how to use online school portals that provide information about attendance, grades, and homework completion. This branch of programming also teaches parents how to talk with children about appropriate online content and how to obtain a library card. The Connected Careers program pairs coursework in digital literacy with the opportunity to earn certifications that promote career advancement. For example, participants can take exams that require a computer and a proctor, including the SAT, ACT, and General Education Development exams, in the same place where they complete their digital training.<sup>33</sup>

Connecting for Good also presently offers certification in Microsoft Office and Cisco basic networking as part of its Connected Careers coursework. In February 2016, the organization began adding microcourses that are only a few hours long, including introductory coursework in Microsoft Excel and Microsoft Word, computer maintenance, keyboarding, and financial literacy. Paired with the hands-on training in digital tools, these certifications are on-ramps to workforce readiness, says Tom Esselman, Connecting for Good's chief executive officer. Participants emerge from the Connected Careers coursework with the technological skills and qualifications needed to obtain entry-level jobs.<sup>34</sup>

In addition to providing education and training, the organization sells refurbished computers to low-income families. This work is also important for sustaining itself; about 20 percent of the organization's \$390,000 operating budget comes

from selling the donated computers and printers that it refurbishes. The rest of its budget comes from providing low-cost technical support to local nonprofits and from foundations, corporate grants, and individual donors.<sup>35</sup>

Connecting for Good also facilitates free and low-cost broadband access throughout the city through more than 50 computer labs, which are available in churches and other organizations as well as in public housing communities. Some of these labs consist of only a handful of computers, whereas others have several hundred.<sup>36</sup> In 2012, the organization also built a wireless mesh network — an inexpensive way to provide Internet connectivity to an entire neighborhood using a system of wireless access points or nodes — to provide free Wi-Fi to 500 low-income households at 3 public housing properties.<sup>37</sup> Currently, the organization also provides low-income households with unlimited 4G Internet access at 5 to 8 Mbps for \$10 per month.<sup>38</sup> Soon, however, residents in the 2,057 apartments managed by the Kansas City, Kansas Housing Authority and in the 1,900 units owned and operated by the Housing Authority of Kansas City, Missouri, will be able to connect to the Internet even faster.<sup>39</sup> In February 2016, West Bluff Townhomes, a public housing development in Kansas City, Missouri, became the first public housing development to receive Google Fiber's free gigabit-speed service, which has since expanded to five additional public housing properties. Google Fiber plans to roll out this service at no cost to the rest of the city's public housing residents. Connecting for Good, in turn, is providing these public housing residents with education and training in Internet use.<sup>40</sup>

As in Austin, building trust within the communities that are receiving Internet connectivity is an issue. Even though the new Google Fiber connections are free for public housing tenants, staff from Connecting for Good need to persuade residents to sign up and allay residents'

fears that they are going to be spied on or viewed as "lab rats," says Esselman.<sup>41</sup>

## Changing Lives

Since its inception in 2011, Connecting for Good has sold more than 3,000 refurbished, low-cost computers to low-income families. Desktop computers (which include the monitor, keyboard, and mouse) sell for as little as \$50, and laptops sell for as little as \$100. Attendance in the classes has risen sharply; in 2014 and 2015, 3,900 people took part in the organization's classes, and more than 2,900 people took a class during the first half of 2016 alone. Esselman attributes this rise in attendance in part to the increased number of courses that Connecting for Good provides, including the microclasses. Although Esselman cautions that the number of people the organization serves may vary, he estimates that through its wireless mesh and computer labs, it provides Internet connectivity to approximately 8,000 people.<sup>42</sup>

Together, education, devices, and broadband connectivity have made meaningful improvements in the lives of Kansas City residents. As an example, Esselman points to training in how to navigate the city's website to complete tasks such as paying a parking ticket. The ability to pay these tickets online is transformative for people who might otherwise ignore the tickets out of fear that they would be arrested if they paid the ticket in person. Because unpaid tickets can accumulate greater fines and even lead to an arrest warrant, knowing that the city's online portal exists, understanding how it works, and possessing the computer access and broadband connectivity to use it can change people's lives, Esselman says.

Although the prevailing assumption is that technology makes people more isolated, Esselman has observed the opposite effect. "Often, you think, 'Why would I care about people getting online to play video games and be on Facebook all the time,'" says Esselman. "What is overlooked in those comments [is] the way social connections through



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Students in the TGH CHA School program open new Chromebooks on the last day of their classes at East Lake Elementary.

the Internet help combat isolation,” particularly among older adults.

Connecting for Good is also piloting a program at three schools to examine whether educating parents in digital literacy helps them become more involved in their children’s schooling. Participants in the pilot program agree to have a teacher or other school staff member sign off on their digital education course after they complete it. The program is evaluating whether a correlation exists between student engagement at school and parental learning in the education program. Although the data will not be available until late 2017, Esselman expects to see a positive correlation between the two. When parents “don’t have to wonder about kids’ attendance, the teachers’ names, whether the kids are completing their homework, and what their grades are,” they can “more creatively and genuinely” engage with their children’s learning.<sup>43</sup>

## Tech Goes Home in Chattanooga

Although Chattanooga, Tennessee, is home to “the Gig,” a publicly owned fiber-optic network that launched in

2010 and is one of the country’s fastest, only 7.5 percent of the city’s Internet subscribers had signed up for it in 2013. Fewer than one-third of residents in the city’s urban core have Internet access at home, even at the most basic speeds.<sup>44</sup> The city’s uneven rates of home broadband connectivity make completing homework difficult for students, even if they have a computer at home. Many adults in this city of 177,000 also lack the digital skills needed for jobs in data entry or skilled manufacturing.<sup>45</sup> As a result, as in Austin, people often are recruited from other cities to fill those jobs. Digital literacy skills among some adults are so underdeveloped that they cannot fill out online job applications for non-technical jobs at places like Walgreens, says Kelly McCarthy, program director of Tech Goes Home Chattanooga (TGH CHA).<sup>46</sup>

Modeled on Tech Goes Home, a national program launched in Boston in 1999 that has trained more than 20,000 low-income people, TGH CHA is run by the Enterprise Center, a public-private partnership whose mandate

includes promoting digital inclusion as a way to improve the city.<sup>47</sup> The city of Chattanooga and Hamilton County provide about 80 percent of the organization’s \$350,000 annual budget, with the remainder coming from foundations and individual donors.<sup>48</sup>

To address the digital divide in Chattanooga, TGH CHA provides four types of programming, each targeted to different groups: TGH CHA School, focused on school-aged children; TGH CHA Community, focused on adults; and TGH CHA Early Childhood, focused on preschool-aged children and their families. The fourth focus area, programming targeted to local businesses, will roll out in January 2017.<sup>49</sup> And although technological challenges manifest differently in each of these communities, TGH CHA is focused on achieving similar goals for all its participants: “digital literacy and education; access to devices; and Internet connectivity,” says McCarthy.<sup>50</sup>

The group partners with organizations — a total of 62 as of fall 2016 — to offer courses at sites throughout Hamilton



County, including elementary, middle, and high schools; nonprofits; libraries; youth and family development centers; and churches. Each of the three types of training focuses on the aspects of digital literacy most relevant to participants. For instance, TGH CHA Community provides 15 hours of tutorials geared toward tasks such as finding a job online, writing a résumé, and using the city's online resources. TGH CHA School offers digital training to families with children attending Hamilton County public schools, helping them access their children's grades and attendance records and find age-appropriate learning resources. TGH CHA Early Childhood works with parents and preschoolers to prepare children for kindergarten through age-appropriate apps and videos.<sup>51</sup>

Once they complete training in any of these three areas, participants can buy a new Chromebook for \$50 and are offered opportunities to sign up for a low-cost home Internet connection. Chattanooga has many low-cost Internet options, due in part to competition among Internet service providers, says McCarthy. Among these services is the city's NetBridge Student Discount Program, which provides access to the Gig for \$26.99 a month — half the regular

cost — to the 20,000 households with students in Hamilton County public schools who receive free or reduced meals.<sup>52</sup> NetBridge is not the lowest-cost connection available; other private companies also offer low-cost connections, such as Comcast's 10 Mbps connection for \$9.95 per month, available to households with a Hamilton County public school student who receives free or reduced school meals.

## A Pilot Program and Beyond

TGH CHA started as a six-month pilot program that ran from January to June 2015 at three schools, a library, a youth and family development center, and a church. Seventy-two people between 4 and 84 years old, from 49 households, completed digital literacy training during that time. Of these, 28 completed the TGH CHA Community program; 40 completed TGH CHA School; and 4 completed TGH CHA Early Childhood.<sup>53</sup> Among the pilot participants, 90 percent had incomes under \$30,000 a year; 68 percent were unemployed, and 17 percent had part-time employment. Three-quarters of participants were women, and more than half (52.8%) were African American.<sup>54</sup> At the pilot's completion, 49 Chromebooks

and iPad minis were distributed, and the percentage of participants with home Internet connections rose from 61 percent to 68 percent, with another 12 percent of participants reporting that they intended to obtain connections.<sup>55</sup>

In all, 1,155 people aged 3 to 93 from 794 households have participated in TGH CHA since its launch in January 2015. Demographically, the participants resemble the cohort from the pilot: nearly three-quarters are African American or Latino; more than one-third (34%) are unemployed; and just over three-quarters (76%) have annual incomes below \$30,000. The organization has distributed 789 new Chromebooks and iPad minis and has helped nearly 150 households sign up for low-cost Internet connections. The organization aims to reach at least 1,247 households by the end of 2016, a goal that McCarthy expects to meet considering that TGH CHA is currently offering more than 70 courses at nearly 50 locations.<sup>56</sup>

Data management is key to the program. Participants are surveyed at their first and last classes about their computer skills, with the average self-assessed computer skill level rising from 4.3 to 7.4 (on a scale of 1 to 10) by the end of the course.<sup>57</sup> This metric reflects participants' increased confidence and comfort with technology, which research shows are important to digital facility.<sup>58</sup> The program also tracks changes in Internet connectivity at home. After the classes, the number of participants who obtain internet connections, whether broadband or hotspot/cellular, increases by 20 to 25 percent, says McCarthy. And six months after classes end, nearly three-quarters of participants report that they are continuing their digital literacy training, both formally and informally.<sup>59</sup>

## Addressing Challenges

One challenge that TGH CHA has faced is reaching participants in the more rural parts of Hamilton County. Although the Gig and other low-cost Internet service providers offer broadband Internet access throughout the county,



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A TGH CHA Community class for seniors at Olivet Baptist Church.



says McCarthy, residents in rural areas, particularly those who lack reliable transportation, face challenges simply getting to TGH CHA's class sites, which are clustered in a few central locations. Some of the partner organizations that teach TGH CHA's classes have started distributing bus passes to participants to make commuting to class possible. Encouraging participants to attend classes can also be difficult, so other sites — both rural and urban — have held raffles for a \$40 bag of groceries to increase attendance.<sup>60</sup>

The organization also adjusted its courses based on results from the pilot program. For example, during the pilot, training sessions were completed in labs equipped with computers that run Windows operating systems. But at the program's end, participants were given the opportunity to purchase a Chromebook. The transition from a computer with a Windows operating system to a Chromebook was jarring for some participants, says McCarthy. As a result, she says, TGH CHA now requires all sites to use Chromebooks so that people “learn on the device they'll be taking home with them.” At sites that don't have Chromebooks on hand for class use, participants must pay the \$50 fee up front. This policy creates a greater incentive to finish the class, says McCarthy, because otherwise participants do not get the Chromebook or a refund.<sup>61</sup>

Despite the many options for home broadband in Hamilton County, ensuring that participants obtain and maintain these connections has not been easy. McCarthy notes that the paperwork needed to qualify for the discounted NetBridge plan has been a barrier for some. In response, TGH CHA initiated connectivity drives at six schools.<sup>62</sup> On nights when parents meet their children's teachers, three Internet service providers, including the municipal provider, EPB, are on hand to help parents determine the plan that best suits their needs. Hosting the vendors at the schools also enables families to quickly verify their eligibility for the



A volunteer works with a TGH CHA School program participant at Red Bank High School.

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free or reduced price school lunch program and immediately provide vendors with the documentation needed to continue the sign-up process; one vendor even schedules installation during these drives. In addition to these school-based drives, TGH CHA is also piloting a new early childhood model in which participants receive two years of free Internet connectivity in addition to an LG Tablet for the same \$50 copay. The importance of such early childhood education, McCarthy says, is evident in studies demonstrating that when early educational experiences extend beyond the preschool classroom and into the home, children are better prepared to succeed in school.<sup>63</sup> Yet “many parents in the demographic we serve may not know how to help prepare their children for kindergarten and beyond,” she says. The goal of TGH CHA, McCarthy says, is to teach parents some of the basic principles of early childhood education, provide them with tools to use at home, and have parents practice using the tools with their child during the TGH CHA course.<sup>64</sup>

TGH CHA's early childhood curriculum requires staff trained in early childhood education to teach parents how to use the devices as educational tools for their children rather than as screens for passive viewing. However, Hamilton County already faces a shortage of day-care and Head Start centers, and staff at existing centers are already stretched thin, making the addition of another program challenging. Moreover, McCarthy points out that because TGH CHA early childhood participants have at least one young child, the chaos and unpredictability inherent to parenting young children can create obstacles that make committing to the classes difficult for families.<sup>65</sup>

McCarthy says that she has learned the importance of coordinating with the trainers teaching the digital literacy courses as early in the process as possible. Often, institutional leaders, such as principals or assistant principals, will express interest in having TGH CHA at their school, but “the volunteers and trainers have to feel they have some ownership” in the program and should be “brought to the table” early on.

McCarthy also points to the flexibility of the Tech Goes Home curriculum as a major programmatic strength. “The focus is not on teaching a specific set of skills, but more about helping participants understand online tools and the relevance of technology in their lives,” she says. Although each of the programs incorporates some of the same elements, the Tech Goes Home model — an open source initiative — is designed to be flexible enough to accommodate communities’ individual needs.<sup>66</sup>

## Conclusion

Unlocking the Connection, Connecting for Good, and TGH CHA rely on public, private, and nonprofit organizations in their pursuit of digital inclusion. The complexity of the digital divide demands this collaborative approach. To help low-income families obtain home broadband connections, the programs depend on networks built, run, and maintained by companies with technological and infrastructural expertise. To provide low-income families with free or affordable computers, the programs rely on other organizations to donate devices for free or at extremely low cost. And even though the programs provide the curricula, to deliver a robust array of digital education classes, the programs depend on partner organizations and anchor institutions to deliver — and sometimes host — the digital coursework.

Although the programs all address three elements of digital inclusion, each stresses the importance of education and training. TGH CHA’s McCarthy observes the need for this education despite high rates of smartphone ownership and the connections to the Internet that these phones afford. “We see that time and again, participants can have a smartphone and can use Facebook and text message all day long, but when they go to [online] job applications,” they do not know how to fill them out, she says.<sup>67</sup> Both Esselman and Crago point out that computers and broadband connections have little use to those who lack the training to use them to improve their lives. Esselman

notes that digital training is so fundamental to quality of life that we ought to talk about education as infrastructure — in other words, providing digital training is as important to addressing the digital divide as is laying miles of fiber-optic cable.<sup>68</sup> It is the knowledge of how to use these tools, he says, that changes people’s lives. **EM**

- <sup>1</sup> Susannah Fox and Lee Rainie. 2014. “The Web at 25 in the U.S. Pew Research Center,” 4.
- <sup>2</sup> Lee Rainie. 2016. “Digital Divides 2016: Internet Governance Forum,” Pew Research Center Presentation.
- <sup>3</sup> Sharon Strover, Joe Straubhaar, Karen Gustafson, Wenhong Chen, Alexi Schrubbe, and Paul Popiel. 2015. “Digital Inclusion in Austin: results from a Citywide Survey,” 2-1.
- <sup>4</sup> Ibid.
- <sup>5</sup> Strover et al., 2-2.
- <sup>6</sup> Ibid.
- <sup>7</sup> Housing Authority of the City of Austin. 2014. “Austin Pathways’ Unlocking the Connection Pre-Submittal Conference,” 4, 13.
- <sup>8</sup> Mindy Ault. 2015. “Unlocking the Connection in Austin, Texas,” 3.
- <sup>9</sup> Unlocking the Connection. 2014. “HUD Secretary Castro joins HACA and Google Fiber in Launching Nation’s First Digital Inclusion Program for Austin Public Housing Residents,” 20 November press release; Austin Pathways. “Unlocking the Connection” ([austinpipelines.org/unlocking-the-connection/](http://austinpipelines.org/unlocking-the-connection/)). Accessed 16 November 2016.
- <sup>10</sup> City of Austin. 2013. “Google Fiber Community Connections Program Frequently Asked Questions (FAQ’s);” Ault, 1.
- <sup>11</sup> Interview with Sylvia Blanco, 19 September 2016.
- <sup>12</sup> Interview with Catherine Crago, 12 September 2016.
- <sup>13</sup> Ibid.
- <sup>14</sup> Ibid.
- <sup>15</sup> Email Correspondence with Sylvia Blanco and Catherine Crago, 17 October 2016.
- <sup>16</sup> Next Century Cities. “Digital Leadership Inclusion Awards” ([nextcenturycities.org/digital-inclusion-awards/](http://nextcenturycities.org/digital-inclusion-awards/)). Accessed 16 November 2016.
- <sup>17</sup> Interview with Catherine Crago.
- <sup>18</sup> Ibid.
- <sup>19</sup> Ibid.
- <sup>20</sup> Ibid.
- <sup>21</sup> Ibid.
- <sup>22</sup> Interview with Sylvia Blanco.
- <sup>23</sup> Interview with Catherine Crago.
- <sup>24</sup> Ibid.
- <sup>25</sup> Interview with Sylvia Blanco.
- <sup>26</sup> Ibid.
- <sup>27</sup> Interview with Catherine Crago.
- <sup>28</sup> Interview with Catherine Crago; Interview with Sylvia Blanco.
- <sup>29</sup> Interview with Sylvia Blanco.
- <sup>30</sup> Interview with Catherine Crago.
- <sup>31</sup> Connecting for Good. “About Us” ([www.connectingforgood.org/about/](http://www.connectingforgood.org/about/)). Accessed 16 November 2016; Google and Mayor’s Bi-State Innovation Team. 2010. “The State of Connectivity in KC,” 8.
- <sup>32</sup> Connecting for Good. “About Us.”
- <sup>33</sup> Interview with Tom Esselman, 22 September 2016.
- <sup>34</sup> Ibid.

- <sup>35</sup> Email correspondence with Tom Esselman, 13 October 2016.
- <sup>36</sup> Interview with Tom Esselman; Email correspondence with Tom Esselman.
- <sup>37</sup> Connecting for Good. “Understanding Mesh Networks (Video)” ([www.connectingforgood.org/understanding-mesh-networks-video/](http://www.connectingforgood.org/understanding-mesh-networks-video/)). Accessed 16 November 2016.
- <sup>38</sup> Connecting for Good. “Internet Access for Low Income Families” ([www.connectingforgood.org/internet-access-low-income-families/](http://www.connectingforgood.org/internet-access-low-income-families/)). Accessed 16 November 2016.
- <sup>39</sup> Kansas City, Kansas Housing Authority. “Public Housing Program” ([www.kckha.org/general-info.html](http://www.kckha.org/general-info.html)). Accessed 16 November 2016; Housing Authority of Kansas City, Missouri. “Public Housing Overview” ([www.hakc.org/affordable\\_housing/public\\_housing\\_overview.aspx](http://www.hakc.org/affordable_housing/public_housing_overview.aspx)). Accessed 16 November 2016.
- <sup>40</sup> U.S. Department of Housing and Urban Development. 2016. “HUD Secretary Castro and Google Fiber Announce First Public Housing Units to be Connected to Ultra High Speed Internet through ConnectHome Initiative,” press release.
- <sup>41</sup> Interview with Tom Esselman.
- <sup>42</sup> Ibid.
- <sup>43</sup> Interview with Tom Esselman.
- <sup>44</sup> Edward Wyatt. 2013. “Fast Internet is Chattanooga’s New Locomotive,” *The New York Times*, 3 February; EPB. “Our History” ([epb.com/content/our-history](http://epb.com/content/our-history)). Accessed 16 November 2016.
- <sup>45</sup> U.S. Census Bureau. 2015. “QuickFacts: Chattanooga city, Tennessee” ([www.census.gov/quickfacts/table/PST045215/4714000.00](http://www.census.gov/quickfacts/table/PST045215/4714000.00)). Accessed 16 November 2016.
- <sup>46</sup> Interview with Kelly McCarthy, 13 September 2016.
- <sup>47</sup> Tech Goes Home. “Impact & Results” ([www.techgoeshome.org/impact](http://www.techgoeshome.org/impact)). Accessed 16 November 2016.
- <sup>48</sup> Email correspondence with Kelly McCarthy, 11 October 2016.
- <sup>49</sup> Tech Goes Home CHA. “About Tech Goes Home” ([techgoeshomecha.org/about-tech-goes-home/](http://techgoeshomecha.org/about-tech-goes-home/)). Accessed 16 November 2016.
- <sup>50</sup> Interview with Kelly McCarthy.
- <sup>51</sup> Ibid.
- <sup>52</sup> EPB. 2015. “Enrollment Underway for EPB Net-Bridge Student Discount Program” ([epb.com/news/enrollment-underway-epb-netbridge-student-discount-program](http://epb.com/news/enrollment-underway-epb-netbridge-student-discount-program)). Accessed 16 November 2016.
- <sup>53</sup> Tech Goes Home CHA. 2015. “Program Report: Pilot – 2016,” 2–3.
- <sup>54</sup> Ibid., 2.
- <sup>55</sup> Ibid.
- <sup>56</sup> Interview with Kelly McCarthy; Email correspondence with Kelly McCarthy, 13 September 2016; Tech Goes Home Chattanooga, Program Report, 5.
- <sup>57</sup> Tech Goes Home Chattanooga, “Student Surveys”; Interview with Kelly McCarthy.
- <sup>58</sup> Matthew S. Eastin and Robert LaRose. 2000. “Internet Self-Efficacy and the Psychology of the Digital Divide,” *Journal of Computer Mediated Communication*, 6:1.
- <sup>59</sup> Interview with Kelly McCarthy.
- <sup>60</sup> Ibid.
- <sup>61</sup> Ibid.
- <sup>62</sup> Ibid.
- <sup>63</sup> See Institute of Medicine. 2000. *From Neurons to Neighborhoods: The Science of Early Childhood Development*, Washington, DC: The National Academies Press.
- <sup>64</sup> Email correspondence with Kelly McCarthy.
- <sup>65</sup> Interview with Kelly McCarthy.
- <sup>66</sup> Ibid.
- <sup>67</sup> Ibid.
- <sup>68</sup> Interview with Tom Esselman.

## Additional Resources

- “What is New in the Digital Divide? Understanding Internet Use by Teenagers from Different Social Backgrounds” (2016), by Marina Micheli examines differences in teenagers’ Internet use according to parents’ socioeconomic status and cultural capital. [www.emeraldinsight.com/doi/abs/10.1108/S2050-206020150000010003](http://www.emeraldinsight.com/doi/abs/10.1108/S2050-206020150000010003).
- “Broadband Internet Access and the Digital Divide: Federal Assistance Programs” (2013), by Lennard G. Kruger and Angele A. Gilroy, reviews federal initiatives aimed at expanding broadband access. [www.fas.org/sgp/crs/misc/RL30719.pdf](http://www.fas.org/sgp/crs/misc/RL30719.pdf).
- The Pew Research Center’s “Internet, Science & Tech” website contains publications, datasets, and other resources on Internet use and the digital divide, including those on digital readiness and the homework gap. [www.pewinternet.org/](http://www.pewinternet.org/).
- “Digital Human Capital: Developing a Framework for Understanding the Economic Impact of Digital Exclusion in Low-Income Communities” (2013), by Amy Bach, Gwen Shaffer, and Todd Wolfson, calls for digital inclusion programs to go beyond connectivity and foster civic engagement and social change. [www.jstor.org/stable/pdf/10.5325/jinfopoli.3.2013.0247.pdf](http://www.jstor.org/stable/pdf/10.5325/jinfopoli.3.2013.0247.pdf).
- “Opportunity for all? Technology and learning in lower-income families” (2016), by Victoria Rideout and Vikki S. Katz, presents findings from a survey of lower-income parents with school-aged children regarding Internet connectivity, usage, and benefits. [www.joanganzcooneycenter.org/wp-content/uploads/2016/01/jgcc\\_opportunityforall.pdf](http://www.joanganzcooneycenter.org/wp-content/uploads/2016/01/jgcc_opportunityforall.pdf).
- “The Digital Divide and Patient Portals: Internet Access Explained Differences in Patient Portal Use for Secure Messaging by Age, Race, and Income” (2016), by Graetz et al., examines the association between patients’ use of online healthcare messaging portals and computer and Internet access. [journals.lww.com/lww-medical-care/toc/2016/08000](http://journals.lww.com/lww-medical-care/toc/2016/08000).
- “Trail-Blazing Digital Inclusion Communities” (2013), by Angela Siefer, describes the evolution of innovative digital inclusion programs in five cities across the nation. [www.webjunction.org/news/webjunction/trailblazing\\_digital\\_inclusion\\_communities.html](http://www.webjunction.org/news/webjunction/trailblazing_digital_inclusion_communities.html).
- “Closing the Digital Divide: Promoting Broadband Adoption Among Underserved Populations” (2012), by Bates et al., examines barriers to broadband adoption and highlights efforts at the federal, state, and local levels to expand broadband adoption. [www.nlc.org/Documents/Find%20City%20Solutions/Research%20Innovation/Infrastructure/Closing\\_Digital\\_Divide\\_Promoting\\_Broadband\\_Adoption\\_Underserved\\_Populations.pdf](http://www.nlc.org/Documents/Find%20City%20Solutions/Research%20Innovation/Infrastructure/Closing_Digital_Divide_Promoting_Broadband_Adoption_Underserved_Populations.pdf).

For additional resources archive, go to [www.huduser.gov/portal/periodicals/em/additional\\_resources\\_2016.html](http://www.huduser.gov/portal/periodicals/em/additional_resources_2016.html).

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