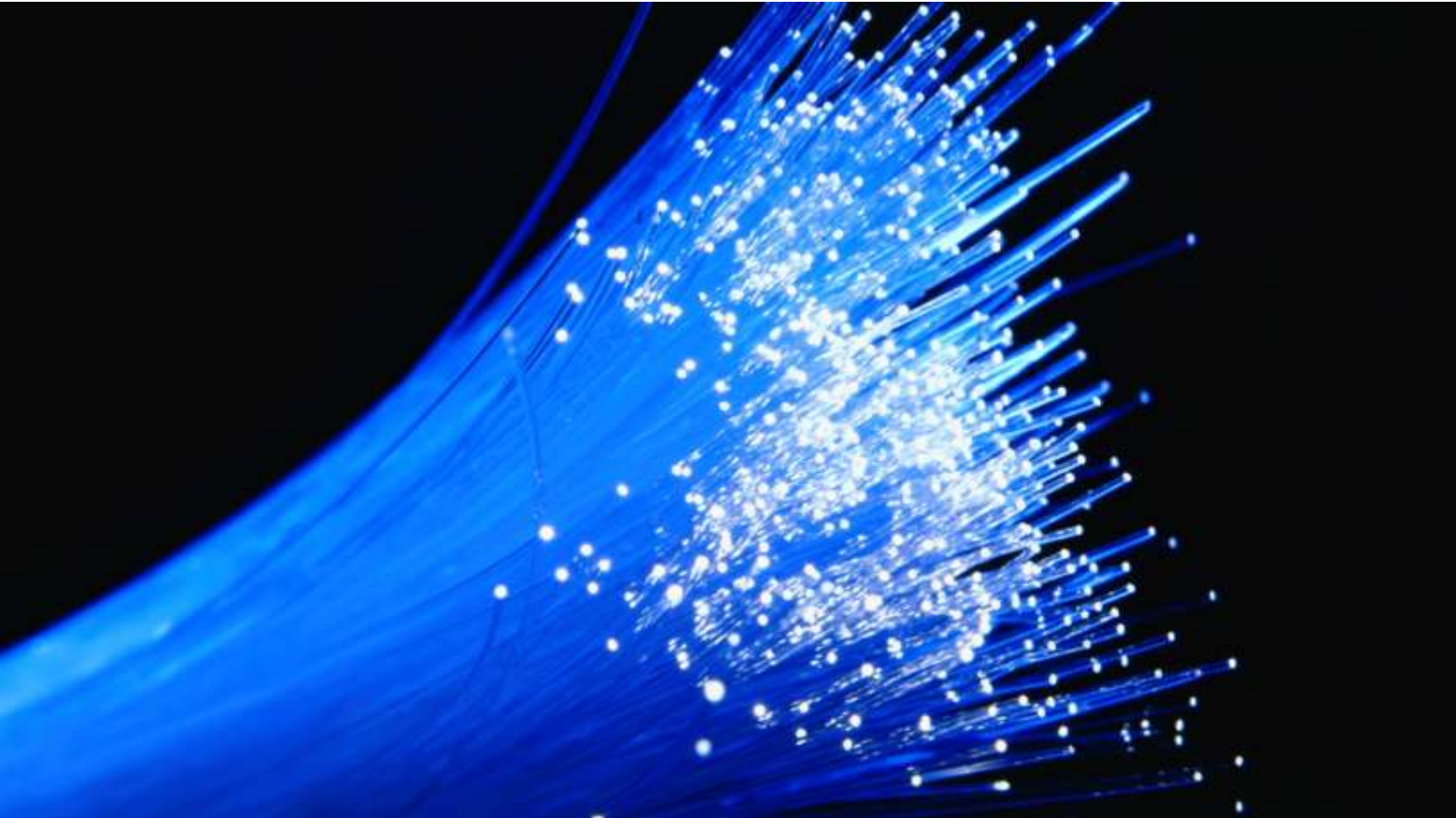# ctc technology & energy

engineering & business consulting

Digital Equity in Cambridge:
Data and Strategic Recommendations

Prepared for the City of Cambridge, MA
March 2021

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1   Study Background and Introduction

In 2015, the Mayor's Blue-Ribbon Commission on Income Insecurity in Cambridge reported that the cost of internet access was a major concern of residents who participated in its focus groups. A year later the City's Broadband Task Force made two basic recommendations: that the City conduct a municipal broadband feasibility study (to expand beyond the capital cost analysis previously conducted); and that the City "directly address digital equity and inclusiveness" by, among other things, conducting targeted outreach to low-income communities, the school system, and Cambridge social service agencies.

Among its observations was this: "Cambridge, with its wealth of resources, can provide a model for how cities should deal with digital inclusiveness."

In response, the City of Cambridge commissioned this study to develop data and to develop strategies. At the highest level, the goal was to develop a full and clear understanding of all problems affecting residents' ability to obtain and effectively use broadband—and to suggest a range of solutions. This study does not presuppose what the problems are or what the solutions should be. This study is about digital inclusiveness, or what the City of Cambridge has called "digital equity."

Digital equity has four elements:

- **Access**: that broadband infrastructure exists, and reliable high-speed broadband plans are available for purchase

- **Affordability:** that broadband service is not only available but can be obtained at reasonable prices by all

- **Devices:** that residents own or have access to well-functioning, up-to-date computers—and have the capacity to maintain and replace these devices if needed.

- **Skills:** that residents have the ability to make full use the often-complex functions and computers and online resources—and thus are able to use these tools to communicate, work, learn, attend medical appointments, and so on—and avoid online harms.

This study, which explores all four aspects, was prepared over the course of late 2019 and 2020 by CTC Technology & Energy, as directed by the City.

To conduct this study, CTC undertook the following activities:

- Analyzed consumer and FCC pricing and availability data, to understand the local broadband market, the presence of competition, and any market changes since the City commissioned its earlier broadband study

- Through a variety of means (surveys, resident interviews, and conversations with local broadband providers) gathered data on the usage of existing low-cost broadband subsidy programs, particularly the $10 Comcast Internet Essentials program

- Conducted a statistically valid mail survey of a sample of the entire City population to understand broadband usage patterns, sentiments, and gaps

- Conducted a statistically valid mail survey of a sample of residents of the Cambridge Housing Authority (CHA) and of subsidized housing for a closer look at lower-income residents and any challenges they face

- Interviewed a range of City stakeholders representing City departments, nonprofits, schools, library, and others (we also have appended the work of the Cambridge Nonprofit Coalition, which separately conducted a survey of local nonprofit staff)

- Interviewed a sampling of Cambridge Housing Authority and subsidized housing residents who volunteered to be interviewed as part of our mail survey, to understand what they pay for services, and what challenges they face

- Conducted in-home internet speed tests of Comcast customers to take hourly measurements over a period of weeks to evaluate service quality and assess potential sources of reported problems, albeit at an anecdotal level

- Interviewed practitioners and experts who have studied or implemented digital equity plans and programs in other cities to glean lessons and suggest strategies that might assist the City and its stakeholders in implementing solutions

- Developed several strategic and programmatic recommendations based on all of the above research and data, informed as well by the examples of models in other cities

In response to some early study findings and challenges presented by the Covid-19 pandemic, the City has already taken certain actions:

- Launched a $50,000 pilot program to assist up to 415 families in obtaining $10 Internet Essentials subscriptions

- Redirected study resources to allow CTC to conduct, in early 2021, preliminary high-level engineering and cost estimation work for high-speed residential broadband service in three CHA developments: Newtowne Court, Washington Elms, and the Manning Apartments

- Engaged in preliminary discussions with Life Science Cares, a nonprofit organization that funds anti-poverty programs and expressed interest in being part of a public-private partnership to address digital inequities

- The Cambridge Public Schools greatly accelerated laptop and hotspot provision efforts, providing all students with laptops and (where needed) hotspots, and the Cambridge Public Library began its first-ever technology lending programs.

- In a parallel effort, the CHA in early February of 2021 issued a request for proposals (RFP) that offered to lease rooftop space at CHA sites and inviting fixed-wireless providers to make proposals so as to provide competitive low-cost services at CHA housing. This could provide a solution to some affordability or access challenges.

The report is organized as follows:

Section 2 abstracts key findings and insights from all the tasks listed above.

Section 3 provides overall strategic recommendations, including discussion of model programs from other cities.

Sections 4 through 10 provide reports from each of the tasks: the broadband market research, Citywide survey, CHA survey, in-home speed test sample, stakeholder interviews, resident interviews, and expert interviews.

We note in particular that the Citywide and Cambridge Housing Authority survey analysis reports, in Sections 5 and 6, contain a wealth of market other data about broadband and computer use by Cambridge residents that may be useful to a wide range of stakeholders.

2   Overview of Study Findings

The following is a summary and overview of primary findings.

2.1   FCC and market data: Comcast remains an effective monopoly in much of the Cambridge fixed internet market but NetBlazr has expanded and a new provider, Starry, recently began competing in the City

Section 4 of this report provides the results of our research on market conditions, the presence of competition, and pricing.

Because the City negotiated buildout requirements in the City's cable franchise agreement with Comcast (and its predecessor owners of the cable system), residential internet service is available everywhere in the City. Services offered by other companies are less uniformly available or, for the most part, do not meet federal criteria for broadband (i.e., at least 25 Mbps download, 3 Mbps upload). The residential market therefore does not have the benefits of widespread high-speed broadband competition, and affordability represents a significant broadband challenge for many members of the Cambridge community, as it does for consumers nationwide. (Our surveys and stakeholder interviews found that low-income consumers often forgo service because of the cost. And as noted in Section 8, where we present the results of interviews with Cambridge Housing Authority residents, some are paying Comcast just $10 monthly for the low-cost Internet Essentials program while others are paying the company as much as $264 monthly for bundled services.)

Verizon provides DSL service in virtually the entire City, but at speeds far below the federal definition of broadband of 25 Mbps download and 3 Mbps upload. Both Verizon and Comcast also provide fiber service in limited areas. While an expansion of Verizon fiber (FiOS) would be welcome, Verizon has given no indication that it will upgrade its infrastructure in Cambridge.

NetBlazr provides an important source of competition—and continues to incrementally expand—in cases where it can offer fixed-wireless service to apartment buildings via line-of-sight connections to rooftop receivers. For example, thanks to a 2015 RFP issued by the Cambridge Housing Authority, NetBlazr now serves two CHA developments, the Millers River Apartments on Lambert Street and the Roosevelt Towers mid-rise on Cambridge Street, providing a viable and lower-cost alternative to Comcast in those locations. Figure 1 shows these sites.

Figure 1: Two Cambridge Housing Authority Sites Are Now Served by NetBlazr in Addition to Comcast

Millers River Apartments, Lambert Street   **Roosevelt Towers Mid-Rise, off Cambridge Street**

However, with respect to the Roosevelt Towers mid-rise, NetBlazr says it has received subscriptions for only "a handful" of customers since it started service in 2016, despite offering a 100Mbps symmetrical service to residents for a discounted price of $20 monthly. With respect to Millers River, NetBlazr says it has no subscriptions because the building is undergoing renovations.

NetBlazr prefers buildings with modern ethernet wiring, with some exceptions. Given that the company's model is building-specific, it may only service certain buildings on a block. Figure 2 shows the areas NetBlazr says it can provide service to apartment buildings or large multi-family buildings if the building owner provides permission to install this equipment.

Figure 2: NetBlazr's Potential Service Area for Multi-Family Buildings
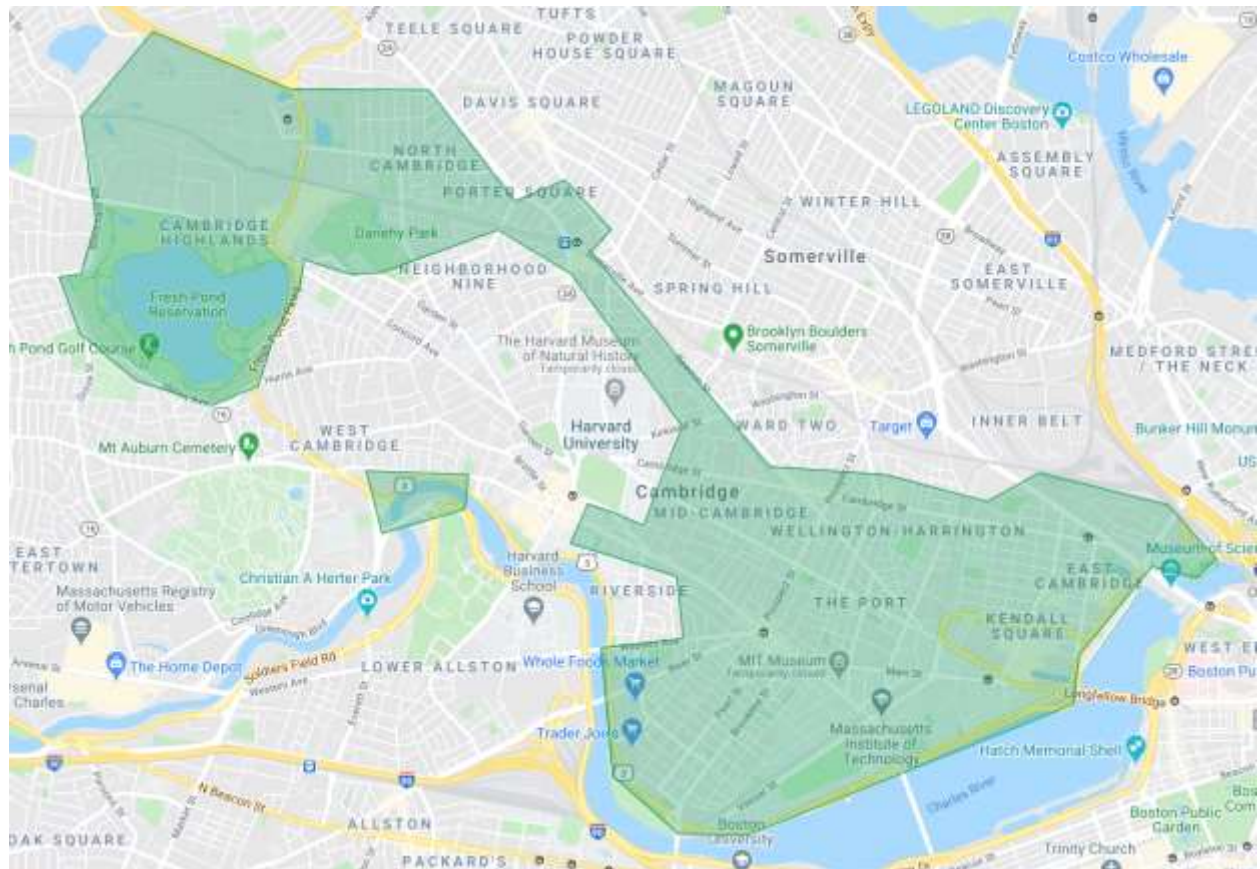
In the five years since the City received its earlier broadband cost study, a fixed-wireless startup company, Starry, has aggressively sought market share in Cambridge. Like NetBlazr, Starry uses in-building wiring once the high-capacity rooftop wireless connection is made. In contrast to NetBlazr, Starry also offers fiber-to-the-premises (FTTP) service in the buildings that host Starry's rooftop base station equipment. This is because at such buildings, Starry pulls fiber into the building to serve the base station and then connects units in that building with fiber. Although Starry did not disclose how many subscriptions it has in Cambridge or which buildings are served over fiber-to-the-premises, CTC was able to determine that the high-rise at 364 Rindge Avenue is one such location. Figure 3 shows this location.

Figure 3: 364 Rindge Avenue is Now Served by Starry in Addition to Comcast

Fixed wireless services will always have a limited reach—the signals are blocked by buildings and even foliage—but both NetBlazr and Starry deliver faster upload speeds than Comcast, have relatively low fixed prices, and offer easy-to-access low-cost programs for eligible residents.

The FCC's Form 477 data summarizes the ISPs' self-reported accounts of where they serve but exaggerates availability because if only one address is served, the whole census block containing that address is marked as having such service. Because Form 477 shows Comcast cable and Verizon DSL providing near-ubiquitous service, it is more revealing to look at where these and other providers say they provide fiber-optic based service. Figure 4 illustrates the census blocks where ISPs have reported to the FCC that they are providing residential fiber service to at least one address. The figure reveals pockets of fiber service from four providers: Comcast, Verizon, Starry, and RCN.

Figure 4: Form 477-Reported Residential Fiber Service Providers
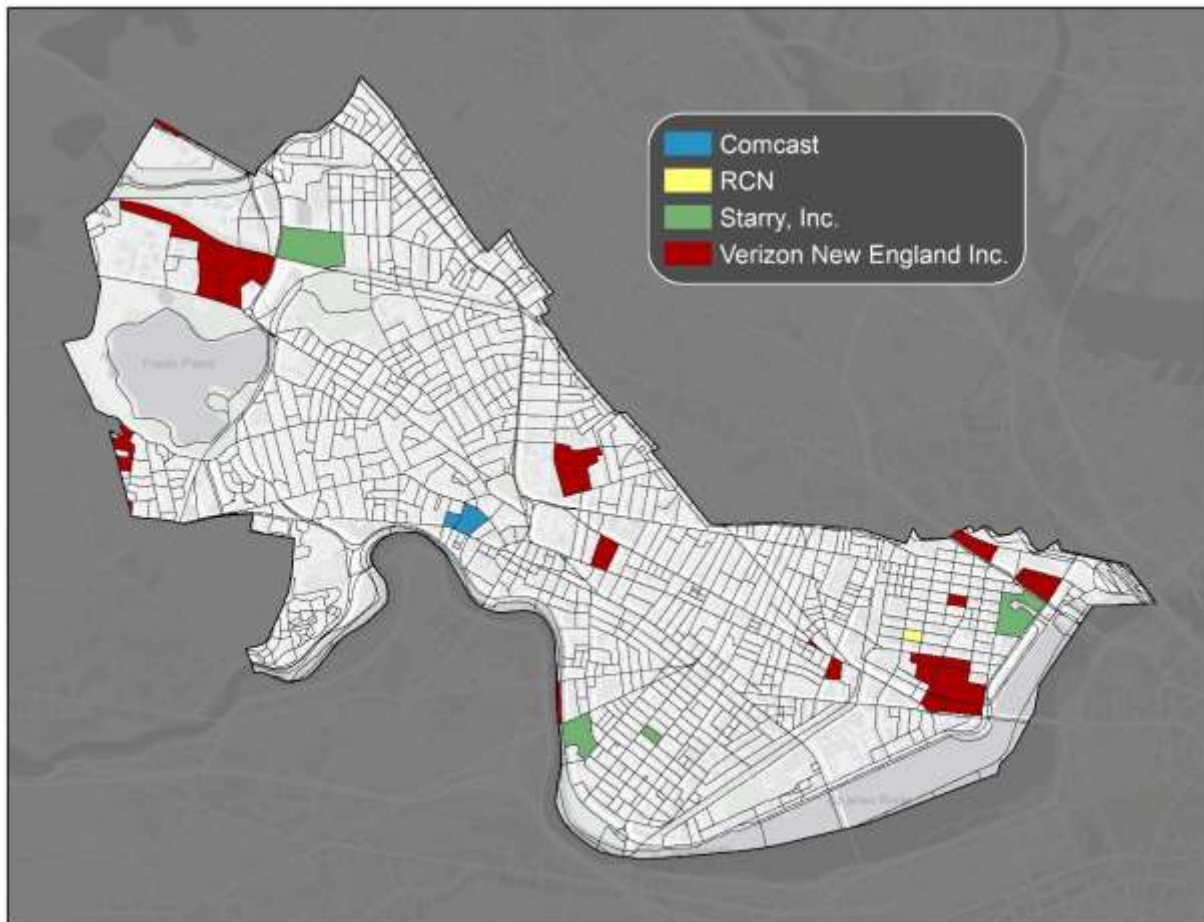
It is reasonable to discount the one square block of fiber service from RCN—a cable company that otherwise does not serve Cambridge. This block consists of a parking lot and the AT&T central office at 149 Rogers Street. CTC's inquiry to RCN was not answered.

The Verizon fiber service is limited, reaching buildings in the Kendall Square and Alewife areas and a few pockets of residential service. Comcast fiber serves a small area between Brattle Street and Mt. Auburn Street west of Harvard Square.

Starry fiber appears in census blocks where the company has provided fiber service to a building, which means that the given building has a base station—a transmitter—on the rooftop. As noted above, the Rindge Towers are one such location. Another appears to be a site on or near the Cambridgeside Galleria, a third appears to be on or near the Cambridge Community Towers on Memorial Drive, a fourth is located on a block in Cambridgeport. Starry claims it can potentially serve up to half of the City's premises, concentrated in apartment buildings.

Our analysis was limited to these four companies; in the case of Verizon, given the very limited availability of fiber, we only analyzed DSL. But we note that there are the seeds of competition present in Cambridge today, with new deployments from NetBlazr and Starry. These capable fixed-wireless providers are competing strongly where they can do so from a technical perspective, and Starry is also doing so with FTTP service in some locations. While these providers are only available on a building-by-building basis, they—unlike Comcast—provide symmetrical service (upload speeds as fast as the download speeds).

Some users rely on mobile plans without also getting a fixed home broadband subscription. Our surveys found that lower-income residents are more likely to rely exclusively on mobile-only subscriptions. This can put these residents at a disadvantage, given that a mobile service is less reliable than fixed residential broadband subscription and that working with documents and spreadsheets is not as easily done on a smartphone as on a larger device. Table 1 provides our findings on this point from the two surveys we conducted in Cambridge.

Table 1: Percent of Cambridge Residents Using a Mobile/Cellular Broadband as Their Only Service

Surveyed Population	Percent who Use Only a Mobile/Broadband Subscription
Sample of all Cambridge Residents	5 percent
Sample of all Cambridge Housing Authority or subsidized housing residents	18 percent

Section 4 contains extensive data about the prices set by the four companies and uses data collected from websites or from company representatives in summer or fall of 2020. (Effective January 2021, Comcast raised its prices by $3/monthly for many of its internet plans.) We reviewed available service plans at 13 addresses chosen at random from each of 13 Cambridge neighborhoods. In practice, this meant we were able to see pricing from Comcast and Verizon DSL, because of the limited availability of NetBlazr and Starry. For those providers, we engaged with company representatives.

Comcast offered numerous and very complex service tiers, often with promotional prices that would rise sharply after 12 or 24 months. Pricing was consistent across the City, but we noted that the speeds for entry-level service, while usually 25 Mbps download, occasionally was presented at a sub-broadband 15 Mbps level; then, on a different day at the same address, were back at again 25 Mbps. (Similarly, speeds for Verizon DSL were inconsistent across the City.)

With Comcast, in all cases, the upload speeds were low: 5 Mbps on the entry-level plans, rising to 10 Mbps with the 300 Mbps download plan. Upload speeds at this level may create challenges

for Cambridge residents who people are working and learning from home and need high-capacity video streams that work consistently.

At the 200 Mbps level—a midrange plan, and the only plan offered by all three companies—the value proposition for NetBlazr and Starry is significantly stronger than that of Comcast. Figure 5 provides this comparison, showing prices in effect in 2020.

Figure 5: Comparison of Prices on 200 Mbps Plans of Comcast, NetBlazr, and Starry

Provider	Advertised Download Speed	Advertised Upload Speed	Monthly Price
Comcast	200 Mbps	5 Mbps	$40 for the first 12 months[1] then $92.95.
NetBlazr	200 Mbps	200 Mbps	$40
Starry	200 Mbps	200 Mbps	$50

Further details on pricing, service plans, and availability for the major fixed broadband providers in Cambridge (Comcast, Verizon DSL, NetBlazr and Starry) are presented in Section 4.

2.2 Comcast's $10 Internet Essentials plan appears significantly underused by potentially eligible residents in Cambridge

The most important reduced-cost service in Cambridge is Comcast's Internet Essentials, which provides service that was recently increased by the company to 50 Mbps download, 5 Mbps upload, for just under $10 a month. Given Comcast's ubiquitous residential service in Cambridge, Internet Essentials is available to all low-income families and in Cambridge who receive any of numerous forms of federal aid, as well as qualifying seniors and veterans.[2]

But the number enrollees to Internet Essentials in Cambridge, while not shared by Comcast, appears to fall significantly short of the potential. The Cambridge Housing Authority manages 4,965 units of housing (where many families may qualify if they receive various forms of federal aid). The Cambridge Public School Department reports that as of October 1, 2020, children living in 2,827 households were enrolled in the Federal School Lunch Program, which means all of their families are eligible for Internet Essentials. Comcast provided CTC with numbers of Internet Essentials connections by year but did not provide a total current number.

Figure 6 presents these numbers together with frames of reference.

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[1] $40 rate ($39.99) reflects a $10 discount for enrolling in automatic payments. Regular rate is $50.
[2] The list of the federal aid programs that confer eligibility to Internet Essentials, as well as other conditions for receiving this service, appears in Section 4.

Figure 6: Numbers of Internet Essentials Connections in Cambridge, with Frames of Reference

Year	Comcast-Reported number of $10 Internet Essentials connections by year in Cambridge	Number of households with children receiving free/reduced school lunch	Number of Cambridge Housing Authority or subsidized housing units in Cambridge
2015	60		
2016	80		
2017	190		
2018	300		
2019	300		
2020	490		
Total enrolled as of Dec. 2020	**Not provided**	**2,827**	**4,965**

Other data point to the same shortfall. Of the 443 residents who responded to the Citywide survey undertaken for this report (see Section 5 for the full report), only two were Internet Essentials customers. And of the CHA residents who responded to the CHA survey for this report, fewer than one in four who were Comcast customers were enrolled in Internet Essentials. Half of CHA Comcast customers who responded to the survey were unaware of the program's existence, though the CHA says it has posted flyers in lobbies and taken other steps to increase awareness. Figure 7 shows data from our CHA survey report (see Section 6 for the full report).

Figure 7: CHA Tenant Responses to Survey Question About Participation in Comcast's $10 Internet Essentials Program
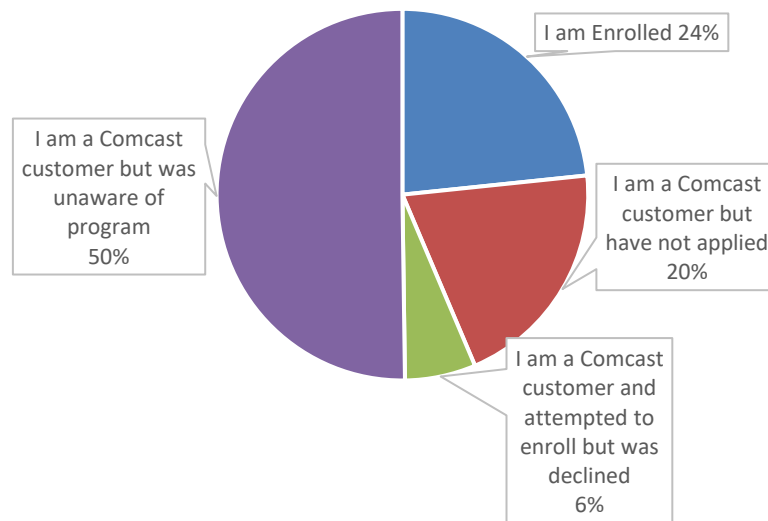
We note that the City of Cambridge has taken action in this area, setting up $50,000 fund to direct-pay up to a potential 415 subscriptions to families identified by the City's Human Services Program. (Starry and NetBlazr also have reduced-cost programs for eligible residents. However, the companies did not share Cambridge-specific data.)

In addition, the federal Lifeline program provides a subsidy of up to $9.25 per month for broadband or voice service (landline or cellular) for qualifying low-income individuals and recipients of other federal assistance such as the Supplemental Nutrition Assistance Program and Medicaid.[3] In 2020, a single-person household with income of $17,226 or less would qualify; a four-person household with income of $35,370 or less would qualify.[4]

But in our Cambridge Housing Authority survey, we found that relatively few Cambridge residents are taking advantage of the Lifeline program—a fact that is consistent with nationwide trends.

Figure 8 depicts this data.

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[3] https://www.lifelinesupport.org/do-i-qualify/ (accessed August 10, 2020).
[4] "Check your eligibility for the Lifeline Program," Massachusetts Department of Telecommunications and Cable, https://www.mass.gov/service-details/check-your-eligibility-for-the-lifeline-program (accessed August 10, 2020).

Figure 8: CHA Tenant Responses When Asked if They Receive a $9.25 Subsidy Under the FCC's Lifeline Program
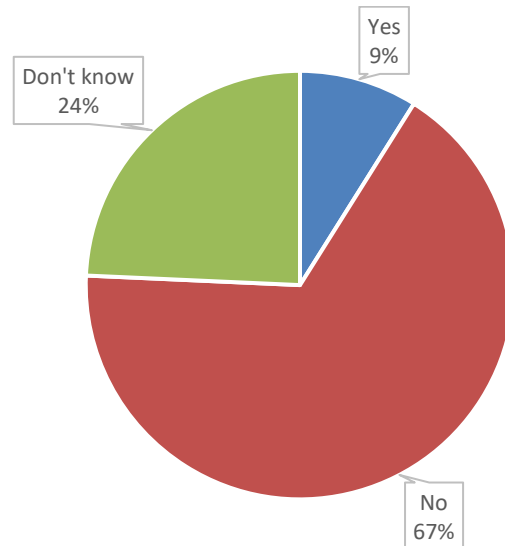
We sought data about Lifeline participation within Cambridge from the Universal Service Administrative Company (USAC), which runs the program for the U.S. Federal Communications Commission, but were told that City-level data are not publicly available.

Section 4 provides more data and context about the low-cost programs and barriers to residents obtaining low-cost services.

2.3 Speed tests conducted over several weeks in Comcast customer homes demonstrate a need for user education in managing in-home networks

Numerous factors can cause internet users to perceive slowdowns or other performance problems. Causes can include congestion on the internet service providers' network, problems involving the in-home network and router equipment, Wi-Fi interference, and device issues ranging from outdated operating systems to malware. Understanding root causes of internet access problems is important to determining what interventions—such as working with an ISP to facilitate network improvements, educating residents about home network and device problems, or attracting a new provider— a City might consider to close performance-related broadband access gaps experienced by users.

Over a period of four weeks in late September and October 2020, CTC conducted hundreds of hourly speed tests in 13 Cambridge residences—all served by Comcast. The homes were all of City employees who responded to an email request seeking volunteers. We issued each resident a piece of custom-built hardware and instructions to plug the device directly into the user's router by means of an ethernet cable. The device then automatically conducted hourly tests of upload speed, download speed, and latency.

Section 7 provides a report on our findings. While we noted some brief, transient performance problems that may or may not have been caused by the Comcast network, the data showed that chronic user-reported problems and slower-than-expected speed test results most likely stemmed from undiagnosed problems with the equipment or network configuration in the home. Interviews with the volunteers also suggested that consumers—in attempts to fix problems— sometimes seek to upgrade their Comcast subscription for "faster" service that may provide little additional value or performance in cases where the problems are actually occurring in the home.

For example, Figure 9 shows the speed test results for a household subscribing to a Comcast 300 Mbps download, 10 Mbps upload plan. The results showed that on the upload side, speeds were almost always 10 Mbps or more, but that on the download side, the customer was never getting more than 100 Mbps. CTC engineers determined that the resident's self-provisioned router was the cause because it was only able to deliver 100 Mbps. The resident said she was satisfied with that speed; as such she could potentially downgrade to a 100 Mbps plan and save hundreds of dollars per year while getting the same effective download performance.

Figure 9: Hourly Speed Test Results Over a Five-Week Period in a Cambridge Household
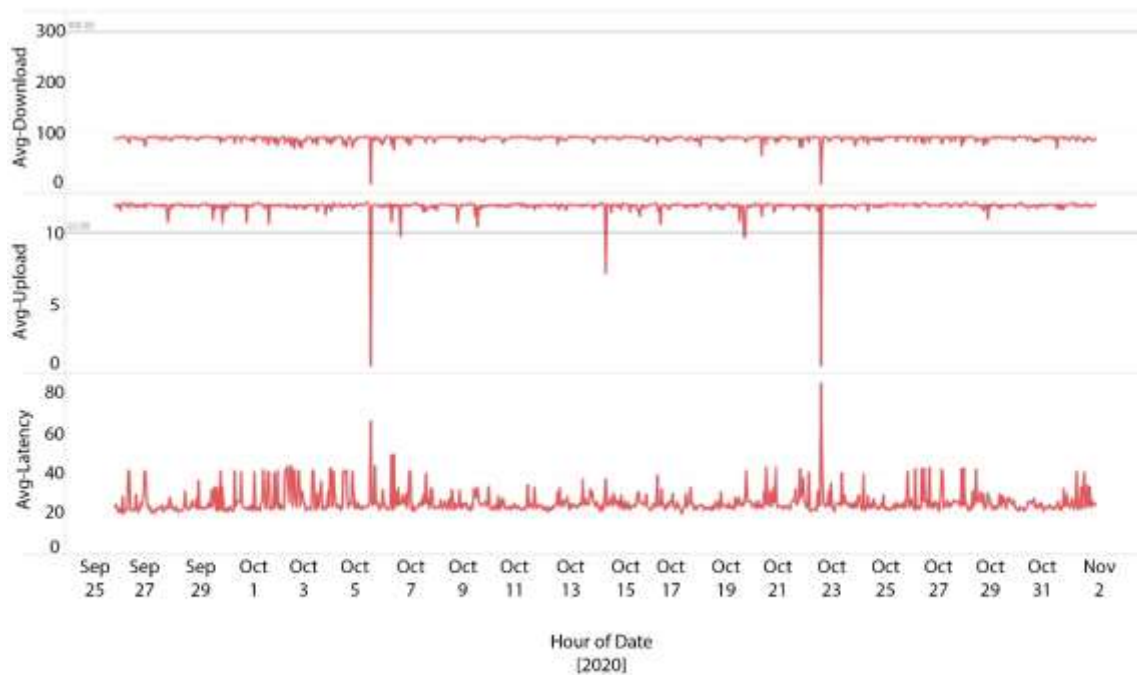
The tests, though limited and anecdotal, did suggest a need to launch or expand user-education campaigns to troubleshoot and ameliorate common problems in home networks and devices.

2.4 Citywide survey shows most are connected but point to more problems with affordability, devices, and skills for older and lower-income residents

CTC conducted a statistically valid sample of all Cambridge residents in the fall of 2019. The full report and detailed analyses are provided in Section 5. Generally, the survey found that residents of Cambridge are highly connected, with 96 percent of households purchasing some form of internet connection. Ninety percent of households have fixed home internet service and 86 percent have a mobile internet service. By and large, most Cambridge residents have access to broadband. Figure 10 presents these data.

Figure 10: Do You Have Internet Service at Home? (All Respondents)

No, 4%   Yes, 96%

Just residential broadband, 10 %

Just mobile service, 5%

Both a resiential broadband connection and a mobile/cellular plan, 81%
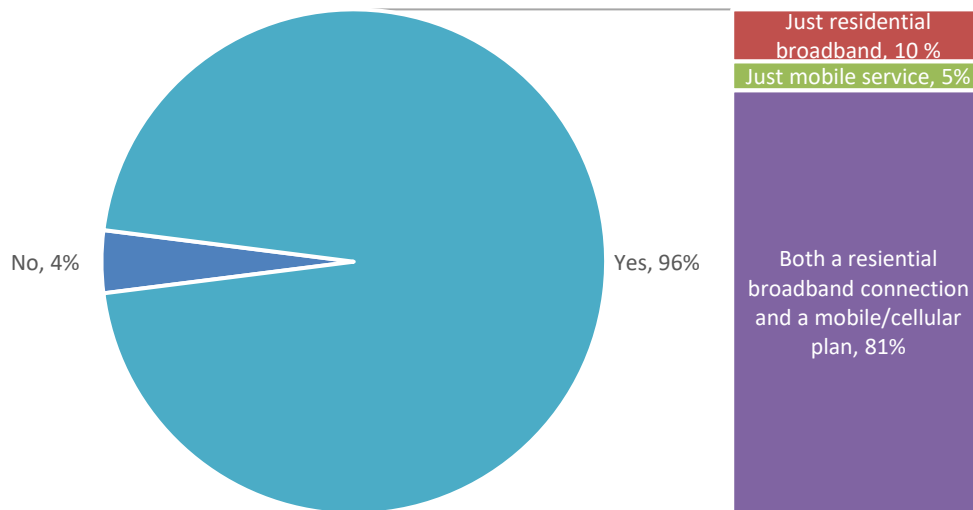
By and large, residents of Cambridge say they are satisfied with their service quality. More than 90 percent are moderately to very satisfied with speed of their connection, and 84 percent are moderately to very satisfied with the reliability of their internet connection. But respondents expressed far less satisfaction with cost and customer service. These data (which primarily relate to Comcast as the dominant provider in Cambridge) are illustrated in Table 2.

Table 2: Satisfaction with Internet Service Aspects

Service Aspect	Mean	Percentages
Speed of Connection	3.8	4% 4% 23% 45% 25%
Reliability of Connection	3.7	4% 12% 18% 42% 24%
Price of Services	2.6	24% 25% 32% 9% 10%
Overall Customer Service	2.7	22% 20% 33% 15% 11%
Ability to Bundle with TV Service	2.7	22% 9% 53% 8% 7%

■ 1 - Very dissatisfied ■ 2 - Slightly satisfied ■ 3 - Moderately satisfied
■ 4 - Very satisfied ■ 5 - Extremely satisfied

The digital equity gaps start to become more evident when we look just at data from older residents and lower-income residents. Those 55 years old or older, and those earning under $100,000 annually are less likely than their counterparts to have some form of internet access at their home. Similar gaps pertain to knowledge and skills needed to make the most effective use of broadband; these factors are discussed in detail in our survey reports. Respondents with a household income of less than $100,000 are less likely than those in higher income households

to describe themselves as skilled in uploading content, blocking spam or unwanted content, creating content using computers and the internet, and accessing a bank account online. At lower income and higher age thresholds, the gaps widen further.

As one example of the data illustrating this trend, people older than 55 years tend to express significantly lower levels of agreement that they know how to do basic things like upload a document to a website, adjust privacy settings, recognize a "phishing" attack, or access their bank account online. Figure 11 presents this data.

Figure 11: Agreement with Statement About Internet Skills by Respondent Age

I know how to...
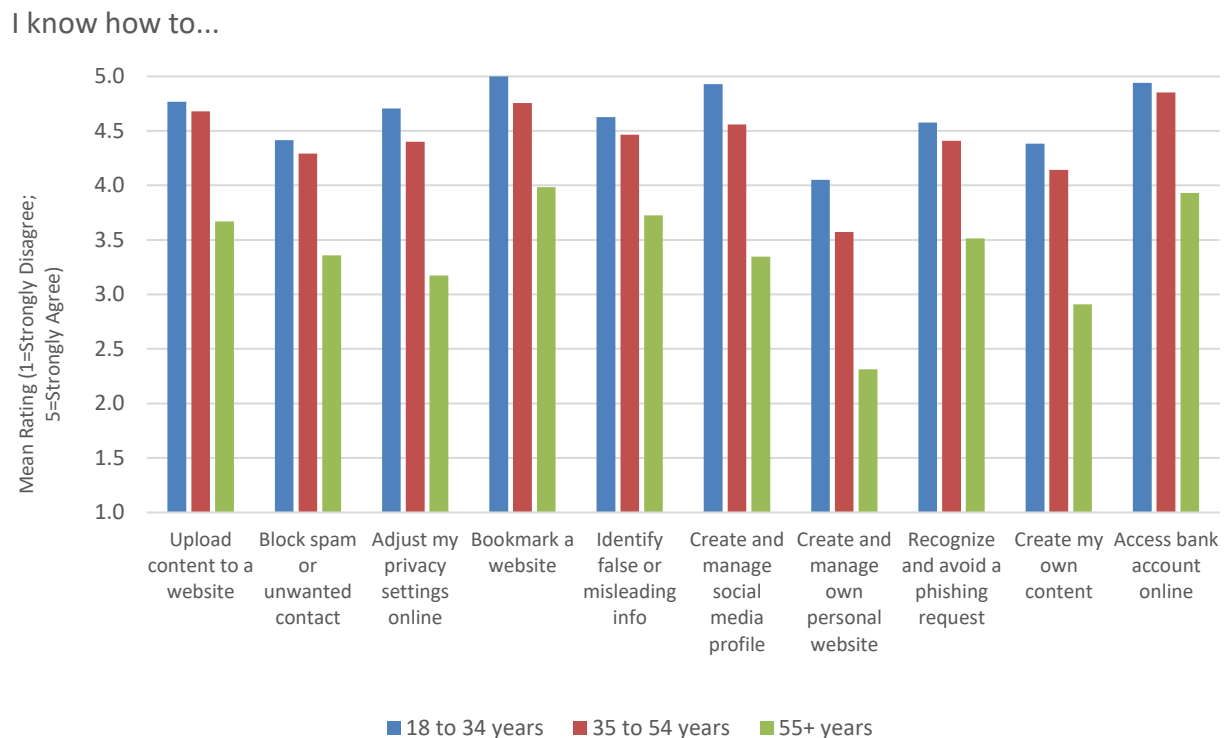
2.5   Housing Authority survey finds many residents face significant challenges related to affordability, device maintenance, and computer skills

In the summer of 2020, CTC conducted a second survey, of residents of CHA housing or subsidized housing. The CHA survey included additional questions regarding device maintenance and broadband skills. A detailed survey report is found in Section 6; this brief summary highlights a small sample of the findings.

Relative to the citywide survey, many more respondents to the CHA survey reported not having home broadband service. Almost 46 percent of the respondents reported not having a home internet connection, and 29 percent had neither a residential connection nor a smartphone connection. CHA's population skews older, which explains part, but not all, of this gap.

Despite these gaps in residential access, most respondents do use the internet. Most (76 percent) respondents access the internet from a range of locations, including many outside the home. But most respondents said they found home broadband unaffordable. Consistent with earlier City findings, just 22 percent of respondents agreed or strongly agreed that the market currently provides high-speed internet at prices they can afford, while 57 percent disagreed or strongly disagreed.

But beyond the cost, many residents expressed significant agreement that they lacked the skills to use the internet effectively; 44 percent either agreed or strongly agreeing that "using the internet is too difficult" and 39 percent either agreed or strongly agreed that "I have no one to teach me how to go online." Figure 12 illustrates the reasons the respondents gave for not using the internet.

Figure 12: Reasons CHA or Subsidized Housing Residents Do Not Use the Internet
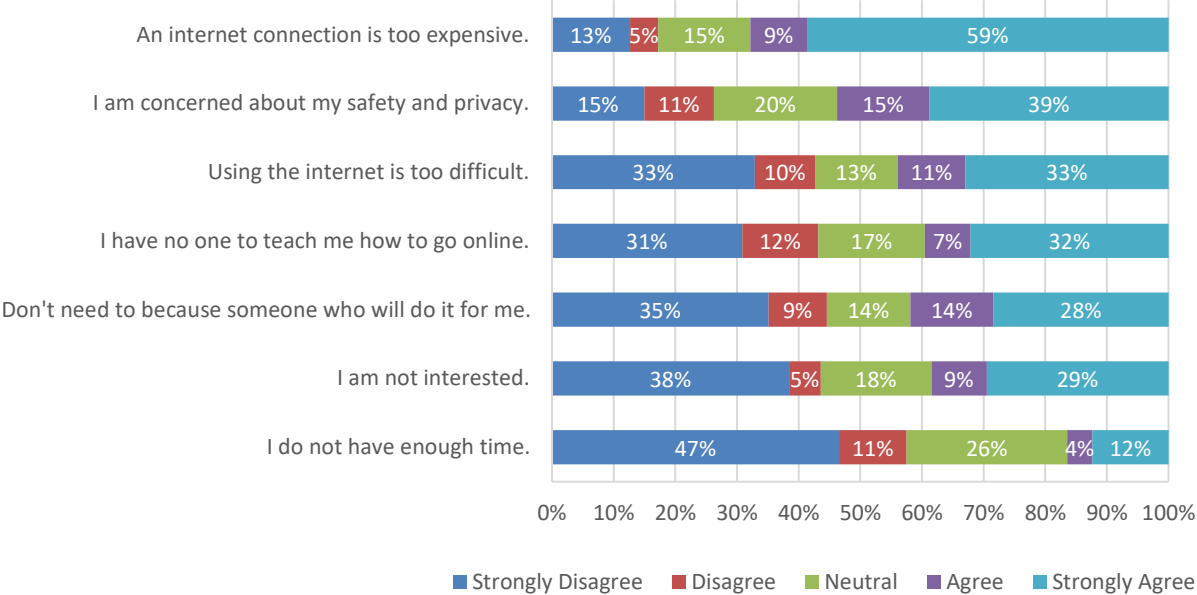
The survey also found more evidence that, among CHA residents, Internet Essentials is significantly underused. Of those with internet connections at home, 68 percent are using Comcast. But of these CHA Comcast subscribers, only 24 percent participate in Internet Essentials. Half of respondents said they were unaware of the program, 20 percent were aware but have not applied, and six percent said they had tried to enroll but were declined.[5]

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[5] After learning of this preliminary finding, the City of Cambridge established a $50,000 fund to purchase 415 Internet Essentials subscription codes to be provided to families in need as determined by the City's Department of Human Services Program.

Beyond facing challenges in obtaining affordable broadband, many CHA households experience significant challenges with their devices. Survey data suggest that almost half of CHA respondents with home internet connections are highly vulnerable to losing their ability to use broadband because of device problems, not connectivity problems. More than one-half (53%) of respondents with internet access have experienced trouble with their computer not working properly and 34 percent experience problems at least monthly. One-fifth (21%) of respondents said they could not replace their computer in the foreseeable future if it became unusable and another 28 percent said it would take one to six months to replace (see Figure 13).

Figure 13: How Long Would It Take You to Replace Your Computer if it Broke?
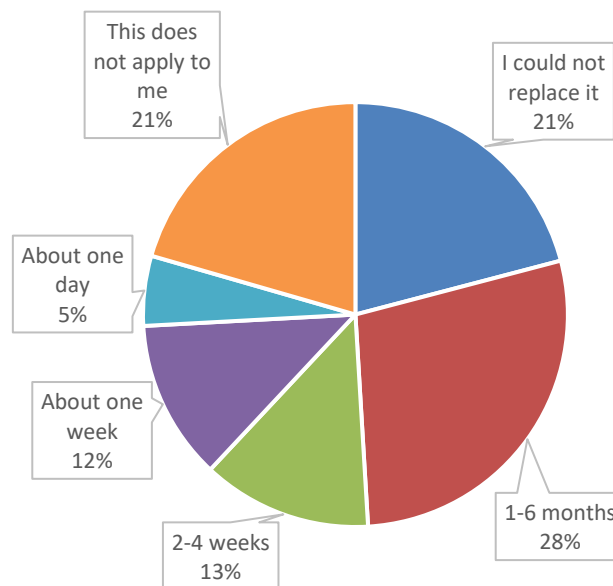
Additionally, the survey data suggest that many CHA residents lack skills for internet use and may be especially vulnerable to online harms. About four in 10 respondents disagreed or strongly disagreed that they know how to use the internet for essential functions like banking, contacting medical support, or purchasing groceries. A similar proportion indicated doubts about technological skills for basic tasks like uploading content, creating a social media profile, or adjusting privacy settings. When asked if they knew how to recognize and avoid a phishing attack, 42 percent disagreed or strongly disagreed. More than one-third (37 percent) disagreed or strongly disagreed that they knew how to recognize false information online and find credible sources of information.

At the same time, among the CHA respondents, there exists a strong desire to improve skills and willingness to attend any available classes or trainings. More than 60 percent agreed or strongly agreed that they would like to become more confident in using computers, the internet; and

more than 50 percent agreed or strongly agreed that they would attend a free or inexpensive class to improve their skills. Figure 14 illustrates these and related responses.

Figure 14: Agreement with Statements About Training Related to Computers and the Internet

Statement	1 - Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agree
I would like to become more confident in using computers, smartphones, and the internet	19%	4%	16%	16%	45%
I would attend a free or inexpensive class to become more confident in using computers, smartphones, and the internet	24%	9%	17%	15%	36%
I would like to know how to better use online resources to find trustworthy information	26%	7%	18%	16%	34%
I would attend a free or inexpensive class in how to use online resources to find trustworthy information	28%	9%	16%	15%	32%
I would like to learn how computers work	31%	9%	18%	15%	28%
I would attend a free or inexpensive class to learn how computers work	33%	9%	16%	15%	27%
I would like to learn how to write software (or code)	41%	10%	12%	13%	24%
I would attend a free or inexpensive class to learn how to write software (or code)	43%	11%	10%	12%	23%

2.6 City stakeholders defined a variety of gaps and made programmatic suggestions

As part of its efforts to evaluate questions related to digital equity and develop strategies for addressing gaps in Cambridge, CTC conducted interviews with a selection of City stakeholders: department heads, nonprofits, and others. Brief highlights from the interviews are presented here; Section 9 provides full interview narratives. The narratives include discussions of what the interviewees viewed as problems, barriers, and potential solutions.

Additionally, the Cambridge Nonprofit Coalition conducted its own internal survey of the needs of the community as perceived by staff members and came to generally similar conclusions as

those of this study. An excerpt from their findings—which represent an additional reflection of the perspectives of stakeholders—are contained here; their report is appended as Appendix C.

Julie Craven, principal of the **Rindge Avenue Upper School**, said the Covid-19 pandemic exposed that the school department had not been fully aware of how many students have inadequate equipment and broadband in

"Providing equitable access to devices & Wi-Fi to middle school students was a new effort prompted by Covid-19. This needs to be non-negotiable: that every student has access to a laptop & high-quality Wi-Fi to keep the digital divide erased. That is a lot more radical than it sounds."

their homes. She stressed the need to fix this permanently, but also indicated a need to impose caregiver education by the time children are in second grade to avoid overuse or even addiction to technology.

Reinhard Engels, manager of innovation and technology for the **Cambridge Public Library**, pointed to a growing usability gap with computers and broadband generally. Library patrons, particularly elderly ones, find it extremely differently to navigate basic tasks involving cloud

*"Imagine an elderly Parkinson's patient looking at a six-picture security prompt and trying to figure out **which ones contain crosswalks**. We deal with this kind of thing every day!"*

services and multi-factor authentication, disconnecting them from many valuable services. He called upon the cloud service providers to solve the problem and for expanded resources and assistance to help seniors and others fully benefit from technology.

Kathryn Fenneman, executive director of Tutoring Plus of Cambridge, said that many families she

works with struggle to afford reliable home internet service. She advocated that there should be mechanisms for affordable internet beyond Comcast's Internet Essentials program, such as service subsidies from the City. Staff members of local nonprofits also conducted their own survey through the Cambridge Nonprofit Coalition.

"It's critical that families do not have to choose between bills and financial obligations and their kids' education. And when there are significant barriers to accessing programs like Comcast Internet Essentials, there needs to be another avenue for families to access affordable internet."

Susan Fleishmann, the retiring executive director of **Cambridge Community Television**, cited a litany of anecdotes about local producers who had low-quality computers and inadequate equipment and broadband in their homes. She suggested the scale of the need was not fully recognized and that any City department providing services to City residents should train staff to ask questions of clients about digital-equity-related needs as part of their intake process to raise awareness of problems and help connect residents with solutions and services.

"We need a citywide campaign to find out who in our community lacks tools, training, or affordable and robust internet access."

Fleishmann, second from left, with the CCTV team, which has long provided computer and video production training opportunities to Cambridge residents.

Charles Franklin, founding member of **Upgrade Cambridge**, software engineer at Akamai, and former candidate for Cambridge City Council, said that internet costs were burdensome to many public housing residents.

He suggested that the City conduct a municipal broadband feasibility study that would examine a range of potential business models and include market research, likely operating expenses, and capital cost estimates that include any City assets that might be leveraged.

> *"Many public housing residents [have] shared that the internet bill was their second highest each month, after only the cost of rent."*

Michelle Godfrey, director of the Department of Human Service Programs, noted that as her department, during the pandemic, moved to Zoom-based delivery of programs (such as the popular "Baby University" program for new parents), she became aware of just how many parents had substandard devices or poor broadband. She said 40 clients could not participate in the Zoom-based educational programs because of various technology roadblocks, such as old iPads or lack of Wi-Fi. Many of the affected people live in Cambridge Housing Authority apartments or other subsidized housing in Cambridge, she said.

> *"You consider places like the Newtowne Court development—those buildings are in the shadows of biotech headquarters, and they don't have good technology. I might be a little biased, because I grew up there, and I know people there who have generational poverty. We need to break that cycle and make sure our neediest families have access to current technology."*

Kessen Green, director of community outreach and programs for the Cambridge Police Department, said that schools have done a good job providing devices to students, but that gaps in internet affordability and adult digital literacy skills remained. He suggested that the development of a STEAM (science, technology, engineering, art, and math) center could help create a pathway for young people in the city to access employment opportunities in Cambridge, both in the city and in other sectors.

Green, right, at a CPD bike helmet distribution event before the pandemic.

"When we talk about the digital divide as a City, we are not usually talking about things like coding, but it's part of it. We need to think about how we can get kids interested in this, and why these resources aren't typically something that families of color have access to."

Russell Harding, community outreach coordinator for the Margaret Fuller House—a nonprofit that works to strengthen and empower youth, families, and community members by addressing inequities in the Port neighborhood—sees the community he serves struggle with the high cost of internet service. While the Margaret Fuller House has a computer room, he says it would likely get more use if they brought back the popular Tech Goes Home courses in the computer room.

"The older population sometimes struggles with technology skills, including accessing online resources that involve using email or clicking links. The Tech Goes Home classes were popular, and people would often call to ask when the next one would take place."

Neil MacInnes-Barker, director of the Department of Veterans Services, noted that many veterans are not well-versed in using technology or why it might be important and helpful to them. Some might benefit from the connections afforded by the internet, but a self-sufficiency culture among veterans stops them asking for help or resources. He said that a small budget, even if just $5,000, would help conduct trainings and pay for devices to hold those trainings and help veterans connect with services and with each other.

"We want to develop the Veterans Center to provide private spaces where veterans can come to take telehealth appointments. And for those who do have a connection and a device at home, we want to offer coaching to help them understand how to access and use telehealth."

Dan Noyes, co-CEO of Tech Goes Home—the nonprofit providing Chromebooks and training to people in need—said instructors at Peabody Elementary School, Cambridge Community Center, Cambridge Housing Authority, and Cambridge Public Library provided distance learning during the pandemic. He added that TGH recently was able to support half the inquiries in Cambridge. Throughout the region, he has a long waiting list of organizations wanting TGH services.

> *"We are proud of the numbers of people we serve, but it is a drop in the bucket. We are severely limited in our capacity to meet the need. If any entity in Cambridge or elsewhere wants us to come in, we need … buy-in from the leadership of whatever organization we are dealing with and on-the-ground instructors within the organization who are excited about helping do this."*

Jim Stewart, director of the First Church Shelter, said the homeless population saw its digital divide grow during the pandemic. People living on the street often need to go online to obtain services or find jobs or housing, but they need power and a free Wi-Fi signal, something that was already tough to find. He said the homeless community would benefit from the provision of more places where these utilities were available, particularly in central locations in Central, Harvard, and Porter Squares so that people could get access near the T stops.

The Cambridge Nonprofit Coalition, a group of Cambridge nonprofit entities, developed a questionnaire for their members to gather opinions and data on digital inequities. The coalition's Digital Equity Working Group, which conducted its effort in parallel with this study, released the results in early December. Their

> *Almost all nonprofit respondents pointed towards a lack of sufficient internet connectivity and digital device access among their clients, especially non-K-12 education-based nonprofits. Various solutions, such as phone and device donations, public charging stations, training on device and internet usage, and internet access or phone data distribution, were suggested, indicating a range of strategies through which digital inequity could be addressed in Cambridge in the near term.*

report appears as Appendix C; its findings, based on a questionnaire distributed to staff of local nonprofits, are in general agreement with those of this study.

2.7 Interviews with residents of CHA and subsidized housing units reveal some pay $10 while others pay $264 monthly to Comcast

CTC also engaged in telephone interviews with Cambridge Housing Authority or subsidized housing residents who had received the mail survey and volunteered for a later interview. The

goal of this task was to collect data regarding monthly bills and to gain insight into respondents' broadband experiences.

We found a wide variation in prices paid to Comcast, with some paying just $10 for the Internet Essentials program and others paying as much as $264 for a 'triple-play' bundle. Residents also were sometimes frustrated over the lack of choice, unaware of choices that did exist, or had misimpressions about service, such as that Internet Essentials would be too slow to be useful, when it did meet the federal definition of "broadband" even before Comcast increased the speed of Internet Essentials to 50 Mbps download, 5 Mbps upload. We have removed names to preserve individual privacy.

Figure 15 summarizes a sample of interviewees' reports about broadband pricing, their market decision, and any problems they have about their service. We have removed names to preserve individual privacy.

Figure 15: Monthly Broadband Bills Paid by and Service Comments of CHA Residents

Interviewee	Address	Provider	Monthly Internet or Bundle Bill	Market Comments	Service Comments
Household of two adults and two children (10, 2)	Oxford Street (Section 8 apartment)	Comcast	$10 (Internet Essentials)	Learned about Internet Essentials from school newsletter	Service works well. Would like better, but not if above $10.
Household of man in his 60s	1221 Cambridge Street (CHA high-rise)	Comcast	$10 (Internet Essentials)	Learned about Internet Essentials from CHA staff	Would rather use public computers at the library. Service works well; occasional Zoom glitches
Household of parent and child in college	Auburn Park Section 8 apartment	Comcast	$54 for 25 Mbps service	Struggles to pay $54 bill. Had not heard of Internet Essentials	Satisfied but loses internet connection "every now and then"
Household with two adults	Roosevelt Mid-Rise Towers, (CHA development)	Comcast	$264 for triple play	Unaware until the interview that NetBlazr recently began serving the building	Unhappy with Comcast customer service and high prices, but wants certain shows
Household with two adults	1221 Cambridge Street (CHA high-rise)	Comcast	$147 for internet and TV	Heard Internet Essentials was slow, has not tried to get it	Internet fine; uses 15-year-old laptop, sometimes has problems
Household with two adults	364 Rindge Avenue high-rise, section 8 unit	Starry	$15 (Starry Connect program for low-income customers)	Starry recently began serving the building; disliked Comcast prices/ service	Good service, free router, good service with frequent medical Zoom appointments

2.8 Subject-matter experts and practitioners in other cities outline strategies that have proven effective elsewhere in the country

CTC conducted interviews with digital equity practitioners and researchers from around the country, including an academic who researches digital coalitions, City staff working on digital inclusion efforts in Seattle, Austin, and Portland; and the general manager of a city-run internet service provider in order to learn more about what kinds of pricing strategies can help increase adoption of residential broadband services by lower-income residents.

Section 10 provides an extensive report describing these conversations and takeaways in detail and including links to relevant resources. Takeaways include:

- Community organizations and nonprofits that are already working with most-affected residents are well suited to assist in overcoming barriers to broadband adoption and addressing device usage and skills gaps

- City staff can play an important role in helping develop an evaluation framework and data collection system at a citywide or regional level, and a digital equity agenda is most likely to succeed when it is integrated and connected to other City goals

- A digital equity agenda needs a champion in a leadership position to encourage cross-departmental collaborations and pursue philanthropic donations

- Digital inclusion coalitions can delegate responsibilities to community organizations, but should define performance metrics and establish accountability mechanism to ensure progress

- Low usage of discounted internet offerings is the result of a lack of awareness and the difficulty involved in navigating the signup process; additionally, bad credit has become a significant barrier to broadband adoption generally

Section 10 concludes with resources and guides from coalitions that have formed to support digital inclusion efforts around the country.

3 Recommendations

In light of the findings of this study, CTC recommends the City explore a range of strategies to address the broadband challenges within Cambridge. Table 3 lists the recommended strategies, and which aspects of digital equity they address. Many of these strategies would or could be conducted in parallel, so this ordering does not reflect a chronology or an order of priority.

Table 3: Recommendations and Relevance to Digital Equity Aspects

Recommendation	Access	Affordability	Devices	Skills
Convene a digital equity and inclusion coalition to guide implementation efforts	X	X	X	X
Expand the City's $50,000 pilot program into a Digital Equity Fund emphasizing device and skills programs		X	X	X
Consider establishing a community digital equity specialist position or similar public support function		X	X	X
Engage local philanthropic organizations to broaden the reach of broadband equity initiatives		X	X	X
Partner with organizations that provide low-cost devices and training to City residents and to expand loaner programs			X	X
Establish a digital skills training corps				X
Conduct a municipal broadband feasibility study that allows exploration of a variety of partnership and facilitation models	X	X		
Facilitate the provision of additional providers of low-cost service in more CHA developments	X	X		
Expand public Wi-Fi and charging stations in core areas, such as Porter and Central Squares	X	X		
Promote the new Emergency Broadband Benefit program to provide temporary relief on bills and purchases for eligible Cambridge residents		X	X	

3.1 Convene a digital equity and inclusion coalition to guide implementation efforts

CTC recommends that the City play a convening role to incent and establish a coalition tasked with actively promoting digital equity and inclusion with a scope of focusing on tasks that expand usage of low-cost plans, improve device access, and enhance digital skills. Potential partners could include the City, the nonprofit community, philanthropies, businesses, CCTV, and library and school entities.

Such coalitions are critical to engage stakeholders and drive change, as a recent Benton Institute report[6] noted. Potential models for such an effort include the Digital Inclusion Alliance San Antonio (DIASA)[7], which is cultivating and promoting public policies and initiatives that prioritize digital equity; the Portland Digital Inclusion Network,[8] a coalition of community organizations interested in raising awareness about digital equity barriers and developing solutions to bridging the digital divide; and the Digital Empowerment Community of Austin, a network of community stakeholders in Austin, TX, working on different facets of the digital equity issues there.[9]

This coalition could be charged with proposing ways to manage initiatives proposed in this report and by other community stakeholders in the digital equity planning process. And it could encourage current providers to improve their marketing and outreach to customers who might qualify for ISPs' existing subsidy programs for low-income residents. It could also try to identify an organization that could pay for internet service for households that are eligible for those programs but not currently enrolled. Representatives of the partners could develop an operational plan for the coalition.

A City government itself is well suited to implementing some solutions, especially on tasks involving infrastructure improvements, staffing, and programs (see later recommendations). But it cannot alone address all challenges related to digital equity, particularly not all relating to connecting residents with subsidy programs, providing devices, assisting with device maintenance and updates, and helping people develop better computer skills.

3.2 Expand the City's $50,000 pilot program into a Digital Equity Fund

The City has already launched a $50,000 initiative to purchase subscription codes that could subsidize up to 415 Internet Essentials subscriptions to families identified as in need by the Cambridge Public Schools and Department of Human Services Program. And the City also funds other programs that indirectly support the goals of digital inclusion, such as the new hotspot and Chromebook lending program at the library. Following certain models elsewhere in the country,

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[6] https://www.benton.org/sites/default/files/growinghealthy_ecosystems.pdf
[7] https://digitalinclusionsa.org/
[8] https://www.portlandoregon.gov/oct/73860
[9] http://austintexas.gov/page/digital-empowerment-community-austin

the City might consider expanding the $50,000 pilot program into a Digital Equity Fund. The City's digital equity and inclusion coalition, if formed, could assist in developing a pipeline of worthy projects, setting priorities, and identifying partners who could provide additional funds and other resources.

As one model, Seattle has used a technology matching fund since 1997 to support local organizations working to close the digital divide.[10] The fund's annual budget has grown to $320,000; it supports an average of 12 organizations per year. Inspired by Seattle's program, the City of Austin launched its Grants for Technology Opportunities Program in 2001.[11] Similarly, the City of Boston began offering $35,000 in grants through its digital equity fund in 2017, and expanded it to $100,000 annually in 2019.

The fund of moderate amount could help support many of the strategic recommendations made, whether by this effort or by stakeholders in the City—such as the Cambridge Nonprofit Coalition and its members—who have an excellent understanding of the problems and connections with the affected populations. And the process of vetting and awarding grant applications will help the City and other stakeholders understand the evolving nature of the problem and maintain good working relationships.

3.3 Consider establishing a community digital equity specialist position

The City and partners could collaborate to fund a full-time City staff member who would serve as a community digital equity specialist. This person could, for example, help residents sign up for broadband subsidy programs, or otherwise address gaps identified by this plan and by stakeholders.[12]

In Cambridge, the staff member could:

- Promote subsidized services (Comcast Internet Essentials, Lifeline, Starry Connect, the NetBlazr low-cost program, and any others) to eligible residents and assist eligible residents in the sign-up process, installation, and usage

- Coordinate with local foundations and philanthropies

- Arrange training opportunities for residents on effective, safe, and secure use of the internet, and partner with nonprofits to address gaps identified as part of this process

- Keep abreast of digital inclusion programs offered in other cities, and identify and

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[10] https://www.seattle.gov/tech/initiatives/digital-equity/technology-matching-fund
[11] https://www.austintexas.gov/department/grant-technology-opportunities-program
[12] One potential model for such a position has been proposed by the National Digital Inclusion Association and is available at this link: https://www.digitalinclusion.org/digital-navigator-model/

pursue any future digital equity program funding opportunities that may arise

- Directly provide training and other services to residents needing help and serve as a central point of contact

3.4 Engage with local philanthropic organizations to broaden the reach of broadband equity initiatives

CTC recommends convening local foundations and other philanthropic entities to determine the types of projects they are willing to fund and their application requirements. It is clear that there is interest on the part of local organizations and foundations to fund new projects and programs aimed at achieving digital equity.

Given the range of potential initiatives outlined in this report, a number of potential project types could be suitable for foundation funding. These include the following (referenced elsewhere in these recommended strategies):

- Provide laptops, Chromebooks, and other devices to low-income residents or others who have devices in poor condition

- Establish resource centers where members of the community can access devices, high-speed internet, and training/mentoring

- Provide funding to a train-the-trainer nonprofit to recruit and pay a corps of tech-savvy community outreach specialists to help older residents or others in need to learn basic digital skills

- Fund the City's construction of new broadband infrastructure, such as fiber or conduit

A model for a foundation role arose earlier this year in Cleveland, where the Cleveland Foundation, Cuyahoga County, and T-Mobile partnered to launch the Greater Cleveland Digital Equity Fund.[13] The fund was initially launched with $3 million in commitments intended to address immediate and long-term needs involving access, computing devices, skills, and technology support. The George Gund Foundation gave an additional $1 million grant to support digital needs—such as hotspots and laptops—for K-12 students in the Cleveland Metropolitan School District and others who lack broadband access and devices to learn remotely during the pandemic. T-Mobile committed to providing 7,500 unlimited data hotspots and $1 million of in-kind equipment donations, while other local organizations will provide up to 10,000 computers and ongoing support to area students.

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[13] https://www.clevelandfoundation.org/news_items/digital-equity-fund/

One potential strategy is to approach banks to see if there may be avenues for them meeting Community Reinvestment Act (CRA) obligations through investments in digital equity. The National Collaborative for Digital Equity's (NCDE's) Guide to CRA Grantmaking for Digital Equity and Economic Inclusion offers more information.

The City might also explore how to protect residents so they do not lose broadband service if they are unable to pay—similar to how residents are protected if they cannot pay an electric or water bill. The City could also consider a debt forgiveness or payoff program. Funding such an effort might be a role for foundations or others in a position to offer grants.

3.5 Partner with organizations to provide low-cost devices and training to City residents and to expand loaner programs

The City could forge partnerships with, or replicate programs offered locally by Tech Goes Home—and in other parts of the country by PCs for People and Tech Soup. These organizations have a variety of successful and scalable models for reselling, refurbishing, or offering new laptops and other devices and training to partner organizations. Tech Goes Home reports that demand far exceeds their capacity, and several stakeholders shared how popular the Tech Goes Home classes are for the residents who had been able to attend them.

The Cambridge Nonprofit Coalition and its members, with their existing staffs and their existing mechanisms for obtaining funds, and the data they have developed about the needs of the people they serve, could potentially take the lead in advancing these kinds of programs, and reporting back to the City on their progress and on the extent to which they face funding gaps, which could be closed with public or private funding sources.

There is also a need – beyond the schools and library continuing what they are doing – to stand up a community loaner program that provides hotspots, laptops and potentially smartphones to those in particular need, such as older residents who are not well-versed in technology but need to attend remote medical appointments. A borrowing program would have significant capital and operating costs—and hotspots are only as good as cellular service where used—but could be helpful to many in the City.

3.6 Establish a digital skills training corps

Cambridge could consider replicating other models found around the country for scaling up training and providing basic technical support for residents. For example, the District of Columbia in recent years launched a program called "All Hands on Tech"[14] that holds events providing free technical support, using District employee technicians to directly help District residents with basic tasks like data backup, computer cleanup, virus removal, and troubleshooting. The District has

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[14] https://connect.dc.gov/free-tech-support

held a total of eight events since 2018 and has directly helped hundreds of people while, along the way, gaining insights on the types of problems District residents experience.

College students in Cambridge could play a greater role, too. In Bloomington, Indiana, Indiana University runs a program called [Serve IT that](#) seeks to apply the technology skills of undergraduates to build capacity in the local nonprofit community to help them better serve their missions. Cambridge undergraduates have knowledge and the capacity to assist with one-on-one digital skills training or tech support workshops—and are likely already doing so in some contexts. High school students could help too, such as to connect with seniors to do basic tasks online. And this would be particularly responsive to survey findings, stakeholder, and Cambridge Nonprofit Coalition reports about unmet needs among seniors and others in the community.

3.7   Conduct a municipal broadband feasibility study that allows exploration of a variety of partnership and facilitation models

CTC understands that the City may procure and undertake a municipal broadband feasibility study and recommends that any procurement for a new study be broad enough to allow for exploration of a variety of partnership and facilitation models. Solutions may differ by site or neighborhood; at the highest level, the goals of improving service and lowering prices will be achieved through competition.

Cambridge's broadband actions should be considered in light of a range of broadband models, including that of a municipal broadband network. The City would be well-served to understand the full range of options it can consider, with analysis of associated benefits and risks. The City should also explore whether and how existing models can be adapted to Cambridge's needs.

Collaboration with the private sector to meet City broadband goals for service, ubiquity, and equity should also be considered. For example, Cambridge has two competitors trying to offer reasonably-priced high speed symmetrical (same upload/download speed) service in the City—NetBlazr and now Starry. These companies offer $20 and $15 monthly plans for low-income consumers with low eligibility barriers. The City would be well-served to consider the potential for public-private collaboration, with existing providers now operating in Cambridge, as well as others who might be interested in entering the Cambridge market.

CTC also recommends that the City's study evaluate the extent to which multi-family property owners may block the ability of any new provider, including a municipal provider, to compete with Comcast. Across the country, some building owners enter into exclusive marketing deals

with incumbents, precluding competition in the multi-family setting. This dynamic does exist in Cambridge. The impact of such practices should be explored. [15]

3.8   Explore the potential to facilitate additional providers of low-cost service in more CHA developments

Cambridge's digital equity gaps skew heavily to lower-income residents. Though it is worth keeping in mind that CHA residents tend to be older (and thus less likely to want internet service), the CHA survey conducted for this report found that 46 percent of respondents are not connected to a fixed residential plan—and that many cite the cost. And among those with Comcast service, relatively few are enrolled in the $10 Comcast Internet Essentials program. Others struggle with high bills; one interview subject told us she was paying $264 for her Comcast bundle. Another, a single mother, worried about Comcast increasing her bill from $54 to $92 after the 12-month marketing period ends and having to go through the hassles of switching the account name to her daughter to keep her Comcast service at the promotional price.

The CHA has already done some important work to facilitate competition. In 2015 it issued an RFP that resulted in NetBlazr providing fixed wireless service to the Millers River Apartments and Roosevelt Towers. And it has also been working to expand Wi-Fi availability in public areas of CHA housing. This work is continuing, and Jay Leslie, the director of information technology, reports that the CHA has pre-wired some facilities with ethernet cable and created a demarcation point to facilitate potential new providers. (As noted above, the CHA also issued a new RFP in February of 2021 to offer rooftop space to fixed-wireless providers.)

Given that these initiatives resulted in expanded options in the past five years (and set the stage for more progress), the City made the decision to shift resources from this existing digital equity study procurement to allow CTC to conduct preliminary high-level engineering and cost estimation work for providing and operating a high-speed residential broadband service in three CHA developments: Newtowne Court, Washington Elms, and the Manning Apartments.

The City, too, has already played a role in bringing free Wi-Fi to some of these areas. In 2016 the City—partnering with the Massachusetts Institute of Technology, Google, and Boston Properties—launched Kendall Wi-Fi, a free high-speed outdoor service to Kendall Square and outdoor areas of nearby Washington Elms and Newtowne Court. Some residents report that they have attempted to use this service within their homes. However, as is typical outdoor Wi-Fi everywhere, it does not work well in most interior settings.

We recommend exploration of the cost and feasibility of bringing City fiber (or fiber from an institutional partner) to these and other sites and seeking partners operate the network and

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[15] Comcast frequently enters into such agreements. Starry reports that would consider revenue-sharing models but not anti-competitive exclusive deals. NetBlazr says it will neither seek exclusive access nor revenue-share.

provide service. It is possible that different technical and business model approaches could apply to different CHA and scatter-site subsidized housing sites.

There are ample models for this. For example, San Francisco, through a partnership with a local ISP, launched a [Fiber to Housing](#) program that offers free broadband in public housing facilities.[16] The local ISP uses a combination of fiber optic and fixed wireless technology to connect the buildings, and some units have wired ethernet connections while others have shared Wi-Fi networks distributed throughout the building. The San Francisco Housing Development Corporation (SFHDC) pays $10 per month per unit, for an estimated total cost of $26,000. The local cable company proposed to charge more than twice this amount to provide a single shared Wi-Fi access point in each building.[17]

3.9 Consider expanding public Wi-Fi in other core areas, such as Porter, Inman, and Central Squares.

With the Kendall Square Wi-Fi initiative as a model, the City may also wish to consider expanding the availability of public Wi-Fi in other high traffic areas such as Porter, Inman and Central Squares. While this not an adequate alternative to residential broadband, some stakeholders indicated that more public Wi-Fi and charging stations might be helpful in addressing some digital equity issues, such as by providing additional means for people who are homeless to access the internet. Visitors to MIT, Harvard, and Kendall Square have ample free Wi-Fi from networks already established in those areas. And it may be possible to find partners to build Wi-Fi in other areas.

3.10 Promote the new Emergency Broadband Benefit program to provide temporary relief on bills and purchases for eligible Cambridge residents

The federal appropriations act that became law in late December 2020 included a new Emergency Broadband Benefit Program, which could play a role in helping Cambridge residents close access gaps. The program is designed to provide a broadband subsidy for eligible households that will appear as a discount on their monthly bills. Once the program is up and running (the rules were released on February 25, and we expect to see the program operational by the end of April),[18] the FCC will reimburse internet service providers up to $50 per month per eligible household. Assuming the funding lasts, the program will continue until six months following the official end of the Covid-19 public health emergency. The program also subsidizes the cost of a laptop, desktop computer, or tablet for each eligible household; ISPs can be

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[16] https://tech.sfgov.org/news/fiber-housing/

[17] https://ilsr.org/wp-content/uploads/2019/03/sf-broadband-public-housing-2019.pdf

[18] Cecilia Kang, "F.C.C. Approves a $50 Monthly High-Speed Internet Subsidy," *New York Times*, Feb. 25, 2021, https://www.nytimes.com/2021/02/25/technology/fcc-broadband-low-income-subsidy.html (accessed Feb. 26, 2021).

reimbursed up to $100 for a connected device, as long as they charge the recipient no more than $50 for it.

The Emergency Broadband Benefit will subsidize broadband service for low-income families and households that have lost income during the Covid-19 pandemic. City efforts to develop a public outreach and support strategy could help maximize enrollment in the Emergency Broadband Benefit program. Tactics could include developing a public information campaign and conducting outreach to community groups, non-profits, and individual residents. ***Further information about this new program is provided in Appendix E.***

4 Broadband Service and Pricing in Cambridge—a Review of Information from Company Websites, FCC Databases, and Interviews

CTC reviewed FCC data, researched websites of broadband providers operating in Cambridge, and engaged in phone conversations with representatives of some internet service providers in order to collect market data on residential broadband pricing, availability, and level of competition in Cambridge. Leaving aside satellite provides and mobile providers, there are four fixed broadband providers in Cambridge:

Comcast is the dominant provider in Cambridge. Because the City negotiated buildout requirements in the City's cable franchise agreement with Comcast (and its predecessor owners of the cable system), high-speed residential internet service is available everywhere in the City. Services offered by other companies are less uniformly available or, for the most part, do not meet federal criteria for broadband (i.e., at least 25 Mbps download, 3 Mbps upload), and the residential market therefore does not have the benefits of widespread broadband competition.

Verizon provides slow DSL service in virtually the entire City through legacy phone lines, but at speeds far below broadband. Its DSL service, though near ubiquitous, is not a broadband competitor. Verizon does also provide its FiOS fiber service in certain limited areas but is not expanding this fiber service.

NetBlazr offers fixed-wireless service to some buildings where they can get permission to install rooftop receivers and establish a line-of-sight from their transmitters. Within the building, internal wiring is used.

Starry, a startup company that has emerged in the past five years, offers fixed-wireless service with a model generally similar to that of NetBlazr. Starry is also offering fiber-to-the-premises (FTTP) service in certain buildings that host Starry's rooftop base station equipment. (This is because at such buildings, Starry pulls fiber into the building to serve the base station and connects units in that building with fiber rather than wirelessly.)

Both NetBlazr and Starry deliver far faster upload speeds than Comcast. In some contexts, the fixed wireless companies are providing important sources of competition. In recent years, thanks to a 2015 RFP issued by the Cambridge Housing Authority, NetBlazr now serves two CHA developments, the Millers' River apartments on Lambert Street and the Roosevelt Towers mid-rise on Cambridge Street.

FCC tracks broadband service available with information reported by broadband providers on a document called "Form 477." This data tends to exaggerate the availability of broadband because if only one address is served, the whole census block containing that address is marked as having such service. Still, in the Cambridge context—where we know Comcast and Verizon DSL are near-

ubiquitous—it is useful to use Form 477 to map just fiber-based service to see the exceptions. Figure 16 shows the census blocks where companies have reported to the FCC that they are providing residential fiber service to at least one address.

Figure 16: Form 477 Reported Residential Fiber Service Providers
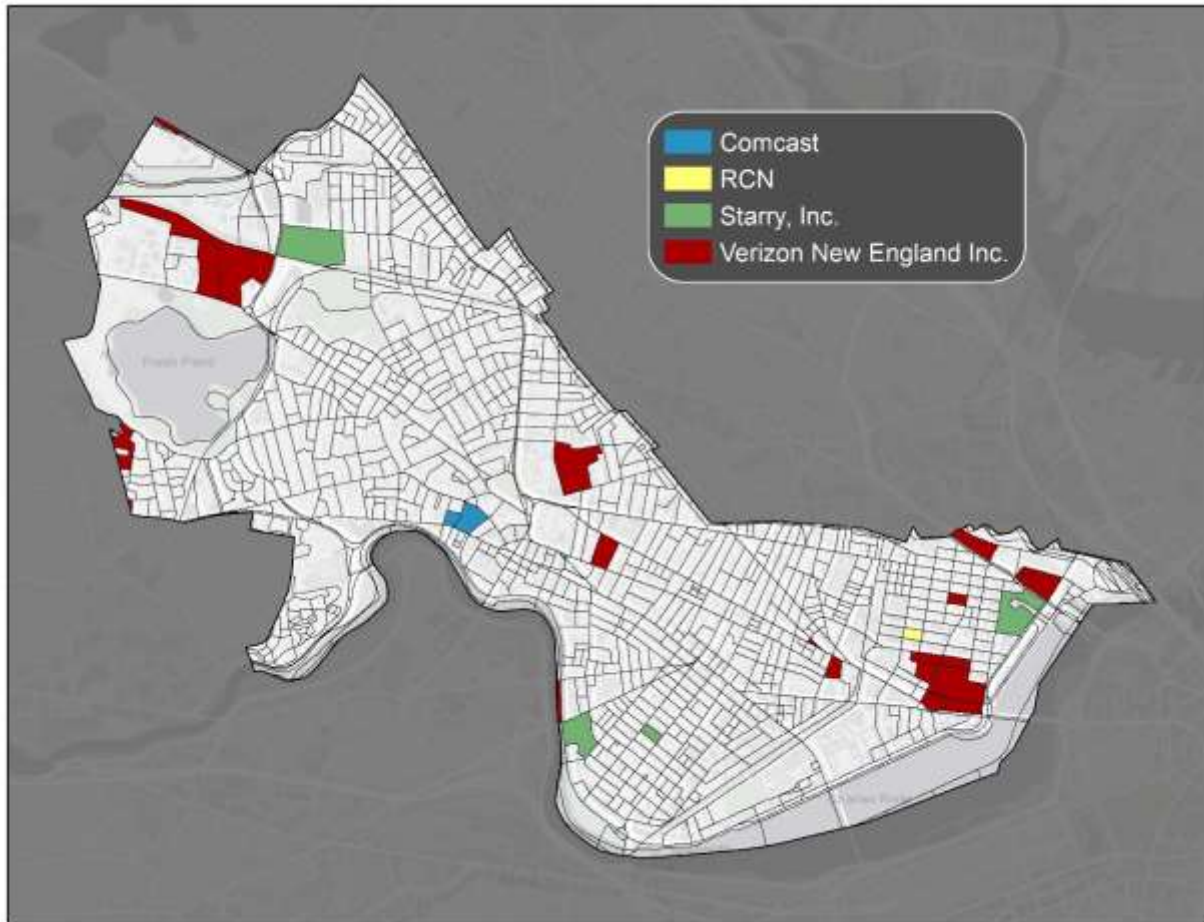
It is reasonable to discount the one square block of fiber service from RCN—a cable company that otherwise does not serve Cambridge. This block consists of a parking lot and the AT&T central office at 149 Rogers Street. CTC's inquiry to RCN was not answered. The Verizon fiber service is limited, reaching buildings in the Kendall Square and Alewife areas and a few pockets of residential service. Comcast fiber serves a small area between Brattle Street and Mt. Auburn Street west of Harvard Square.

Starry fiber appears in census blocks where the company has provided fiber service to a building, which in turn means that the given building has a base station—a transmitter—on the rooftop. That high-rise apartments at 364 Rindge Avenue are apparently one such location (one of our resident interviews was with a tenant who had Starry service). Another appears to be a site on

or near the Cambridgeside Galleria, a third appears to be on or near the Cambridge Community Towers on Memorial Drive, a fourth is located on a block in Cambridgeport.

In interviews with CTC, NetBlazr and Starry both claim they can serve a significant portion of the City. NetBlazr will only come to "multifamily" buildings and prefers buildings with modern ethernet wiring, with some exceptions. Given that the company's model is building-specific, it may only service certain buildings on a block. With those important caveats, Figure 17 shows the areas NetBlazr says it is capable of serving.

Figure 17: Areas Within Which NetBlazr Says it Can Serve Multi-Family Buildings
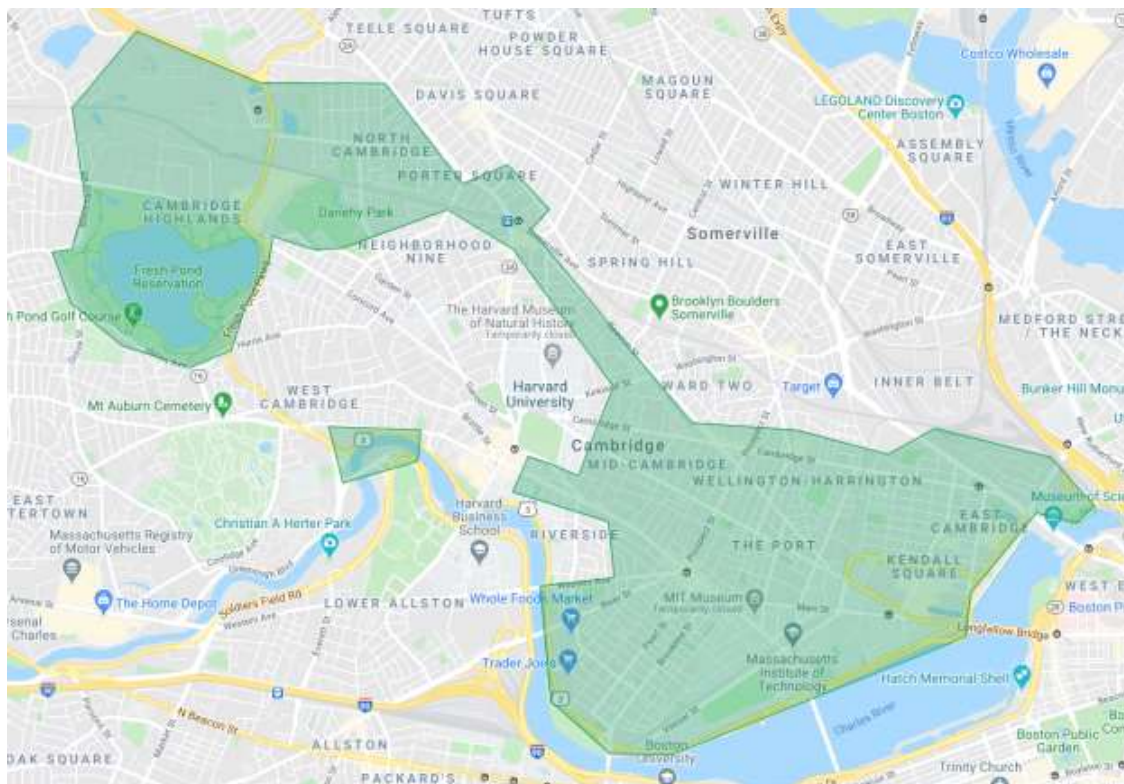
Starry made similar claims, saying it could potentially serve up to half of the City's premises, again concentrated in apartment buildings. Citing competitive concerns, Starry declined to provide a map of its service area or to state how many customers it serves in Cambridge. However, it can be inferred from the Form 477 data that Starry has base station equipment atop at least four tall buildings in the areas shaded green in the map above. This puts Starry it in a position to serve premises within a line-of-sight from those sites.

As a further practical obstacle, both NetBlazr and Starry services rely on the agreement of building owners to put equipment on the rooftop, where the company then connects with in-building wiring to reach individual units. Starry stated that it may deploy a different technology

that does not require the use of building wiring. The company has created prototypes of (and garnered considerable media attention for) a model in which it delivers service directly to receivers mounted on customer windowsills. This opens up the possibility for service to single-family homes and to apartments where it does not have access to internal wiring. But this model has apparently not been deployed in Cambridge. It is not clear when, or if, this rollout will occur.

At the highest level, we note that there are the seeds of high-speed broadband competition present in Cambridge today. But there is a long way to go to make this competition comprehensive.[19]

4.1 Analysis of fixed broadband service providers

4.1.1 Pricing and speed offerings vary among the four fixed providers in Cambridge

We reviewed prices and service plans offered by Comcast, Verizon (DSL), NetBlazr (fixed wireless), and Starry (fixed wireless or fiber). We note at the outset that all of this research was conducted in the summer and fall of 2020.

 On January 1, 2021, Comcast increased prices on many of its plans. These increases included a $3 monthly rate increase for all of its internet plans except the "Performance Starter" and "Gigabit Pro" tiers. These updated rates are included in Appendix D.

With respect to advertised offers, we collected pricing in 12 of Cambridge's 13 neighborhoods, as defined by the City's Community Development Department, shown in Figure 18.[20] We did not analyze anything in "Area 2/MIT" due to a lack of residential addresses in the neighborhood, which is mainly the MIT campus.

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[19] Some landlords enter into marketing and revenue agreements with Comcast, taking payments that incentivize them to enforce a monopoly in the building.

[20] "Cambridge Neighborhoods," Community Development Department, City of Cambridge, Feb. 18, 2016, https://www.cambridgema.gov/-/media/Files/CDD/Maps/Neighborhood/cddmap_neigh_index.pdf (accessed Dec. 4, 2020).

Figure 18: Cambridge Neighborhoods
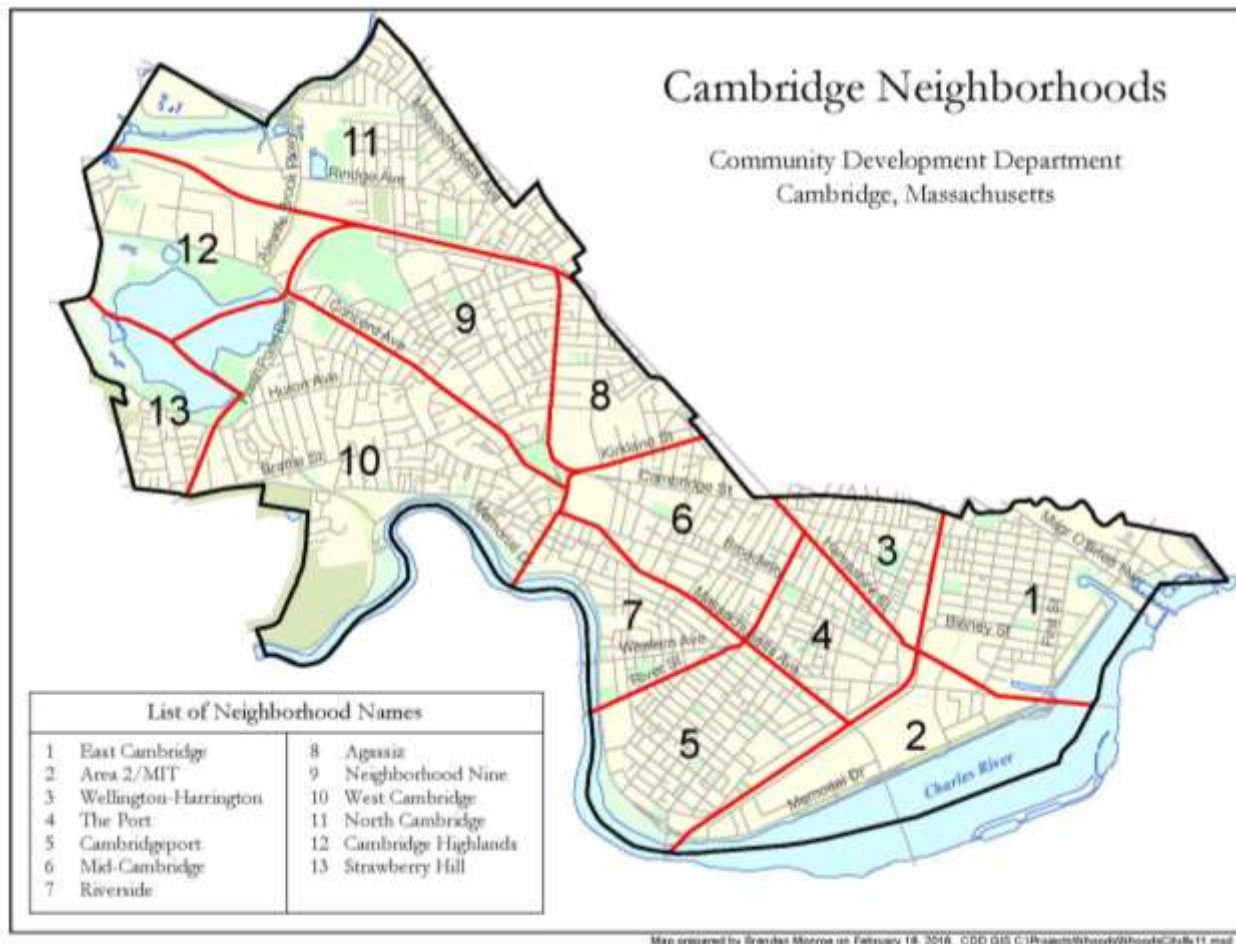
We randomly selected residential addresses in each neighborhood to determine available service and advertised pricing. We used the same addresses in each neighborhood when checking provider offerings, but in all cases, for the random addresses we checked, we only found offers from Comcast and Verizon DSL. (We obtained pricing and service tiers from Starry and NetBlazr by calling company representatives.)

In general, Comcast offered myriad plans and tended to promote bundles; their upload speeds were far slower than those of the fixed wireless providers, and the prices generally increased after 12 or 24 months. Verizon DSL offered just one price tier, though its advertised DSL speed was slower at some addresses than others, and there were some inconsistencies in reported service availability. We noted that Comcast's entry level plan (the Performance Starter plan) occasionally advertised 15 Mbps download speeds, not 25 Mbps download, at the same address and for the same price.

4.1.2 Comcast offers many service tiers, but most have modest upload speeds and many include sharp price increases after promotional periods end

We noted consistent service levels and pricing from Comcast across neighborhoods. But upload speeds were not easy to find on the Comcast website and, when we did find them, they were relatively slow: 5 Mbps on the entry-level plans, only reaching 10 Mbps if you took a 300 Mbps download plan. Though these speeds technically meet the FCC's definition of "broadband," upload speeds at this level are increasingly inadequate in an age when people and students are working and doing schoolwork from home and may need high-capacity video streams that work consistently.

Table 4: Comcast's Advertised Service Plans shows Comcast's advertised speeds for internet-only plans. Actual prices paid can be far higher if the consumer has selected bundled services and an initial promotional period has ended. And some consumers who may be eligible and have applied for the company's Internet Essentials program pay just $10 a month, as described in the next section, where we discuss low-cost plans for eligible consumers.

We note again that on January 1, 2021, Comcast increased prices $3 on all of these plans other than "Performance Starter" and "Gigabit Pro." These increased rates are not reflected in the table below or in the screenshots provided elsewhere in this report, because this data was collected in 2020. The updated rate card is provided in Appendix D.

Table 4: Comcast's Advertised Service Plans in Cambridge

Package	Internet Speed	Monthly Price	Notes
Performance Starter	25/5 Mbps	$49.95	No term agreement required; pricing does not include a router. Regular rate is $54.95/month.
Performance Internet	100/5 Mbps	$77.95	No term agreement required; pricing does not include a router.
Performance Pro	200/5 Mbps	$39.99 for the first 12 months, then $92.95	No term agreement required; pricing does not include a router. Regular introductory rate is $49.99/month for the first year. $39.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.
Blast! Internet (with one-year term agreement)	300/10 Mbps	$59.99 for the first 24 months, then $97.95	One-year term agreement required; pricing does not include a router. Regular introductory rate is $69.99/month for the first 24 months. $59.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.

Package	Internet Speed	Monthly Price	Notes
Blast! Internet (with no term agreement)	300/10 Mbps	$69.99 for the first 12 months, then $97.95	No term agreement required; pricing does not include a router. Regular introductory rate is $79.99/month for the first 12 months. $69.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.
Extreme Pro Internet (with one-year term agreement)	600/15 Mbps	$69.99 for the first 24 months, then $102.95	One-year term agreement required; pricing does not include a router. Regular introductory rate is $79.99/month for the first 24 months. $69.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.
Extreme Pro Internet (with no term agreement)	600/15 Mbps	$79.99 for the first 12 months, then $102.95	No term agreement required; pricing does not include a router. Regular introductory rate is $89.99/month for the first 12 months. $79.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.
Gigabit (with two-year term agreement)	1,000/35 Mbps	$79.99 for the first 24 months, $89.99 for months 25-36, then $107.95	Two-year term agreement required; pricing does not include a router. Regular introductory rate is $89.99/month for the first 36 months. $79.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.
Gigabit (with no term agreement)	1,000/35 Mbps	$89.99 for the first 12 months, then $107.95	No term agreement required; pricing does not include a router. Regular introductory rate is $99.99/month for the first 12 months. $89.99 rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months.
Gigabit Pro	2/2 Gbps	$299.95	Two-year term agreement required; pricing does not include a router.

In conducting pricing research, CTC observed an inconsistency in advertised download speeds for Comcast's slowest internet package, the Performance Starter package. While the package usually advertised download speeds of 25 Mbps, occasionally the package advertised 15 Mbps download speeds for the same price. The two versions of the package were sometimes displayed at different times for the same address. This inconsistency is documented in Figure 19 and Figure 20 below.

Figure 19: Comcast's Performance Starter Package Advertises 25 Mbps Download Speeds at an Address in Neighborhood 6
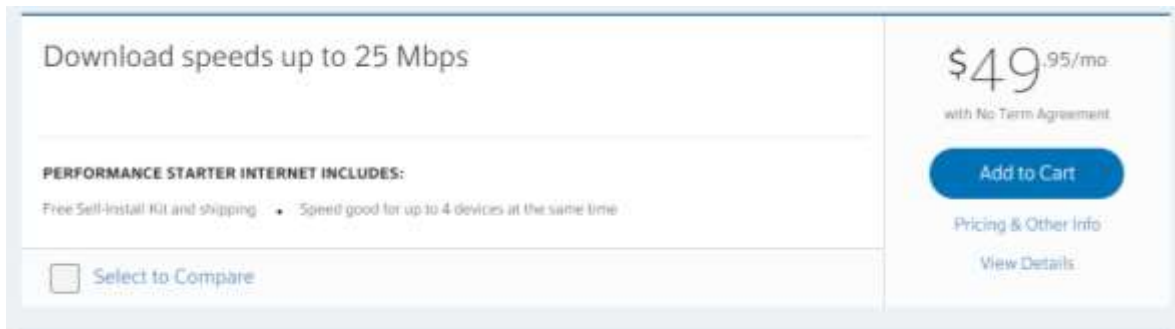
Figure 20: Comcast's Performance Starter Package Advertises 15 Mbps Download Speeds at the Same Address in Neighborhood 6

4.1.3 Verizon DSL prices are consistent, but speeds are extremely low and vary by address

Verizon offers DSL residential internet services in a phone-bundled package for $40 plus a required phone service for $29.99, for a total of $69.99. (As noted above, given the very limited available of Verizon FiOS service, we did not research FiOS pricing.) While Verizon only offers a single internet package with one price structure, at the time of CTC's pricing research in August 2020, the package offered different speeds at different addresses, and two addresses did not have any Verizon DSL service. At the time of our research in August, at the addresses we checked in neighborhoods five, seven, eight, and nine, Verizon offered DSL service of "up to 3.1–7 Mbps." But at the addresses in neighborhoods one, three, four, ten, eleven, and twelve, the advertised speed associated with the same price was an even slower "up to 1.1–3 Mbps." Table 5 shows the differences between the two packages offered at different addresses.

Table 5: Verizon DSL Internet Plan Speeds Differ by Address

Package	Internet Speed	Monthly Price	Notes
High-Speed Internet	1.1 – 3 Mbps; available at addresses in neighborhoods one, three, four, ten, eleven, and twelve in August 2020	$40 for internet service; $69.99 with required phone add-on	No annual contract is required; pricing does not include a router
High-Speed Internet	3.1 – 7 Mbps; available at addresses in neighborhoods five, seven, eight, and nine in August 2020	$40 for internet service; $69.99 with required phone add-on	No annual contract is required; pricing does not include a router

Figure 21 and Figure 22, below, are screengrabs documenting that Verizon offered different speeds in different areas of Cambridge—sometimes 1.1–3 Mbps, sometimes 3.1–7 Mbps—at the same price. Figure 23 documents the lack of available Verizon service—even DSL—at the addresses we checked in neighborhoods six and thirteen.

Figure 21: Verizon DSL Offered "up to 1.1 – 3 Mbps" at the Single Addresses We Checked in Neighborhoods 1, 3, 4, 10, 11 and 12 in August 2020
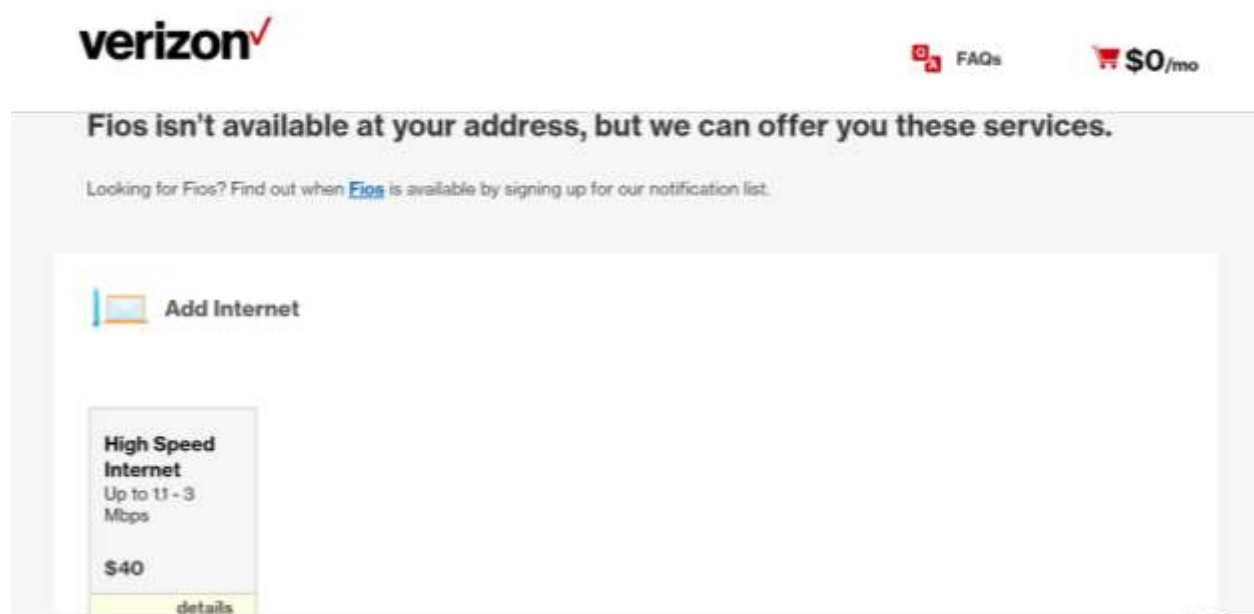
Figure 22: Verizon DSL Offered "up to 3.1 – 7 Mbps" at the Single Addresses We Checked in Neighborhoods 5, 7, 8, and 9 in August 2020
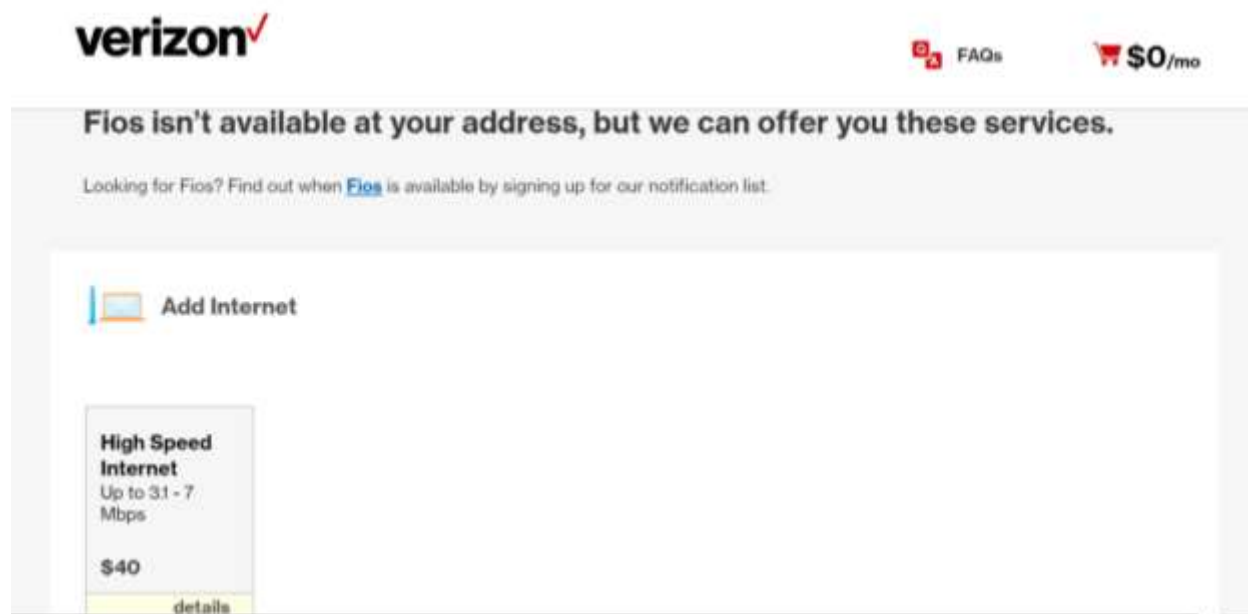
Figure 23: Verizon DSL Was Not Available at an Address in Neighborhood 6 and an Address in Neighborhood 13 in August 2020
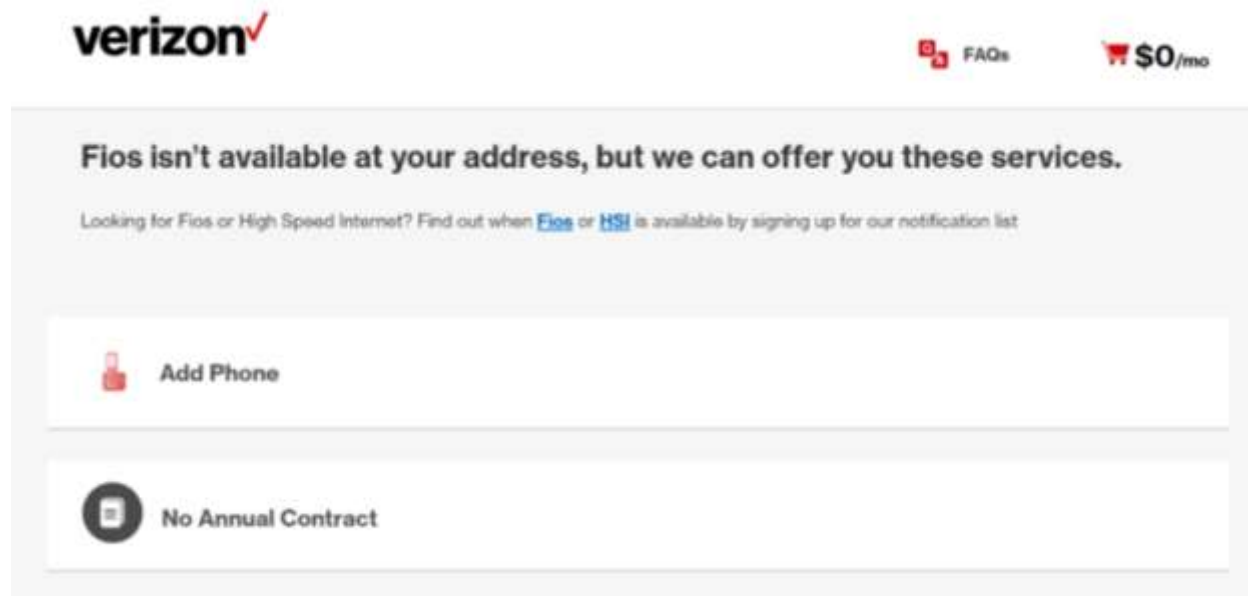
When checking service availability again at the same address for neighborhood 13 in December 2020, the Verizon website reported both that there was 0.5-1 Mbps DSL service available, and that no DSL internet service was available at the address at different times on the same day.

Figure 24 and Figure 25 document this inconsistency in reported availability at the same address on the same day.

Figure 24: Verizon DSL Availability at an Address in Neighborhood 13 in December 2020
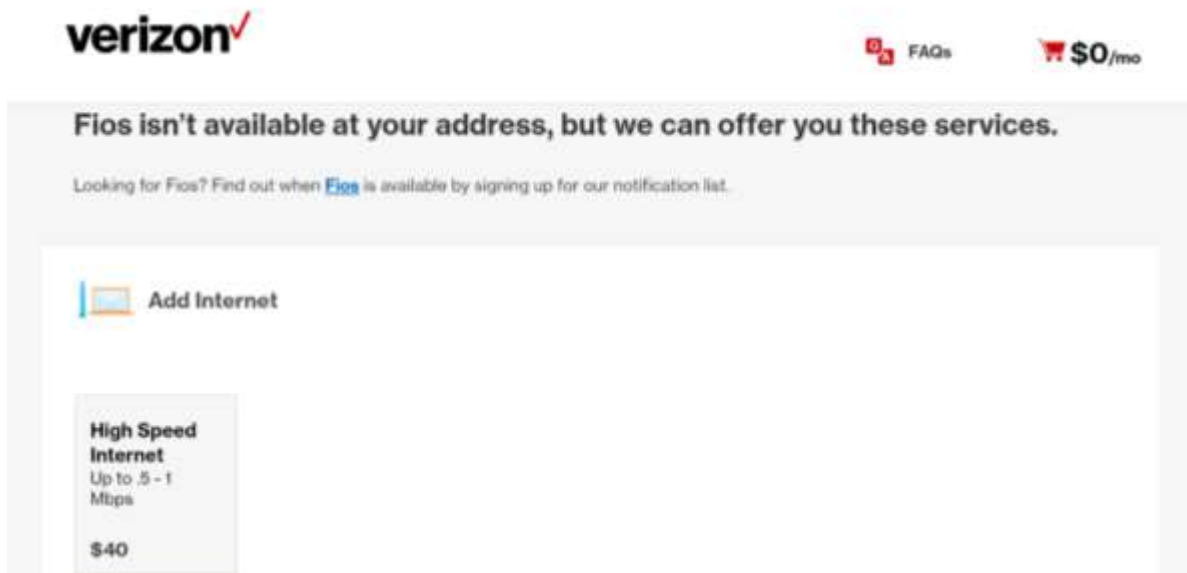
Figure 25: Verizon DSL was Reported Unavailable at the Same Address in Neighborhood 13 on the Same Day in December 2020
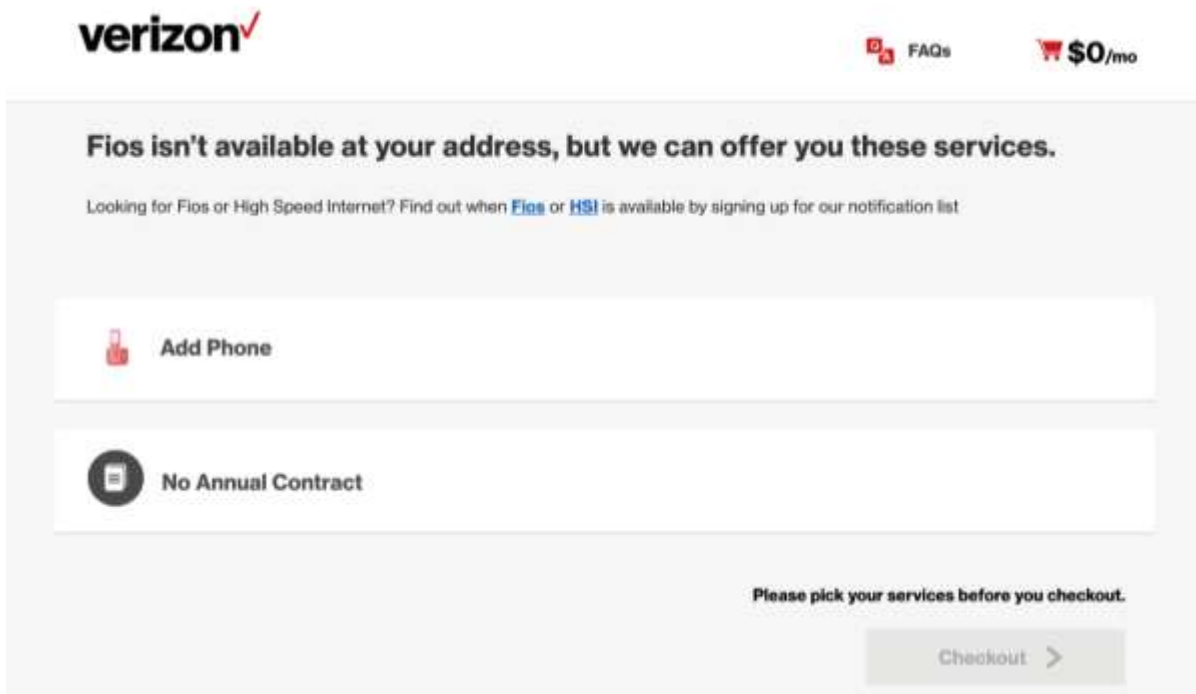
4.1.4 NetBlazr and Starry offer consistent pricing and symmetrical speeds, but availability is limited

The pricing tiers of NetBlazr's and Starry's service are simple and clear, and unlike Comcast, the service levels are symmetrical. Table 6 shows NetBlazr's pricing and speed tiers, including its lower pricing for eligible low-income consumers.

Table 6: NetBlazr Services and Monthly Pricing

Service Offering	Pricing	Monthly Price Reflecting Low-Income Discount
500/500 Mbps (requires ethernet wiring in building)	$60 (or $50 per month if customer makes one-time $600 annual payment)	$40
200/200 Mbps	$40	$20
100/100 Mbps (building with Cat 3 wiring)	$40	$20

Table 7 shows Starry's single speed tier—and its lower-cost price and speed tier for low-income consumers.

Table 7: Starry Services and Pricing

Service Offering	Monthly Price
Standard Plan 200/200 Mbps	$50
Low-Cost Plan (Starry Connect) 30/3 Mbps	$15

4.1.5 Starry and NetBlazr provide superior value over Comcast at midrange 200 Mbps plan

For consumers who have access to Starry or NetBlazr service—and who can make do with just internet service and then purchase video services separaely—Starry and NetBlazr provide a far superior value proposition at the mid-range 200 Mbps plan. Figure 26 compares offers from the three providers at this service tier—the only one allowing apples-apples comparisons, given that it's the only tier offered by Starry and one of two offered by netBlazr.

Figure 26: Comparing 200 Mbps Plans of Comcast, NetBlazr, and Starry

Provider	Advertised Download Speed	Advertised Upload Speed	Monthly Price
Comcast	200 Mbps	5 Mbps	$40 for the first 12 months, then $92.95[21]
NetBlazr	200 Mbps	200 Mbps	$40
Starry	200 Mbps	200 Mbps	$50

4.2 Analysis of low-cost services and subsidy programs available to eligible residents

The most important low-cost broadband service in Cambridge is Comcast's $10 Internet Essentials program. Comcast is available to virtually all residences, and Internet Essentials is, in theory, available to virtually all low-income families in Cambridge who may be receive one of a number of forms of federal or other aid. This section analyzes data on Internet Essentials usage and describes the NetBlazr and Starry programs.

4.2.1 Comcast has improved its $10 Internet Essentials product for low-income residents in response to Covid-19, but barriers remain

Since 2011, Comcast has offered its Internet Essentials program as a step to help close the digital divide: Eligible low-income customers pay $9.95 per month (rounded to $10 in most references in this report) for a wired internet connection. In response to the Covid-19 crisis, Comcast offered two free months of service to new enrollees.[22] Internet Essentials also includes added benefits; customers can purchase a refurbished computer for $149.99,[23] and can access out-of-home Wi-Fi on Comcast's Wi-Fi hotspots across the country.[24]

A persistent criticism of the Internet Essentials program had been its slow speeds. However, in response to the Covid-19 pandemic, Comcast increased the program's connection speeds to the federal definition of broadband at 25 Mbps download, 3 Mbps upload—a welcome

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[21] The Comcast $40 ($39.99) rate reflects $10/month discount for enrolling in automatic payments and paperless billing; discount is available for the first 24 months. Regular rate is $50 ($49.99).

[22] "Internet Essentials," Comcast, https://www.internetessentials.com/ and "Internet Essentials: Staying Connected During Coronavirus," Comcast, https://www.internetessentials.com/covid19 (accessed September 21, 2020).

[23] Comcast, "Internet Essentials Programs."

[24] Comcast, "Internet Essentials Programs."

improvement.[25] Then, in early 2021, Comcast announced it was further increasing the speed to 50 Mbps download, 5 Mbps upload.

When the program started, Comcast only allowed families with children that qualified for the National School Lunch Program to apply. The company later expanded the program to four qualifying groups:[26]

- Families that have a child who qualifies for the National School Lunch Program (NSLP)

- Families that receive HUD housing assistance

- Low-income veterans who receive federal or state public assistance

- Seniors (62 years of age or older) who receive public or state assistance[27]

Then, in August 2019, Comcast announced a major expansion of its eligibility requirements—adding eight additional categories that will enable more low-income residents to acquire the service:

- Families who qualify for Medicaid

- Families who are approved for Supplemental Nutrition Assistance Program (SNAP) benefits

- Families who are eligible for Temporary Assistance for Needy Families (TANF)

- Families who are eligible for the Low-Income Home Energy Assistance Program (LIHEAP)

- Families who are eligible for the Women, Infants, and Children (WIC) program

- Families who are eligible for tribal assistance

- Families who have received a Federal Pell Grant from a local community college [Colorado and Illinois only]

- Families who have a family member who qualifies for Supplemental Security Income (SSI)

Even with the expanded eligibility requirements, however, Comcast stipulates that a customer of the Internet Essentials program must not have received service from Comcast within the past 90 days.[28] This makes it difficult for people who were paying for service to switch to the more affordable Internet Essentials plan (for example, if a job loss means that a customer now qualifies for the lower-cost service). Comcast did, however, temporarily suspend another requirement in

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[25] "Internet Essentials: Staying Connected During Coronavirus," Comcast, https://www.internetessentials.com/covid19 (accessed September 21, 2020).

[26] Comcast, "Internet Essentials Programs," 2019, https://www.internetessentials.com/ (accessed August 2019)

[27] This program is being offered on a trial basis and is not offered in Baltimore as of the writing of this report.

[28] Comcast, "FAQs," 2019, https://www.internetessentials.com/get-help (accessed June 2019).

response to Covid-19; eligible households that have an outstanding Comcast bill were able to enroll (through December 31, 2020), whereas before they would have been prevented from doing so until they paid their outstanding balance.

Comcast deserves credit for improving the Internet Essentials program, but barriers to participation clearly remain—and the low apparent utilization in Cambridge seem to suggest those barriers are high. Documented problems include a difficult application process and challenges with customer service. [29] Nationally, Comcast announced that the program has connected approximately two million homes[30]—only a portion of eligible households.

4.2.2 A review of Cambridge data sources shows that enrollment in Internet Essentials likely covers only a fraction of eligible City residents

In response to a request from CTC, Comcast furnished information about Internet Essentials enrollments in Cambridge each year through 2020 but did not furnish the total number of subscriptions now active. Use of this important resource appears to fall significantly short of the potential. The Cambridge Public Schools Department reports that 2,827 families with children in Cambridge schools were enrolled in the free or reduced lunch program in late 2019. There are 4,965 units of CHA or subsidized housing in the city – a rough (but not perfect) proxy for potential eligibility. We compared the Comcast numbers with the numbers of potentially eligible families. Figure 27 provides the results of this comparison.

Figure 27: Numbers of Internet Essentials connections in Cambridge, and Frames of Reference

Year	Comcast-Reported Number of $10 Internet Essentials Connections each year	Number of households with children receiving free/reduced school lunch	Number of CHA or subsidized housing units in Cambridge
2015	60		
2016	80		
2017	190		
2018	300		
2019	300		
2020	490		
Total as of December 2020	Not provided	2,827	4,965

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[29] Nicole Thelin, "Get Low Cost Internet from Comcast!," February 27, 2017, https://lowincomerelief.com/get-low-cost-internet-comcast/ (accessed June 2019).

[30] "Comcast Announces Largest Ever Expansion of Its Internet Essentials Program to Reach All Low-Income Americans," Business Wire, Aug. 6, 2019, www.businesswire.com/news/home/20190806005141/en/Comcast-Announces-Largest-Expansion-Internet-Essentials-Program (accessed August 2019).

There are other indicators of low uptake. Of the 443 residents who responded to our Citywide survey, only two said they were Internet Essentials customers. And of the CHA residents, fewer than one in four who were Comcast customers were enrolled in the program. Half of CHA Comcast customers who responded to our survey were unaware of its existence (though we note that the CHA has posted flyers in lobbies and taken other steps to increase awareness). Figure 28 provides this data.

Figure 28: CHA Tenant Responses to Survey Question About Participation in Comcast's $10 Internet Essentials Program
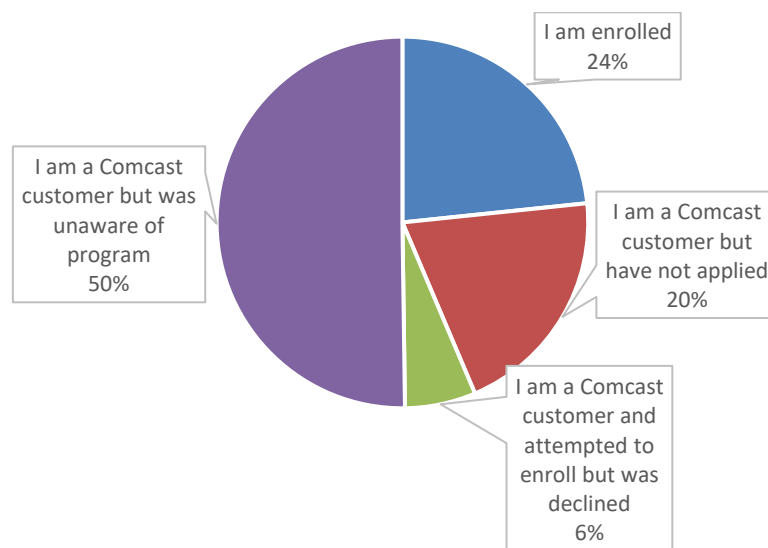
Jay Leslie, the CHA director of information technology, indicated in interviews with CTC that barriers to residents enrolling in Internet Essentials include a lack of awareness (in spite of efforts by the CHA) the requirement that there be a 90-day gap from an existing subscription, and the existence of past unpaid debts to Comcast.

Already the City of Cambridge has taken action in this area, setting up $50,000 fund to direct-pay subscriptions to families identified by the City's Human Services Programs.

4.2.3 Starry and NetBlazr also offer low-cost programs but did not disclose the total number of enrollees in Cambridge

Starry and NetBlazr also have subsidy programs. Starry offers a single $15 plan with 30 Mbps download, 3 Mbps upload for low-income consumers, called Starry Connect. Starry told us that 21,000 units are enrolled in the low-income program in the five cities it serves nationwide, including 3,000 units in the Boston metro area. However, it would not share any Cambridge-specific data of any kind.

Starry's eligibility structure removes the burden of proof from the individual. For example, the company requires no credit checks or documentation of eligibility (for example, that the resident is enrolled in food assistance or other benefit programs) in order to sign up for Starry Connect. Any resident in a building that meets one of the following criteria is eligible:

- Is a public housing authority building
- Is in a community that is at least 90 percent subsidized by federal, state, or local programs
- Is rent or income regulated
- Is workforce development housing.

NetBlazr's low-cost program structure consists of a lower price; $20 lower than the regular price for its standard plans. NetBlazr says it offers this reduced pricing at any affordable housing complex it services. It also allows customers who are in a deeded affordable unit in market rate housing to access this pricing. Table 8 provides NetBlazr's low-cost program information; Table 9 provides information on Starry's one low-cost program.

Table 8: NetBlazr's Monthly Pricing for Low-Income Consumers

Service	Cost
500/500 Mbps (requires ethernet wiring in building)	$40
200/200 Mbps	$20
100/100 Mbps (building with Cat 3 wiring)	$20

Table 9: Starry low-cost plan and pricing

Service Offering	Speed	Cost
Starry Low-Cost Plan (Starry Connect)	30/3 Mbps	$15 per month

NetBlazr now serves the Millers River Apartments on Lambert Street and the Roosevelt Mid-Rise Towers site on Cambridge Street. The presence of NetBlazr means residents of these buildings have as choice of providers, Comcast or NetBlazr, and access to their respective low-cost programs. However, as noted above, NetBlazr says it has received subscriptions for only a handful of customers at the Roosevelt mid-rise since it started service in 2016, despite offering a 100Mbps symmetrical service to residents for $20 monthly. With respect to Millers River, NetBlazr says it has no subscriptions because the building is undergoing renovations. Figure 29 shows these sites.

Figure 29: Cambridge Housing Authority Sites Newly Served by NetBlazr

Millers River Apartments, Lambert Street

Roosevelt Towers Mid-Rise, off Cambridge Street

And Starry serves 364 Rindge Avenue, which includes subsidized apartments, and we are aware of at least one subsidized rental unit tenant who is using Starry (see resident interviews); this tenant pays $15 per month for a 30 Mbps download, 3 Mbps upload "Starry Connect" service and expressed satisfaction with that service. Figure 30 shows this location.

Figure 30: Rindge Towers at 364 Rindge Avenue Are Now Served by Starry
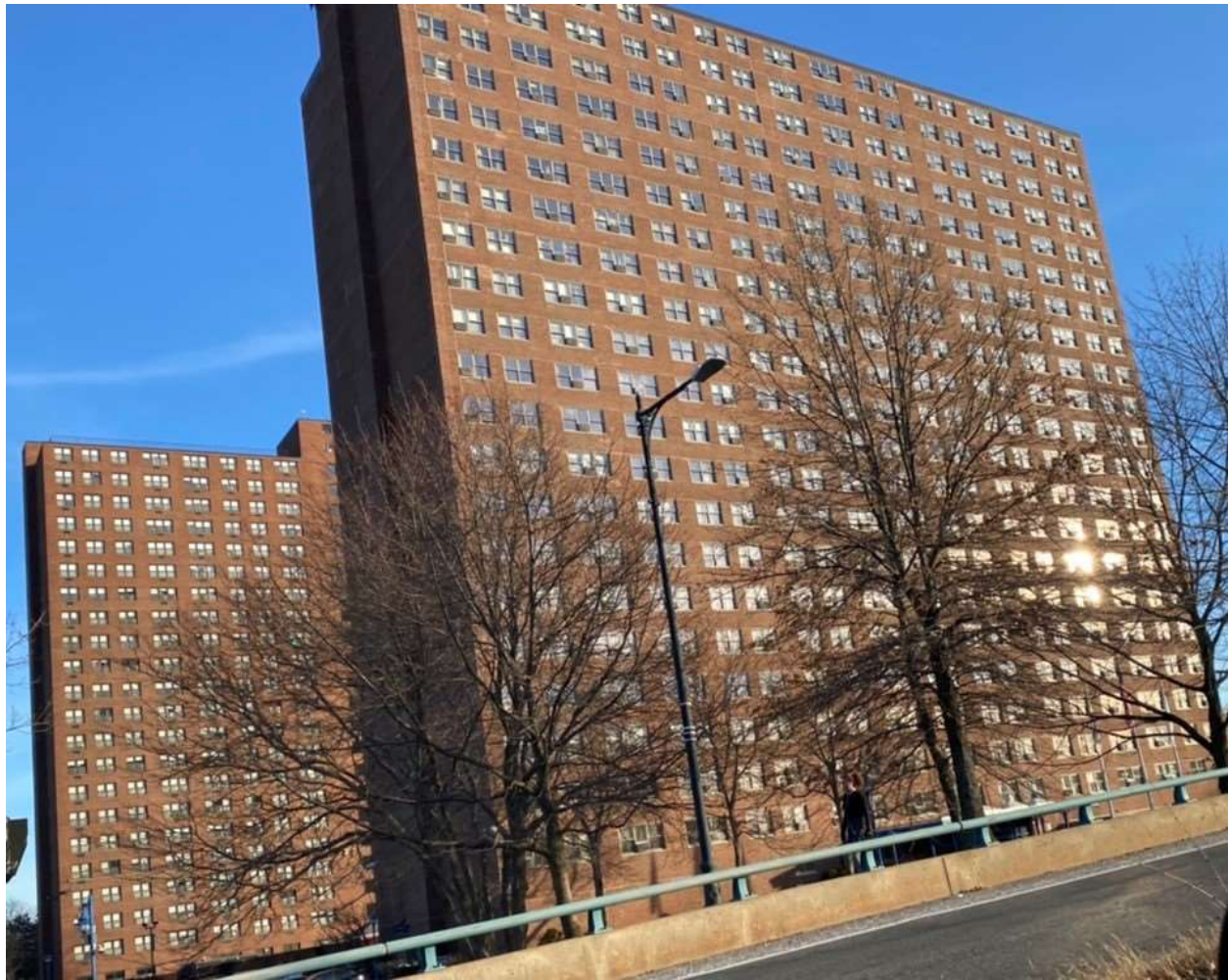
4.2.4 Relatively few residents appear to obtain the federal Lifeline $9.25 monthly subsidy in Cambridge

The federal Lifeline program provides a subsidy of up to $9.25 per month for broadband or voice service (landline or cellular) for qualifying low-income individuals and recipients of other federal assistance such as the Supplemental Nutrition Assistance Program and Medicaid.[31] The income threshold is based on a percentage of federal poverty levels and varies by the size of a household. In 2020, a single-person household with income of $17,226 or less would qualify; a four-person household with income of $35,370 or less would qualify.[32]

Administered for the Federal Communications Commission by the Universal Service Administrative Company (USAC, the same entity that oversees the E-rate subsidy program for

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[31] https://www.lifelinesupport.org/do-i-qualify/ (accessed August 10, 2020).

[32] "Check your eligibility for the Lifeline Program," Massachusetts Department of Telecommunications and Cable, https://www.mass.gov/service-details/check-your-eligibility-for-the-lifeline-program (accessed August 10, 2020).

schools and libraries), Lifeline participation levels are tracked through the National Lifeline Accountability Database (NLAD). Once a customer has qualified for Lifeline and requests service, "their service provider must enroll them in the program" through the NLAD.[33] The NLAD is only accessible to service providers and state agencies.[34]

In our Cambridge Housing Authority survey, we found that relatively few Cambridge residents are taking advantage of this program. Figure 31 depicts this data.

Figure 31: CHA Tenant Responses When Asked if They Receive a $9.25 Subsidy Under the FCC's Lifeline Program
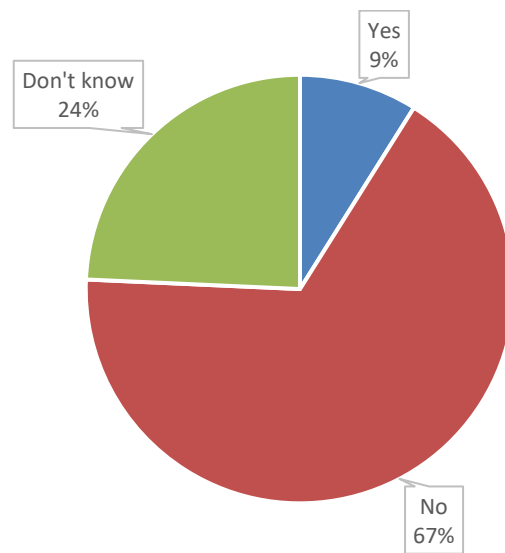
We requested Lifeline participation data for the Cambridge market but were informed by USAC that city-level data are not publicly available.[35] If Cambridge follows state or national trends (and our survey data tends to show it does), relatively few eligible households receive the Lifeline subsidy—because Lifeline serves only a fraction of eligible households in Massachusetts and nationwide.[36] According to the most recent USAC data, in 2018 only 18 percent of eligible Massachusetts residents—about 168,000 out of 925,000 eligible residents—participated in Lifeline. In the same year, participation among eligible residents in the 50 states, the District of Columbia, and Puerto Rico was only 25 percent.[37]

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[33] https://www.usac.org/lifeline/enrollment/ (accessed August 10, 2020).

[34] https://www.usac.org/lifeline/enrollment/national-lifeline-accountability-database-nlad/account-types/ (accessed August 10, 2020).

[35] USAC service center email to CTC in response to information request, August 13, 2020.

[36] https://www.usac.org/lifeline/ (accessed August 10, 2020).

[37] "Program Data: Lifeline Participation," USAC, https://www.usac.org/lifeline/learn/program-data/ (accessed August 10, 2020).

At both the state and national levels, too, the Lifeline participation numbers have been on a downward trajectory. Massachusetts residents' participation dropped 23 percent in 2016; the national participation level dropped from 33 percent that year.[38]

One reason for the low participation levels nationwide may be the difficulties that eligible residents face in signing up for the program; the New America Foundation recently documented these challenges.[39] The Commonwealth of Massachusetts reduces the hurdle, if only marginally, by presenting clear and concise information about Lifeline—and a consumer hotline telephone number—on the Department of Telecommunications and Cable website.[40] And for Cambridge residents who are eligible and are able to get over the hurdles of enrolling, 39 companies offer Lifeline-eligible service in Cambridge, according to USAC's open data portal.[41]

4.3 Analysis of FCC Form 481 and annual rate survey data

The FCC annually collects information on ISP pricing through two different vehicles. The first is an annual rate survey, which is used to create benchmarks for broadband pricing for recipients of certain subsidies, particularly for high-cost support under the Universal Service Fund. A sample is gathered from both incumbents and non-incumbents. In addition, every incumbent eligible telecommunications carrier (ETC) that receives these subsidies is annually required to submit information about its pricing down to the exchange level on the Form 481.

These datasets would allow for comparison of pricing in Cambridge and in other parts of the country for subsidized incumbent telecommunications carriers with a national footprint such as Verizon.[42] To our knowledge, the Form 481 and annual rate survey data have never been released publicly by the FCC; as stated in our proposal we did request these data for the Cambridge market from USAC but, as with the Lifeline data, were informed that no city-level datasets are publicly available.[43]

It is not clear to use that this information would have added considerable value. We were able to collect Verizon DSL pricing data and make the straightforward conclusion that the speeds are grossly inadequate and the pricing very high for the speeds delivered.

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[38] 201911113_Lifeline-Data-and-Statistics.xls, downloaded from "Program Data: Lifeline Participation," USAC, https://www.usac.org/lifeline/learn/program-data/ (accessed August 10, 2020).

[39] https://www.newamerica.org/weekly/lifeline-low-income-americans/ (accessed August 10, 2020).

[40] https://www.mass.gov/service-details/lifeline-services, https://www.mass.gov/how-to/apply-for-a-discounted-communications-service-through-the-lifeline-program (accessed August 10, 2020).

[41] https://opendata.usac.org/browse?category=Lifeline&limitTo=datasets (accessed August 10, 2020).

[42] We note that, if the datasets were available, they would be incomplete, because the forms are required only of subsidized incumbent telecommunications carriers (such as Verizon) and not cable operators (such as Comcast) or other non-incumbent ISPs.

[43] USAC service center email to CTC in response to information request, August 18, 2020.

4.4 Analysis of U.S. Census survey data on broadband and income provides another confirmation that lower family income is correlated with lower residential broadband adoption

Although the survey data we produced in Cambridge is of a far more granular and useful level, we also reviewed American Community Survey data,[44] collected by the U.S. Census bureau, and analyzed how consumer decisions to take home broadband subscriptions relate to family income. We plotted census tracks in Cambridge to see how many respondents reported having a home broadband subscription (Figure 32).

Figure 32: U.S. Census Data – Households with a Broadband Subscription
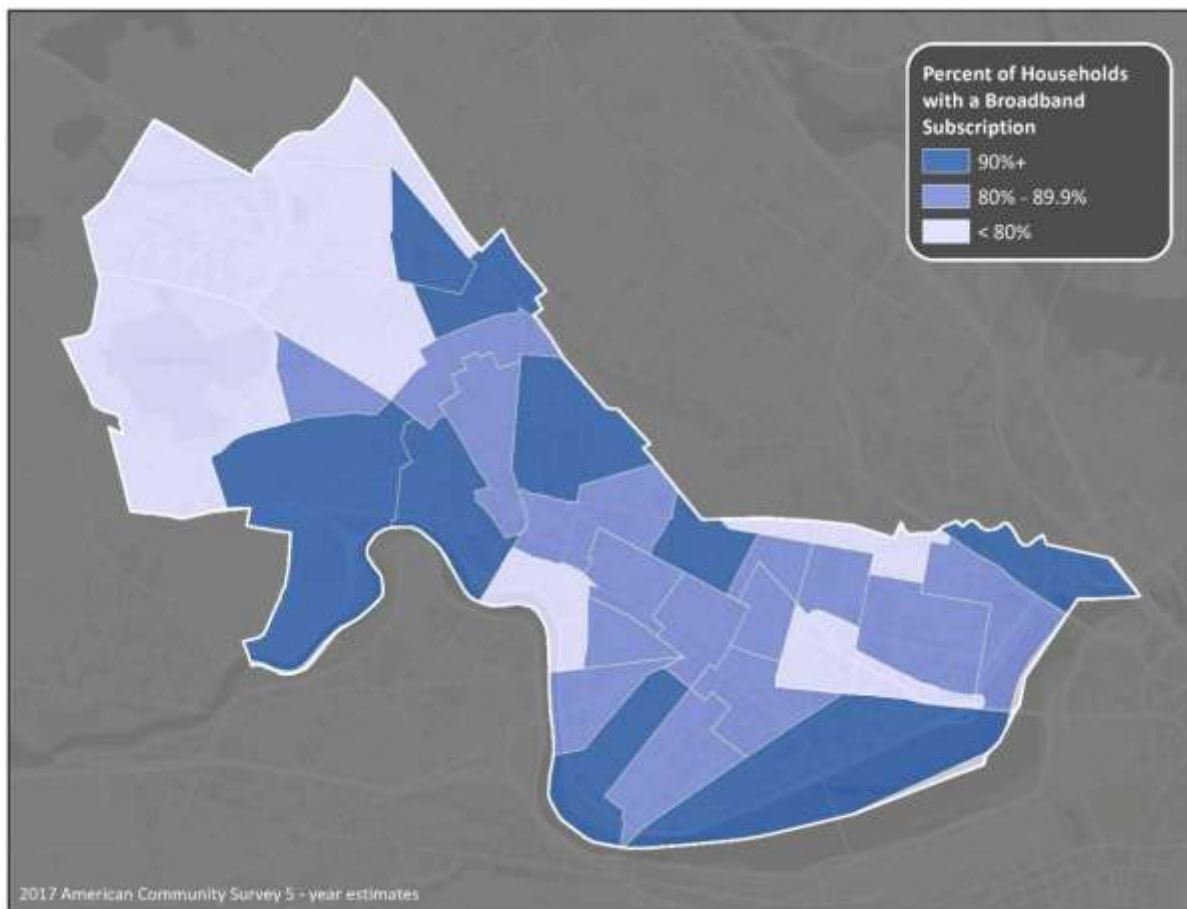
We then plotted how the choice to subscribe lined up with family income, and found that lower family incomes is strongly associated with having no home broadband scubscription (Figure 33).

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[44] "American Community Survey," U.S. Census Bureau, https://www.census.gov/programs-surveys/acs/about.html

Figure 33: Correlation of Family Income and Lack of Internet Service
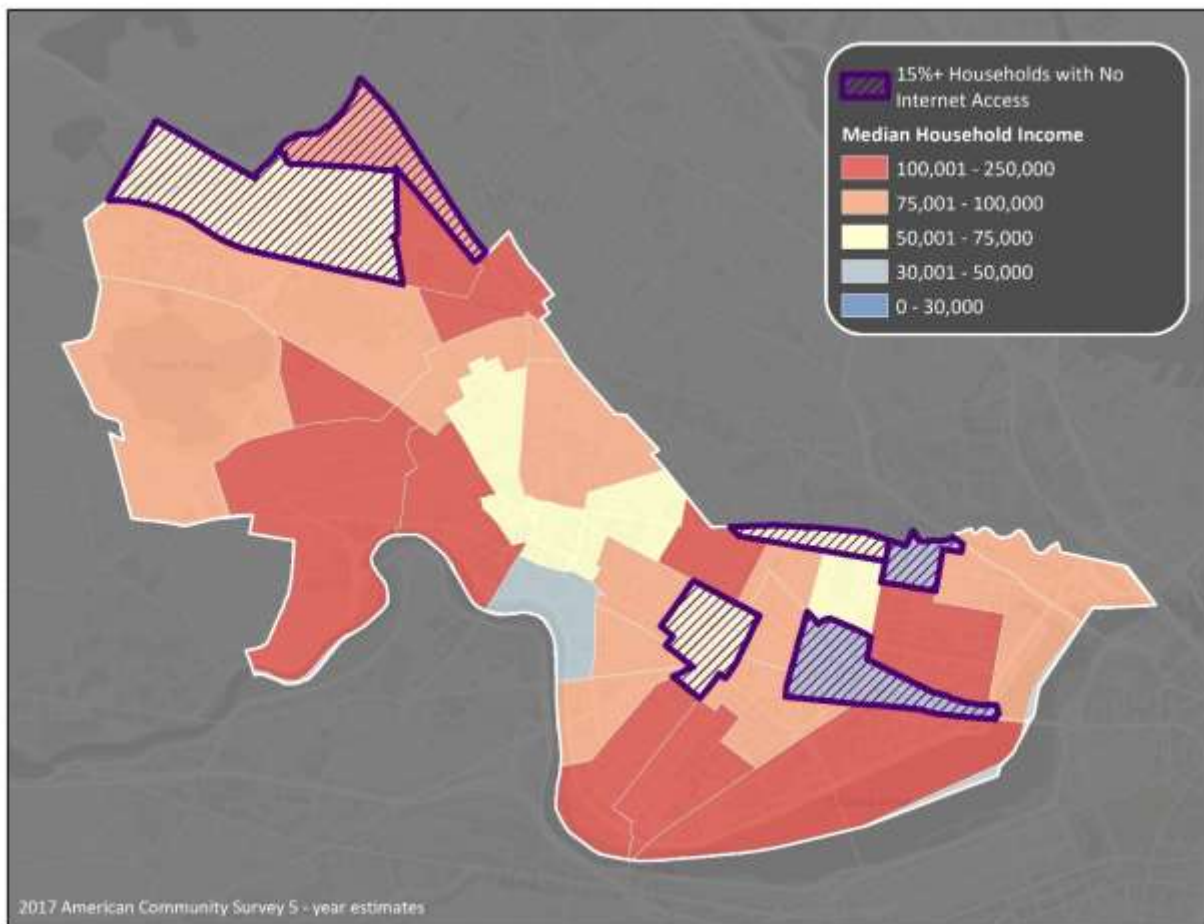
4.5 Lower-income Cambridge residents are more likely to use a mobile/cellular subscription as their only internet service

While our analysis was about the four fixed residential providers mentioned above (Comcast, Verizon, NetBlazr, and Starry), some users rely on mobile plans without also getting a fixed home broadband subscription. Our surveys found that lower-income residents are more likely to rely exclusively on mobile-only subscriptions. This can put these residents at a disadvantage, given that a mobile service is less reliable than fixed residential broadband subscription and that working with documents and spreadsheets is not as easily done on a smartphone as on a larger device. Table 10 provides our survey findings on this point; 18 percent of the lower-income residents surveyed in the CHA survey relied exclusively on a mobile/cellular plan, compared to only 5 percent of the citywide sample of residents.

Table 10: Percent of Cambridge Residents Using a Mobile/Cellular Broadband as Their Only Service

Surveyed Population	Percent who Use Only a Mobile/Broadband Subscription
Sample of all Cambridge Residents	5 percent
Sample of all Cambridge Housing Authority or subsidized housing residents	18 percent

Low-income and price-sensitive consumers are more likely to depend on mobile service – a fact that the survey data in Cambridge confirm. But larger shifts toward mobile services and somewhat away from fixed residential plans are evident nationwide. Data show that the proportion of American adults with high-speed broadband service at home increased steadily from 2000 to 2016, when 73 percent of U.S. residents had broadband service at home (meaning, a service other than their mobile/cellular plan). But as of the beginning of 2018, adoption had dipped from 73 percent to 65 percent, according to survey data while, at the same time, the number of people who only took a mobile/cellular plan grew from 12 percent in 2016 to 20 percent in 2018.[45]

This trend could increase if the wireless industry changes its pricing and data cap structures and becomes more competitive with wireline services for more consumers. For example, Comcast is using its cable infrastructure as a backbone platform for a Wi-Fi based mobile service. Signals are distributed largely by the Wi-Fi routers in residential cable customers' homes, supplemented by Wi-Fi routers that are placed on the operators' outside plant (OSP) infrastructure, usually midspan between poles. The aggregated Wi-Fi infrastructure effectively forms a mesh network that acts as a platform for wireless service.

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[45] http://www.pewinternet.org/fact-sheet/internet-broadband/, accessed October 2018

5 Citywide Mail Survey Report

As part of its efforts to perform a comprehensive evaluation of broadband gaps—in access, affordability, and skills—affecting low-income and other populations, the City of Cambridge conducted a statistically-valid mail survey of residents in 2019 (see Appendix A).

The survey was intended to do two things. First, it was intended to gather basic data about the types of services to which Cambridge residents subscribe, use of these services, and willingness to switch to alternatives. Second, it was designed to provide insights into questions of access, affordability, and ability to use broadband effectively, including by asking about price sensitivity, self-assessment of internet skills, and acquisition of subsidized services.

The survey brought forth useful insights on its own. But it will also serve as a baseline against which later face-to-face interviews (using the same questions) with segments of the population may be compared to identify gaps and inform the development of City strategies.

Key findings include:

- Residents are highly connected, with 96 percent of households having some form of internet connection. Specifically, 90 percent of residents have home internet service and 86 percent have a cellular/mobile telephone with internet. Only four percent lack any form of access to the internet at home.

- Eight in 10 respondents have a cable modem internet connection, which means they use Comcast, while other connection types represent much smaller shares of the Cambridge market: six percent use fixed wireless, four percent use fiber, and three percent use DSL.

- Only two of the 443 respondents reported taking advantage of Internet Essentials, the Comcast subsidized service. Given that 69 respondents reported having family incomes of $75,000 or less, and 35 of these had family incomes of $50,000 or less, these responses may suggest a significant underutilization of Internet Essentials by eligible families in Cambridge. The face-to-face interviews will further explore this topic.

- Respondents with a household income of less than $100,000 are less likely than those in higher income households to describe themselves as skilled in uploading content, blocking spam or unwanted content, creating content using computers and the internet, and accessing a bank account online. This data points to a skills gap for lower-income residents.

- Those ages 55+ and those earning under $100,000 annually are less likely than their counterparts to have some form of internet access at their home. Specifically, 66 percent of the < $50k subgroup and 79 percent of the < $75k subgroup have internet access, compared with 96 percent of all respondents.

- Five percent of all respondents, and 11 percent of those earning under $100,000 annually, only use a smartphone for home internet access. This may limit their ability to fully utilize online services at home.

- Respondents with just one type of internet connection (either a home internet connection or a smartphone only) are disproportionately lower income. Respondents with both types of connections have a higher household income. Specifically, 64 percent (14 of 21) respondents with a smartphone only for internet access earn under $100,000 per year (four earn under $75,000 per year), compared with 31 percent of all respondents. Also, 51 percent (20 of 38) respondents with only a home internet connection (no smartphone) earn under $100,000.

- Households earning under $100,000 per year are less likely than higher income households to <u>frequently</u> use their *home internet connection* for connecting to a work computer and accessing home security/other 'smart home' devices, and they are more likely to frequently use their home internet connection for social media and accessing educational resources.

- Households earning under $100,000 per year are less likely than higher income households to <u>frequently</u> use their *cellular/mobile internet connection* for online shopping, and they are more likely to frequently use their cellular/mobile internet service for accessing educational resources.

- Seven in 10 respondents have jobs that require home internet access, and 45 percent of household members currently telework. Overall, 55 percent of households use the internet for educational purposes.

- Households earning under $150,000 are less likely than higher income households to need internet access for work; however, this group also has a higher share of respondents ages 55+. When controlling for respondent age, the low-income group has as high of a need for internet access as do higher income individuals.

- Overall, there is strong support for ensuring access to competitively priced broadband services, with 79 percent strongly agreeing. One-third of respondents disagreed or strongly disagreed that the market currently offers affordable high-speed internet.

- Respondents indicated some willingness to purchase 100 Mbps or 1 Gbps internet service, especially at monthly prices lower than $90 per month. Specifically, 81 percent would be extremely willing to purchase 100 Mbps internet service for $50 per month, and 88 percent would be extremely willing to purchase 1 Gbps internet service at this same price point. Additionally, 42 percent would be extremely willing to purchase 100 Mbps internet service for $70 per month, and 59 percent would be extremely willing to purchase 1 Gbps internet service for $70 per month. Willingness to switch drops sharply at higher price points.

5.1   Survey process

A total of 3,000 survey packets were mailed first-class in September 2019 to a random selection of residential households with a goal of receiving at least 450 valid responses. Recipients were provided with a postage-paid business reply mail envelope in which to return the completed questionnaire.

A total of 443 useable surveys were received by the date of analysis[46], providing a gross[47] response rate of 14.5 percent. The margin of error for aggregate results at the 95 percent confidence level for 443 responses is ±4.6 percent, within the initial sample design criteria. That is, for questions with valid responses from all survey respondents, one would be 95 percent confident (19 times in 20) that the survey responses lie within ±4.6 percent of the target population as a whole (roughly 44,000 households in the City of Cambridge).

The survey responses were entered into SPSS[48] software and the entries were coded and labeled. SPSS databases were formatted, cleaned, and verified prior to the data analysis. Address information was merged with the survey results using the unique survey identifiers printed on each survey. The survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions. Statistically significant differences between subgroups of response categories are highlighted and discussed where relevant.

The survey responses were weighted based on the age of the respondent. Since older persons are more likely to respond to surveys than younger persons, the age-weighting corrects for the potential bias based on the age of the respondent. In this manner, the results more closely reflect the opinions of the City's adult population.

Table 11 and Figure 34 summarize the weighting used for survey analysis.

Table 11: Age Weighting

Age Cohort	Census Population (Adult)	**Survey Responses	Weight
18-34	57,891	101	2.51
35-44	13,284	70	0.83
45-54	9,289	62	0.66
55-64	4,352	72	0.26
65+	12,513	121	0.45
Total	97,329	426	
**Not all respondents provided their age.			

[46] At least 25 responses were received after analysis had begun and are not included in these results.
[47] 211 surveys were undeliverable, mostly to vacant residences. The "net" response rate is 434/(3,000-211) = 15.6%.
[48] Statistical Package for the Social Sciences (http://www-01.ibm.com/software/analytics/spss/)

Figure 34: Age of Respondents and Adult Population
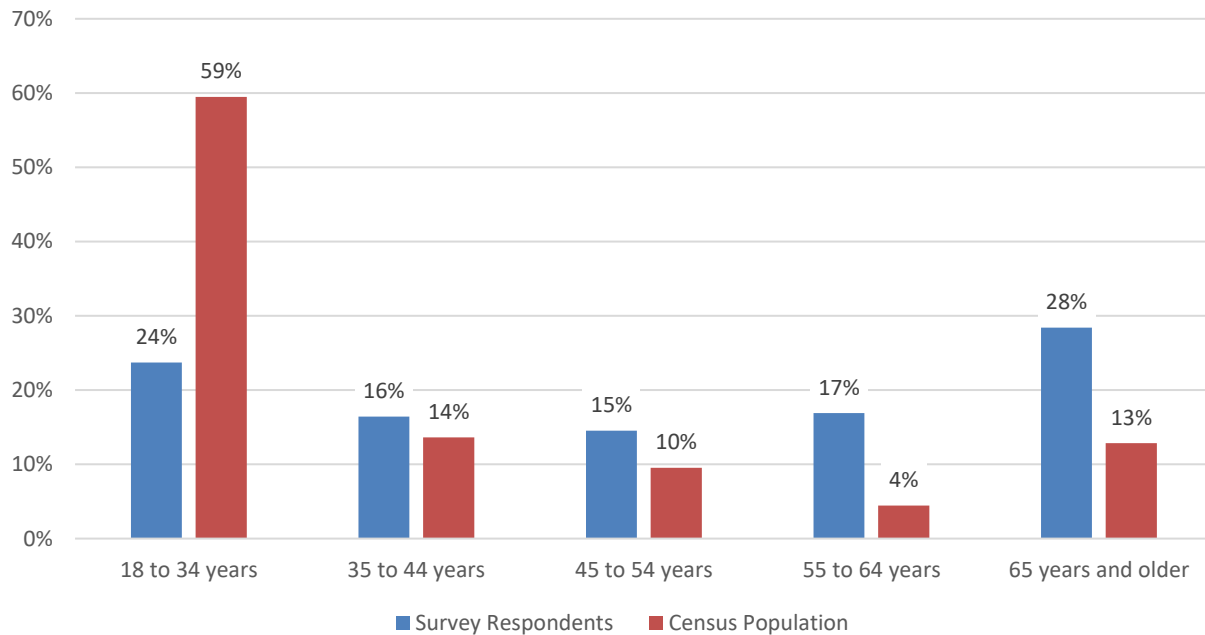
The following sections summarize the survey findings.

5.2   Survey results

The results presented in this report are based on analysis of information provided by 443 respondents from an estimated 44,000 residences in the City of Cambridge. Results are representative of the set of households with a confidence interval of ±4.6 percent at the aggregate level.

Unless otherwise indicated, the percentages reported are based on the "valid" responses from those who provided a definite answer and do not reflect individuals who said "don't know" or otherwise did not supply an answer because the question did not apply to them. Key statistically significant results ($p \leq 0.05$) are noted where appropriate.

5.2.1   Home internet connection and use

Respondents were asked about their home internet connection types and providers, use of the internet for various activities, and satisfaction and importance of features related to internet service. This information provides valuable insight into residents' need for various internet and related communications services.

5.2.1.1   Communications services

Respondents provided information about the communications services currently purchased for their household. As illustrated in Figure 35, almost all households have internet access, including nine in 10 with internet service in the home and 86 percent with cellular/mobile telephone

service with internet. Fewer households have cable/satellite television service, landline telephone service, or home internet service (excluding cellular/mobile). Overall, 96 percent of respondents indicated having some internet access—either a home connection or via smartphone.

Figure 35: Communication Services Purchased
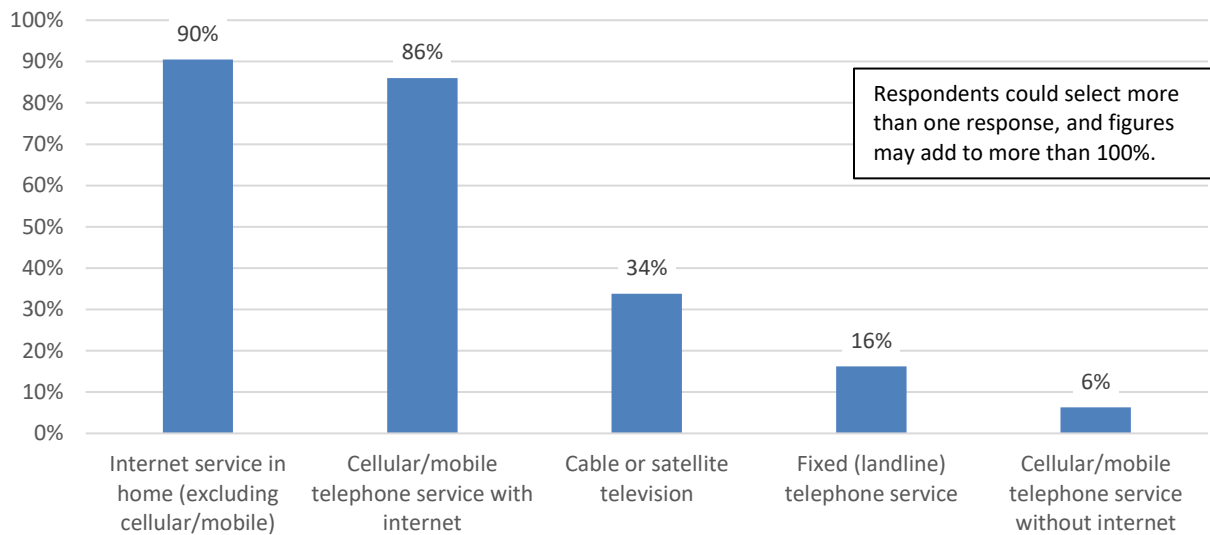
Purchase of cable or satellite television, fixed (landline) telephone service, or cellular/mobile service without internet is higher among those ages 55 and older, while use of internet services in the home and cellular/mobile telephone with internet is lower among this age cohort (see Figure 36).

Figure 36: Services Purchased by Respondent Age
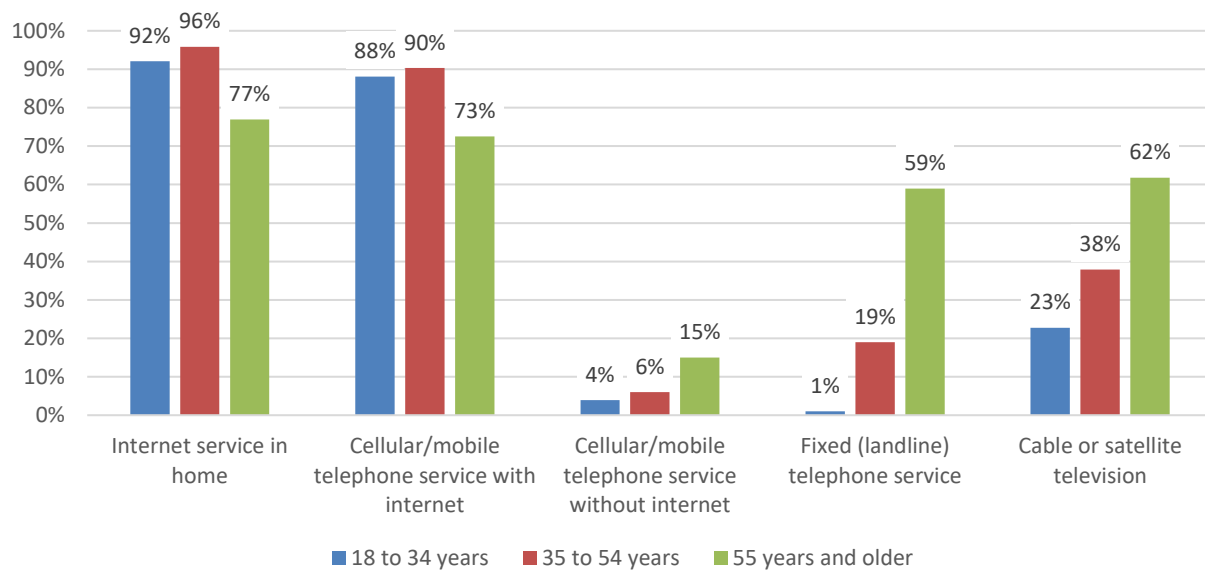
Use of internet service is correlated with household income. Households with than less $100,000 annual income are less likely than households with a higher average household income to have internet access at home or via smartphone, as illustrated in Figure 37.

Figure 37: Services Purchased by Household Income
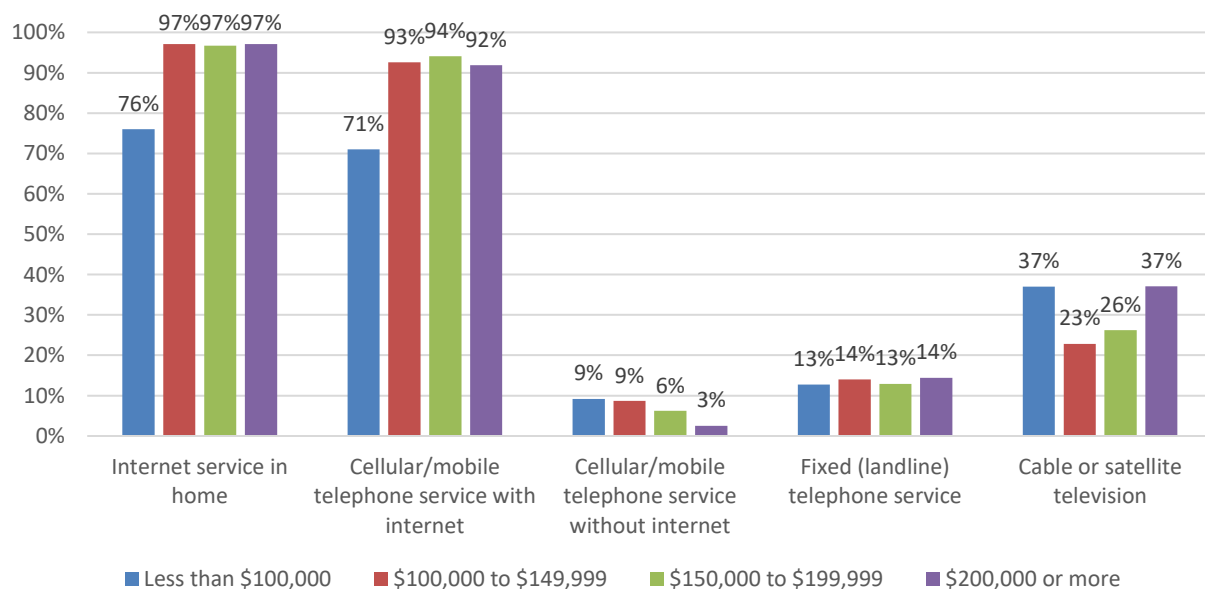
As discussed previously, most respondents have some internet access, including 81 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone). Another five percent of respondents have a smartphone only (no home internet),

and 10 percent have a home connection only (no smartphone). Total internet access by demographics is illustrated in Table 12.

Table 12: Internet Access by Key Demographics

	No Internet Service	Home Internet Connection	Smartphone	Both Home/ Smartphone	Total Internet Access	*Total Weighted Count*
TOTAL	**4%**	**10%**	**5%**	**81%**	**96%**	***443***
Respondent Age						
18 to 34 years	3%	9%	5%	83%	97%	*253*
35 to 54 years	1%	9%	3%	87%	99%	*99*
55 years and older	12%	16%	11%	61%	88%	*74*
Education						
Four-year college degree	5%	14%	5%	76%	95%	*132*
Graduate degree	2%	8%	6%	85%	98%	*274*
Household Income						
Less than $100,000	13%	16%	11%	60%	87%	*121*
< $25k	*20%*	*12%*	*8%*	*60%*	*80%*	*12*
< $50k	*34%*	*24%*	*7%*	*35%*	*66%*	*35*
< $75k	*21%*	*19%*	*5%*	*54%*	*79%*	*69*
$100,000 to $149,999	1%	7%	2%	90%	99%	*77*
$150,000 to $199,999	0%	6%	3%	91%	100%	*77*
$200,000 or more	0%	8%	3%	89%	100%	*110*
Race/Ethnicity						
Other race/ethnicity	7%	11%	6%	77%	93%	*120*
White/Caucasian only	3%	10%	5%	82%	97%	*309*
Gender Identity						
Female	4%	10%	7%	80%	96%	*172*
Male	5%	9%	6%	80%	95%	*221*
Other	0%	65%	0%	35%	100%	*1*
Total Household Size (Adults + Children)						
1	9%	14%	14%	62%	91%	*43*
2	5%	11%	6%	78%	95%	*179*
3	3%	7%	2%	88%	97%	*114*
4 or more	1%	11%	4%	84%	99%	*97*
Children in Household						
No Children in HH	5%	12%	7%	76%	95%	*221*
Children in HH	3%	8%	3%	85%	97%	*211*
Own/Rent Residence						
Own	3%	8%	6%	83%	97%	*163*
Rent	5%	11%	5%	79%	95%	*268*
Years at Residence						
Less than 1 year	0%	12%	0%	88%	100%	*108*
1 to 2 years	0%	7%	6%	88%	100%	*99*
3 to 4 years	0%	10%	7%	83%	100%	*57*
5 or more years	11%	11%	8%	70%	89%	*169*

5.2.1.2 Importance of communications services

Respondents were asked to indicate the importance of various communication services to their household, using a scale where 1 is "Not at All Important" and 5 is "Extremely Important." The mean importance of various service aspects is illustrated in Figure 38, while detailed responses are illustrated in Figure 39.

Figure 38: Importance of Communication Service Aspects (Mean Ratings)
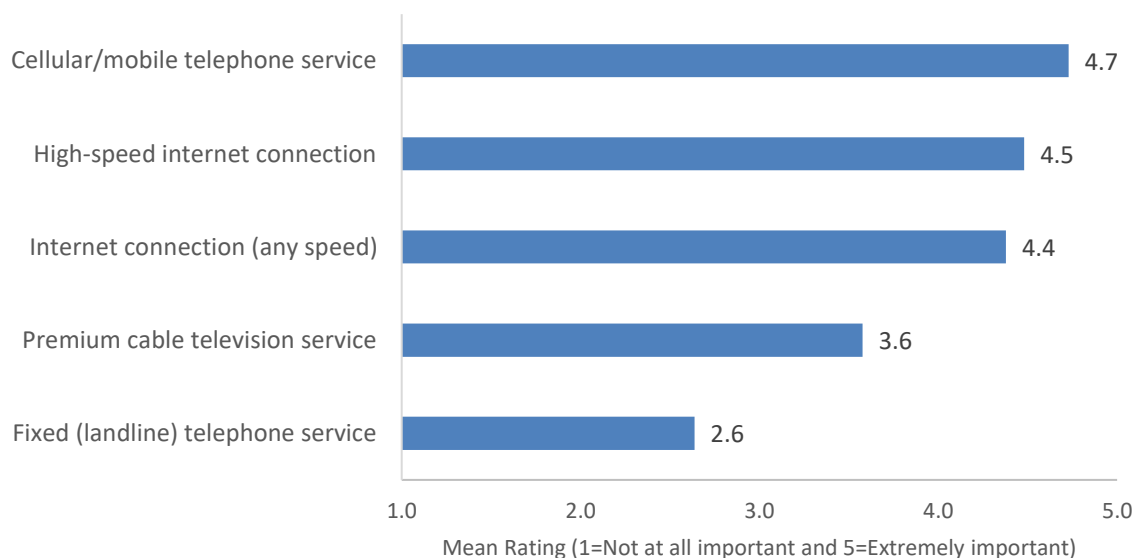
Figure 39: Importance of Communication Service Aspects
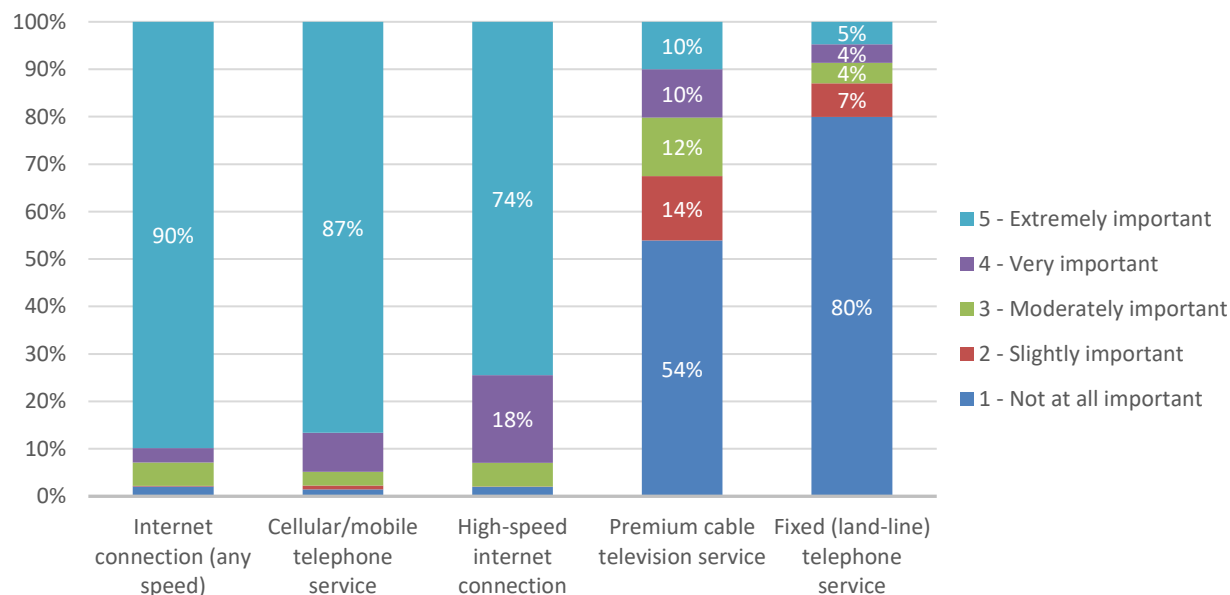
Cellular/mobile telephone and internet services are extremely important to respondents, while premium cable television service and fixed (landline) telephone service are significantly less

important. Specifically, nine in 10 said an internet connection of any speed is important, and 87 percent said cellular/mobile phone service is extremely important. Nearly three-fourths of respondents said high-speed internet is extremely important.

Figure 40 and Figure 41 illustrate the importance of high-speed internet service by the age of the respondent and by household income. The importance of internet services is slightly lower for those ages 55+ and those earning under $100,000 annually compared with their counterparts.

Figure 40: Importance of Communication Services by Respondent Age

Legend: 18 to 34 years | 35 to 54 years | 55+ years
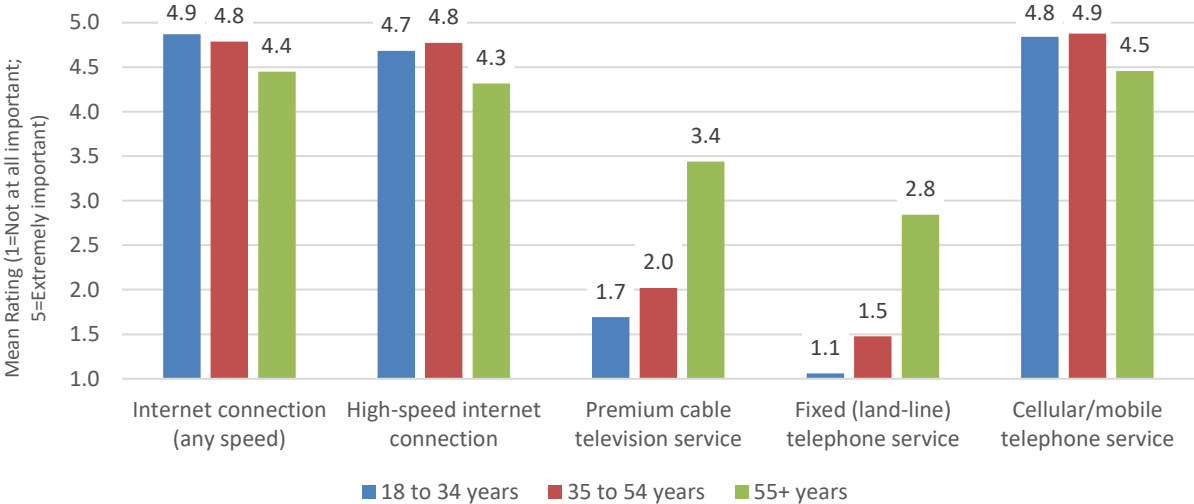
Figure 41: Importance of Communication Services by Household Income

Legend: Less than $100,000 | $100,000 to $149,999 | $150,000 to $199,999 | $200,000 or more
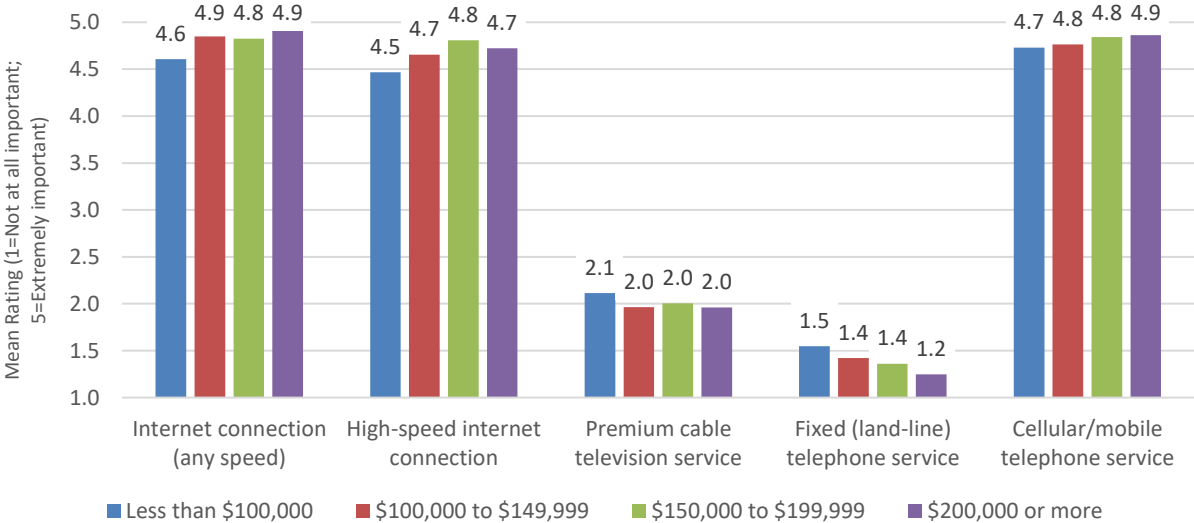
5.2.1.3 Internet services purchased

Respondents were asked about their purchase of internet services for their home. As shown in

Figure 42 a majority of homes (98 percent) reported having home internet service, consistent with 96 percent reporting internet access via a home connection or via a smartphone in Question 1. Cable modem is the leading internet service used, while other connection types represent much smaller shares of the Cambridge market area.

Figure 42: Have Internet Service
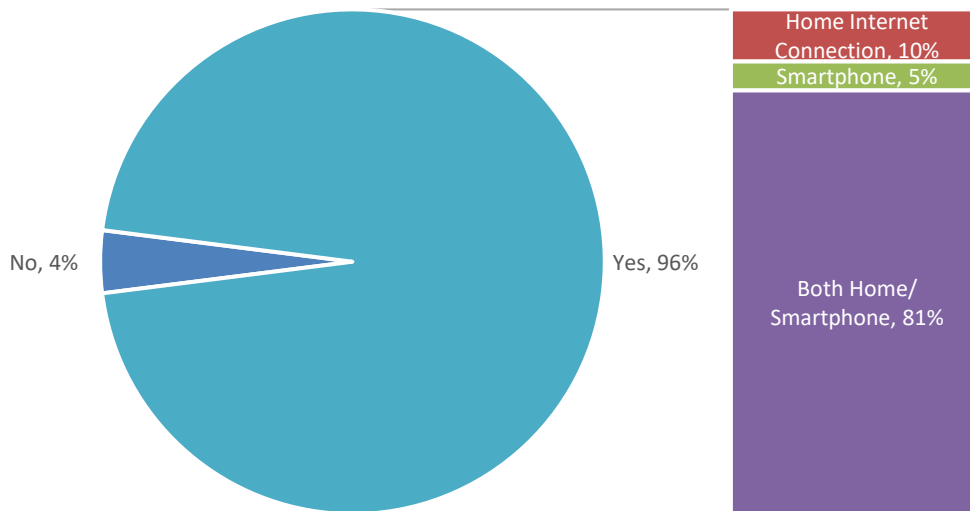
Figure 43: Primary Home Internet Service
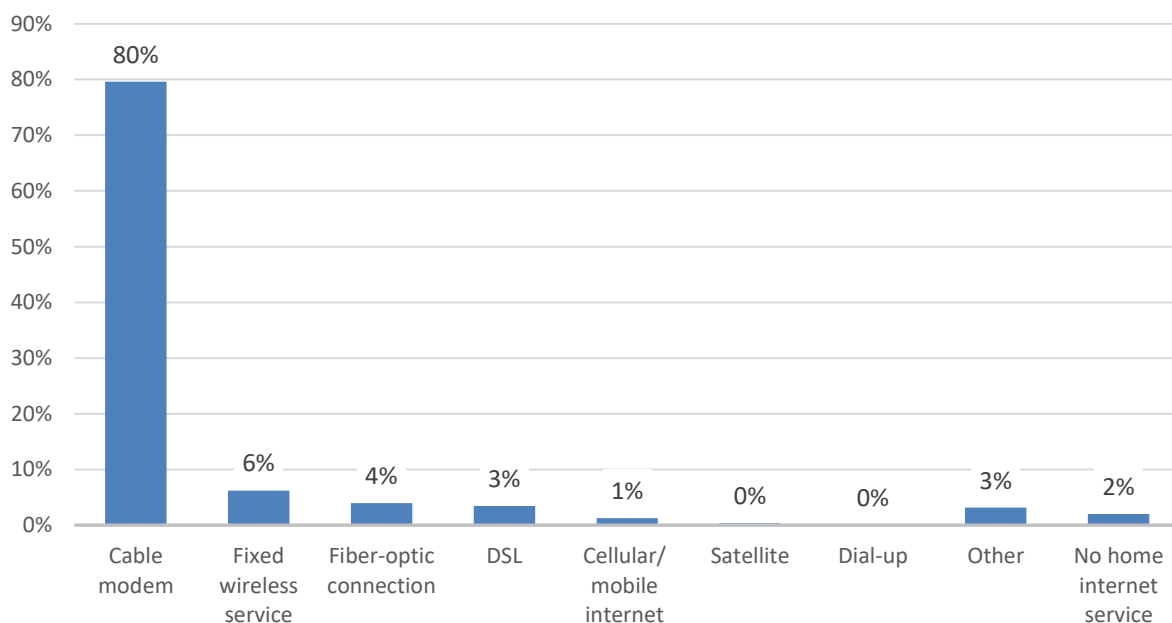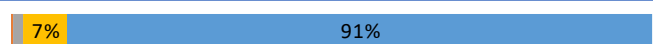
5.2.1.4 Internet service aspects

Home internet subscribers were asked to evaluate their satisfaction with various internet service aspects. This was compared with importance ratings given for these same aspects. The importance and satisfaction levels among internet users are compared in the following tables and graphs.

5.2.1.4.1 Importance

Respondents were asked to rate their levels of importance and satisfaction with various internet service aspects. Respondents rated connection reliability as the most important aspect, with nine in 10 saying it is extremely important, as shown in Table 13. Nearly two-thirds of respondents said connection speed is extremely important, and one-half said price of services is extremely important. The ability to bundle with television service is not important compared with other service aspects.

Table 13: Importance of Internet Service Aspects

Service Aspect	Mean	Percentages
Speed of Connection	4.6	6% / 29% / 64%
Reliability of Connection	4.9	7% / 91%
Price of Services	4.3	16% / 33% / 49%
Overall Customer Service	3.6	3% / 8% / 31% / 35% / 22%
Ability to Bundle with TV Service	1.7	64% / 14% / 13% / 5% / 4%

■ 1 - Not at all important   ■ 2 - Slightly important   ■ 3 - Moderately important
■ 4 - Very important   ■ 5 - Extremely important

5.2.1.4.2 Satisfaction

Overall, respondents are moderately to very satisfied with speed and reliability of their internet connection, as shown in Table 14. They are less satisfied with price, customer service, and ability to bundle with TV service. The lower satisfaction levels could indicate a desire for improved service offerings or a willingness to switch internet service providers if needs are not being met.

Table 14: Satisfaction with Internet Service Aspects

Service Aspect	Mean	Percentages				
Speed of Connection	3.8	4%	4%	23%	45%	25%
Reliability of Connection	3.7	4%	12%	18%	42%	24%
Price of Services	2.6	24%	25%	32%	9%	10%
Overall Customer Service	2.7	22%	20%	33%	15%	11%
Ability to Bundle with TV Service	2.7	22%	9%	53%	8%	7%

- 1 - Very dissatisfied
- 2 - Slightly satisfied
- 3 - Moderately satisfied
- 4 - Very satisfied
- 5 - Extremely satisfied

5.2.1.4.3 Performance

Comparing respondents' stated importance and satisfaction with service aspects allows an evaluation of how well internet service providers are meeting the needs of customers (see Figure 44). Aspects that have higher stated importance than satisfaction can be considered areas in need of improvement. Aspects that have higher satisfaction than importance are areas where the market is meeting or exceeding customers' needs. However, it should be cautioned that the extremely high level of importance placed on some aspects (such as reliability) may make it nearly impossible to attain satisfaction levels equal to importance levels.

Figure 44: Importance of and Satisfaction with Internet Service Aspects
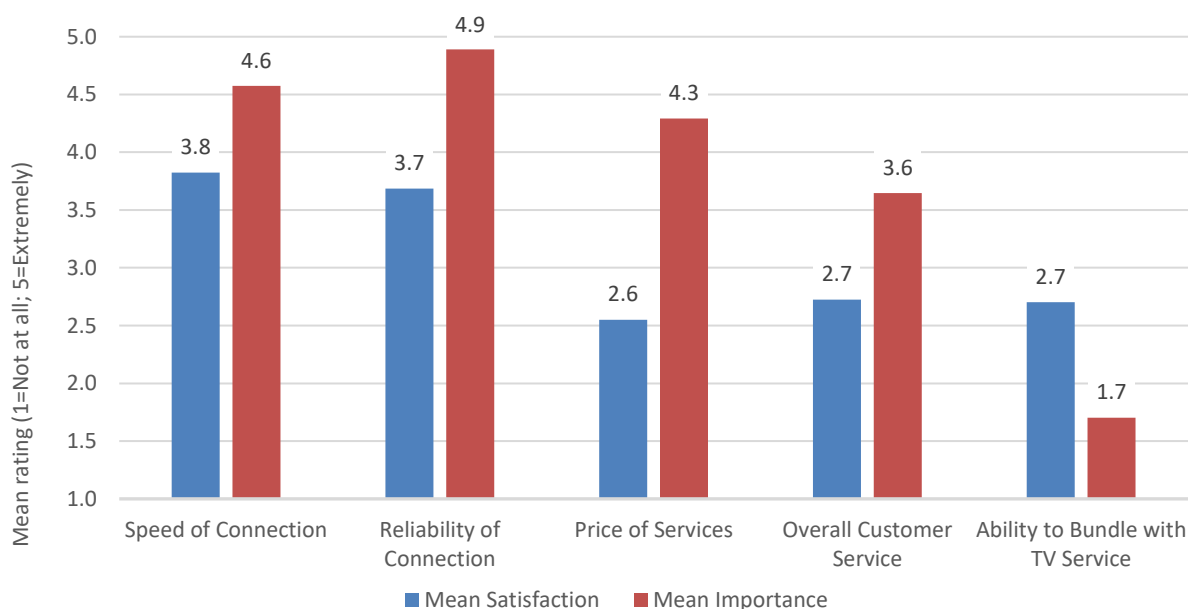
The difference between importance and satisfaction of home internet aspects is also presented in the "gap" analysis table (see Table 15). The largest gaps between importance and performance

are for price of services and reliability of connection, followed by overall customer service and connection speed. The ability to bundle exceeded expectations, given the low importance placed on this service aspect.

Table 15: Internet Service Aspect "Gap" Analysis

	Mean Satisfaction	Mean Importance	GAP < = >	Customer Expectations
Price of Services	2.6	4.3	-1.7	Not Met
Reliability of Connection	3.7	4.9	-1.2	Not Met
Overall Customer Service	2.7	3.6	-0.9	Not Met
Speed of Connection	3.8	4.6	-0.7	Not Met
Ability to Bundle with TV Service	2.7	1.7	1.0	Exceeded

The importance placed on price of services is correlated with household income. The overall satisfaction level with this service aspect does not vary significantly by income; however, lower income households have a larger gap in expectations give the higher importance placed on this item (see Figure 45). The performance gap does not very significantly by household income for other service aspects.

Figure 45: Importance of and Satisfaction with Price of Internet Service by Household Income
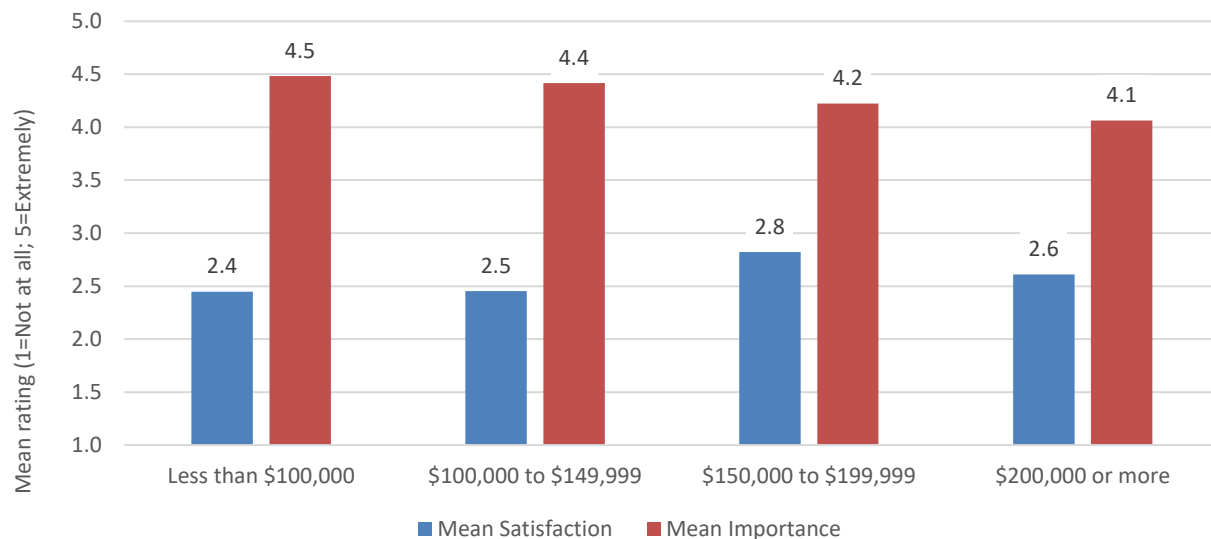
Only slight differences in importance of internet service aspects by connection type were found; however, there are significant differences in satisfaction by connection type for some key aspects of service, as illustrated in Figure 46. Specifically, cable modem subscribers are less satisfied with

connection speed, reliability, price, and overall customer service compared with all other internet subscribers.

Figure 46: Satisfaction with Internet Service Aspects by Connection Type
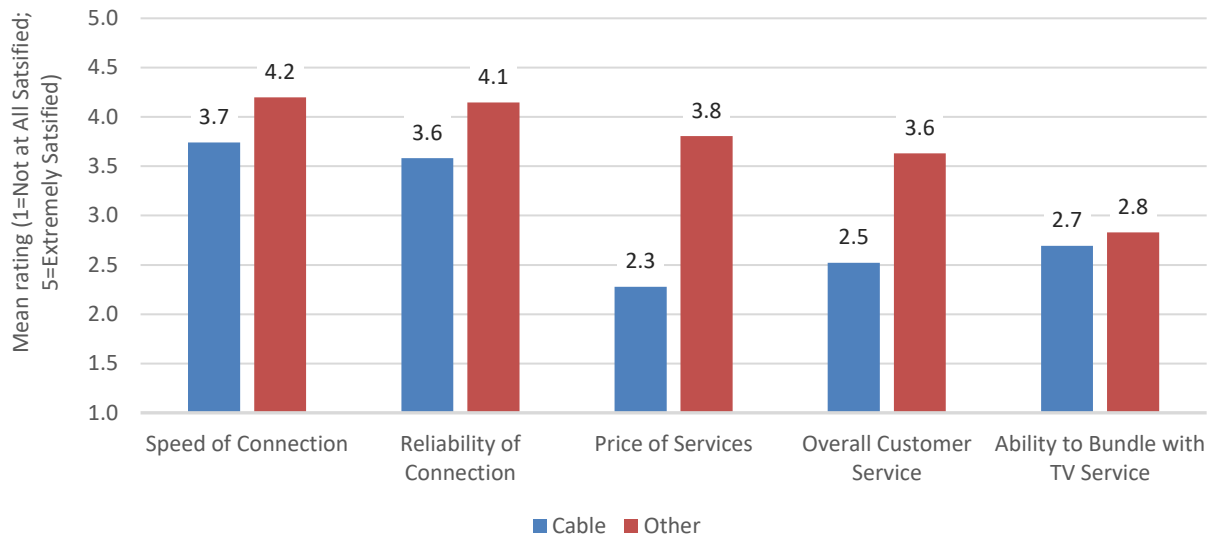
5.2.1.5 Personal computing devices

Respondents were asked to indicate the number of personal computing devices they have in the home. As might be expected, almost all (96 percent) respondents with internet access (either home connection or smartphone) have at least one personal computing device.

Figure 47: Number of Personal Computing Devices

Eight in 10 respondents have three or more personal computing devices, including 45 percent with at least five devices (see Figure 47).

Saturation of personal computing devices is high among households with multiple members. Seven in 10 two-member households have five or more devices. Approximately nine in 10 households with three or more residents have at least five personal computing devices (see Figure 48).
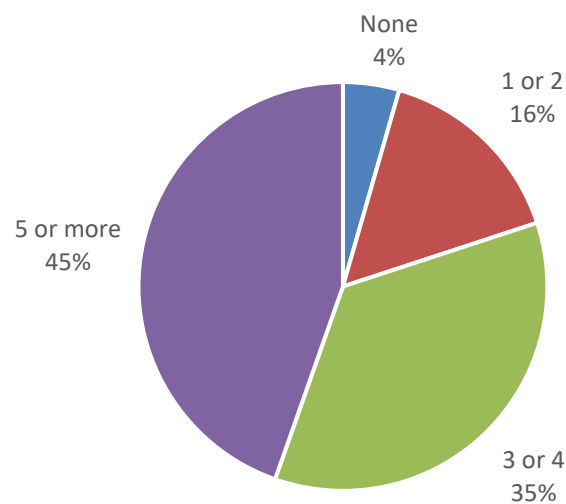
Figure 48: Number of Personal Computing Devices in Home by Household Size
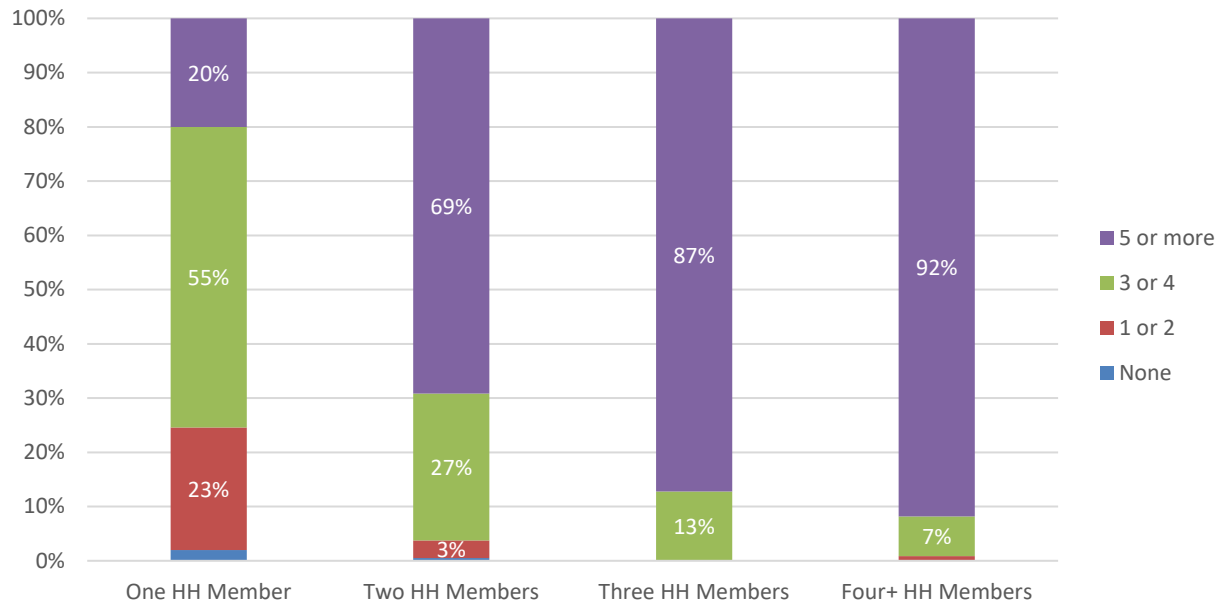
Respondents ages 55+ have fewer personal computing devices in the home compared with younger respondents, as illustrated in Figure 49.

Figure 49: Number of Personal Computing Devices in Home by Respondent Age
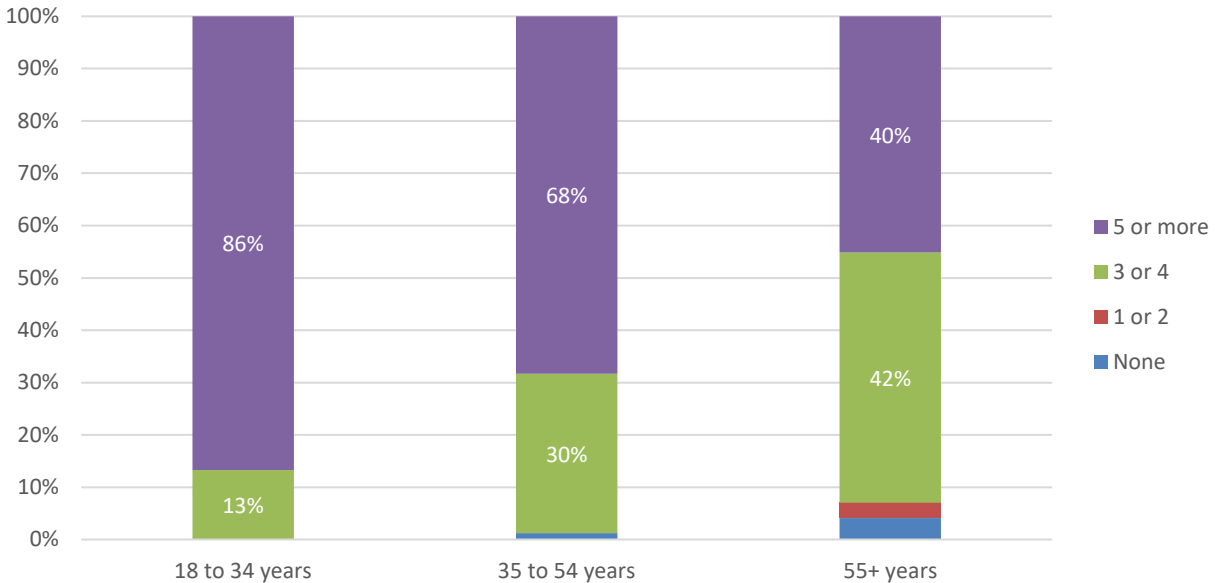
Households earning less than $100,000 per year have fewer computing devices than do higher income households, although the majority of all households have at least three devices (see Figure 50).

Figure 50: Number of Personal Computing Devices in Home by Household Income
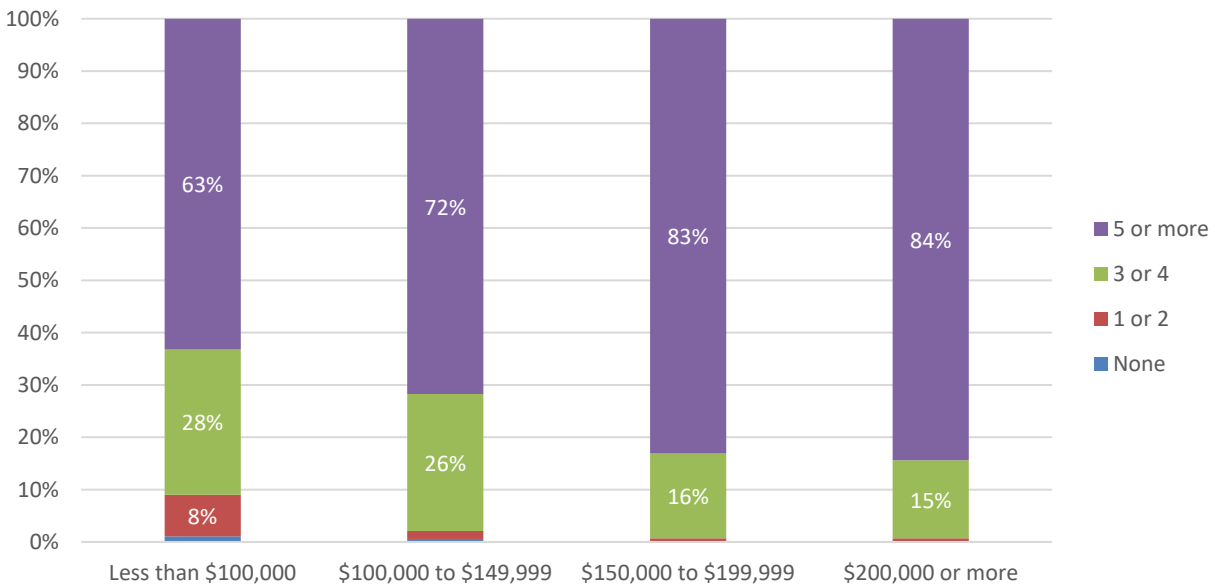
5.2.1.6 Cost of internet service

As Figure 51 illustrates, 23 percent of subscribers pay over $100 per month for home internet, with the estimated monthly average cost for internet service being $75. Cable modem subscribers pay more per month on average compared with other internet services.

Figure 51: Monthly Price for Internet Service
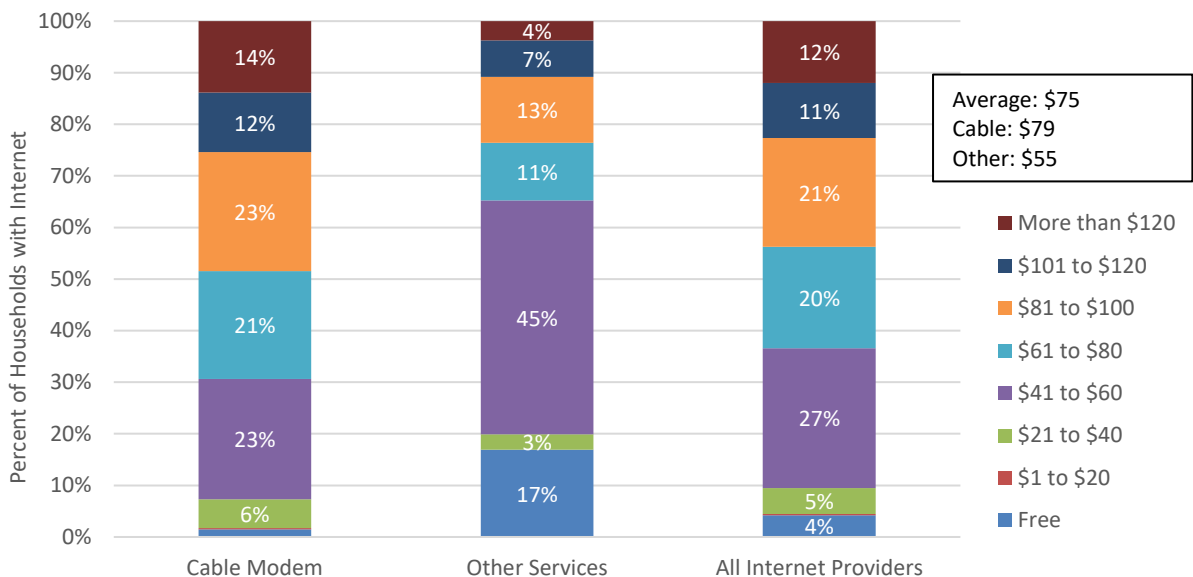
Households earning under $100,000 annually pay an estimated average monthly price of $66 for internet service. Just 13 percent of lower-income households receive free internet service, while one-third pay over $80 per month (see Figure 52).

Figure 52: Monthly Price for Internet Service by Household Income

Legend (income box):
Less than $100,000 .... $66
<$25k (n=9) $77
<$50k (n=29) $68
<$75k (n=61) $69
$100,000 to $149,999 .... $78
$150,000 to $199,999 .... $75

Legend (colors):
■ More than $120
■ $101 to $120
■ $81 to $100
■ $61 to $80
■ $41 to $60
■ $21 to $40
■ $1 to $20
■ Free
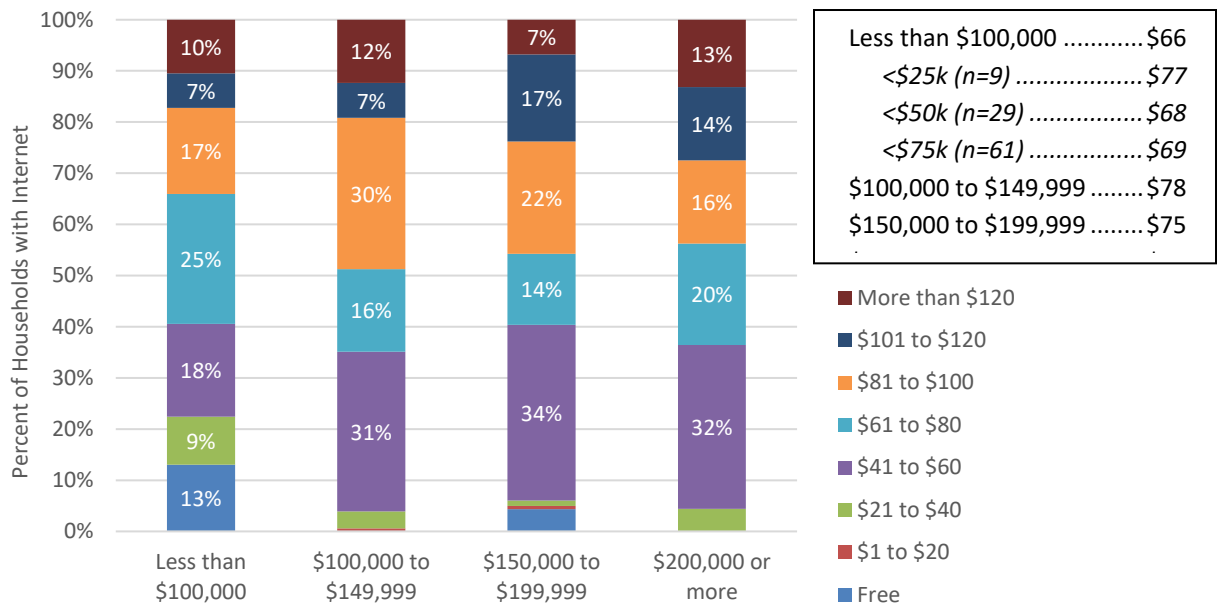
Forty-three percent of internet subscribers said their monthly internet fee is part of a bundled service (see Figure 53). Estimated monthly prices for bundled and unbundled services are shown in Figure 54. As may be expected, bundled services cost more in total than do unbundled services.

Figure 53: Monthly Internet Fee Is Part of Bundled Service
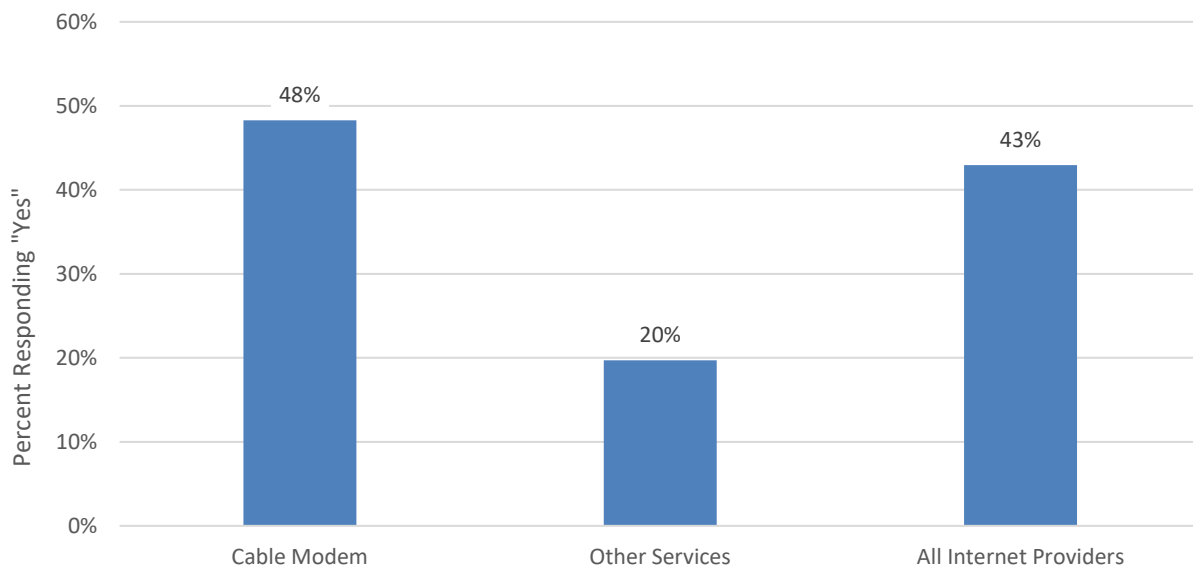
Figure 54: Estimated Average Monthly Price for Bundled and Non-Bundled Internet Service
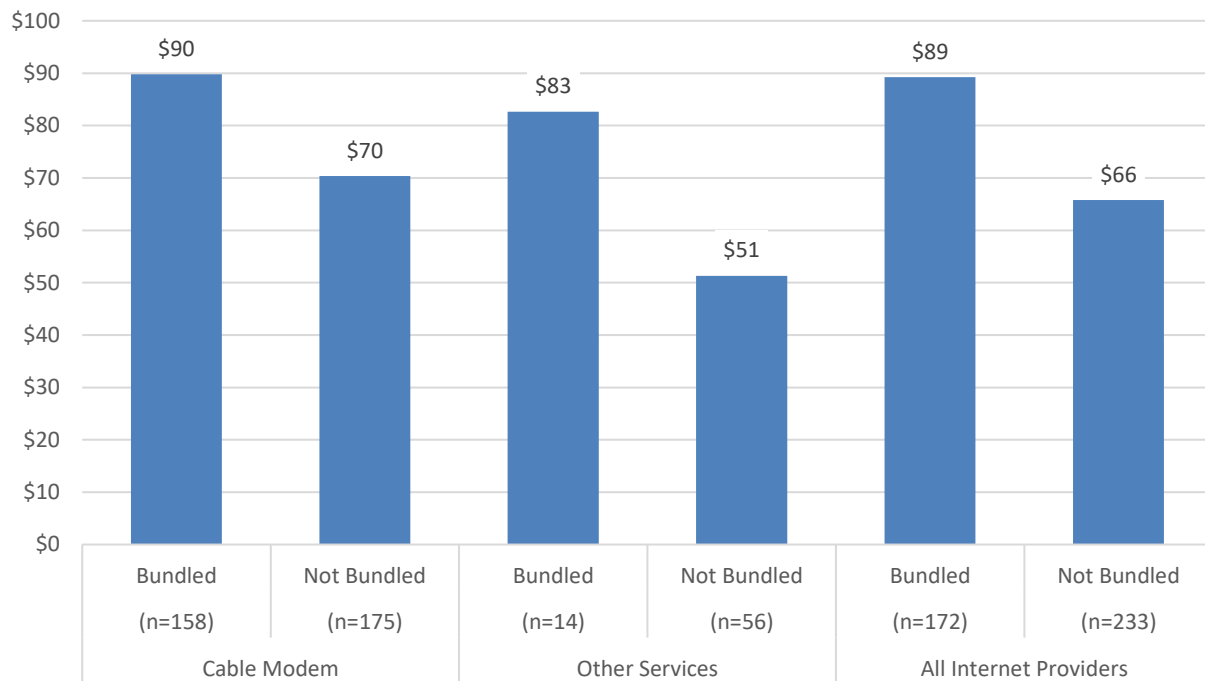
5.2.1.7 Internet uses and skills

Respondents were asked about their use of their home internet connection and of their cellular/ mobile internet connection for various activities, as illustrated in Figure 55 and Figure 56. Among those items listed, the home internet connection is most frequently used for shopping online, banking or paying bills, and watching movies/videos/TV. Almost all respondents do these activities at least occasionally.

Figure 55: Home Internet Connection Use for Various Activities

Activity	Never	Occasionally	Frequently
Shopping online		41%	58%
Banking or paying bills		28%	69%
Watching movies, videos, or TV		12%	86%
Listening to music	7%	26%	66%
Using social media	7%	34%	58%
Accessing cloud-based file storage and sharing	8%	41%	51%
Connecting to a work computer	9%	27%	64%
Accessing educational resources	12%	50%	38%
Accessing medical services	14%	71%	15%
Accessing government information	17%	67%	16%
Playing online games	46%	26%	28%
Accessing home security/other 'smart home' devices	61%	22%	18%
Running a home business	77%	14%	9%

A smartphone is used most frequently for social media and for listening to music, with roughly six in 10 respondents partaking frequently. Only a small segment of respondents frequently uses a cellular/mobile internet connection for other activities.

Figure 56: Cellular/Mobile Connection Use for Various Activities
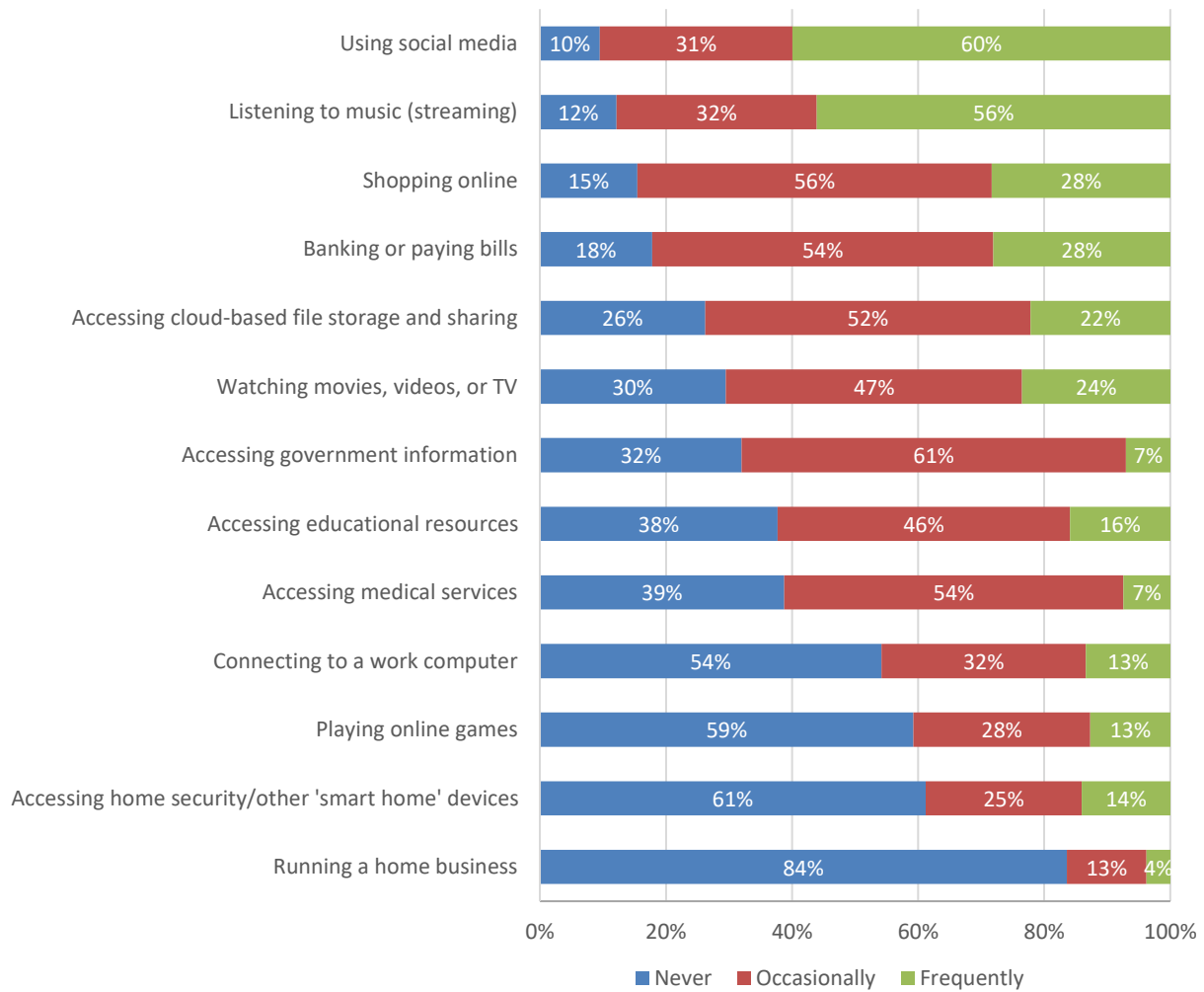
Respondents are far less likely to use a cellular/mobile connection than a home internet connection for many of the activities listed, especially connecting to a work computer or accessing information and resources. Still, a sizable share of respondents is using a smartphone at least occasionally for most activities, including nearly one-half who connect to a work computer with a smartphone. Figure 57 compares the percentage of respondents by connection type who ever use their connection for key activities.

Figure 57: Internet Connection Ever Used for Various Activities by Connection Type

Listening to music (streaming): Home Internet 93%, Smartphone 88%
Watching movies, videos, or TV: Home Internet 97%, Smartphone 70%
Playing online games: Home Internet 54%, Smartphone 41%
Connecting to a work computer: Home Internet 91%, Smartphone 46%
Using social media: Home Internet 93%, Smartphone 90%
Shopping online: Home Internet 99%, Smartphone 85%
Running a home business: Home Internet 23%, Smartphone 16%
Accessing educational resources: Home Internet 88%, Smartphone 62%
Accessing government information: Home Internet 83%, Smartphone 68%
Accessing medical services: Home Internet 86%, Smartphone 61%
Banking or paying bills: Home Internet 98%, Smartphone 82%
Accessing home security/other 'smart home' devices: Home Internet 39%, Smartphone 39%
Accessing cloud-based file storage and sharing: Home Internet 92%, Smartphone 74%

Percent Occasionally/Frequently Using Connection

■ Home Internet   ■ Smartphone

The gaps between home internet usage and cellular/mobile phone use are more evident when looking at the share of respondents who *frequently* use their internet connection for various activities (see Figure 58). Only a small share of respondents frequently uses a cellular/mobile internet connection for most activities. Although 46 percent of respondents ever use a smartphone for connecting to a work computer, just 13 percent do so frequently.

Figure 58: Internet Connection Frequently Used for Various Activities by Connection Type
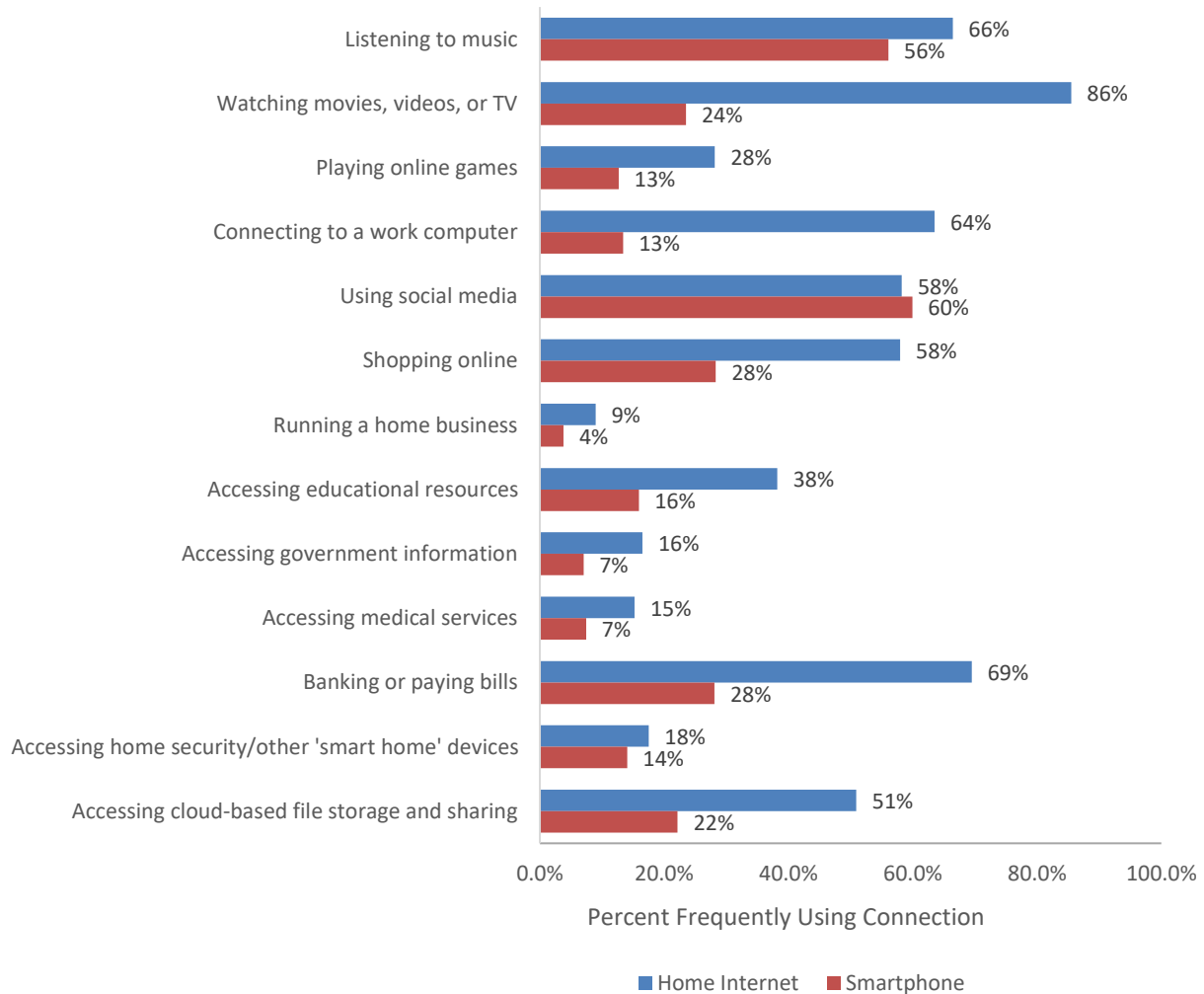
5.2.1.7.1   Internet uses by income groups

Households earning under $100,000 per year are less likely than higher income households to <u>ever</u> use their *home internet connection* for connecting to a work computer and accessing home security/other 'smart home' devices (see Figure 59).

Figure 59: Home Internet Connection Ever Used for Various Activities by Household Income
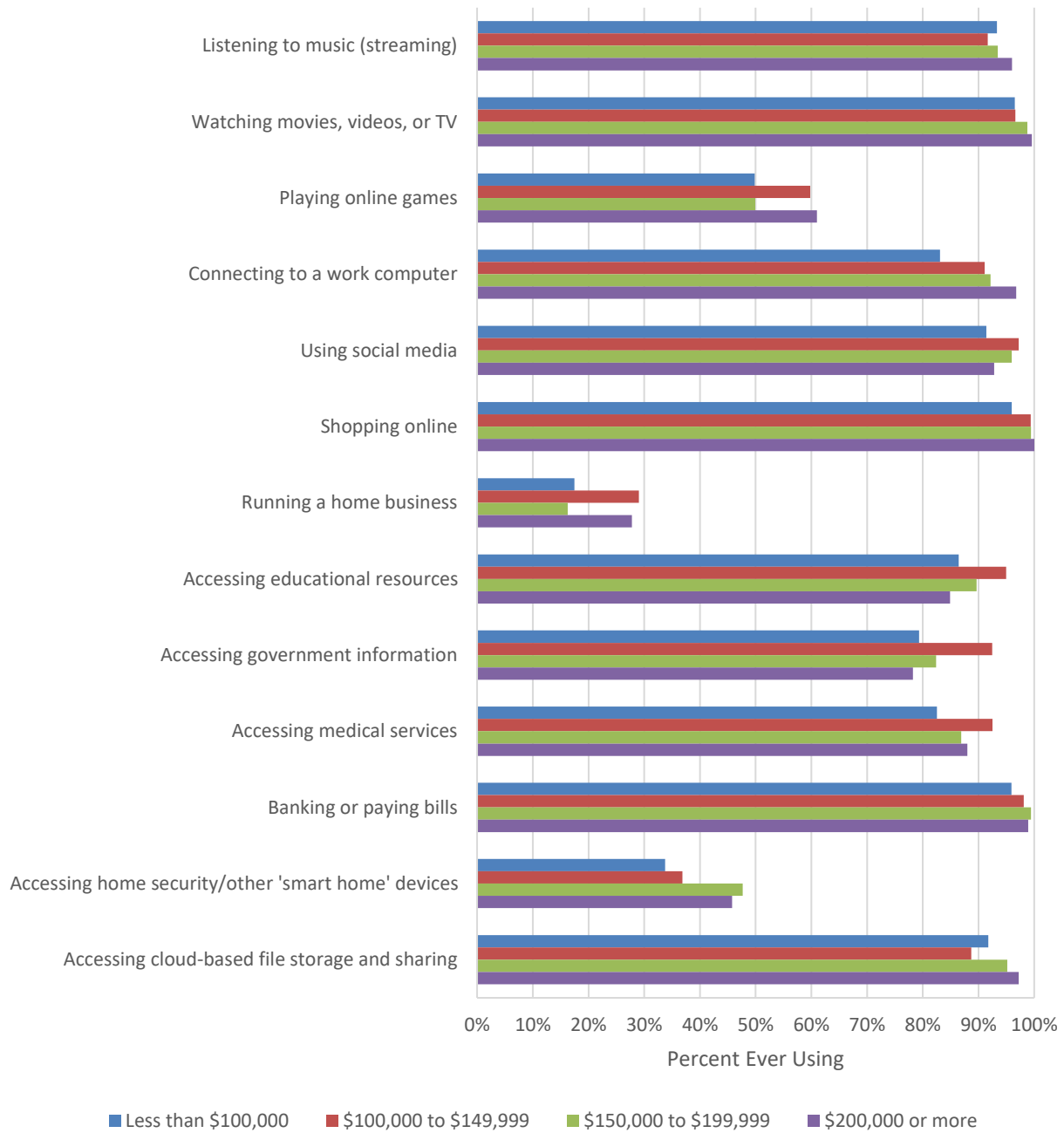
Households earning under $100,000 per year are less likely than higher income households to frequently use their *home internet connection* for connecting to a work computer and accessing home security/other 'smart home' devices, and they are more likely to frequently use their home internet connection for social media and for accessing educational resources (see Figure 60).

Figure 60: Home Internet Connection Frequently Used for Various Activities by Household Income
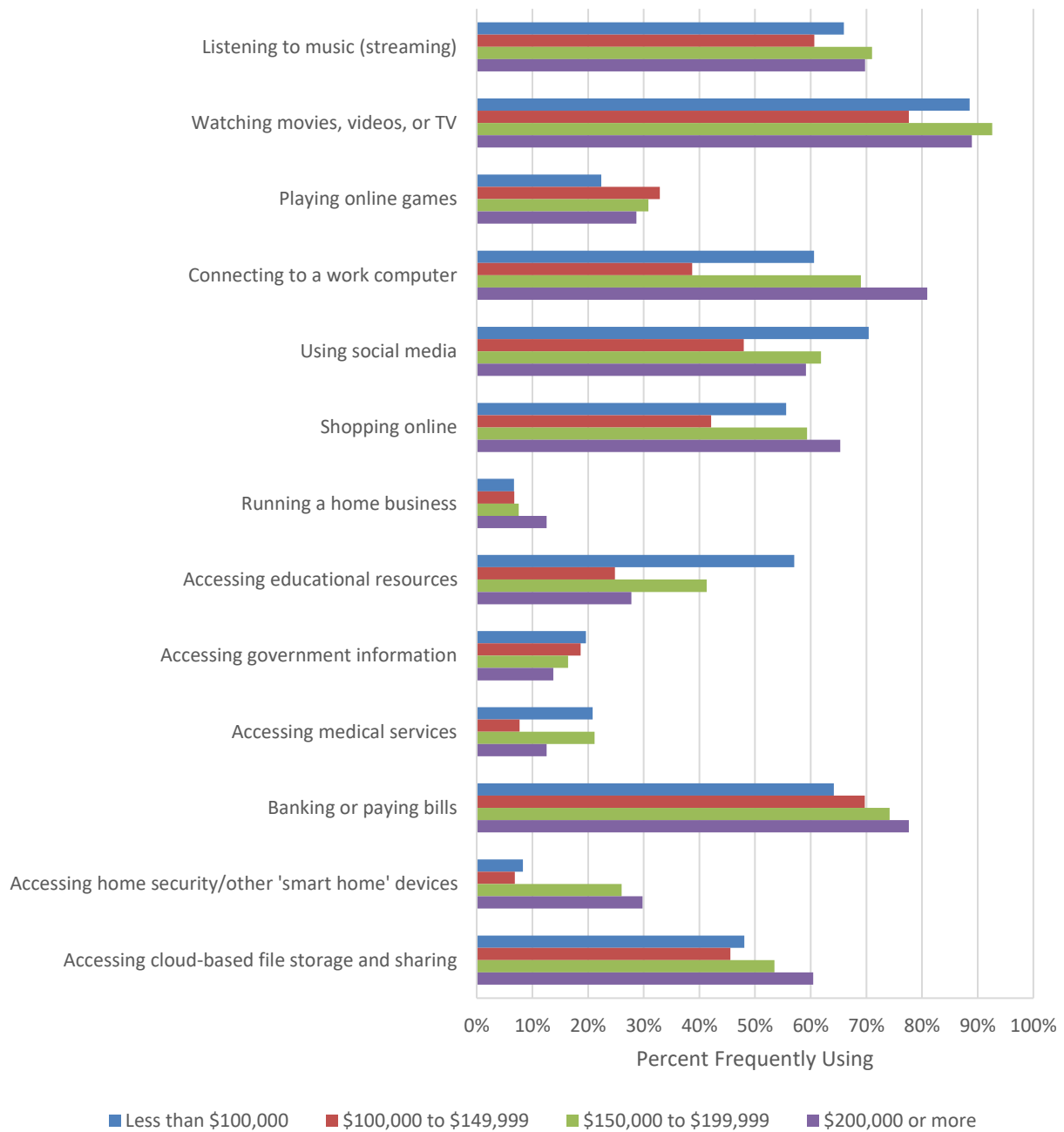
Households earning under $100,000 per year are less likely than higher income households to <u>ever</u> use their *cellular/mobile internet connection* for banking, online shopping, to connect to a work computer, or to stream music or videos (see Figure 61).

Figure 61: Cellular/Mobile Connection Ever Used for Various Activities by Household Income
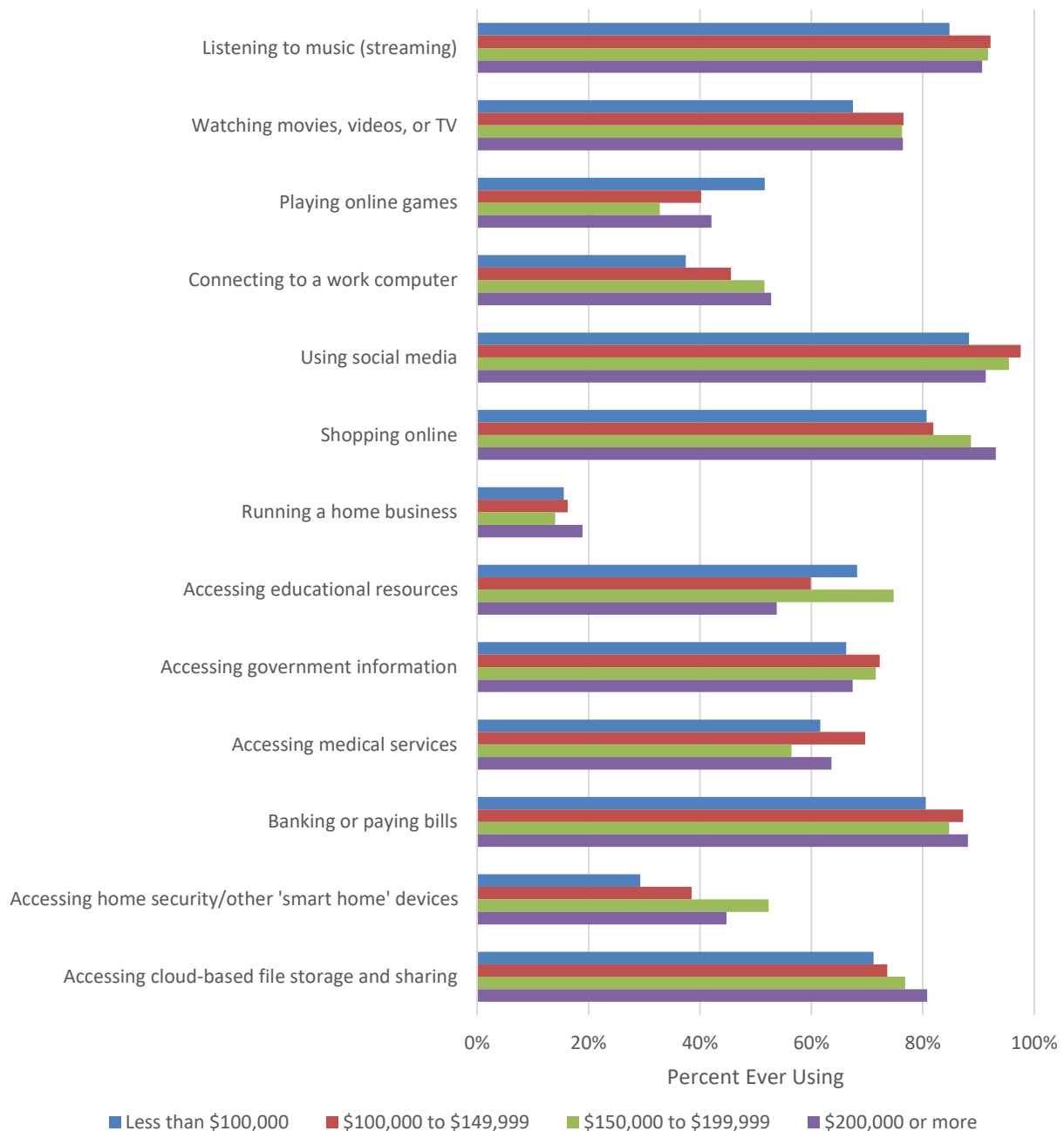
Households earning under $100,000 per year are less likely than higher income households to frequently use their *cellular/mobile internet connection* for online shopping, and they are more likely to frequently use their cellular/mobile internet service for accessing educational resources (see Figure 62).

Figure 62: Cellular/Mobile Connection Frequently Used for Various Activities by Household Income
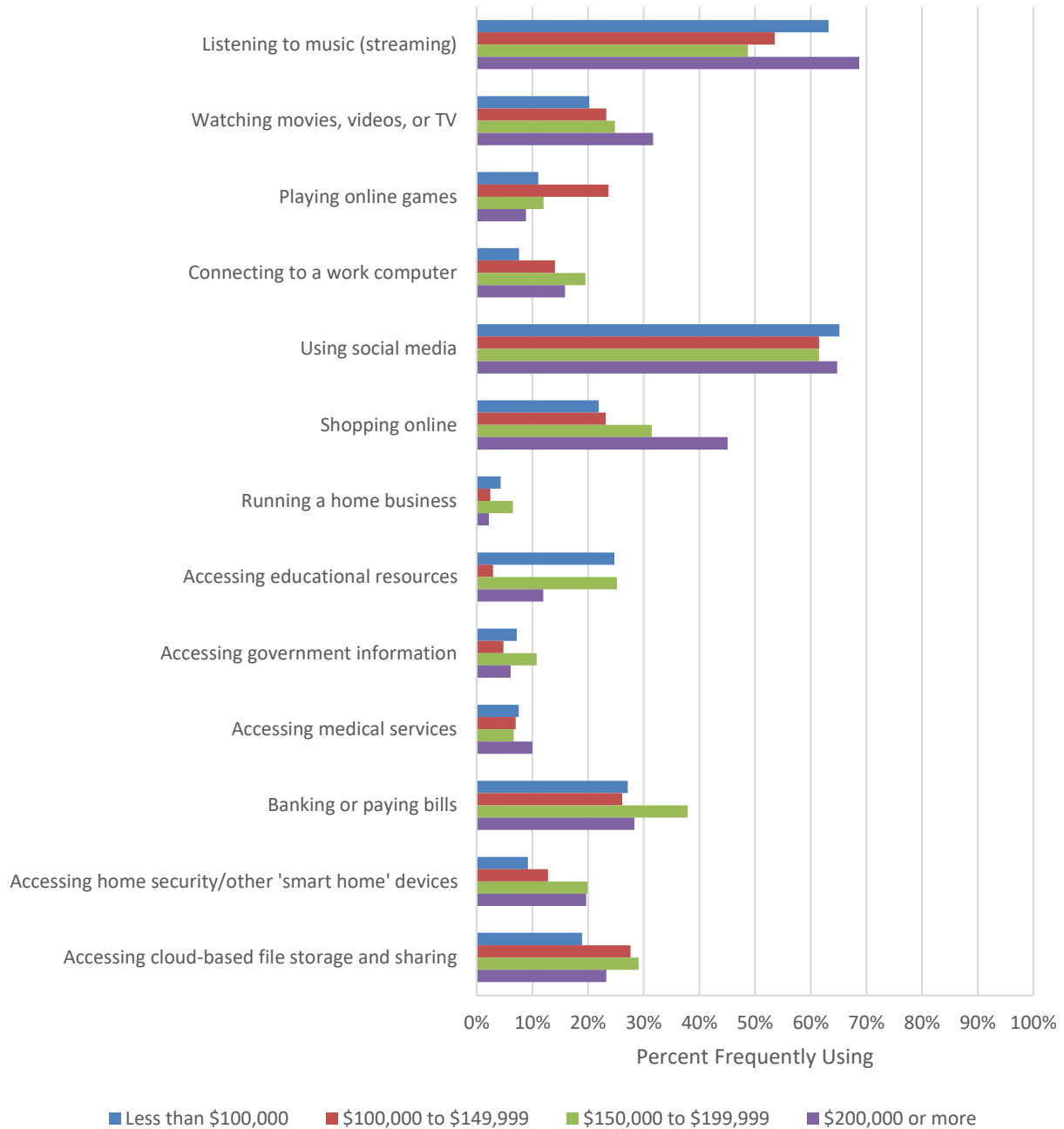
5.2.1.7.2 Smartphone user segments

Individuals were classified into one of three groups, based on their overall usage of a smartphone for various activities. One-third of internet subscribers frequently use their smartphone for key activities, as shown in Figure 63.

These highly connected individuals are using their smartphone for social media, streaming music, online shopping, banking, and watching movies, videos, or TV (see Figure 64). A sizable percentage use their smartphone for other functions, including accessing information and resources. One-fourth are frequently connecting to a work computer via their smartphone.

Figure 63: Smartphone User Segments

Infrequent User 17%

Frequent User 34%

Moderate User 49%
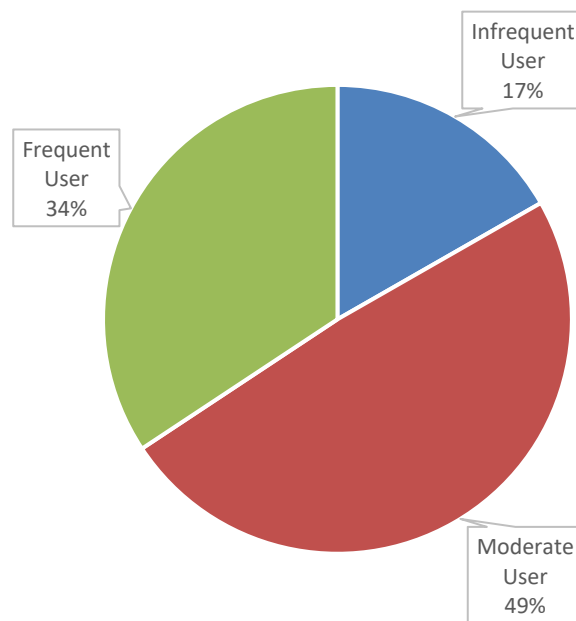
Figure 64: Smartphone Activity for Frequent Users

Activity	Percent
Using social media	92%
Listening to music (streaming)	79%
Shopping online	65%
Banking or paying bills	61%
Watching movies, videos, or TV	57%
Accessing cloud-based file storage and sharing	46%
Accessing educational resources	41%
Accessing home security/other 'smart home' devices	30%
Playing online games	26%
Connecting to a work computer	25%
Accessing medical services	20%
Accessing government information	19%
Running a home business	6%

Percent Frequently Using

Usage is highly correlated with age of respondent and less so with other demographics characteristics, such as household income. The majority of frequent smartphone users are ages 18 to 34. Table 16 shows the demographic profile of the various segments of smartphone users.

Table 16: Demographic Profile of Smartphone User Segments

		Infrequent User	Moderate User	Frequent User	Total
Internet Service in Home	Home Internet Connection	32%	8%	3%	10%
	Smartphone	1%	4%	6%	6%
	Both Home/Smartphone	66%	88%	91%	84%
	Total	*65*	*187*	*136*	*425*
Respondent Age	18 to 34 years	52%	59%	70%	59%
	35 to 54 years	16%	27%	23%	23%
	55 years and older	32%	15%	7%	17%
	Total	*63*	*188*	*136*	*426*
Highest Level of Education	Four-year college degree	20%	33%	36%	33%
	Graduate degree	80%	67%	64%	67%
	Total	*60*	*185*	*131*	*407*
Household Income	Less than $100,000	40%	28%	28%	31%
	$100,000 to $149,999	27%	23%	17%	20%
	$150,000 to $199,999	17%	22%	21%	20%
	$200,000 or more	16%	27%	34%	29%
	Total	*51*	*171*	*130*	*385*
Race/Ethnicity	Other race/ethnicity	17%	22%	39%	28%
	White/Caucasian only	83%	78%	61%	72%
	Total	*63*	*189*	*134*	*428*
Gender	Female	52%	39%	39%	44%
	Male	48%	61%	61%	56%
	Other	0%	0%	0%	0%
	Total	*58*	*179*	*117*	*394*
Children in Household	No Children in HH	47%	48%	55%	51%
	Children in HH	53%	52%	45%	49%
	Total	*65*	*192*	*135*	*433*
Own/Rent Residence	Own	41%	38%	34%	38%
	Rent	59%	62%	66%	62%
	Total	*65*	*193*	*134*	*431*
Years at Current Residence	Less than 1 year	30%	27%	25%	25%
	1 to 2 years	8%	22%	32%	23%
	3 to 4 years	7%	13%	17%	13%
	5 or more years	56%	38%	26%	39%
	Total	*64*	*192*	*135*	*433*

5.2.1.7.3 Internet skills

Respondents were also asked to indicate their level of agreement with various statements about their internet skills. Average rating scores are highlighted in Figure 65, while Figure 66 shows detailed responses.

Figure 65: Agreement with Statement About Internet Skills (Mean Ratings)

I know how to...

Statement	Mean Rating
Bookmark a website/add to favorites	4.8
Access bank account online	4.7
Upload content to a website	4.6
Create/manage social media profile	4.6
Identify false info online and find credible sources	4.4
Adjust my privacy settings online	4.4
Recognize and avoid a phishing request	4.3
Block spam or unwanted content	4.2
Create my own content using computers and the internet	4.1
Create and manage my own personal website	3.6

Mean Rating (1=Strongly Disagree and 5=Strongly Agree)

Overall, most internet subscribers agree that they know how to use the internet for various functions. At least three-fourths of respondents strongly agreed they can use the internet for bookmarking a website, accessing a bank account online, uploading content to a website, and creating/managing a social media profile. Over one-half of respondents strongly agreed that they know how to use the internet for other functions, with the exception of creating and managing a personal website. Respondents ages 55 and older were less likely to agree that they are skilled in various uses of the internet (see Figure 67).

Figure 66: Agreement with Statement About Internet Skills

I know how to...
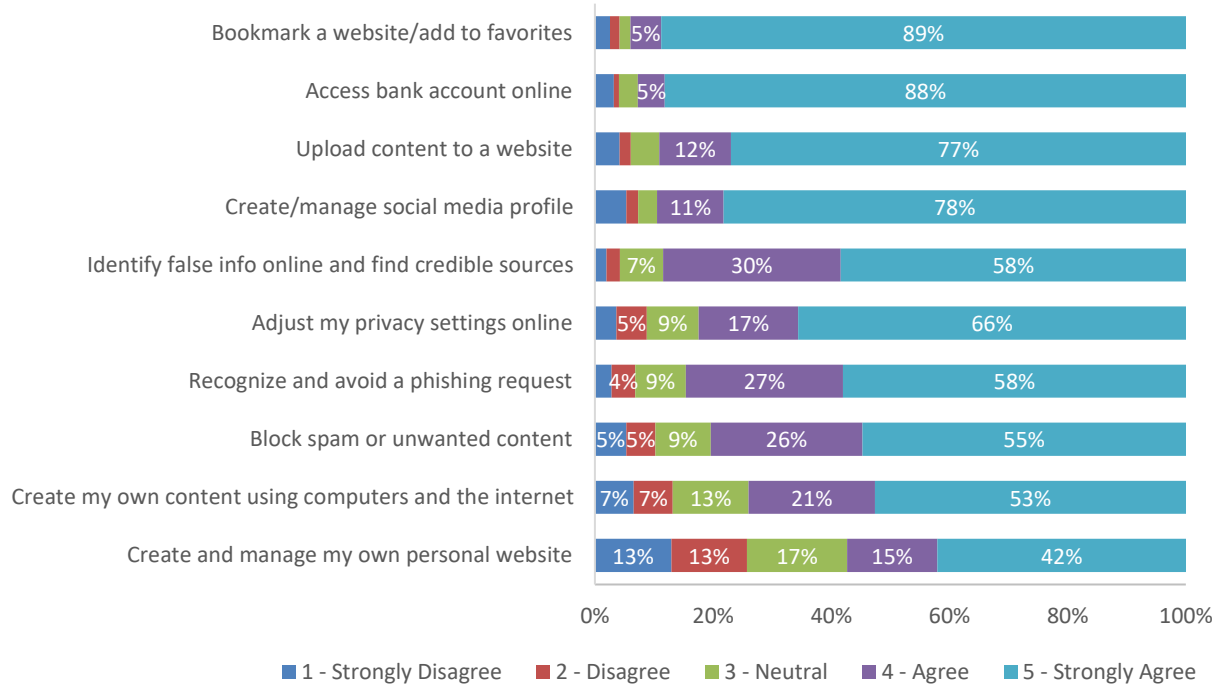
Figure 67: Agreement with Statement About Internet Skills by Respondent Age

I know how to...
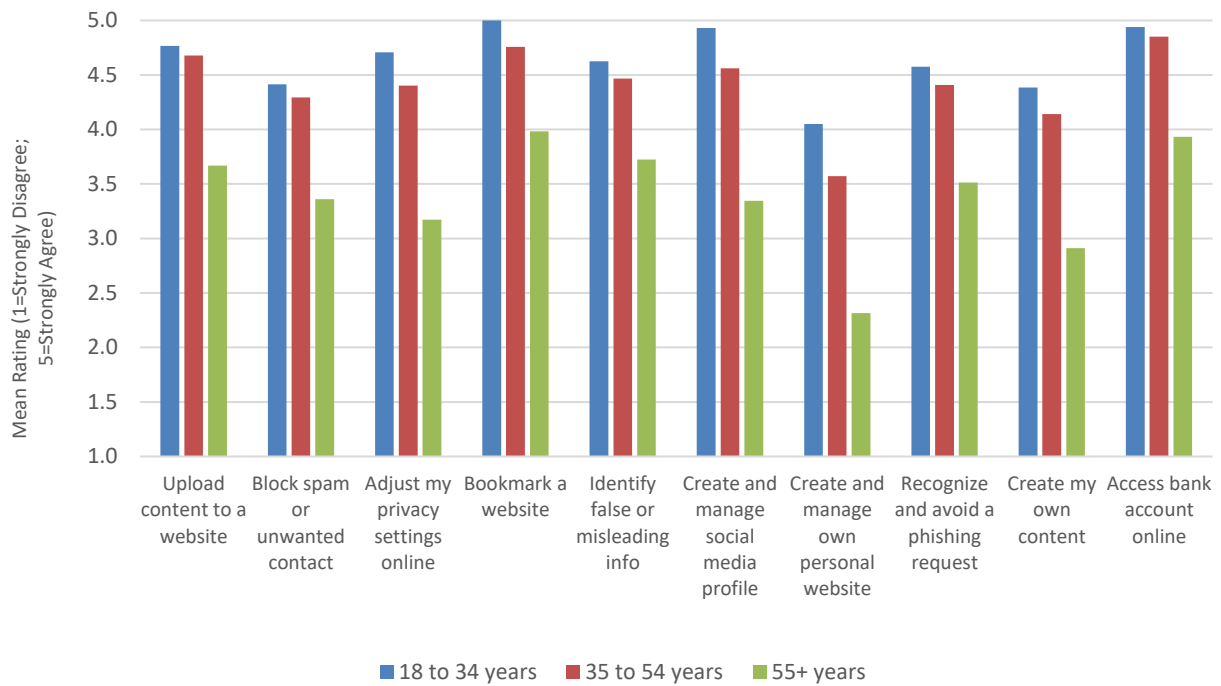
The percentage of respondents who agree they have certain internet skills also varies by other demographic characteristics. Although lower educated respondents (those with a four-year degree vs. those with a graduate degree) and renters (vs. owners) are more likely to have key internet skills, these folks are also disproportionately younger (ages 18 to 34 years).

Females were less likely than males to agree they are skilled in all areas listed, with the exception of bookmarking a website and creating a social media profile (see Figure 68).

Figure 68: Agreement with Statement About Internet Skills by Gender

I know how to...
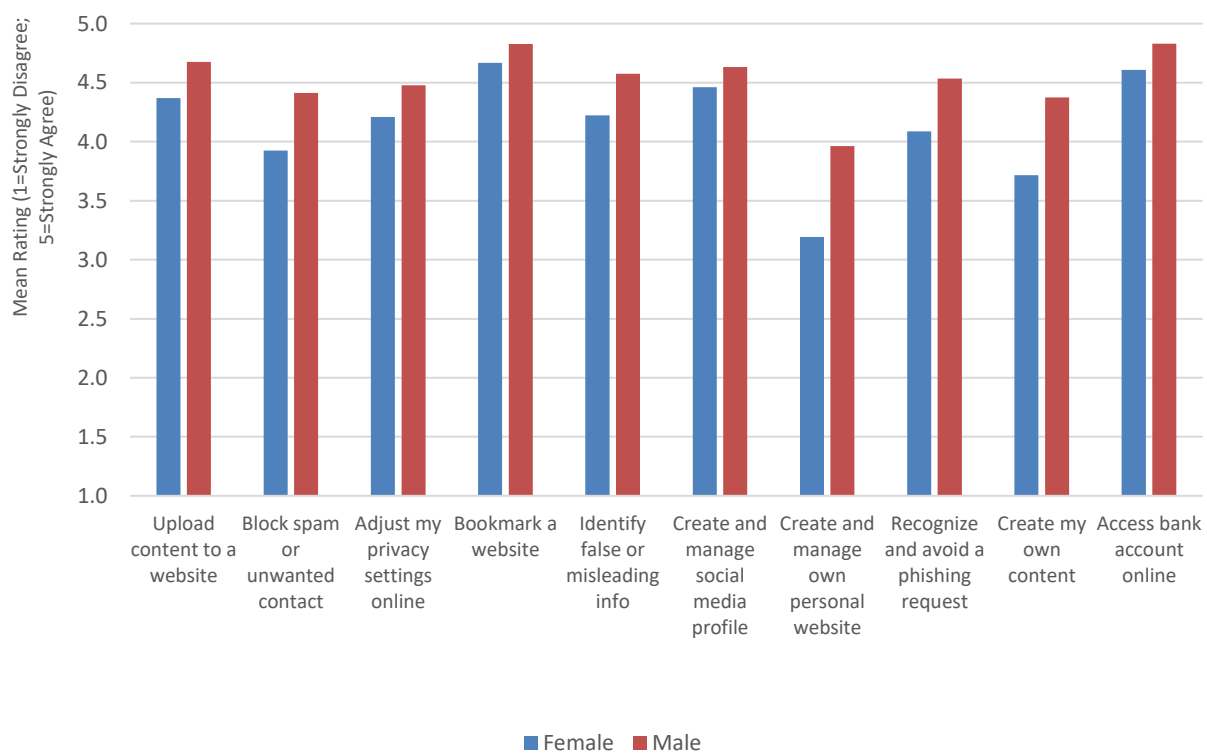
Additionally, respondents with a household income of less than $100,000 are less likely than those in higher income households to be skilled with uploading content, blocking spam or unwanted content, creating content using computers and the internet, and accessing a bank account online (see Figure 69).

Figure 69: Agreement with Statement About Internet Skills by Household Income

I know how to...
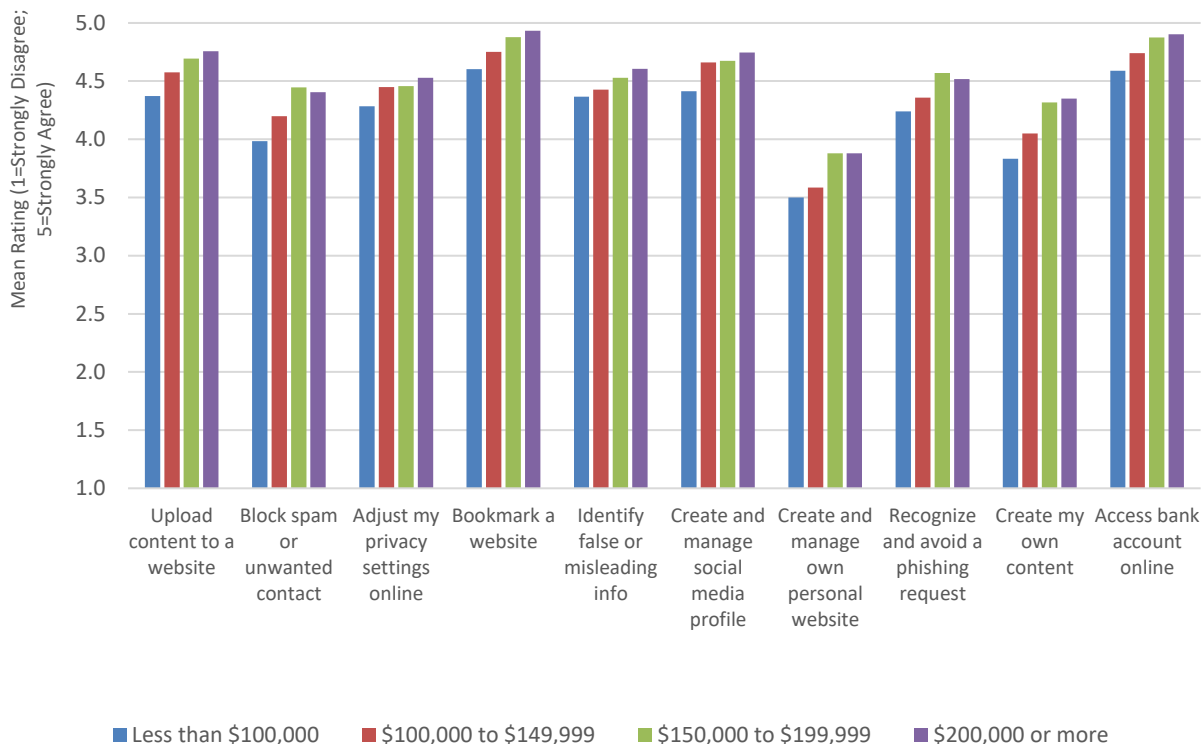
5.2.1.7.4 Internet use by location

Respondents were also asked to indicate how often they use the internet in various locations. As shown in Figure 70, most respondents use their internet at home or at work daily. Other locations are used less frequently, with the majority of respondents saying that internet use in public, city buildings never happens.

Figure 70: How Often Use the Internet in Various Locations
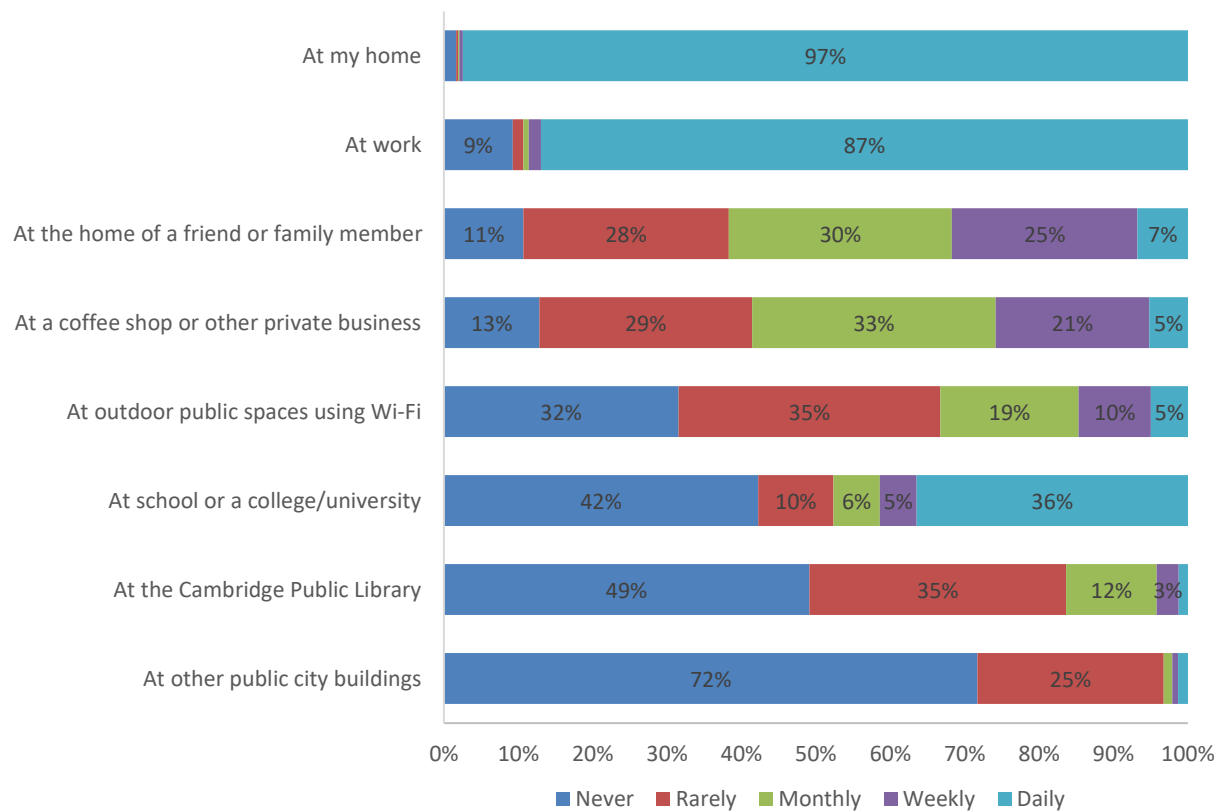
Younger respondents ages 18 to 34 and those earning under $100,000 annually are more likely to use the internet daily at school or college/university, compared with older and higher-income respondents. Those ages 55 and older and those earning under $100,000 per year are less likely to use the internet connection at work, as might be expected (see Figure 71 and Figure 72).

Figure 71: Daily Use of the Internet by Respondent Age
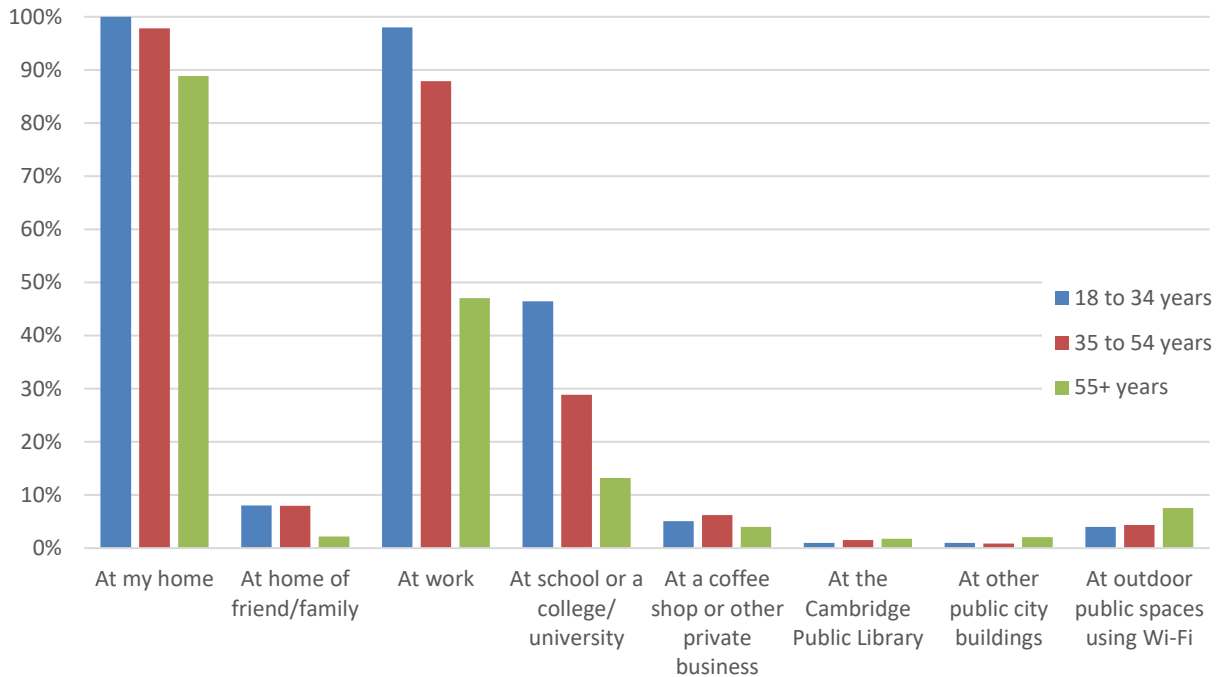
Figure 72: Daily Use of the Internet by Household Income
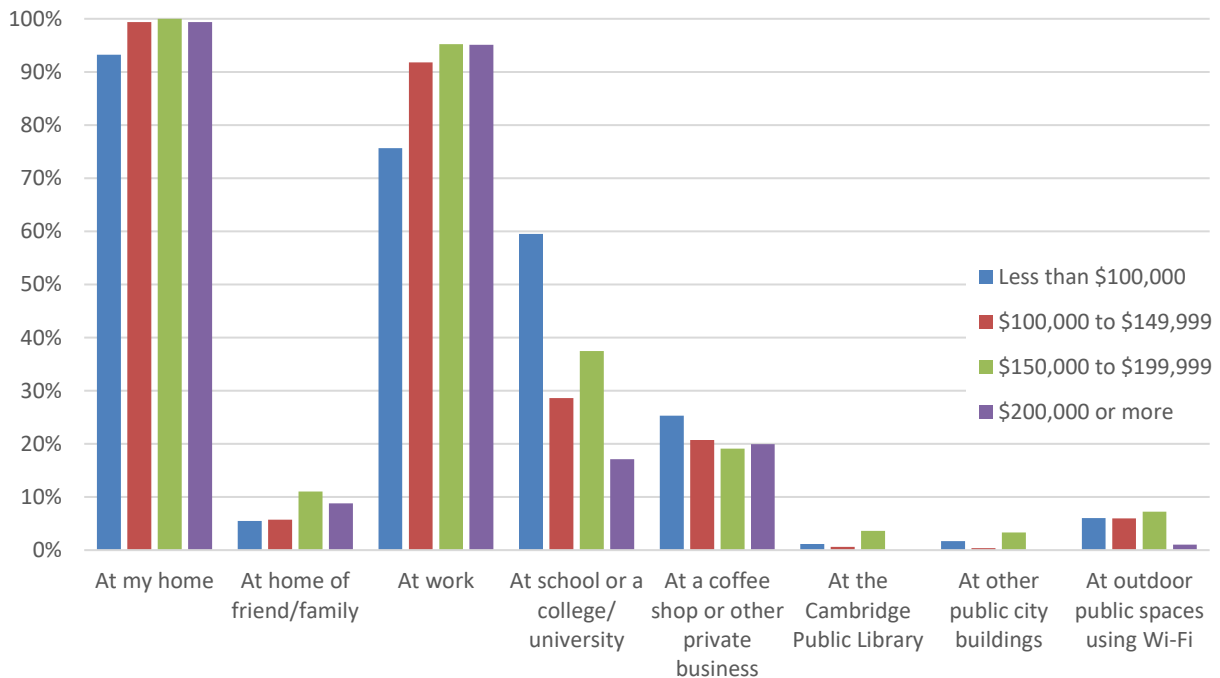
Specifically, respondents earning under $100,000 per year are less likely than higher income respondents to ever use the internet at work or at a coffee shop or other private business; they

are more likely to ever use the internet at school or college/university (see Figure 73 to Figure 75). Use of the internet at the Cambridge Public Library, other public buildings, and outdoor public spaces did not vary significantly by household income.

Figure 73: Use of the Internet at Work by Household Income
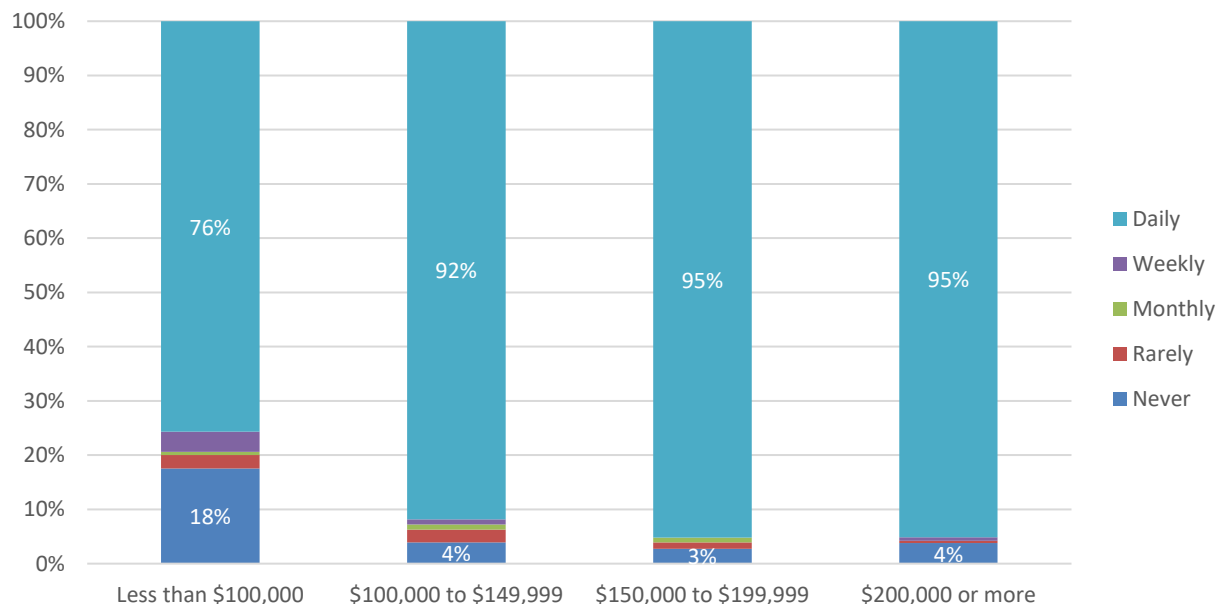
Figure 74: Use of the Internet at School or College/University by Household Income
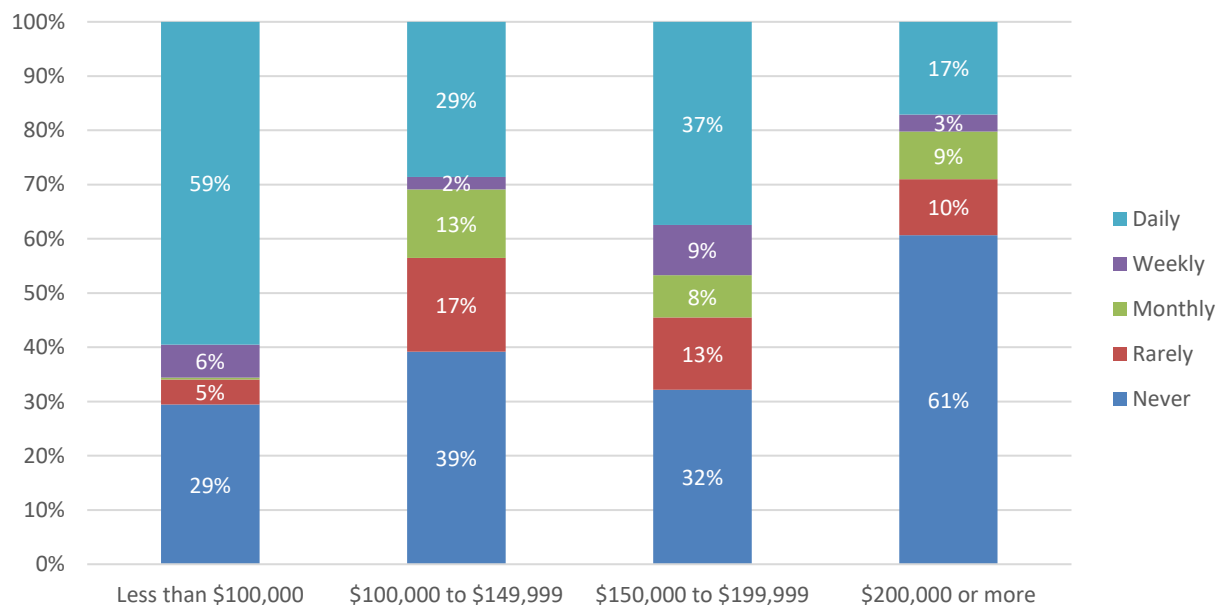
Figure 75: Use of the Internet at Coffee Shop or Other Private Business by Household Income
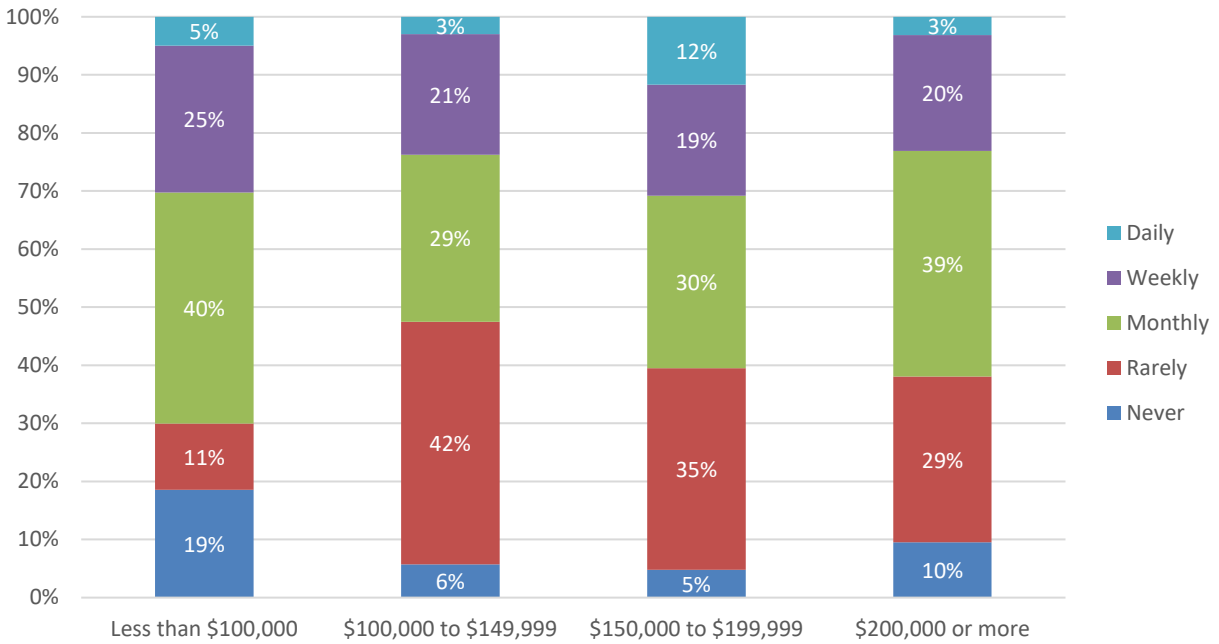
5.2.2 Internet use for jobs/careers

Seven in 10 respondents said their job requires them to have internet access at home (see Figure 76). As illustrated in Figure 77, respondents under age 55 (who are more likely to be employed) are more likely to have a job that requires internet access from home.

Figure 76: Job Requires Homes Internet Access
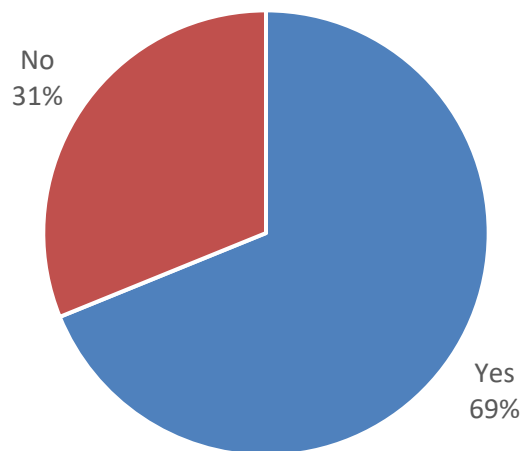
Figure 77: Internet Access Required for Job by Respondent Age
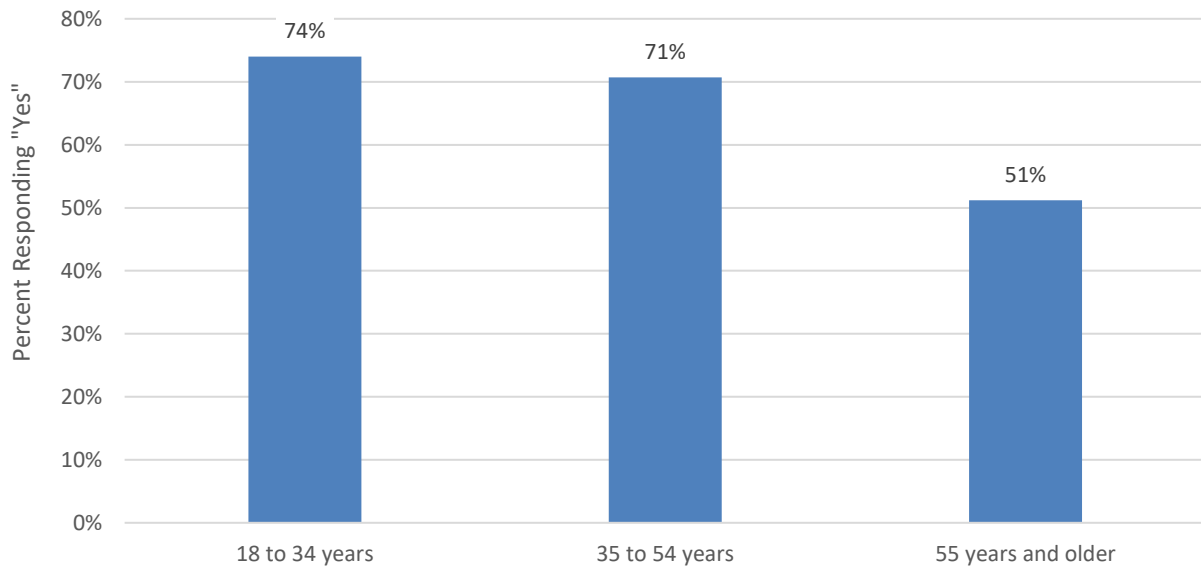
As illustrated in Figure 78, those earning $150,000 or more per year are more likely than those with a lower household income to have a job that requires internet access. Six in 10 of those earning less than $100,000 need internet access for a job (including 50% of those earning under $75,000 and 39% of those earning under $50,000 per year). However, lower income groups have a higher proportion of individuals ages 55 years and older. When controlling for respondent age, the low-income group has as high of a need for internet access compared with higher income individuals.

Figure 78: Internet Access Required for Job by Household Income
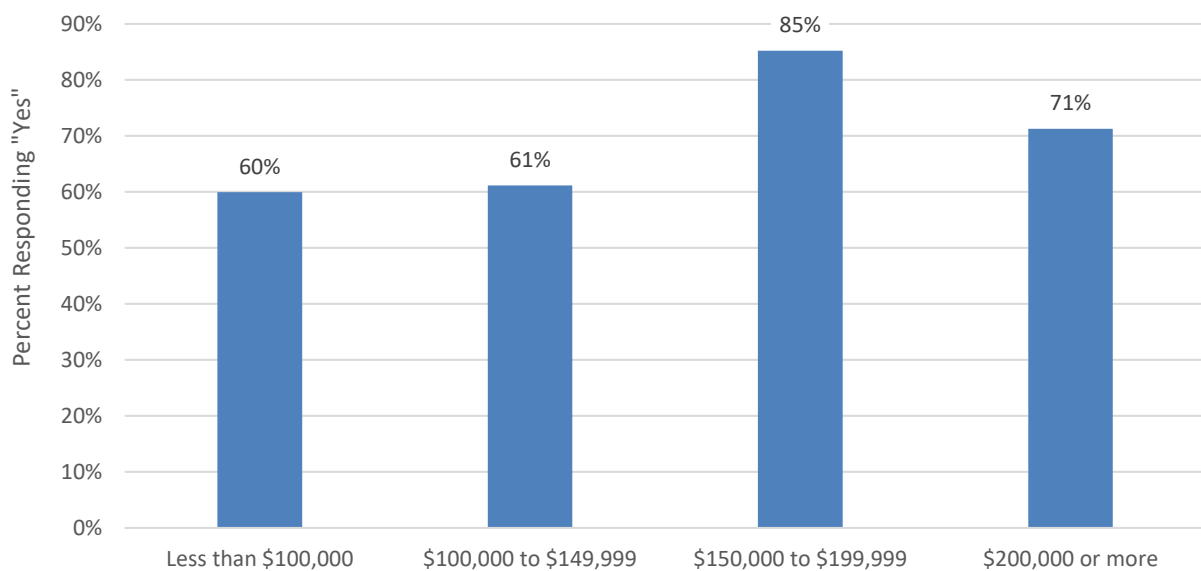
As shown in Figure 79 below, 29 percent of respondents indicated that someone in their household already teleworks from home, and another 15 percent would like to telework.

Figure 79: Household Member Teleworking
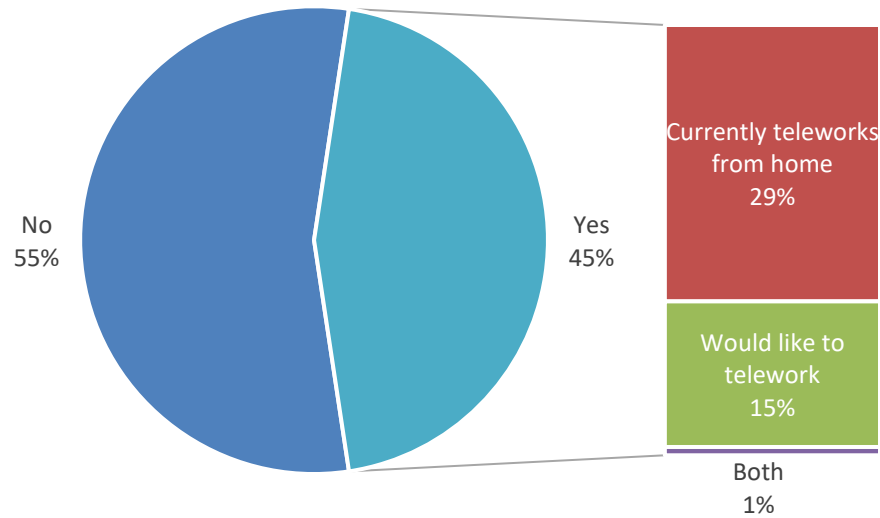
Respondents under age 55 are more likely than older respondents to telework or have a household member who would like to telework (see Figure 80). Additionally, households with an annual income of $200,000 or more are more likely to have a member who currently telecommutes, compared with households with lower annual income (see Figure 81).

Figure 80: Teleworking Status by Respondent Age
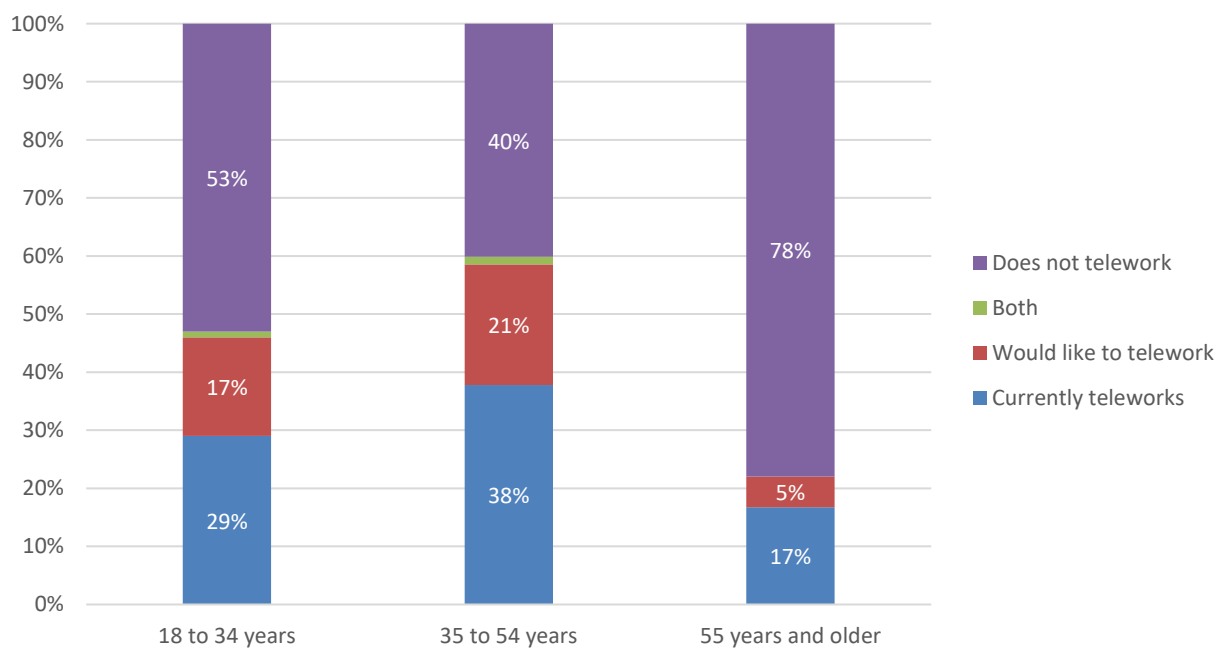
Figure 81: Teleworking Status by Household Income

More than one-fifth of respondents either have a home-based business or are planning to start one within the next three years, as illustrated in Figure 82.

Figure 82: Own or Plan to Start a Home-Based Business
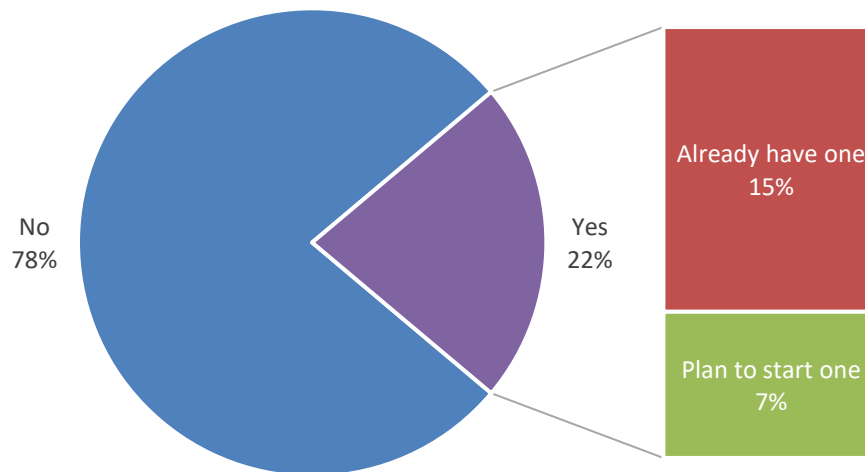
As shown in Figure 83, respondents ages 18 to 34 years are somewhat less likely than older respondents to either have or plan to start a home-based business. Those ages 55 and older are somewhat more likely to already have a home-based business.

Figure 83: Own or Plan to Start a Home-Based Business by Respondent Age
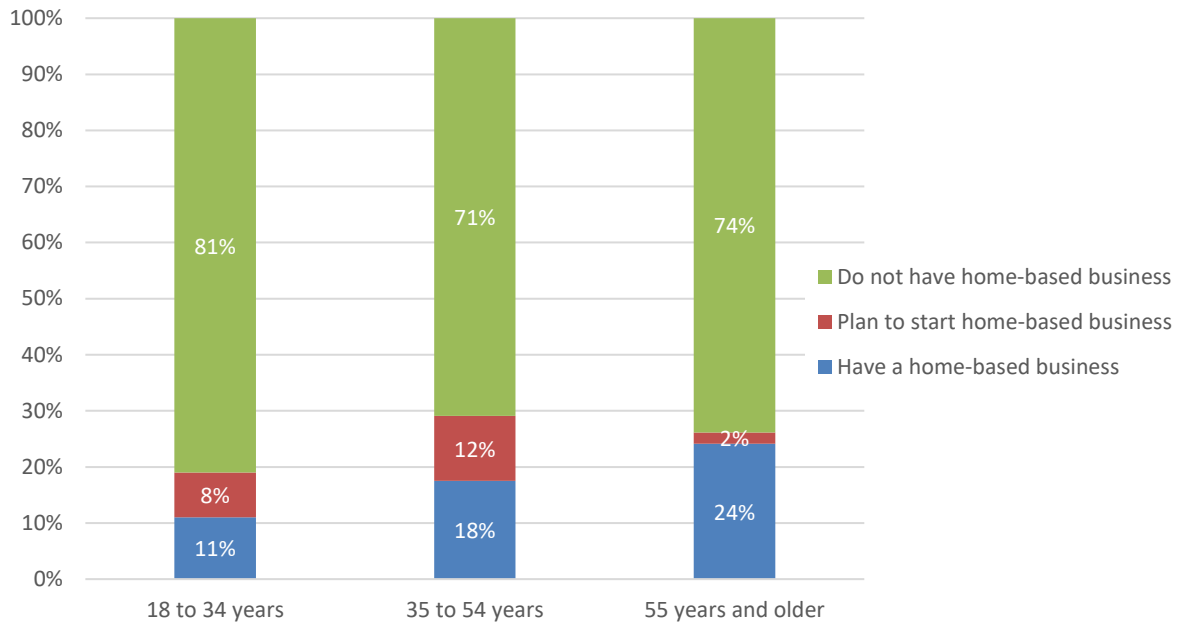
A high-speed data or internet connection is extremely important for most of those who telework or would like to telework (86 percent) and for those with a planned or existing home-based business (79 percent), as shown in Figure 84 and Figure 85. Intuitively, those who do not telework or have a planned/existing home-based business find the need for high-speed internet for these aspects to be less important.

Figure 84: Importance of High-Speed Internet for Teleworking
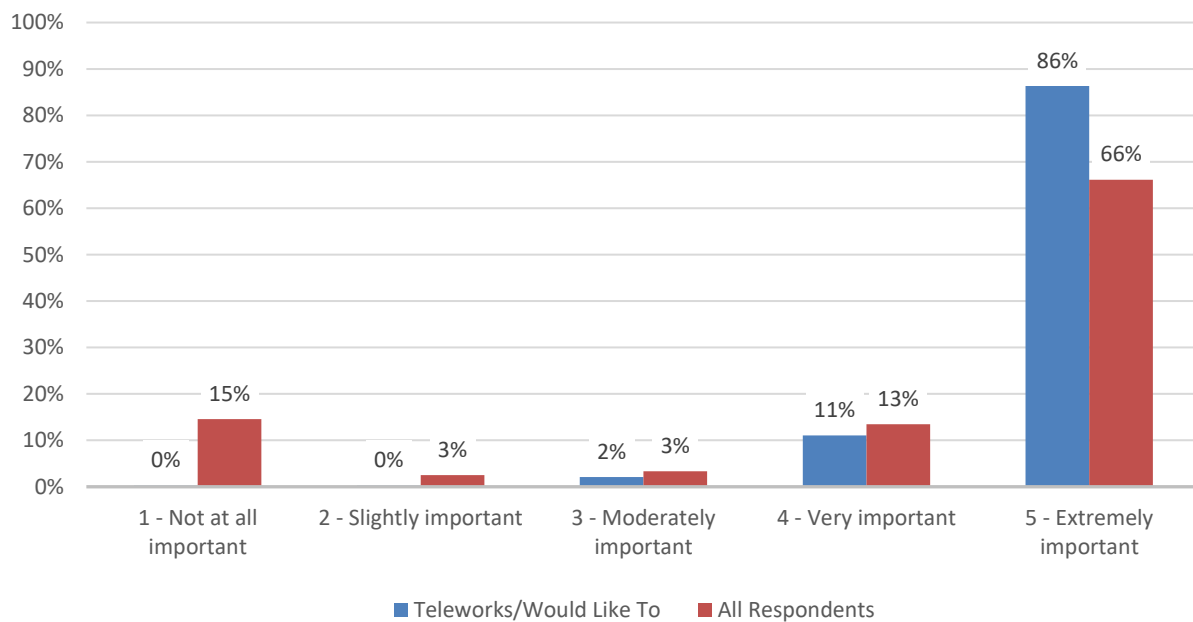
Figure 85: Importance of High-Speed Internet for Home-Based Business
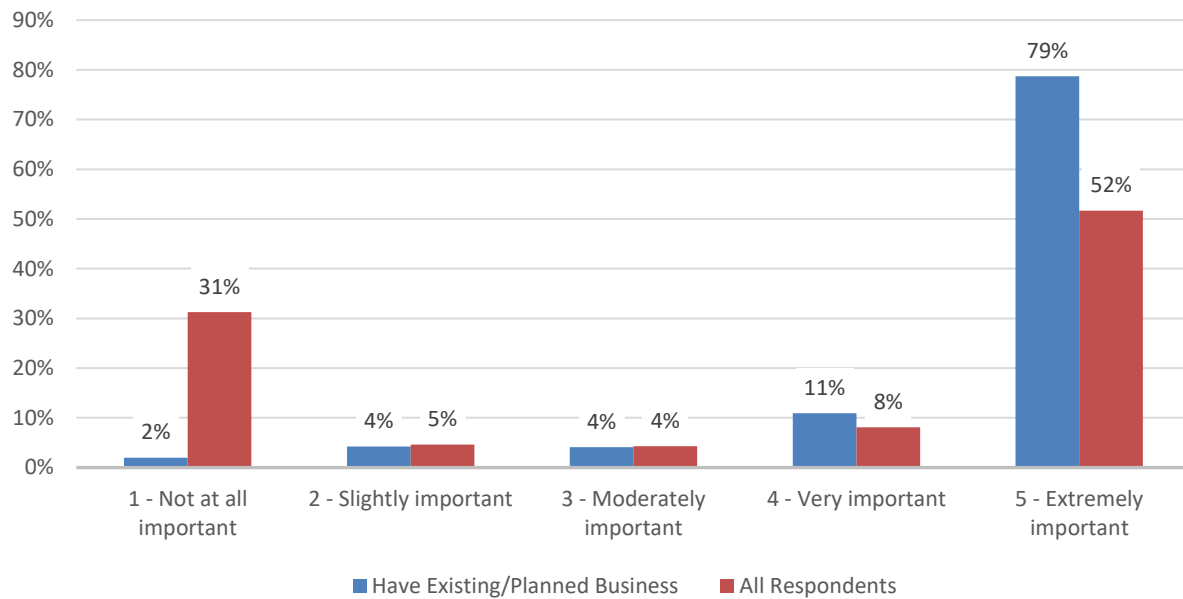
5.2.3 Internet use for education

Respondents were asked if they or a household member use an internet connection for educational purposes, such as completing assignments, research, or study related to coursework or formal education. Overall, 55 percent of respondents reported using the internet for educational reasons (see Figure 86). Just two percent of all respondents (or five percent of those who use the internet for education) use the internet for homeschooling.

Figure 86: Use of Internet for Educational Purposes
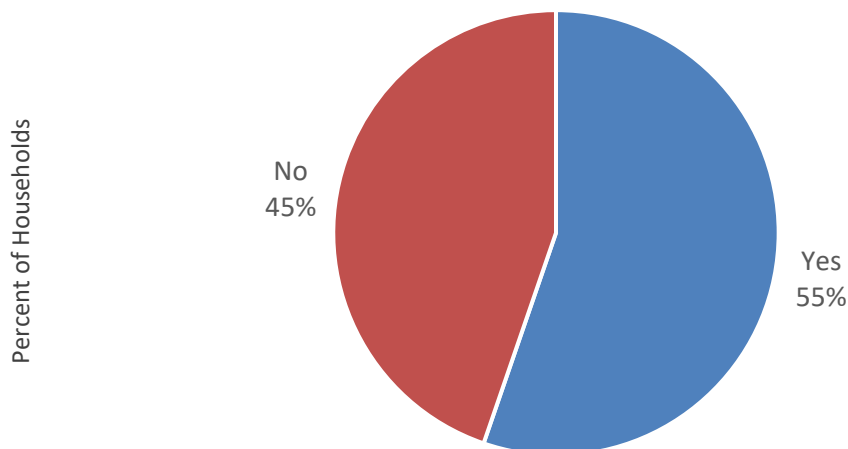
Use of the internet for educational purposes decreases as respondent age increases. Nearly two-thirds of those ages 18 to 34 years use the internet for educational purposes (see Figure 87).

Figure 87: Use of Internet for Educational Purposes by Respondent Age
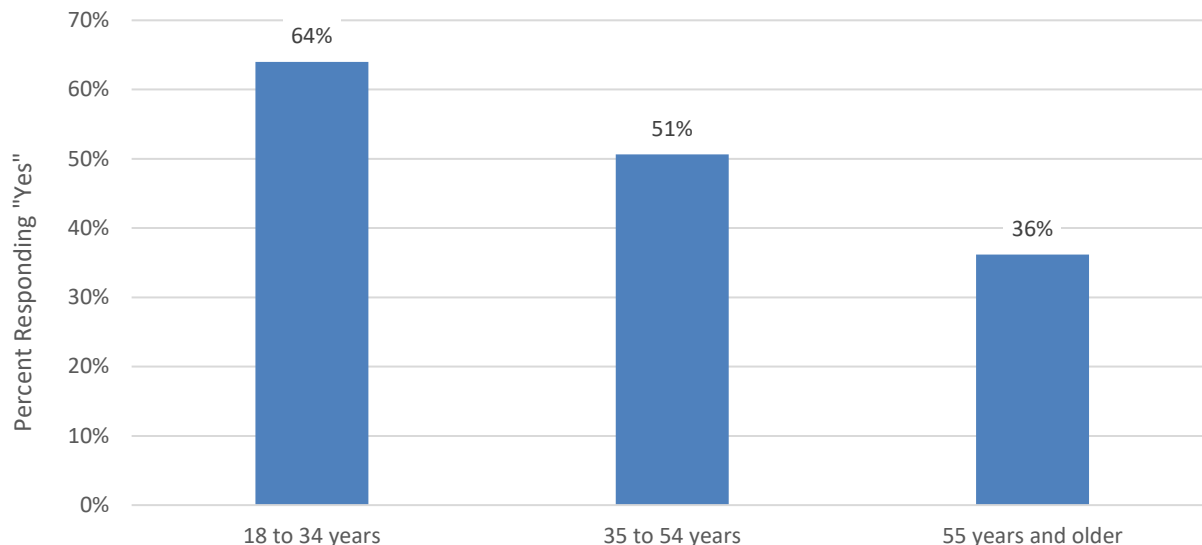
Respondents with a household income of $150,000 to $199,999 are the most likely to use the internet for educational purposes, as shown in Figure 88.

Figure 88: Use of Internet for Educational Purposes by Household Income
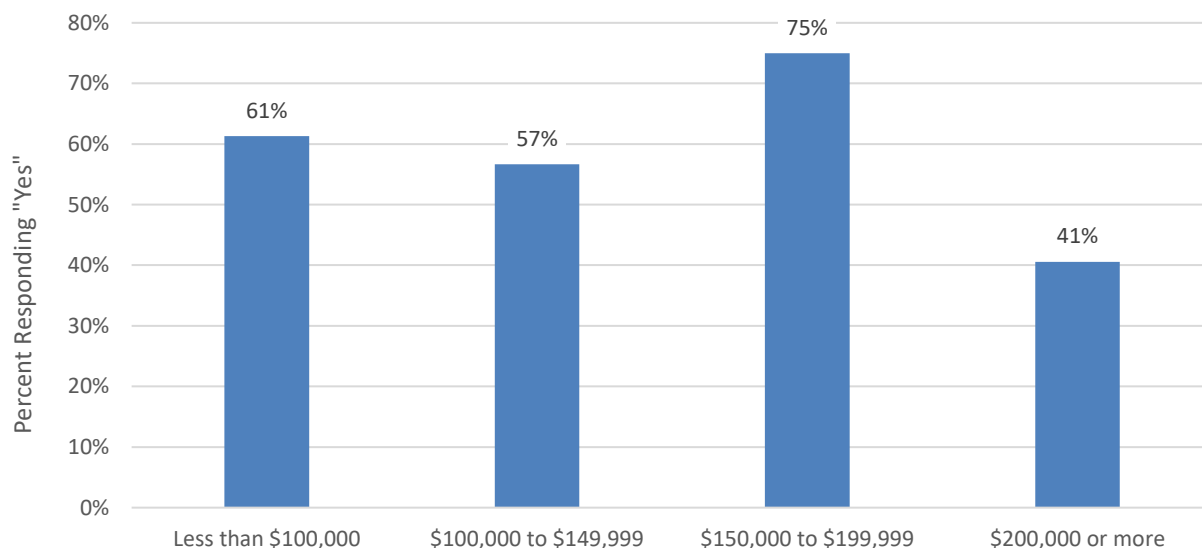
Respondents use the internet across a range of education levels. Among those who use the internet for educational purposes, 66 percent use it for graduate level education and 45 percent use it for continuing/adult education (see Figure 89).

Figure 89: Education Level for Which Internet Connection Is Used
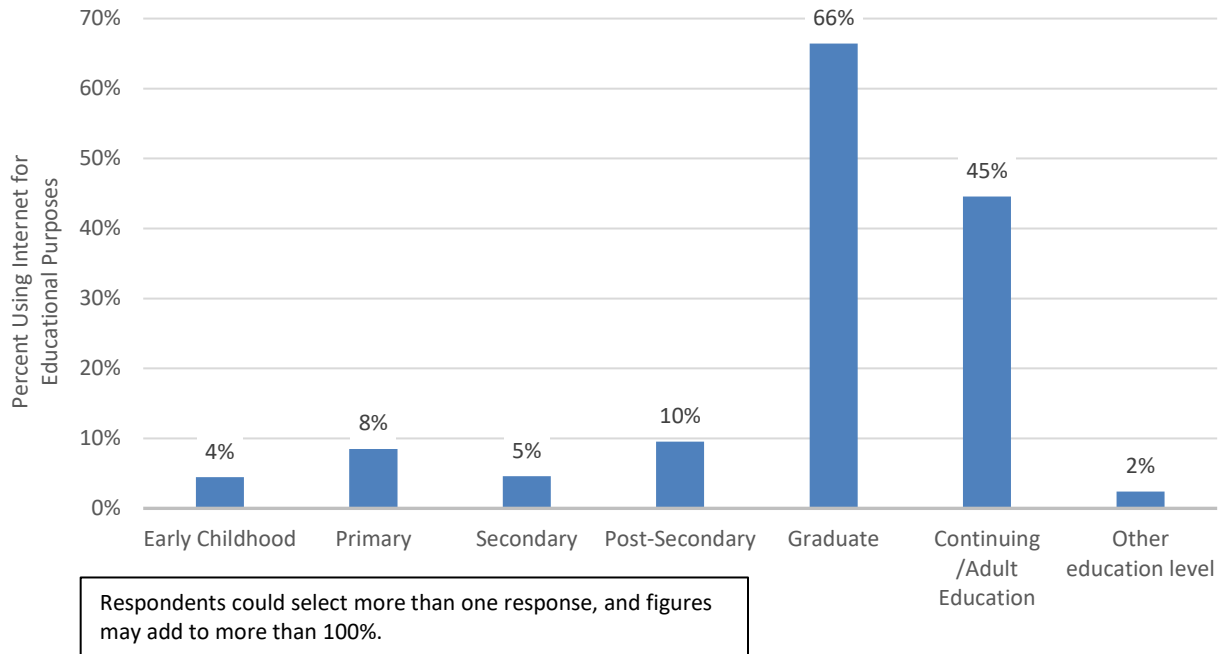
Respondents could select more than one response, and figures may add to more than 100%.

Use of the internet for educational purposes is related to presence of children in the household, as might be expected, particularly for early childhood, primary, and secondary education needs. Those without children in the home are more likely to use the internet for graduate education (see Figure 90).

Figure 90: Education Level for Which Internet Connection Is Used by Children in Household
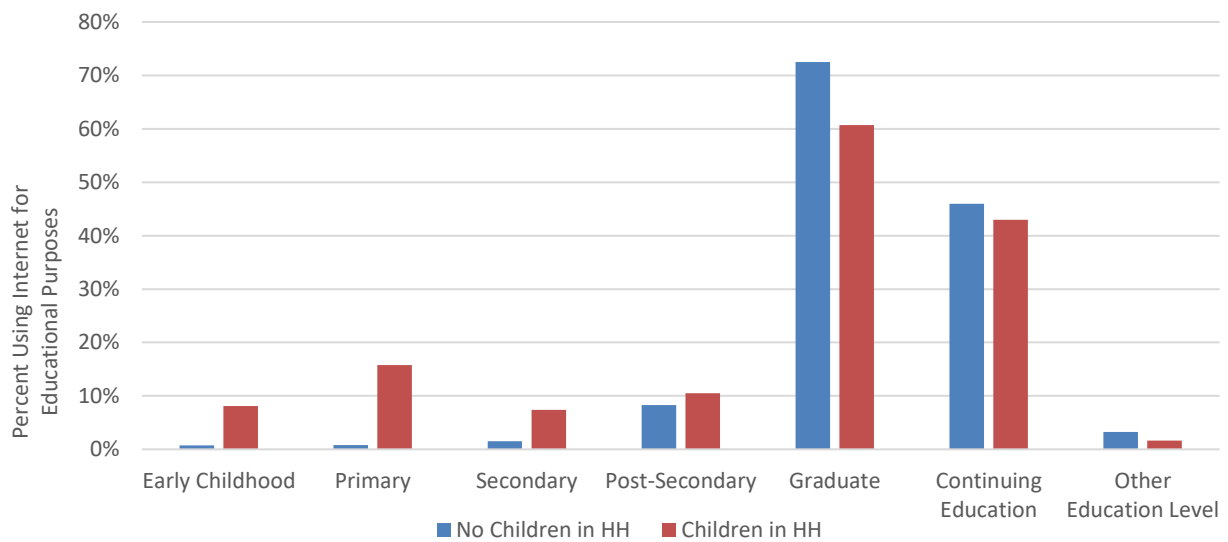
Similarly, use of the internet for educational purposes is correlated with respondent age, as illustrated in Figure 91. Respondents between ages 35 to 54 are more likely than older and younger respondents to use the internet for early childhood and primary education. Use of the internet for graduate education is highest among those ages 18 to 34 years.

Figure 91: Education Level for Which Internet Connection Is Used by Respondent Age
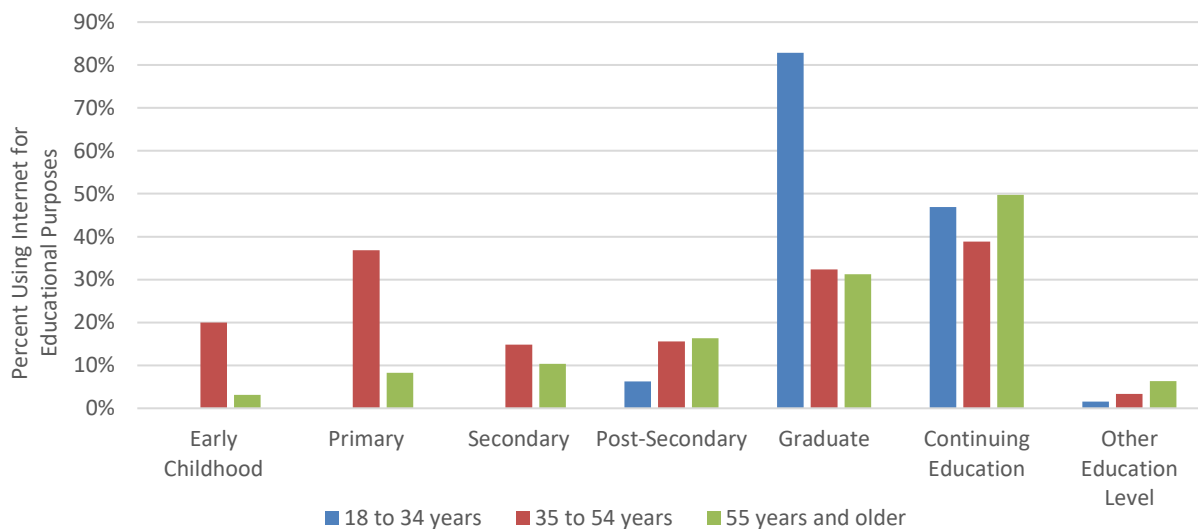
Similarly, respondents earning under $100,000 per year are more likely to use an internet connection for graduate level education, while those in higher income households are more likely to use an internet connection for continuing education (see Figure 92).

Figure 92: Education Level for Which Internet Connection Is Used by Household Income
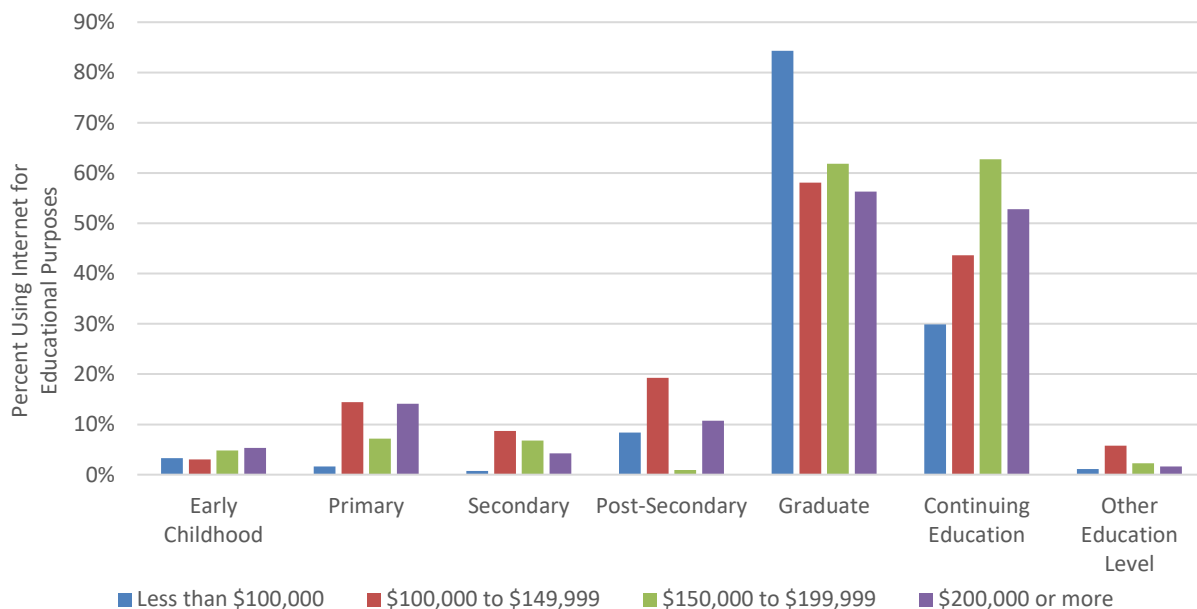
Among those who use the internet for educational purposes, 62 percent said a high-speed internet connection is extremely important and 23 percent said it is very important for their education needs (see Figure 93).

Figure 93: Importance of High-Speed Internet for Education Needs
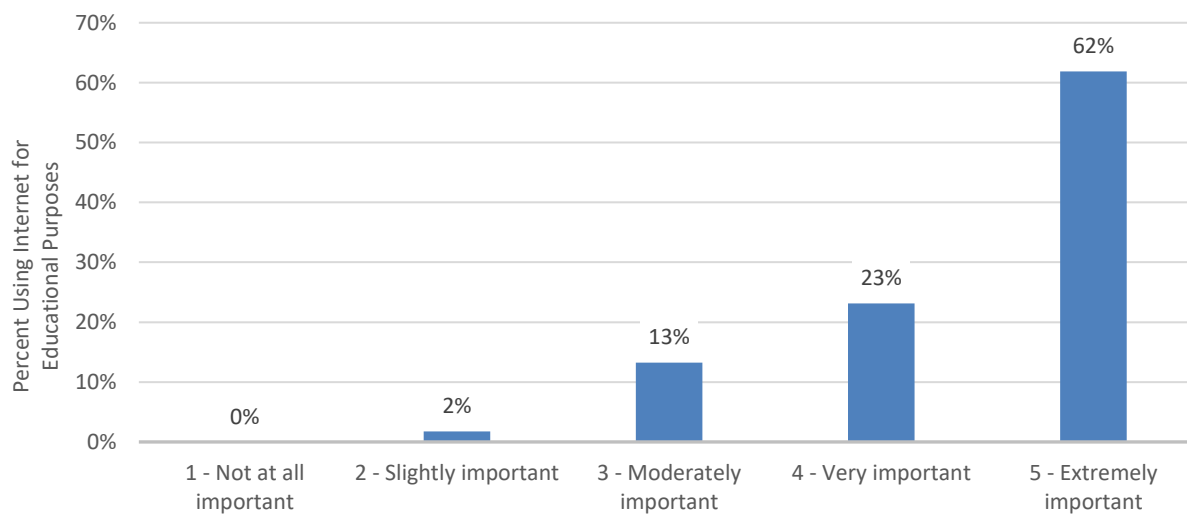
5.2.4 Respondent opinions

Respondents were asked their opinions about the City's role in providing or promoting broadband communications services within the area. Figure 94 illustrates the mean ratings, while Figure 95 provides detailed responses to each portion of the question.

Figure 94: Opinions About the Role(s) for City of Cambridge (Mean Ratings)

Mean Rating: 1= Strongly Disagree and 5=Strongly Agree
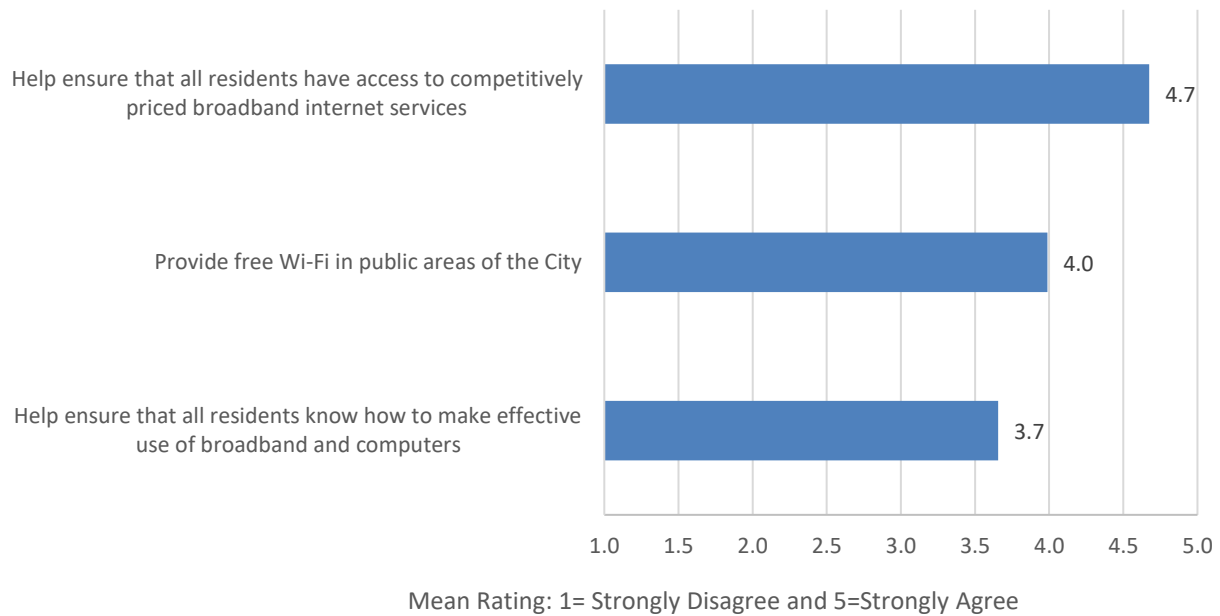
Figure 95: Opinions About the Role(s) for City of Cambridge
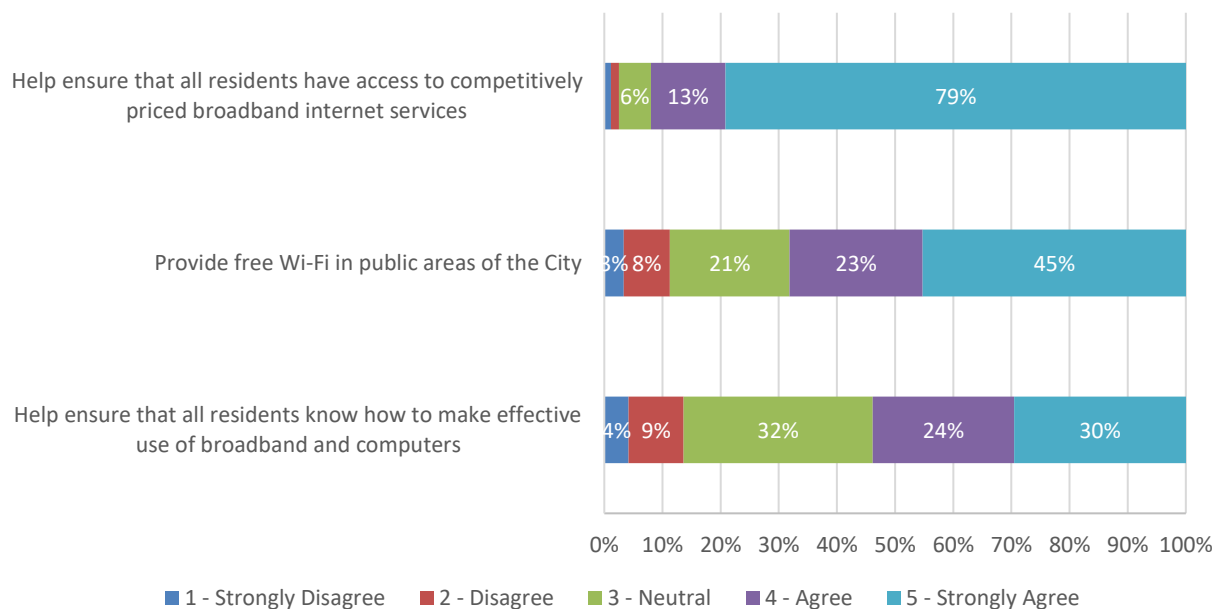
Overall, there is strong support for ensuring access to competitively priced broadband services, with 79 percent strongly agreeing. Two-thirds agreed the City should provide free Wi-Fi in public areas, but only 45 percent strongly agreed. Overall, there is moderate support for helping to ensure all residents know how to make effective use of broadband and computers.

Respondents were also asked their opinion of the current broadband market. Overall, respondents moderately to strongly agreed with most statements. Agreement was somewhat lower for the market offering high-speed internet at prices they can afford. The average agreement with broadband availability statements is shown in Figure 96. Detailed responses to statements about broadband availability are illustrated in Figure 97.

Figure 96: Opinions About the Broadband Internet Market (Mean Ratings)

Mean Rating: 1= Strongly Disagree and 5=Strongly Agree
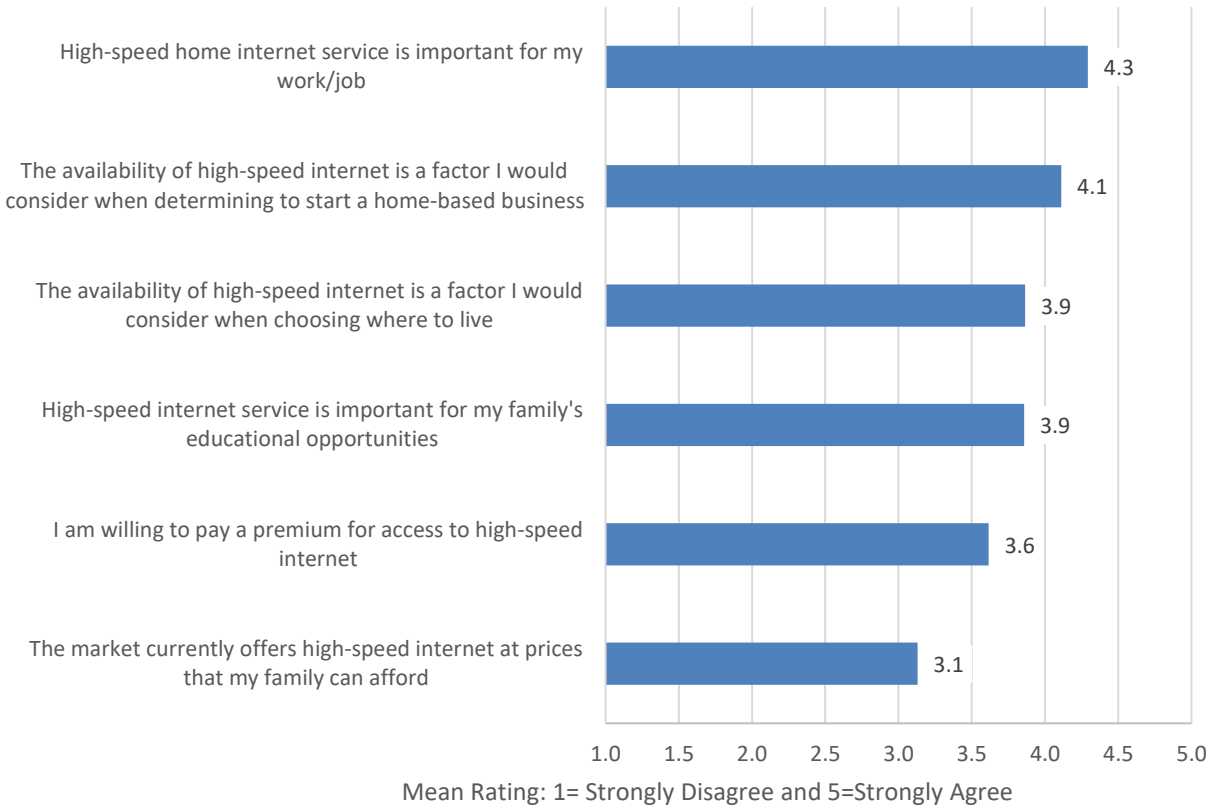
Figure 97: Opinions About the Broadband Internet Market
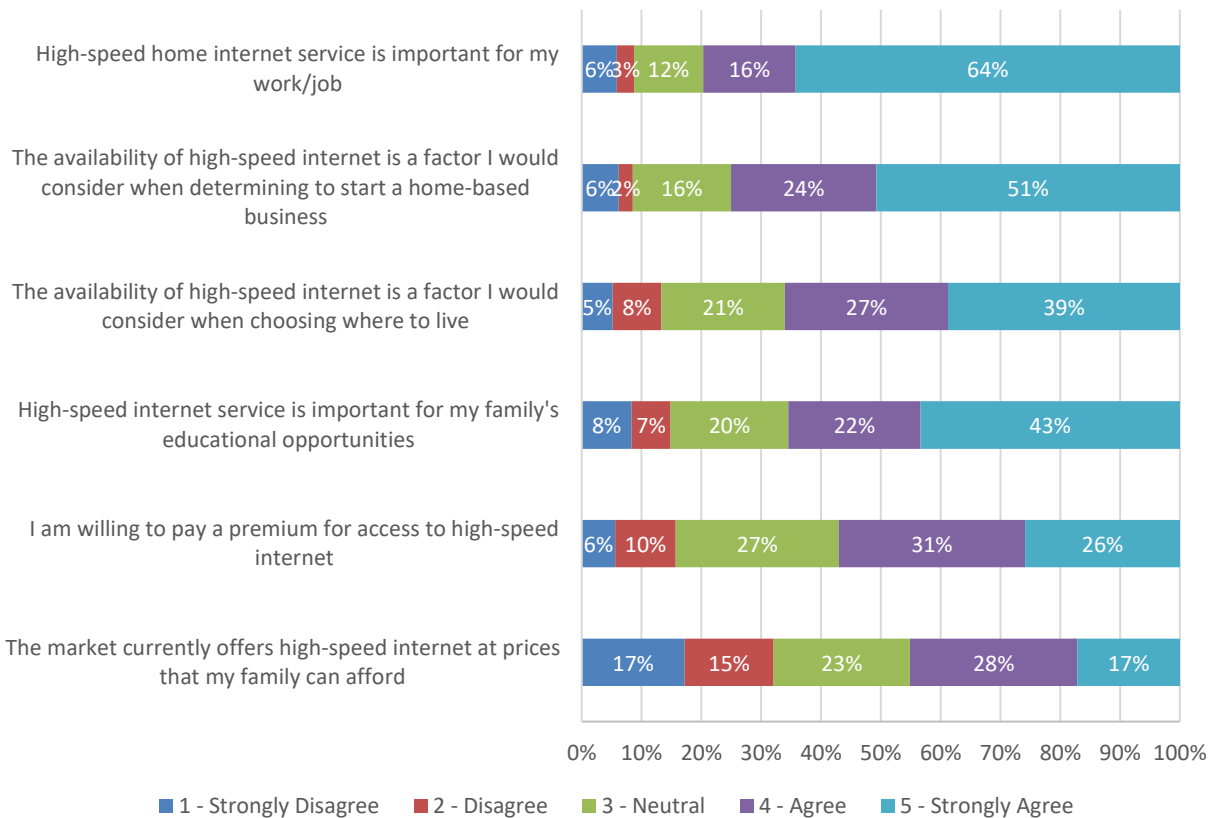
Nearly two-thirds of respondents strongly agreed and 16 percent agreed that high-speed internet is important for their work/job. Two-thirds of respondents agreed or strongly agreed that high-speed internet service is important for their family's educational opportunities.

At the same time, one-third of respondents disagreed or strongly disagreed that the market currently provides high-speed internet at prices they can afford, suggesting some need for affordable broadband internet among a segment of respondents. More than one-half of respondents are willing to pay a premium for access to high-speed internet.

As illustrated in Figure 98, respondents ages 55 and older were less likely to agree with statements about the importance of broadband internet service and the willingness to pay a premium for access to high-speed internet.

Agreement with the availability of affordable high-speed internet and the willingness to pay a premium for access to high-speed internet is correlated with household income. Those in lower income households were less likely to agree with these statements (see Figure 99).

Figure 98: Opinions About Broadband Internet by Respondent Age
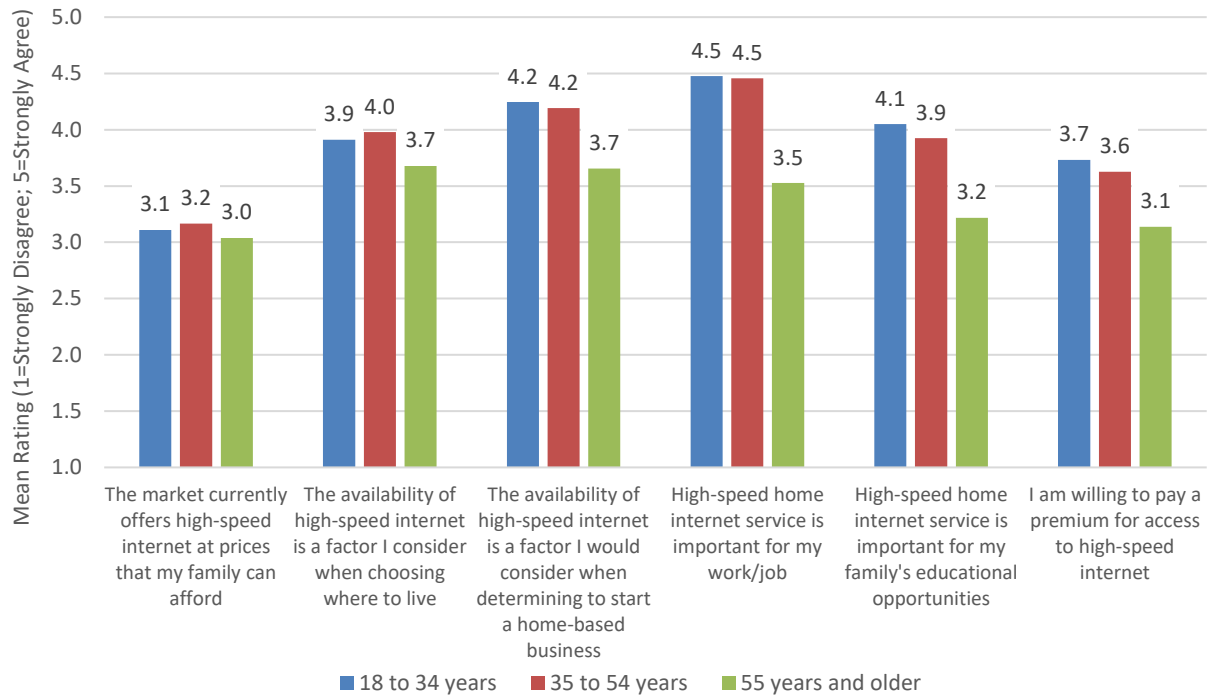
Figure 99: Opinions About Broadband Internet by Household Income
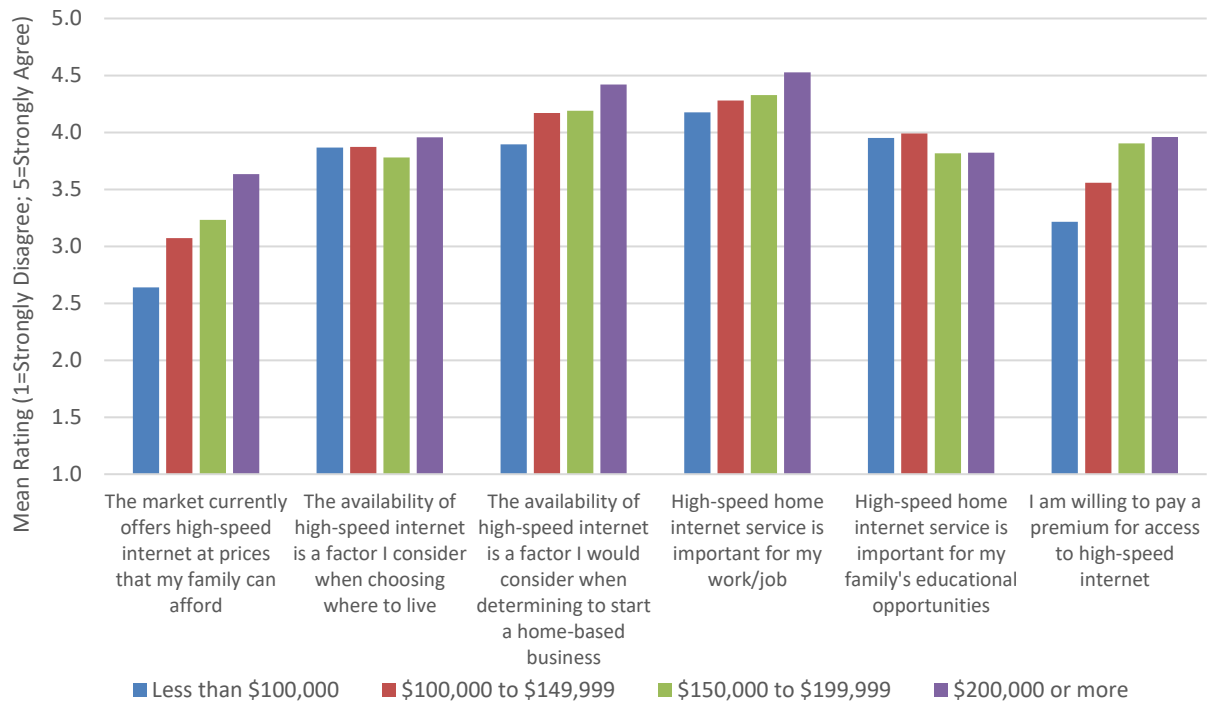
5.2.4.1 Willingness to Purchase High-Speed Internet Service

Respondents were asked if they would be willing to purchase high-speed internet service (defined as 100 Mbps) for various price levels. The mean willingness to purchase across this array of questions is illustrated in Figure 100, while detailed responses are illustrated in Figure 101.

Figure 100: Willingness to Purchase 100 Mbps Internet at Price Levels (Mean Ratings)
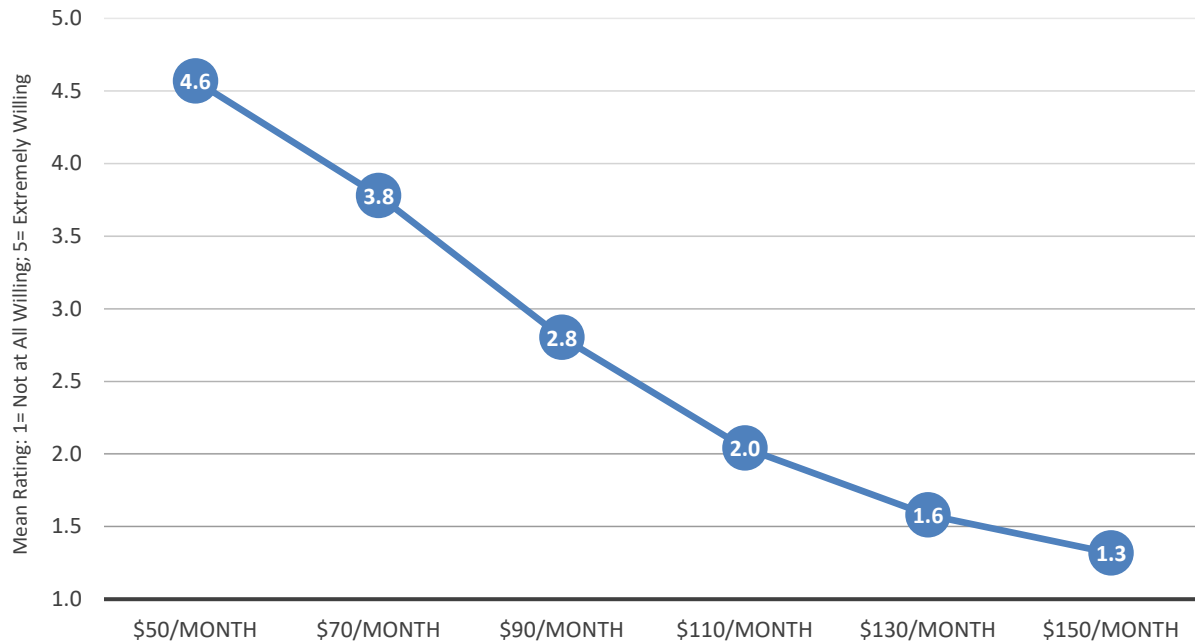
Figure 101: Willingness to Purchase 100 Mbps Internet at Various Price Levels
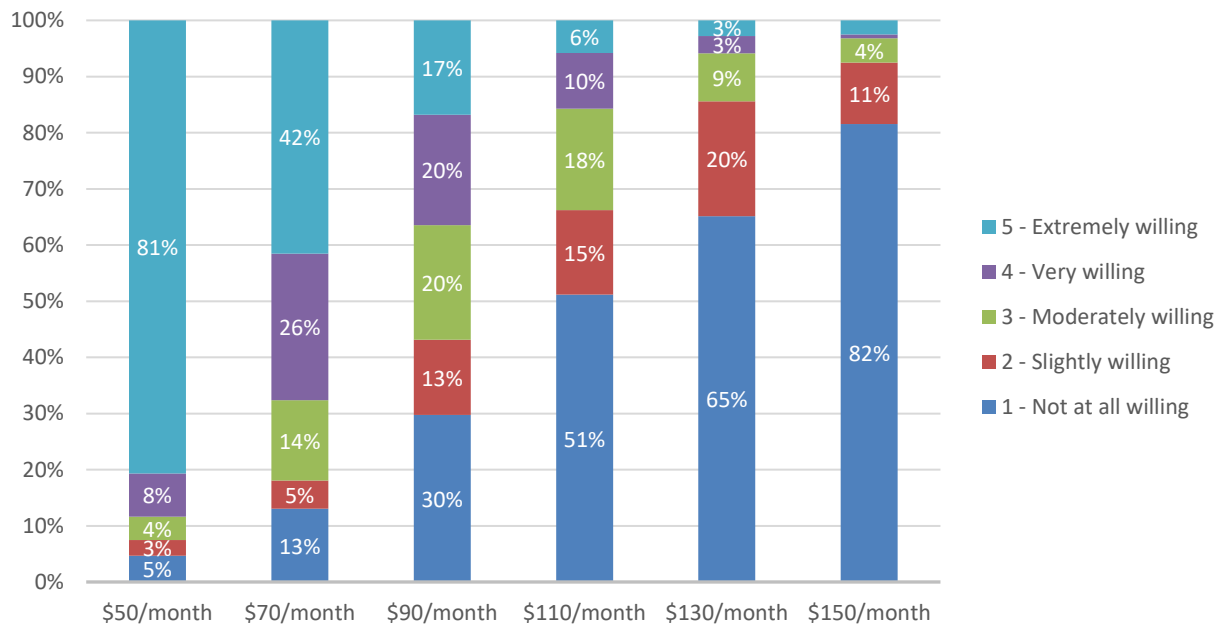
Respondents' willingness to purchase 100 Mbps internet service is high at $50 per month, but it drops considerably as the price increases. The mean rating falls to 3.8 at a price point of $70 per month and 2.8 at a price point of $90 per month (slightly to moderately willing). From another perspective, 81 percent of respondents are extremely willing to purchase 100 Mbps internet for $50 per month, dropping to 42 percent at $70 per month and 17 percent at $90 per month.

The willingness to purchase high-speed internet service is also correlated with some demographic characteristics of the respondents, including household income (see Figure 102). The likelihood of purchasing high-speed internet tends to increase as household income increases.

Figure 102: Willingness to Purchase 100 Mbps Internet Service by Household Income
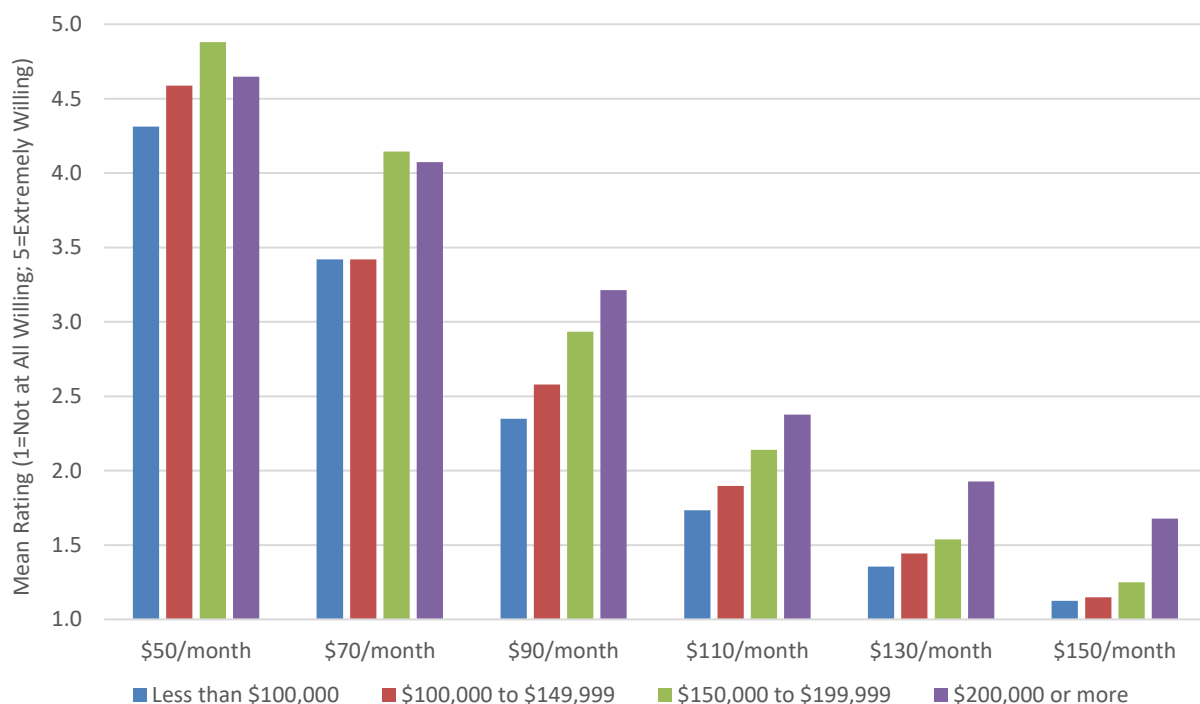
Table 17 shows willingness to purchase 100 Mbps internet service at different price points for various income groups, including those in lower-income households. Please keep in mind that the counts are relatively small for some income groups and the results may not be reliable.

Table 17: Willingness to Purchase 100 Mbps Internet Service by Household Income

		< $50k	< $75k	<$100k	$100-$149k	$150-$199k	$200k +
$50 per month	Mean	4.2	4.4	4.3	4.6	4.9	4.6
	Valid N	34	67	118	75	73	104
$70 per month	Mean	3.2	3.3	3.4	3.4	4.1	4.1
	Valid N	31	63	115	75	73	104
$90 per month	Mean	2.1	2.2	2.3	2.6	2.9	3.2
	Valid N	31	64	115	75	73	103
$110 per month	Mean	1.5	1.7	1.7	1.9	2.1	2.4
	Valid N	31	63	115	75	73	103
$130 per month	Mean	1.3	1.4	1.4	1.4	1.5	1.9
	Valid N	31	63	115	75	73	102
$150 per month	Mean	1.2	1.2	1.1	1.1	1.2	1.7
	Valid N	31	63	115	75	73	103
Mean Willingness (1=Not at All Willing; 5=Extremely Willing)							

Respondents were also asked if they would be willing to purchase 1 Gbps internet service at various price levels. The mean willingness to purchase across this array of questions is illustrated in Figure 103, while detailed responses are illustrated in Figure 104.

Figure 103: Willingness to Purchase 1 Gbps Internet at Price Levels (Mean Ratings)
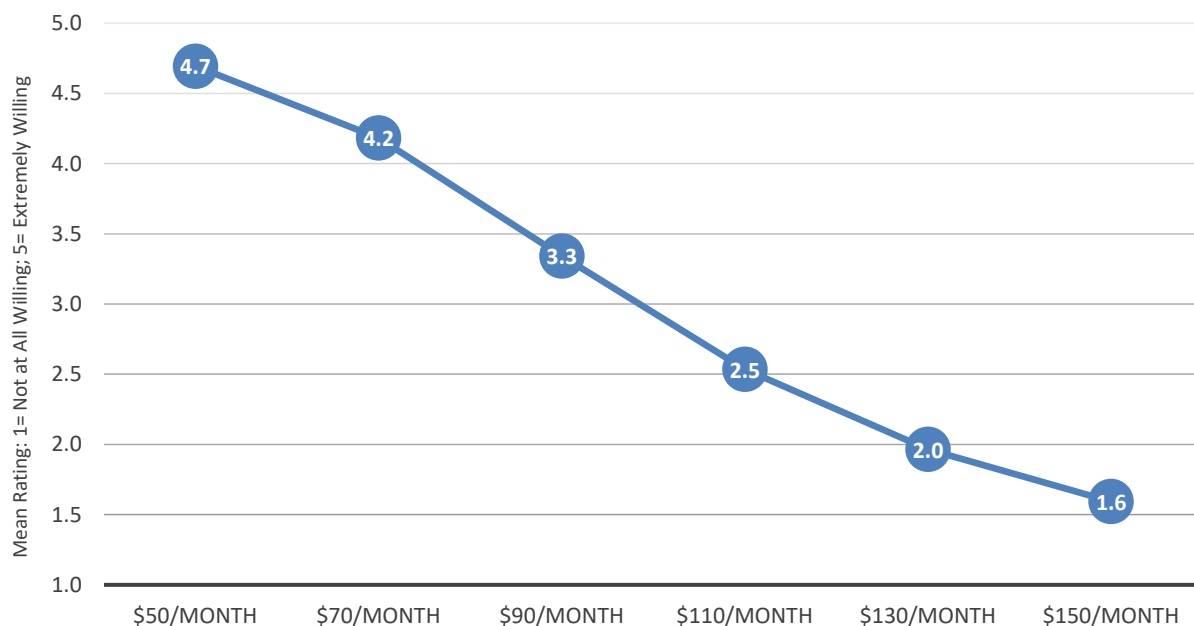
Figure 104: Willingness to Purchase 1 Gbps Internet at Various Price Levels
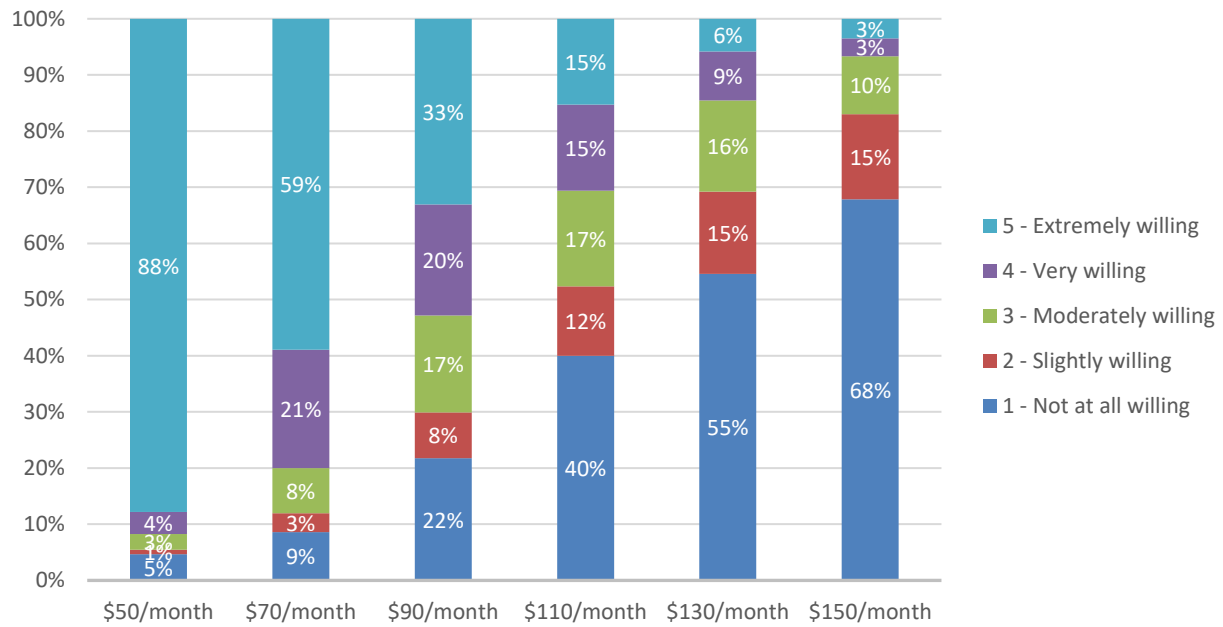
The likelihood of purchasing high-speed internet tends to increase as household income increases (see Figure 105).

Figure 105: Willingness to Purchase 1 Gbps Internet Service by Household Income
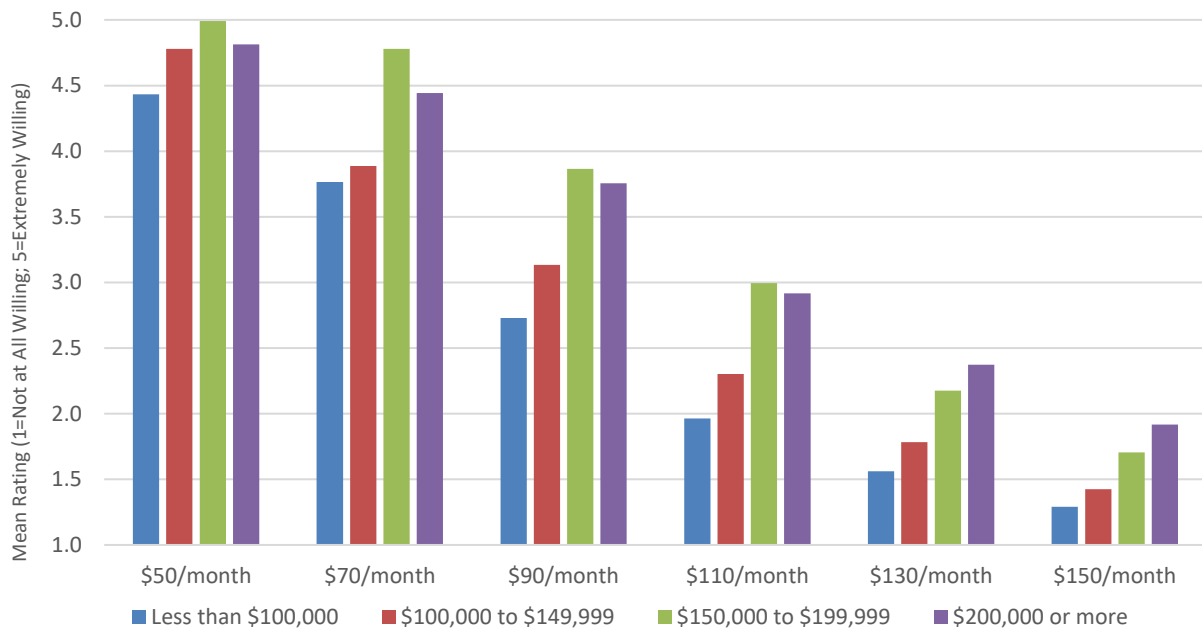
Table 18 shows willingness to purchase 1 Gbps internet service at different price points for various income groups, including those in lower-income households. Please keep in mind that the counts are relatively small for some income groups and the results may not be reliable.

Table 18: Willingness to Purchase 1 Gbps Internet Service by Household Income

		< $50k	< $75k	<$100k	$100-$149k	$150-$199k	$200k +
$50 per month	Mean	4.3	4.3	4.4	4.8	5.0	4.8
	Valid N	34	67	118	75	74	107
$70 per month	Mean	3.3	3.5	3.8	3.9	4.8	4.4
	Valid N	30	63	114	75	74	107
$90 per month	Mean	2.4	2.5	2.7	3.1	3.9	3.8
	Valid N	30	63	115	75	74	106
$110 per month	Mean	1.9	1.9	2.0	2.3	3.0	2.9
	Valid N	30	63	114	75	74	106
$130 per month	Mean	1.5	1.5	1.6	1.8	2.2	2.4
	Valid N	30	63	114	75	74	106
$150 per month	Mean	1.4	1.2	1.3	1.4	1.7	1.9
	Valid N	30	63	114	75	74	105
Mean Willingness (1=Not at All Willing; 5=Extremely Willing)							

5.2.4.2 Importance of Home Internet Features

Respondents were asked to evaluate the importance of various features of home internet. The mean importance ratings are shown in Figure 106, while detailed responses are shown in Figure 107.

Figure 106: Importance of Home Internet Features (Mean Ratings)

Mean Rating (1=Not at all important and 5=Extremely important)
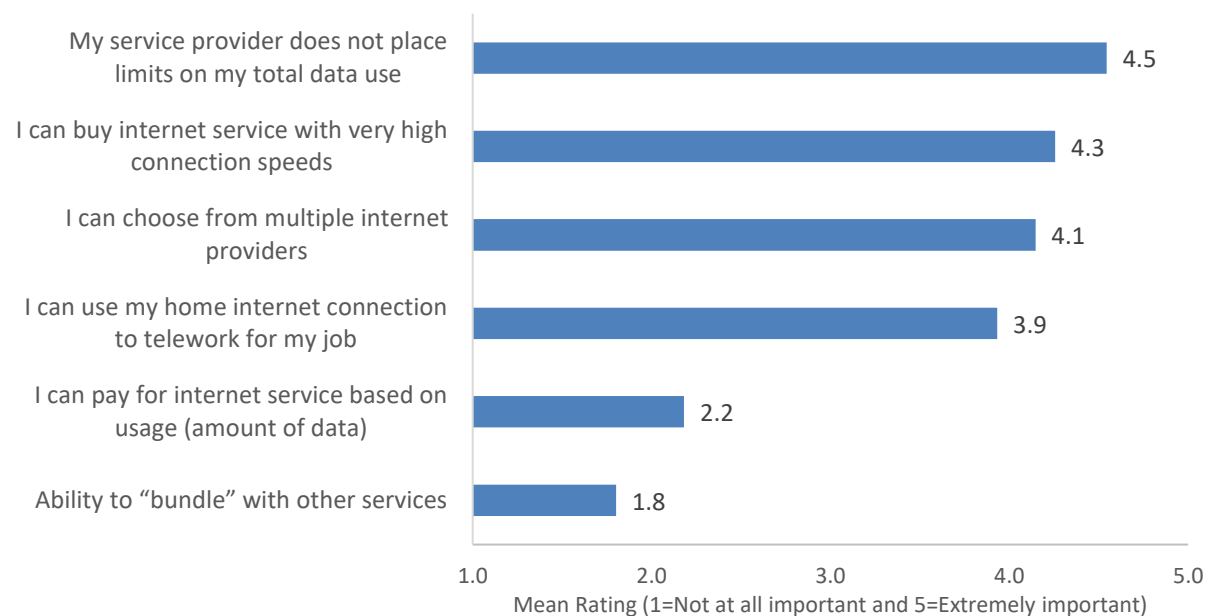
Figure 107: Importance of Home Internet Features
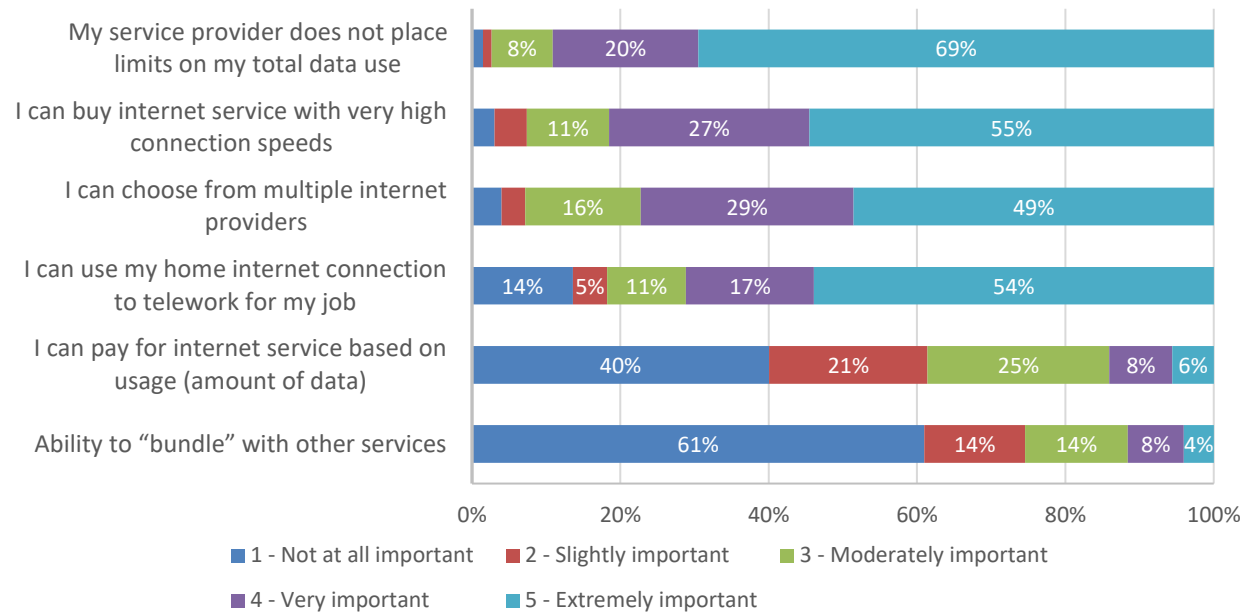
The most important home internet feature among those evaluated is unlimited data use, with 69 percent saying this feature is extremely important. Four in 10 said paying for data based on usage is not at all important, and six in 10 said the ability to bundle with other services is not at all important; these features are more important among respondents ages 55 and older (see Figure 108).

Figure 108: Important of Home Internet Features by Respondent Age
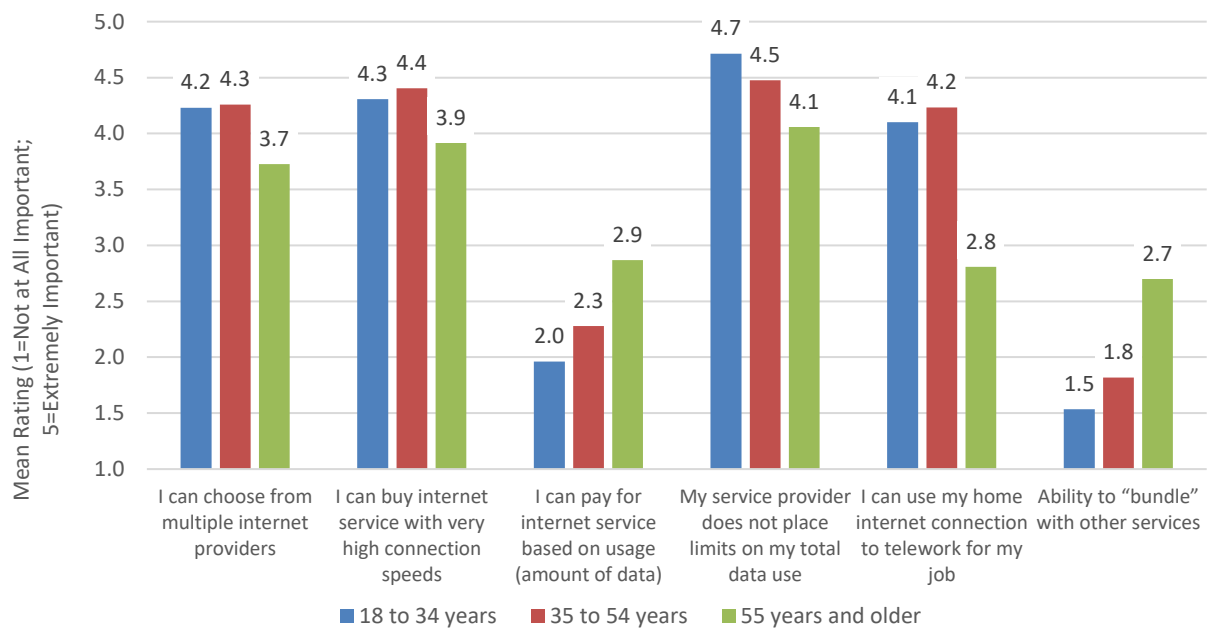
5.2.5 Programs for low-income subscribers

Respondents were asked if they are enrolled in Comcast's Internet Essentials program or if they receive a subsidy under the FCC's "Lifeline" programs. Less than one percent of respondents participate in the program or subsidy for low-income subscribers.

Only two of the 443 respondents reported taking advantage of Internet Essentials, the Comcast subsidized service, or receiving a subsidy under the FCC's "Lifeline" program. One individual enrolled in Internet Essentials did not report a household income, and one reported a higher household income of $150,000 to $199,999. Among the 69 respondents with household incomes of $75,000 or less, seven were unsure if they are enrolled.

5.2.6 Respondent information

Basic demographic information was gathered from survey respondents and is summarized in this section. Several comparisons of respondent demographic information and other survey questions were provided previously in this report.

As indicated previously regarding age-weighting, disproportionate shares of survey respondents were in the older age cohorts relative to the City's adult population as a whole. Approximately 28 percent of survey respondents are ages 65 and older, compared with 13 percent of the population. Conversely, only 24 percent of survey respondents are ages 18 to 34, compared with 59 percent of the population (see Figure 109). The weighted survey results presented in this report are adjusted to account for these differences and to provide results that are more representative of the City's population, as discussed previously.

Figure 109: Age of Respondents and City of Cambridge Adult Population
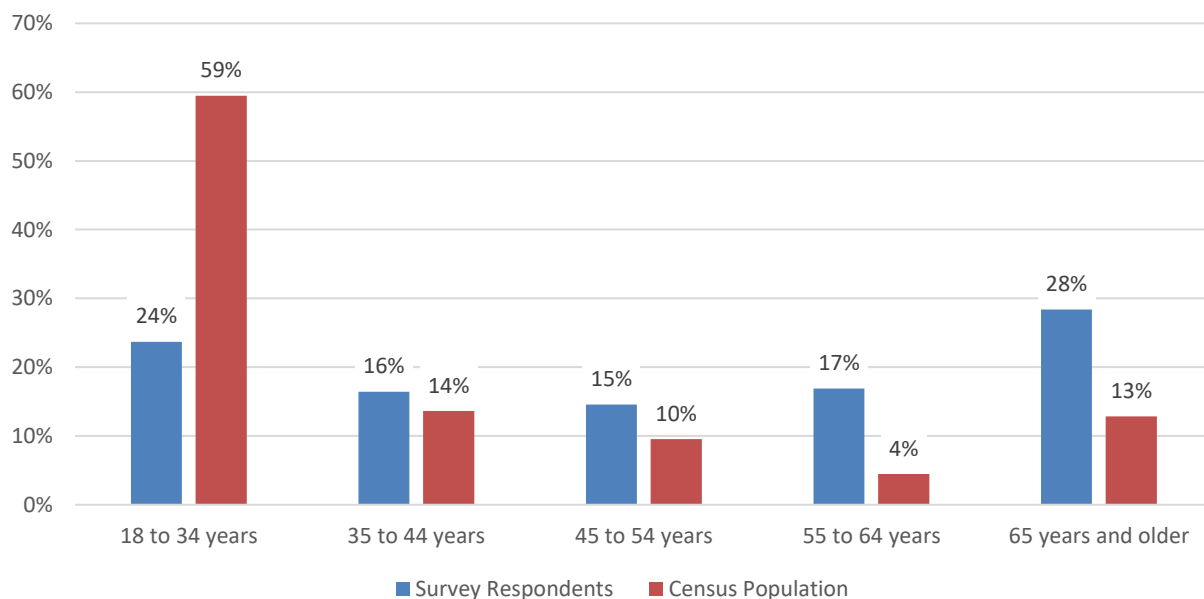
Table 19 highlights the demographic characteristics of survey respondents, broken out by respondent age. Respondents ages 35 to 54 years are more likely than older and younger respondents to have children in the household. More than four in 10 respondents ages 35 to 54 years have four or more household members, compared with 20 percent of respondents ages 18 to 34 and seven percent of respondents ages 55 and older. As may be expected, respondent age is correlated with years lived at residence. More than nine in 10 respondents ages 55 and older have lived at their residence for at least five years.

Table 19: Demographic Profile by Respondent Age

Age Cohort		18-34	35-54	55+	Total
Highest level of education	Some high school	0%	1%	2%	1%
	Completed high school	0%	2%	8%	2%
	Two-year college or technical degree	0%	1%	7%	1%
	Four-year college degree	39%	23%	16%	31%
	Graduate degree	61%	74%	66%	65%
	Weighted Count	*251*	*97*	*73*	*423*
Approximate annual household income	Less than $25,000	2%	2%	8%	3%
	$25,000 to $49,999	5%	6%	11%	6%
	$50,000 to $74,999	7%	9%	15%	9%
	$75,000 to $99,999	18%	4%	11%	13%
	$100,000 to $149,999	20%	21%	20%	20%
	$150,000 to $199,999	21%	23%	13%	20%
	$200,000 or more	27%	36%	22%	29%
	Weighted Count	*241*	*85*	*59*	*385*
Race/Ethnicity	Other race/ethnicity	32%	25%	16%	28%
	White/Caucasian only	68%	75%	84%	72%
	Weighted Count	*251*	*96*	*67*	*428*
Gender identity	Female	40%	46%	55%	44%
	Male	60%	53%	45%	56%
	Other	0%	1%	1%	0%
	Weighted Count	*228*	*85*	*67*	*394*
Total Household Size (Adults + Children)	1	6%	6%	27%	10%
	2	44%	29%	45%	41%
	3	31%	21%	21%	26%
	4 or more	20%	43%	7%	22%
	Weighted Count	*253*	*97*	*68*	*433*
Presence of Children in HH	No Children in HH	55%	28%	63%	51%
	Children in HH	45%	72%	37%	49%
	Weighted Count	*253*	*97*	*68*	*433*
Number of years lived at current residence	Less than 1 year	38%	8%	2%	25%
	1 to 2 years	34%	12%	2%	23%
	3 to 4 years	13%	19%	4%	13%
	5 or more years	16%	61%	92%	39%
	Weighted Count	*253*	*98*	*68*	*433*

The respondents' highest level of education attained is summarized in Figure 110. Nearly two-thirds of respondents have a graduate degree, and 31 percent have a four-year college degree.

Figure 110: Education of Respondent
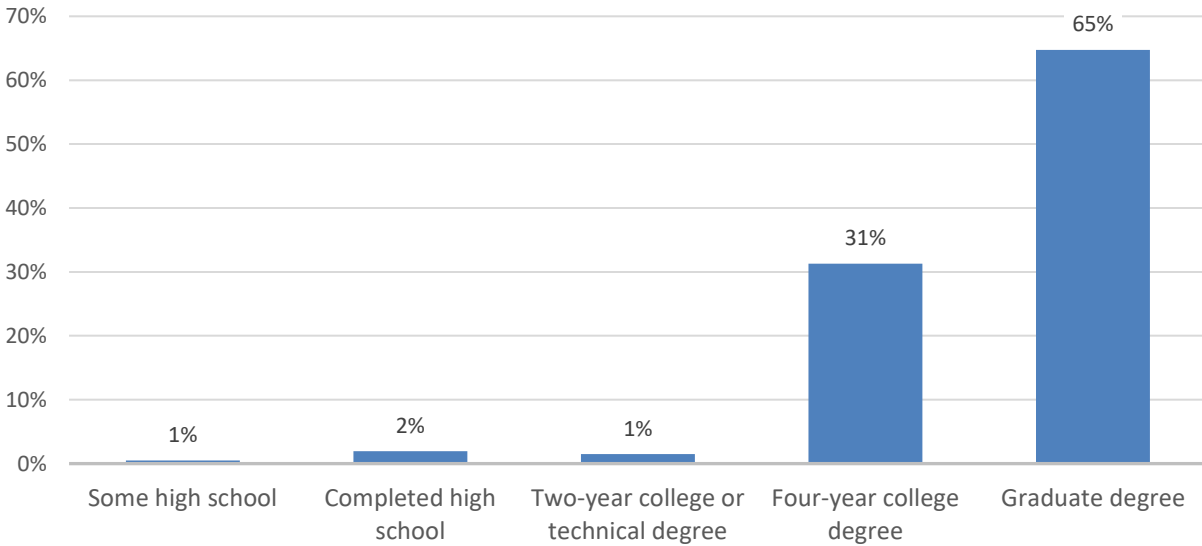
More than two-thirds of respondents have a household income of $100,000 or more, and one-half earn $150,000 or more per year. Just nine percent of respondents have a household income under $50,000, as shown in Figure 111.

Figure 111: Annual Household Income
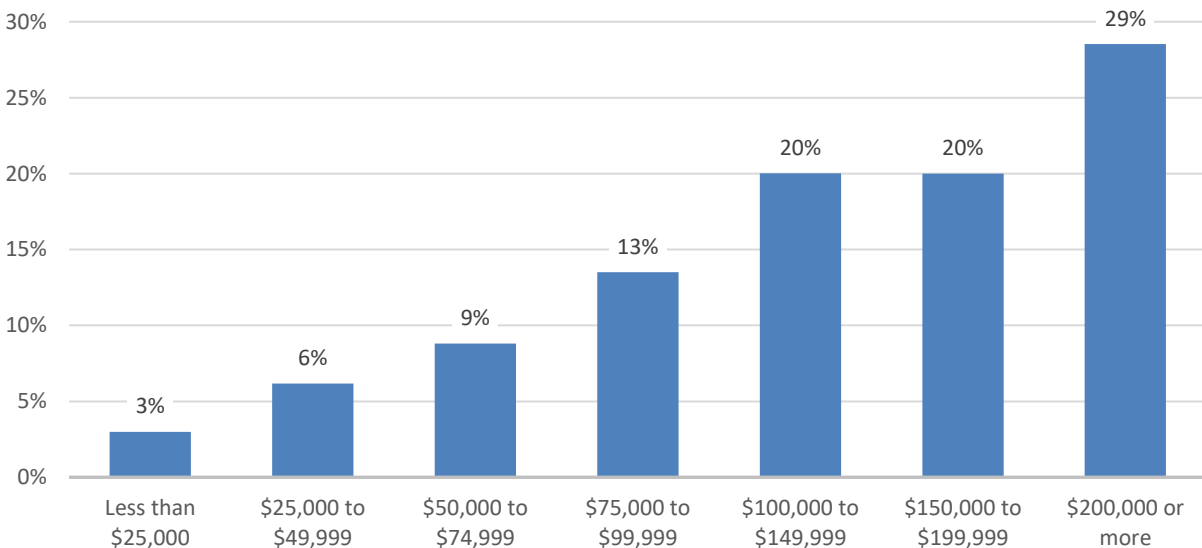
Eight in 10 survey respondents are white, non-Hispanic, as illustrated in Figure 112. More than one-half (56 percent) of respondents identify as male, and 44 percent identify as female (see Figure 113).

Figure 112: Race/Ethnicity

Respondents could select more than one response, and figures may add to more than 100%.
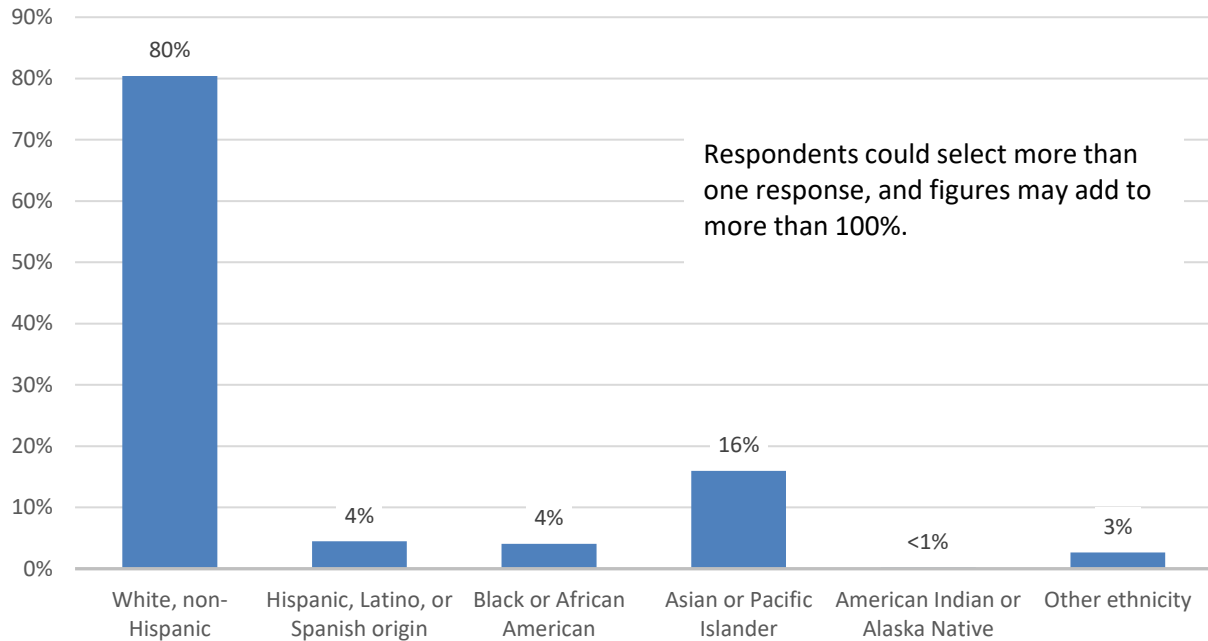
Figure 113: Gender Identity
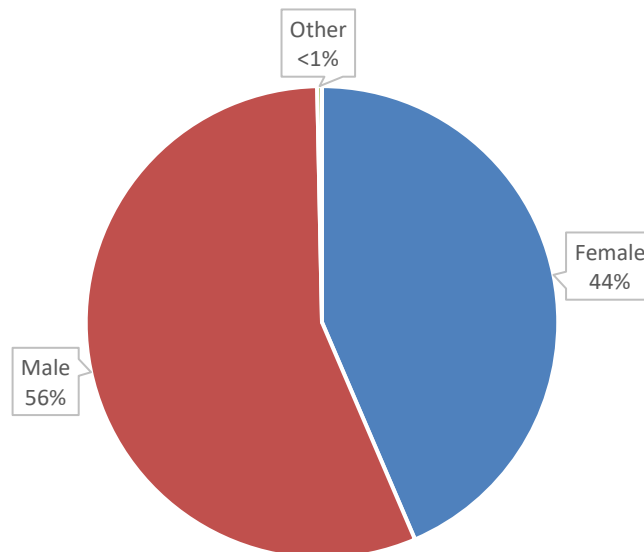
Figure 114: Total Household Size

- Four or more HH members 22%
- One HH member 10%
- Two HH members 42%
- Three HH members 26%
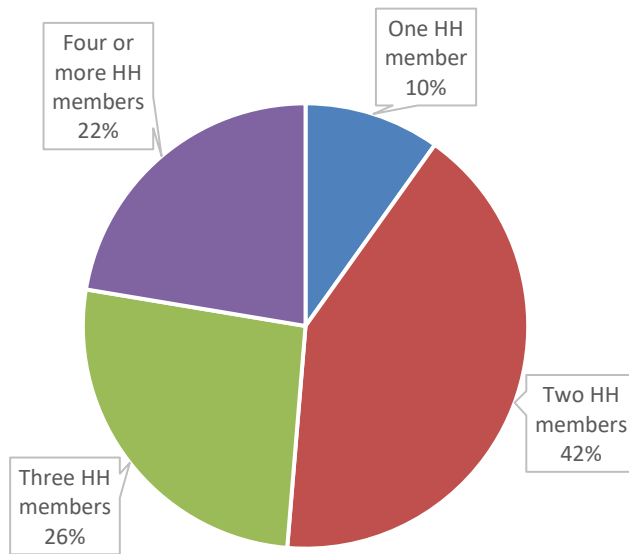
Respondents were asked to indicate the number of adults and children in their household. Only 10 percent of respondents have just one person living in the household, and 42 percent have two household members (including both adults and children). Another 26 percent have three household members, and 22 percent have four or more household members (Figure 114).

About one-fourth of respondents have at least one child under age 18 living at home, as shown in Figure 115.

Figure 115: Number of Children in the Household

- No Children in HH, 51%
- Children in HH, 49%
- One child, 37%
- Two children, 7%
- Three children, 4%
- Four+ children, 1%
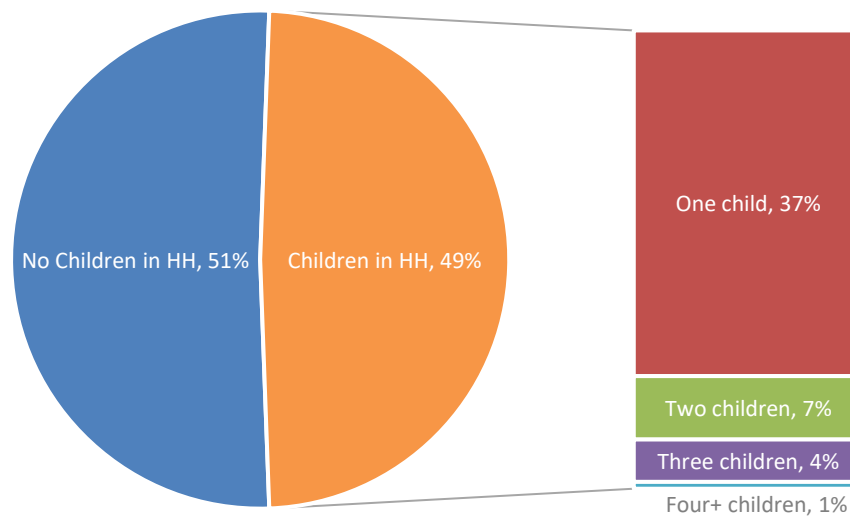
The majority of respondents own their home (see Figure 116). Eighty-six percent of respondents have lived at their residence for five or more years, as shown in Figure 117.

Figure 116: Own or Rent Residence

Rent, 62%

Own, 38%
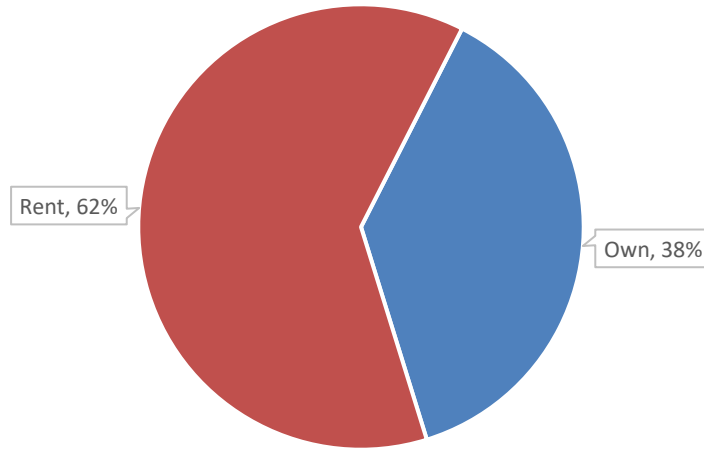
Figure 117: Length of Residence at Current Address

5 or more years, 39%

Less than 1 year, 25%

3 to 4 years, 13%

1 to 2 years, 23%
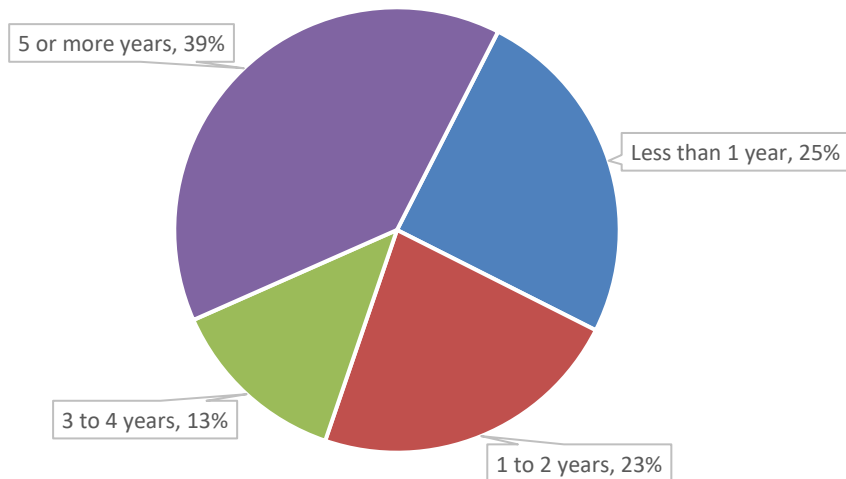
6 Cambridge Housing Authority Survey Report

As part of its efforts to perform a comprehensive evaluation of broadband gaps affecting low-income and other populations—and to build on the insights developed from a citywide residential survey conducted in 2019—the City of Cambridge and its Cambridge Housing Authority (CHA) commissioned a mail survey of individuals who live in CHA housing developments—or who are recipients of Housing Choice Voucher Program (Section 8) subsidies and live elsewhere in the City—in the summer of 2020. (For simplicity in this report, we will refer to this effort as the "CHA survey" and refer to the recipients as "CHA residents.")

The CHA survey was intended to gather basic data about the types of services to which CHA residents subscribe, their use of these services (including subsidized programs such as Comcast Internet Essentials), and gaps in their ability to obtain services. Additionally, the survey was designed to provide insights about CHA residents' ability to make effective use of broadband and computers and to identify any barriers to doing so—whether that involved access to broadband, access to well-functioning devices, or skills. To this end, the survey asked residents to provide information about ownership of and ability to maintain computers, and to assess their ability to perform a broad range of tasks online. Finally, the survey included questions intended to gather data about the extent to which the Covid-19 pandemic changed internet usage patterns.

In terms of the residential broadband access gap, 46 percent of respondents reported that they do not subscribe to residential internet service and 29 percent have neither a residential internet subscription nor a mobile subscription. In comparison, the broader survey of Cambridge residents conducted in 2019 showed just 10 percent of households without residential internet service and four percent of households without any internet access (residential service or mobile).

At the same time, for those who do have subscriptions, there appears to be significant underutilization of existing low-cost subsidy programs for which many CHA residents may be eligible. But regardless of how today's unconnected residents may acquire or access broadband, their ability to make effective use of that resource will be limited until many of the residents obtain reliable devices and develop better skills. Many experience problems at least monthly with their computing devices, and 49 percent said that if their computer stopped functioning, they would not be able to fix or replace the device for months or even longer.

Compared with respondents in the 2019 city-wide survey, CHA residents are significantly less skilled with using the internet and computers for basic tasks, such as bookmarking a website, uploading content, or avoiding phishing scams. Similarly, many respondents reported that they lack skills in making use of online resources. For example, nearly one-half of respondents disagreed or strongly disagreed that they knew how to purchase groceries online, and four in 10 disagreed or strongly disagreed that they knew how to access their bank online. Nearly four in

10 disagreed or strongly disagreed that they knew how to recognize false information online and find credible sources.

Of the respondents who cared for children, about one-third disagreed or strongly disagreed that they possessed the skills to assist children in completing homework online—and less than one-half agreed or strongly agreed that they knew how to set up parental controls or filters. But significant interest exists in overcoming these and other gaps; for example, 36 percent strongly agreed they would like to attend training sessions to learn how to better use broadband and computers, and 44 percent of those with children strongly agreed that they are interested in learning how to identify online risks.

The Covid-19 pandemic accentuated these challenges. For example, at the time of survey, 29 percent of respondents used the internet for educational purposes, compared to 19 percent before the pandemic. Among the small number of responses that came from households with children, 93 percent used the internet for educational purposes, compared with 57 percent before the pandemic. But the gaps will persist once the pandemic recedes.

This report documents the survey process, discusses methodologies, and presents results intended to assist the City and the CHA in developing strategies to close the identified gaps.

6.1   Key findings

Key findings are here presented thematically in three subsections: broadband access gaps, device utilization gaps, and skills gaps. These and other findings are presented in greater detail in the body of the report.

6.1.1   Broadband access gaps

The survey found substantial gaps in acquisition of residential internet access services, but also that relatively few residents are taking advantage of available subsidized programs. The following are key findings:

- **Substantial percentages of residents do not have a home internet connection.** About 46 percent reported not having a home internet connection; 44 percent reported not having cellular/mobile phone with internet service; and 29 percent reported having neither form of service at home. Those who lacked either form of service tended to be older.

- **Most of those with internet service are Comcast customers.** Of those with internet service, approximately two-thirds (68 percent) said they have Comcast as their internet service provider, nine percent use Verizon DSL or mobile, and five percent use T-Mobile/Sprint. Further detail on companies and technologies reportedly used by respondents are provided in the body of the report.

- **CHA residents may be significantly underutilizing existing broadband subsidy programs.**

Only 24 percent of Comcast subscribers who responded participate in the Comcast Internet Essentials program, while 50 percent were unaware of the program, 20 percent were aware but have not applied, and six percent enrolled but were declined.

- **Some CHA residents who need internet access at home for work are not using services that are likely to always suffice for telework.** Among internet users who report only using mobile phone service, dial-up, or satellite internet services, 10 percent say they need home internet service for their job.

- **Eighteen percent of all respondents only use a smartphone for home internet access.** This may limit their ability to fully utilize online services at home.

- **Most respondents say they find broadband unaffordable.** Just 22 percent of respondents agreed or strongly agreed that the market currently provides high-speed internet at prices they can afford, while 57 percent disagreed or strongly disagreed, suggesting a need for affordable broadband internet among a large segment of respondents.

- **CHA residents are very price sensitive.** Just 16 percent of respondents are willing to pay a premium for access to high-speed internet. Willingness to purchase high-speed internet for $10 a month is high (57 percent were extremely willing) but this willingness drops sharply at higher price points.

- **Despite these various gaps, most respondents do use the internet.** Most (76 percent) respondents access the internet from any location, including a range of locations outside the home. However, use of the internet outside of the home has declined significantly during the Covid-19 pandemic, particularly for those who use the internet outside the home on rare occasions.

6.1.2 Device utilization gaps

With respect to respondents' computer device ownership and their self-assessment of their skills in using, maintaining, and potentially repairing these devices, the survey revealed that CHA survey respondents face significant challenges. The following are key findings:

- **Many respondents do not have a computer with internet access in the home.** Nearly four in 10 respondents have no internet access or report having internet access but no laptop, desktop, or tablet computer.

- **Many households have experienced frequent issues with their computing devices not working properly.** More than one-half (53%) of respondents with internet access have experienced trouble with their computer not working properly; 34 percent experience problems at least monthly.

- **More than one-half of respondents may have trouble maintaining their computers.** Fifty-four percent disagreed or strongly disagreed that they know how to troubleshoot issues with technology.

- **About one-half of respondents would not be able to quickly replace non-working computers.** One-fifth (21%) of respondents said they could not replace their computer in the foreseeable future if it became unusable, and another 28 percent said it would take one to six months to replace them. Adding these two datapoints, 49 percent of CHA respondents with home internet are at risk of not being able to use broadband for very long periods because of computer problems, rather than residential internet connectivity problems.

6.1.3   Skills gaps in using broadband and computers

Residents reported significant challenges with respect to their ability to perform basic functions online and avoid harms. Respondents also expressed interest in improving those skills. Key findings include:

- **Many CHA residents may be vulnerable to online harms and disinformation.** When asked if they knew how to recognize and avoid a phishing attack, 42 percent disagreed or strongly disagreed. More than one-third (37 percent) disagreed or strongly disagreed that they knew how to recognize false information online and find credible sources of information.

- **Many respondents lack skills in doing basic tasks on the internet.** About four in 10 respondents disagreed or strongly disagreed that they can use the internet for essential functions like banking, contacting medical support, or purchasing groceries. A similar proportion indicated doubts about technological skills for basic tasks like uploading content, creating a social media profile, bookmarking a website, and adjusting privacy settings, for which more than four in 10 disagreed or strongly disagreed. Additionally, 51 percent of respondents strongly disagreed that they knew how to create their own personal website.

- **Most caregivers report that children under their care have adequate broadband skills.** While the sample size of respondents who had children living at home was relatively small (46), 43 percent strongly agreed and 25 percent agreed that their children are sufficiently skilled in computer use to complete their homework on their own.

- **However, many caregivers do not have adequate skills to help their children when needed.** One-third of respondents disagreed or strongly disagreed that their computer skills are good enough to help their children complete their homework, while 20 percent were neutral.

- **Older residents in particular have less confidence in their ability to use the internet.** Respondents ages 55 and older were less likely to agree that they are skilled in various

uses of the internet. Respondents under age 55 expressed some agreement with statements about their internet skills, particularly creating/managing social media profile, accessing their bank account online, uploading content, blocking spam or unwanted content, and adjusting privacy settings.

- **Many respondents are interested in becoming more confident in using computers, smartphones, and the internet.** Specifically, 45 percent of respondents strongly agreed that they would like to become more confident in using computers and related technology, and 36 percent strongly agreed they would like to attend training.

- **Residents have some interest in getting help learning how to navigate around the negative aspects of internet use.** Many respondents disagreed or strongly disagreed that their children have the skills to identify false or misleading information (38%) or that they can recognize and avoid online financial scams or predators (39%). Although 42 percent of caretakers know how to set up parental controls or filters online, another 38 percent disagreed or strongly disagreed. However, seven in 10 respondents agreed or strongly agreed that they interested in learning how to identify risks for the children in their care.

6.2 Survey process

CTC developed the draft survey instrument and the City provided revisions and approved the final questionnaire. The City also provided a list of households to which the survey packet would be mailed. A total of 2,700 survey packets were mailed first-class in July to CHA residents. Recipients were provided with a postage-paid business reply mail envelope in which to return the completed questionnaire.

A total of 359 useable questionnaires were received by the date of analysis, providing a response rate of 13.3 percent. The margin of error for aggregate results at the 95 percent confidence level for 359 responses is ±4.8 percent. That is, for questions with valid responses from all survey respondents, one would be 95 percent confident (19 times in 20) that the survey responses lie within ±4.8 percent of the target population as a whole.

The survey responses were entered into SPSS[49] software and the entries were coded and labeled. SPSS databases were formatted, cleaned, and verified prior to the data analysis. Address information was merged with the survey results using the unique survey identifiers printed on each survey. The survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions. Statistically significant differences between subgroups of response categories are highlighted and discussed where relevant.

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[49] Statistical Package for the Social Sciences (http://www-01.ibm.com/software/analytics/spss/)

The following sections summarize the survey findings.

6.3 Survey results

The results presented in this report are based on analysis of information provided by 359 CHA residents. Unless otherwise indicated, the percentages reported are based on the "valid" responses from those who provided a definite answer and do not reflect individuals who said "don't know" or otherwise did not supply an answer because the question did not apply to them. Key statistically significant results (p ≤ 0.05) are noted where appropriate.

6.3.1 Internet connection and use

Respondents were asked about their use of the internet, including home internet connection types and providers, use of the internet for various activities, and satisfaction and importance of features related to internet service. This information provides valuable insight into residents' need for various internet and related communications services.

6.3.1.1 Internet usage

Three-fourths of respondents make some use of the internet, on any device from any location, as shown in Figure 118. Respondents under ages 55 are more likely than older respondents to use the internet.

Figure 118: Internet Usage by Respondent Age
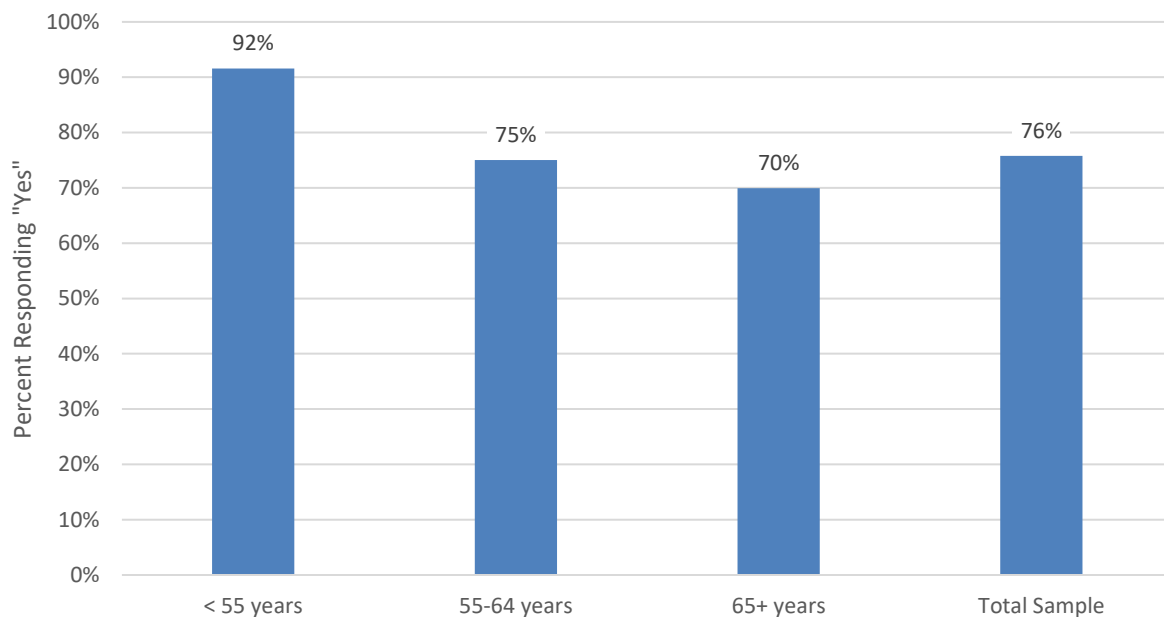
Internet usage is higher among those with a four-year college degree or higher compared with a lower level of education (see Figure 119). Use of the internet is also higher for those earning $25,000 or more compared with those earning under $25,000 (89% vs. 73%), but this cohort is also more likely to be under age 65.

Figure 119: Internet Usage by Education
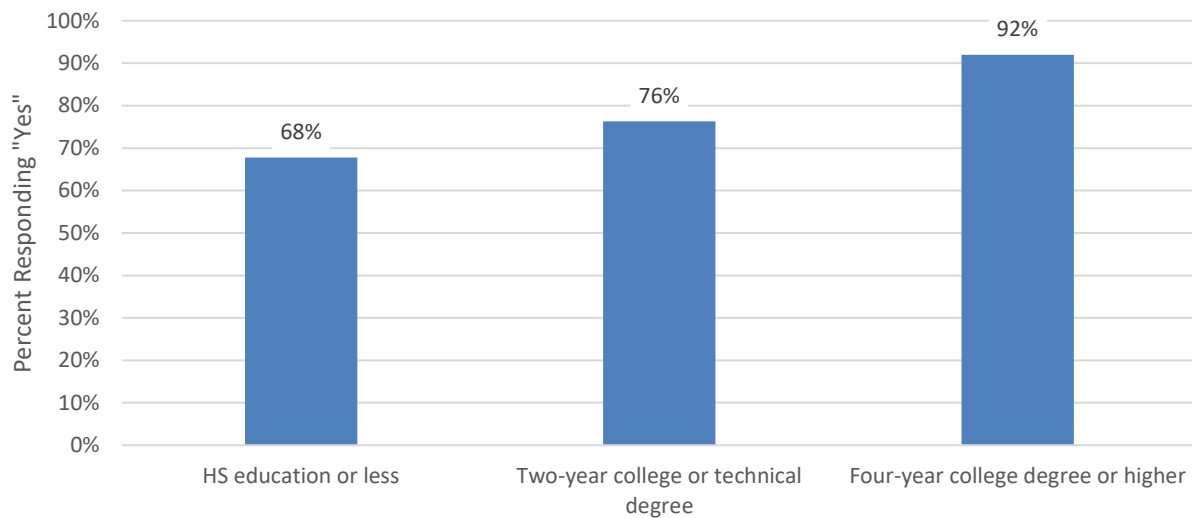
Almost all respondents with home internet service or a smartphone do personally access the internet. Approximately 39 percent of respondents without internet service at home access the internet from other locations. Agreement with reasons for not accessing the internet are highlighted in Figure 120 and Figure 121. Cost is the leading barrier to internet access, with six in 10 of those who do not access the internet strongly agreeing that a connection is too expensive.

Figure 120: Reasons for Not Using the Internet (Mean Ratings)

An internet connection is too expensive. — 4.0
I am concerned about my safety and privacy. — 3.5
Using the internet is too difficult. — 3.0
I have no one to teach me how to go online. — 3.0
Don't need to because someone who will do it for me. — 2.9
I am not interested. — 2.9
I do not have enough time. — 2.2

Mean Rating (1=Strongly Disagree and 5=Strongly Agree)
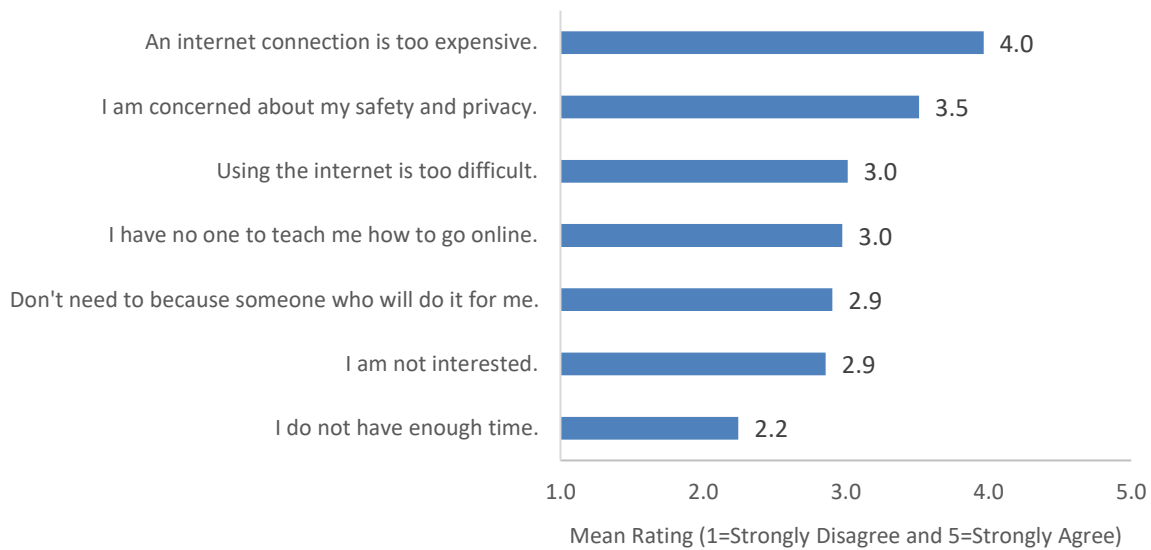
Figure 121: Reasons for Not Using the Internet

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
An internet connection is too expensive.	13%	5%	15%	9%	59%
I am concerned about my safety and privacy.	15%	11%	20%	15%	39%
Using the internet is too difficult.	33%	10%	13%	11%	33%
I have no one to teach me how to go online.	31%	12%	17%	7%	32%
Don't need to because someone who will do it for me.	35%	9%	14%	14%	28%
I am not interested.	38%	5%	18%	9%	29%
I do not have enough time.	47%	11%	26%	4%	12%

6.3.1.2 Internet use by location

Respondents were also asked to indicate how often they use the internet in various locations <u>before</u> and <u>during</u> the Covid pandemic. As shown in Figure 122, use of internet services outside of the home has declined significantly during the Covid-19 pandemic, which makes sense as many public areas and work settings have not been accessible.

Figure 122: Ever Use the Internet in Various Locations Before and During Covid-19 Pandemic
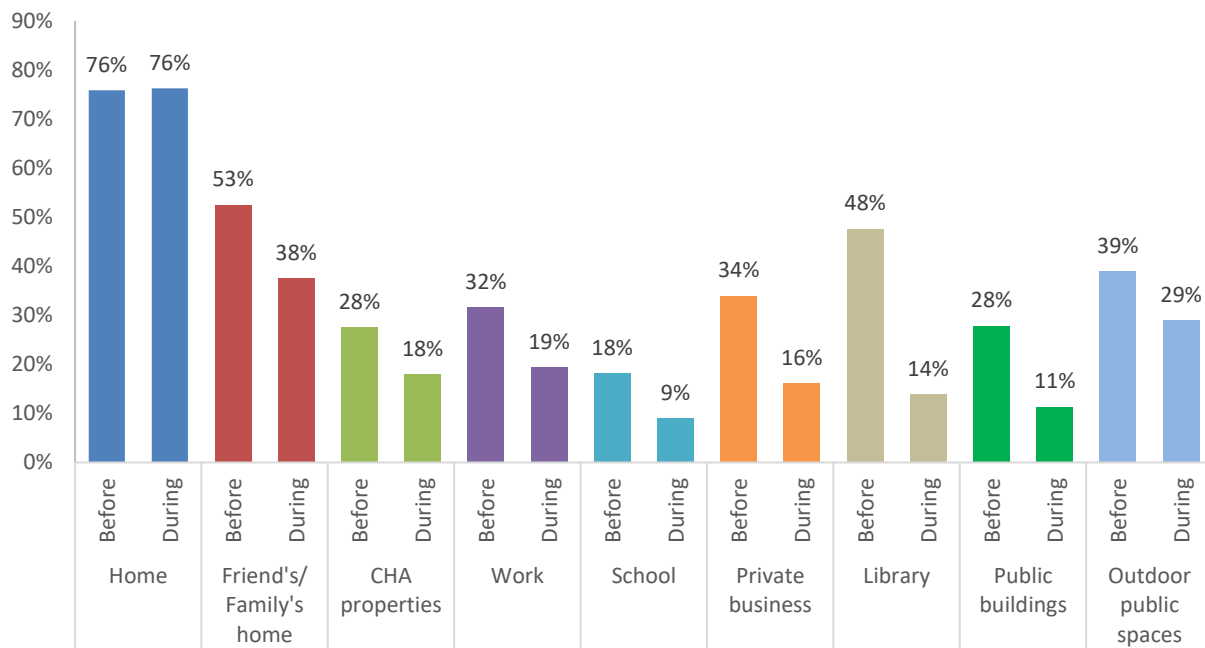
Significantly, use of the internet at the Cambridge Public Library declined from 48 percent of respondents pre-Covid to 14 percent currently. Use in schools dropped in half from 18 percent to nine percent of respondents. Use in public buildings (28% vs. 11%) and outdoor public spaces (39% vs. 29%) also declined. Use of the internet at CHA properties declined from 28 percent of respondents pre-Covid to 18 percent. Use of the internet also fell in work settings (32% vs. 19%) and private businesses (34% vs. 16%) when comparing pre-Covid and during-Covid figures. Usage inside the home remained flat.

Figure 123 and Figure 124 show detailed usage of the internet at various locations, before and during the pandemic. Only a small segment of respondents made regular use (monthly, weekly, or daily) of the internet outside of the home, pre-Covid or during the Covid-19 pandemic. In particular, private businesses, public settings, and other homes (friend/family) have seen a significant decline in the very occasional users (rarely use).

Figure 123: How Often Use the Internet in Various Locations Before Covid-19 Pandemic

Location	Never	Rarely	Monthly	Weekly	Daily
Home	24%	3%	2%	7%	64%
Friend's/family's home	48%	30%	7%	8%	7%
CHA properties	72%	13%	4%	4%	6%
Work	68%	9%	1%	4%	18%
School	82%	6%	2%	4%	7%
Private business	66%	20%	5%	4%	4%
Library	52%	24%	9%	10%	5%
Public buildings	72%	17%	4%	5%	2%
Outdoor public spaces	61%	16%	5%	9%	9%
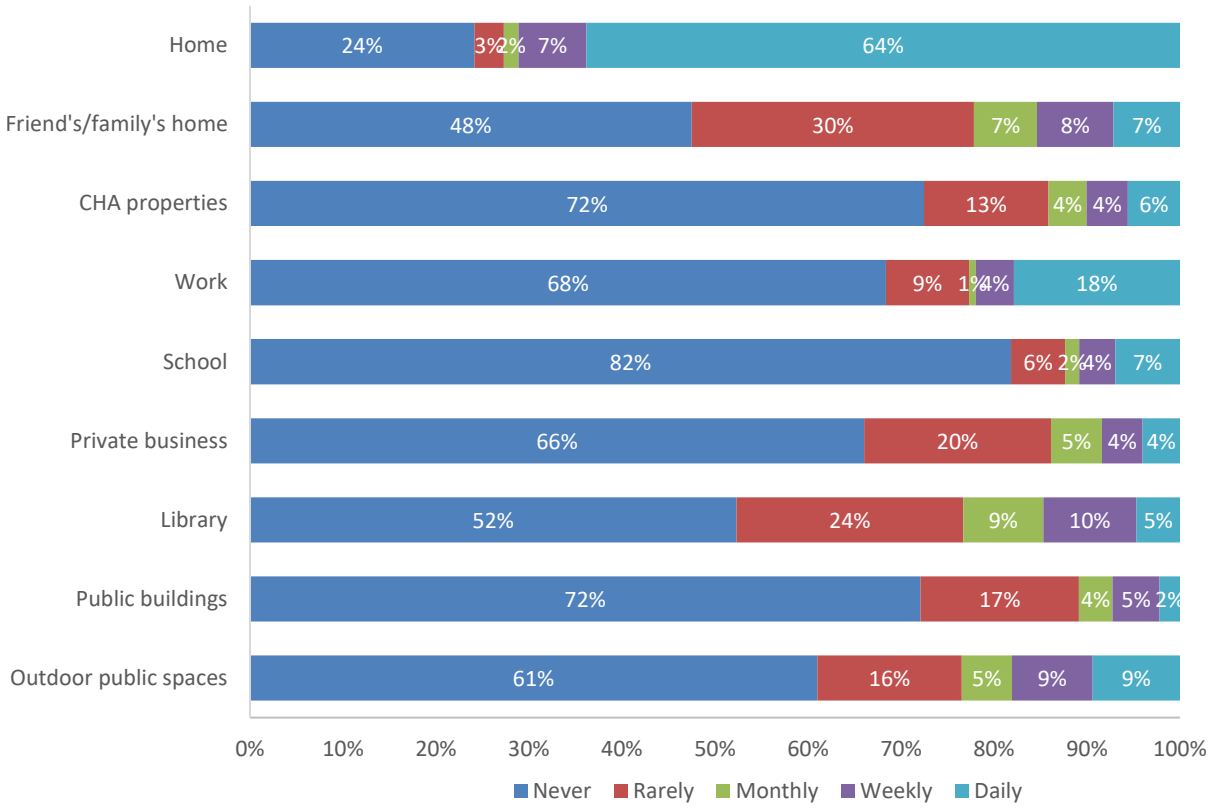
Figure 124: How Often Use the Internet in Various Locations During Covid-19 Pandemic
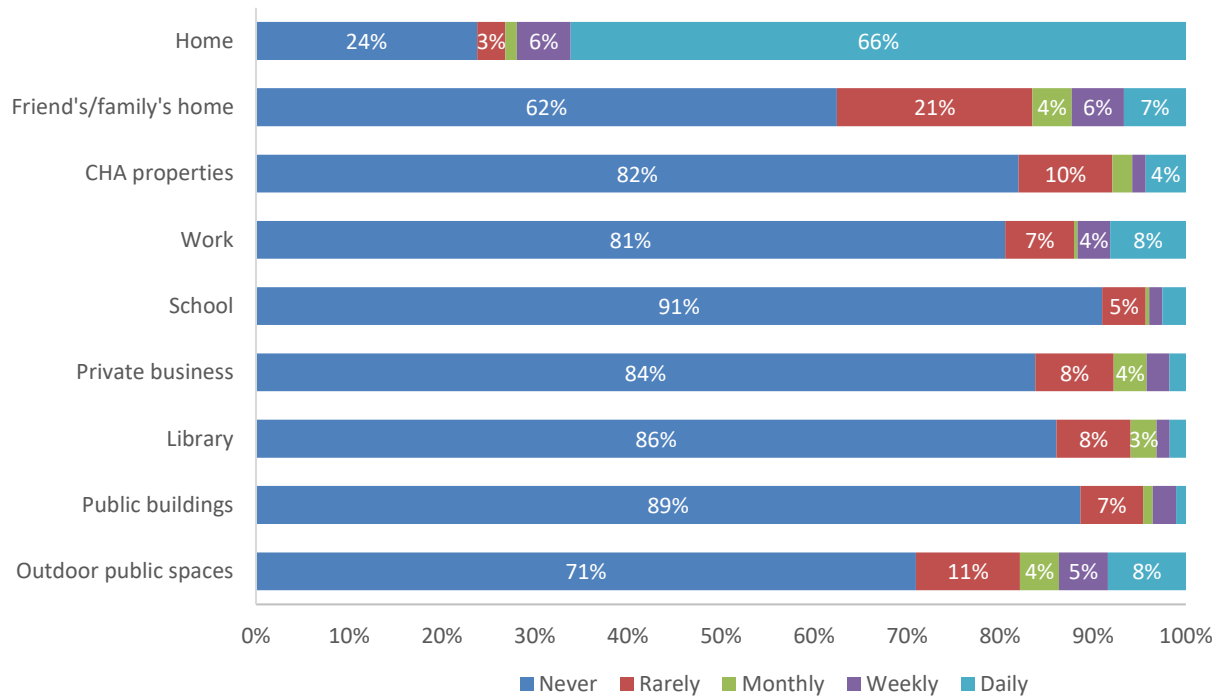
As illustrated in Figure 125 and Figure 126, respondents ages 65+ are less likely than younger respondents to make use of the internet, both currently and pre-Covid-19 pandemic.

Figure 125: Daily Use of the Internet Before Covid-19 Pandemic by Respondent Age
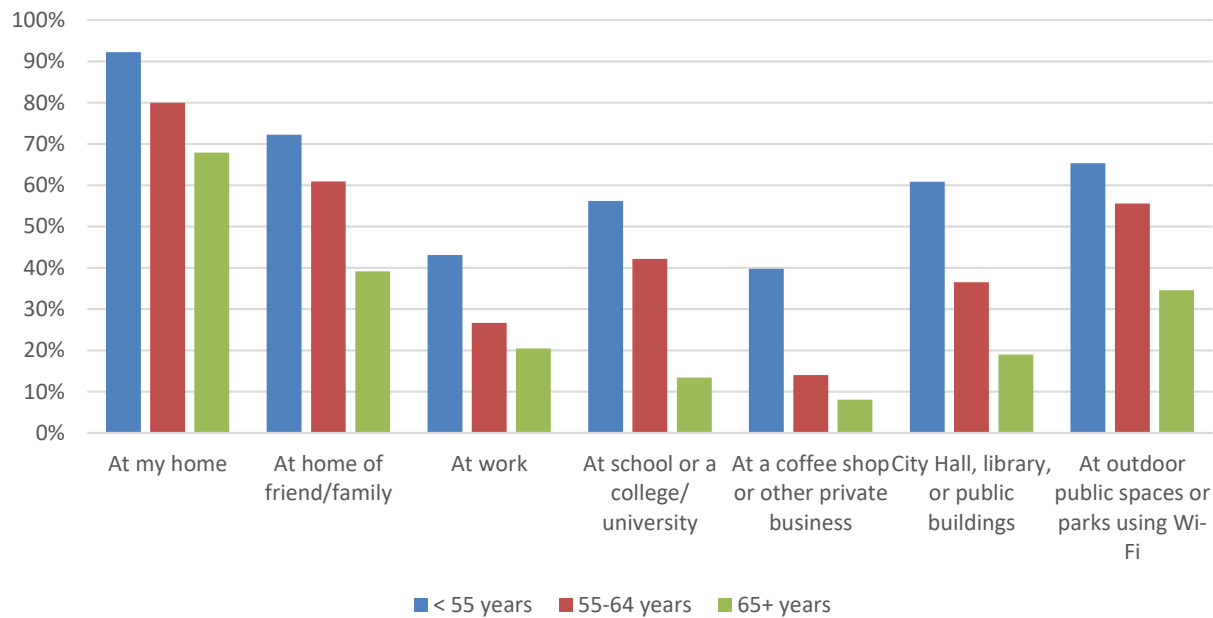
Figure 126: Daily Use of the Internet During Covid-19 Pandemic by Respondent Age
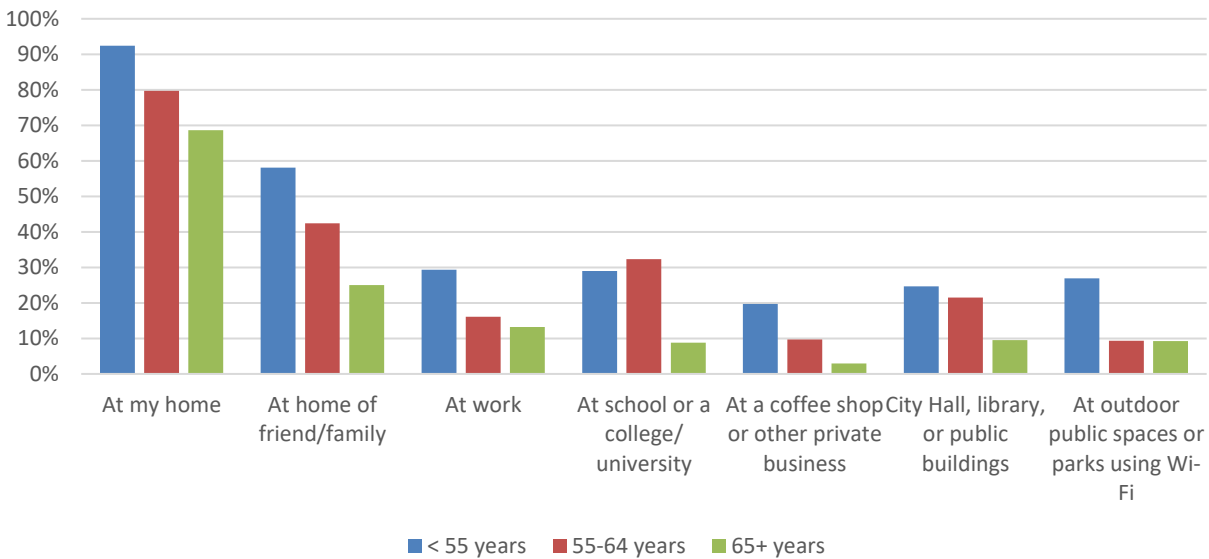
6.3.1.3 Communications services

Saturation of communications services currently purchased for the household is illustrated in Figure 127 and Figure 128. Overall, 71 percent of respondents indicated having some internet access—either a home connection or via smartphone (29 percent do not have internet or did not respond). Specifically, 56 percent have cellular/mobile telephone service with internet and 54 percent have internet service in the home. Fewer households have cable/satellite television service, landline telephone service, cellular/mobile telephone service without internet, and free Wi-Fi service.

Figure 127: Communication Services Purchased

Respondents could select more than one response, and figures may add to more than 100%.

Cellular/mobile telephone service with internet	56%
Internet service in home (excluding cellular/mobile)	54%
Cable or satellite television	36%
Landline telephone service	30%
Cellular/mobile telephone service without internet	14%
Free Wi-Fi service	13%
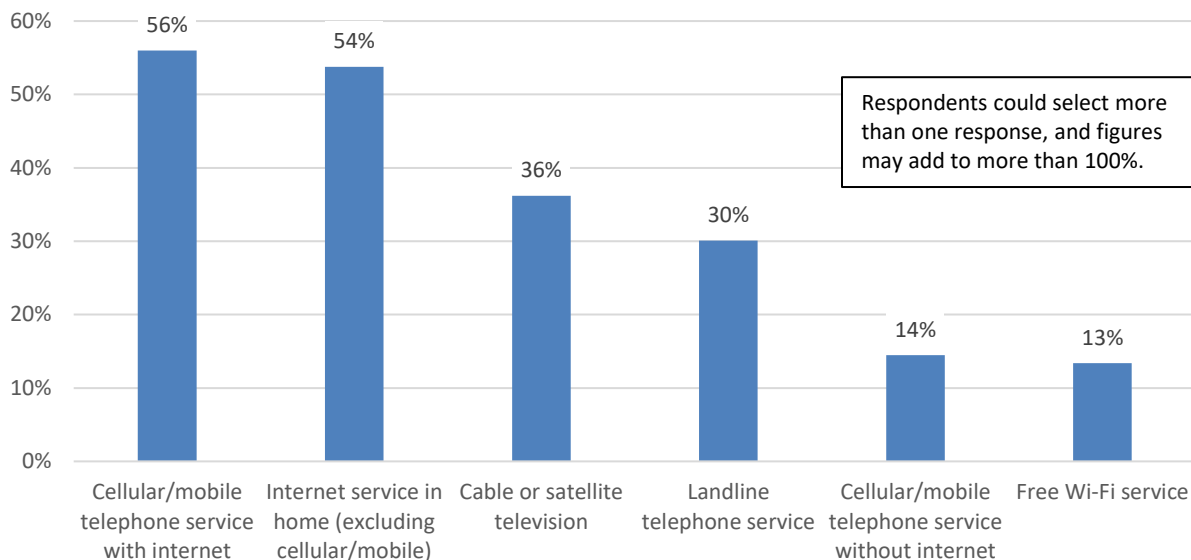
Figure 128: Internet Services Purchased

Yes, 71%
None/ no response, 29%

Home Internet Connection, 15%
Smartphone, 18%
Both Home/ Smartphone, 38%
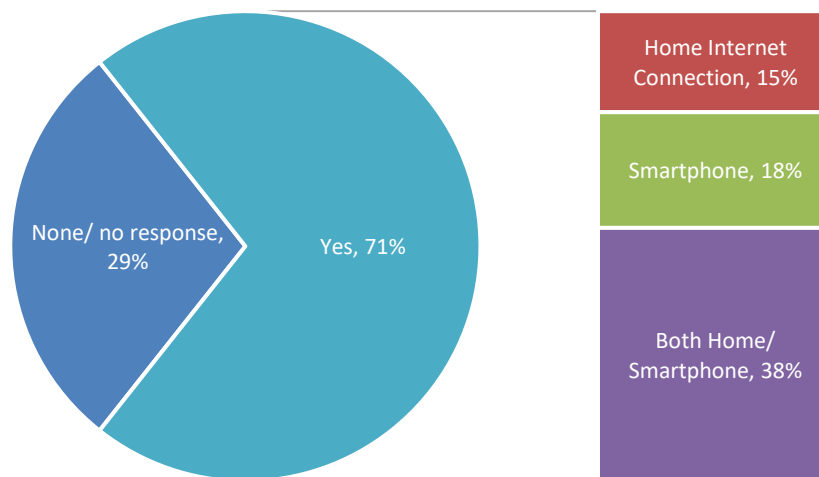
More than three-fourths (77 percent) of respondents under age 55 purchase internet service in the home, compared with 46 percent of those ages 55 to 64 years and 49 percent of those ages 65+ years. Additionally, those ages 65+ are less likely than younger respondents to purchase cellular/mobile telephone service with internet and are more likely to purchase cellular/mobile telephone service without internet or landline telephone service (see Figure 129).

Figure 129: Communication Services Purchased by Respondent Age

Bar chart showing communication services purchased by respondent age group (< 55 years, 55-64 years, 65+ years).

Service	< 55 years	55-64 years	65+ years
Internet service in home	77%	46%	49%
Cellular/mobile telephone service with internet	78%	68%	42%
Cellular/mobile telephone service without internet	11%	10%	18%
Fixed (landline) telephone service	17%	29%	37%
Cable or satellite television	33%	35%	39%
Free Wi-Fi service	16%	14%	12%

■ < 55 years   ■ 55-64 years   ■ 65+ years
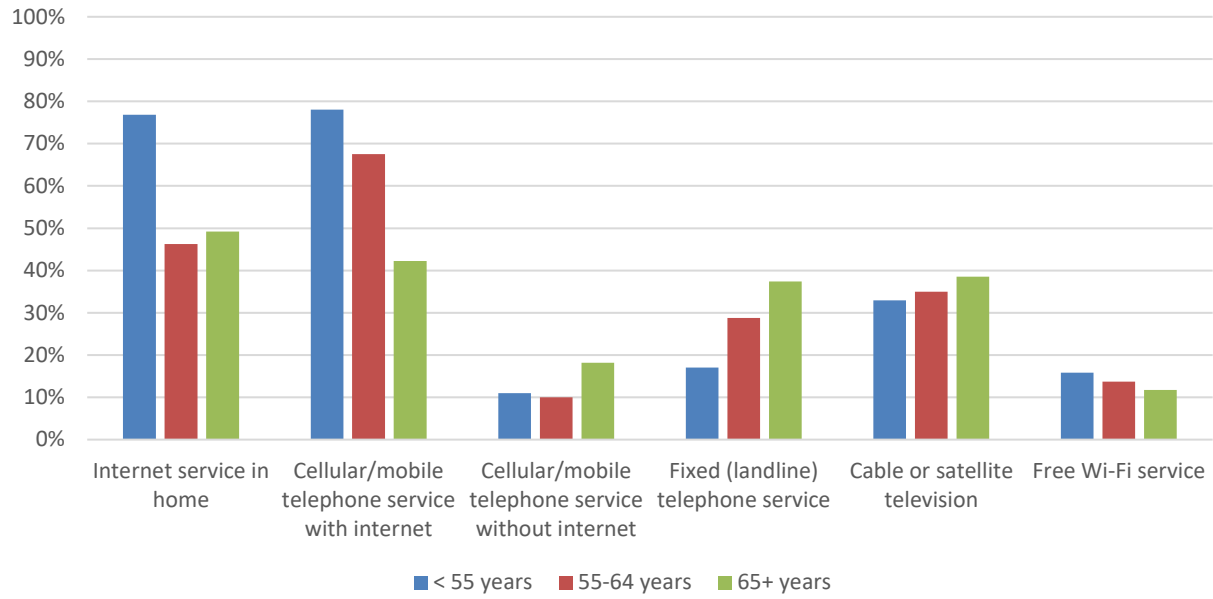
As discussed previously, most respondents have some internet access, including 38 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone). Eighteen percent of respondents have a smartphone only for accessing the internet. Total internet access by demographics is illustrated in Table 20. Internet access is lower among those ages 55+, those with a high school education or less, and those earning under $25,000 per year (who are more likely to be ages 65+).

Table 20: Internet Access by Key Demographics

	No Internet Service	Home Internet Connection	Smartphone	Both Home/ Smartphone	Total Internet Access	Total Count
TOTAL	**29%**	**15%**	**18%**	**38%**	**71%**	*359*
Respondent Age						
18 to 54 years	9%	13%	15%	63%	91%	*82*
55 to 64 years	24%	9%	30%	38%	76%	*80*
65 years and older	38%	20%	13%	29%	62%	*187*
Education						
HS education or less	33%	13%	20%	34%	67%	*148*
Two-year college or technical degree	21%	17%	24%	38%	79%	*71*
Four-year college degree +	22%	19%	10%	49%	78%	*116*
Income						
Less than $25,000	32%	14%	16%	38%	68%	*222*
$25,000 or more	8%	17%	24%	51%	92%	*76*
Race/Ethnicity						
White, non-Hispanic	30%	17%	15%	37%	70%	*151*
Black	24%	15%	25%	36%	76%	*104*
Biracial/Multiracial/Other	27%	13%	13%	46%	73%	*84*
Gender Identity						
Identify as female	24%	17%	20%	39%	76%	*203*
Identify as male	33%	15%	15%	37%	67%	*119*
Total Household Size (Adults + Children)						
One	33%	18%	19%	30%	67%	*243*
Two or more	12%	11%	13%	65%	88%	*94*
Children in Household						
No Children in HH	29%	17%	17%	37%	71%	*307*
Children in HH	7%	10%	20%	63%	93%	*30*
Years at Residence						
Less than 5 years	22%	14%	24%	41%	78%	*116*
5 or more years	31%	17%	14%	39%	69%	*233*

6.3.1.4 Importance of communications services

Respondents were asked to indicate the importance of various communication services to their household, using a scale where 1 is "Not at All Important" and 5 is "Extremely Important." The mean importance of various service aspects is illustrated in Figure 130, while detailed responses are illustrated in Figure 131.

Figure 130: Importance of Communication Service Aspects (Mean Ratings)
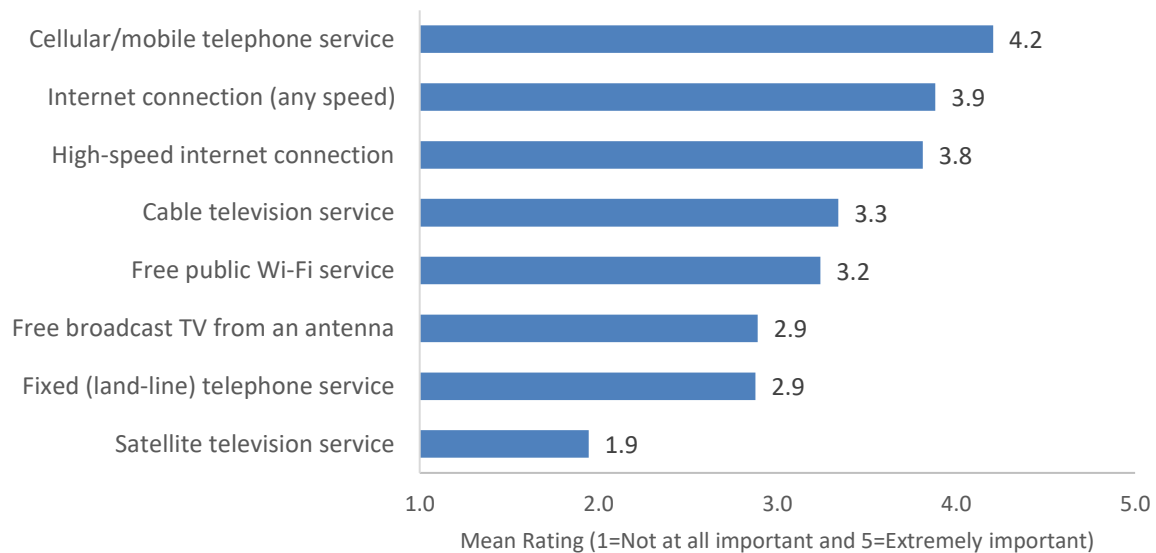
Figure 131: Importance of Communication Service Aspects
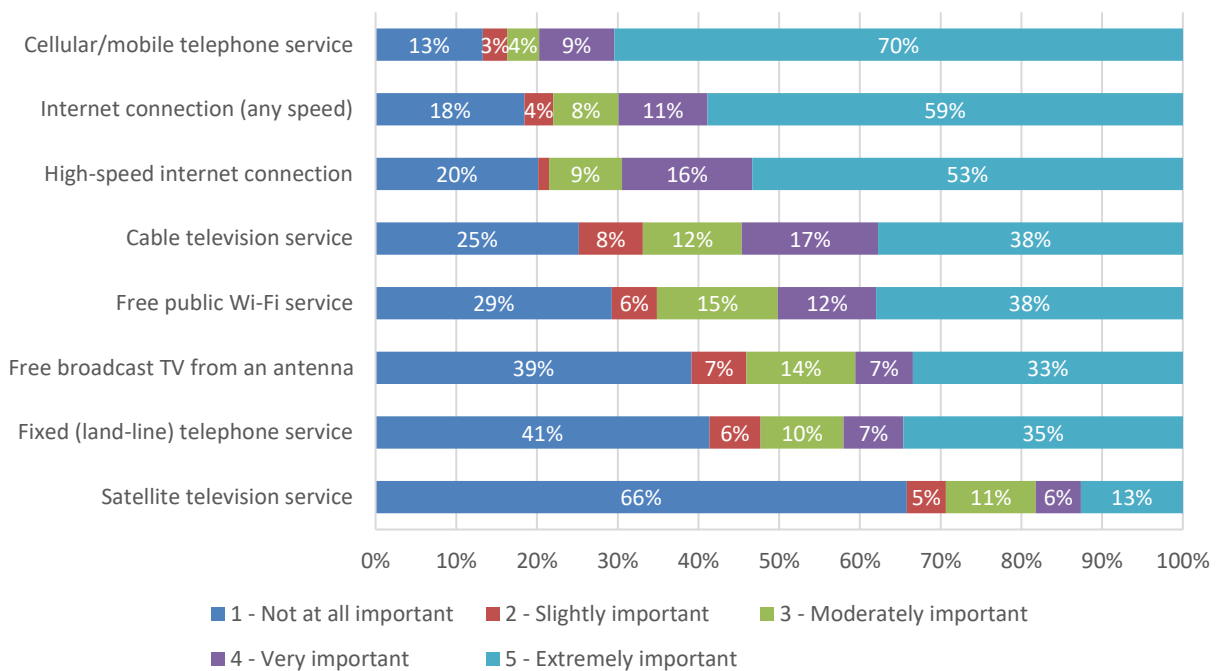
Cellular/mobile telephone and internet services are very important to respondents, while television services and landline telephone service are significantly less important. Specifically, 70 percent of respondents said cellular/mobile phone service is extremely important, and 59 said an internet connection of any speed is important. More than one-half (53%) of respondents said high-speed internet is extremely important.

Figure 132 and Figure 133 illustrate the importance of internet services and mobile telephone service by the age of the respondent and by connectivity. The importance of internet services is slightly lower for older respondents and those without internet services. Internet users with below criteria service (dial-up, mobile, satellite) also rated the importance of home internet services lower than did those with faster connections.

Figure 132: Importance of Communication Services by Respondent Age
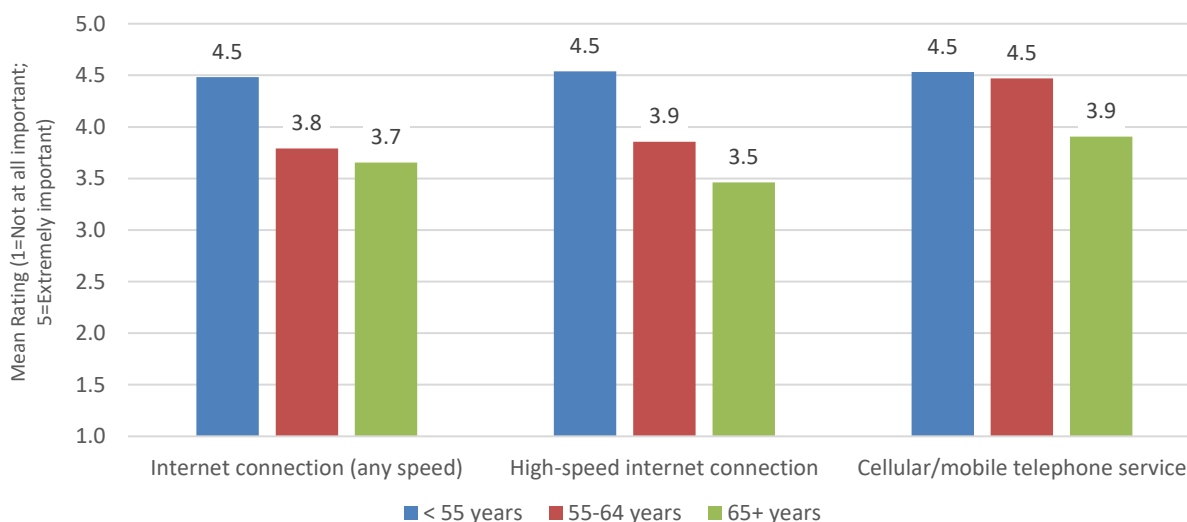
Figure 133: Importance of Communication Services by Connectivity
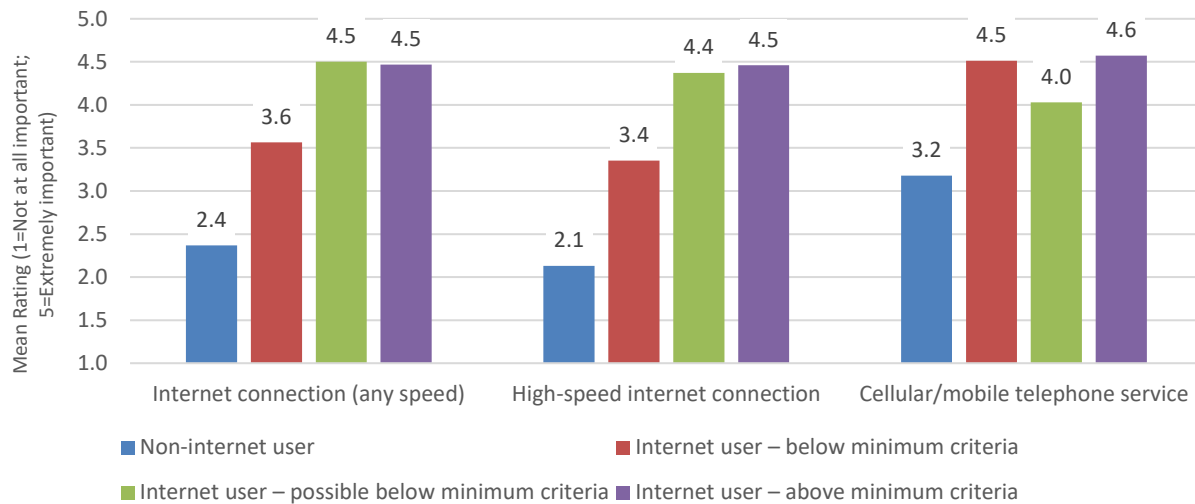
6.3.1.5 Internet services purchased

As shown in Figure 134, a majority of respondents (72 percent) reported having home internet service, consistent with 71 percent reporting internet access in Question 5. (Specifically, 14 percent said they do not have access and 12 percent gave no response.) Cable modem (36%) is the leading internet service used, while 11 percent primarily use a cellular/mobile connection.

Figure 134: Primary Home Internet Service
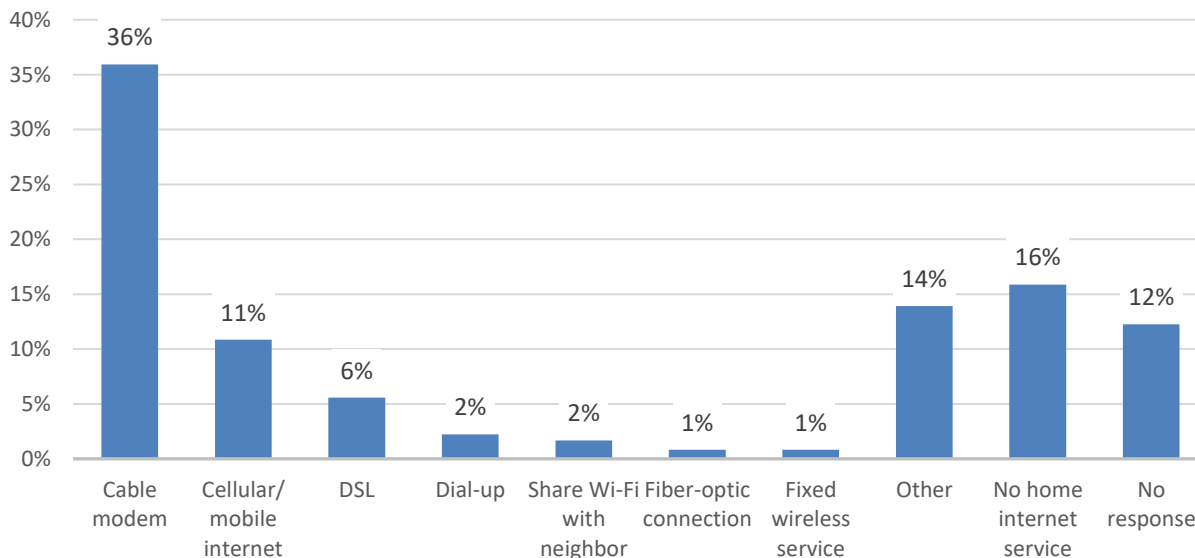
As illustrated in Figure 135, approximately two-thirds of respondents with internet service subscribe to Comcast (cable service).

Figure 135: Primary Internet Service Provider
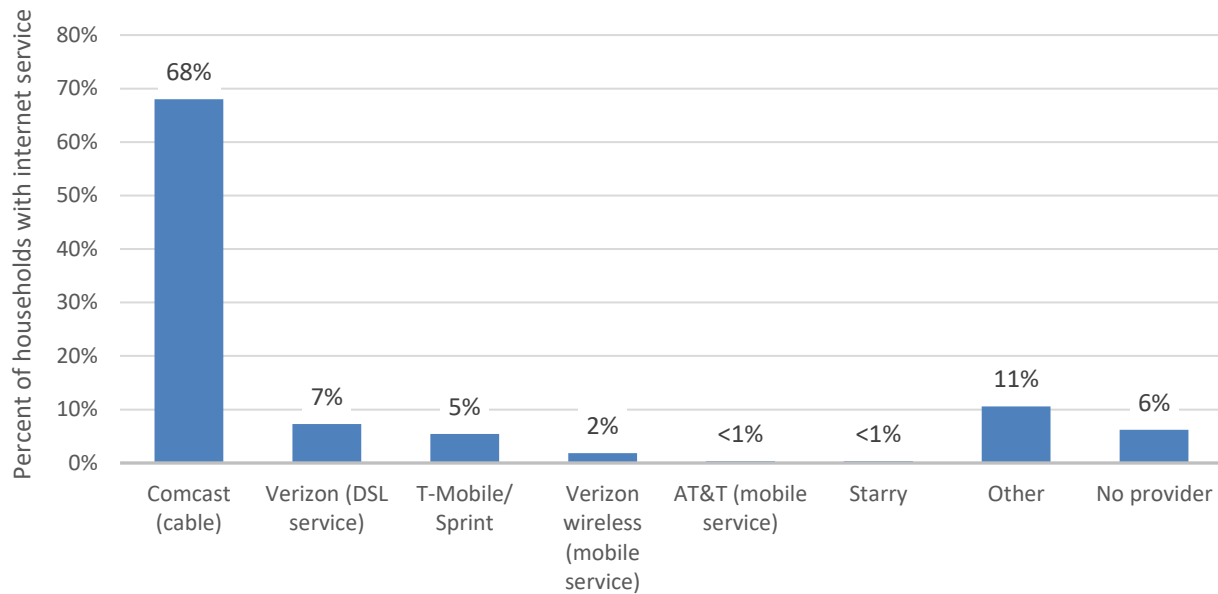
Respondents were segmented into connectivity groups based on type of internet service:

1. No internet service
2. Below minimum criteria (Dial-up, satellite, cellular/mobile)
3. Possible below minimum criteria (DSL, fixed wireless, other)
4. Above minimum criteria (fiber, cable modem)

Although most households have internet access, 41 percent have service that is below or possibly below the minimum criteria (see Figure 136).

Those with service below the minimum criteria rated the importance of high-speed internet somewhat lower than did those with service above the minimum criteria. Still, high-speed internet service is moderately to very important on average to those with below minimum criteria connection.

Figure 136: Internet Connectivity Groups

Non-internet user (none, no response) 28%

Internet user – above minimum criteria (fiber, cable modem) 48%

Internet user – below minimum criteria (Dial-up, satellite, cellular/mobile) 13%

Internet user – possible below minimum criteria (DSL, fixed wireless, other) 11%
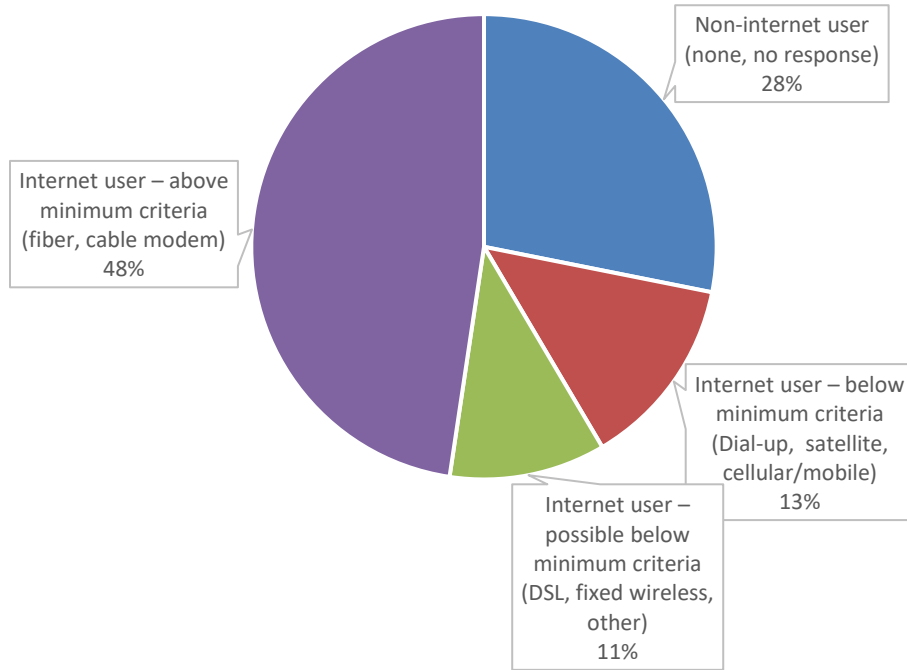
6.3.1.6 Programs for low-income subscribers

Comcast customers were asked if they are enrolled in the ISP's Internet Essentials program for low-income households. As illustrated in Figure 137, just one-fourth of Comcast customers are enrolled in the program. One-half of Comcast customers were unaware of the program, and another 20 percent were aware but have not applied.

Figure 137: Participate in Comcast's Internet Essentials Program
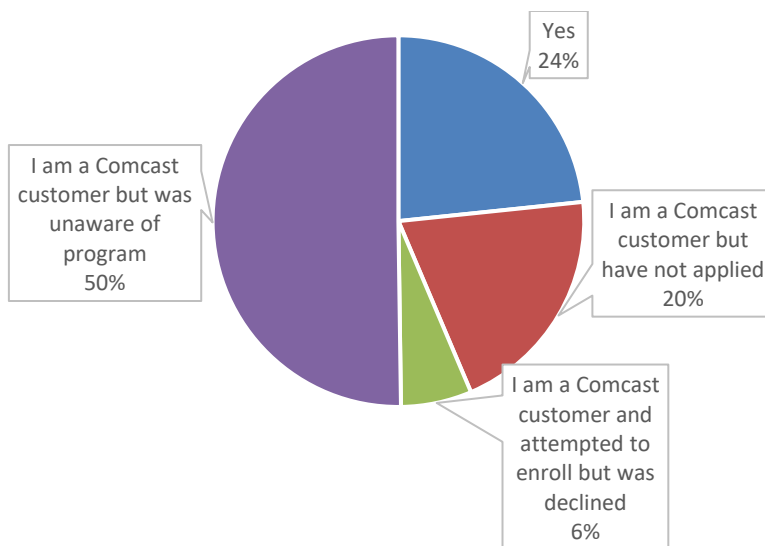
Just nine percent of subscribers receive the $9.25 subsidy under the FCC's Lifeline program, and 24 percent are unsure if they receive the subsidy. Most households are not receiving the subsidy (see Figure 138).

Figure 138: Receive $9.25 Subsidy Under FCC's Lifeline Program
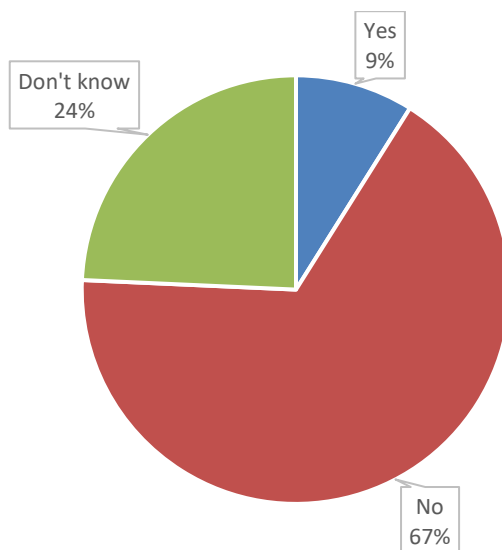
6.3.1.7 Internet service aspects

Home internet subscribers were asked to evaluate their satisfaction with various internet service aspects. This was compared with importance ratings given for these same aspects. The importance and satisfaction levels among internet users are compared in the following tables and graphs.

6.3.1.7.1 Importance

Respondents rated connection reliability and cost as the most important internet service aspects, with at least three-fourths saying each aspect is extremely important, as shown in Table 21. Six in 10 respondents rated connection speed and overall customer service as extremely important. Ability to bundle services is somewhat less important to internet subscribers.

Table 21: Importance of Internet Service Aspects

Service Aspect	Mean	Percentages
Speed of Connection	4.2	8% / 9% / 22% / 59%
Reliability of Connection	4.5	7% / 4% / 13% / 75%
Price of Services	4.5	6% / 6% / 8% / 79%
Overall Customer Service	4.3	7% / 9% / 22% / 60%
Ability to Bundle with TV and Phone	3.4	23% / 7% / 16% / 12% / 42%

■ 1 - Not at all important   ■ 2 - Slightly important   ■ 3 - Moderately important
■ 4 - Very important   ■ 5 - Extremely important

6.3.1.7.2 Satisfaction

Overall, respondents are moderately to very satisfied with aspects of their internet service, as shown in Table 22. More than one-half of respondents are very or extremely satisfied with connection speed and reliability. They are less satisfied with price compared with other service aspects, which is typical in satisfaction surveys.

Table 22: Satisfaction with Internet Service Aspects

Service Aspect	Mean	Percentages
Speed of Connection	3.6	9% / 6% / 31% / 25% / 29%
Reliability of Connection	3.7	8% / 6% / 29% / 29% / 29%
Price of Services	2.7	35% / 14% / 20% / 9% / 22%
Overall Customer Service	3.3	11% / 15% / 29% / 23% / 22%
Ability to Bundle with TV and Phone	2.9	23% / 11% / 30% / 19% / 17%

■ 1 - Very dissatisfied   ■ 2 - Slightly satisfied   ■ 3 - Moderately satisfied
■ 4 - Very satisfied   ■ 5 - Extremely satisfied

Respondents with below minimum criteria service (dial-up, mobile, satellite) were less likely than those with other services to be satisfied with connection speed and reliability (see Figure 139).

Figure 139: Satisfaction with Internet Service Aspects by Connectivity

- Internet user – below minimum criteria
- Internet user – possible below minimum criteria
- Internet user – above minimum criteria
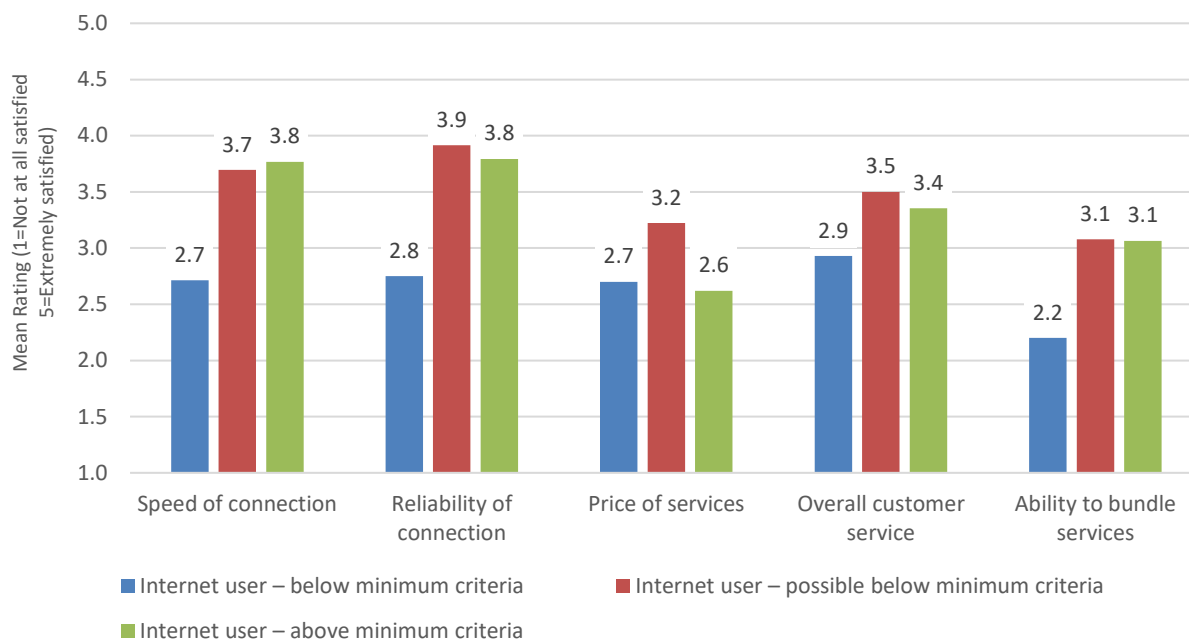
On average, respondents have about the same level of satisfaction with internet service aspects as they did before the Covid-19 pandemic. However, a segment of subscribers has become much less satisfied with their service, particularly for cost and ability to bundle (see Table 23).

Table 23: Change in Satisfaction with Internet Service Aspects During Covid-19 Pandemic

Service Aspect	Mean	Percentages				
Speed of Connection	3.2	12%	9%	46%	17%	16%
Reliability of Connection	3.2	9%	9%	49%	18%	15%
Price of Services	2.7	27%	14%	39%	8%	13%
Overall Customer Service	3.1	13%	12%	44%	16%	15%
Ability to Bundle with TV and Phone	2.8	22%	12%	47%	9%	11%

- 1 - Much less satisfied
- 2 - Slightly less satisfied
- 3 - About the same level of satisfaction
- 4 - Slightly more satisfied
- 5 - Much more satisfied

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6.3.1.7.3 Performance

Comparing respondents' stated importance and satisfaction with service aspects allows an evaluation of how well internet service providers are meeting the needs of customers (see Figure 140). Aspects that have higher stated importance than satisfaction can be considered areas in need of improvement. Aspects that have higher satisfaction than importance are areas where the market is meeting or exceeding customers' needs. However, it should be cautioned that the extremely high level of importance placed on some aspects (such as reliability) may make it nearly impossible to attain satisfaction levels equal to importance levels.

Figure 140: Importance of and Satisfaction with Internet Service Aspects
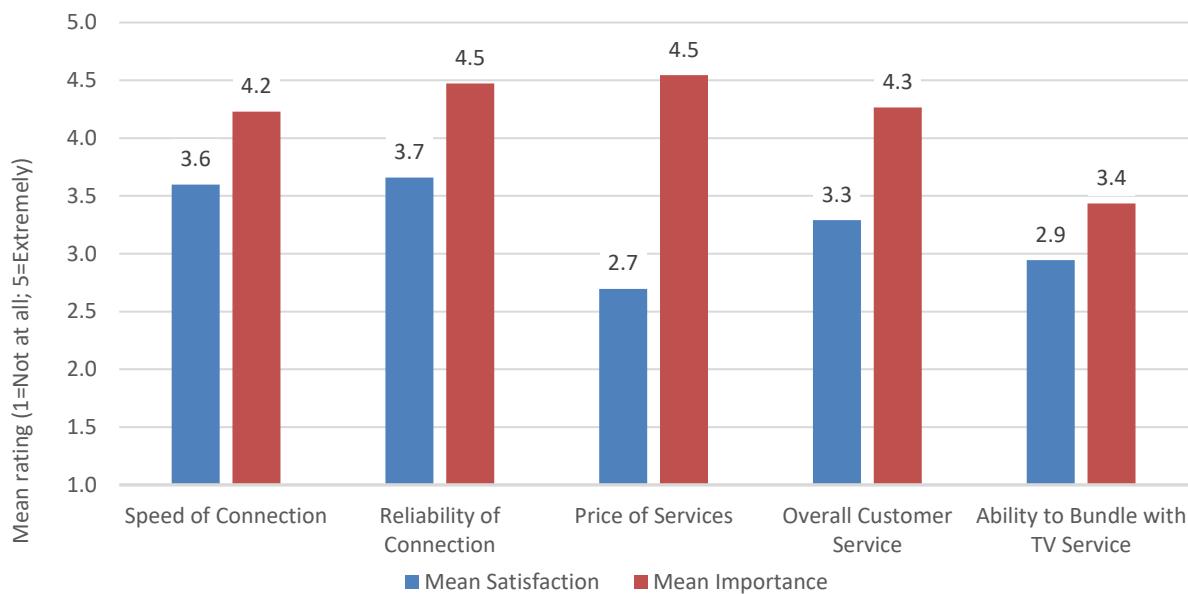
The difference between importance and satisfaction of home internet aspects is also presented in the "gap" analysis table (see Table 24). The largest gap between importance and performance is for price of services, followed by overall customer service and reliability of connection. The lower satisfaction levels could indicate a desire for improved service offerings or a willingness to switch internet service providers if needs are not being met.

Table 24: Internet Service Aspect "Gap" Analysis

	Mean Satisfaction	Mean Importance	GAP < = >	Customer Expectations
Price of Services	2.7	4.5	-1.8	**Not Met**
Overall Customer Service	3.3	4.3	-1.0	**Not Met**
Reliability of Connection	3.7	4.5	-0.8	**Not Met**
Speed of Connection	3.6	4.2	-0.6	**Not Met**
Ability to Bundle with TV Service	2.9	3.4	-0.5	**Not Met**

6.3.1.8 Personal computing devices

Respondents were asked to indicate the number of personal computing devices they have in the home. As might be expected, almost all (96 percent) respondents with internet access (either home connection or smartphone) have at least one personal computing device.

Figure 141: Number of Personal Computing Devices

Nine in 10 respondents with internet have one or more personal computing devices, including 38 percent with at least three devices. More than half of respondents have one or two devices (Figure 141).
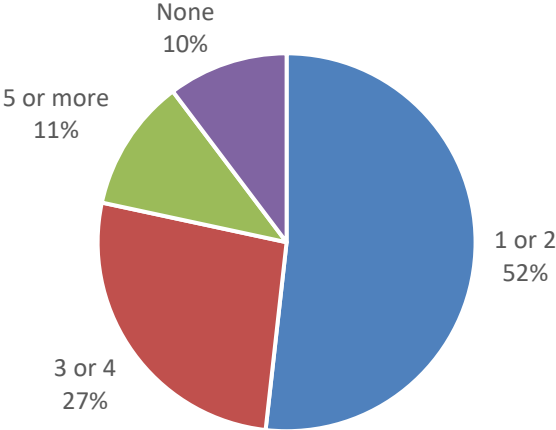
Two-thirds of respondents who live alone have one or two personal computing devices, while another one-fourth have three or more devices (see Figure 142).

Respondents with multiple household members appear more devices on average. Seven in 10 have three or more personal computing devices.

Figure 142: Number of Personal Computing Devices in Home by Household Size
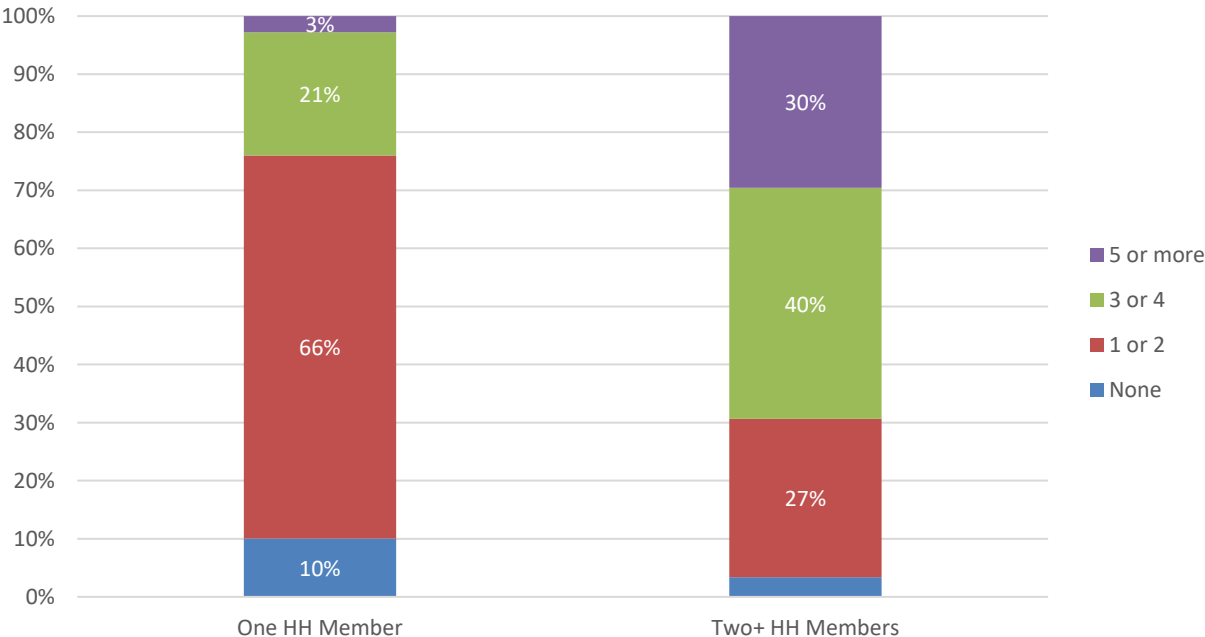
6.3.1.9 Devices in the home

About 37 percent of all respondents have no internet access or report having internet access but no laptop, desktop, or tablet computer. Among internet subscribers, use of devices to connect to the internet is relatively high, with only 14 percent not selecting any device. Use of smartphone is highest, with 60 percent of internet subscribers using one to access the internet, followed by laptops (50 percent), as illustrated in Figure 143. Three in 10 respondents with home internet use tablet computers and 24 percent use a desktop computer. Fewer respondents use entertainment devices like a Smart TV (27 percent) or console gaming device (11 percent) to access the internet.

Figure 143: Devices Used to Access the Internet
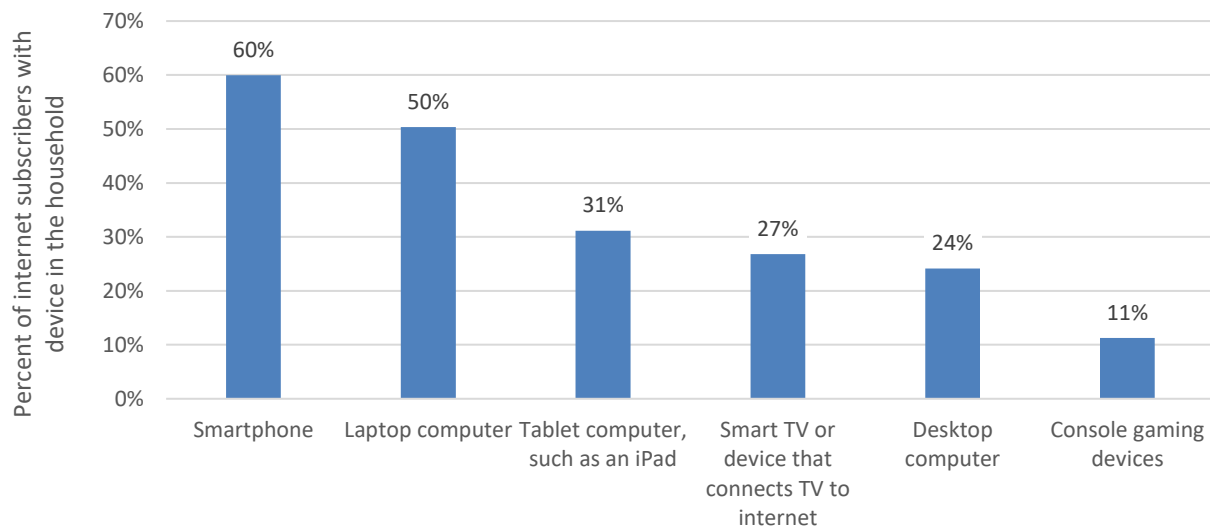
With the exception of desktop computers, internet subscribers ages 65+ are less likely than younger respondents to use various devices to access the internet, as illustrated in Figure 144.

Figure 144: Devices Used to Access the Internet by Respondent Age
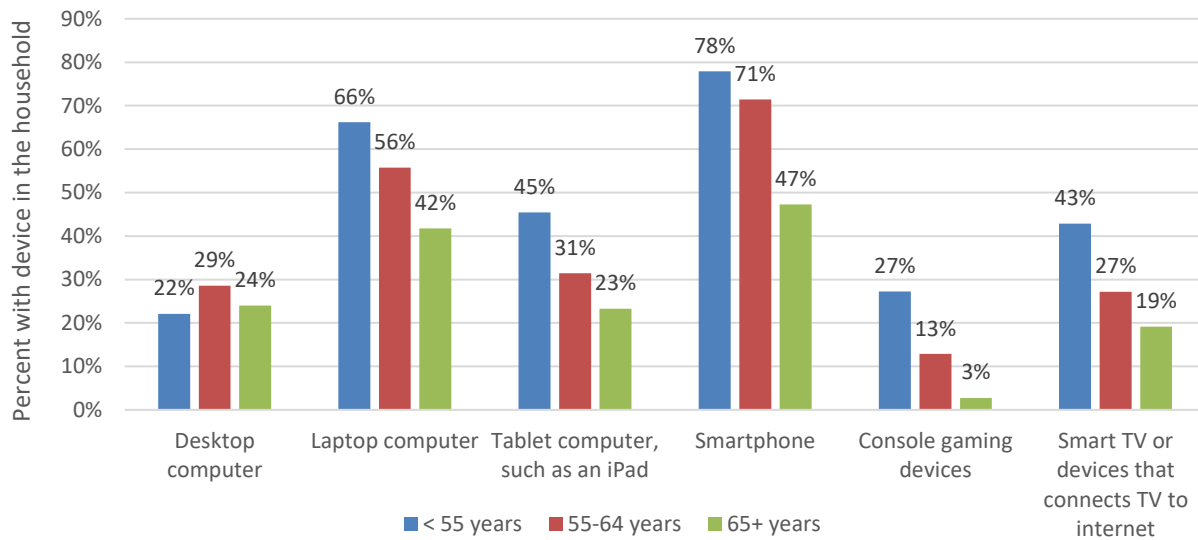
Respondents who live alone are less likely to make use of various devices to connect to the internet, as shown in Figure 145. Nearly three-fourths of households with multiple members have a smartphone, compared with 58 percent with one household member.

Figure 145: Devices Used to Access the Internet by Household Size
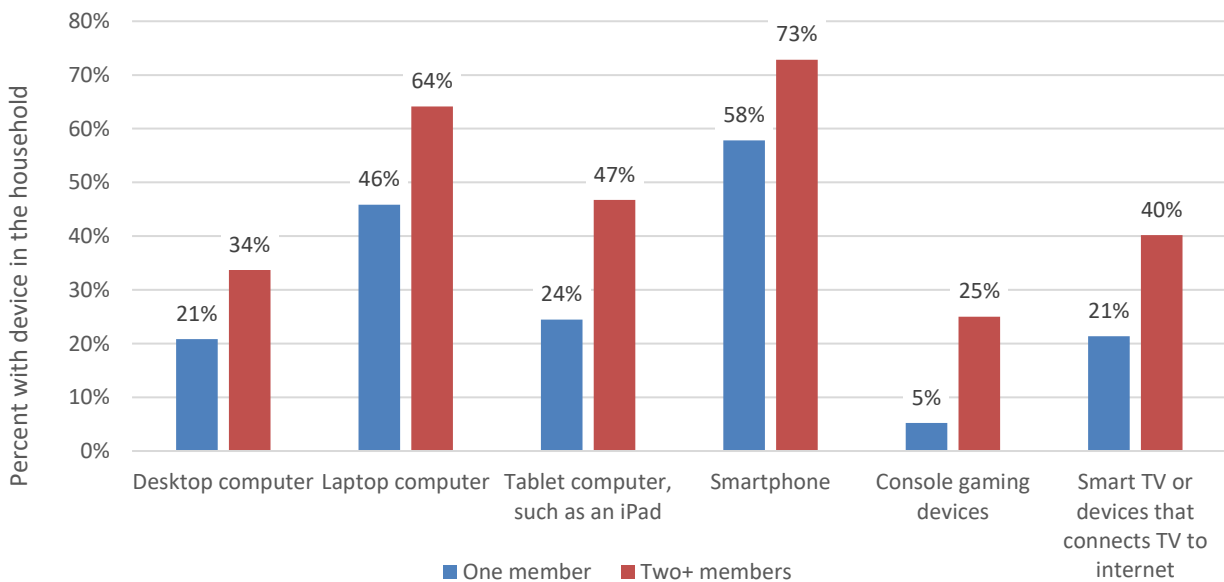
Nine percent of households have a device issued by the school district, and five percent have an employer-issued computer (see Figure 146 and Figure 147).

Figure 146: Have School-Issued Device

Yes
9%

No
91%
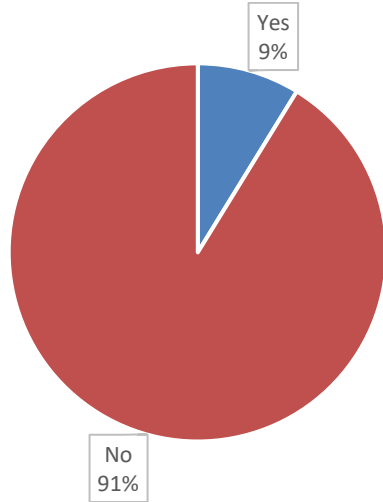
Figure 147: Have Employer-Issued Computer

Yes
5%

No
95%
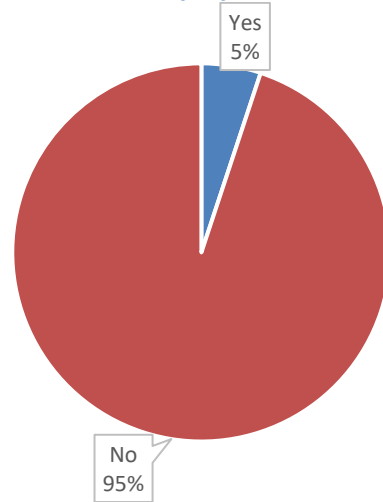
Thirteen of 28 households with children (46 percent) have a device issued by the school district, as shown in Figure 148.

Figure 148: Have a School District-Issued Device by Children in Household
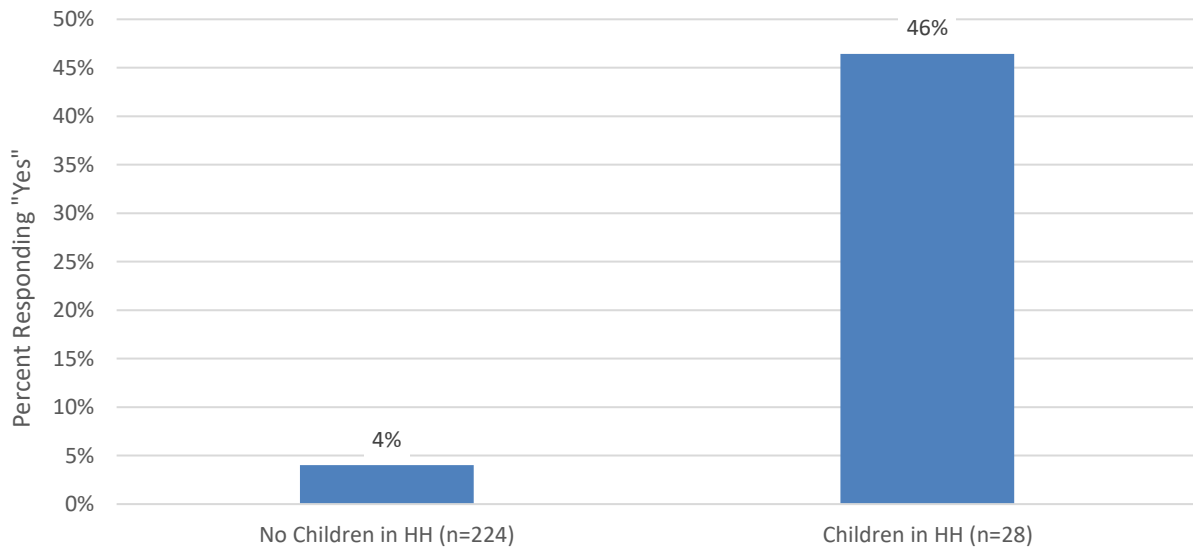
Respondents under age 55 are more likely than older respondents to have a household member with an employer-issued computer (see Figure 149).

Figure 149: Have an Employer-Issued Device by Respondent Age
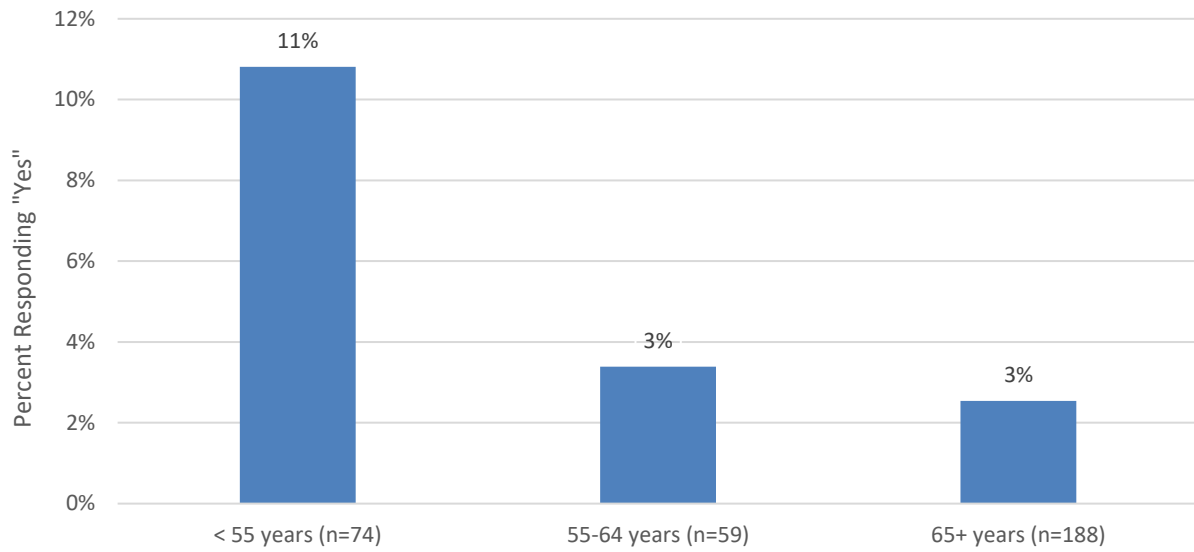
Respondents with home internet service were asked how often their primary computer becomes inaccessible or unusable, and how long it would take to replace the computer if it became lost or damaged beyond repair. More than one-half (53 percent) of respondents have had some issues with their computer (see Figure 150).

Figure 150: Computer Becomes Unusable
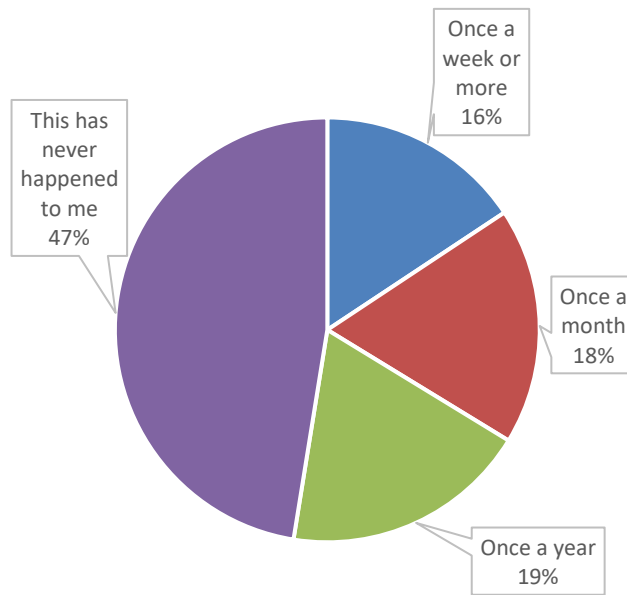
One-fifth of respondents said they could not replace their computer if it became unusable, and another 28 percent said it would take one to six months to replace (see Figure 151).

Figure 151: When Could Replace Computer
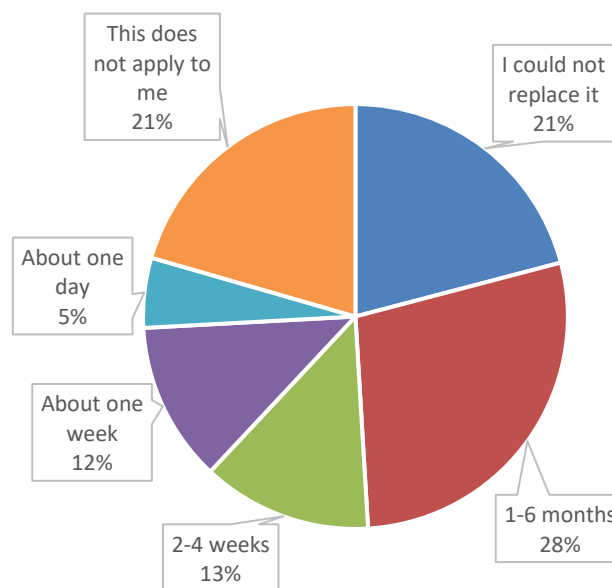
6.3.1.10 Cost of internet service

Respondents were asked to give the cost of their home internet service. Estimated monthly price of internet is shown in Figure 152, for customers who bundle (49 percent) or do not bundle (51 percent) internet service. The estimated monthly average cost for internet service is $62. Four in 10 respondents with unbundled internet service pay $10 or less per month.

Figure 152: Monthly Price for Internet Service
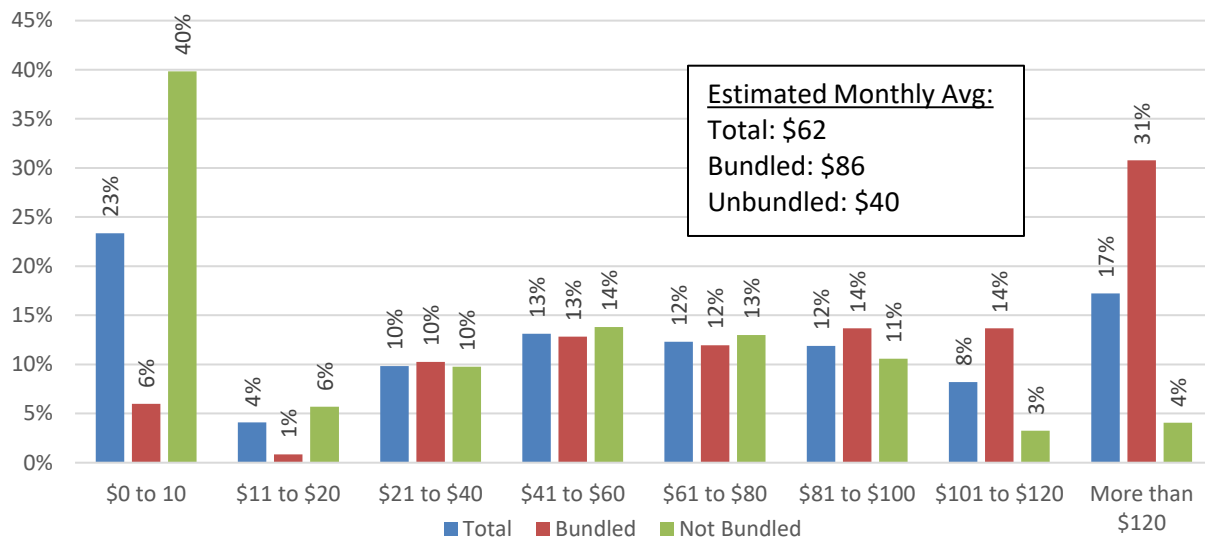
Mean (average) and median charges for Comcast customers not enrolled in the Internet Essentials program are displayed in Figure 153. The average cost is $134 for regular monthly charges and $121 for the Xfinity package.

Figure 153: Monthly Charges for Comcast Customers Not in the Internet Essentials Program
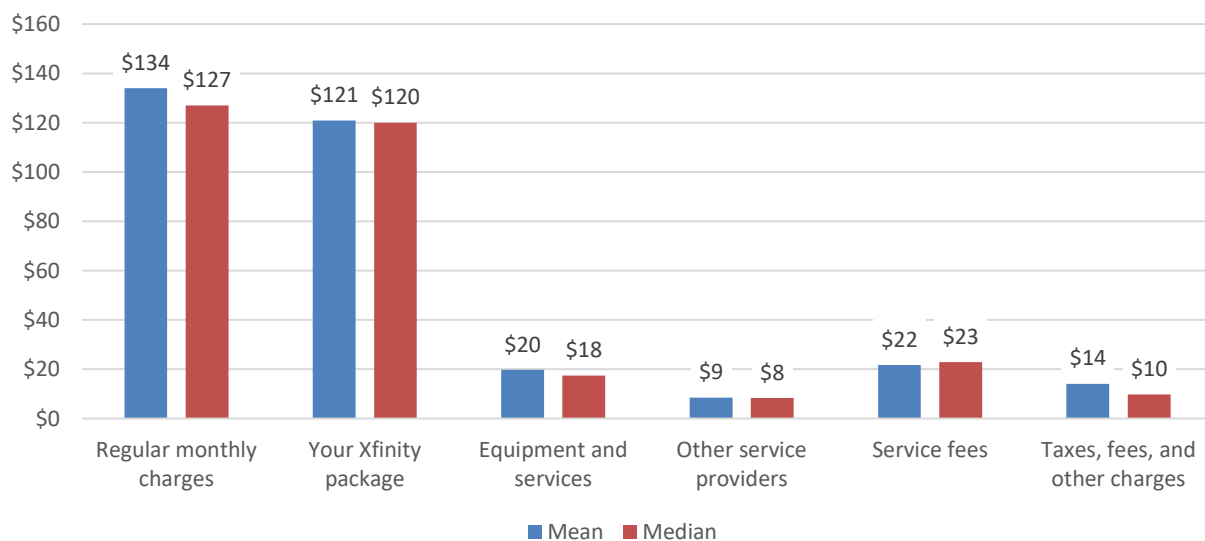
6.3.1.11 Internet uses

Respondents were asked about their use of their home internet connection and of their cellular/ mobile internet connection for various activities.

6.3.1.11.1 Home internet connection

Among those items listed, the home internet connection is most frequently used for watching movies, videos, or TV, followed by streaming music, banking or paying bills, and using social media (see Figure 154). A home internet connection is less frequently used for other activities.

Some respondents use a home internet connection to access other key information and services. Seven in 10 respondents access government information at least occasionally, and nearly two-thirds at least occasionally access medical services or educational resources. While 28 percent frequently use their home internet to access educational resources or for homework, another 37 percent never use it for this purpose. Subscribers are less likely to ever use their home internet to connect to a work computer (34 percent) or run a home-based business (9 percent).

Figure 154: Home Internet Connection Use for Various Activities
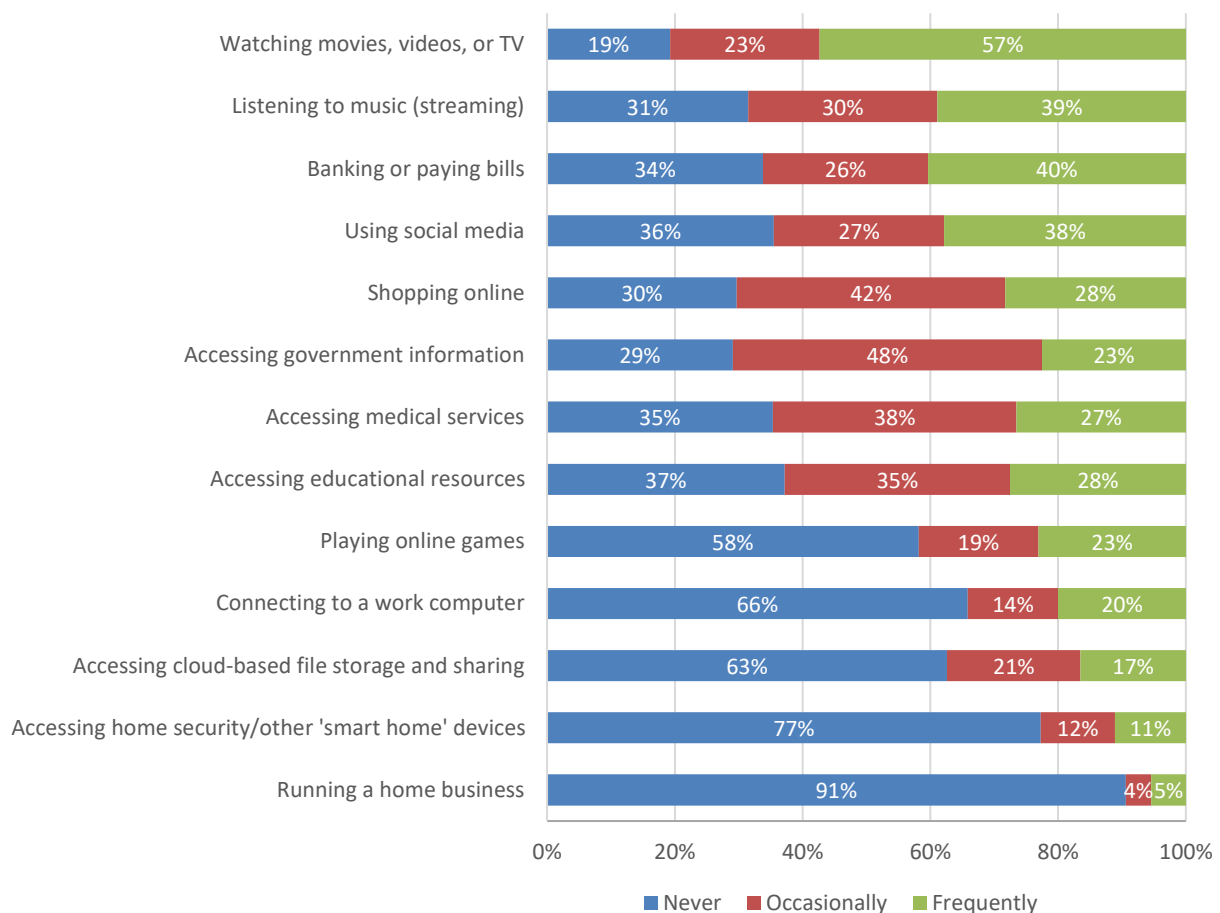
6.3.1.11.2 Cellular/mobile connection

A smartphone is used most frequently for social media, streaming music, and watching movies, videos, or TV as shown in Figure 155. More than one-half of respondents at least occasionally use a cellular/mobile connection for banking (54%), shopping online (53%), accessing government information (53%), or accessing medical services (54%). A smaller segment of respondents uses a smartphone to ever access educational resources (46%), connect to a work computer (28%), or run a home business (8%).

Figure 155: Cellular/Mobile Connection Use for Various Activities
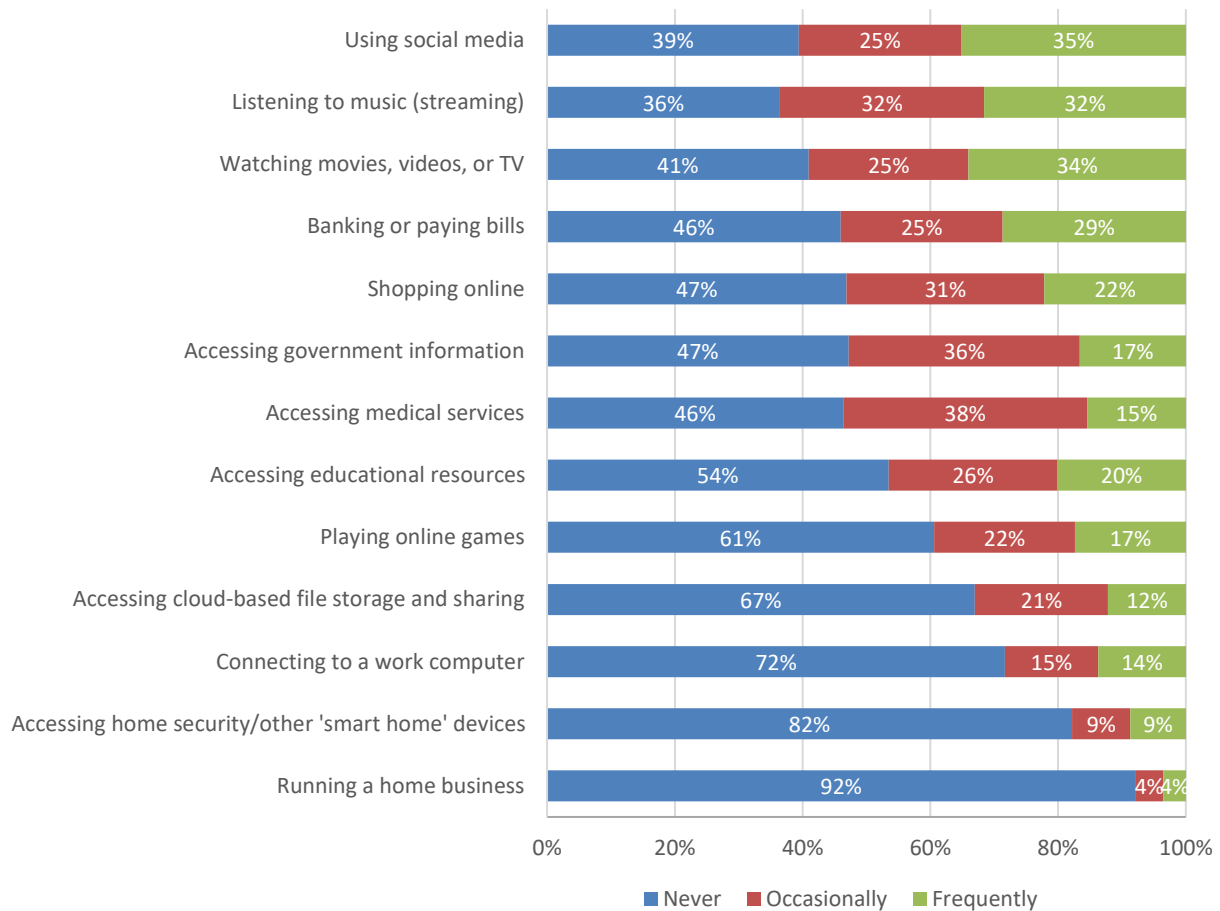
Figure 156 compares the percentage of respondents by connection type who ever use their connection for various activities. Respondents are less likely to use a cellular/mobile connection than a home internet connection for many activities listed, including streaming video and shopping online.

Internet subscribers are more likely to use a home internet connection to access key information and services (e.g., accessing educational resources, government information, or medical services), but a sizeable segment of respondents does use a smartphone for these activities as discussed previously.

Figure 156: Internet Connection Ever Used for Various Activities by Connection Type

Percent Occasionally/Frequently Using Connection

■ Home Internet ■ Cellphone
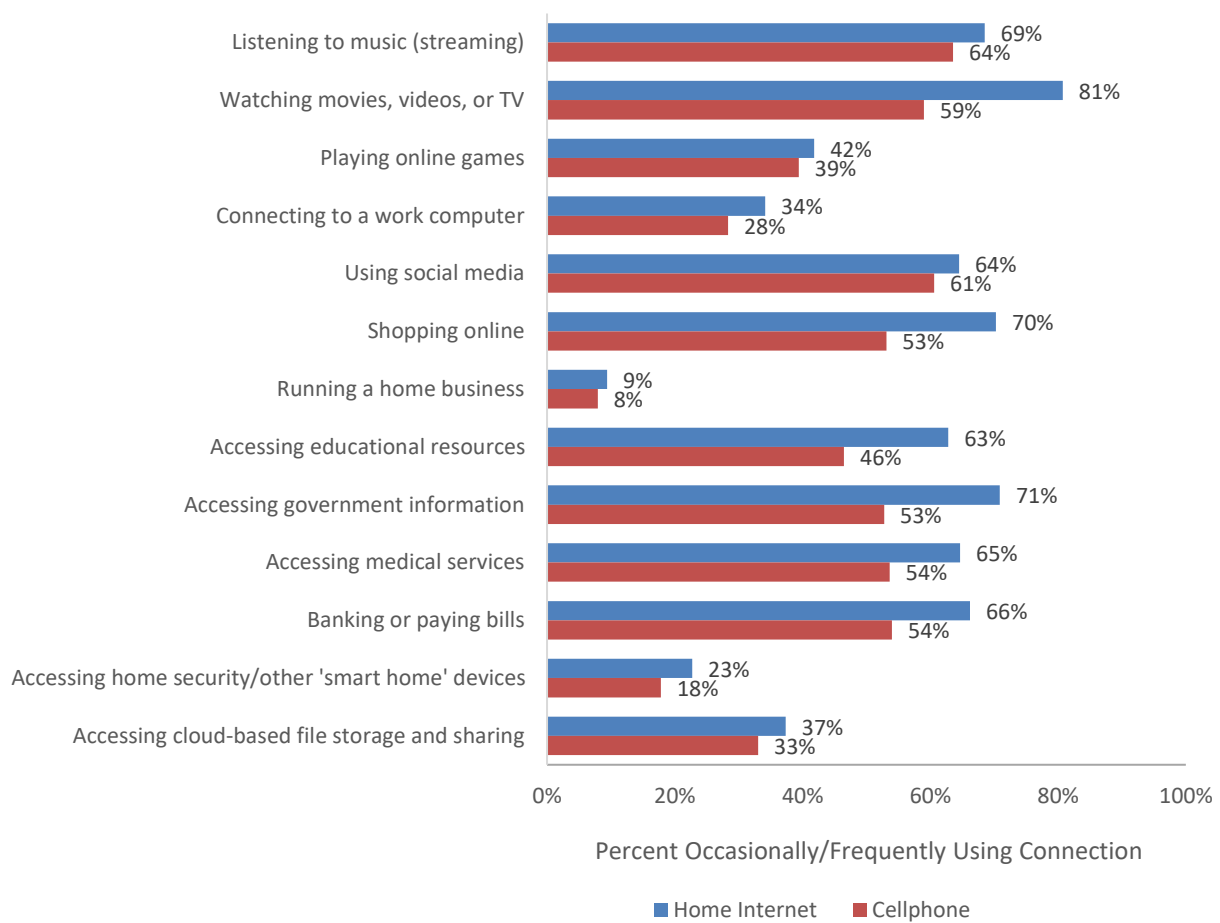
6.3.1.11.3 Internet uses by respondent age

Respondents under age 55 are more likely than older respondents to ever use their *home internet connection* or *cellular/mobile connection* for some key activities, as illustrated in Table 25 and Table 26. Respondents under age 55 are more likely than older respondents to ever use their *home internet connection* for streaming music, watching videos, playing online games, connecting to a work computer, and using social media in particular. Respondents ages 65+ were less likely than younger respondents to use a *cellular/mobile connection* for the various activities.

Table 25: Home Internet Connection Ever Used for Various Activities by Respondent Age

	< 55 years	55-64 years	65+ years
Listening to music (streaming)	83%	67%	58%
Watching movies, videos, or TV	91%	80%	73%
Playing online games	59%	38%	31%
Connecting to a work computer	52%	33%	20%
Using social media	73%	67%	55%
Shopping online	73%	72%	67%
Running a home business	9%	10%	10%
Accessing educational resources	68%	61%	60%
Accessing government information	71%	70%	70%
Accessing medical services	65%	67%	63%
Banking or paying bills	74%	69%	58%
Accessing home security/other 'smart home' devices	26%	20%	22%
Accessing cloud-based file storage and sharing	48%	33%	31%

Table 26: Cellular/Mobile Connection Ever Used for Various Activities by Respondent Age

	< 55 years	55-64 years	65+ years
Listening to music (streaming)	90%	65%	44%
Watching movies, videos, or TV	78%	59%	44%
Playing online games	51%	44%	28%
Connecting to a work computer	39%	38%	14%
Using social media	75%	61%	49%
Shopping online	68%	63%	35%
Running a home business	7%	10%	8%
Accessing educational resources	63%	49%	30%
Accessing government information	63%	52%	44%
Accessing medical services	65%	58%	42%
Banking or paying bills	69%	60%	37%
Accessing home security/other 'smart home' devices	22%	15%	17%
Accessing cloud-based file storage and sharing	45%	28%	28%

6.3.1.11.4 Internet uses by children in household

As shown in Table 27, the few households with children in them (18 respondents) make occasional or frequent use of their internet connections for most key activities.

All households with children (and that have internet service) ever use a home internet connection to access educational resources, including 67 percent who access it frequently (based on 28 respondents). At the same time, 86 percent of households with children use a cellular/mobile connection for accessing educational resources, including 50 percent who do so frequently and 36 percent who do so occasionally.

Table 27: Internet/Smartphone Ever Used for Various Activities by Children in Household

	Home Internet Connection		Cellular/Mobile Connection	
	No Children in HH	Children in HH	No Children in HH	Children in HH
Listening to music (streaming)	67%	**82%**	60%	**90%**
Watching movies, videos, or TV	79%	**96%**	54%	**86%**
Playing online games	39%	**67%**	36%	**69%**
Connecting to a work computer	29%	**67%**	23%	**59%**
Using social media	62%	**85%**	57%	**86%**
Shopping online	70%	**78%**	51%	**71%**
Running a home business	9%	**7%**	7%	**7%**
Accessing educational resources	58%	**100%**	41%	**86%**
Accessing government information	70%	**79%**	49%	**69%**
Accessing medical services	63%	**82%**	51%	**72%**
Banking or paying bills	64%	**82%**	50%	**79%**
Accessing home security/other 'smart home' devices	22%	**26%**	18%	**17%**
Accessing cloud-based file storage and sharing	39%	**33%**	34%	**28%**

6.3.1.12 Internet skills

Respondents were asked to indicate their level of agreement with various statements about their internet skills. Average rating scores are highlighted in Figure 157, while Figure 158 shows detailed responses.

Figure 157: Agreement with Statements About Internet Skills (Mean Ratings)

Statement	Mean Rating
Access my bank account online	3.1
Identify false or misleading info online and find credible sources	3.0
Connect with my doctor or other medical support online	3.0
Upload content to a website	3.0
Block spam or unwanted content	2.9
Create/manage social media profile	2.9
Bookmark a website or add to favorites	2.9
Adjust my privacy settings online	2.9
Purchase groceries and food online	2.8
Recognize and avoid a phishing scam	2.8
Create my own content using computers/internet	2.5
Troubleshoot issues with technology	2.4
Create/manage my own personal website	2.1

Mean Rating (1=Strongly Disagree and 5=Strongly Agree)

Figure 158: Agreement with Statements About Internet Skills

Statement	1 - Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agree
Access my bank account online	34%	7%	13%	13%	34%
Identify false or misleading info online and find credible sources	28%	9%	19%	18%	26%
Connect with my doctor or other medical support online	31%	8%	16%	14%	30%
Upload content to a website	30%	11%	19%	10%	29%
Block spam or unwanted content	32%	10%	21%	11%	26%
Create/manage social media profile	34%	9%	17%	14%	26%
Bookmark a website or add to favorites	35%	10%	16%	9%	29%
Adjust my privacy settings online	33%	10%	19%	14%	24%
Purchase groceries and food online	36%	9%	19%	8%	28%
Recognize and avoid a phishing scam	31%	12%	24%	13%	21%
Create my own content using computers/internet	43%	13%	17%	10%	17%
Troubleshoot issues with technology	41%	13%	20%	14%	12%
Create/manage my own personal website	51%	14%	16%	6%	12%

On average, internet subscribers were neutral on whether they know how to use the internet for most functions, and they tended to split on strongly agreeing and strongly disagreeing with most skills. A sizeable share of respondents did not agree that they were skilled in various uses of computers and the internet.

Many respondents indicated that they cannot use the internet for specific essential functions like banking, contacting medical support, or purchasing groceries. Four in 10 respondents disagreed or strongly disagreed that they know how to access their bank account online or connect with their doctor/medical support online. Nearly one-half of respondents disagreed or strongly disagreed that they can purchase groceries and food online.

Respondents also expressed some disagreement with their technological skills for general tasks like uploading content, creating a social media profile, bookmarking a website, and adjusting

privacy settings, for which more than four in 10 disagreed or strongly disagreed. Four in 10 respondents strongly disagreed that they could troubleshoot issues with technology, and another 13 percent disagreed. One-half (51%) of respondents strongly disagreed that they could create and manage their own personal website.

As may be expected, respondents without internet service were less likely than those with home internet to agree with statements about their internet skills (see Table 28). Additionally, those with a below criteria connection (dial-up, cellular/mobile, satellite) rated their abilities lower than did those with a high-speed connection above minimum criteria.

Table 28: Agreement with Statements About Internet Skills (Mean Ratings) by Connectivity

	Non-internet user		Internet user – below minimum criteria		Internet user – possible below minimum criteria		Internet user – above minimum criteria	
	Mean	Count	Mean	Count	Mean	Count	Mean	Count
I know how to upload content (such as videos, photos, music) to a website	1.8	48	2.7	41	3.4	39	3.4	165
I know how to block spam or unwanted content	1.8	48	2.8	41	3.0	37	3.3	165
I know how to adjust my privacy settings online, such as on Facebook or other sites	1.7	48	2.6	40	3.0	38	3.3	165
I know how to bookmark a website or add a website to my list of favorites	1.8	48	2.3	40	3.3	38	3.4	163
I know how to identify false or misleading information online and find credible sources of information	2.0	48	2.7	39	3.3	38	3.4	164
I know how to create and manage my own personal profile on Facebook or other social network site	1.8	48	2.5	40	3.1	38	3.4	164
I know how to create and manage my own personal website	1.7	47	1.9	40	2.1	38	2.4	163
I know how to recognize and avoid a phishing scam	1.9	47	2.5	40	3.0	38	3.2	162
I know how to create my own content (such as videos, photos, music) using computers and the internet	1.6	48	2.1	40	2.6	38	2.8	164
I know how to access my bank account online to perform tasks such as paying bills or depositing checks with my phone	1.7	49	2.8	41	3.2	38	3.6	165
I feel confident in my ability to troubleshoot issues with technology when they arise	1.7	48	1.8	40	2.7	38	2.8	164
I know how to purchase groceries and food online	1.7	47	2.4	40	3.4	38	3.2	163
I know how connect with my doctor or other medical support online	1.9	48	2.7	41	3.5	38	3.4	165

Similarly, respondents ages 55 and older were less likely to agree that they are skilled in various uses of the internet (see Table 29). Respondents under age 55 expressed some agreement with statements about their internet skills, particularly creating/managing social media profile, accessing their bank account online, uploading content, blocking spam or unwanted content, and adjusting privacy settings. They were somewhat less likely to agree that they can troubleshoot issues with technology or create/manage their own personal website.

Table 29: Agreement with Statements About Internet Skills (Mean Ratings) by Age

	< 55 years		55-64 years		65+ years	
	Mean	**Count**	**Mean**	**Count**	**Mean**	**Count**
I know how to upload content (such as videos, photos, music) to a website	3.8	82	3.0	72	2.5	158
I know how to block spam or unwanted content	3.8	82	2.8	72	2.5	155
I know how to adjust my privacy settings online, such as on Facebook or other sites	3.8	82	2.7	71	2.4	155
I know how to bookmark a website or add a website to my list of favorites	3.6	82	3.0	71	2.5	155
I know how to identify false or misleading information online and find credible sources of information	3.7	81	3.1	72	2.7	155
I know how to create and manage my own personal profile on Facebook or other social network site	3.9	82	3.0	69	2.4	155
I know how to create and manage my own personal website	2.7	81	2.1	72	1.9	154
I know how to recognize and avoid a phishing scam	3.5	81	2.8	71	2.5	154
I know how to create my own content (such as videos, photos, music) using computers and the internet	3.3	81	2.4	72	2.1	156
I know how to access my bank account online to perform tasks such as paying bills or depositing checks with my phone	3.9	82	3.3	73	2.5	156
I feel confident in my ability to troubleshoot issues with technology when they arise	3.1	82	2.5	71	2.1	156
I know how to purchase groceries and food online	3.5	80	3.0	71	2.4	155
I know how connect with my doctor or other medical support online	3.7	82	3.1	72	2.7	155

6.3.1.13 Computer and internet training

Respondents were also asked their level of agreement with various statements about receiving training related to computers and the internet. Average rating scores are highlighted in Figure 159, while Figure 160 shows detailed responses.

Overall, there is only slight to moderate interest in learning about or in attending a class about writing software/code. On average, there is moderate interest in becoming more confident in using computers, smartphones, and the internet, in learning how computers work, or in using online resources to find trustworthy information. However, there is a relatively sizable subsegment of respondents who strongly agreed that they would be interesting in training.

Figure 159: Agreement with Statements About Training Related to Computers and the Internet (Mean Ratings)
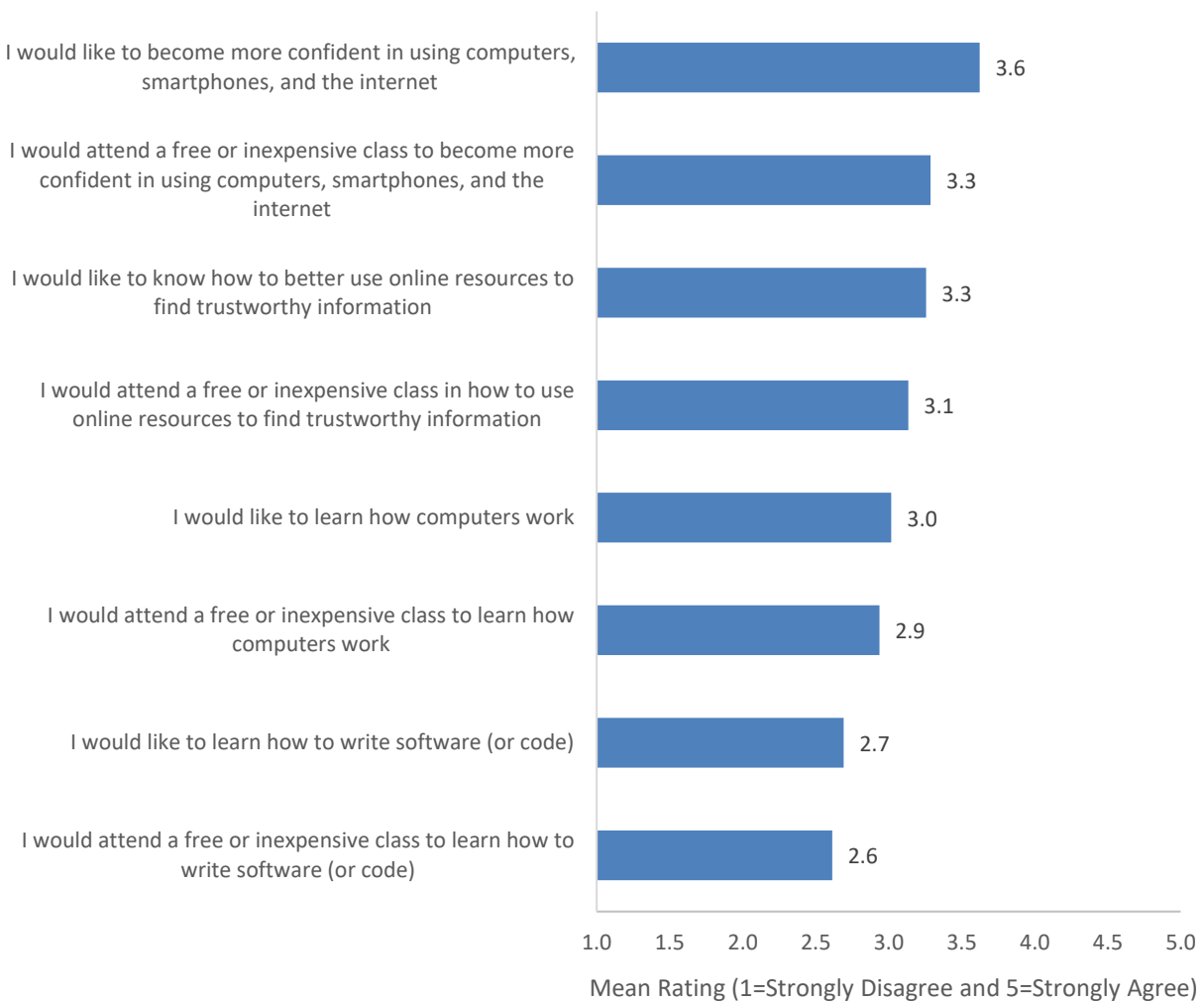
Mean Rating (1=Strongly Disagree and 5=Strongly Agree)

Specifically, 45 percent of respondents strongly agreed that they would like to become more confident in using computers and related technology, and 36 percent strongly agreed they would like to attend training.

Similarly, 34 percent of respondents strongly agreed about wanting to know how to better use online resources to find trustworthy information, and 32 percent strongly agreed they are interested in training. Another 28 percent of respondents strongly agreed that they would like to learn how computers work, and 27 percent strongly agreed that they would attend a free or inexpensive class on this topic.

Figure 160: Agreement with Statements About Training Related to Computers and the Internet

Statement	1 - Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agree
I would like to become more confident in using computers, smartphones, and the internet	19%	4%	16%	16%	45%
I would attend a free or inexpensive class to become more confident in using computers, smartphones, and the internet	24%	9%	17%	15%	36%
I would like to know how to better use online resources to find trustworthy information	26%	7%	18%	16%	34%
I would attend a free or inexpensive class in how to use online resources to find trustworthy information	28%	9%	16%	15%	32%
I would like to learn how computers work	31%	9%	18%	15%	28%
I would attend a free or inexpensive class to learn how computers work	33%	9%	16%	15%	27%
I would like to learn how to write software (or code)	41%	10%	12%	13%	24%
I would attend a free or inexpensive class to learn how to write software (or code)	43%	11%	10%	12%	23%

Interest in training varies significantly by age of respondent. As illustrated in Figure 161, those under age 65 expressed greater interest in learning how computers work or how to write software/code, as well as attending a class about these topics, compared with older respondents.

Figure 161: Agreement with Statements About Training by Respondent Age

Mean Rating (1=Strongly Disagree and 5=Strongly Agree)

■ < 55 years ■ 55-64 years ■ 65+ years
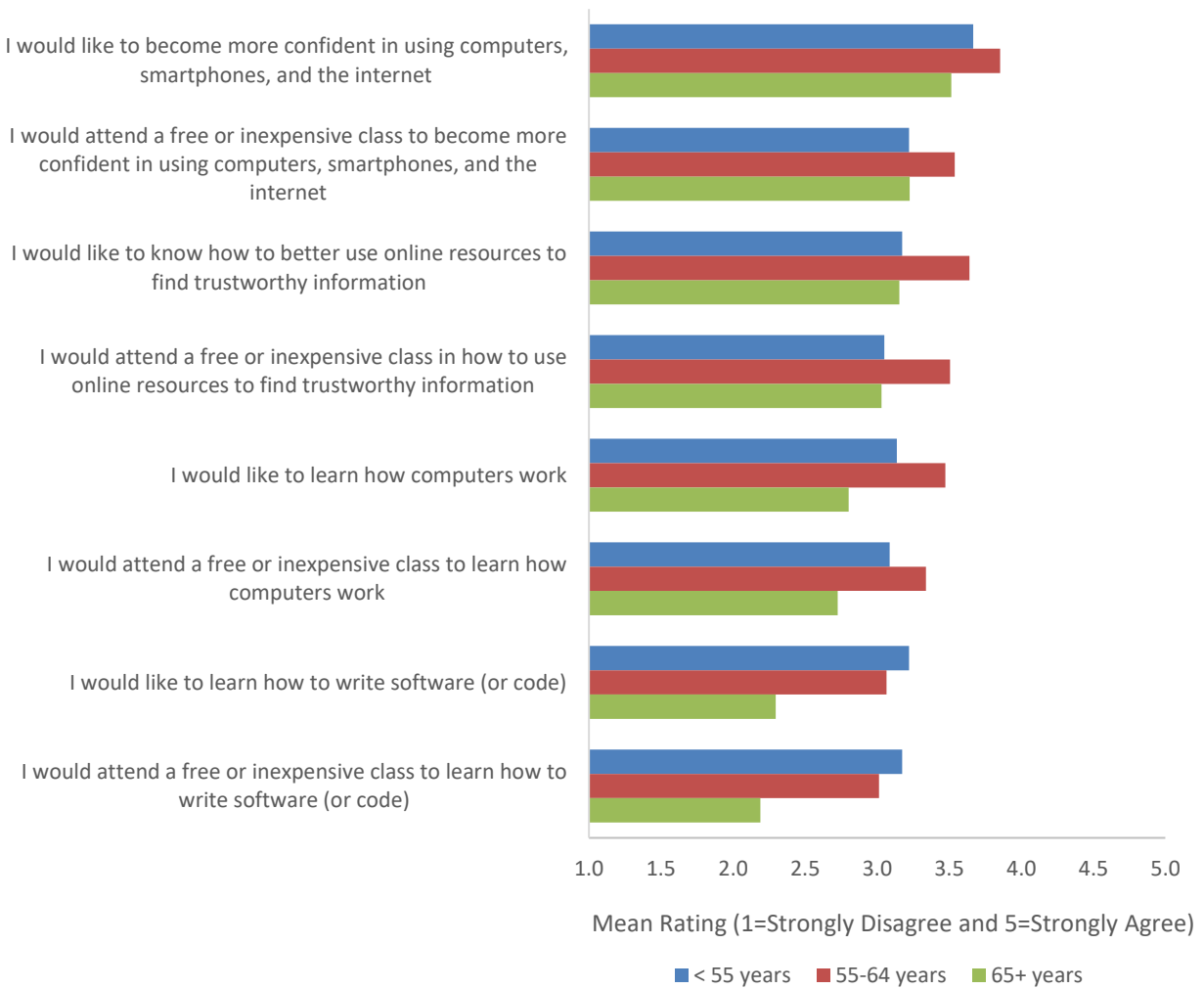
6.3.2   Technology for minor children

Just 46 (13%) respondents said they are the parent, guardian, or primary caretaker of children or grandchildren under the age of 18. Respondents under age 55, respondents earning $25,000+ per year, and black respondents are more likely than their counterparts to a be a parent, guardian, or caretaker (see Figure 162 through Figure 164).

Figure 162: Have Minor Children by Age
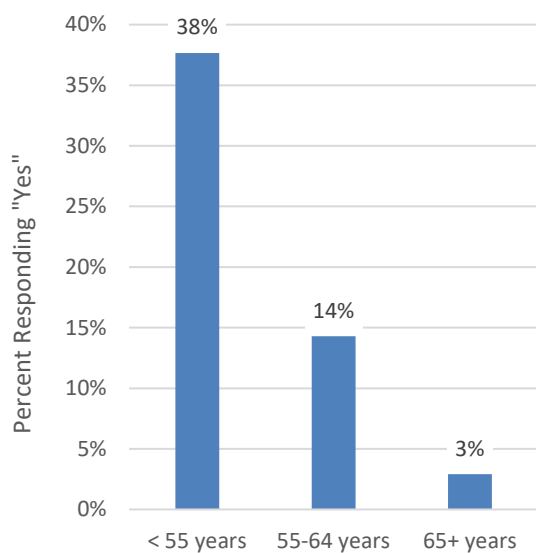
Figure 163: Have Minor Children by Income
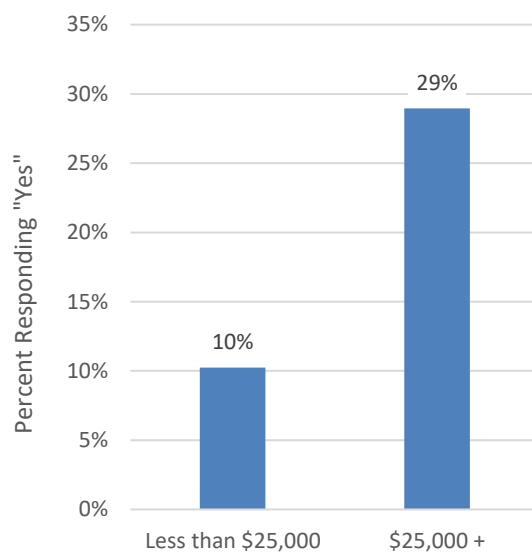
Figure 164: Have Minor Children by Ethnicity
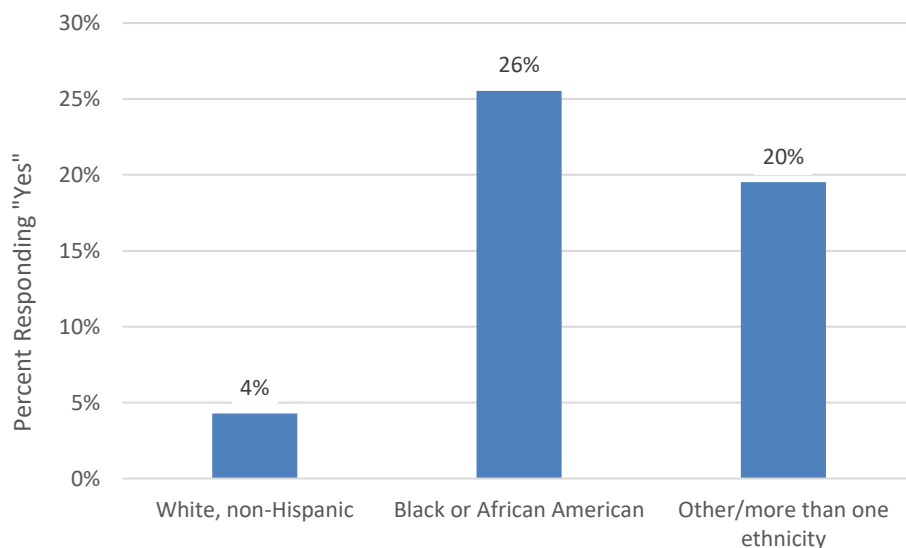
6.3.2.1   Use of Technology

Respondents who are the parent, legal guardian, or primary caretaker for any child or grandchild under the age of 18 were asked their level of agreement with statements about how their minor

child is able to make beneficial use of technology. Average rating scores are highlighted in Figure 165, while Figure 166 shows detailed responses.

Figure 165: Agreement with Statements About Minor Children's Use of Technology

(Mean Ratings)

Mean Rating (1=Strongly Disagree and 5=Strongly Agree)
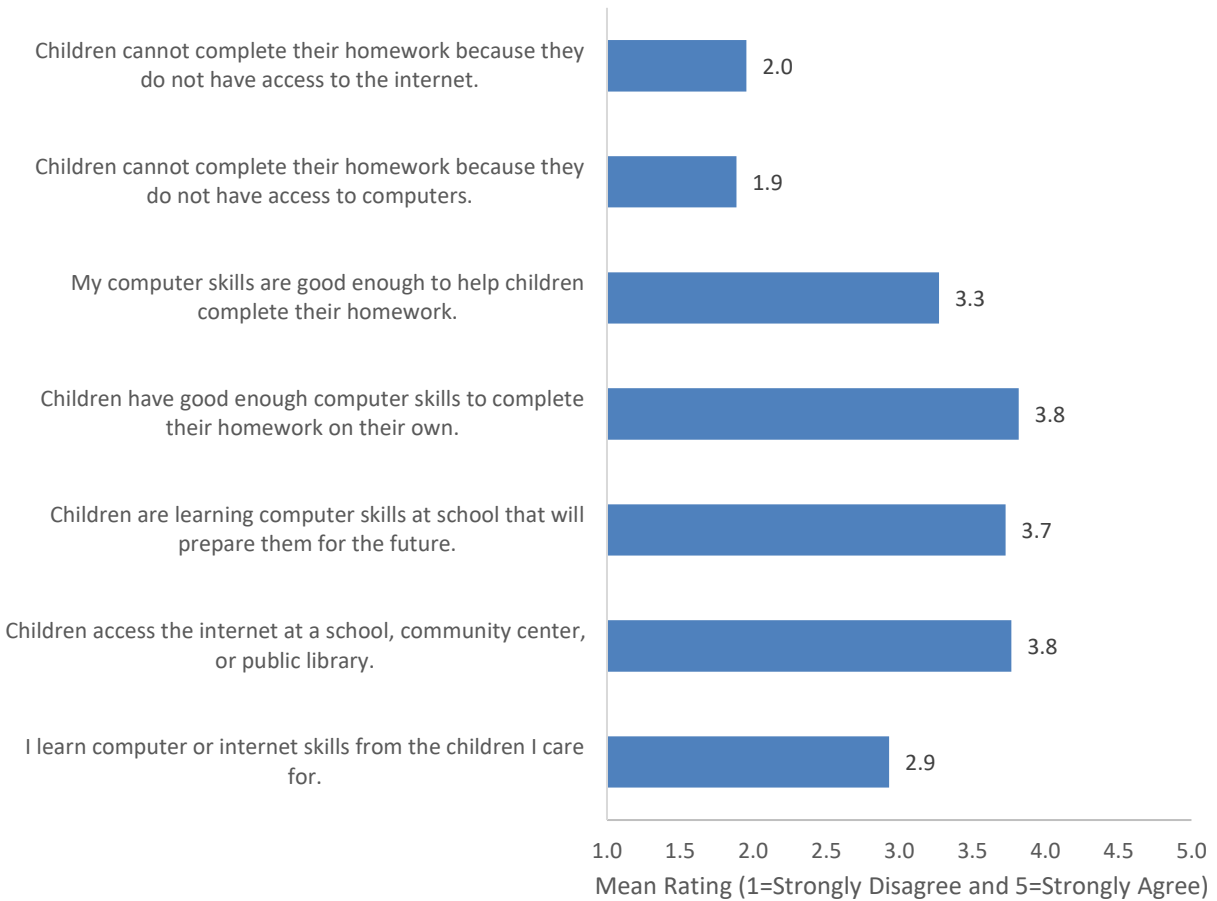
Figure 166: Agreement with Statements About Minor Children's Use of Technology

Statement	1 - Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agree
Children cannot complete their homework because they do not have access to the internet.	52%	18%	18%	5%	7%
Children cannot complete their homework because they do not have access to computers.	57%	14%	18%	7%	5%
My computer skills are good enough to help children complete their homework.	14%	20%	20%	16%	30%
Children have good enough computer skills to complete their homework on their own.	11%	7%	14%	25%	43%
Children are learning computer skills at school that will prepare them for the future.	2%	7%	34%	30%	27%
Children access the internet at a school, community center, or public library.	9%		26%	28%	35%
I learn computer or internet skills from the children I care for.	25%	14%	23%	20%	18%

A majority of respondents indicated that the children in their care have sufficient internet access and skills, although a sizeable segment were less likely to agree with statements about their own skills. Most respondents strongly disagreed that their minor children cannot complete their homework because they do not have access to the internet (23 of 44; 52%) or computers (25 of 44; 57%). Only five respondents (12 percent) agreed or strongly agreed.

Nineteen of 44 respondents (43%) strongly agreed that their children have good enough computer skills to complete their homework on their own, and 11 respondents (25%) agreed. Just eight respondents (18 percent) disagreed or strongly disagreed with this statement.

Fewer respondents agreed (7 of 44; 16%) or strongly agreed (13 or 44; 30%) that their own computer skills are good enough to help their children complete their homework. Only a small segment of respondents agreed (9 of 44; 20%) or strongly agreed (8 of 44; 18%) that they learn computer or internet skills from the children in their care.

Twelve of 44 respondents (27%) strongly agreed that their children are learning computer skills at school that will prepare them for the future. Few respondents disagreed with this statement. More than six in 10 respondents agreed or strongly agreed that their children access the internet at a school, community center of public library.

6.3.2.2 Minimize Online Risks

Respondents with minor children were also asked their level of agreement with statements about the skills they or their children possess to avoid or minimize online risks. Average rating scores are highlighted in Figure 167, while Figure 168 shows detailed responses.

Although most households with minor children do have access to the internet and computers, respondents agree that there are some risks associated with internet use. Overall, respondents were neutral or somewhat agreed that they are aware of the extent to which children are exposed to online risk, that they are interested in learning how to identify risks for the children in their care, or that they know how to set up parental controls or filters online. Specifically, 19 of 43 respondents (44%) strongly agreed and 11 of 43 respondents (26%) somewhat agreed that they are interested in learning how to identify online risks.

Figure 167: Agreement with Statements About Minimizing Online Risks (Mean Ratings)
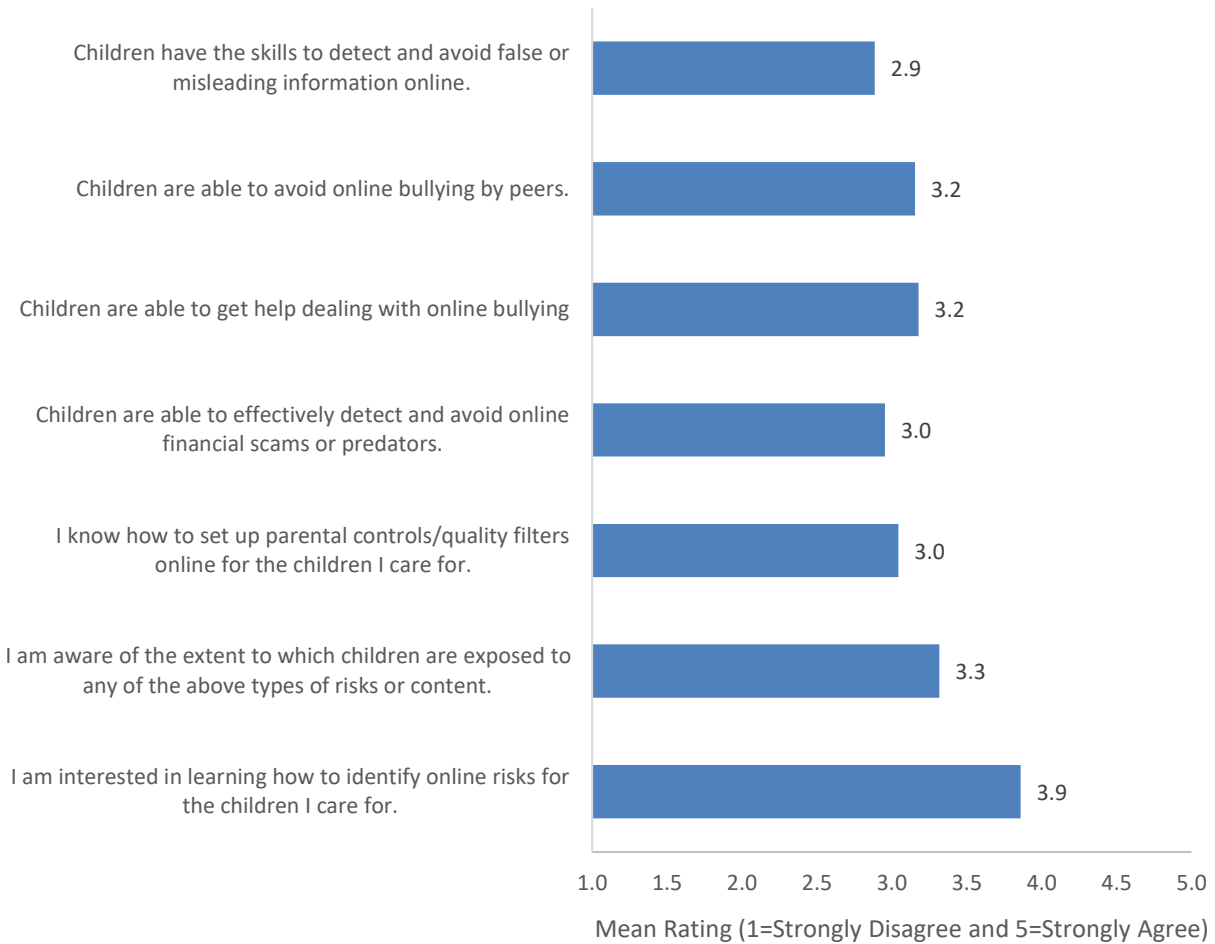
Although most respondents agreed or were neutral with the various statements about internet safety, a sizeable segment of respondents disagreed that their children are able to minimize or avoid online risks. Specifically, many respondents disagreed or strongly disagreed that their children can detect and avoid false or misleading information (38%), avoid online bullying (33%), get help for online bullying (37%), or detect and avoid financial scams and predators (39%).

Figure 168: Agreement with Statements About Minimizing Online Risks

Statement	1 - Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agree
Children have the skills to detect and avoid false or misleading information online.	20%	18%	25%	25%	11%
Children are able to avoid online bullying by peers.	20%	13%	20%	24%	22%
Children are able to get help dealing with online bullying	24%	13%	7%	31%	24%
Children are able to effectively detect and avoid online financial scams or predators.	25%	14%	18%	27%	16%
I know how to set up parental controls/quality filters online for the children I care for.	20%	18%	20%	22%	20%
I am aware of the extent to which children are exposed to any of the above types of risks or content.	16%	11%	20%	30%	23%
I am interested in learning how to identify online risks for the children I care for.	12%	5%	14%	26%	44%

6.3.3 Internet Use for jobs/careers

Just 14 percent of respondents said they have a job that requires them to have internet access at home. More than one-half of respondents (52 percent) are retired or not employed (see Figure 169).

Figure 169: Job Requires Homes Internet Access
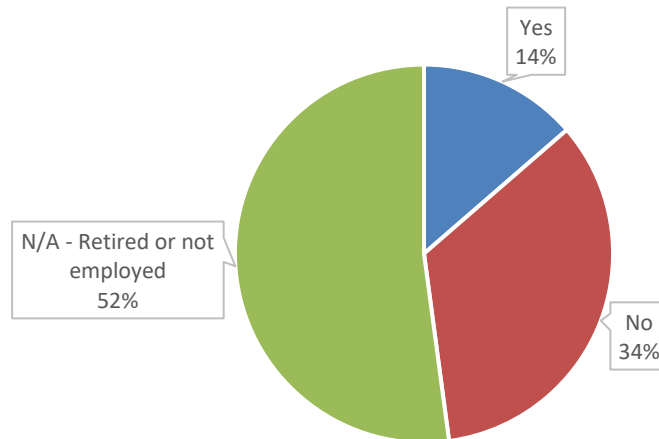
One in 10 respondents with below criteria internet service (dial-up, cellular/mobile, satellite) have a job that requires home internet access, as shown in Figure 170. Also, need for internet access for a job is highly associated with respondent age, as may be expected, with the majority of those ages 65+ retired or not employed (see Figure 171). About one-fourth (26%) of respondents under age 55 have a job that requires internet access.

Figure 170: Job Requires Homes Internet Access by Connectivity
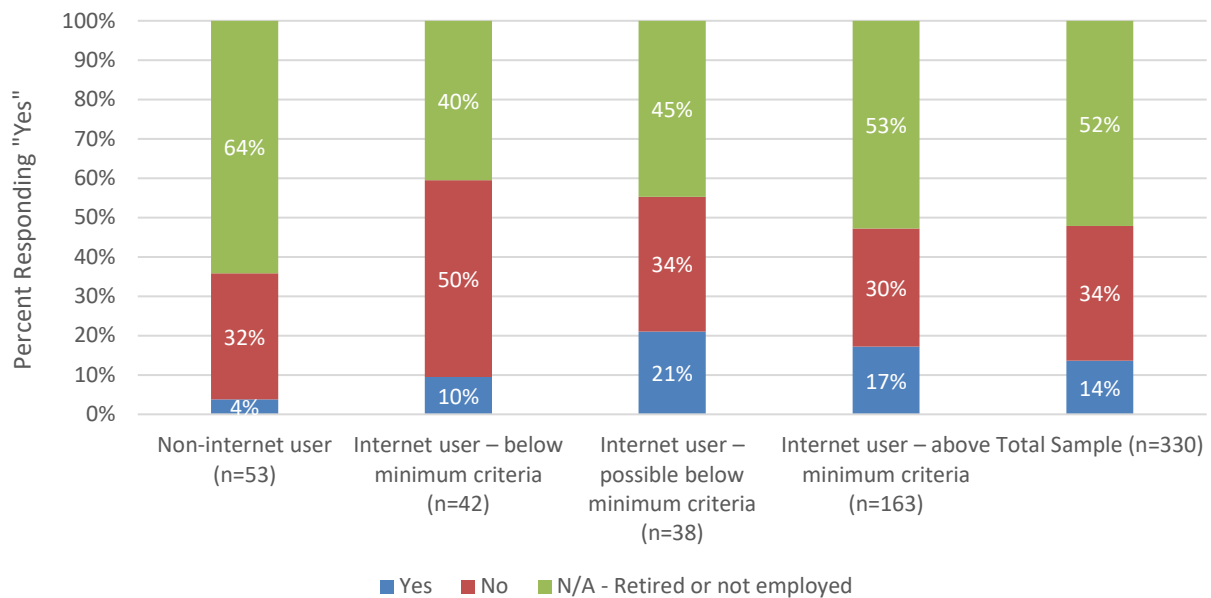
Figure 171: Job Requires Homes Internet Access by Respondent Age
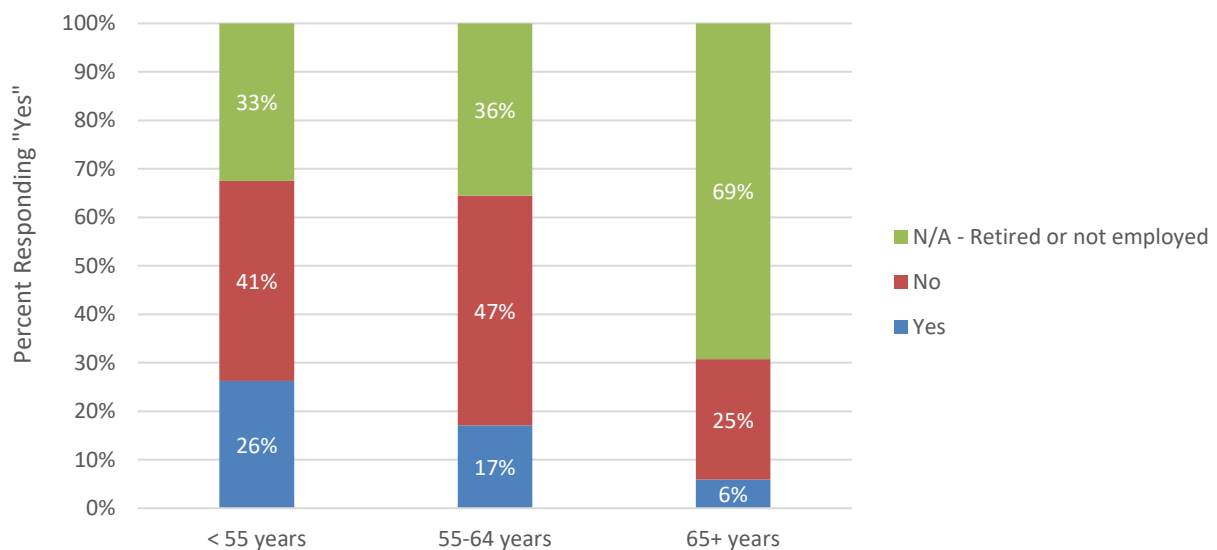
As shown in Figure 172 below, just 7 percent of respondents indicated that someone in their household already teleworks from home, and another eight percent would like to telework. Ten out of 24 (42 percent) respondents/household members who currently telework did so before the Covid-19 pandemic, while 14 out of 24 (58 percent) did not.

Figure 172: Household Member Teleworking
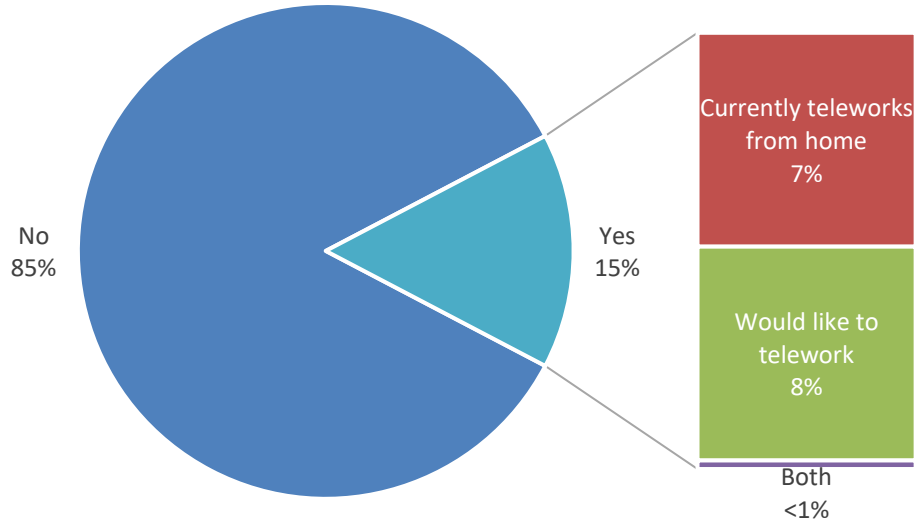
Respondents under age 55 are more likely than older respondents to have a household member who currently teleworks or would like to telework (see Figure 173).

Figure 173: Teleworking Status by Respondent Age
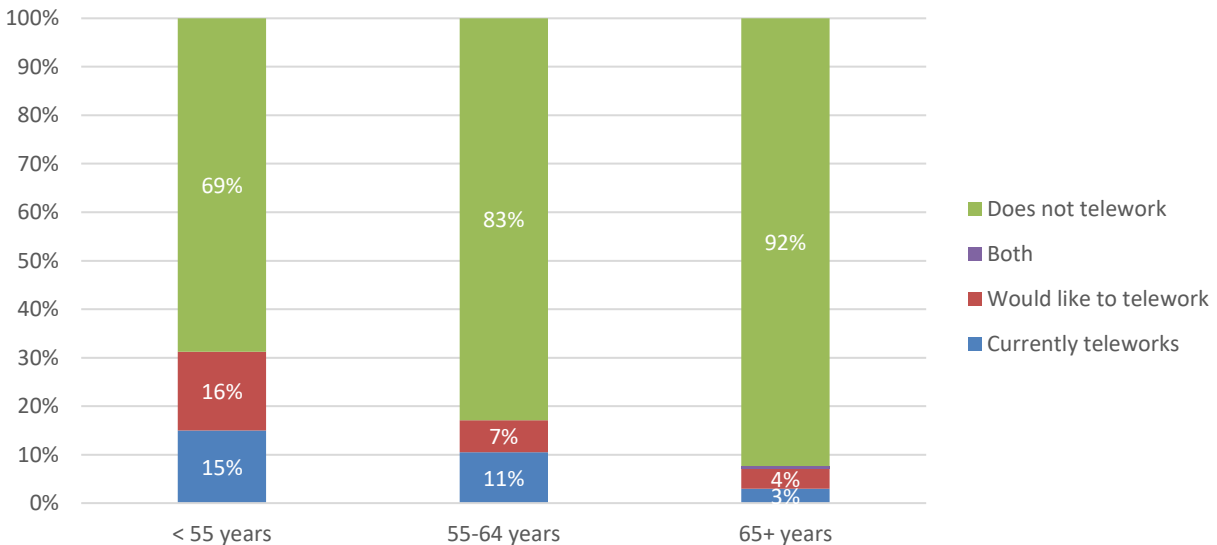
Seven percent of respondents either have a home-based business or are planning to start one within the next three years, as illustrated in Figure 174. No statistically significant differences by demographics were found.

Figure 174: Own or Plan to Start a Home-Based Business
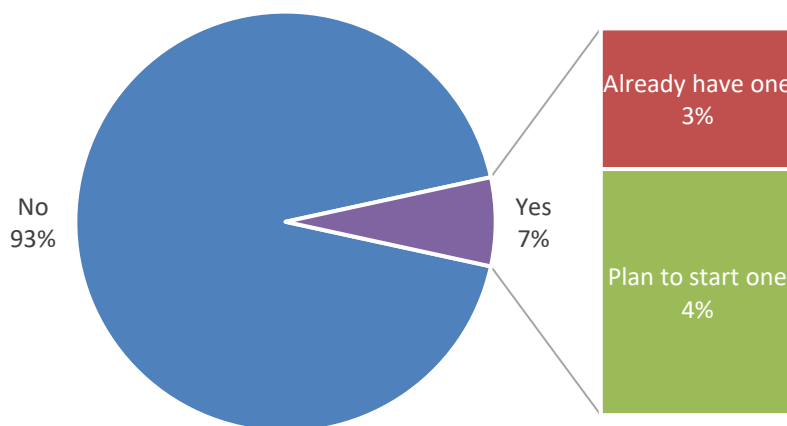
Overall, high-speed internet is moderately important for applying for/research new job opportunities and for working from home (teleworking), as shown in Figure 175. It is slightly important for a planned/existing home-based business, likely because few respondents have a home business.

Figure 175: Importance of High-Speed Internet
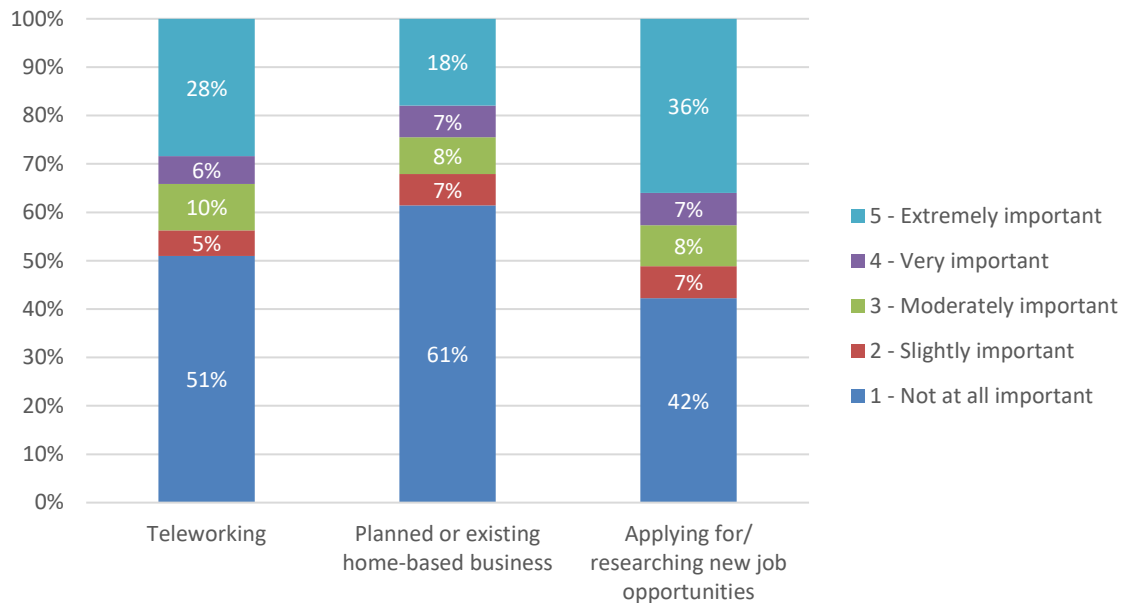
However, a high-speed data or internet connection is extremely important for most of those who currently telework or would like to telework (87 percent) and for those who have a planned or existing home-based business (58 percent), as shown in Figure 176. Intuitively, those who do not telework or have a planned/existing home-based business find the need for high-speed internet for these aspects to be less important.

Figure 176: Importance of High-Speed Internet for Teleworking and for Home-Based Business (Among Those Who Telework or Have a Home-Based Business)
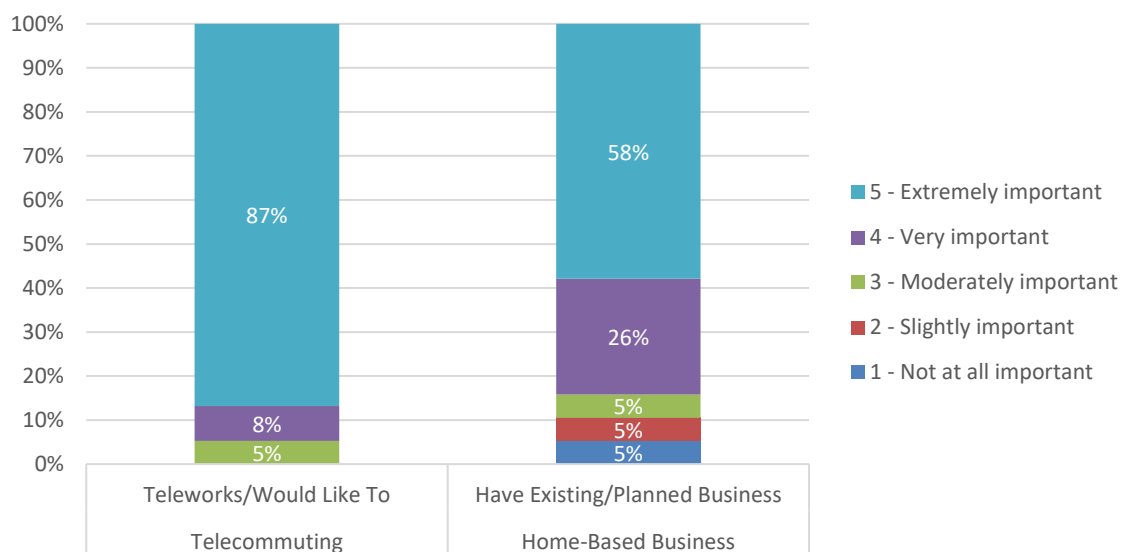
6.3.4 Internet use for education

Respondents were asked if they or a household member use an internet connection for educational purposes, such as completing assignments, research, or study related to coursework or formal education. Overall, 29 percent of households have a member who uses the internet for educational reasons, and 19 percent have a member who used the internet for educational purposes before the Covid-19 pandemic (see Figure 177). Additionally, one in 10 households has a member who uses the internet for homeschooling.

Household use of the internet for educational purposes is higher for those under age 55 years. More than one-half (56 percent) of respondents under age 55 have a household member who currently uses the internet for education, and 35 percent have a household member who used the internet for educational purposes prior to the Covid-19 pandemic (see Figure 178).

Figure 177: Use of Internet for Educational Purposes
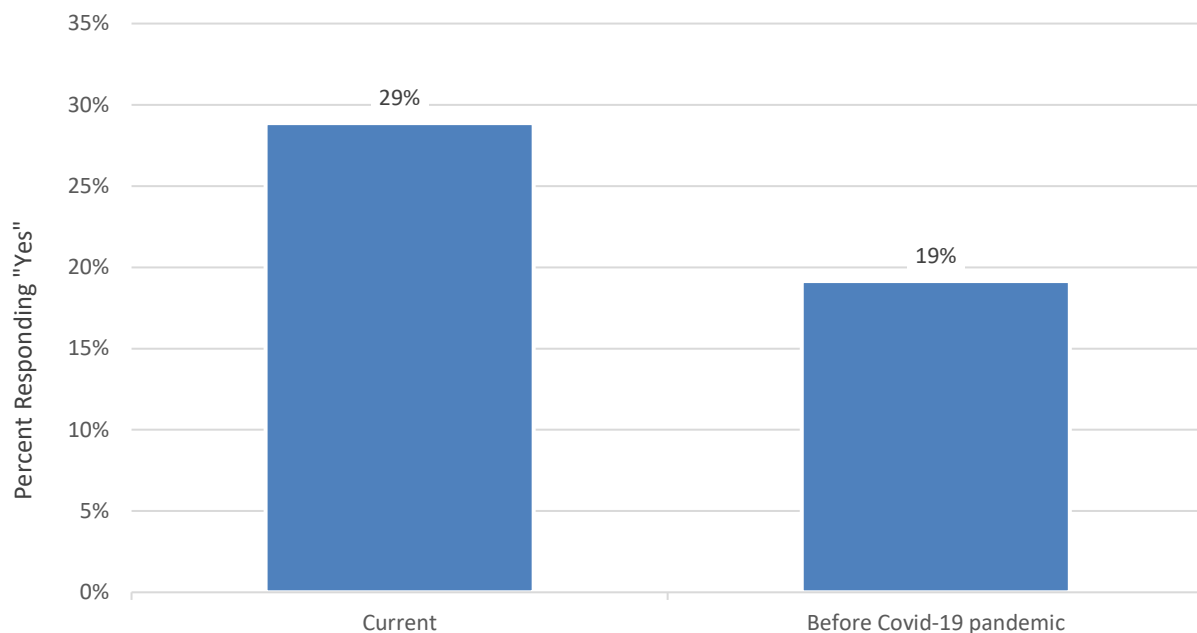
Figure 178: Use of Internet for Educational Purposes by Respondent Age
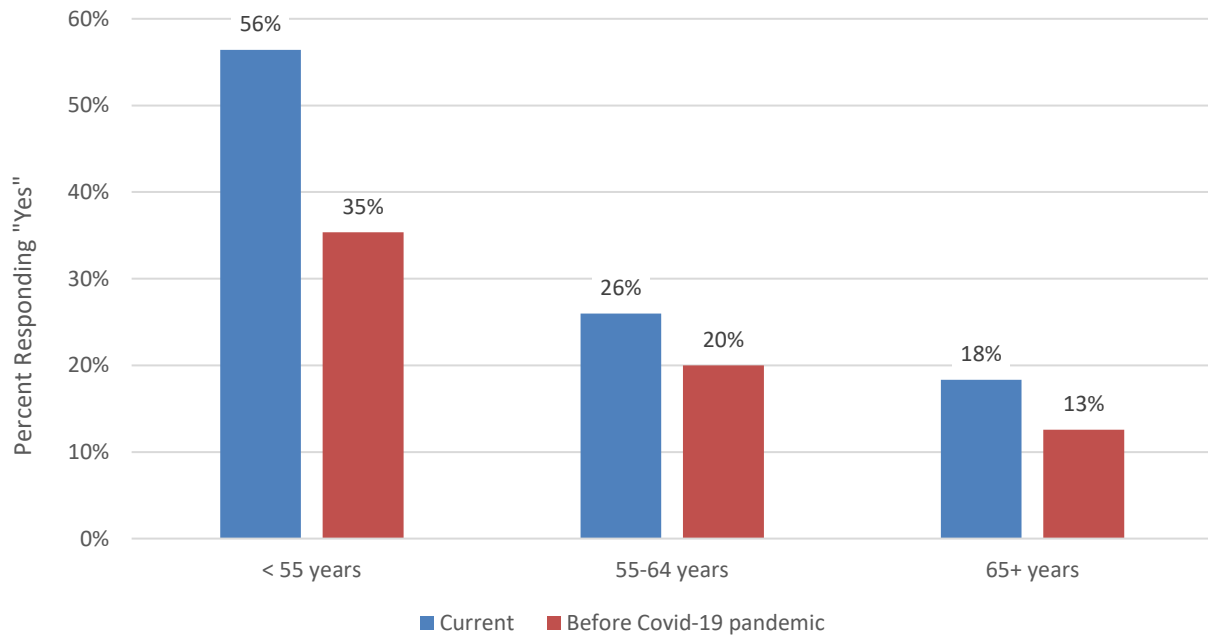
Most respondents with children in the household (27 of 29; or 93 percent) currently use the internet for educational purposes, compared with 17 of 30 respondents (57 percent) prior to the Covid-19 pandemic, as shown in Figure 179.

Figure 179: Use of Internet for Educational Purposes by Children in Household
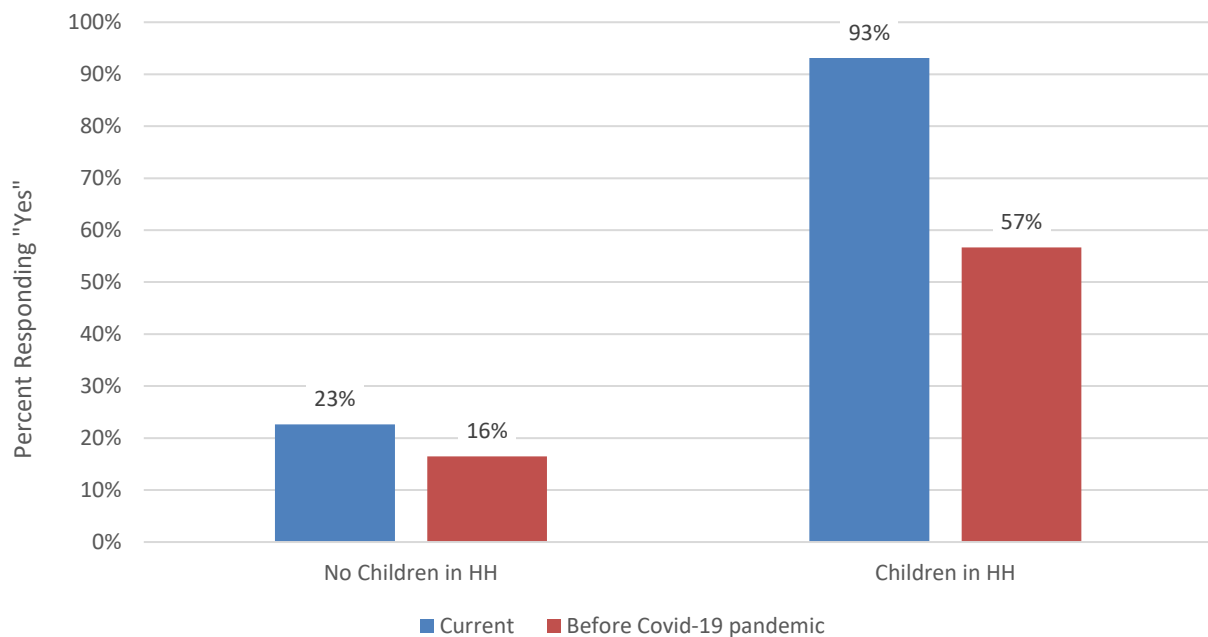
Respondents use the internet across a range of education levels. Among those who use the internet for educational purposes, 24 percent use it for primary education and 23 percent use it for secondary education. Additionally, 27 percent use the internet for post-secondary education, and 28 percent use it for graduate-level education (see Figure 180).

Figure 180: Education Level for Which Internet Connection Is Used
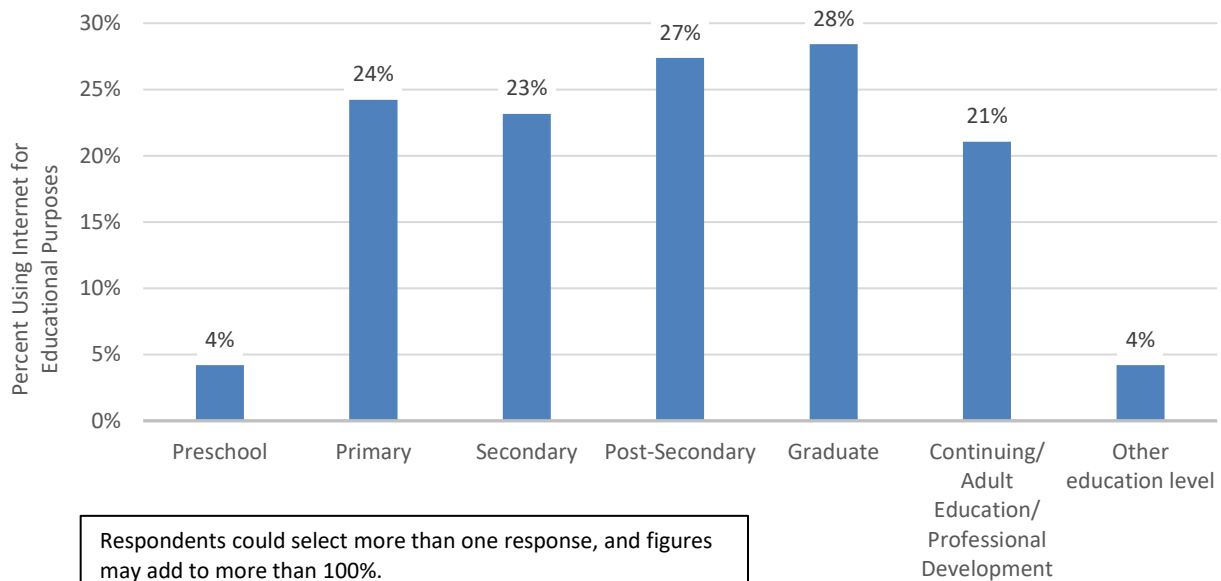
Respondents could select more than one response, and figures may add to more than 100%.

Use of the internet for educational purposes is related to presence of children in the household, as might be expected. Those with children in the home are more likely to use the internet for preschool, primary, and secondary education (see Figure 181).

Figure 181: Education Level for Which Internet Connection Is Used by Children in Household
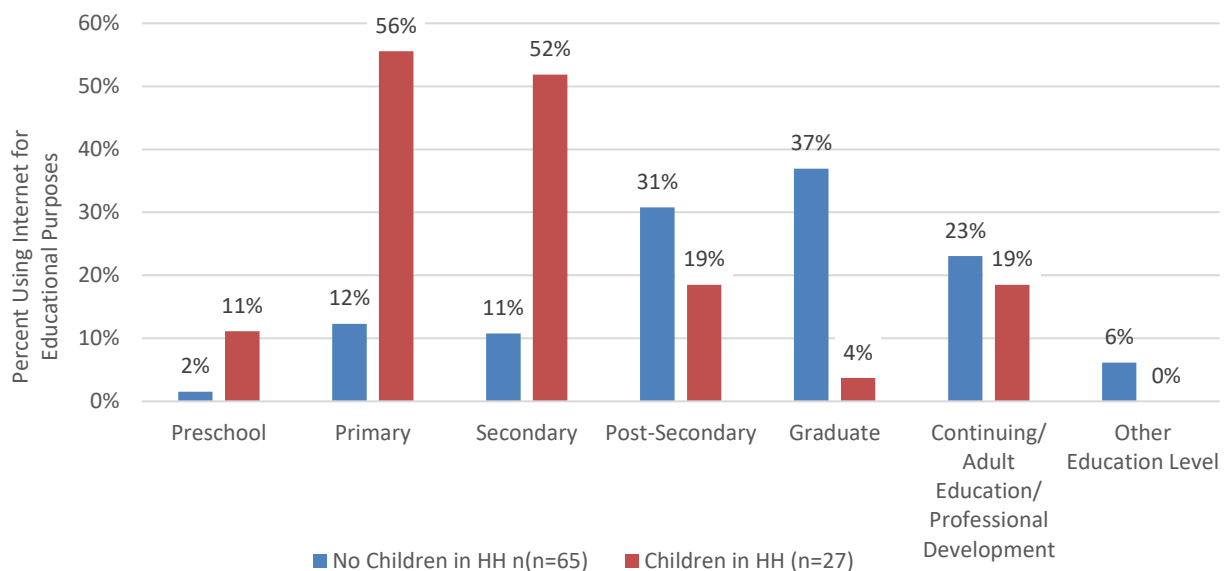
More than one-half of respondents (54 percent) who use the internet for educational purposes said a high-speed internet connection is extremely important for their education needs, and 35 percent said it is very important (see Figure 182).

Figure 182: Importance of High-Speed Internet for Education Needs
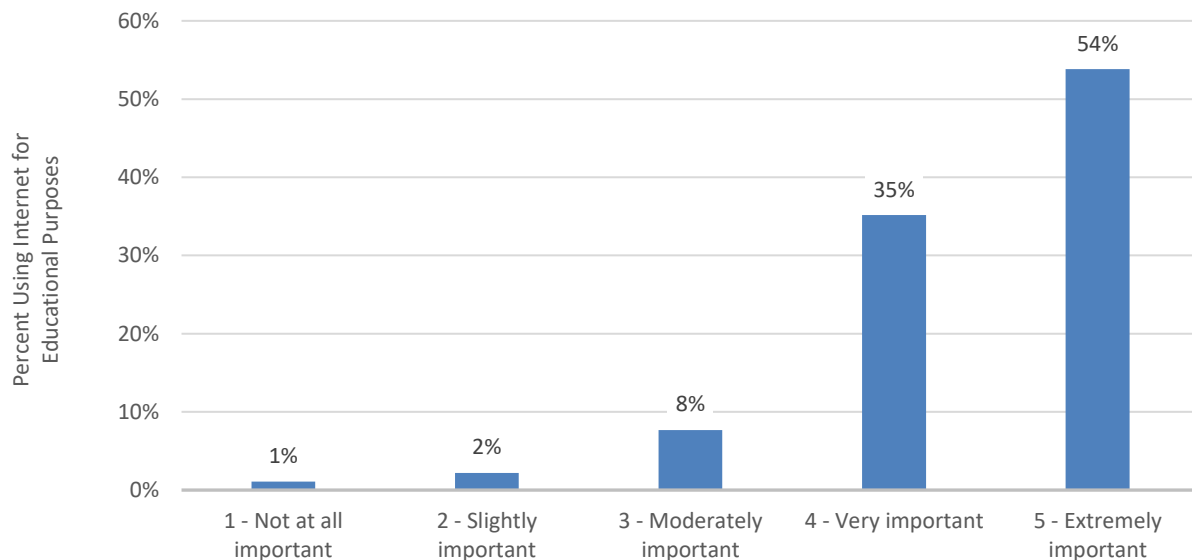
6.3.5 Respondent opinions

Respondents were asked their opinion of the current broadband market. The average agreement with broadband availability statements is shown in Figure 183, while detailed responses are shown in Figure 184.

Overall, respondents moderately agreed with most statements. Agreement was somewhat lower for importance of high-speed internet service for respondents' work/job (43 percent strongly disagree), the market offering high-speed internet at prices they can afford (44 percent strongly disagree) and willingness to pay a premium for access to high-speed internet (48 percent strongly disagree).

Approximately four in 10 respondents agreed or strongly agreed that the availability of high-speed internet is a factor they would consider when choosing where to live or when determining to start a home-based business. Three in 10 respondents strongly agreed that high-speed internet service is important for their family's educational opportunities, but another 36 percent strongly disagreed.

Just 22 percent of respondents agreed or strongly agreed that the market currently provides high-speed internet at prices they can afford, while 57 percent disagreed or strongly disagreed, suggesting a need for affordable broadband internet among a large segment of respondents. Just

16 percent of respondents are willing to pay a premium for access to high-speed internet, while 48 percent strongly disagreed, and 13 percent disagreed.

Figure 183: Opinions About the Broadband Internet Market (Mean Ratings)

Mean Rating: 1= Strongly Disagree and 5=Strongly Agree
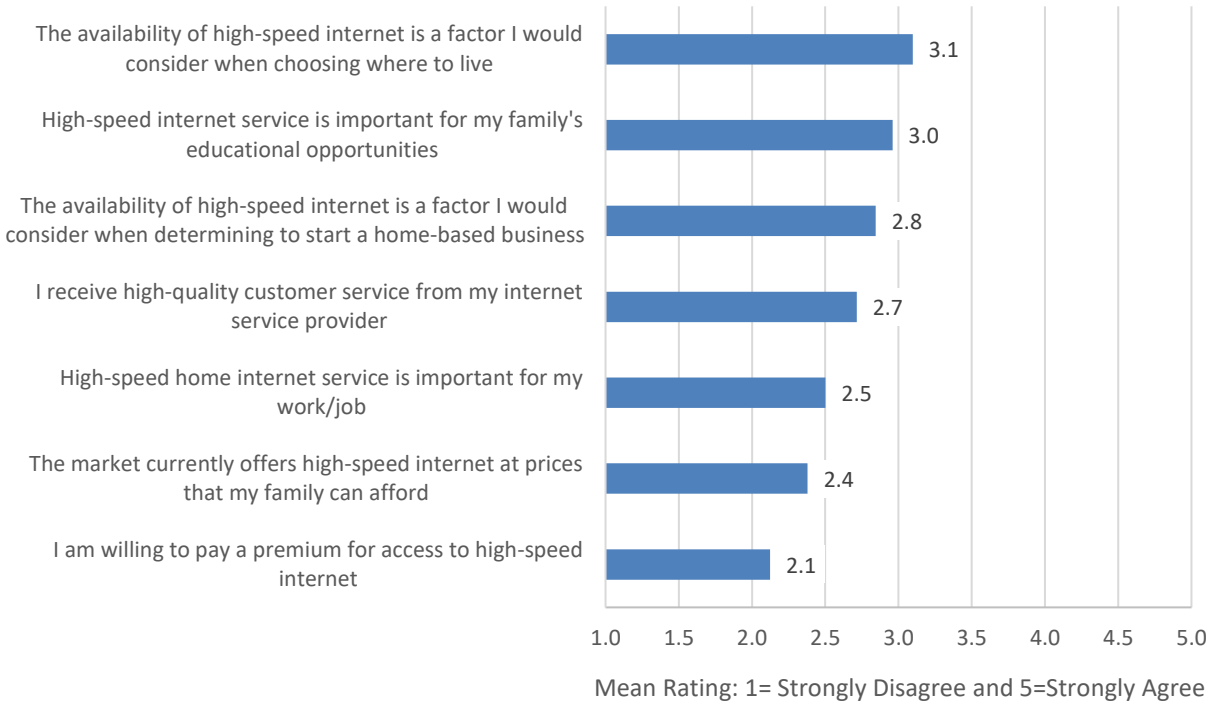
Figure 184: Opinions About the Broadband Internet Market

Statement	1 - Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agree
The availability of high-speed internet is a factor I would consider when choosing where to live	26%	8%	23%	16%	26%
High-speed internet service is important for my family's educational opportunities	36%	5%	16%	13%	30%
The availability of high-speed internet is a factor I would consider when determining to start a home-based…	39%	6%	16%	13%	27%
I receive high-quality customer service from my internet service provider	31%	9%	30%	18%	12%
High-speed home internet service is important for my work/job	43%	12%	18%	8%	20%
The market currently offers high-speed internet at prices that my family can afford	44%	13%	22%	6%	16%
I am willing to pay a premium for access to high-speed internet	48%	13%	22%	10%	6%

Respondents with no internet service or below criteria internet service (i.e., dial-up, cellular/mobile, satellite) placed less importance on high-speed internet for their work/job or for educational opportunities compared with those with higher speed connections, and they were less likely to agree that high-speed internet access is a factor when choosing where to live or when determining to start a home-based business. They were also less likely to agree that they receive high-quality customer service from their ISP, that the market offers affordable high-speed internet service, and that they would be willing to pay a premium for access to high-speed internet (see Figure 185).

Figure 185: Opinions About Broadband Internet by Connectivity

Mean Rating: 1= Strongly Disagree and 5=Strongly Agree

- Non-internet user
- Internet user – below minimum criteria
- Internet user – possible below minimum criteria
- Internet user – above minimum criteria
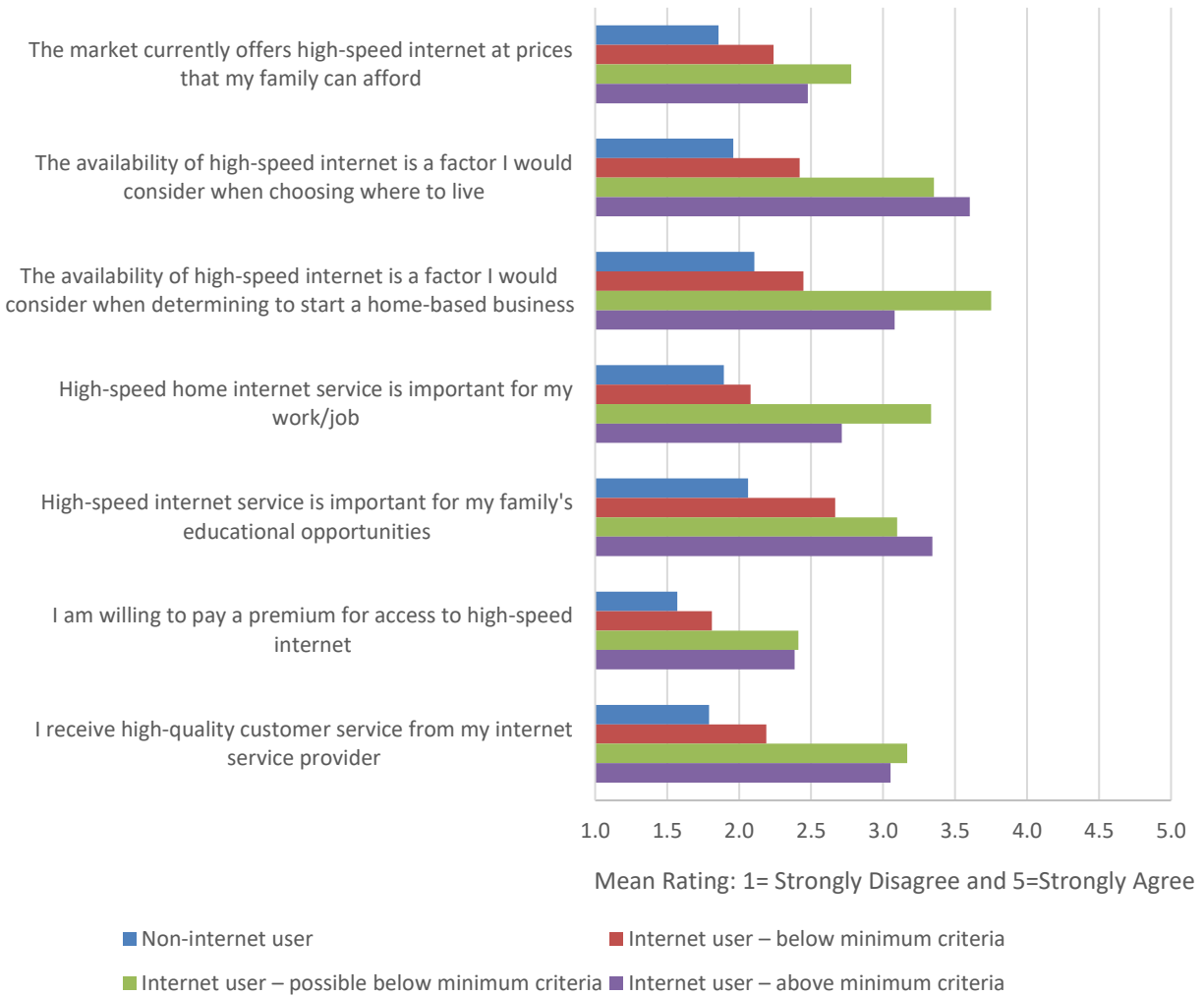
As illustrated in Figure 186, respondents ages 65+ were less likely than younger respondents to agree with statements about broadband access and affordability, with the exception of the market currently offering affordable high-speed internet. Respondents under age 55 were more likely than older respondents to agree that high-speed internet service is important for their family's educational opportunities.

Figure 186: Opinions About Broadband Internet by Respondent Age
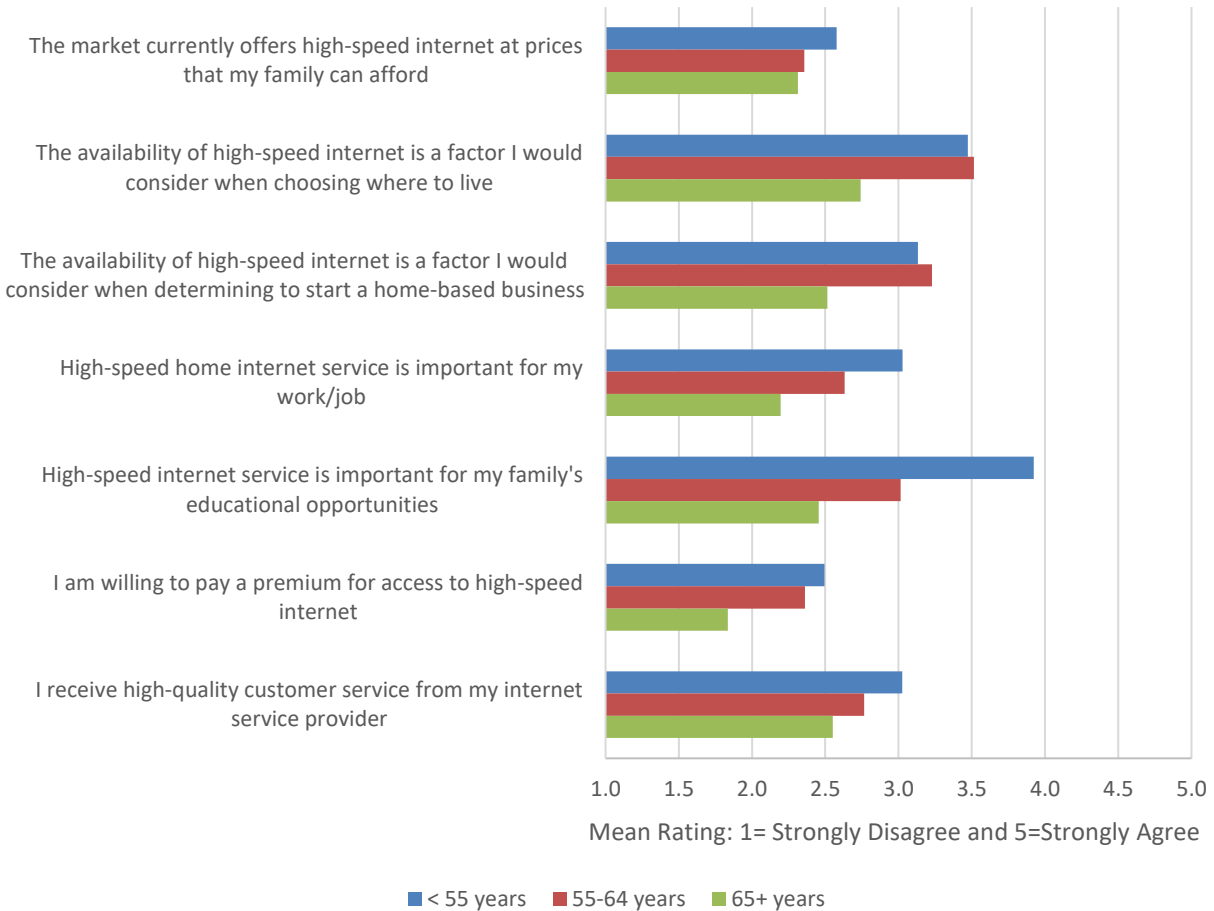
6.3.5.1 Willingness to purchase high-speed internet service

Respondents were asked if they would be willing to purchase extremely fast internet service (defined as 1 Gbps) for various price levels. The mean willingness to purchase across this array of questions is illustrated in Figure 187, while detailed responses are illustrated in Figure 188.

Figure 187: Willingness to Purchase 1 Gbps Internet at Price Levels (Mean Ratings)
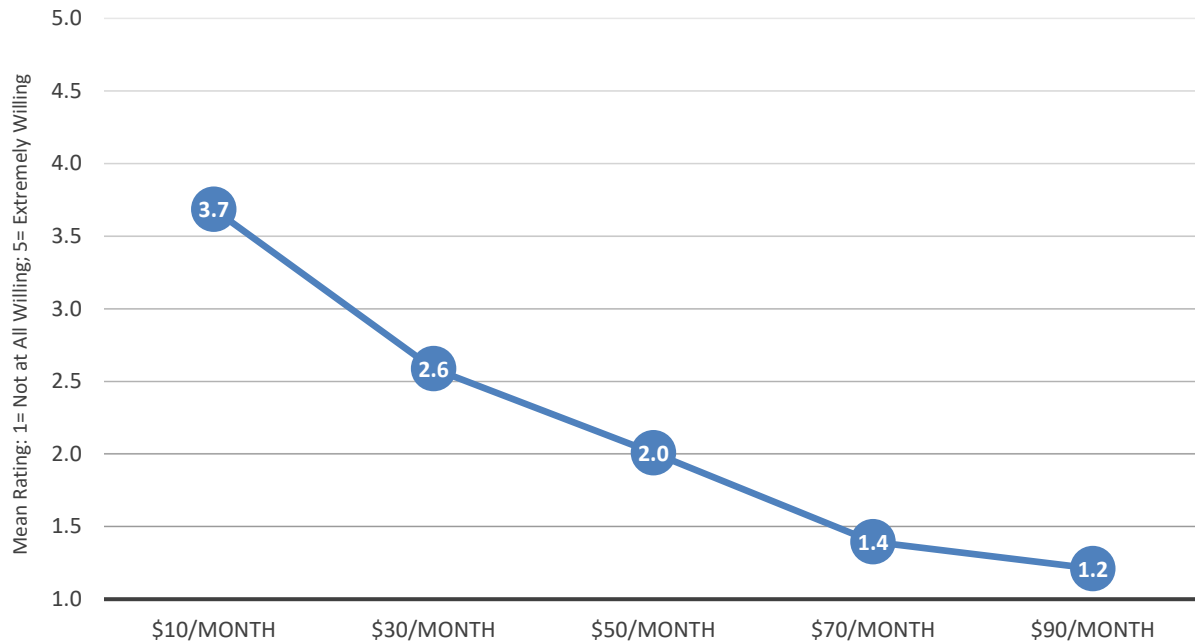
Figure 188: Willingness to Purchase 1 Gbps Internet at Various Price Levels
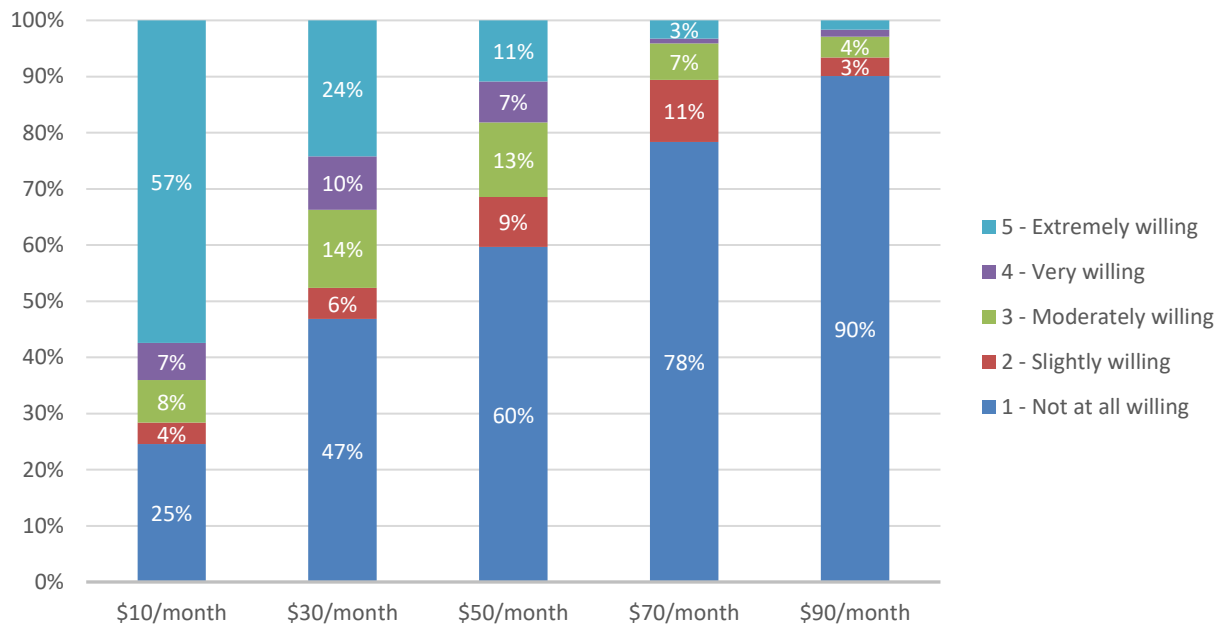
Respondents' willingness to purchase 1 Gbps internet service is moderate at $10 per month (3.7 mean), but it drops considerably as the price increases. The mean rating falls to 2.6 at a price point of $30 per month and 2.0 at a price point of $50 per month (slightly to moderately willing). From another perspective, 57 percent of respondents are extremely willing to purchase 1 Gbps internet for $10 per month, dropping to 24 percent at $30 per month and 11 percent at $50 per month.

As shown in Figure 189, respondents who already have above criteria internet service (cable, fiber) and those with possible below level service (DSL, fixed wireless, other) would be more willing to purchase 1-Gbps internet service, compared with those with no service or below level service.

Figure 189: Willingness to Purchase 1 Gbps Internet Service by Connectivity
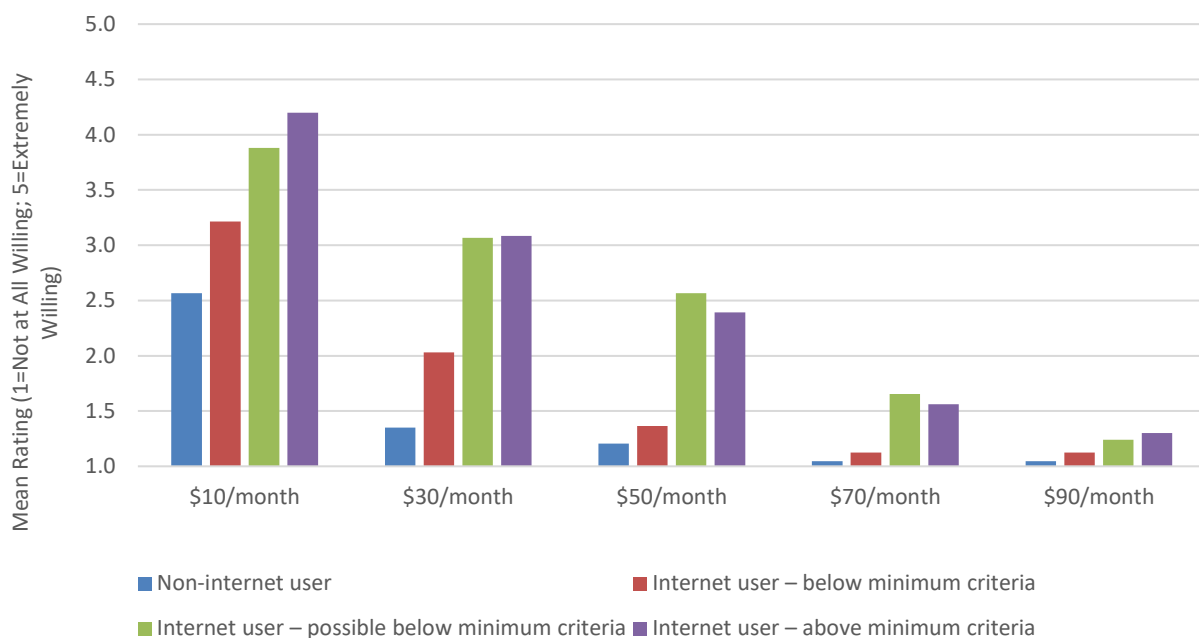
The willingness to purchase high-speed internet service is correlated with respondent age (see Figure 190). Respondents under age 55 would be more willing than older respondents to purchase high-speed internet service at various price points.

Figure 190: Willingness to Purchase 1 Gbps Internet Service by Respondent Age
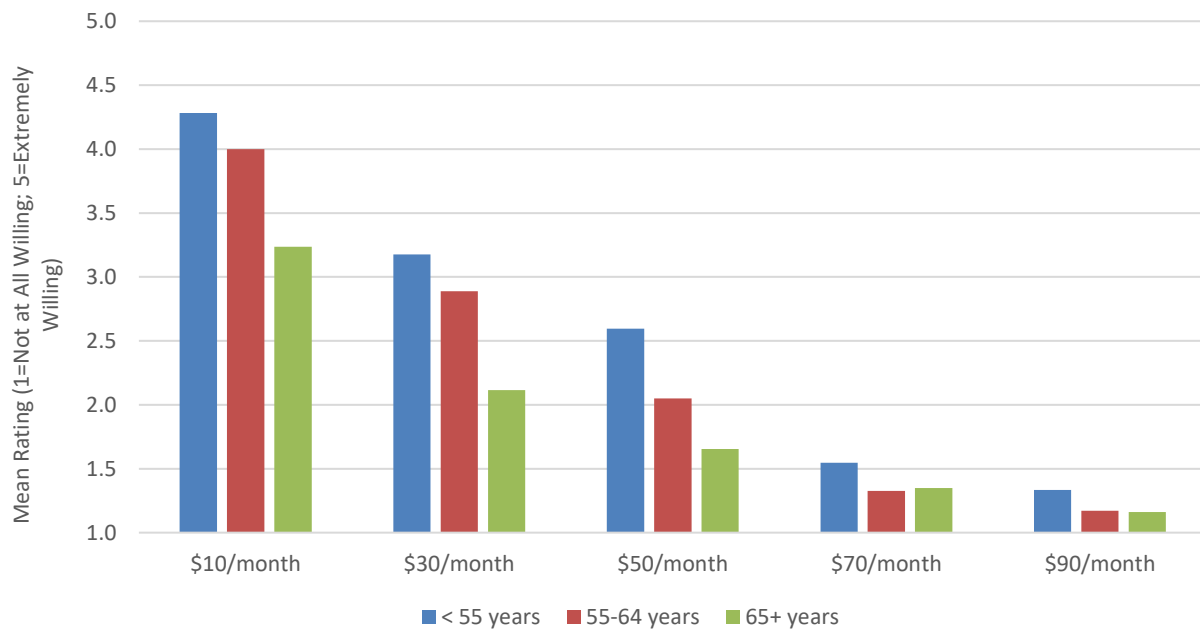
6.3.5.2 *Importance of home internet features*

Respondents were asked to evaluate the importance of various features of home internet. The mean importance ratings are shown in Figure 191, while detailed responses are shown in Figure 192.

Figure 191: Importance of Home Internet Features (Mean Ratings)
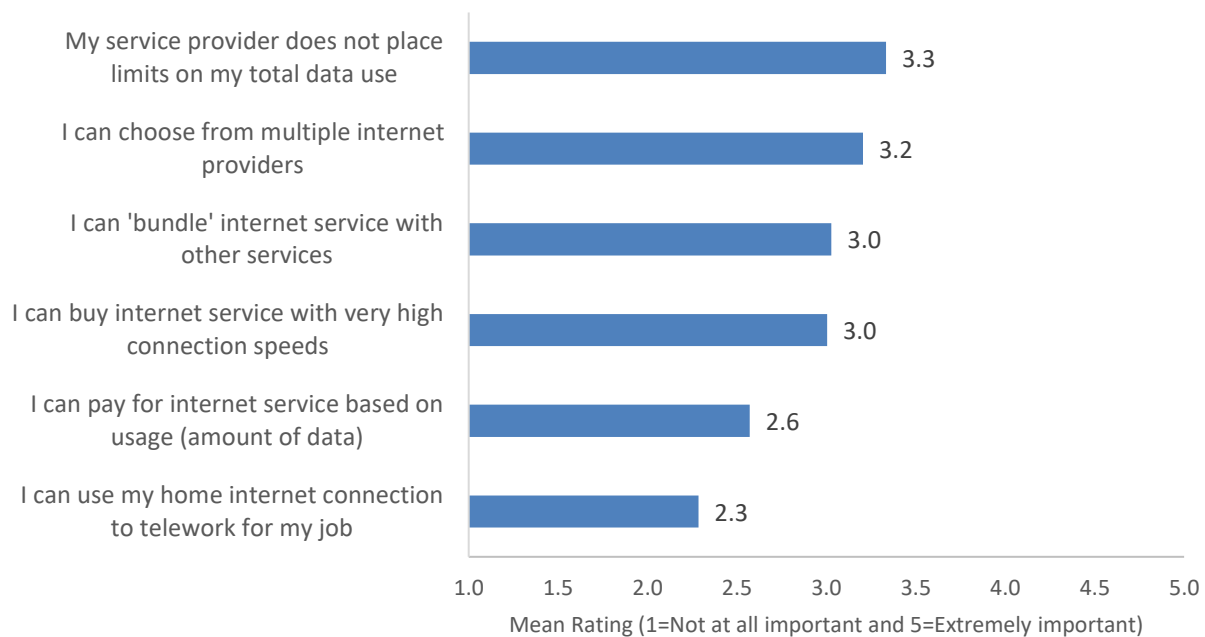
Figure 192: Importance of Home Internet Features
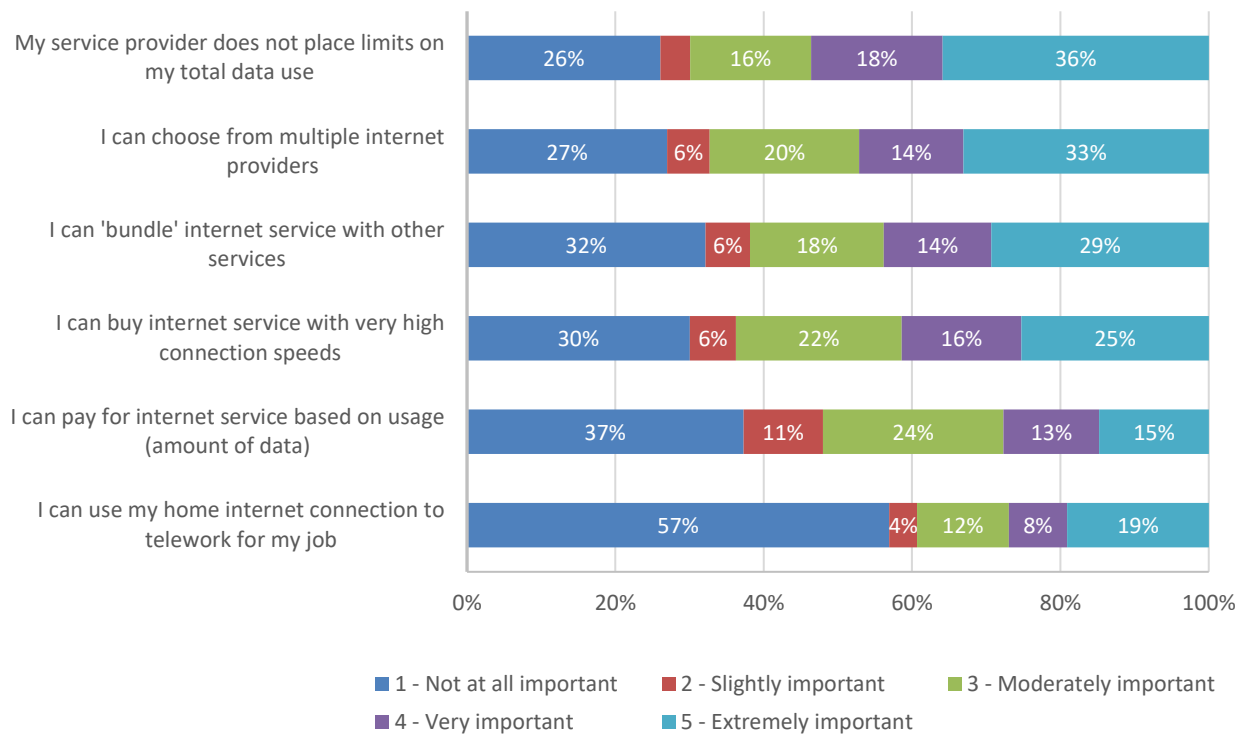
The internet service aspects evaluated are slightly to moderately important to respondents. The most important home internet features among those evaluated is unlimited data use (36 percent extremely important) and ability to choose among multiple providers (33 percent extremely important), followed closely by ability to bundle services (29 percent extremely important) and ability to buy very high-speed internet service (25% extremely important). The ability to pay for service based on usage (37 percent not at all important) and using a home internet connection to telework (57 percent not at all important) are significantly less important aspects.

As shown in Figure 193, non-internet users and those with below criteria connections (dial-up, cellular/mobile, satellite) placed less importance on the different aspects of internet service, compared with those with at or above criteria connections.

Respondents ages 65+ placed less important on various features of home internet service, compared with respondents under age 65 (see Figure 194).

Figure 193: Importance of Home Internet Features by Connectivity

Mean Rating: 1= Not at All Important and 5=Extremely Important

- Non-internet user
- Internet user – below minimum criteria
- Internet user – possible below minimum criteria
- Internet user – above minimum criteria
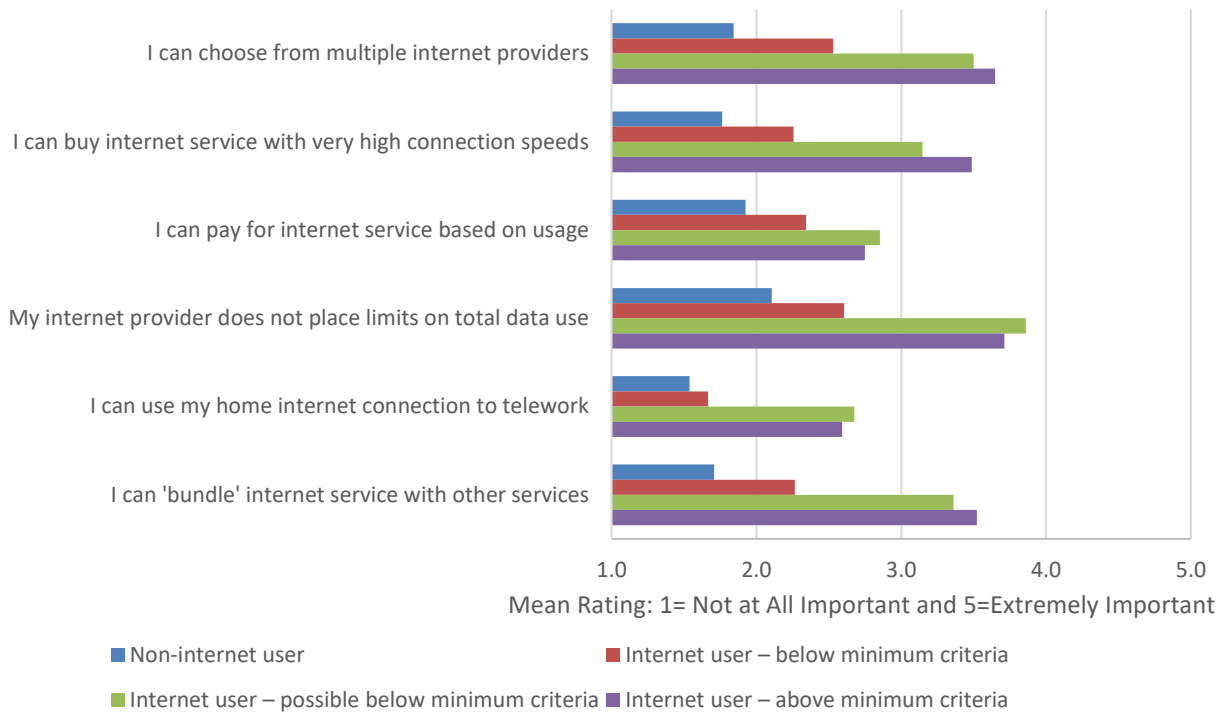
Figure 194: Importance of Home Internet Features by Respondent Age

Mean Rating: 1= Not at All Important and 5=Extremely Important

- < 55 years
- 55-64 years
- 65+ years
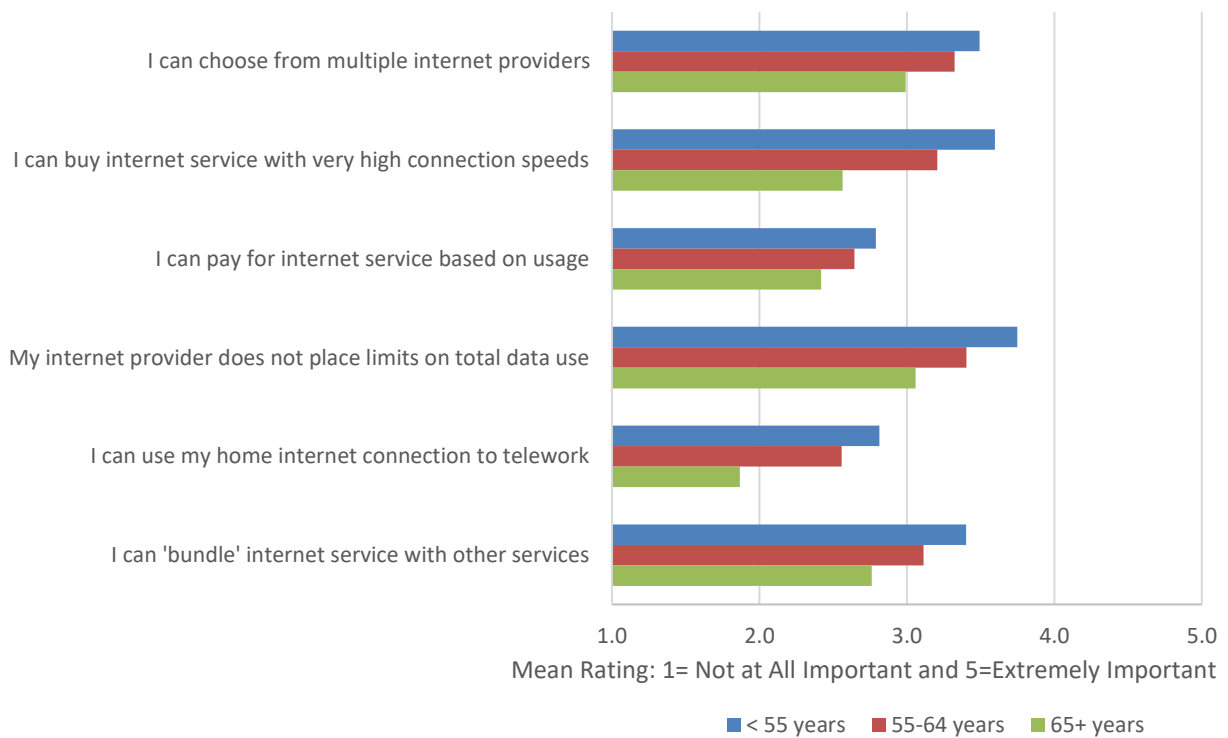
6.3.6   Respondent information

Basic demographic information was gathered from survey respondents and is summarized in this section. Several comparisons of respondent demographic information and other survey questions were provided previously in this report. Table 30 highlights the demographic characteristics of survey respondents, broken out by respondent age.

Respondents under age 55 are more likely than older respondents to have children under age 18 living in the home/have multiple household members, be a racial/ethnic minority, and earn $25,000 or more annually. Conversely, older respondents ages 65+ are more likely than younger respondents to live alone, to earn less than $25,000, and to be white, non-Hispanic.

Table 30: Demographic Profile by Respondent Age

Age Cohort		< 55	55-64	65+	Total
Highest Level of Education	HS education or less	46%	47%	41%	44%
	Two-year college or technical degree	27%	26%	16%	21%
	Four-year college degree or higher	27%	26%	42%	35%
	Total	*82*	*76*	*176*	*335*
Household Income	Less than $25,000	64%	69%	82%	74%
	$25,000 +	36%	31%	18%	26%
	Total	*76*	*70*	*152*	*298*
Race/Ethnicity	White, non-Hispanic	22%	45%	55%	45%
	Black or African American	41%	32%	26%	31%
	Other/more than one ethnicity	38%	22%	19%	25%
	Total	*79*	*77*	*181*	*339*
Gender	Female	67%	63%	60%	62%
	Male	33%	34%	39%	37%
	Other	0%	3%	1%	1%
	Total	*75*	*73*	*175*	*325*
Household Size	One HH member	46%	67%	85%	72%
	Two + HH members	54%	33%	15%	28%
	Total	*80*	*76*	*179*	*337*
Children in Household	No Children in HH	79%	88%	98%	91%
	Children in HH	21%	12%	2%	9%
	Total	*80*	*76*	*179*	*337*
Years in Residence	Less than 5 years	48%	41%	24%	33%
	5 or more years	52%	59%	76%	67%
	Total	*82*	*80*	*184*	*349*

Figure 195 illustrates the age distribution of the respondent. Approximately 23 percent of respondents are under age 55, 23 percent are ages 55 to 64 years, and 54 percent are 65 years and older.

Figure 195: Respondent Age
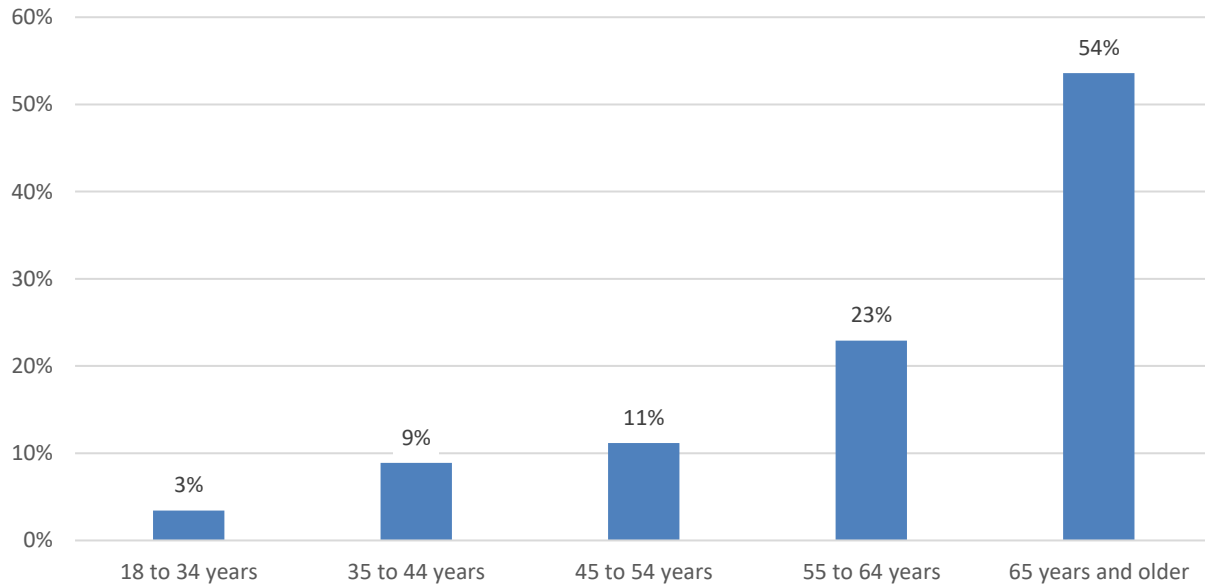
The respondents' highest level of education attained is summarized in Figure 196. Forty-four percent of respondents have a high school education or less, 21 percent have a two-year college or technical degree, and 35 percent have a four-year college or higher level of education.

Figure 196: Education of Respondent
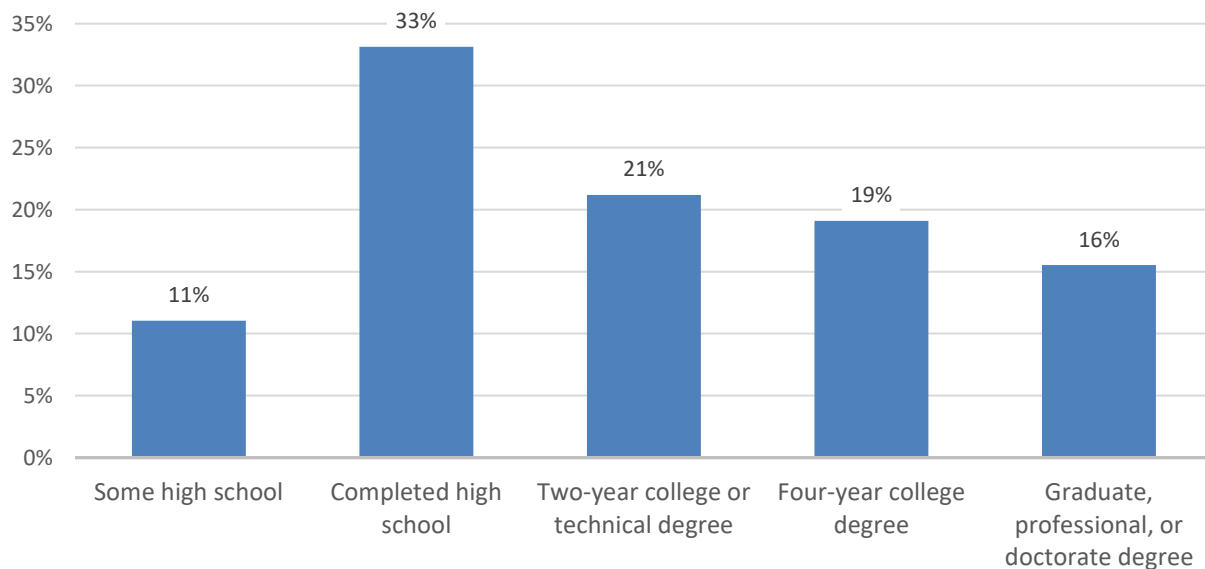
Three-fourths of respondents earn less than $25,000 per year, 20 percent earn $25,000 but less than $50,000, and five percent have a household income of $50,000 but less than $75,000 (see Figure 197).

Figure 197: Annual Household Income
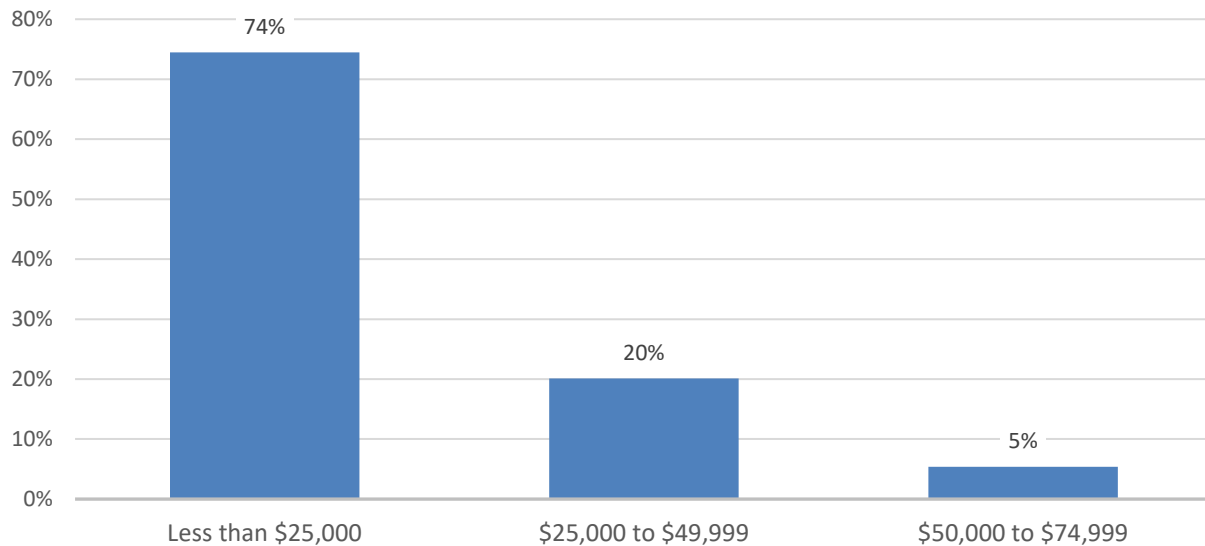
Forty-five percent of respondents are white, non-Hispanic, and 31 percent are black or African American, as illustrated in Figure 198. Another 10 percent are of Hispanic, Latino, or Spanish origin, six percent are Asian or Pacific Islander, and two percent are American Indian or Alaskan Native.

Figure 198: Ethnicity
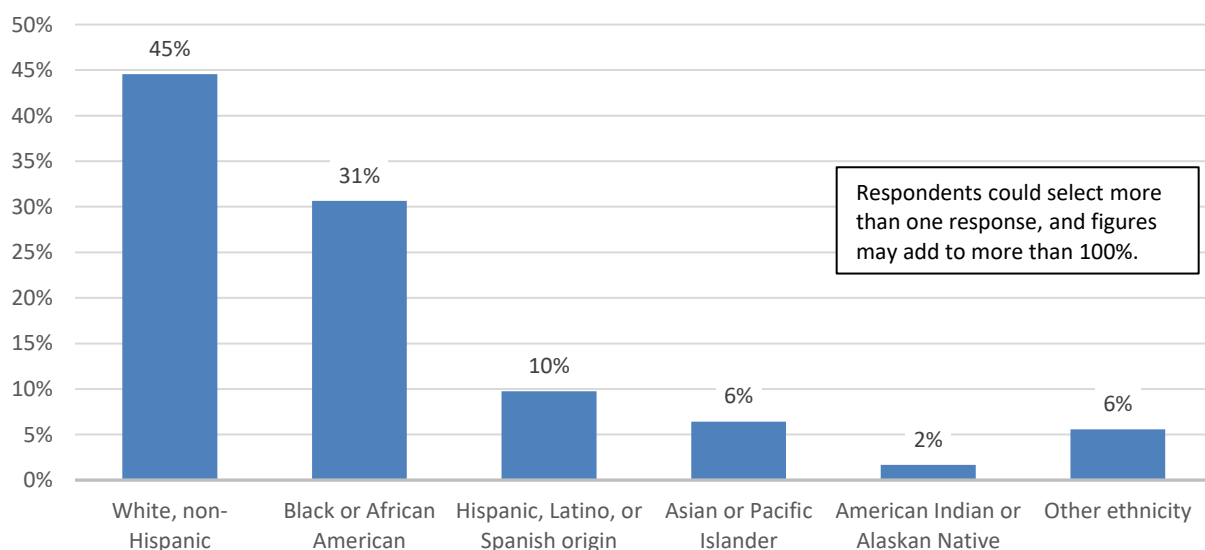
More than six in 10 (62 percent) respondents identify as female, and 37 percent identify as male (see Figure 199).

Figure 199: Gender Identity
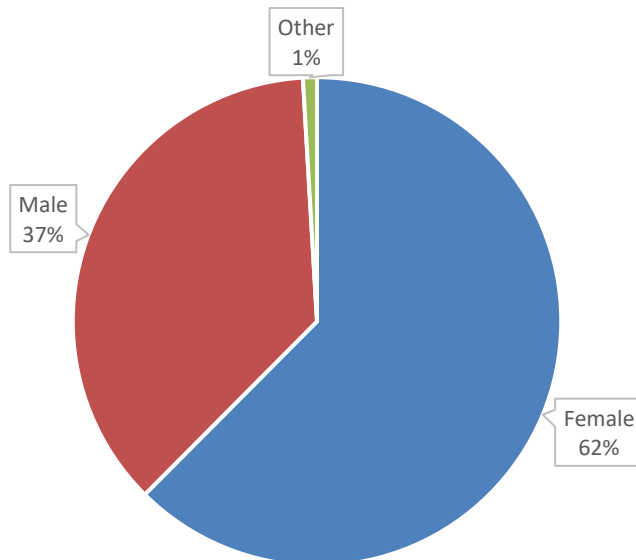
Respondents were asked to indicate the number of adults and children in their household. Most respondents live alone/have just one household member (see Figure 200). One in 10 respondents have children living in the household (see Figure 201).

Figure 200: Total Household Size
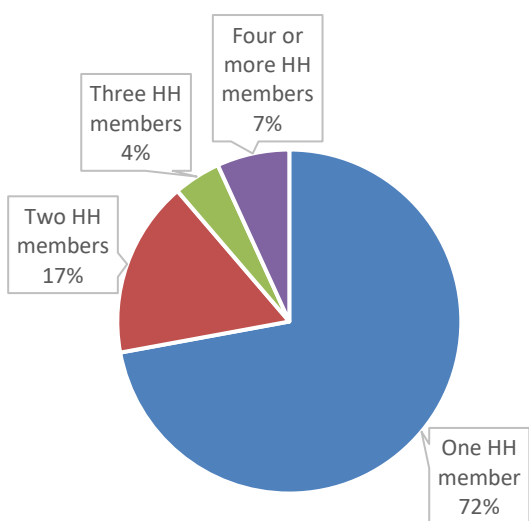
Figure 201: Number of Children in HH
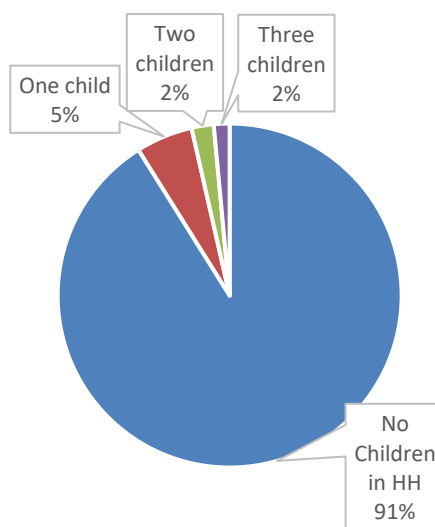
Two-thirds of respondents have lived at their current residence for five or more years, as shown in. Another one-fourth have resided at the home for one to four years, while six percent have lived at the residence for less than one year (see Figure 202).

Figure 202: Number of Years Lived at Current Residence

Less than 1 year
6%

1 to 2 years
12%

3 to 4 years
15%

5 or more years
67%
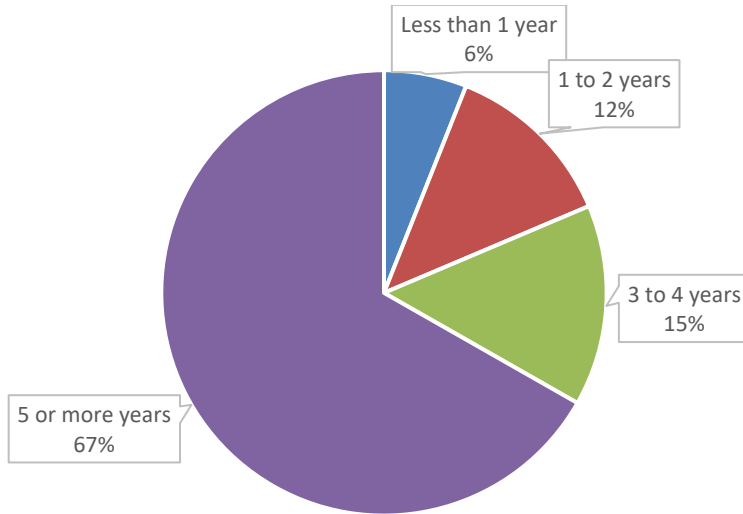
7 Results of Hourly Speed Tests at Homes of Comcast Customers

Over a period of four weeks in late September and October 2020, CTC conducted speed tests in 13 Cambridge residences—all served by Comcast. The homes were all of City employees who responded to an email request from a colleague Lee Gianetti seeking volunteers. We issued each resident a piece of custom-built hardware and instructions to plug the device directly into the user's router by means of an ethernet cable, thereby bypassing issues or limitations that might be caused by a customer's home Wi-Fi network. The device then automatically conducted hourly tests of upload speed, download speed, and latency—that is, the time it took for data to make a round trip from the home to speed test websites (called Ookla and M-Lab). Our goal was to see if we could gain insights into the potential cause of reported user problems or identify evidence of systemic network performance issues. This section provides observations from a representative portion of these tests.

7.1 Background and rationale for performing in-home tests

Understanding the root causes of internet service problems is important to determining what interventions a City or other entity might consider—such as working with an ISP to facilitate network improvements, educating residents about fixing in-home problems, or trying to attract a new provider—to close access gaps or inequities that are the result of poor performance.

When residents experience slow internet connections or interruptions, they often assume the ISP is to blame. Indeed, oversubscription on a given part of a network, or heavy simultaneous demand, such as for high-definition movies, can cause slowdowns to occur. And an ISP's local network equipment can break down.

But there are also many potential sources of problems inside the residence: Wi-Fi interference, malware on a computer, poorly configured or outdated routers, and multiple users sharing bandwidth.[50] And there are also potential sources of problems beyond the City's boundaries; the internet, after all, is an interconnected network of networks. Clicking on link on your laptop sends pieces of data called "packets" through numerous network hops to the server (or computer) hosting the website. Issues on any of these hops, or heavy demand at the website, can increase a phenomenon called "latency," or delays in the round-trip travel time of the packets.

Given these fundamental aspects of internet engineering, Comcast—like other ISPs providing residential service—provides "up to" a specific level of data speeds the customer subscribes to. Speeds vary and the company does not guarantee them. Customers wanting guarantees—typically commercial customers for whom even a short network outage can be costly—can seek

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[50] Comcast provides minimum system recommendations for each speed tier it offers; these can be found at https://www.xfinity.com/support/internet/requirements-to-run-xfinity-internet-service/

something called a "service level agreement" promising specific performance levels and, if outages occur, response times.

7.2   Observations from three representative examples

Our testing methodology was necessarily subject to the vagaries of in-home demand (such as the shifting numbers of users on the network), differences in and age of routers used by customers, and the performance of the speed test websites. And after the testing was completed, we noted that some users connected devices into mesh networks, while others delayed installing or removed them early. And our testing device was not capable of measuring speeds higher than about 700 Mbps, making it impossible for us to measure the full performance of the one volunteer who had 1,000 Mbps (1 Gigabit) service.

In reporting on our findings, we determined it would be most useful to describe three tests which we believe illustrate at an anecdotal, but representative, level what we found at all 13 residences.

7.2.1   A May Street resident's complaint not reflected in speed test

CTC issued one device to a family on May Street. The resident reported terrible service, with emails taking a long time to send or receive, and the "circle of death"—the spinning wheel icon indicating videos and other content was not loading. The problems were so bad that the resident—assuming the problem was caused by Comcast—later ordered an upgrade in service from the 200 Mbps download, 5 Mbps upload package to a 300 Mbps download, 10 Mbps Comcast, at another $20 per month.

However, we found nothing in the speed test that indicated a problem on the Comcast network. Indeed, the upload speed was always between 5 Mbps and 6 Mbps, and the download speed ranged from above 200 Mbps to 50 Mbps, but never falling below 50 Mbps—which is more than adequate for everyday use and would not explain slow-loading email. Latency, or the measure of travel time between the home and the speed test, did not reveal anything telling. CTC informed the user of our findings and provided a list of potential items to troubleshoot, suggesting they save $240 year by reverting to the previous service level. Figure 203 shows the results, plotted hourly.

Figure 203: Results of Hourly Speed Tests at a May Street Residence
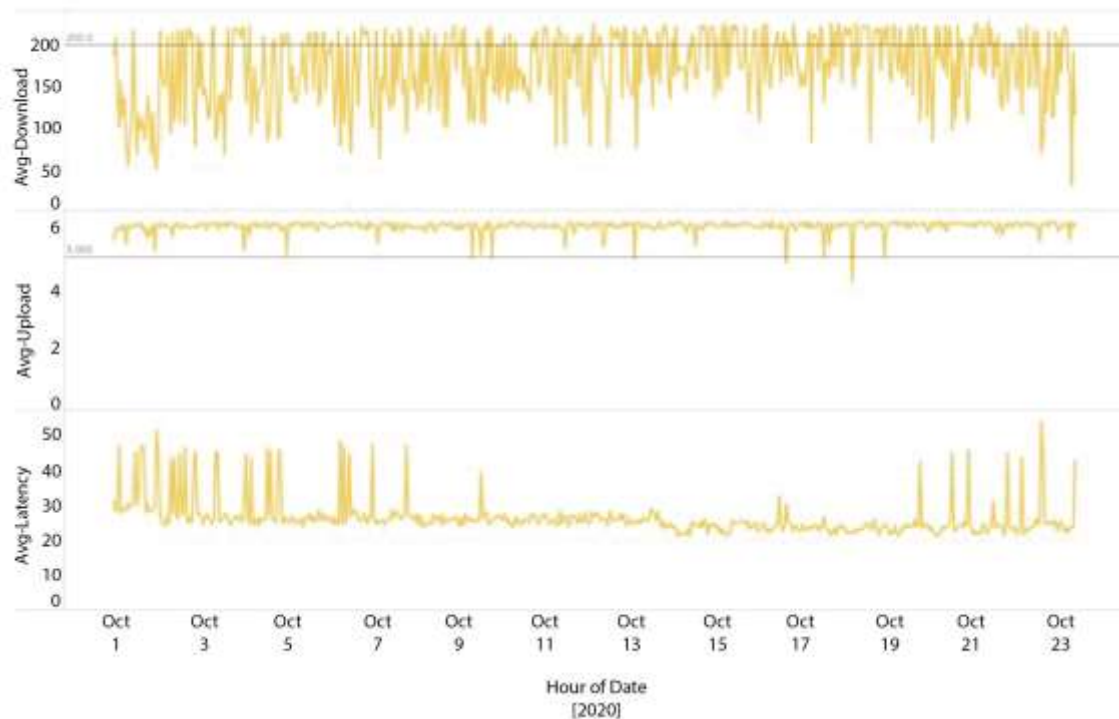
7.2.2   Bristol Street customer device limitations: speeds one-third the level expected

A Bristol Street resident who subscribes to the 300 Mbps download, 10 Mbps upload plan did not complain of any major problems – just that when more than one person used Wi-Fi, the service seemed to slow down. What we found most interesting in this volunteer's test was that while the upload speeds were almost always just above the 10 Mbps level, as advertised, the download speed was tested to be far lower than expected on a consistent basis. Whereas the couple was paying for "up to 300 Mbps" service, the download speeds never got beyond 100 Mbps—not even once.

At first glance it appeared that Comcast was not delivering. But in fact, the signature of this speed test suggested that something in the home was keeping speeds down. Upon further investigation with the customer, we determined the make and model of the router and determined that the ports are the limiting factor, because they are able to support only 100 Mbps connections. It is also likely the outdated router was the cause of the Wi-Fi slowdowns the customer was experiencing. We followed up to advise the customers that if they wished to make full use of the available speed, they should upgrade the router (which they, not Comcast, had supplied)—or that, conversely, they could save some money by downgrading their plan to 100 Mbps. Figure 204 shows the speed test results at this residence.

Figure 204: Test Results Lead to a Diagnosis of an Outdated Router Limiting Available Speeds
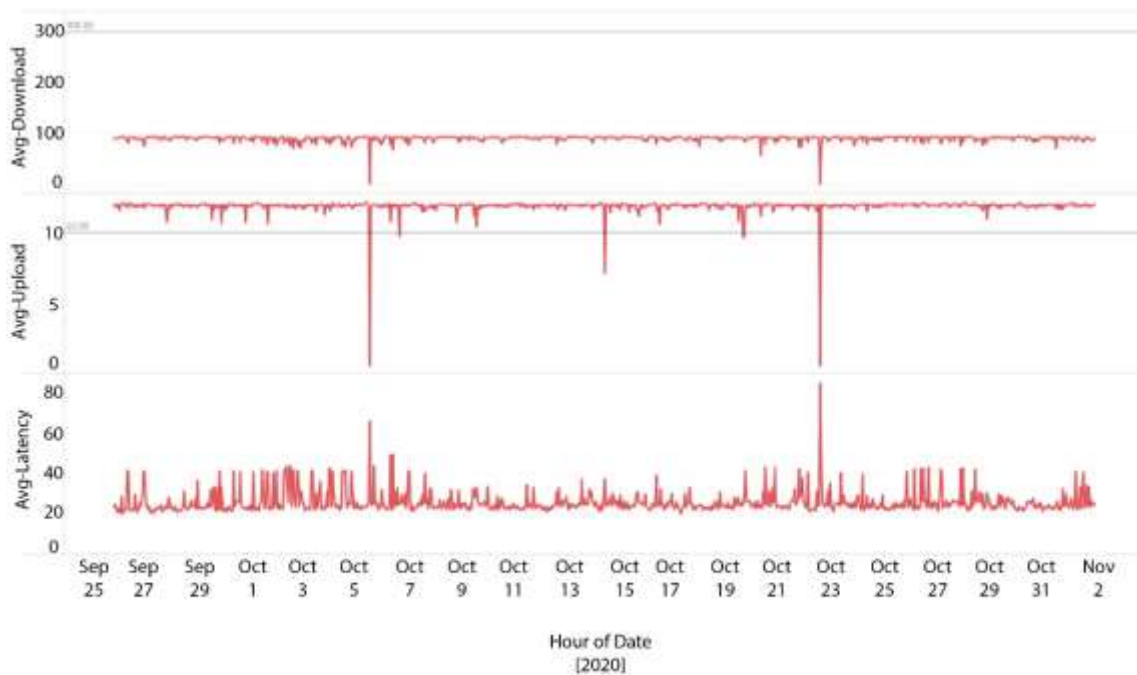
7.2.3 A 10-hour slowdown could be caused by Comcast or a problem in the home

A Dana Street resident who volunteered for our tests reported that her speeds were consistently lower than advertised (she was referring to numbers she produced on her own tests, not slowness she experienced as a user). But she did not report any more specific service problems. She was subscribing to 200 Mbps download, 5 Mbps upload service. As with the first user, we noted that her speeds were consistently between 200 Mbps and 50 Mbps, with spikes potentially related to demand on other parts of the network—but not dropping to levels that might result in perceived slowdowns. Upload stayed steady at between 5 Mbps and 6 Mbps.

The numbers we saw would likely not have caused any perceived performance problems. We did, however, find a 10-hour overnight gap on September 28 that appears to reflect a brief network outage that may have been caused by Comcast. Potential causes could have been a port that failed, affecting part of a neighborhood. We did not note any similar issue at other residences, so if there was indeed a Comcast outage, it was localized. And it is possible that a transient problem in her modem, and not Comcast, was the cause. Figure 205 shows her data, presented not as absolute numbers but as a percentage of her advertised download and upload speeds.

Figure 205: Overnight Network Outage Apparent at One Residence
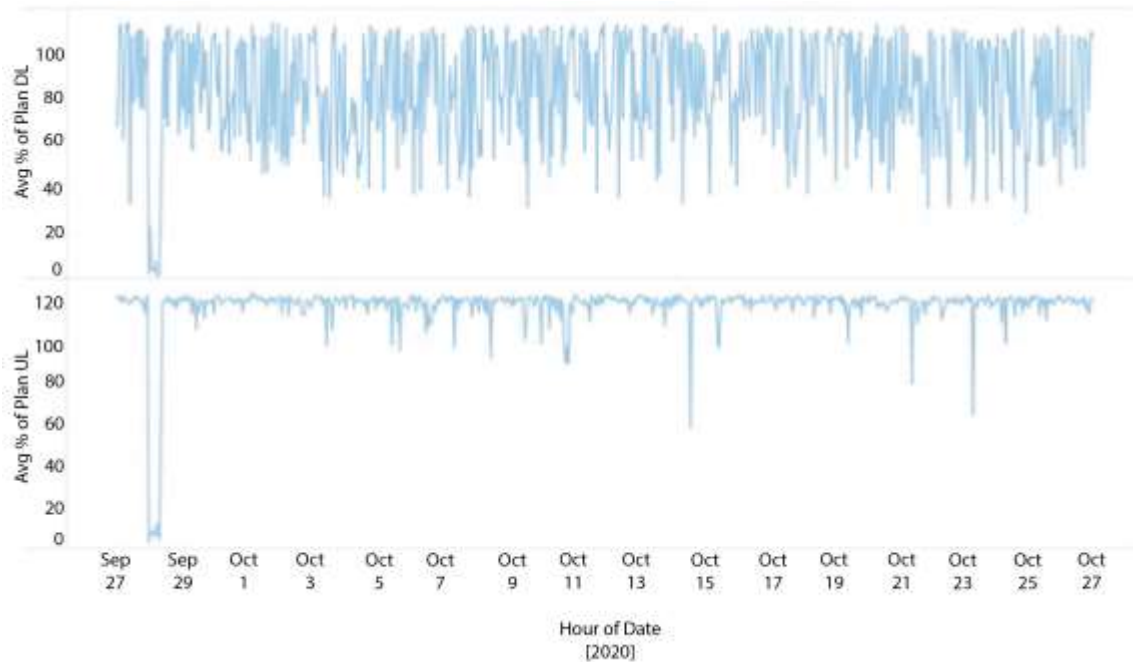
7.3 Speed test data point to a need for greater user education

It would take a more comprehensive study than the one we were able to undertake to reach wider conclusions. With that said, in the homes we examined, we generally inferred that problems in the home, rather than on the Comcast network, were most likely to blame for user-reported problems or for slower-than-expected speed tests. We also note that confusion over root causes sometimes leads consumers to pay Comcast more money for "faster" service that was not needed and does not address the core problems.

Comcast comes in for its share of criticism—slow customer service, byzantine pricing, and obstacles to obtaining the low-cost Internet Essentials program—but it would be a mistake to automatically blame the company for performance issues experienced in the home. Even these limited tests show the value of launching or expanding user-education campaigns to ameliorate common problems in customer homes and thus address common broadband access problems in Cambridge.[51]

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[51] More information on Comcast network management, sources of performance problems, and methods for checking and updating the router in your home can be found here: https://www.xfinity.com/networkmanagement

8 Report on Resident Interviews

CTC also engaged in telephone interviews with certain Cambridge Housing Authority or subsidized housing residents, as a way to gain anecdotal more insights from lower-income or older Cambridge residents. A primary goal of this task to find out what their Comcast or other monthly bill consisted of and to provide any additional insights about individual experiences and problems.

Our methodology was as follows: At the end of our CHA survey, we included a question asking if the respondent would be willing to be interviewed. Of the respondents, 78 did indicate such willingness. In November we called all 78 of these individuals. While we did not have the capacity to make repeated callbacks—and not all residents proved willing to have a conversation when we did reach them—we did connect with and interview 15 residents, of whom seven later agreed to have their experiences published in this report. Because not all of the residents agreed to use their names, we have not published any identifying information. These interviews thus provide anecdotal data from a self-selected group that was further narrowed by our ability to reach them and their willingness to discuss their experiences.

In terms of their monthly bills, some had no service, some were paying $10 under Internet Essentials, and some were paying as much as $264 a month to Comcast. Others were struggling to pay for a $54 basic 25Mbps plan. Many of the comments the residents made at the end of the survey involved a desire to obtain better computers or skills, as opposed to more bandwidth.

Figure 206 summarizes a sample of interviewees' reports about broadband pricing, their market decision, and any problems they have about their service.

Figure 206: Monthly Broadband or Bundle Bills Paid by Interviewed Residents

Interviewee	Address	Provider	Monthly Internet or Bundle Bill	Market Comments	Service Comments
Household of two adults and two children (10, 2)	Oxford Street (Section 8 apartment)	Comcast	$10 (Internet Essentials)	Learned about Internet Essentials from school newsletter	Service works well. Would like better, but not if it costs more than $10.
Household of man in 60s	1221 Cambridge Street (CHA high-rise)	Comcast	$10 (Internet Essentials)	Learned about Internet Essentials from CHA	Would rather use public computers at the library. Service works well; occasional Zoom glitches
Household of parent and child in college	Auburn Park Section 8 apartment	Comcast	$54 for basic 25 Mbps service	Struggles to pay $54 bill. Had not heard of Internet Essentials	Satisfied but loses internet connection "every now and then"
Household with two adults	Roosevelt Mid-Rise Towers, (CHA development)	Comcast	$264 for triple play	Unaware until the interview that NetBlazr recently began serving the building	Poor Comcast customer service and high prices, but wants certain shows
Household with two adults	1221 Cambridge Street (CHA high-rise)	Comcast	$147 for internet and TV	Heard Internet Essentials was slow so has not tried to get it	Internet fine; uses 15-year-old laptop and sometimes has problems
Household with two adults	364 Rindge Avenue high-rise, section 8 unit (Rindge Towers)	Starry	$15 (Starry Connect program for low-income customers)	Starry recently began serving the building; disliked Comcast prices/ service	Good service, free router, good service with frequent medical Zoom appointments

9   Full Stakeholder Interview Narratives

The following are full first-person narratives developed from our interviews with select Cambridge stakeholders representing a variety of public and nonprofit stakeholders. These narratives were very briefly excerpted above; these are the full writeups developed in collaboration with, and approved by, each individual.

9.1   Julie Craven, head of school, Rindge Avenue Upper School

As the principal of one of Cambridge's middle schools, I was fortunate to be part of a very intentional and effective effort by the Cambridge Public School Department to ensure all students had access to a Chromebook and a hotspot within the first few weeks of the Covid-19 closure. We were also fortunate that every upper school educator had a district-issued computer; we need to make sure that clerks have them too. Covid-19 revealed that the broadband and computer access gaps were deeper than we had understood. But there was also a silver lining in that it forced us to educate in new ways, ones we should build upon.

Taking the first part—for many years, teachers have used Google Classroom as a central tech tool in the classroom. The kids are working on shared documents, typing up projects, and accessing assignments online. What we have known for a while is that if you do not have a laptop, you are working to try and do all those classroom activities on borrowed laptops. The kids who do not have Wi-Fi have to do it at the library at the hours the library is open—or find Wi-Fi elsewhere. While we have had one computer for each student at the middle school level for a few years, but these are computers that remain at school. In contrast, all high school students are issued Chromebooks to take home for their years in high school. At the middle school level, our historic practice was to survey students and their families to determine what they have at home. The Covid closure made us realize the information gathered from these surveys was insufficient. I can think of one family in particular, an immigrant family with an elementary school student, middle school student, and high school student. They had told us "we are fine, we don't need a laptop, we have Wi-Fi." But it turned out, a couple of weeks into the closure, that the whole family was actually using just one laptop issued to the high school student and using a parent's smartphone as a Wi-Fi hotspot. After we learned this, we issued laptops for the two younger kids and a hotspot for the family. There are probably a number of families who have said "we have technology at home" who might have a situation like that.

I think every principal would say that we want to make sure all school students have their own laptop—certainly from 4th grade on up (the elementary principals can speak better to the appropriate device for younger students) and that all families have access to high quality Wi-Fi throughout their educational careers. Kids not all having access to their own laptop and Wi-Fi is an impediment. It is the digital divide, and we absolutely see this play out in the classroom, with some students left unable to access opportunities at home or trying to do assignments on

smartphones which becomes a frustrating and limiting endeavor. Providing equitable access to devices and Wi-Fi to middle school students was a new effort prompted by Covid, and we do not want to lose that. This needs to be a non-negotiable, that every student has access to a laptop and high-quality Wi-Fi to keep the digital divide erased. That is a lot more radical than it sounds.

On the second part, Covid upended the traditional way of education. It actually helped us see things more clearly. It pushed us to think about school in a new way, with a "flipped classroom" perspective where the basic instruction is delivered online asynchronously, and the classroom or synchronous face to face time is used for projects, collaboration and activities intentionally structured to surface and address misconceptions and allow students to co-construct understandings. This idea of a teacher sitting in a class offering direct instruction to the entire class is an antiquated model. Kids should be accessing the instruction online at their own pace, with many options for choice and pathways based on proficiency; then, in the classroom, the teacher/expert is coaching them through things, helping them grapple with the information, engaging in Socratic circles, working in science labs. Resources like Khan Academy have a great deal of rich content as well as paths to explore the content Kids can get control over that, instead of it all being on the teacher. We asked kids to talk about what the experience of distance learning was like for them, and they said: "I learned to be independent. I used to just go to a teacher when I had a problem. Now I have to solve the problems for myself. And that feels good." Clearly, we want to leverage the best of both worlds—online and classroom—to do this, we need universal device and Wi-Fi access for all students, certainly no later than 4th grade.

The final point I want to make has to do with the tech education and support families need. At the upper school levels, we have very strong curriculum designed to support students in being safe and responsible digital citizens. However, we have seen over and over that, by middle school, habits or even tech addictions are already formed; we are closing the door after the horse is already out of the barn. Schools cannot do this alone. Cambridge needs to help families think through the rules they want to set around internet access and tech usage well before they are ready to give smart phones and laptops to their children—I am thinking caregiver education certainly by second grade. Families of course will make decisions that work best for themselves, but we need to help them see the potential future impact. It is hard to imagine what it is like to grapple with a middle schooler who wants to argue with you about everything when you only have small children in front of you, but if you wait to set limits until you see there is a problem, then it is too late.

9.2 Reinhard Engels, manager of innovation and technology, Cambridge Public Library

The Cambridge Public Library provides free public access to Wi-Fi, desktop and laptop computers, and printing. It is a fundamental part of what we do. During the COVID-19 closure, working with

our partners in the City's Department of Human Services programs, we delivered some of these services remotely by loaning out more than 130 computers and hotspots *(see full list below)*. Dozens more devices went out to staff so they could work remotely. Even as we plan to make more Chromebooks and hotspots available to the general public, we expect that we may need to increase our capacity significantly.

We also offer both free in-person technology classes led by volunteers and staff, as well as online courses through services such as Lynda.com. Sometimes we get more than 20 students, sometimes two. Our partnership with Tech Goes Home, where students who complete an entire multi-session course can take home a heavily subsidized or free Chromebook, has been particularly successful. In addition to computer basics, we also offer more advanced workshops and courses around digital fabrication and multimedia. We were up to three bi-weekly classes with ten and 14 kids each before the closure. During the closure, some of the classes were relatively easy to deliver (pre-recorded online classes work just as well), and others still function but not to the same degree (students meeting through Zoom). But anything online is challenging for community members with limited technical skills (and access) who need our help most.

We are contending with a pervasive and growing issue involving usability. People are baffled, increasingly, by software. Computers have always been confusing to many people. But with the move to the cloud—which has been great for the young and tech-savvy—many older and less technically sophisticated people seem to have fallen even farther behind. The sheer complexity of authentication and account management is a roadblock for many older residents. Imagine an elderly Parkinson's patient looking at a six-picture security prompt and trying to figure out which of the six contain crosswalks. We deal with this kind of thing every day. You take it up a level to financial transactions—it gets into this impossible Kafkaesque realm. And older people—and homeless people—often do not have multiple devices for multi-factor authentication. This problem is hard to quantify, but it is large and sort of terrifying.

Besides the conceptual leap to the cloud, which many people (especially older patrons) struggle with, it is also structurally harder for libraries to provide access to many of these cloud services. Services are increasingly bound up with individual user accounts rather than computers, and this makes it much harder for us to provide them to our patrons. People used to do word processing and multimedia editing all on their local computer. It was straightforward for a library to provide and configure such a computer. But now, with everything moving into the cloud, it is challenging. They increasingly need individual accounts. Sometimes they are free accounts but require information like phone numbers which patrons may not have. Sometimes the services are not free, and the library has no good mechanism to pay for them.

Cloud service providers should be urged to do more to make their products accessible to vulnerable populations, to make sure it is possible to run their products in an environment where

a single library license can (by whatever mechanism) be shared by many users without compromising privacy. They should be urged to make sure their "freemium" tier services do not require phone numbers, physical addresses, credit cards, or other hurdles that might prevent (say) the homeless from taking advantage of them. We have made some progress on this working with Google, but it is limited to accounts created from our Library IP addresses.

Free public wireless access must be increased. Now it is available at our libraries and some other City buildings. There are many other areas that it would make sense to expand to. For example, the community rooms in Cambridge Housing Authority buildings currently have free Wi-Fi, but it typically does not extend beyond these rooms. Wiring the entire buildings would be an important step towards getting all Cambridge residents decent connectivity.

With good wireless, the device problem is relatively straightforward. Chromebooks are so cheap and easy to manage that many public schools went 1:1 even before the pandemic (now most Cambridge Public Schools students have one). The Library could expand its short-term takeout program significantly if decent home wireless could be counted on, and perhaps expand it to something longer term, something even approaching a 1:1 for families in public housing for example, with training provided on-site via librarian facilitated Tech Goes Home classes offering students a permanent device at the end. If we can provide Chromebooks for all Cambridge kids, it does not seem that far a leap to do it for all Cambridge families in public housing.

During the Covid-19 closure we loaned:

- *93 Chromebooks and 15 mobile hotspots to adult students enrolled in Community Learning Center courses*
- *14 MacBooks with high-end creative software to teens in the STEAM Academy (which provides immersive summer and multi-week after-school courses in science, technology, engineering, arts, and math, open to all Cambridge youth but prioritizing underserved communities).*
- *Two Chromebooks to instructors in the Department of Human Services Program Birth to Third Grade initiative for professional development,*
- *Five Chromebooks to residents of the Cambridge Rehabilitation & Nursing Center so they can keep in better touch with family members.*

9.3   Kathryn Fenneman, executive director, Tutoring Plus of Cambridge

Tutoring Plus is a local nonprofit that offers free tutoring and mentoring programs to between 180 and 200 students per year in grades four through 12. Our largest program is one-to-one tutoring and mentoring. We operate in community spaces in order to remove transportation barriers for our families. We work in seven locations in Cambridge; two are school-based and five are based in public or subsidized housing community rooms.

We have been operating fully remotely since March. We saw the impacts of the digital inequities prior to the COVID-19 pandemic, but the pandemic has exacerbated those gaps. Access to reliable internet is the problem that affects our students and instructors the most. Home internet often is not adequate for remote instruction, especially when families have multiple people at home who need to use the internet at once. Several families we work with have had difficulty accessing Comcast Internet Essentials because they have existing debt with Comcast that they are unable to pay off.

About eight years ago, Tutoring Plus began offering Chromebooks on-site so that students could complete assignments and access resources if they did not have internet and a computer at home. We would also allow students to borrow the Chromebooks to take home overnight if they needed to do so. Now with the pandemic, the school district has done a good job of making Chromebooks available to students, so now essentially every household has at least one laptop. We will still loan out Chromebooks if, for example, families need more than one device to support multiple students or if a school-issued Chromebook is no longer working.

Our students have grown increasingly comfortable using technology in the past year, but parents sometimes need support. We are a very community-based organization and have built a lot of trust with the families we serve. Because of this, offering technology skills support is probably where we can most effectively play a role. People are comfortable receiving support from those they trust, and we have built strong relationships in the community. We have been in the community for decades and are a trusted resource for families. Many parents have reached out to us for help navigating their child's online learning devices and platforms. We have not historically addressed technology training, but we do see a need on the parent side now.

If the City chooses not to pursue a municipal broadband network, it is really important for the City to provide internet subsidies to families in need. It is critical that families do not have to choose between bills and financial obligations and their kids' education. And when there are significant barriers to accessing programs like Comcast Internet Essentials, there needs to be another avenue for families to access affordable internet.

There are existing tech-focused nonprofits such as Tech Goes Home that do excellent work supplying devices and training. By supporting these organizations with deep experience, we can make sure that resources are being targeted to those in need, as opposed to broadly allocated without direction.

It is also important to work with the Cambridge Housing Authority, Just-A-Start, Homeowner's Rehab, and other subsidized housing providers to support, replicate, or grow any of their digital equity initiatives. The most vulnerable populations in our community often live in public or

subsidized housing, and it is essential to make sure their efforts are supported and their successes are built upon.

9.4   Susan Fleischmann, executive director, Cambridge Community Television

Cambridge Community Television (CCTV) has been involved with digital equity issues since widespread reliance on computers and the internet began in the mid-1990s. We work to nurture a strong, equitable and diverse community by providing tools and training to foster free speech, civic engagement, and creative expression while connecting people to collaboratively produced media that is responsive, relevant, and effective in a fast-changing technological environment.

In 2019, for example, we provided 750 seats in 141 media art and technology workshops to more than 500 unique participants; produced approximately 24,000 hours of programming on three community access cable channels to 27,000 homes; provided a year-round Youth Media Program serving 44 teens; made access to equipment and facilities available to almost 600 members, six days each week; and provided 190 slots to seniors for computer workshops, one-to-one assistance, and drop-ins.

The pandemic shone a harsh light on the digital inequities faced by so many. I have been thinking about this a lot lately, as I am privileged enough to be able to work from home. Aside from work, I reach for my computer multiple times a day, to look up something I am curious about, decide what to watch on TV, check the news, order groceries, pay bills, play card games with friends— the list goes on. What if my partner and I had to share one computer? What if we had a school-aged child in the house—or more than one—who needed to use that computer for homework or remote learning? Even if we each had our own device to use, what if the internet connection was too slow or inconsistent for us each to do what we needed to do?

The spring semester of CCTV's School Year Production came to a screeching halt on March 13. It became practically impossible for us to maintain contact with the teens in our program. Most are new immigrants, and, as we had learned in the fall semester, their technical skills (aside from TikTok) are limited. They have very little technology at home and were likely trying to manage distance learning with the new technology provided by the school department. When CCTV started its summer program, we found that two high-school age students did not have internet at home; they rely on their smartphones.

CCTV offers a weekly drop-in program for older adults, called Computers for 50+. Of those we serve, many are able to afford their own devices and an internet connection but lack training and ongoing technical support. Since the shutdown, we have lost touch with others who have no access (to devices and/or internet) in their homes and rely on CCTV's lab for basic computing. One regular attendee, Amir, had to wait for his daughter to come to his home to set up his computer and she now sits with him during the weekly lessons. Two brothers who came

to the lab together each week have a smart phone but do not really know how to use it; Jerry has no email address, just a phone number. We are upgrading our Zoom account so that we have the capacity to call him and others who do not have internet access.

CCTV hosts approximately 35 live shows weekly from its host-operated set. During the shutdown, we attempted to offer the same service from people's homes via Google Meet or Zoom but some people do not have a computer at home. One or two do not even have smartphones.

The live producers have a variety of challenges. One only has a landline with local service; the one public computer in his group home is in a common space that was off-limits due to the coronavirus. We call him for voice-only shows, something his health care providers are so far unable to do with their telehealth platforms. Others have broken computers, old ones where they wait weeks to get compatible webcams, weak Wi-Fi, or are unable to plug in an Ethernet cable because they are using iPads. Even basic computer literacy issues are a problem for many of our producers. Many had used FaceTime before, but professional video chat tools were a big leap.

We need a citywide campaign to find out who in our community lacks tools, training, or affordable and robust internet access. I will make the assumption that the families and individuals for whom lack of access is an issue are lower income, and perhaps recent immigrants experiencing language and cultural barriers. I will also make the assumption that many of them are already engaged with other City services.

The providers who engage with these families and individuals are often aware of problems their clients are facing in their homes, e.g., lack of heat, or insufficient food. If all providers—including in-school, after-school, and ESOL teachers, health care providers, senior center staff—were trained to pay attention to digital equity as a critical need and include digital equity questions in their intakes, we would have a better picture of the depth of this issue in Cambridge. We also could potentially have City employees ask digital equity questions when interacting with those who are obtaining parking permits, paying real estate taxes, or registering to vote.

9.5   Charles Franklin, member of Upgrade Cambridge and software engineer

In addition to being a founding member of Upgrade Cambridge I am a software engineer at Akamai and a former candidate for Cambridge City Council. In my time running for City Council, I spoke with community members who lived in public and affordable housing about the burdensome cost of home internet. Many public housing residents shared that the internet bill was their second highest each month, after only the cost of rent. The Cambridge Housing Authority had attempted to deploy Wi-Fi in its buildings, but the signals were not very strong in apartments themselves. The connection worked best in the lobby and other public spaces, and people often did not feel comfortable working in communal spaces.

To address the high cost of internet, I am working with members of the Cambridge Residents Alliance— a nonprofit citizen group that works to preserve and improve the city's quality of life— among others to provide a direct subsidy to residents for home internet. We have allocated $10,000 from a grant from the city intended to benefit Area 4 residents, also known as the Port, in order to provide Comcast Internet Essentials to qualifying residents of the neighborhood for at least 6 months. The program is eligibility limited, and we have created fliers that ask residents to contact the City, which then can provide the subsidy.

Personally, my home internet had been very unreliable until recently. My connection went down a lot, and the customer service was poor at best.

Upgrade Cambridge is a citizen advocacy group that has been pushing the city to create a full municipal broadband network. Because the report that Tilson delivered to the City estimated the cost of a network if no assets were available whatsoever, that cost estimate represents a worst-case scenario. Upgrade Cambridge is asking that the city conduct a feasibility study to analyze available assets, such as poles, conduit, and existing fiber, and estimate the cost of a network with those assets taken into consideration—and go farther to examine a range of potential business models and to estimate likely consumer demand.

9.6   Michelle Godfrey, director, Department of Human Service Programs

Through our Center for Families programs we provide support each year to about 700 Cambridge families with children up to age eight. We always look for ways to interact with the parents, because we know stronger parents mean stronger kids. We have play groups, parent education programs, a program called "Baby University," and many others.

With the onset of Covid-19 our capacity to provide programming went down by about half, and we tried to provide services remotely to that half. We became heavily reliant on Zoom meetings. For example, we ran a monthly mothers' group where we distribute materials for an activity ahead of time, dropping things like painting supplies at people's doors so they can pick them up. Then the women jump on Zoom and we run the activities.

Through this we found that many families just do not have access. We had 40 people who recently told us they could not get on because of the technology. Mostly because they had old devices—like a 7-year-old iPad that someone got from her sister, or old Chromebooks—but also because they lacked access to Wi-Fi. Some are Housing Authority residents; some are in subsidized housing.

We worked with partners to get people Wi-Fi and help them use hotspots. We were able to solve it for 15 of those families. But there is another problem in that even when people get access, some lack the skills. The City set up a disaster relief fund where families could apply for assistance

for rent or utilities, that kind of thing. But there was a portal you had to log into. We had staff who spent significant amounts of time with a small group of people who could not access the platform. We had 10 to 15 families who said: "How do I do that?" We would have to walk people through, telling them how to access and do things like upload your paystub.

We need to support families with updated technology, universal Wi-Fi access, and training for families on accessing technology, and on connecting families to programs or resources to get tech support. All of this is particularly true for our lower income families. You consider places like the Newtowne Court development—those buildings are in the shadows of biotech headquarters, and they do not have good technology. I might be a little biased, because I grew up there, and I know there are people there who have generational poverty. We need to break that cycle and make sure our neediest families have access to current technology.

9.7 Kessen Green, director of community outreach and programs, Cambridge Police

My role at the Cambridge Police Department is to be a liaison between the police department and the community, to build trust in the community, and to find avenues of employment in the department for young people in Cambridge. I work to help youth, families, and residents understand that they can make an impact at the department and have a shared role in constructing a new structure of policing. I also work with our officers to educate them about how to interact with the community, especially when relationships may be frayed.

Over time, my role has included conversations with community members about internet and computer use, especially in terms of educational programs and how to navigate employment opportunities, though this is not often a main focus of our conversations.

One success has been that schools are providing students with Chromebooks. That being said, many families are not able to support internet access in the home. It is hard for families to keep up with bills, and sometimes they come up short, whether that is due to income level, the number of kids in the house, or some other reason.

Youth in the community have adjusted to this challenge better than most. They can rarely say that they do not have access, because they can use their smartphones even if they cannot get connectivity at home. In the cases in which kids are the only English speakers in the household, they also take on the role of trainer for family members when it comes to using technology.

While schools have provided resources for families, we need to make sure there are resources for the adult population. Given that the pandemic eliminated our indoor public spaces, one solution could be to create an outdoor café or public space where people can sign up for a time to use the computers.

Students not being in school physically is affecting how I can perform outreach at the police department. For example, the Explorers Program for middle schoolers and the Summer Youth Police Academy for high schoolers are two in-person programs that we run, and recruitment for young people took place in person, too. Now that I cannot connect with kids at school, not everyone will have exposure to these opportunities.

Separately from my role at the police department, I have also been involved in the Young People's Project, which is a math literacy nonprofit. This work addresses the question of who has access to the resources and opportunities to succeed in STEAM [science, technology, engineering, art, and math]. The Young People's Project attempts to create a fun pathway using mathematics for kids to engage in this work. A lot of the organization's work has to do with mathematics and coding. When we talk about the digital divide as a city, we are not usually talking about things like coding, but it is part of it. We need to think about how we can get kids interested in this, and why these resources are not typically something that families of color have access to.

One initiative I would love to see is a STEAM center that creates a pathway for young people in the city to access the employment opportunities in Cambridge. We need to provide our youth with the resources they need to be able to take advantage of those jobs. A "Digital STEAM Center" could help build up those skills and help kids take their lives to another level.

We have the resources and the empty buildings to be able to do this. As a city, we need to ask how much we value the potential of our young people, especially in terms of creating pathways for them to be gainfully employed and build families. Are we preparing our young people to be employed in our city, from taking on roles with traffic and lights to being council members and city managers?

9.8 Russell Harding, community outreach coordinator, Margaret Fuller Neighborhood House

The Margaret Fuller Neighborhood House (MFNH) is a nonprofit, located at 71 Cherry Street in Cambridge, that works to strengthen and empower youth, families, and community members by addressing inequities in the Port neighborhood. My role is to connect those in need to resources at the city and beyond, such as employment opportunities, SNAP benefits, health insurance, and schooling.

The people I work with are savvy about finding access to the internet. Even if they do not have access to internet at home, they use hotspots, public Wi-Fi, and other resources. Some people even use iPhones without a cell phone plan because the phone can use Wi-Fi to make calls.

MFNH has a computer room with 12 desktop Macs that is open to the public from 9 a.m. to 6 p.m., Monday through Friday. People use it for things like making copies, writing, and applying

for jobs. We see some use, but it is probably underutilized. We did see a lot of interest when we worked with Tech Goes Home to host basic digital skills classes. The students that signed up for those classes were mostly older individuals. The older population sometimes struggles with technology skills, including accessing online resources that involve using email or clicking links. The Tech Goes Home classes were popular, and people would often call to ask when the next one would take place. My recommendation would be to use the computer room to make more classes with Tech Goes Home available to the community. This could also help engage the older population.

MFNH also offers a bill assistance program that began May 1, 2020. Cable bills have been the second most frequently requested for assistance, after rent. Additionally, the Port Neighborhood Coalition supported a program for free internet for a year to 75 people, and they reached full program capacity after just three information sessions. The program offered vouchers for service to applicants that met public assistance eligibility requirements, were residents of the Port, and did not have kids in school. Based on these things, I can see that there is a demand for help with high internet costs.

9.9 Neil MacInnes-Barker, director, Department of Veterans Services

The Cambridge Department of Veterans' Services ensures that veterans have access to essential services such as shelter, food, and medical care. Our clients include those in Cambridge who meet income eligibility requirements for veterans' benefits under Massachusetts law—who currently number about 100—as well as about 50 additional veterans a month who need help accessing other types of assistance.

In addition to supplying veterans with eligible benefits, we also provide veterans with programming such as networking, socializing, writing workshops, support for specific groups (such as LGBTQ or foreign-born veterans), and activities to support emotional and physical healing, such as acupuncture, meditation, and painting classes. Many of these activities take place at the Veterans' Center.

Veterans need help with technology and the internet. Many are older, and do not understand how to use technology or why it might be important to them. Cost is another barrier. And finally, there is a unique self-sufficiency culture among veterans that results in individuals often concealing their needs, which can act as a barrier to asking for help or resources. This is why Veterans' Services is so important.

Veterans' Services provides some resources to help community members get online, but there are gaps we currently are not able to fill. The Veterans' Center has a public computer that people can use to access the internet, write resumes, and other tasks. This computer is also used for some training, including teaching individuals how to use e-benefits. In addition to the computer,

the Center includes an amplified phone, which uses the internet to provide live captioning of phone calls for the hard of hearing. Currently, veterans are eligible to receive care at home through telehealth but need an internet connection at home and digital skills. Computer use can be particularly difficult for older clients and those with cognitive struggles. We want to develop the Veterans' Center to provide private spaces where veterans can come to take telehealth appointments. And for those who do have a connection and a device at home, we want to offer coaching to help them understand how to access and use telehealth.

In order to make this possible, we would first need the Veterans' Center to be given healthcare provider status and designated as an official telehealth center by the federal Department of Veterans Affairs, which is something we are working on.

In addition to enabling telehealth specifically, we would like to host workshops to teach digital literacy skills more broadly, such as to help veterans use online benefits calculators.

A small budget, maybe $5,000 or less, to be able to purchase tools to conduct trainings would be helpful. We need a few devices, such as iPads, to be able to hold trainings and work with clients. In addition, access to a staff person to conduct trainings would be helpful.

It is also important to ensure that our veterans have the internet at home. For example, the amplified phones that provide live call captioning can be provided for free, if the veteran has access to the internet at home. A budget from the city for approximately 10 home internet connections and analog phones per year would be really helpful in providing this resource. It is possible that the cost to the city would only be 25 percent of the total cost if the costs can be partially covered by the state.

The pandemic has definitely amplified some of the needs in our community. Specifically, our older population that lives in public or senior housing has been cut off from their families and support networks. Many of them cannot understand why they are being isolated during the pandemic. We worked to get free iPads to those individuals so that they could talk to their families, but we could always use more.

9.10 Dan Noyes, Co-CEO, Tech Goes Home

We are a nonprofit that provided computers and skills training to those in need in Boston and surrounding communities, including Cambridge. Today, we find ourselves more motivated than ever to fight digital exclusion, which is also a racial and social justice issue. Amid the ongoing COVID-19 pandemic, Tech Goes Home continues bringing together the critical trio of digital skills, internet, and a device on which members of the Cambridge community can continue their education, apply for jobs and unemployment benefits, order essentials online, and access telehealth.

Three-quarters of TGH learners have household incomes under $35,000; 30 percent of adult learners are unemployed. Eighty-five percent of TGH learners are people of color, and nearly half are immigrants. The idea is that you give people the tools they need to open doors of opportunity. For us, we focus on things like 'How do I find a job? How do I use telehealth? How do I communicate with teachers?' Our view is that we are breaking cycles, specifically around poverty.

We have been in Boson for 20 years; until 2014, we were just in Boston. We started in Cambridge in the fall of 2017, and since then we have had 406 Cambridge residents graduate from a TGH course. (Completing a 15-hour course makes a person a graduate.) Our largest program in Cambridge is our school program, an intergenerational program where students and their caregivers learn technology skills together. TGH serves Cambridge residents from age three to 94.

Our work continued with a distance-learning model during the pandemic. In our TGH Distance Learning Program, TGH certified instructors at Cambridge organizations such as Peabody Elementary School, Cambridge Community Center, Cambridge Housing Authority, and Cambridge Public Library provide 18 hours of interactive digital literacy sessions online. At the beginning of the course, learners receive a Chromebook and, if they do not have it, internet access. By supplying the technology, we ensure that learners can participate remotely while also using their new device to fulfill their essential needs at home during this crisis.

We are proud of the numbers of people we serve, but it is a drop in the bucket. We are severely limited in our capacity to meet the need. In July we had 48 Cambridge residents enrolled in a TGH distance learning course. We are currently only able to support half the inquiries for courses in Cambridge. The demand for our program is so high right now that we cannot even come close to filling the requests. I have a waiting list of 30 organizations wanting us to come into their communities.

If any entity in Cambridge or elsewhere wants us to come in, we need three things. We need buy-in from the leadership of whatever organization we are dealing with. We need on-the-ground instructors within the organization who are excited about helping do this and are not just being told to do it. If you have got those supports in place, it will work. And the third thing is that we want to be serving the right people. We want to serve people in need. We do not want to run TGH courses for people who make $100,000 a year.

We never reach out to recruit sites for training. Somebody has to be interested enough that they reach out to us. When we onboard new sites, there is an interview with leadership with our program team, that gives our team a good sense of what the organization wants to do. And we have a rather rigorous screening process for our instructors. They have to go through a three-hour training and assessment of their skill level. Together we can work toward a more equitable

society where all members of our community have access to the digital world and the opportunities it provides.

9.11 Jim Stewart, director, First Church Shelter

We have 14 residents in our shelter and contract with City to give out about 120 meals every Monday, Wednesday, Saturday, and Sunday night, at 11 Garden Street. We are not the only shelter; there are others in the City including 240 Albany Street, the Heading Home Shelter on School Street, the War Memorial Shelter at the high school, and the Y to Y shelter in the basement of the Unitarian Church in Harvard Square. And then there are an estimated 500 homeless folks who are outside sleeping in the parks and stashing themselves away in other places.

Most of them have some kind of mobile device. If they are seeking a room in an SRO or looking on Craigslist for a living situation, they need to be reachable, and people want to do it by text or email. Accessing services or renewing your status for food stamps and other programs requires interfacing with agencies and providers. Even before the pandemic it was most efficient to do so online. During the pandemic, it became basically only the way to do it.

They need power and a free signal. There are all kinds of signals floating around that you can sign in and pay for, but there is not a broadband signal that the City provides everywhere. But this used to be something people could figure out in various places, whether at the Housing Authority or the multi-service center, library, or someplace near Harvard or MIT. People are resourceful; at MIT or Harvard they comport themselves discreetly. At Harvard Law School they would go into the café there. (They would not necessarily look like faculty, but they were not pushing a grocery cart with all their belongings, either.) In places like that, they could get power and a few signals.

But this stopped with the COVID-19 shutdown and was not ideal in the first place. We need something broadly available in public places. There are some solar charging places, one in Harvard, one in Central, but not enough of them and they do not have Wi-Fi. If there was a place in Central, Harvard, and Porter Square with Wi-Fi access and power, with opportunities for several dozen people to gain access out in front of the T stop, this would help a lot. With or without a pandemic we need as much access for people in as many different settings as possible that is not disruptive to the general public; you cannot have 80 homeless people hanging around the Out of Town Newsstand.

Then there is the equipment itself. People who are homeless, especially the people who are living outside, tend not to have very high-quality equipment and devices to begin with. In terms of getting devices – you used to be able to get free phones, which they used to call the Obamaphones (slang term for free wireless phones under the FCC's Lifeline program). You used to be able to walk into the multi-service service and it would get handed to you – it was service

you could get within a short period of time and would get a certain number of minutes per month. But they are not easy to get anymore.

10 Input from Experts, Practitioners, and Examples from Other Cities

As the political will to address digital inequity grows in Cambridge, it is important to learn from the experiences of municipalities that have been working towards greater digital inclusion long before stay-at-home orders multiplied the impacts of the problem. In an effort to learn from their experiences, CTC conducted interviews with digital equity practitioners and researchers from around the country. We had conversations with an academic researching digital coalition nationwide, as well as City staff working on digital inclusion efforts in Seattle, Austin, and Portland. We also spoke with the general manager of a city-run internet service provider in order to learn more about what strategies are effective when a city plays a more active role in delivering service to citizens.

This section describes some of the strategies these cities have used to create more digitally inclusive communities. Rather than providing an exhaustive list of initiatives, it aims to highlight some of the lessons these practitioners have learned about what strategies have the greatest impact, what hurdles are likely to arise, and what kind of roles City government is best suited to play in the digital equity ecosystem. Key lessons learned include:

- Community organizations already working with target populations are best suited to assist in overcoming barriers to broadband adoption

- A digital equity agenda is most likely to succeed when it is integrated and connected to other City goals

- City staff can play an important role in helping develop an evaluation framework and data collection system at a citywide or regional level

- Only a fraction of potentially eligible households makes use of discounted internet offerings, both because of a lack of awareness and the difficulty involved in navigating the sign-up process

- Regular community assessments allow City staff to reset priorities in light of shifts in barriers to adoption

- A digital equity agenda needs a champion in a leadership position to encourage cross-departmental collaborations and pursue philanthropic donations

- Digital inclusion coalitions can delegate responsibilities to community organizations, but should define performance metrics and establish accountability mechanism to ensure progress

- Bad credit has become a significant barrier to broadband adoption

The section concludes with resources and guides from coalitions that have formed to support digital inclusion efforts around the country.

10.1 Colin Rhinesmith, assistant professor, School of Library and Information Science at Simmons College

For a broad overview of the most successful broadband adoption strategies, we spoke with Colin Rhinesmith, Assistant Professor in the School of Library and Information Science at Simmons College, and a faculty associate with the Berkman Klein Center for Internet & Society at Harvard University.[52] His 2016 report on *Digital Inclusion and Meaningful Adoption Initiatives* includes numerous examples of how grassroots digital inclusion organizations are successfully addressing different aspects of the problem, sometimes with the support of various City agencies, but often without municipal involvement. In our conversation he emphasized that organizations already working with target population groups are best suited to help individuals address barriers to digital inclusion. Ideally city government can help these organizations develop effective adoption initiatives and provide financial and technical support to increase their capacity to respond. The individual or family, through their connection to the digital inclusion organization, is then supported by other community partners that in some cases also provide digital inclusion services (Figure 207).[53]

Figure 207. Community Connections Help Individuals and Families Access Digital Technology

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Rhinesmith has asked organizations working on digital inclusion how well they track the outcomes of their interventions. Almost universally these organizations report that they wish they did this better, but time and money constraints kept them from devoting additional resources towards measuring impact.[54] Rhinesmith noted that organizations continue to struggle to afford the software that would allow them to easily assess their impact over time. The philanthropic community wants a measure of the value of their donations, and a lack of data measuring the impact of digital inclusion work is hindering the ability of these organizations to secure additional funding. A lack of quality data is also slowing the development of clear sets of best practices for adoption initiatives.

Cities can play an important role in helping develop an evaluation framework and data collection system at a citywide or regional level. Providing an easy-to-use data collection system for community partners can help them to measure their impact in a way that is legible to donors and grant committees. Having everyone providing digital equity services collecting similar data points and using the same assessment tools will help organizations work together to ensure individuals receive the interventions necessary for full digital inclusion.

Rhinesmith's recent research has focused on digital inclusion coalitions and the work they are doing to respond to the COVID-19 pandemic. In some cases, City governments took an active role in convening these coalitions, but in others, the coalition emerged from the grassroots and city agencies have joined as participants.[55] **In cities where City staff has played a leading role in convening the coalition, bringing a wide range of stakeholders into a room together can deliver enormous value in itself.**

City involvement is especially important in bringing the ISPs into the conversation, and their participation is critical in meaningfully addressing some of the major barriers to adoption.

Rhinesmith warns against thinking of digital inclusion as a problem that will ever be fully resolved. As long as technology continues to evolve, people will continue to seek out spaces where they can learn from members of their community to use new applications and devices and understand emerging threats. There will always be new barriers that emerge that will keep people from adopting digital technologies in socially beneficial ways. While the immediate need is enormous, success will not come in one giant push to get everyone connected. Instead, it will take regular assessment and long-term support for the community organizations that take ownership over solving a part of the problem.

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[54] Ibid.

[55] Colin Rhinesmith and Susan Kennedy, "Growing Healthy Digital Equity Ecosystems During COVID-19 and Beyond," *Benton Institute for Broadband and Society*, November, 2020, https://www.benton.org/sites/default/files/growinghealthy_ecosystems.pdf (accessed November, 2020).

Cities have an important role to play in convening stakeholders, supporting the helping individuals overcome barriers to adoption, and developing a framework to measure the impact of interventions.

10.2 Seattle, Washington

Since 1997, the City of Seattle has offered a Technology Matching Fund to support local organizations working to close the digital divide. With an annual budget today of $320,000, the fund provides up to $25,000 each to an average of twelve community organizations per year.[56] The organizations agree to a 1:1 match through contributions of volunteer labor, materials, professional services, or cash (Table 31).

Table 31. Seattle's History of Advancing Digital Equity and Fostering Best-in-Class Internet Infrastructure

Year	Event
1994-5	Opened its first public computer labs.
1997	Started Technology Matching Fund in 1997; $5.7 million in grants have been awarded.
1999	Created the Cable Customer Bill of Rights to ensure responsive service from cable companies.
2000	Developed Goals for a Technology Healthy Community that led to the first community survey.
2010	Began efforts that led to low-income internet discount programs.
2012	Allowed its fiber optic cable network's excess capacity to be used for high-speed internet.
2014	Passed an ordinance to reduce barriers for new market entrants.
2015	Launched Digital Equity Initiative. Modernized the Cable Code, partly to ensure build-out to low-income households.
2016	Launched Digital Equity Initiative Action Plan. Seattle's history of advancing digital equity and fostering best-in-class internet infrastructure Built out public Wi-Fi inside community centers, with initial funding support from Google.

Source: https://durkan.seattle.gov/wp-content/uploads/sites/9/2020/09/Internet-for-All-Seattle-Report-FINAL.pdf, Appendix A (accessed December 7, 2020)

David Keyes, Digital Equity Manager for the City, pointed out some of beneficial effects of implementing the fund:

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[56] Technology Matching Fund, *City of Seattle*, https://www.seattle.gov/tech/initiatives/digital-equity/technology-matching-fund (accessed November, 2020).

- Increased capacity among grassroots organizations working on digital inclusion initiatives
- Built more trust among the organizations
- Established better understanding of the needs of target population groups.[57]

The fund's review panel consists of a mix of City staff and community leaders to ensure that funded projects are responsive to community needs while accomplishing the City's digital inclusion objectives. Mr. Keyes emphasized the value of working with those organizations already providing services to target communities to help them incorporate broadband adoption initiatives into their offerings.

Getting assessment data back from partners can be a challenge, so Mr. Keyes tries to learn about their existing data collection practices in order to understand where there may be opportunities to gather key statistics. **The City strives to use its data collection process to deliver useful data back to community partners that they can then use to pursue other funding opportunities.**

The City conducts regular technology access and adoption studies. It launched a [Digital Equity Initiative] in 2015,[58] followed by a [Digital Equity Initiative Action Plan] the next year.[59] In the plan, the City set three priorities for itself:

- Provide high-quality devices and technical support.
- Ensure available, affordable internet connectivity.
- Deliver technology training opportunities to all residents

The City divided its strategies into discrete action items and regularly updates its plan to reflect progress made on each action item.[60]

As digital inclusion has become a higher priority for the City, it has begun to affect how the City approaches infrastructure planning and development. Mr. Keyes emphasized the importance of having a champion whose time is dedicated to pushing the digital equity initiative forward, and who can engage across departments and agencies in order to increase buy-in and participation. **A city's digital equity agenda is most likely to succeed when it is integrated and connected to other city goals.**

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[57] David Keyes (Digital Equity Manager, City of Seattle), telephone interview, November 9, 2020.

[58] Digital Equity, *City of Seattle,* http://www.seattle.gov/tech/initiatives/digital-equity (accessed November, 2020).

[59] "Digital Equity Initiative Action Plan, Phase 2," *City of Seattle,* https://www.seattle.gov/Documents/Departments/Tech/DigitalEquity_PhaseII.pdf (accessed November, 2020).

[60] "Internet For All Seattle Report," *City of Seattle*, September 2020, https://durkan.seattle.gov/wp-content/uploads/sites/9/2020/09/Internet-for-All-Seattle-Report-FINAL.pdf (accessed November, 2020).

Throughout the City, Seattle provides free Wi-Fi in 76 sites and continues to explore ways to use existing and planned fiber assets in order to expand free or low-cost broadband connections in targeted areas (Figure 208).

The City designated digital equity zones deemed important to improving internet access for lower-income residents and has prioritized deploying additional WIFI access points in those locations. It is also working on connecting Seattle Housing Authority properties to City fiber. Using City fiber for backhaul, the Housing Authority will be able to purchase bulk bandwidth at a fraction of the price it would pay a private ISP to offer service to households with no costs to the household. Residents will enjoy far greater bandwidth than ISPs offer to their discount-service customers. Thanks to the cost advantage of buying bandwidth in bulk, the cost of service may be low enough to be absorbed into the overall price of rent, thereby avoiding a potentially significant financial burden for residents.

The City has found that only a fraction of households potentially eligible for discounted internet offerings are taking advantage of them. In fact, the most recent community survey showed that only 53% of potentially eligible households were even aware of the discounted offerings. In response to those findings, the City has prioritized outreach to raise awareness through community partners and various City agencies already working with target communities. The City has found that the sign-up process for the discounted services is often complex, especially when an eligible household has existing service from the ISP or wants to bundle services. In some cases, City staff work with eligible households to navigate the sign-up process.

Figure 208. With Initial Funding from Google, Seattle Built Out Public Access Centers
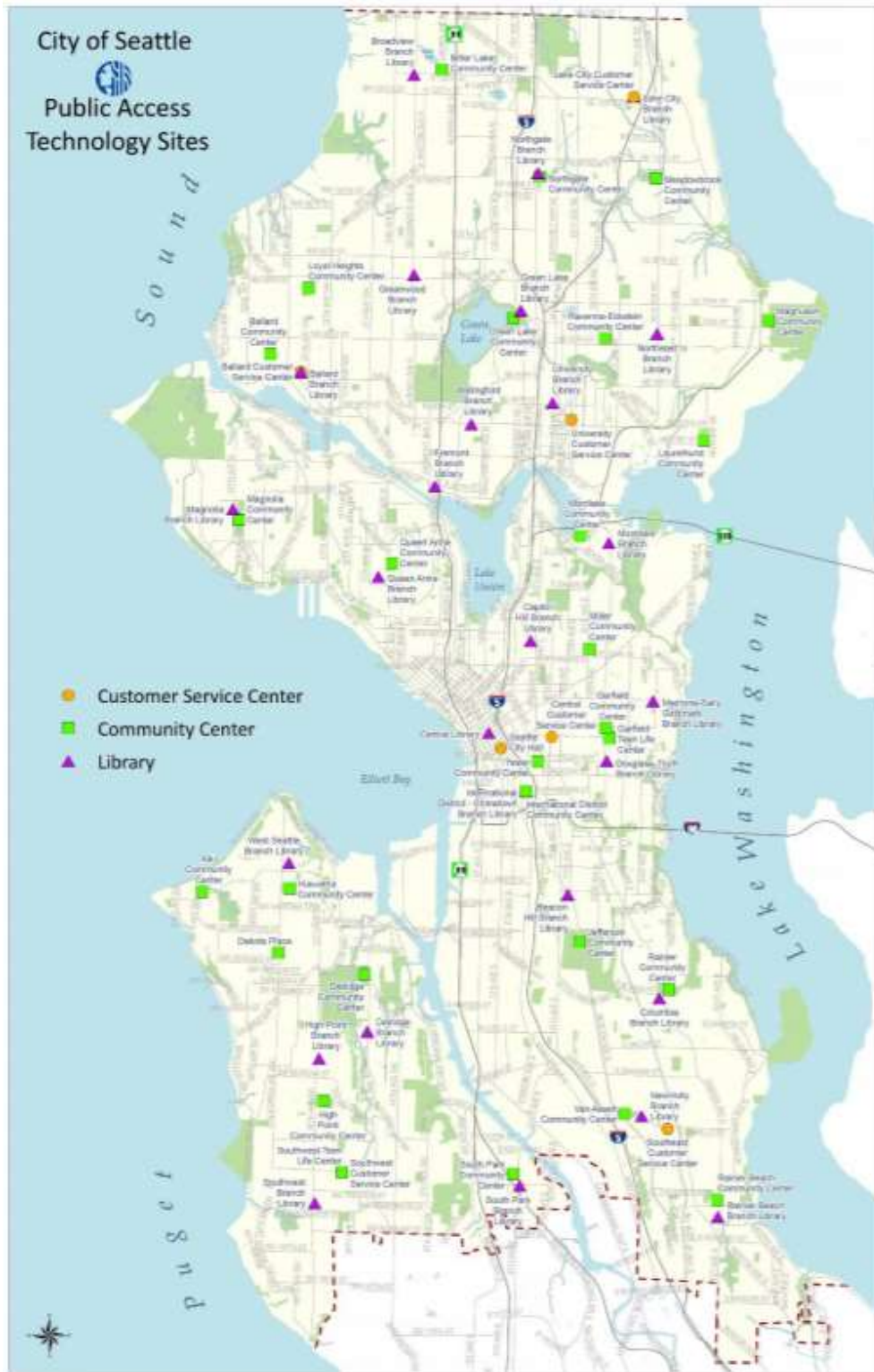
The City is working to ensure that all Seattle residents have the digital skills necessary for full participation in society. However, they have found that "digital literacy" encompasses a wide

range of skill sets. It is often unclear exactly what which digital skills are taught in a given training course and which are needed by each segment of the population. To address the problem, the City partnered with researchers at the University of Washington to identify and compare digital skills and competencies recommended by fifteen popular frameworks and curricula. They have published their findings,[61] and continue to work on establishing well-defined digital competency standards and assessment tools that can be used across City departments and community organizations.

10.3 Austin, Texas

The City of Austin has also been working to assess and address the problem of digital inclusion for decades. Their first community technology assessment dates back to 1998, and in 2001, inspired by Seattle's Technology Matching Fund, the City of Austin launched its Grants for Technology Opportunities (GTOP) Program.[62] In 2015, City staff helped convene the Digital Empowerment Community of Austin with participation from more than 80 community stakeholders. The coalition continues to meet regularly and publish a newsletter with updates from Austin's digital equity ecosystem. Various working groups are developing collaborative solutions to shared problems, like standardizing digital literacy training curriculum and creating a playbook for program trainers helping low-income Austin residents who want to start a career in technology.

We spoke to John Spiers, the program manager of Austin's Office of Telecommunications and Regulatory Affairs about some of the lessons the City has learned in its efforts to help citizens overcome barriers to adoption.[63] He stressed the importance of regularly assessing the problem in order to keep track of how barriers to adoption shift over time. In their 2014 community technology survey, the largest reported barrier to broadband adoption was price. By 2018, the largest reported barrier to broadband adoption was privacy concerns. Over those four years, Google Fiber entered the market putting negative pricing pressure on incumbents, and revelations about how social media companies were mishandling personal data led to a growing concern with data privacy. Regular assessment allows the City to shift priorities to address current barriers to adoption.

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[61] Stacey Wedlake, et al., "Digital Skill Sets for Diverse Users," *Social Science Research Network,* July 19, 2019, https://ssrn.com/abstract=3427252 (accessed November, 2020).

[62] Grant for Technology Opportunities Program, *City of Austin,* https://www.austintexas.gov/department/grant-technology-opportunities-program (accessed November, 2020)

[63] John Spiers (program manager, City of Austin's Office of Telecommunications and Regulatory Affairs), November 3, 2020.

Through a partnership with Google Fiber, the City's Housing Authority plans to eventually provide free home broadband in public housing facilities.[64] However, although Google has committed to connecting the housing authority facilities, they will only do so when they are built out in the surrounding neighborhood, and so far, the build out has so far been focused on the neighborhoods with the greatest registered demand. The housing authority is working with other ISPs in the interim to provide more limited service to residents while they wait to see if Google Fiber will ever build in their neighborhood and provide the promised free service.

The City's GTOP program has grown to receive $400,000 in annual appropriations. They have broken the program into three separate funds in order to support a wide range of community organizations at different stages of growth (Table 32).

The Core Fund offers grants between $10,000 and $35,000, and applicants must demonstrate proof of insurance. There are fewer requirements on applicants for applicants of the Mini Fund (offering $5,000-10,000 grants) and Capacity Fund ($150-$2,500).[65] Spiers noted that collecting data from applicants has been critical in generating the datapoints necessary to persuade City Council members to continue to grow the funds' annual allocation.

Table 32. Austin's Grant for Technology Opportunities Program has three award pathways.

Type of Funding	Award Amount	Goal
GTP's Core	$10,000 – $35,000	Increase internet access and the use and skills of digital and communications technology devices.
GTP's Mini	$5,000 – $10,000	Provide a low barrier to service delivery.
GTOP's Capacity	$150 – $2,500	Fund the purchase of hardware, software, and equipment related to digital equity.

10.4 Portland, Oregon

Since 2014, the City of Portland has worked in close collaboration with Multnomah County and the Library to address barriers to digital inclusion. City staff helped convene the Digital Inclusion

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[64] Community Connections Program, *City of Austin,* http://austintexas.gov/page/community-connections-program (accessed November, 2020).

[65] Source: https://www.austintexas.gov/department/grant-technology-opportunities-program(accessed December 7, 2020).

Network (DIN)[66], and the DIN developed a Digital Equity Action Plan (DEAP) in 2016[67] to set the digital equity agenda for City departments and supporting partners to pursue for the next three years (Table 33).

Table 33. Portland's Digital Access Action Plan

Goal	Area	Action Planned
1	Access	Ensure access to affordable highspeed Internet and devices for those in need.
2	Support and Training	Provide training and support to ensure that everyone has the skills to use digital technology to enhance their quality of life.
3	Leadership and Capacity Building	Empower community partners to bridge the digital divide through funding, coordination, training, and staff resources.
4	Connecting to the Digital Economy	Create opportunities for jobs in the digital economy for underserved populations.
5	Policy	Build a policy framework that supports digital equity and meaningful Internet adoption, leading to better community outcomes.

Source: https://www.portlandoregon.gov/oct/article/643895 (accessed December 7, 2020).

We spoke with Rebecca Gibbons, Digital Equity Program Coordinator to hear about lessons learned during the execution of the plan.[68] She reported that having the plan created immediate value in bringing people to the table and enabling greater cross-departmental collaboration within the city. However, a lack of a performance metrics and accountability structures have made it difficult to measure how much progress they have been able to make. They are working on a digital inclusiveness index for households in order to make it easier to track where progress is being made and will provide more support to coalition members in gathering data during the implementation of the next three-year plan.

The City worked closely with the community to set the agenda and strategy laid out in the DEAP. In the next iteration of the plan, they are working to create structures that will allow community members and organizations to take the lead on some strategic action items. Community organizations volunteered to take on responsibility for implementing various aspects of the first DEAP, but there was no accountability mechanism built in to remind the community partners of their commitments. The City, County and Library have all made progress on their strategic action

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[66] Digital Inclusion Network, *City of Portland*, https://www.portlandoregon.gov/oct/73860 (accessed November, 2020).

[67] "Digital Equity Action Plan," *City of Portland,* April 2016. https://www.portlandoregon.gov/oct/article/643895 (accessed November 2020).

[68] Rebecca Gibbons (Digital Equity Program Coordinator, City of Portland), telephone interview, October 20, 2020.

items, but they are hoping to get more community buy-in during the implementation of the next three-year strategic plan.

Ms. Gibbons stressed the importance of having a digital-equity champion at the leadership level within the City. Until digital equity becomes a priority for the CIO, CTO or Mayor, it is difficult to incorporate the digital-equity agenda into the goals of the various departments and agencies who work with target population groups. A champion is also important when pursuing philanthropic donations and corporate sponsorship of adoption initiatives.

Wilson, North Carolina

For insight into the digital-equity strategies provided by a City delivering broadband services to residents, we spoke to Will Aycock, General Manager of Greenlight, a city-owned telecommunication service in Wilson, NC.[69] When classes went remote last spring, the city-owned fiber network made it easy to install an additional 30 public Wi-Fi access points for students with minimal new investment, but Greenlight has been working to create a more digitally inclusive community for years before the pandemic hit. The City's public housing facilities were some of the first buildings connected to Greenlight's fiber network. In addition to providing free Wi-Fi in communal areas, Greenlight has partnered with the Wilson Housing Authority to offer residents of all the units a 40 Mbps symmetrical broadband service for $50 per month.

Initially the service saw impressive demand, but the adoption rate dropped over time as some residents struggled to pay their monthly bills and service was disconnected. Normally establishing service requires a credit check and an initial deposit based on the credit risk. Greenlight realized **bad credit has become a significant barrier to broadband adoption**, so they adapted their business practices to ensure bad credit does not bar households from receiving the benefits of home broadband. Greenlight adapted their usage monitoring app to serve as a prepaid broadband service. Prepaid customers add money to their account ahead of time, and a daily usage charge draws it slowly draws it down. Once their balance reaches zero, service is inactive until they deliver payment through any of the utility's payment methods, including cash. Allowing an account to become inactive does not harm a customer's credit score like failing to pay a bill. The service is available to all customers and has helped increase Greenlight's adoption rate in low-income areas increase from below 10 percent to above 25 percent.

Greenlight also offers everyone a $10 per month lifeline broadband service. While the service does not guarantee a specific bit rate, Greenlight staff manages the service to ensure it provides all subscribers with the ability to conduct a high-quality video call. Customers can switch back and forth between the lifeline service and higher quality service tiers as needed. The lifeline

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[69] Will Aycock (General Manager, Wilson Greenlight), telephone interview, October 28, 2020.

service has proven particularly popular amongst elderly customers living on a fixed income, who often have minimal bandwidth requirements.

10.5 Digital equity guides and resources

Numerous coalitions have formed to support digital inclusion work happening at the grassroots, and to help scale successful solutions. They have developed the following guidebooks and resource pages to help individuals pursuing digital equity learn what is working in other communities and develop their own plan of action.

National Digital Inclusion Alliance's (NDIA'S) Discount Internet Guidebook offers a guide for digital inclusion practitioners wanting to help their community find affordable home broadband service. It describes large ISPs affordable broadband options and explains how eligible households can sign up.

Digital Inclusion Coalition Guidebook reports on lessons learned from six established community-wide digital inclusion coalitions in an effort to help local communities implement their own digital inclusion coalition.

Digital Inclusion Start-Up Manual provides guidance for communities looking to increase access and use of technology in disadvantaged communities through digital literacy training, affordable home broadband, affordable devices, and tech support. The guidebook was updated in September 2020 to reflect best practices around Digital Inclusion programming in the age of COVID-19.

NDIA's Resource Page includes link to strategy guides, local government plans and reports, sources of data and research on the digital divide.

National Collaborative for Digital Equity's (NCDE's) Guide to CRA Grantmaking for Digital Equity and Economic Inclusion offers a detailed description of how banks can meet Community Reinvestment Act (CRA) obligations through investments in digital equity.

NCDE's Digital Equity Resource Page provides links to sources of free and low-cost broadband, devices, apps, software, and technical support, as well as other digital literacy, education, and professional development resources.

Consortium for School Networking's Digital Equity Toolkit details strategies that school systems are successfully using to narrow the Homework Gap in their communities, as well as guidance on how these steps can integrate with broader digital inclusion efforts.

HUD's ConnectHome Playbook provides a step by step guide for building a digital equity initiative, lessons from 28 pilot projects, and tips for how ConnectHome partners can help families in HUD-assisted housing overcome some barriers to adoption.

Appendix A: Citywide Survey Instrument

Cambridge, Massachusetts

Internet Usage Survey

September 2019

> *Even if you do not have home internet service, please complete the relevant portions of this survey form and return to us. Your opinions, experiences, and information are important to us.*
>
> *If you need help completing this survey in your language, please email lgianetti@cambridgema.gov or call 617-349-3317.*

The City of Cambridge is sending you this survey as part of its research into how residents use internet services. *The information gathered will not be used to sell you anything.* It will not be used for any purpose other than to help the City understand how residents use internet services and to explore strategies to improve internet accessibility and affordability in Cambridge.

Even if you do not have internet access at your home, please complete the relevant portions of this survey. We value your input.

How long will the survey take?
This survey should take approximately 10 minutes to complete.

What is the due date to complete the survey?
Please return your completed form in the enclosed postage-paid envelope by **October 4, 2019**.

What if I have questions about the survey?
If you have questions regarding this survey, please contact Lee Gianetti, director of communications, at 617-349-3317 or send an email to lgianetti@cambridgema.gov.

Thank you in advance for your participation!

1. **Which of the following services do you currently purchase for your household or personal use?** (✓ *all that apply*)

   □1 Internet service in my home (<u>excluding cellular/mobile</u>)
   □2 Cellular/mobile telephone service with internet (smartphone)
   □3 Cellular/mobile telephone service <u>without</u> internet (basic phone)
   □4 Fixed (land line) telephone service
   □5 Cable or satellite television
   □6 Don't know
   □7 None of the above

2. **How important are the following services to your household?** (*please circle your response for each aspect, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important*)

Aspect	Not at all important				Extremely important
(a) Internet connection (any speed)	1	2	3	4	5
(b) High-speed internet connection	1	2	3	4	5
(c) Cable television service	1	2	3	4	5
(d) Fixed (land-line) telephone service	1	2	3	4	5
(e) Cellular/mobile telephone service	1	2	3	4	5

3. **What is your <u>primary</u> <u>home</u> internet service connection?** (✓ *only <u>one</u>*)

   □1 No home internet service **(Please <u>skip</u> to Question 12)**
   □2 Telephone line (dial-up)
   □3 Digital Subscriber Line (DSL) (from Verizon or other)
   □4 Cable modem (from Comcast)
   □5 Satellite (from DirecTV, Dish Network, or HughesNet, etc.)
   □6 Cellular/mobile internet (smartphone, mobile Wi-Fi hotspot)
   □7 Fiber-optic connection
   □8 Fixed wireless service (from NetBlazr or Starry or other, not just wireless router in home)
   □9 Other (Please specify: _____)

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4. **How important are the following aspects of your primary _home_ internet service if you have or were to purchase broadband internet service?** *(please circle your response for each aspect, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important)*

Aspect	Not at all important				Extremely important
(a) Speed of connection	1	2	3	4	5
(b) Reliability of connection	1	2	3	4	5
(c) Price of services	1	2	3	4	5
(d) Overall customer service	1	2	3	4	5
(e) Ability to "bundle" with TV and phone	1	2	3	4	5

5. **How satisfied are you with the following aspects of your current _home_ internet service?** *(please circle your response for each aspect, where 1=Not at all satisfied, 2=Slightly satisfied, 3=Moderately satisfied, 4=Very satisfied, 5=Extremely satisfied)*

Aspect	Not at all Satisfied				Extremely Satisfied
(a) Speed of connection	1	2	3	4	5
(b) Reliability of connection	1	2	3	4	5
(c) Price of services	1	2	3	4	5
(d) Overall customer service	1	2	3	4	5
(e) Ability to "bundle" with TV and phone (not applicable if your primary home connection is a smartphone)	1	2	3	4	5

6. **How many personal computing devices (desktop/laptop computers, tablets, smartphones) do you have in your home?**

- ☐1 1 or 2
- ☐2 3 or 4
- ☐3 5 or more
- ☐4 I do not have any personal computing devices in my home

2

7. **Approximately how much does your household pay PER MONTH for your *home* internet service (not including television or phone service if you bundle services)?**

1	Free		5	$61 to $80
2	$1 to $20		6	$81 to $100
3	$21 to $40		7	$101 to $120
4	$41 to $60		8	More than $120

8. **Is the fee in Question 7 part of a bundled package (purchased together with cable TV or phone service)?**

1	Yes
2	No

9. **How likely is it that you would:** *(please circle your response for each aspect, where 1=Not at all likely, 2=Slightly likely, 3=Moderately likely, 4=Very likely, 5=Extremely likely)*

Factor	Not at All Likely				Extremely Likely
(a) Recommend your home internet service provider to someone else	1	2	3	4	5
(b) Renew your contract with your internet service provider	1	2	3	4	5
(c) Switch your primary home internet service provider if an alternative provider were less expensive	1	2	3	4	5

3

10. If your primary home internet connection is **NOT** a **cellular/mobile connection (smartphone)**, how often does a member of your household use your primary home internet connection for: *(please circle your response for each activity)*

Home Internet Activity	*Never*	*Occasionally*	*Frequently*
(a) Listening to music (streaming)	1	2	3
(b) Watching movies, videos, or TV	1	2	3
(c) Playing online games	1	2	3
(d) Connecting to a work computer	1	2	3
(e) Using social media	1	2	3
(f) Shopping online	1	2	3
(g) Running a home business	1	2	3
(h) Accessing educational resources	1	2	3
(i) Accessing government information	1	2	3
(j) Accessing medical services	1	2	3
(k) Banking or paying bills	1	2	3
(l) Accessing home security/other "smart home" devices	1	2	3
(m) Accessing cloud-based file storage and sharing	1	2	3

11. How often does a member of your household use a *cellular/ mobile* **internet connection (smartphone)** for: *(please circle your response for each activity)*

Home Internet Activity	*Never*	*Occasionally*	*Frequently*
(a) Listening to music (streaming)	1	2	3
(b) Watching movies, videos, or TV	1	2	3
(c) Playing online games	1	2	3
(d) Connecting to a work computer	1	2	3
(e) Using social media	1	2	3
(f) Shopping online	1	2	3
(g) Running a home business	1	2	3
(h) Accessing educational resources	1	2	3
(i) Accessing government information	1	2	3
(j) Accessing medical services	1	2	3
(k) Banking or paying bills	1	2	3
(l) Accessing home security/other "smart home" devices	1	2	3
(m) Accessing cloud-based file storage and sharing	1	2	3

4

12. **Please indicate how much you disagree or agree with the following statements regarding your internet skills.** *(please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)*

Skill	Strongly Disagree				Strongly Agree
(a) I know how to upload content (such as videos, photos, music) to a website	1	2	3	4	5
(b) I know how to block spam or unwanted content	1	2	3	4	5
(c) I know how to adjust my privacy settings online, such as on Facebook or other sites	1	2	3	4	5
(d) I know how to bookmark a website or add a website to my list of favorites	1	2	3	4	5
(e) I know how to identify false or misleading information online and find credible sources of information	1	2	3	4	5
(f) I know how to create and manage my own personal profile on Facebook or other social network site	1	2	3	4	5
(g) I know how to create and manage my own personal website	1	2	3	4	5
(h) I know how to recognize and avoid a phishing request	1	2	3	4	5
(i) I know how to create my own content (such as videos, photos, music) using computers and the internet	1	2	3	4	5
(j) I know how to access my bank account online to perform tasks such as paying bills or depositing checks with my phone	1	2	3	4	5

5

13. **Please indicate how often you use the internet in the following locations on average, where 1=never, 2=rarely, 3=at least monthly, 4=at least weekly, and 5=at least daily.**

Location	Never	Rarely	Monthly	Weekly	Daily
(a) At my home	1	2	3	4	5
(b) At the home of a friend or family member	1	2	3	4	5
(c) At work	1	2	3	4	5
(d) At school or a college/university	1	2	3	4	5
(e) At a coffee shop or other private business	1	2	3	4	5
(f) At the Cambridge Public Library	1	2	3	4	5
(g) At other public city buildings such as City Hall, Senior Center, or Community Learning Center.	1	2	3	4	5
(h) At outdoor public spaces using Wi-Fi	1	2	3	4	5

14. **Does your job require you to have internet access at your home?**

    1 Yes
    2 No

15. **Are you or is any member of your household currently teleworking, or interested in telework opportunities?**

    1 Someone in my household currently does telework from home
    2 Someone in my household would like to telework
    3 No

16. **Does someone in your household have a home-based business or plan to start a home-based business in the next three years?**

    1 Yes, I/we already have a home-based business
    2 Yes, I/we plan to start one in next three years
    3 No

6

17. How important is a high-speed data or internet connection for: *(please circle your response for each aspect, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important)*

Aspect	Not at All Important				Extremely Important	N/A
(a) Teleworking	1	2	3	4	5	9
(b) Planned/existing home-based business	1	2	3	4	5	9

18. Does a member of your household use the internet connection for educational purposes, such as completing assignments, research, home-schooling, or study related to coursework or formal education?

1   Yes

2   No **(Please skip to Question 22)**

19. Does a member of your household use the internet connection for educational purposes related to homeschooling?

1   Yes

2   No

20. For what education level is your internet connection used?
(✓ all that apply)

1   Early Childhood (Preschool, 3K, 4K)

2   Primary (Grades 5k – 8)

3   Secondary (Grades 9 – 12)

4   Post-Secondary (Technical/vocational training, college, etc.)

5   Graduate (Graduate, post-graduate, professional degree)

6   Continuing or Adult Education/Professional Development

7   Other _____

21. How important is a high-speed internet connection for your educational needs?

1   Not at all important   4   Very important

2   Slightly important   5   Extremely important

3   Moderately important

7

ROLE OF THE CITY

22. Please indicate to what extent you disagree or agree that the City of Cambridge should do the following: *(please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)*

Aspect	Strongly Disagree				Strongly Agree
(a) Help ensure that all residents have access to competitively priced broadband internet services	1	2	3	4	5
(b) Help ensure that all residents know how to make effective use of broadband and computers	1	2	3	4	5
(c) Provide free Wi-Fi in public areas of the City	1	2	3	4	5

23. Please indicate to what extent you disagree or agree with the following statements: *(please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree)*

Aspect	Strongly Disagree				Strongly Agree
(a) The market currently offers high-speed internet at prices that my family can afford	1	2	3	4	5
(b) The availability of high-speed internet is a factor I would consider when choosing where to live	1	2	3	4	5
(c) The availability of high-speed internet is a factor I would consider when determining to start a home-based business	1	2	3	4	5
(d) High-speed home internet service is important for my work/job	1	2	3	4	5
(e) High-speed home internet service is important for my family's educational opportunities	1	2	3	4	5
(f) I am willing to pay a premium for access to high-speed internet	1	2	3	4	5

8

24. **Consider at what price level you would be interested in purchasing high speed internet service from another commercial service provider. How willing would you be to purchase 100 Mbps (very fast, fiber optic level of service) for the following monthly price?** *(please circle your response at each price level, where 1=Not at all willing, 2=Slightly willing, 3=Moderately willing, 4=Very willing, 5=Extremely willing)*

Monthly Price	Not at all willing				Extremely willing
(a) $50 per month	1	2	3	4	5
(b) $70 per month	1	2	3	4	5
(c) $90 per month	1	2	3	4	5
(d) $110 per month	1	2	3	4	5
(e) $130 per month	1	2	3	4	5
(f) $150 per month	1	2	3	4	5

25. **Consider at what price level you would be interested in purchasing high speed internet service from another commercial service provider. How willing would you be to purchase 1 Gbps (an even faster fiber optic level of service) for the following monthly price?** *(please circle your response at each price level, where 1=Not at all willing, 2=Slightly willing, 3=Moderately willing, 4=Very willing, 5=Extremely willing)*

Monthly Price	Not at all willing				Extremely willing
(a) $50 per month	1	2	3	4	5
(b) $70 per month	1	2	3	4	5
(c) $90 per month	1	2	3	4	5
(d) $110 per month	1	2	3	4	5
(e) $130 per month	1	2	3	4	5
(f) $150 per month	1	2	3	4	5

9

26. **How important to you are the following features in your home internet service?** *(please circle your response for each aspect, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important)*

Feature	Not at All Important				Extremely Important
(a) I can choose from multiple internet providers	1	2	3	4	5
(b) I can buy internet service with very high connection speeds	1	2	3	4	5
(c) I can pay for internet service based on usage (amount of data)	1	2	3	4	5
(d) My service provider does not place limits on my total data use	1	2	3	4	5
(e) I can use my home internet connection to telework for my job	1	2	3	4	5
(f) Ability to "bundle" with other services	1	2	3	4	5

27. **Are you enrolled in Comcast's Internet Essentials program, which provides $9.95 (plus tax) home internet service and other benefits to eligible low-income subscribers?**

   ☐1 Yes
   ☐2 No
   ☐3 Don't know

28. **Do you receive a $9.25 subsidy on either a wireline or wireless broadband service under the FCC's "Lifeline" program, which is available to eligible low-income subscribers?**

   ☐1 Yes
   ☐2 No
   ☐3 Don't know

10

INFORMATION ABOUT YOU

The following questions will help describe the total group of survey respondents. Your individual information will not be reported separately—it will be reported only as a part of a larger group to help ensure that the respondents are a representative sample of the residents of the City of Cambridge.

29. Which of the following best describes your age?

- ☐1 18 to 34 years
- ☐2 35 to 44 years
- ☐3 45 to 54 years
- ☐4 55 to 64 years
- ☐5 65 years and older

30. What is the highest level of education you have completed?

- ☐1 Some high school
- ☐2 Completed high school
- ☐3 Two-year college or technical degree
- ☐4 Four-year college degree
- ☐5 Graduate, professional, or doctorate degree

31. What is your approximate annual _household_ income?

- ☐1 Less than $25,000
- ☐2 $25,000 to $49,999
- ☐3 $50,000 to $74,999
- ☐4 $75,000 to $99,999
- ☐5 $100,000 to $149,999
- ☐6 $150,000 to $199,999
- ☐7 $200,000 or more
- ☐8 Prefer not to answer

32. **What is your ethnicity?** (✓ *all that apply*)

  ☐₁ White, non-Hispanic
  ☐₂ Hispanic, Latino, or Spanish origin
  ☐₃ Black or African American
  ☐₄ Asian or Pacific Islander
  ☐₅ American Indian or Alaska Native
  ☐₆ Other: _____

33. **What is your gender identity?**

  (please specify): _____

34. **How many people reside in your home (adults and children)?**

Adults (including yourself)	Children age 18 and younger
☐₁ 1	☐₁ None
☐₂ 2	☐₂ 1
☐₃ 3	☐₃ 2
☐₄ 4 or more	☐₄ 3
	☐₅ 4 or more

35. **Do you own or rent your residence?**

  ☐₁ Own
  ☐₂ Rent

36. **How long have you lived at your current address?**

  ☐₁ Less than 1 year
  ☐₂ 1 to 2 years
  ☐₃ 3 to 4 years
  ☐₄ 5 or more years

Thank you for completing this survey!

12

Appendix B: Cambridge Housing Authority Survey Instrument

Cambridge Housing Authority

Internet Usage Survey

July 2020

Even if you do not have home internet service, please complete the relevant portions of this survey and return to us. Your opinions, experiences, and information are important to us.

If you need help completing this survey in your language, contact Lee Gianetti, Director of Communications, at 617-349-3317 or lgianetti@cambridgema.gov

The City of Cambridge is sending you this survey as part of its research into how Cambridge Housing Authority (CHA) residents use internet services. *The information gathered will not be used to sell you anything, and individual responses will not be shared with CHA or the City.* The survey data will be used to help the City explore strategies to improve internet accessibility and affordability in CHA housing and to help residents make effective use of broadband and computers.

Even if you do not have internet access at your home, please complete the relevant portions of this survey.

How long will the survey take?
This survey should take approximately 15 minutes to complete.

What is the due date to complete the survey?
Please return your completed form in the enclosed postage-paid envelope by <u>July 25, 2020</u>.

What if I have questions about the survey?
If you have questions regarding this survey, please contact Lee Gianetti, the director of communications for the City of Cambridge, at 617-349-3317 or lgianetti@cambridgema.gov
Thank you in advance for your participation!

1. **Do you use the internet (also known as "going online") on any device from any location (e.g. home, work, community center, school, CHA office, coffee shop, library, friend's house, etc)?**

   ☐ Yes **(Please skip to Question 3)**
   ☐ No **(Please complete the entire survey)**

2. **Thinking about the reasons why you do NOT use the internet, please indicate how much you agree or disagree with the following statements.**

   Please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Reason	Strongly Disagree				Strongly Agree
(a) An internet connection is too expensive.	1	2	3	4	5
(b) I am concerned about my safety and privacy.	1	2	3	4	5
(c) I do not have enough time.	1	2	3	4	5
(d) I am not interested.	1	2	3	4	5
(e) I don't need to go online because I have someone who will do it for me.	1	2	3	4	5
(f) I have no one to teach me how to go online.	1	2	3	4	5
(g) Using the internet is too difficult	1	2	3	4	5

1

3. Thinking about your normal habits <u>before</u> the Covid-19 pandemic, please indicate how often you used the internet in the following locations on average, where 1=never, 2=rarely, 3=at least monthly, 4=at least weekly, and 5=at least daily.

Location	Never	Rarely	Monthly	Weekly	Daily
(a) At my home	1	2	3	4	5
(b) At the home of a friend or family member	1	2	3	4	5
(c) In community spaces at CHA properties	1	2	3	4	5
(d) At work	1	2	3	4	5
(e) At school or a college/university	1	2	3	4	5
(f) At a coffee shop or other private business	1	2	3	4	5
(g) At the Cambridge Public Library	1	2	3	4	5
(h) At other public city buildings such as City Hall, Senior Center, or Community Learning Center.	1	2	3	4	5
(i) At outdoor public spaces using Wi-Fi	1	2	3	4	5

4. Thinking about how you have been using the internet <u>during</u> the Covid-19 pandemic, please indicate how often you use the internet in the following locations on average, where 1=never, 2=rarely, 3=at least monthly, 4=at least weekly, and 5=at least daily.

Location	Never	Rarely	Monthly	Weekly	Daily
(a) At my home	1	2	3	4	5
(b) At the home of a friend or family member	1	2	3	4	5
(c) In community spaces at CHA properties	1	2	3	4	5

2

(d) At work	1	2	3	4	5
(e) At school or a college/university	1	2	3	4	5
(f) At a coffee shop or other private business	1	2	3	4	5
(g) At the Cambridge Public Library	1	2	3	4	5
(h) At other public city buildings such as City Hall, Senior Center, or Community Learning Center.	1	2	3	4	5
(i) At outdoor public spaces using Wi-Fi	1	2	3	4	5

5. **Which of the following services do you or other people in your household currently use?** (✔ *all that apply*)

- ☐ Internet service in my home (not including cellular/mobile)
- ☐ Cellular/mobile telephone service with internet (smartphone)
- ☐ Cellular/mobile telephone service without internet (basic phone)
- ☐ Landline telephone service
- ☐ Cable or satellite television
- ☐ Free Wi-Fi service
- ☐ Don't know
- ☐ None of the above

3

6. How important are the following services to your household?

Please circle your response for each category, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important

Service	Not at all important				Extremely important
(a) Internet connection (any speed)	1	2	3	4	5
(b) High-speed internet connection	1	2	3	4	5
(c) Cable television service	1	2	3	4	5
(d) Free broadcast TV from an antenna	1	2	3	4	5
(e) Satellite television service	1	2	3	4	5
(f) Fixed (land-line) telephone service	1	2	3	4	5
(g) Cellular/mobile telephone service	1	2	3	4	5
(h) Free public Wi-Fi service	1	2	3	4	5

7. How do you or other people in your household <u>connect to the</u> internet in your home? Select only the primary method. (✓ only <u>one</u>)

- ☐ Members of my household never connect to the internet at home, not even from a smartphone **(Please <u>skip</u> to Question 19)**
- ☐ Telephone line (dial-up)
- ☐ Digital Subscriber Line (DSL) (from Verizon or other)
- ☐ Cable modem (from Comcast)
- ☐ Satellite (from DirecTV Dish Network, or HughesNet, etc.)
- ☐ Cellular/mobile internet (such as via a smartphone)
- ☐ Share Wi-Fi with a neighbor
- ☐ Mobile hotspot borrowed from the Cambridge School Department
- ☐ Fiber-optic connection
- ☐ Fixed wireless service (from NetBlazr or Starry or other, not just wireless router in home)
- ☐ Other (Please specify: _____)

4

8. **What company is the primary internet service provider for your home?**
   (✓ only one)

   ☐ Comcast (cable service)
   ☐ Dish Network
   ☐ Verizon (DSL service)
   ☐ AT&T (mobile phone)
   ☐ Verizon wireless (mobile service)
   ☐ T-Mobile/Sprint, also called "New T-Mobile" (mobile service)
   ☐ NetBlazr
   ☐ Starry
   ☐ Other (Please specify:_____)
   ☐ No provider

9. **If you are a Comcast customer, are you enrolled in Comcast's Internet Essentials program, which provides low-cost home internet service and other benefits to eligible low-income subscribers?**

   ☐ Yes
   ☐ I am a Comcast customer but have not applied
   ☐ I am a Comcast customer and attempted to enroll in this program but was declined
   ☐ I am a Comcast customer but was unaware of this program until now

10. **Do you receive a $9.25 subsidy on either a wireline or wireless broadband service under the FCC's "Lifeline" program, which is available to eligible low-income subscribers?**

    ☐ Yes
    ☐ No
    ☐ Don't know

5

11. **How important are the following aspects of your primary _home_ internet service if you have or were to purchase broadband internet service?**
(please circle your response for each aspect, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important)

Aspect	Not at all important				Extremely important
(a) Speed of connection	1	2	3	4	5
(b) Reliability of connection	1	2	3	4	5
(c) Price of services	1	2	3	4	5
(d) Overall customer service	1	2	3	4	5
(e) Ability to "bundle" with TV and phone	1	2	3	4	5

12. **How satisfied are you with the following aspects of your current _home_ internet service?** (please circle your response for each aspect, where 1=Not at all satisfied, 2=Slightly satisfied, 3=Moderately satisfied, 4=Very satisfied, 5=Extremely satisfied)

Aspect	Not at all Satisfied				Extremely Satisfied
(a) Speed of connection	1	2	3	4	5
(b) Reliability of connection	1	2	3	4	5
(c) Price of services	1	2	3	4	5
(d) Overall customer service	1	2	3	4	5
(e) Ability to "bundle" with TV and phone (not applicable if your primary home connection is a smartphone)	1	2	3	4	5

13. **Thinking about how the Covid-19 pandemic may have affected your satisfaction with your current *home* internet service, how did this satisfaction change for the following aspects?** *(please circle your response for each aspect, where 1=Much less satisfied, 2=Slightly less satisfied, 3=About the same level of satisfaction, 4=Slightly more satisfied, 5=Much more satisfied)*

Aspect	Much less satisfied during pandemic			Much more satisfied during pandemic	
(f) Speed of connection	1	2	3	4	5
(g) Reliability of connection	1	2	3	4	5
(h) Price of services	1	2	3	4	5
(i) Overall customer service	1	2	3	4	5
(j) Ability to "bundle" with TV and phone (not applicable if your primary home connection is a smartphone)	1	2	3	4	5

14. **How many devices such as desktop/laptop computers, tablets, smartphones, internet-connected console gaming devices, are used in your home?**

    ☐ 1 or 2
    ☐ 3 or 4
    ☐ 5 or more
    ☐ I do not have any of these devices in my home

15. **Which devices do you or other members of your household use to access the internet in your home? Check all that apply.**

    ☐ Desktop computer
    ☐ Laptop computer
    ☐ Tablet computer, such as an iPad
    ☐ Smartphone
    ☐ Console gaming devices
    ☐ Smart TV or device that connects TV to internet (e.g. Roku)

16. **Were any of the devices you mentioned in the previous question issued by the Cambridge public schools?**

    ☐ Yes
    ☐ No

7

17. **Is the computer you primarily use issued by your employer?**

    ☐ Yes *(please skip to question 20)*
    ☐ No

18. **Thinking about the computer you primarily use (desktop, laptop or tablet computer), how often does it become unavailable or unusable for any reason?**

    ☐ Once a week or more
    ☐ Once a month
    ☐ Once a year
    ☐ This has never happened to me

19. **Thinking about the computer you primarily use (desktop, laptop or tablet computer), if it were lost or damaged beyond repair, how long do you think it would take you to replace it?**

    ☐ I could not replace it
    ☐ 1-6 months
    ☐ 2-4 weeks
    ☐ About one week
    ☐ About one day
    ☐ This does not apply to me

20. **Approximately how much does your household pay PER MONTH for your _home_ internet service (not including television or phone service if you bundle services)?**

    ☐ $0 to $10   ☐ $61 to $80
    ☐ $11 to $20   ☐ $81 to $100
    ☐ $21 to $40   ☐ $101 to $120
    ☐ $41 to $60   ☐ More than $120

21. **Is the fee in Question 15 part of a bundled package (purchased together with cable TV or phone service)?**

    ☐ Yes
    ☐ No

22. **If you are a Comcast customer who is not enrolled in Comcast's Internet Essentials program, we'd like to know what you are charged each month. If you are willing to share this information please refer to your bill and look for the summary of charges (often found on Page 3). Please enter the dollar figures you see after:**

"Regular Monthly Charges"_____ $_____
"Your Xfinity Package" _____$_____
"Equipment and Services" _____ $_____
"Other Service Providers"_____$_____
"Service Fees"_____ $_____
"Taxes, Fees and Other Charges" _$_____

23. **If your primary home internet connection is NOT a cellular/mobile connection (smartphone), how often does a member of your household use your primary home internet connection for:** *(please circle your response for each activity)*

Home Internet Activity	Never	Occasionally	Frequently
(a) Listening to music (streaming)	1	2	3
(b) Watching movies, videos, or TV	1	2	3
(c) Playing online games	1	2	3
(d) Connecting to work	1	2	3
(e) Using social media	1	2	3
(f) Shopping online	1	2	3
(g) Running a home business	1	2	3
(h) Accessing educational resources	1	2	3
(i) Accessing government information	1	2	3
(j) Accessing medical services	1	2	3
(k) Banking or paying bills	1	2	3
(l) Accessing home security/other "smart home" devices	1	2	3
(m) Accessing cloud-based file storage and sharing	1	2	3

24. How often does a member of your household use a _cellular/ mobile_ internet connection (smartphone) for:

Please circle your response for each activity

Home Internet Activity	Never	Occasionally	Frequently
(a) Listening to music (streaming)	1	2	3
(b) Watching movies, videos, or TV	1	2	3
(c) Playing online games	1	2	3
(d) Connecting to work	1	2	3
(e) Using social media	1	2	3
(f) Shopping online	1	2	3
(g) Running a home business	1	2	3
(h) Accessing educational resources	1	2	3
(i) Accessing government information	1	2	3
(j) Accessing medical services	1	2	3
(k) Banking or paying bills	1	2	3
(l) Accessing home security/other "smart home" devices	1	2	3
(m) Accessing cloud-based file storage and sharing	1	2	3

25. **Please rate how much you disagree or agree with the following statements regarding your computer and internet skills.**

Please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Skill	Strongly Disagree				Strongly Agree
(a) I know how to upload content (such as videos, photos, music) to a website.	1	2	3	4	5
(b) I know how to block spam or unwanted content.	1	2	3	4	5
(c) I know how to adjust my privacy settings online, such as on Facebook or other sites.	1	2	3	4	5
(d) I know how to bookmark a website or add a website to my list of favorites.	1	2	3	4	5
(e) I know how to identify false or misleading information online and find credible sources of information.	1	2	3	4	5
(f) I know how to create and manage my own personal profile on Facebook or other social network site.	1	2	3	4	5
(g) I know how to create and manage my own personal website.	1	2	3	4	5
(h) I know how to recognize and avoid a phishing scam.	1	2	3	4	5
(i) I know how to create my own content (such as videos, photos, music) using computers and the internet.	1	2	3	4	5
(j) I know how to access my bank account online to perform tasks such as paying bills or depositing checks with my phone.	1	2	3	4	5
(k) I know how to troubleshoot issues with technology when they arise.	1	2	3	4	5
(l) I know how to purchase groceries and food online.	1	2	3	4	5
(m) I know how to connect with my doctor or other medical support online.	1	2	3	4	5

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26. **Please rate how much you disagree or agree with the following statements.**

Please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Statement	Strongly Disagree				Strongly Agree
(a) I would like to become more confident in using computers, smartphones, and the internet.	1	2	3	4	5
(b) I would attend a free or inexpensive class to become more confident in using computers, smartphones, and the internet.	1	2	3	4	5
(c) I would like to know how to better use online resources to find trustworthy information.	1	2	3	4	5
(d) I would attend a free or inexpensive class on how to use online resources to find trustworthy information.	1	2	3	4	5
(e) I would like to learn how computers work.	1	2	3	4	5
(f) I would attend a free or inexpensive class to learn how computers work.	1	2	3	4	5
(g) I would like to learn how to write software (or "code").	1	2	3	4	5
(h) I would attend a free or inexpensive class to learn how to write software (or "code").	1	2	3	4	5

TECHNOLOGY FOR CHILDREN

27. Are you the parent, legal guardian or primary caregiver for any child or grandchild under the age of 18?

☐ Yes   ☐ No (Please skip to **Question 30**)

28. Please rate how much you disagree or agree with the following statements about the benefits of technology for the children you care for.

Please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Statement	Strongly Disagree				Strongly Agree
(a) The children I care for cannot complete their homework because they do not have access to the internet.	1	2	3	4	5
(b) The children I care for cannot complete their homework because they do not have access to computers.	1	2	3	4	5
(c) My computer skills are good enough to help children I care for to complete their homework.	1	2	3	4	5
(d) The children I care for have good enough computer skills to complete their homework on their own.	1	2	3	4	5
(e) The children I care for are learning computer skills at school that will prepare them for the future.	1	2	3	4	5
(f) The children I care for access the internet at school, a community center, or a public library.	1	2	3	4	5
(g) I learn computer or internet skills from the children I care for.	1	2	3	4	5

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29. **Please rate how much you disagree or agree with the following statements about internet safety for you and the children you care for.**

Please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Internet Safety	Strongly Disagree				Strongly Agree
(a) The children I care for have the skills to detect and avoid false or misleading information online.	1	2	3	4	5
(b) The children I care for are able to avoid online bullying by peers.	1	2	3	4	5
(c) The children I care for know how to get help dealing with online bullying.	1	2	3	4	5
(d) The children I care for know how to recognize and avoid online financial scams or predators.	1	2	3	4	5
(e) I know how to set up parental controls/quality filters online for the children I care for.	1	2	3	4	5
(f) I feel that I am aware of the extent to which children I care for are exposed to any of the above types of risks or content.	1	2	3	4	5
(g) I am interested in learning how to identify online risks for the children I care for.	1	2	3	4	5

INTERNET FOR EMPLOYMENT

30. **Does your job require you to have internet access at your home?**

    ☐ Yes
    ☐ No
    ☐ Does not apply: Retired or not employed at this time

31. **Are you or any member of your household currently working from home using computers and the internet (teleworking) or interested in doing so?**

    ☐ Someone in my household currently teleworks
    ☐ Someone in my household would like to telework
    ☐ No

32. **If you checked the first box in the previous question, was that person working from home using computers and the internet (teleworking) before the Covid-19 pandemic?**

    ☐ Yes
    ☐ No

33. **Does someone in your household have a home-based business or plan to start a home-based business in the next three years?**

    ☐ Yes, I/we already have a home-based business
    ☐ Yes, I/we plan to start one in next three years
    ☐ No

34. **How important is high-speed internet access for:**

    Please circle your response for each item below where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important

	Not at all important			Extremely important		N/A
(a) Working from home (teleworking)	1	2	3	4	5	6
(b) Planned/existing home-based business	1	2	3	4	5	6
(c) Applying for/researching new job opportunities	1	2	3	4	5	6

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INTERNET FOR EDUCATION

35. **Does a member of your household use the internet for educational purposes, such as completing assignments, research, homeschooling, professional development, or study related to coursework or formal education?**

    ☐ Yes
    ☐ No **(Please skip to Question 40)**

36. **If you checked "yes" to the previous question, did that member of your household use the internet for educational purposes <u>before</u> the Covid-19 pandemic?**

    ☐ Yes
    ☐ No

37. **Does a member of your household use the internet for educational purposes related to homeschooling?**

    ☐ Yes
    ☐ No

38. **What is the current education level of those using your internet connection in your household?** (✓ *all that apply*)

    ☐ Preschool (early childhood)
    ☐ Primary (kindergarten – Grade 8)
    ☐ Secondary (Grades 9 – 12)
    ☐ Post-Secondary (Technical/vocational training, college, etc.)
    ☐ Graduate (Graduate, post-graduate, professional degree)
    ☐ Continuing or Adult Education/Professional Development
    ☐ Other _____

39. **How important is high-speed internet for your household educational needs?**

    ☐ Not at all important   ☐ Very important
    ☐ Slightly important   ☐ Extremely important
    ☐ Moderately important

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INTERNET ACCESS & AFFORDABILITY

40. Please indicate to what extent you disagree or agree with the following statements.

Please circle your response for each statement, where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Statements	Strongly Disagree				Strongly Agree
(a) The market currently offers high-speed internet at prices that my family can afford.	1	2	3	4	5
(b) The availability of high-speed internet is a factor I would consider when choosing where to live.	1	2	3	4	5
(c) The availability of high-speed internet is a factor I would consider when determining to start a home-based business.	1	2	3	4	5
(d) High-speed home internet service is important for my work/job.	1	2	3	4	5
(e) High-speed home internet service is important for my family's educational opportunities.	1	2	3	4	5
(f) I am willing to pay a premium for access to high-speed internet.	1	2	3	4	5
(g) I receive high-quality customer service from my internet service provider.	1	2	3	4	5

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Extremely fast internet service is considered 1 Gigabit per second or more. This speed can handle multiple high-definition videos at the same time or transmit large video or other files almost instantly.

41. **How much would you be willing to pay monthly for extremely fast home internet service?**

Please circle your response at each price level, where 1=Not at all willing, 2=Slightly willing, 3=Moderately willing, 4=Very willing, 5=Extremely willing

Monthly Price	Not at all willing				Extremely willing
(a) $10 per month	1	2	3	4	5
(b) $30 per month	1	2	3	4	5
(c) $50 per month	1	2	3	4	5
(d) $70 per month	1	2	3	4	5
(e) $90 per month	1	2	3	4	5

42. **How important are the following features in your home internet service?**

Please circle your response for each aspect, where 1=Not at all important, 2=Slightly important, 3=Moderately important, 4=Very important, 5=Extremely important

Feature	Not at all important				Extremely important
(a) I can choose from multiple internet providers.	1	2	3	4	5
(b) I can buy internet service with very high connection speeds.	1	2	3	4	5
(c) I can pay for internet service based on usage (amount of data).	1	2	3	4	5
(d) My internet provider does not place limits on my total data use.	1	2	3	4	5
(e) I can use my home internet connection to telework for my job.	1	2	3	4	5
(f) I can "bundle" internet service with other services such as phone and cable TV.	1	2	3	4	5

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INFORMATION ABOUT YOU

The following questions will help describe the total group of survey respondents. Your individual information will not be reported separately—it will be reported only as a part of a larger group to help ensure that the respondents are a representative sample of the residents of the Cambridge Housing Authority.

43. Which of the following best describes your age?

- ☐ 18 to 34 years
- ☐ 35 to 44 years
- ☐ 45 to 54 years
- ☐ 55 to 64 years
- ☐ 65 years and older

44. What is the highest level of education you have completed?

- ☐ Some high school
- ☐ Completed high school
- ☐ Two-year college or technical degree
- ☐ Four-year college degree
- ☐ Graduate, professional, or doctorate degree

45. What is your approximate annual <u>household</u> income?

- ☐ Less than $25,000
- ☐ $25,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $149,999
- ☐ $150,000 to $199,999
- ☐ $200,000 or more
- ☐ Prefer not to answer

46. What is your ethnicity? (✓ *all that apply*)

☐ White, non-Hispanic
☐ Hispanic, Latino, or Spanish origin
☐ Black or African American
☐ Asian or Pacific Islander
☐ American Indian or Alaska Native
☐ Other: _____

47. What is your gender identity?

(please specify): _____

48. How many people reside in your home (adults and children)?

Adults (including yourself)	Children age 18 and younger
☐ 1	☐ None
☐ 2	☐ 1
☐ 3	☐ 2
☐ 4 or more	☐ 3
	☐ 4 or more

49. How long have you lived at your current address?

☐ Less than 1 year
☐ 1 to 2 years
☐ 3 to 4 years
☐ 5 or more years

50. Would you be willing to be interviewed by phone by the City of Cambridge or its survey contractor about your internet-related experiences so we can learn more about how you use the internet and your needs?

☐ No
☐ Yes
If you checked "yes" please provide your name and phone number and the general topic you'd like to discuss:

Name:_____

Phone number:_____

Topic:_____

Thank you for completing this survey!

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Appendix C: Cambridge Nonprofit Coalition Staff Survey Report

--DRAFT--

Nonprofit Staff Perceptions of Digital Equity in Cambridge

Data Analysis by Alex Cheng, Ethan Lee, Lucas Pao, and Leo Saenge, Harvard Open Data Project

Survey designed and conducted by the Cambridge Digital Equity Working Group

As the COVID-19 pandemic continues to impact people and organizations across the world, digital equity has become a crucial issue. Access to reliable internet connections and digital devices has become more vital than ever for institutions and Cambridge residents, with many programs and services having moved online as a result of social distancing requirements.

The Cambridge Digital Working Group (led by Boston- based Tech Goes Home) surveyed the staff from Cambridge-based nonprofits on their perception of their clients' access to technology (hardware, connectivity and technical skills.) The analysis revealed significant unmet need across a wide range of different populations.

Background of Survey Respondents

Representatives from 53 different Cambridge serving nonprofits responded to the Digital Equity Survey. Respondents represented organizations from a variety of service and programmatic areas. (Note that some nonprofits listed themselves as focusing on multiple issues, which was accounted for in calculating the frequency of nonprofits representing each one).

Services Provided by Respondent Organizations
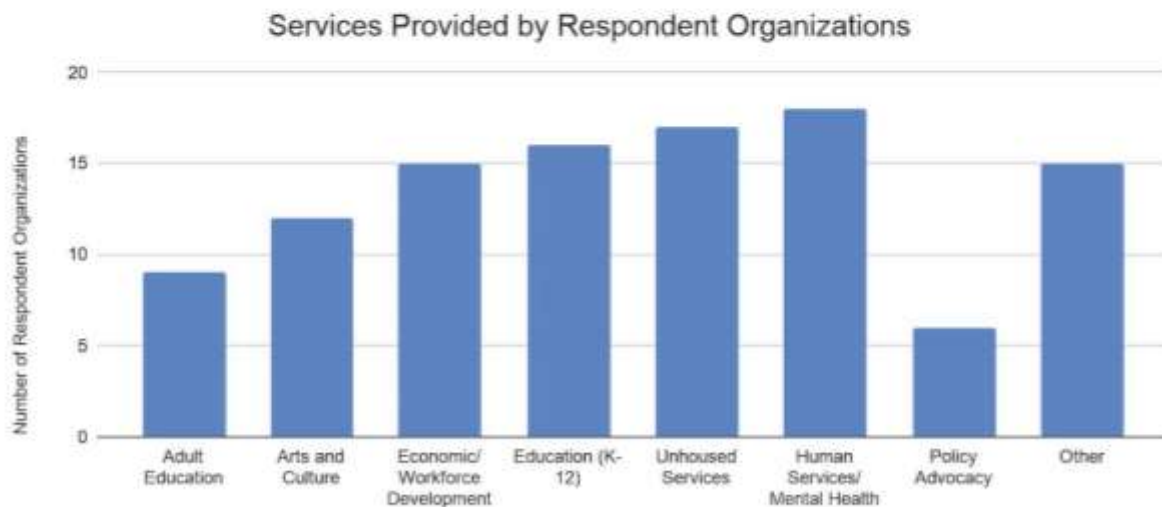
Most respondents (80.4%) noted that their clients require use of the internet for a wide variety of activities ranging from participating in telehealth appointments, and educational classes, to filing for benefits and conducting employment searches, with only around 10 reporting that their clients do not need to use the internet. Respondents also overwhelmingly noted that digital

devices are necessary to access their services, with 17.6% reporting that their clients do not need such devices.

Digital Equity Issues and Needs of Respondents

Survey respondents reported similar challenges in their clients' access to devices and access to the internet.

Beginning with internet connectivity, reported challenges include:

- Poor connection
- Slow speeds
- Limited plan or data caps

Client Issues with Internet Connectivity
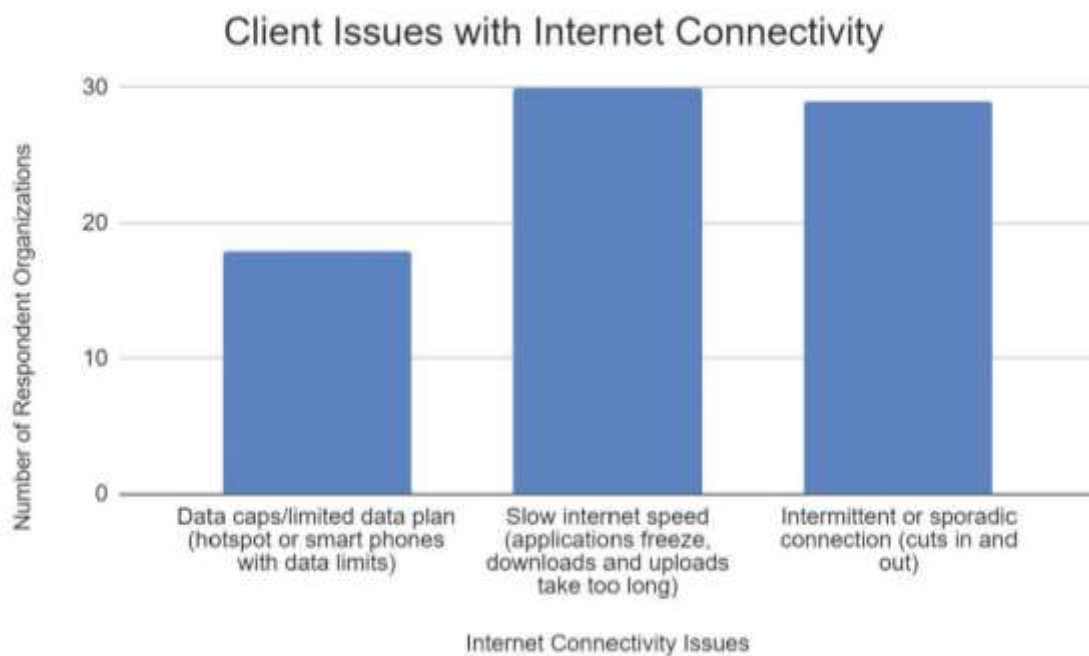
Among respondents, nearly 60% reported their clients were experiencing slow internet speeds and 54.9% said that they were experiencing intermittent or sporadic connections. This presented a major concern, as most respondents required internet access for their clients to participate in programs and services.

This may be because the most common type of internet connection among those who had internet was from cell phone data, followed by internet from public Wi-Fi access (see chart below). Public internet connections tend to be less reliable and slower than a standard Wi-Fi connection due to the large number of users and devices that automatically connect to these connections, and could explain why many respondent clients are experiencing connectivity issues.

It is also significant that overall, the second most common type of internet connection reported was no internet connection at all, posing a significant barrier for clients attempting to access services.

Clients without sufficient internet connection: Connection type
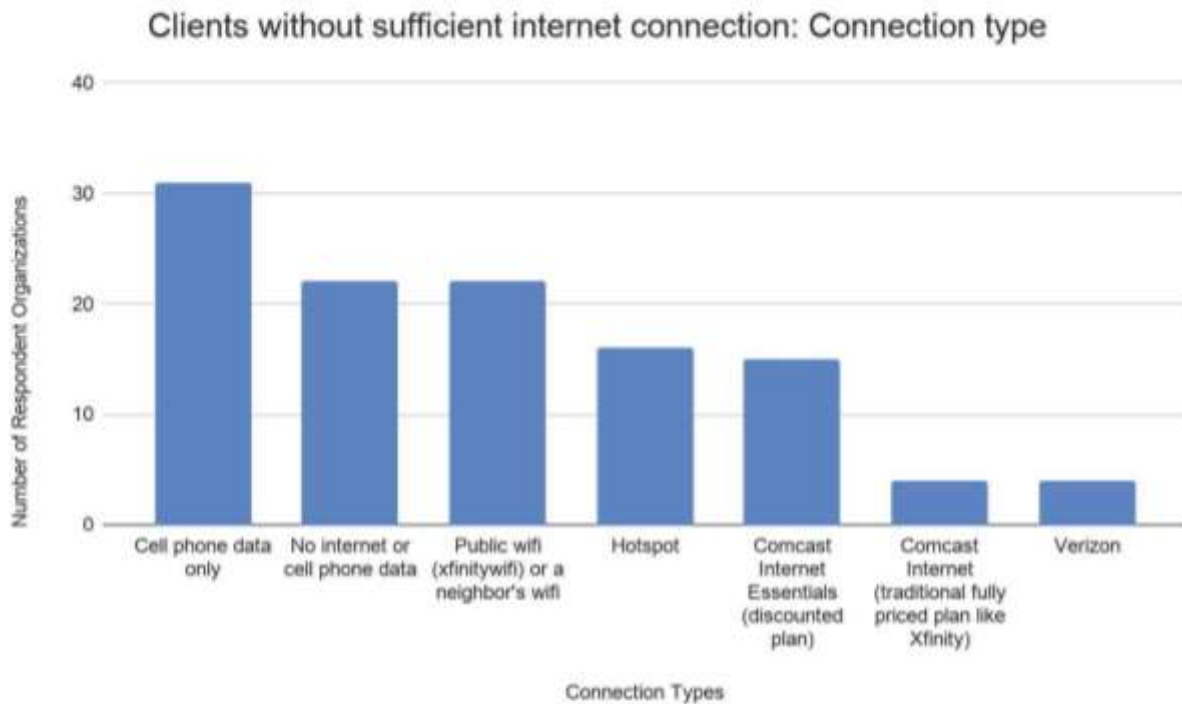
Respondents working in K-12 education, arts and culture, and human services reported that internet access was necessary at significantly higher ($p < 0.05$) rate, while organizations working with the unhoused or other populations noted that internet access was less necessary to access their services.

Similar trends held true for the need for digital devices by nonprofit program participants across nonprofit subsectors. K-12 education, arts and culture, and human services nonprofits noted that their clients required digital devices at a significantly higher rate. Additionally, the nonprofit subsector with the most respondents noting that digital devices were not needed were unhoused services providers. *It is worth noting, however, that well over half of respondents, regardless of organization type, reported providing services that require digital devices or internet access.*

Do clients have sufficient internet connectivity to access services and obtain essentials?
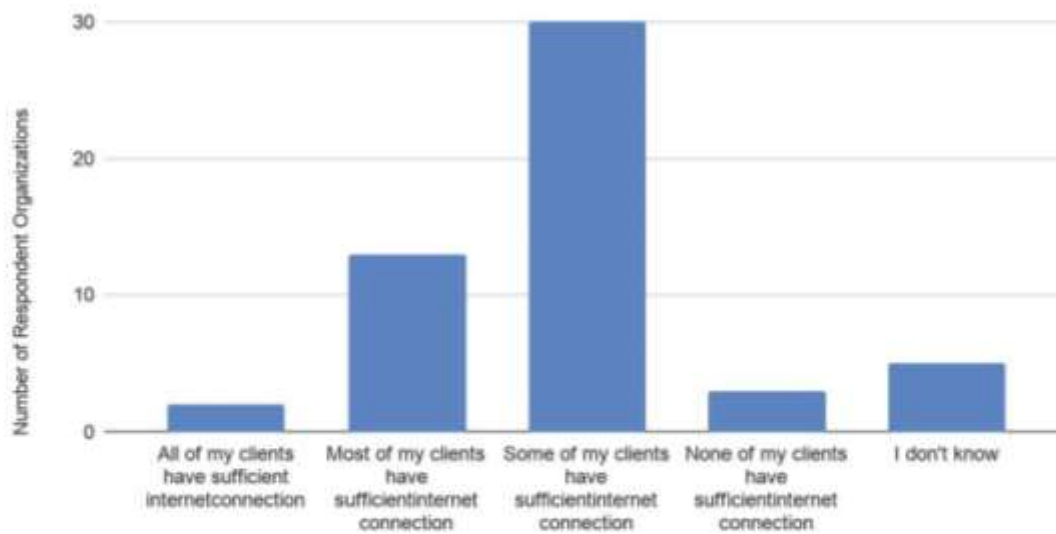
Unfortunately, fewer than 10% of respondents that required internet access for programs felt that all their clients had sufficient internet access. The majority noted that only some of their clients had internet access. Around 6% of respondents noted that none of their clients had the necessary internet access for their services. No type of organization was statistically significant in predicting the intensity of internet access need, after accounting for the full range of organization types.

Do clients have a digital device (computer, tablet, smartphone) to access services and obtain essentials?
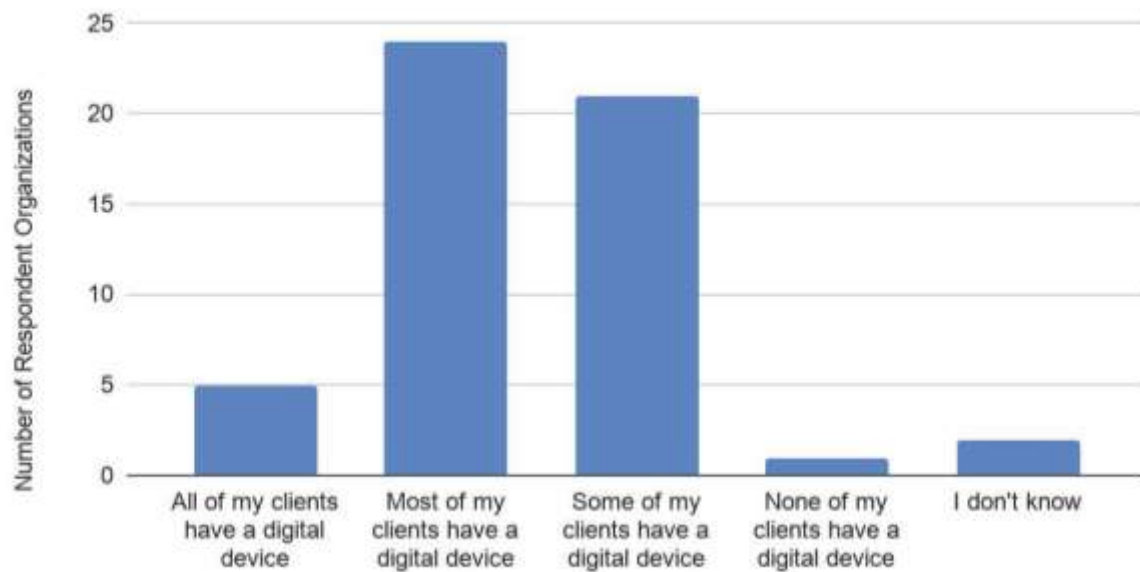
Among respondents that required device access, the picture was similar: fewer than 10% of respondents reported that all their clients had the digital devices necessary to access services. However, unlike reported internet access issues, the percentage of nonprofits reporting that most or all clients had access was significantly higher (greater than half of all respondents). In addition, while K-12 education providers had significantly greater device access, all other organization types did not. *This suggests that our results here are biased by the presence of K-12 education organizations and <u>highlights the unmet need for devices within other areas.</u>*

Nonprofit Digital Equity Needs as Highlighted in Anecdotes

Anecdotes from survey respondents highlighted the need for more investment in digital equity and in distributing technology to nonprofit organizations and their clients more broadly. In addition to addressing the more well-known issues of unequal device distribution, respondents pointed to other specific difficulties that become apparent when conducting virtual activities.

One representative of Cambridge Community Television, which provides training in free speech and civic engagement, emphasized the lack of internet and technology experience possessed by their program participants. The respondent elaborated, "Of those we serve, many are able to afford their own devices and an internet connection but lack training and ongoing technical support. Since the shutdown, we have lost touch with others who have no access (to devices and/or internet) in their homes."

A respondent from The Dance Complex, which provides dance classes, built on this concern by describing the decreased ability for their students to participate over live streams: "We can

assume that there is an unknown quantity of people not even trying to engage through a live-streamed virtual class, and wouldn't think to reach out."

Still another respondent from On The Rise, which provides a community for homeless and formerly-homeless women, wrote that privacy and phone data limits are detrimental to their members: "Many of our program participants use phones with limited minutes, and don't have enough data to do basic tasks online - it's also a barrier to long phone calls. Also, many are in congregate settings where it is difficult to have/protect privacy."

Respondents suggested a variety of potential shorter term solutions to the digital inequity experienced by Cambridge residents including: donation & distribution of digital devices, such as phones, tablets, or computers, public charging stations and a "user friendly web-based educational platform" that could be universally implemented across education-based institutions.

Effectively Addressing Digital Inequity in Cambridge

The responses to the digital equity survey reveal an alarming need for digital devices and reliable internet access, at a time when many critical services have moved online. A vast majority of the survey respondents noted that internet and/or digital device access is required to access services, which shows the urgent need within our community.

Almost all nonprofit respondents also pointed towards a lack of sufficient internet connectivity and digital device access among their clients, especially non-K-12 education-based nonprofits. Various solutions, such as phone and device donations, public charging stations, training on device and internet usage, and internet access or phone data distribution, were suggested, indicating a range of strategies through which digital inequity could be addressed in Cambridge in the near term.

About this report

This article was an analysis by the Harvard Open Data Project, a student-faculty group that analyzes public Harvard data to hold Harvard institutions accountable. For anonymized data or the code used to make the graphs in this article, contact us at board@hodp.org.

The survey was designed, and outreach conducted, by the Cambridge Digital Equity Working Group, which is made up of Cambridge serving nonprofits and public agencies working to address issues related to digital equity. The Cambridge Digital Equity Working Group, led by Tech Goes Home, grew out of Cambridge Nonprofit Coalition (CNC) meetings at the beginning of the COVID-19 pandemic, where concerns about the digital divide were repeatedly raised as obstacles to residents accessing services and other resources. Organizations engaged in the working group have included, Cambridge Nonprofit Coalition, City of Cambridge, Cambridge Public Library, Cambridge Public Schools, Cambridge Community Television, Cambridge Community Foundation, Innovators for Purpose, MIT, and Tech Goes Home.

Appendix D: Comcast Updated Rate Card for Cambridge

Services & Pricing   Effective January 1, 2021   1-800-xfinity | xfinity.com   **xfinity**

Cambridge, MA

BUNDLED PACKAGES[1,2]

QUAD PLAY PACKAGES
QUAD PLAY PACKAGE PRICING BELOW IS ADDITIONAL TO TRIPLE PLAY PACKAGE PRICING

with Xfinity Home Security add[32]	$30.00
with Xfinity Home Security Plus add[33]	$40.00

TRIPLE PLAY PACKAGES[49]

Standard+ More
Includes Limited Basic, Expanded Basic and HD programming for primary outlet, 20 Hour DVR Service, Performance Pro Internet and Unlimited Voice

	$130.99
SurePrice[41]	$124.99
- with Gigabit Pro Internet upgrade add[42]	$235.00
- with Xfinity Mobile save	$-10.00
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Blast! Internet upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00

Select+ More
Includes Limited Basic, Expanded Basic, Digital Preferred Tier and HD programming for primary outlet, DVR Service, Extreme Pro Internet and Unlimited Voice

	$159.99
SurePrice[41]	$134.99
- with Gigabit Pro Internet upgrade add[42]	$235.00
- with Xfinity Mobile save	$-10.00
- with Premium DVR Service upgrade add	$10.00
- with Gigabit Internet upgrade add	$30.00

Signature+ More
Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, and HD programming for primary outlet, Premium DVR Service, Gigabit Internet, Unlimited Data, Unlimited Voice and Netflix Standard HD Plan

	$189.99
SurePrice[41]	$164.99
- with Gigabit Pro Internet upgrade add[42]	$235.00
- with Xfinity Mobile save	$-10.00
- with Netflix Premium UHD Plan upgrade add	$4.00

Super+ More
Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, HBO Max, Showtime, TMC, More Sports & Entertainment Package and HD programming for primary outlet, Premium DVR Service, Gigabit Internet, Unlimited Data, Unlimited Voice and Netflix Standard HD Plan

	$199.99
SurePrice[41]	$184.99
- with Gigabit Pro Internet upgrade add[42]	$235.00
- with Xfinity Mobile save	$-10.00
- with Netflix Premium UHD Plan upgrade add	$4.00

DOUBLE PLAY PACKAGES[40]

Choice Double Play[43]
Includes Choice Limited TV and Performance Internet

	$89.99
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Performance Pro Internet upgrade add	$15.00
- with Blast! Internet upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[42]	$235.00

Standard+
Includes Limited Basic, Expanded Basic and HD programming for primary outlet, 20 Hour DVR Service, and Performance Pro Internet

	$110.99
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Blast! Internet upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[42]	$235.00

Select+
Includes Limited Basic, Expanded Basic, Digital Preferred Tier and HD programming for primary outlet, 20 Hour DVR Service, and Blast! Internet

	$139.99
- with DVR Service upgrade add	$10.00
- with Premium DVR Service upgrade add	$20.00
- with Extreme Pro Internet upgrade add	$25.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[42]	$235.00

Signature+
Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, and HD programming for primary outlet, DVR Service, Extreme Pro Internet, and Netflix Standard HD Plan

	$169.99
- with Premium DVR Service upgrade add	$10.00
- with Netflix Premium UHD Plan upgrade add	$4.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[42]	$235.00

Super+
Includes Limited Basic, Expanded Basic, Digital Preferred Tier, Epix, HBO Max, Showtime, TMC and HD programming for primary outlet, DVR Service, Extreme Pro Internet, and Netflix Standard HD Plan

	$189.99
- with Premium DVR Service upgrade add	$10.00
- with Netflix Premium UHD Plan upgrade add	$4.00
- with Gigabit Internet upgrade add	$30.00
- with Gigabit Pro Internet upgrade add[42]	$235.00

XFINITY TV[1]

BASIC SERVICES

Limited Basic[5,10]	$8.00
Broadcast TV Fee[24]	$18.60
Franchise Costs[4]	$0.96
Expanded Basic[3] Includes Kids & Family, Entertainment and Sports & News	$53.25

XFINITY TV SERVICES

Choice Limited TV[38] Includes Limited Basic, Streampix, 10 hours DVR Service and HD programming	$30.00
Choice TV[39] Includes Limited Basic, Streampix, 20 hours DVR Service, HD programming and Broadcast TV Fee	$30.00
- with TV Box	$32.90

Genre Packs[28] Choose up to 2

Kids & Family Includes kid and family-friendly channels including Disney Channel, Nickelodeon and Universal Kids	$10.00
Entertainment Includes entertainment channels including A&E, AMC, Bravo, Food Network, FX, TNT and VH1	$15.00
Sports & News Includes sports and news channels including CNBC, CNN, ESPN, Golf, MSNBC and NBC Sports	$30.00
Extra[30] Includes Limited Basic, Expanded Basic for primary outlet, additional digital channels; access to Pay-Per-View and On Demand programming and Music Choice	$61.25

Digital Preferred Tier[9] Includes over 65 channels including CBS College Sports, Destination America, Disney XD and Science Channel	$17.95
Digital Preferred Tier plus One Premium Includes Digital Preferred Tier and choice of Showtime, Cinemax, or The Movie Channel	$29.95
Digital Preferred Tier with HBO Max Includes Digital Preferred Tier and HBO Max	$32.94
Digital Premier Tier Includes Digital Preferred Tier, HBO Max, Showtime, Epix, Hitz and The Movie Channel	$64.94
More Sports & Entertainment Package[44] Includes over 15 channels including NFL Red Zone, ESPNews and TCM	$9.95
Deportes[3] Includes over 6 deportes channels including ESPN Deportes, FOX Deportes and NBC Universo	$5.00
Xfinity TV Latino[3] Includes over 50 channels of Spanish language programming	$17.95
With Choice Double Play or Standard, Select, Signature, Super Double or Triple Play Packages	$10.00
HBO Max[3]	$14.99
HBO[3]	$15.00
Showtime[3]	$12.00
Starz[3]	$8.99
Cinemax[3]	$12.00
The Movie Channel[3]	$12.00
Epix[29]	$6.99
Playboy[3]	$15.00
HD Technology Fee[7]	$9.95
DVR Service[37]	$10.00
Premium DVR Service[40]	$20.00
Service to Additional TV[6]	$7.50
with DVR Service[5]	$17.50
with CableCARD or compatible customer owned device[45]	$4.60
Service to Additional TV with TV Adapter[11]	$7.50

INTERNATIONAL SELECTIONS[31]

ART: Arabic	$9.99
TV Globo: Brazilian	$19.99
Brazilian 2 Pack Includes TV Globo and SporTV	$24.99
Brazilian 4 Pack Includes TV Globo, SporTV, Band Internacional and Record TV	$34.99
Mandarin 2 Pack Includes Phoenix Info News and Phoenix North America	$6.99
Mandarin 4 Pack Includes CTI Zhong Tian, CCTV4, Phoenix Info News and Phoenix North America	$19.99
Filipino 2 Pack Includes GMA Pinoy w/ GMA Video On Demand and GMA Life	$14.99
Filipino 3 Pack Includes GMA Pinoy w/ GMA Video On Demand, GMA Life and TFC	$22.99
TV5MONDE: French With Cinema On Demand	$9.99
DW Deutsche +: German	$9.99
Antenna: Greek	$14.99
The Israeli Network	$19.99
Rai Italia: Italian	$9.99
Italian 2 Pack Includes Rai Italia and Mediaset	$14.99
TV JAPAN	$24.99
SIC: Portuguese	$9.99
Portuguese 2 Pack Includes RTPi and SIC	$14.99
Impact TV: Russian Add-on With any International package	$6.99
Russian 2 Pack Includes Channel One Russia and NTV America	$14.99
Russian 4 Pack Includes Channel One Russia, RTN, TV1000 Russian Kino and NTV America	$26.99
Russian 5 Pack Includes Channel One Russia, RTVi, NTV America, RTR-Planeta and Rossiya 24	$26.99
Russian 8 Pack Includes Channel One Russia, RTN, RTVi, TV1000 Russian Kino, NTV America, RTR-Planeta, Rossiya 24 and CTC	$34.99
Willow: Cricket Add-on With any International package	$6.99
Willow: Cricket	$14.99
Zee TV: Hindi	$14.99

SET: Hindi	$14.99
Hindi 2 Pack Includes Zee TV and SET	$24.99
Hindi Pack Includes Zee TV, SET, TV Asia and NDTV 24x7	$29.99
Hindi Plus Pack Includes Zee TV, SET, TV Asia, NDTV 24x7, Eros Now and Willow	$39.99
SBTN: Vietnamese	$14.99
TVB Jade: Cantonese	$10.99
Record TV: Brazilian	$14.99
ABP News: Hindi	$7.99
TFC: Filipino	$11.99

PAY-PER-VIEW AND ON DEMAND SUBSCRIPTION SERVICES

Eros Now On Demand[36]	$12.99
Eros Now On Demand[36] w/a South Asian international selection	$9.99
here! TV On Demand[36]	$7.99
Filipino On Demand[36]	$7.99
Filipino On Demand[36] w/a Filipino international selection	$5.99
The Jewish Channel On Demand[36]	$6.99
Gaiam TV Fit & Yoga On Demand[36]	$7.99
Lifetime Movie Club On Demand[36]	$3.99
History Vault On Demand[36]	$4.99
Kidstream On Demand[36]	$4.99
Grokker Yoga Fitness On Demand[36]	$6.99
UP Faith and Family On Demand[36]	$5.99
Anime Network On Demand[36]	$6.99
Stingray Karaoke On Demand[36]	$8.99
DOGTV On Demand[36]	$4.99
Gaia On Demand[36]	$11.99
AMC + On Demand[35]	$8.99
Stingray Classica On Demand[36]	$6.99
TumbleBooksTV On Demand[36]	$4.99
FitFusion On Demand[36]	$6.99
CuriosityStream On Demand[36]	$2.99
PlayKids On Demand[27]	$6.99
Daily Burn On Demand[27]	$14.99
Xive TV On Demand[27]	$4.99
Quark On Demand[27]	$4.99
Linn Mountain TV On Demand[27]	$3.99
Touchfit TV On Demand[27]	$4.99
Disney Story Central On Demand[36]	$4.99
Acorn TV On Demand[36]	$5.99
Stephens Drum Shed On Demand[27]	$4.99
Pro Guitar Lessons On Demand[27]	$4.99
MagellanTV History On Demand[27]	$5.99
Craftsy On Demand[36]	$7.99
WE tv + On Demand[36]	$5.99
The Great Courses Signature On Demand[27]	$7.99
Pantaya On Demand[36]	$5.99
DJAZZ On Demand[27]	$6.99
Ride TV On Demand[27]	$4.99
Outside TV Features On Demand[27]	$4.99
The Reading Corner On Demand[27]	$3.99
Hopster On Demand[27]	$6.99
Brown Sugar On Demand[27]	$3.99
Stingray Qello On Demand[27]	$7.99
Echoboom Sports On Demand[27]	$5.99
GOLFPASS On Demand[27]	$4.99

Hallmark Movies Now On Demand[27]	$6.99
Dove Channel On Demand[27]	$4.99
Kocowa On Demand[27]	$6.99
WHAM On Demand[27]	$2.99
Gravitas Movies On Demand[27]	$4.99
MHz Choice On Demand[27]	$7.99
Hi-YAH! On Demand[27]	$2.99
True Royalty On Demand[27]	$5.99
Real Vision On Demand[27]	$14.99
Docurama On Demand[27]	$4.99
Con TV On Demand[27]	$4.99
Walter Presents On Demand[27]	$6.99
Dekkoo On Demand[27]	$9.99
ZooMoo On Demand[27]	$2.99
Miniteve On Demand[27]	$1.99
WildBrain On Demand[27]	$5.99
Cinemoi On Demand[27]	$2.99
Fox Nation On Demand[36]	$5.99
Wanderlust On Demand[27]	$9.99
Music Choice Karaoke On Demand[27]	$6.99
Music Choice Relax On Demand[27]	$5.99
Curious World On Demand[27]	$3.99
kweliTV On Demand[27]	$5.99
Marquee TV On Demand[27]	$8.99
Passionflix On Demand[27]	$5.99
Conspiracy TV On Demand[27]	$4.99
FlixFling On Demand[27]	$7.99
A&E Crime Central On Demand[27]	$4.99
CultFlix On Demand[27]	$4.99
CineFest On Demand[27]	$4.99
Hitz[34,36]	$12.00
Streampix[13,36]	$4.99
Pay-Per-View and On Demand Movies and Events[12,36] (per title or event)	Prices Vary
Revry On Demand[27]	$6.99
Vivid On Demand Subscription[14,36]	$19.99
Hustler On Demand Subscription[14,36]	$19.99
TEN On Demand Subscription[14,36]	$19.99
Brazzers On Demand[14,36]	$19.99
Girlfriends Films On Demand[14,36]	$19.99
Too Much for TV On Demand[36]	$14.99
Wicked On Demand[14,36]	$19.99
Urban Fantasy On Demand[14,36]	$19.99
Falcon On Demand[14,36]	$19.99
Homegrown Amateur On Demand[14,36]	$19.99
Evil Angel On Demand[14,36]	$19.99
Mature Lust On Demand[14,36]	$19.99
Penthouse On Demand[14,36]	$19.99
XTSY On Demand[14,36]	$19.99
Reality Kings On Demand[14,36]	$19.99
Arouse On Demand[14,36]	$19.99
Bang On Demand[14,36]	$19.99

SPORTS PACKAGES[35]

MLB Extra Innings	Call 1-800-XFINITY for pricing
NHL Center Ice	Call 1-800-XFINITY for pricing
NBA League Pass	Call 1-800-XFINITY for pricing

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XFINITY TV EQUIPMENT

TV Box Limited Basic	$1.20
TV Box	$2.50
Remote	$0.40
HD TV Box Limited Basic	$1.20
TV Adapter (Limited Basic — Primary TV)	$0.00
TV Adapter (Limited Basic — 1st and 2nd Additional TVs)	$0.00
TV Adapter (Limited Basic — 3rd Additional TV)	$0.50
CableCARD (first card in device)	$0.00

INSTALLATION
(PER OCCURRENCE UNLESS NOTED)

	Initial Installation of Service	After Initial Installation of Service
Unwired Home[15,16] (Standard Installation)	$47.00	N/A
Wired Home[15,16] (Standard Installation)	$47.00	N/A
Professional Installation[16,17]	$100.00	N/A
Technician Assisted Installation[47]	$39.99	N/A
In-Home Service Visit[48]	N/A	$70.00
In-Home Service Visit (Xfinity TV)	N/A	$55.00
Installation of each Additional Outlet[18]	$20.00	$45.00
Connect Customer Owned Equipment	$12.00	$40.00
Upgrade of Service (In-home visit required)		$40.00
Downgrade of Service (In-home visit required)		$17.00
Hourly Service Charge[18] (Custom Installation)		$50.00
Xfinity Internet Gigabit Pro Professional Installation (per occurrence)		$500.00
Wireless Networking On-Site Professional Set-Up (Separate trip, per occurrence)		$99.95
Wireless Networking On-Site Professional Set-Up (each additional device over 4 devices per occurrence)		$29.95

REACTIVATION
(NO IN-HOME VISIT REQUIRED—PER OCCURRENCE UNLESS NOTED)

Reactivation - TV	$1.99
Reactivation - Internet	$6.00
Reactivation - Voice	$6.00

MISCELLANEOUS (PER OCCURRENCE UNLESS NOTED)

Customer-Owned Video Equipment Credit See www.xfinity.com/equipmentpolicy for additional information	$2.90
Regional Sports Fee[25] (per month)	$10.75
Returned Payment Item (each)	$20.00
Late Fee	5% of overdue balance
Agent Assisted Payment For payment made by phone with a Customer Care Representative	$5.99
Unreturned or Damaged Equipment Fees[19] (per piece)	Replacement Cost
Getting Started Kit Shipping and Handling (Standard Shipping)	$15.00
Getting Started Kit Shipping and Handling (Priority Shipping)	$29.95
Accessory Shipping and Handling	$5.95

XFINITY VOICE[1,20]

Xfinity Voice—Unlimited	$44.95
With TV and Internet Service	$39.95
Xfinity Voice—Local with More	$34.95
With TV or Internet Service	$24.95

XFINITY INTERNET[1, 21]

	Xfinity Internet Service Only	with Xfinity TV or Voice Service[26]
Performance Starter	$54.95	$40.95
Performance	$80.95	$64.95
Performance Pro	$95.95	$79.95
Blast!	$100.95	$84.95
Extreme Pro[22]	$105.95	$89.95
Gigabit[22]	$110.95	$94.95
Gigabit Pro[22,23]	$299.95	$299.95
Modem Rental		$14.00
Wireless Adapter (each, one-time charge)		$30.00
Gigabit Pro Activation Fee (per occurrence)		$500.00
In-Home Service Visit (per occurrence)		$40.00
Unreturned or Damaged Equipment Fees[19] (per piece, per occurrence)		Replacement Cost

1 Certain services available separately or as a part of other levels of service. Xfinity services are subject to Comcast's standard terms and conditions of service. Unless otherwise specified, prices shown are the monthly charge for the corresponding service, equipment or package. Prices shown do not include applicable taxes, franchise fees, FCC fees, Regulatory Cost Recovery, Public Access fees, other state or local fees or other applicable charges (e.g., per-call toll or international charges). Prices, services and features are subject to change. If you are an Xfinity TV customer and you own a compatible TV Box or CableCARD device, please call 1-800-XFINITY for pricing information or visit www.xfinity.com/equipmentpolicy. © 2020 Comcast. All rights reserved.
2 Requires a compatible modem and TV Box with remote, CableCARD or compatible customer owned device.
3 Requires Limited Basic, TV Box, CableCARD or compatible customer owned device.
4 Franchise Costs are costs associated with providing public, educational and/or government access facilities and equipment and/or other related costs in your community.
5 Requires HD Technology Fee. Service to Additional TV with TV Box required for DVR Service on additional TVs. Not available to customers with Limited Basic only.
6 Includes TV Box. Digital service tier on additional TV corresponds to digital service tier on primary outlet. HD programming requires HD Technology Fee. Not available to Limited Basic only customers.
7 Not available to customers with Limited Basic only. Must subscribe to HD Technology Fee to receive HD programming.
8 Requires TV Box, TV Adapter, CableCARD or compatible customer owned device. Discount of 10% off of Limited Basic (including discount on Broadcast TV Fee, Franchise Costs, and Regional Sports Fee) or discount of 10% off of Digital Starter (including discount on Broadcast TV Fee, Franchise Costs and Regional Sports Fee) available to seniors who qualify. Age and income restrictions apply. Call 1-800-XFINITY for more information.
9 Requires Extra.
10 Discount of 10% off of Limited Basic (including discount on Broadcast TV Fee, Franchise Costs, and Regional Sports Fee) or discount of 10% off of Extra (including discount on Broadcast TV Fee, Franchise Costs and Regional Sports Fee) available to seniors who qualify. Age and income restrictions apply. Call 1-800-XFINITY for more information.
11 Includes TV Adapter and remote. Digital service tier on additional TV corresponds to digital service tier on primary outlet. Does not include access to On Demand content, premium channels or channel numbers above 1000 unless otherwise noted on the channel lineup. Not available to customers with Limited Basic only.
12 Price of Pay-Per-View and On Demand Movie or Event is displayed prior to the completion of the Pay-Per-View or On Demand ordering process.
13 Requires Limited Basic and TV Box and remote or compatible customer owned device. Requires HD Technology Fee to receive HD programming.
14 One month minimum purchase required. Not available in all areas.
15 Applies to Xfinity TV only installations.
16 Standard installation includes installation of service line up to 125 feet from existing Comcast plant for the primary outlet only, except as otherwise required under local franchise agreement. Comcast does not perform custom installations, including installations which require in-wall wiring, wiring in extensive drop ceilings, basements, or crawl spaces.
17 Includes standard installation of Xfinity TV, Xfinity Internet and/or Xfinity Voice and installation of additional outlets and wireless networking set-up if requested at time order is placed. Does not include installations of Xfinity TV only, Xfinity Home Security or Xfinity Gigabit Pro Internet.
18 Initial installation of Service charges apply to Xfinity TV only installations.
19 Contact 1-800-XFINITY for questions regarding equipment replacement charges.
20 Requires a compatible modem. Unlimited Local and Long Distance package pricing applies only to direct dialed calls from home to locations included in the plan. Plans do not include other international calls. For more information regarding Xfinity Voice pricing go to https://www.xfinity.com/Corporate/About/PhoneTermsOfService/ComcastDigitalVoice/cdvresidential.
21 A compatible modem is required. For more information regarding Xfinity Internet go to http://www.xfinity.com/Internet-service.html.
22 Not available in all areas. May require installation and non-refundable installation charge.
23 Requires 2 year contract. Monthly rental of Gigabit Pro cable modem/router additional. Activation and professional installation fees additional. Gigabit Pro does not qualify for Comcast 30-day money back guarantee.
24 Applies to Limited Basic and Xfinity Instant TV.
25 Applies to Extra and above, and Sports & News.
26 Xfinity Internet discount does not apply to Xfinity Instant TV.
27 Requires Limited Basic with X1 TV Box and Xfinity Internet service.

28 Requires Choice Double Play, Choice Limited TV or Choice TV. Cannot be combined with Limited Basic only.
29 Requires Limited Basic, HD Technology Fee and TV Box, CableCARD or compatible customer owned device.
30 Discount of 10% off Limited Basic (including discount on Broadcast TV Fee and FRC) or Discount or 10% off of Digital Starter (including discount on Broadcast TV Fee, Regional Sports Fee, and FRC) available to seniors who qualify for discount. Age and income restrictions apply. Call 1-800-XFINITY for more information.
31 Requires Limited Basic with X1 TV Box or compatible customer owned device and Xfinity Internet service.
32 Equipment required at an additional cost. For additional information go to http://www.xfinity.com/homesecurity.
33 Includes Xfinity Home Security and 24/7 Video Recording for up to 4 cameras. Equipment required at an additional cost. For more information on 24/7 Video Recording go to http://www.xfinity.com/videorecording.
34 Requires Limited Basic TV service and a compatible Xfinity TV Box or customer owned device.
35 Requires Limited Basic, HD Technology Fee, X1 TV Box with remote or compatible customer owned device. Sports Package subscriptions can be billed at once or in 4 total payments. Call 1-800-XFINITY to cancel subscription within 30 days of first charge to bill. Charges are non-refundable after 30 days of first charge to bill. Restrictions may apply.
36 Requires Limited Basic, TV Box or compatible customer owned device with Xfinity Internet.
37 Requires HD Technology Fee and TV Box or compatible customer owned device. DVR Service with compatible customer owned device limited to 60 hours DVR Service.
38 Requires TV Box, CableCARD or compatible customer owned device. 10 Hours DVR Service available with X1 TV Box (X1 TV Box requires subscription to one Genre Pack) or compatible customer owned device. Cannot be combined with Xfinity Voice or Xfinity Home Security.
39 Requires minimum of Xfinity Performance Internet service and an Xfinity Flex Streaming device. Choice TV available for ordering through the Flex box only. 20 hours DVR Service available with X1 TV Box or compatible customer owned device. Not eligible for multiproduct pricing on Xfinity Internet, Xfinity Voice or Xfinity Home Security.
40 20 Hour DVR Service requires Xfinity Internet Service and either an X1 TV Box or compatible customer owned device.
41 SurePrice only available for 12 months to customers with Standard+ More, Select+ More, Signature+ More and Super+ More packages after qualifying 12 month promotional pricing.
42 Requires 2-year contract. Monthly rental of Gigabit Pro compatible modem/router additional. Activation and professional installation fees additional. Gigabit Pro does not qualify for Comcast 30-day money back guarantee.
43 Cannot be combined with Sports & News genre pack.
44 Requires Extra.
45 Not available to customers with Limited Basic only. Includes a customer-owned video equipment credit. An additional charge will apply for additional CableCARDs in the same device.
46 Requires Xfinity TV Latino, More Sports & Entertainment Package, Choice TV Double Play with one Genre Pack, Choice TV, or Extra or higher, Xfinity Internet, TV Box or compatible customer owned equipment.
47 Includes delivery of up to a total of three Get Started Kits for Xfinity TV, Xfinity Internet, or Xfinity Voice and a network signal test. Requires service address activation for Xfinity services within in the last 2 years. Does not include installation or relocation of outlets, equipment installation, setup or troubleshooting, or installation of Xfinity Home or Xfinity Gigabit Pro Internet.
48 Applies to installation, relocation and activation of additional outlets as well as upgrade downgrades of service after initial installation of service and in-home visits. Does not cover installation or in-home visits for Xfinity Home Security.
49 20 Hour DVR Service requires Xfinity Internet Service and either an X1 TV Box or compatible customer owned device. For information on Unlimited Data, please visit www.dataplans.xfinity.com.

Xfinity Home Security License Numbers:
AL: 001484, 001504; AR: 12-030; AZ: ROC 280515, BTR 18287-0; CA: CSLB 974291, ACO 7118; CT: ELC 0189754-C5; DE: FAL-0299, FAC-0293, SSPS 11-123; FL: EF0000921, EF20001002, EF0001095; GA: LVA406303, LVA408264, LVU406390, LVA406354; IL: PACA 127-001502; LA: F1691; MA: SS-001968; MD: 107-1776; ME: LM50017039; MI: 3601206247; MN: TS674412; NC: 2335-CSA, 29443-SP-FA/LV; NJ: Burglar and Fire Alarm Business Lic. # 34BF00047790; NM: 373379; NY: licensed by the N.Y.S. Department of State 12000305421; OH: LIC# 53-89-1732; OR: CCB 192945; SC: BAC-13497, FAC-13440; TN: ACL 1597, ACL 1804; TX: ACR-1672104, 1818, 916922, 800571; UT: 8226921-6501; VA: 2705145389, DCJS 11-7361; VT: ES-02366; WA: COMCABS892DS, WASHINGTON, DC: ECS 902687, BBL 602512000005; WV: WV049211.

MS: 15018010
Valid 1/1/19. See www.xfinity.com/home-security for current list.

87731000: 2260

Appendix E: Perspective on the New Broadband Benefit Program

Among the many broadband funding streams included in the federal appropriations act that became law in late December 2020, the new Emergency Broadband Benefit Program could play a role in helping Cambridge residents close access gaps. In the sections below, we explain the basics of the new program—then identify ways in which the City might play a role in helping low-income residents realize the program's benefits.

What Is the Emergency Broadband Benefit Program?

The program is designed to provide a broadband subsidy for eligible households that will appear as a discount on their monthly bills. Once the program is up and running (the rules were released on February 25, and we expect to see the program operational by the end of April),[70] the FCC will reimburse internet service providers up to $50 per month per eligible household ($75 per month for households on tribal lands). Assuming the funding lasts, the program will continue until six months following the official end of the Covid-19 public health emergency.

Notably, the program also subsidizes the cost of a laptop, desktop computer, or tablet for each eligible household; ISPs can be reimbursed up to $100 for a connected device, as long as they charge the recipient no more than $50 for it.

The Emergency Broadband Benefit will subsidize broadband service for low-income families and households that have lost income during the Covid-19 pandemic. As we describe here, though, the FCC's rules will address two intertwined issues: Who is eligible, and how will those participants be able to prove their eligibility?

First, who is eligible? The law defines eligibility broadly as a household in which at least one member:

- Qualifies for Lifeline (i.e., has income at or below 135 percent of the federal poverty guidelines; receives benefits from Medicaid, the Supplemental Nutrition Assistance Program, Supplemental Security Income, Federal Public Housing Assistance, or a Veterans and Survivors Pension Benefit)

- Participates in the National School Lunch Program or the School Breakfast Program

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[70] Cecilia Kang, "F.C.C. Approves a $50 Monthly High-Speed Internet Subsidy," *New York Times*, Feb. 25, 2021, https://www.nytimes.com/2021/02/25/technology/fcc-broadband-low-income-subsidy.html (accessed Feb. 26, 2021).

- "[h]as experienced a substantial loss of income since February 29, 2020, that is documented by layoff or furlough notice, application for unemployment insurance benefits, or similar documentation"

- Received a federal Pell grant during the current award year

- "[m]eets the eligibility criteria for a participating provider's existing low-income or Covid-19 program"

Verification of a customer's eligibility to participate in the program is a key point the FCC will need to define during its 60-day comment period.[71] The appropriations bill spells out some clear approaches around the existing Lifeline program verification process but gives the FCC latitude on accepting other methods.

Participating ISPs will be able to verify household eligibility in one of three ways:

1. Based on the National Verifier or the National Lifeline Accountability Database

2. Based on a school's verification of a household member's participation in the National School Lunch Program or the School Breakfast Program

3. Based on the ISP's "alternative verification process" (which must be deemed sufficient by the FCC "to avoid waste, fraud, and abuse")

How Will Residents Enroll?

Eligible telecommunications carriers (ETC) are automatically eligible to participate in the program. ISPs that are not ETCs will need to go through an approval process before they can participate. The approval process for ISPs is another one of the issues the FCC is addressing during its comment period; the law stipulates the approval process be "expedited," given that the program is intended to quickly help bridge the digital divide.

As with the federal Lifeline service and other established subsidy programs (such as the State of Alabama's "ABC for Students" program), the enrollment process is expected to be straightforward: An eligible resident of your community should be able to call a participating ISP and provide information that verifies their eligibility—then the ISP should enroll the resident, deliver service, and apply the $50 or $75 monthly subsidy to their account. The ISP will then request reimbursement from the FCC.

The law establishing the program has some built-in consumer protections: The National Verifier is required to approve an eligible household within two days of a request for verification. ISPs

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[71] https://www.fcc.gov/document/fcc-seeks-comment-new-emergency-broadband-benefit-program

cannot require a household to pay an early termination fee if the household enters into a contract in order to receive the service. And households cannot be subject to a waiting period to receive service based on having previously received service from the provider.

What Are the Program's Long-Term Benefits?

The law states the program will run six months beyond the end of the public health emergency, but that is only if the funding is sufficient to cover the ISPs' charges for all of the participants. We are optimistic the $3.2 billion allocated to the program might provide a year's worth of funding. That said, we anticipate there will be appetite in Congress to appropriate future funds to keep the program operating—given the enormous need for broadband that has so clearly been illuminated by the Covid crisis. We already have observed lobbying in Washington to make the program permanent, but we have real doubt whether the political will for that exists.

The short-term impacts of the Emergency Broadband Benefit Program are clear: Participating households will save $50 to $75 per month on their broadband service. But beyond the important financial implications of the subsidy, this program also might have a positive long-term effect on broadband adoption rates among households that have never had broadband service before (or who have had to give up broadband because it became unaffordable for them). To the extent that cost has been the barrier preventing residents from subscribing to available services, this program might convince non-adopters to try broadband—and, if they find value in the service, potentially to keep the subscription once the subsidy sunsets.

What Challenges Will Residents Face With the Program?

We do not yet know what guidelines and requirements the FCC will enact for this program—but we believe there are areas of concern in the statute depending on how the FCC structures the program. Most notably, we are concerned **there could be a significant burden on families to prove their eligibility and ensure their subsidy is appropriately applied**.

A family may, for instance, need to call their provider to ask for service and determine how to apply the subsidy. This is not an insignificant burden for the families this subsidy is intended to help, nor is the potential financial risk to those families a minor point (i.e., they might be responsible for paying $50 or $75 more per month if the subsidy is not accurately applied). That potential uncertainty alone may prevent some eligible residents from adopting service.

A second potential pain point is the burden on smaller ISPs, which will have to verify families' eligibility under the FCC rules. For large ISPs this task will be relatively easy; they have access to the federal Lifeline verifier, for example, and many have streamlined processes to verify eligibility for their own low-income programs.

The federal statute suggests, for example, that an ISP can confirm a customer's eligibility by calling the local school to verify their participation in the National School Lunch Program. While well-intentioned, this could place a significant burden on small ISPs (not to mention schools). The eligibility verification process could prevent small ISPs from participating in the program—and thus deny their existing or potential customers the opportunity to get the subsidy.

The delay in the availability of the subsidy is a third potential pain point for participants. The law went into effect in late December and requires that the FCC stand up the program rules within 60 days. They should, at that point, announce the timeline for the initial program launch. While they are well on their way, having issued proposed rules and a request for comments, any delay is an additional burden on many families waiting to enroll. Additionally, it is reasonable to assume the FCC will make the program's impact retroactive—so, for example, an ISP can bill the FCC for the January and February reimbursement amounts once the program launches in March; however, final rules will bear out the extent of eventual support.

How Can the City Help Residents Take Advantage of the Program?

On the surface, the Emergency Broadband Benefit program involves only ISPs, customers, and the FCC: A customer calls the ISP, the ISP verifies their eligibility, and the ISP is reimbursed by the FCC. The reality is that a City government can play a key role in helping their residents make the most of this opportunity—rather than assuming the FCC and large ISPs will take on those responsibilities—and in the process, narrow the digital divide in their communities.

One lesson learned from programs designed to subsidize broadband service for low-income households is how challenging it is to reach eligible families—and, in many cases, to convince them that the opportunity is real, valuable, and worth their time. City efforts to develop a public outreach and support strategy could thus be critical to maximizing enrollment in the Emergency Broadband Benefit program.

Tactics could include:

- Developing a public information campaign

- Conducting outreach to community groups, non-profits, and individual residents

Such efforts would be designed to help residents understand and overcome their very prudent and reasonable considerations with regard to hidden fees and other risks of participation. In the event that residents do encounter problems with enrollment or billing, the government role could be the type of consumer protection that it provides in other spheres.