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LARIMER COUNTY

COMMITTED TO EXCELLENCE

Broadband Study
Phase I: Needs Assessment

Prepared for Larimer County, Colorado
June 2018

Columbia Telecommunications Corporation

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1 Executive Summary

In March 2017, Larimer County, Colorado (the County), engaged with CTC Technology & Energy (CTC) to conduct a phased feasibility study (the Project) of options to make broadband available to every resident and business within the County. This report, the first of three planned deliverables, summarizes our initial findings.

1.1 Key Findings

This report establishes a baseline for the County as it continues to consider viable options to address broadband availability in the unincorporated areas of the County.

- Discussions with private sector providers in the County illuminated that **some target areas are within the existing or planned footprint of private providers and power authorities, permitting processes are a key focus for providers, and that the County may need to work with multiple providers to achieve its goals;**

- Key findings from the residential survey include that **nine in 10 survey respondents have some form of internet connection (home connection or smartphone), and about one-half of respondents indicated that the County should install a state-of-the-art communications network, including 33 percent who indicated that the County should offer services directly.**

- Fixed wireless and satellite providers hold 20 percent each of the responding market, while DSL is the primary connection for 19 percent of responding households. 18 percent of responding households use cable modem access, and 15 percent use another technology (mobile, fiber, dial-up, or other). **8 percent of households responded that they do not have internet.**

- We caution the County not to infer that low adoption rates automatically mean low availability or affordability. No doubt there are households that wish to remain "off the grid", or do not wish to pay for internet at their residence. That said, **one fourth of respondents that do not have internet indicated that internet access isn't available at their home, and another fourth indicated it was too expensive for them.**

- Most of the survey responses align across all areas, indicating that the conclusions drawn in this analysis likely apply to the entirety of the surveyed areas. However, in the area that includes the Highway 14 corridor, Laramie River Road, and Cherokee Park Road **(Survey Area D), the least populated of the six survey areas, 18 percent of respondents indicated they do not have internet access.** This area also includes the highest concentration of satellite access, and second lowest concentration of fixed wireless access.

Ultimately, one of the most important steps the County must take is to determine what it is able and willing to do, which will help illuminate for the private sector the degree to which the County is truly able to "partner."

1.2 Background

The County is well aware that there is a lack of availability of broadband in its unincorporated areas. Indeed, the County reports that 48 percent of private land does not have access to broadband, and anecdotal evidence suggests that it is a significant challenge for businesses and residents outside of the major city centers in the County to access affordable, dependable, high-speed internet service.

County stakeholders assert that "broadband is a critical part of every community's infrastructure that impacts the economy, safety, well-being, education and overall connectedness of [Larimer County] residents, businesses and institutions."[1] With that in mind, the County's vision is to enable the availability of high-speed, reliable, and affordable internet to all homes and businesses in the County.

In this first phase of the Project, CTC engaged with the County's Broadband Steering Committee, managers, and officials to better understand the County's goals and the local broadband landscape. CTC team members also met with representatives of private sector providers to understand the challenges they encounter in deploying broadband infrastructure in the County, and steps the County might take to help facilitate deployment.

Finally, CTC developed and administered a residential survey to six "survey areas"—unincorporated areas of the County developed using the County Mountain Resilience Plan[2] within the County to obtain statistically valid information on the broadband landscape in unincorporated areas of the County.

1.3 On-Site Discussions with the County and the Private Sector Helped Shape the Scope of the Project

CTC held a series of on-site meetings to understand the County's goals and objectives, and to discuss the particular challenges of deploying broadband services to unincorporated areas of the County. Our findings include the following:

[1] "Larimer Broadband Project," Larimer County, CO. Available: https://www.larimer.org/broadband (accessed April 2018).

[2] "Mountain Resilience Plan," Larimer County, CO. Available: https://larimercompplan.com/document/mountain-resilience-plan (accessed April 2018).

- The County's goal is to find a solution that will enable 100 Mbps (download) residential and 200 Mbps commercial services to every home and business in the County, reaffirming its assertion that "Everywhere is Somewhere";
- The County wants to focus efforts on its unincorporated areas;
- The County aims to facilitate rather than fund the solution; and
- The County does not have a preconceived idea of the best course of action; rather, it aims to develop a "toolkit" that will enable it to take a multi-tiered approach.

For more discussion of these topics, please see Section 2.1.

Our discussions with providers in the area illuminated, from the private sector's viewpoint, specific deployment challenges and steps the County might take to help facilitate future deployments. Our findings include the following:

- Deploying broadband infrastructure is expensive in many parts of the County's target areas;
- Some target areas are within the existing or planned footprint of private providers and power authorities;
- Permitting processes are a key focus for providers;
- The County may need to work with multiple providers to achieve its goals;
- It will be important for the County to determine and articulate its own plans; and
- Consumer demand will drive the County's efforts.

For more discussion of these topics, please see Section 2.2.

1.4 Findings from Residential Survey

As part of its efforts to evaluate and improve the area's internet access and quality, Larimer County conducted a survey of residents in selected unincorporated areas of the County in early 2018. Key findings include:

- Larimer County residents are highly connected, with nine in 10 respondents having some form of internet connection (home connection or smartphone). Residents in the area directly west of Ft. Collins appear to be well-connected, with 95 percent having some internet service. In comparison, nearly one-fifth of households in the northwest part of the County do not purchase internet services.

- Fixed wireless, satellite, DSL, and cable modem have almost equal shares of the market at approximately one-fifth each. Use of a fixed wireless connection is higher in the southern and northeastern parts of the County compared with other areas, while use of a cable modem connection is highest in the area directly west of Ft. Collins, and use of a satellite connection is highest in the northwest area of the County.

- Reliability of the internet connection ranks as the most important aspect of internet service, followed by connection speed. Residents are generally satisfied with the speed and reliability of their internet service, but the high importance placed on these factors may signal some willingness to switch providers if needs are not being met.

- Respondents indicated a willingness to switch to a very high-speed internet connection, especially at monthly prices at or lower than $70 per month or for upfront installation fees at or below $100. Willingness to switch drops sharply at higher price points.

- One-half of respondents' employers allow telework, and 31 percent of responding households have a member who already teleworks. Three-fourths of household members who can telework and with fast home internet connections do telework from home.

- One-half of respondents purchase satellite television service, while 21 percent receive television service through the internet, 15 percent have antenna (over-the-air) television service, and 12 percent have cable television. The most important television programming features are local programming and news programming.

- About one-half of respondents indicated that the County should install a state-of-the-art communications network, including 33 percent who indicated that the County should offer services directly.

Section 4 of this report documents the survey process, discusses methodologies, presents results, and provides key findings that will help Larimer County assess the current state and ongoing needs of its residents regarding high-speed communications services. A copy of the survey is included in Appendix A. Maps of selected question responses are included in Appendix B.

2 Stakeholder Meetings

Over the course of Phase I of the project, CTC engaged in on-site meetings with stakeholders and providers in the County to get a clear idea of the project, the broadband landscape, and any potential partnerships with the private sector that may be able to help the County achieve its goals.

2.1 Discussions with County Stakeholders Helped Frame the Problem and a Blueprint for a Solution

In early October 2017, CTC met with County representatives to better understand the County's goals, as well as the unique challenges associated with addressing broadband availability. These discussions helped to frame this report and will inform the structure of subsequent phases of the Project.

These on-site meetings sought to engage County employees, including representatives from the public affairs, economic development, resiliency, and County Manager's offices, to develop a sense of broadband needs in the County. While CTC asked some specific questions, stakeholders were also encouraged to have a free-flowing discussion about their broadband needs and the role they believe the County should take in addressing any gaps they felt existed in the market.

The goals of these discussions included:

- Understanding the background on the County's initiative
- Defining the areas of the County where the Project will focus its efforts
- Identifying key Project goals and objectives
- Outlining the County's "best case" outcome of this phase of the Project
- Gauging the level of involvement—from "hands off" to full retail service provider—the County hopes to take in the process
- Illuminating the County's competitive landscape for broadband services (see Section 3)

2.1.1 "Everywhere is Somewhere"

As a core guiding tenet of this initiative, County stakeholders assert that "broadband is a critical part of every community's infrastructure that impacts the economy, safety, well-being, education and overall connectedness of [Larimer County] residents, businesses and institutions."[3] With that

[3] "Larimer Broadband Project," Larimer County, CO. Available: https://www.larimer.org/broadband, (accessed April 2018).

in mind, the County's vision is to enable inclusive, high-speed, reliable, and affordable internet to all homes and businesses in the County.

Our initial discussions revealed that 48 percent of private land in the County is not served by broadband. This problem initially proved so overwhelming to the County that its initial desire to address the situation never gained traction. Further, stakeholders reported that emergency management issues from two previous disasters showed how isolated, and in turn vulnerable, some areas of the County are. County representatives detailed complete connectivity outages lasting for days at a time, with little to no response from incumbent providers to help avoid repeating the issue in the future.

As the problem became more obvious, and an increasing number of residents in unincorporated areas voiced frustration with the scant availability and/or high price of broadband service, the County began to look in earnest at its potential role in addressing the problem.

Reflecting a pragmatic approach to the problem, the County's goal is to help "move the needle" on countywide broadband availability. Although 1 Gigabit per second (Gbps, or "gig") speeds have received increased attention nationwide, the County recognizes that such speeds are well beyond the needs of residents and businesses in its underserved and unserved areas. Indeed, many residents and businesses only have access to services well below the Federal Communications Commission's definition of broadband—25 Megabits per second (Mbps) download/3 Mbps upload. Given this, the County's goal is to find a solution that will enable 100 Mbps residential and 200 Mbps commercial services to every home and business in the County, reaffirming its assertion that "Everywhere is Somewhere."

2.1.2 The County Wants to Focus Its Efforts on Unincorporated Areas

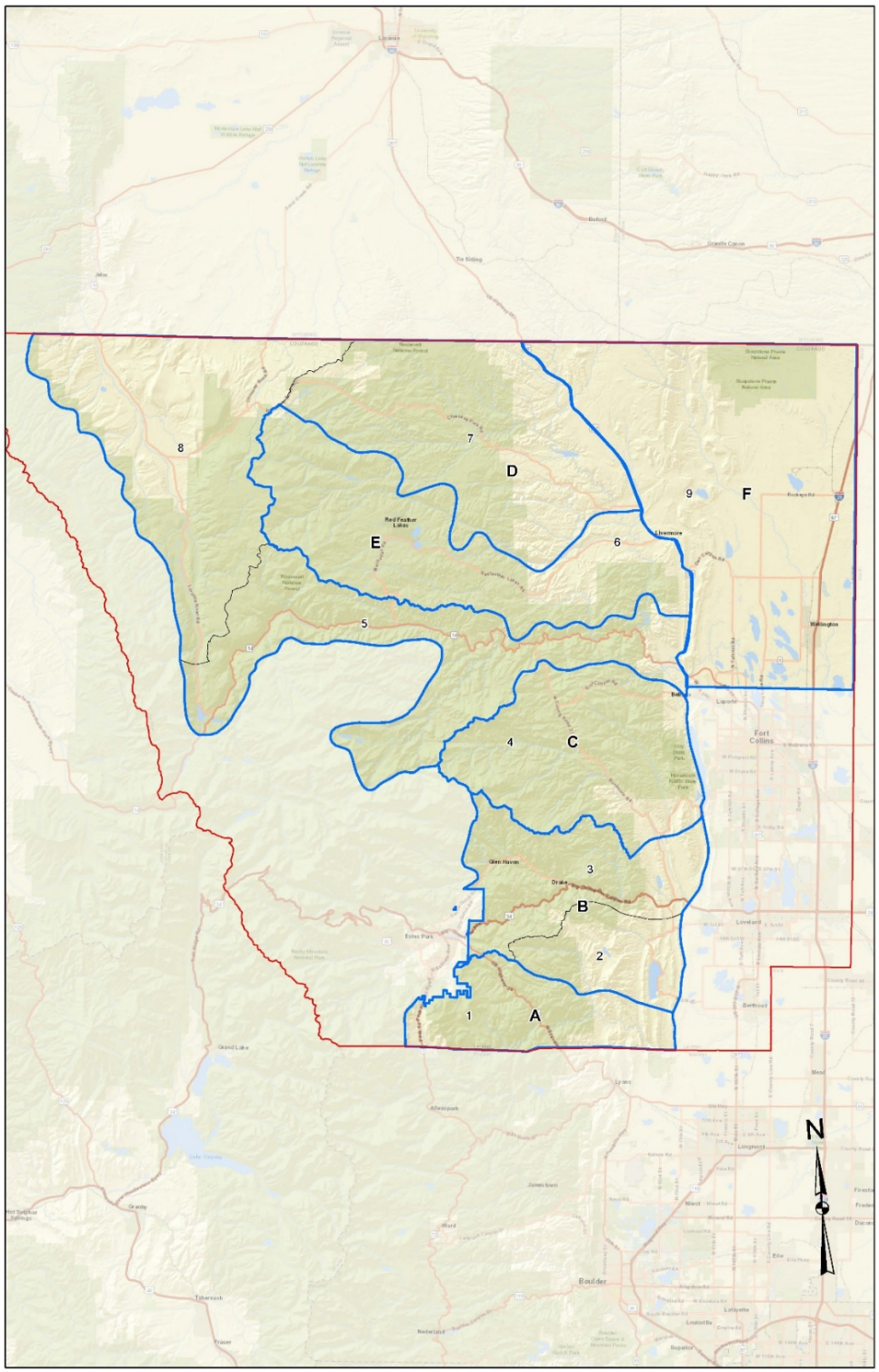
Stakeholders noted an understanding of the challenges of ubiquitous broadband availability in the County, including the distance between population centers outside of the southeastern portion of the County, the population density in these areas, and the overall size of the County itself. Recognizing that these challenges were less of a problem in the larger cities, and that the cities themselves were already making steps to address the issue, the County shifted its perspective—looking to address the broadband problem in the unincorporated areas of the County.

The County developed a map of the areas in which it wishes to focus its efforts, using the Mountain Resilience Plan as a starting point.[4] From the eight areas identified in the plan, the

[4] "Mountain Planning Areas," Larimer County, CO. Available: https://www.larimercompplan.com/mountain-planning-areas (accessed April 2018).

County selected a ninth area to include in the Project's efforts. Figure 1 is a map of these areas. Alphabetical characters on this map indicate Survey Areas, discussed further in Section 4.

Figure 1: Unincorporated Areas of Larimer County for Inclusion in Broadband Project



2.1.3 The County Aims to Facilitate Rather Than Fund the Solution

Discussions with stakeholders revealed that unlike the cities of Estes Park, Fort Collins, Greeley, and Loveland, the County has little interest in becoming a retail service provider—that is, deploying infrastructure, providing internet service, and handling customer relationships. Rather, the County is looking for actionable steps it can take to coordinate with the private sector to facilitate the deployment of internet service to every home and business in the unincorporated areas of the County. This insight spurred our discussions with local providers, discussed in Section 2.2, below.

2.1.4 The County Does Not Have a Preconceived Idea of the Best Course of Action

The County is approaching this Project with commendable openness. Stakeholders expressed an earnest desire to understand the current broadband environment based on the results of the statistically valid survey (see Section 4), rather than anecdotal information. Further, County stakeholders expressed their understanding that the solution may be more of a "toolkit," representing a multi-faceted strategy to address the unincorporated areas of the County on a case-by-case basis.

County representatives encouraged thoughtful reflection on the results of all phases of the Project before determining a strategy to move forward. We believe this patience and diligence may help the County garner actionable solutions to address broadband issues for the greatest number of County residents and businesses.

2.2 Partner Discussions Led to Important Insights

Engaging local and regional providers was an essential component of CTC's community outreach on behalf of the County. We facilitated in-depth discussions about two complementary issues: 1) the County's plans to serve target areas, and 2) the providers' current footprints, infrastructure, and service offerings in these areas.

These discussions sought to achieve the following objectives regarding the County's target areas:

- Include providers in the County's planning and strategic process
- Determine what services, if any, are currently offered by local and regional providers
- Identify existing infrastructure that may be available for County use
- Gather providers' perspectives regarding steps the County may take to support and spur private-sector investment and deployment
- Foster collaboration between the public and private sectors to encourage the greatest potential for broadband deployment and expansion

The County scheduled the series of on-site and teleconference meetings in December 2017 and January 2018. In an effort to stimulate frank discussions with providers, County representatives did not attend these discussions. CTC met with nearly a dozen local providers, ranging from very small wireless internet service providers (WISPs) to large incumbents with a national footprint.

In the sections below, we describe our findings.

2.2.1 Deploying Broadband Infrastructure Is Expensive in Many Parts of the County's Target Areas

Throughout CTC's discussions with providers, the high cost to deploy broadband infrastructure in the County's desired target areas was often central to the conversation. Most providers we spoke with noted that the County's target areas are likely not well-served today because it will be expensive and challenging to deploy infrastructure there.

Particularly for the private sector, the necessary return on investment (ROI) simply does not exist in these areas to justify infrastructure deployment and expansion. Even for providers that may have infrastructure nearby, the sparse density and complex terrain—especially in the western and northwestern portions of the County—make expanding to these areas difficult and unlikely.

2.2.2 Some Target Areas Are Within the Existing or Planned Footprint of Private Providers and Power Authorities

Certain portions of the County's target areas—specifically the southern portions of the County—are being served today, particularly by smaller regional WISPs. In some of these locations, providers may not currently be active, but have plans to offer service to these areas in the near future.

Areas where service providers are expanding or plan to expand service are typically more densely populated than other portions of the County's target locations. While these areas are hardly urban, they contain a reasonable potential customer base and often lack access to a variety of provider choices. This makes these areas desirable to potential providers that seek a reasonable ROI to justify the cost of extending service there.

Providers that have begun extending service to these areas already have an existing footprint nearby. Thus, the incremental cost to bring service to these locations is significantly less than if the providers sought to serve areas much farther away from their existing infrastructure.

Additionally, discussions with representatives from local power authorities (Poudre Valley Rural Electric Association and Platte River Power Authority) illuminated two potential strategies. In the first, Poudre Valley Power Authority's future construction efforts in unincorporated areas of the County may enable the County to co-build or lease dark fiber from the Authority, which may enable the County to connect some anchor institutions to bring fiber into communities. Second,

Platte River Power Authority may be open to a lit service arrangement, wherein the County could use PRPA fiber as one piece of its overall strategy. Both authorities are open to further discussion with the County in the future.

2.2.3 Permitting Processes Are a Key Focus for Providers

Complex, confusing, time-consuming, and expensive permitting processes were raised in every provider discussion CTC held. That is, every private-sector provider with which CTC engaged had input and experiences regarding difficult permitting processes in Larimer County, the state of Colorado, and even throughout the United States.

While frustration with expensive and convoluted public permitting processes is not unique to Colorado or Larimer County, there are distinct local characteristics and complicating factors, especially in the County's target areas. Specifically, some of the County's identified target areas contain significant acreage of public land over which the County has no jurisdiction and for which gaining access to public rights-of-way (PROW) can be extremely cost- or time-prohibitive. Providers indicated that in some locations, the process is not at all straightforward, and it may be nearly impossible to even *begin* the permitting process to gain access.

Several providers indicated that access to federally owned land is especially onerous, and can take nearly two years to even receive an answer, let alone permission. In some cases, even after waiting for long periods after seeking access to federal land, providers' applications are rejected. Long waiting periods can significantly affect a provider's ability to develop infrastructure, hinder speed to market, and substantially alter construction and deployment plans.

All the providers indicated that any steps the County can take to streamline its own permitting processes could be a major incentive to infrastructure deployment. Some providers claimed that simply having transparent policies and procedures combined with simplified costs and a guaranteed timeline would be sufficient. Others asked that the County consider waiving permitting fees entirely for private-sector infrastructure deployment, particularly in target areas.

2.2.4 The County May Need to Work with Multiple Providers to Achieve Its Goals

Given the vast range of potential customers and terrain that spans the County's target areas, it may be appropriate for the County to consider developing a combination of solutions that focuses on how best to serve certain areas. A global approach to deploying infrastructure and expanding service offerings in the County's target areas may not be feasible. Instead, working with multiple providers to develop necessary infrastructure to incent private investment and service expansion may be in the County's best interest.

2.2.5 It Will Be Important for the County to Determine and Articulate Its Own Definitive Plans

Every group of representatives with which we spoke indicated that they would be amenable to working with the County to achieve public-sector goals, especially given that the County does not seek to directly compete in the retail space with private industry.[5] However, these were preliminary discussions, and an ongoing dialogue will be necessary to flesh out what is truly possible between the County and the local providers.

Ultimately, one of the most important steps the County must take is to determine what it is able and willing to do, which will help illuminate for the private sector the degree to which the County is truly able to "partner." For example, if the County were willing to deploy fiber infrastructure in key locations to support WISP expansion of last-mile service, it would be important to articulate that willingness in concrete terms throughout ongoing discussions with private providers.

2.2.6 Consumer Demand Will Drive the County's Efforts

CTC released a survey in January 2018 to identify the broadband services used by residents in the County's target areas. This market research is a critical complement to the provider discussions we held because it will help further refine the County's target areas (i.e., by focusing on areas where broadband services are most limited, or where residents perceive the greatest need). Aggregating the responses to these surveys will aid the County in understanding where the greatest need exists, which will be a vital part of the planning process going forward.

[5] We note that the County has not entirely ruled out the possibility of acting as the retail service provider in certain situations where no alternative exists, but that entering the market as a for-choice provider is not one of the County's chief objectives. Rather, it would be a last-resort approach that the County may consider if private providers are unwilling or unable to serve certain areas.

3 Competitive Assessment

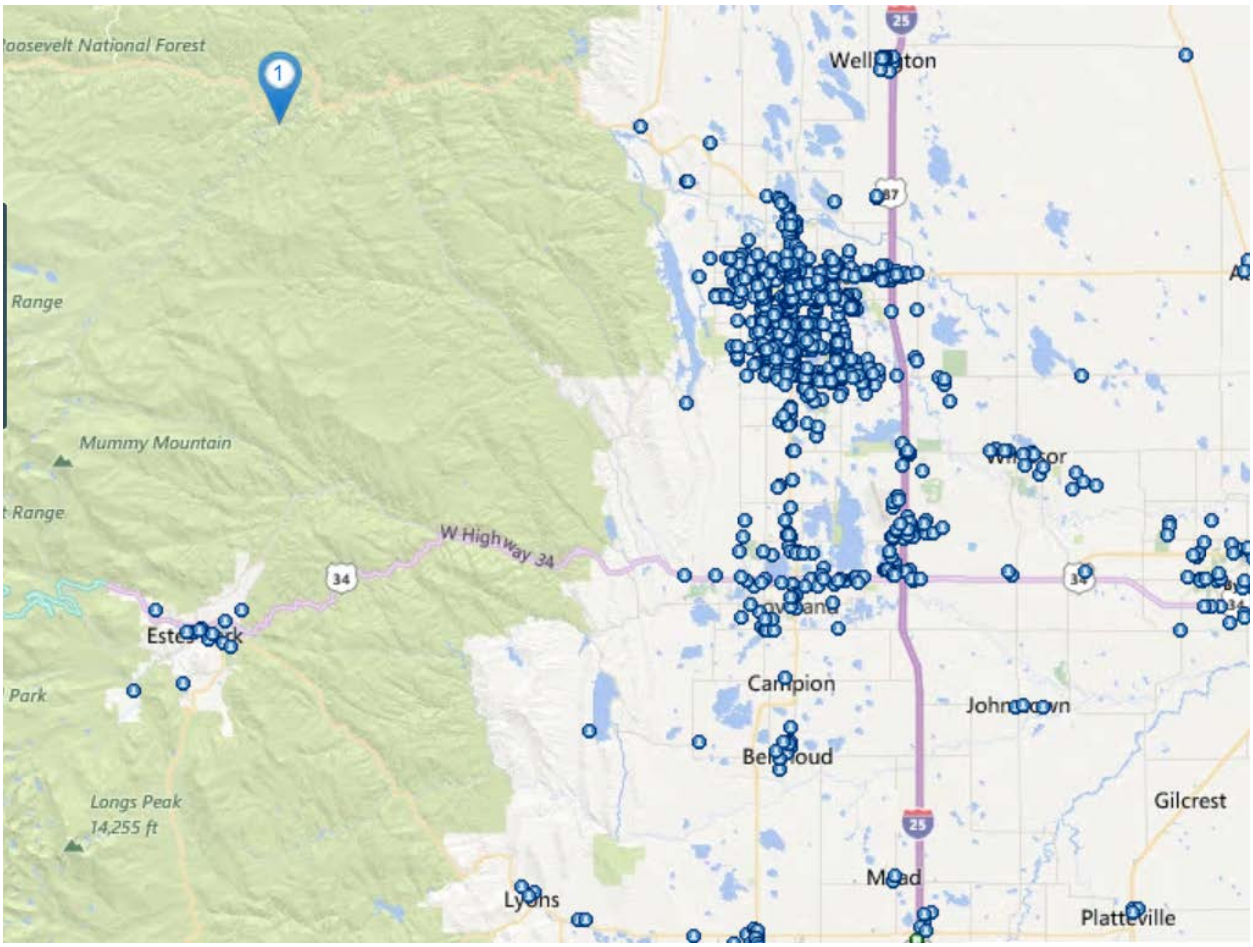
3.1 Enterprise Service Providers in Larimer County

This section provides an overview of broadband services available to medium and large business customers in Larimer County. We identified 10 enterprise service providers in the region that offer data transport services with speeds that range from 1 megabit per second (Mbps) to 10 gigabits per second (Gbps).

3.1.1 Overview of Service Availability and Pricing

Figure 2 shows the locations of lit buildings in the County, as serviced by some of the providers described below.

Figure 2: Lit Buildings in the County[6]



[6] Obtained from FiberLocator, March 2018. Infrastructure data available on FiberLocator is gathered from information provided by network carriers, which may not be complete. This is not intended to be a comprehensive representation of all fiber in the area.

Service providers that do not own infrastructure in the County offer lit services[7] through agreements with other local providers—tailoring these services to customers' requirements (e.g., speed, class of service). Service to locations close to the provider's network infrastructure is generally priced lower than service to more distance locations.

Comprehensive pricing comparisons are difficult, if not impossible, to compile for two reasons. First, service providers rarely make pricing publicly available, and will typically provide quotes only for a bona fide potential customer. Second, enterprise service providers do not have standard rates. Unlike the residential services that CenturyLink and Comcast deliver for a set monthly fee, enterprise services such as these are customized to individual customers' specific needs—and priced accordingly.

Enterprise service providers in the County offer Ethernet and Dedicated Internet Access (DIA) services. Ethernet service can be classified into three types: Ethernet Private Line (EPL or E-Line), Ethernet Virtual Private Line (EVPL), and ELAN. These services may be known by different names among providers.

EPL is a dedicated, point-to-point, high-bandwidth Layer 2 private line between two customer locations. EVPL service is like EPL, but is not dedicated between two locations. Instead, it provides the ability to multiplex multiple services from different customer locations (i.e., multiple virtual connections) to another point on the network. ELAN is a multipoint-to-multipoint connectivity service that enables customers to connect physically distributed locations across a Metropolitan Area Network (MAN), as if they are on the same Local Area Network (LAN).

Internet services over Ethernet are typically classified under two categories: Dedicated Internet Access (DIA) and Multiprotocol Label Switching (MPLS) based IP Virtual Private Networks (IP-VPN). Providers prefer to offer DIA services between locations on their networks (on-net) and provision MPLS-based services for connecting locations that are off-net (using last-mile connectivity from CenturyLink or Comcast) to avoid construction and installation costs.

MPLS-based networks provide high performance for real-time applications—such as voice and video—and are typically priced higher.

Customers can choose a type of Ethernet service based on their bandwidth demands and the number of locations they need to connect. Typically, Ethernet services are used by large business that have IT staff to manage their network.

[7] A "lit service" is one where the service provider owns and operates the network electronics which connect to, and "light," a fiber optic network.

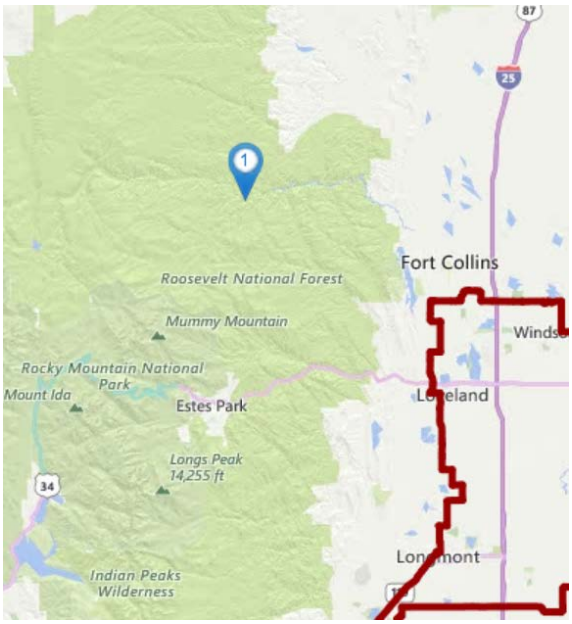
3.1.2 Enterprise Services

The carriers that provide these services in the County include Birch, CenturyLink, Comcast, FRII, Level (3), MegaPath, MHO, TDS, Windstream, XO, and Zayo. Prices depend on the bandwidth, location, proximity to the existing network, and network configuration; whether the service is protected or unprotected; and whether the service has a switched or mesh structure. Additional non-recurring charges may be assessed for installation, equipment, or other services.

Birch offers Ethernet and DIA services in the region. It can offer up to 1 Gbps symmetric service.[8]

CenturyLink provides point-to-point inter-city and intra-city configurations for full-duplex data transmission. The company offers Ethernet speeds of 2 Mbps to 100 Gbps.[9] Figure 3 shows part of the CenturyLink metro fiber network in the region.

Figure 3: CenturyLink Metro Fiber Network[10]

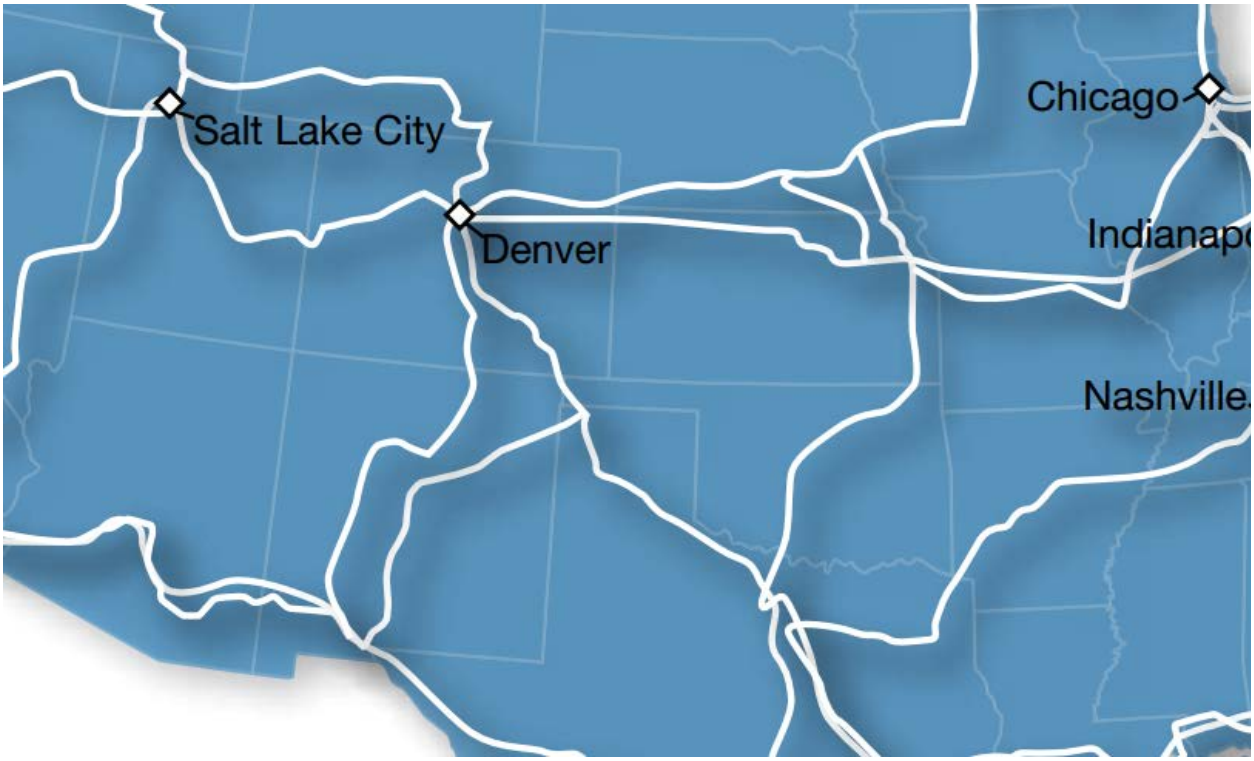


Comcast provides DIA and Ethernet services. Its EPL service enables customers to connect their customer premises equipment (CPE), such as a modem, using an Ethernet interface, as well as using any Virtual Local Area Networks (VLAN) or Ethernet control protocol across the service without coordination with Comcast. EPL service is offered with 10 Mbps, 100 Mbps, 1 Gbps, or

[8] http://www.birch.com/solution/size/enterprise, accessed March 2018.
[9] http://www.centurylink.com/business/networking/ethernet.html, accessed March 2018.
[10] Obtained from FiberLocator, March 2018. See footnote 6.

10 Gbps Ethernet User-to-Network Interfaces (UNI) and is available in speed increments from 1 Mbps to 10 Gbps.[11] Comcast's fiber optic backbone network is depicted in Figure 4.[12]

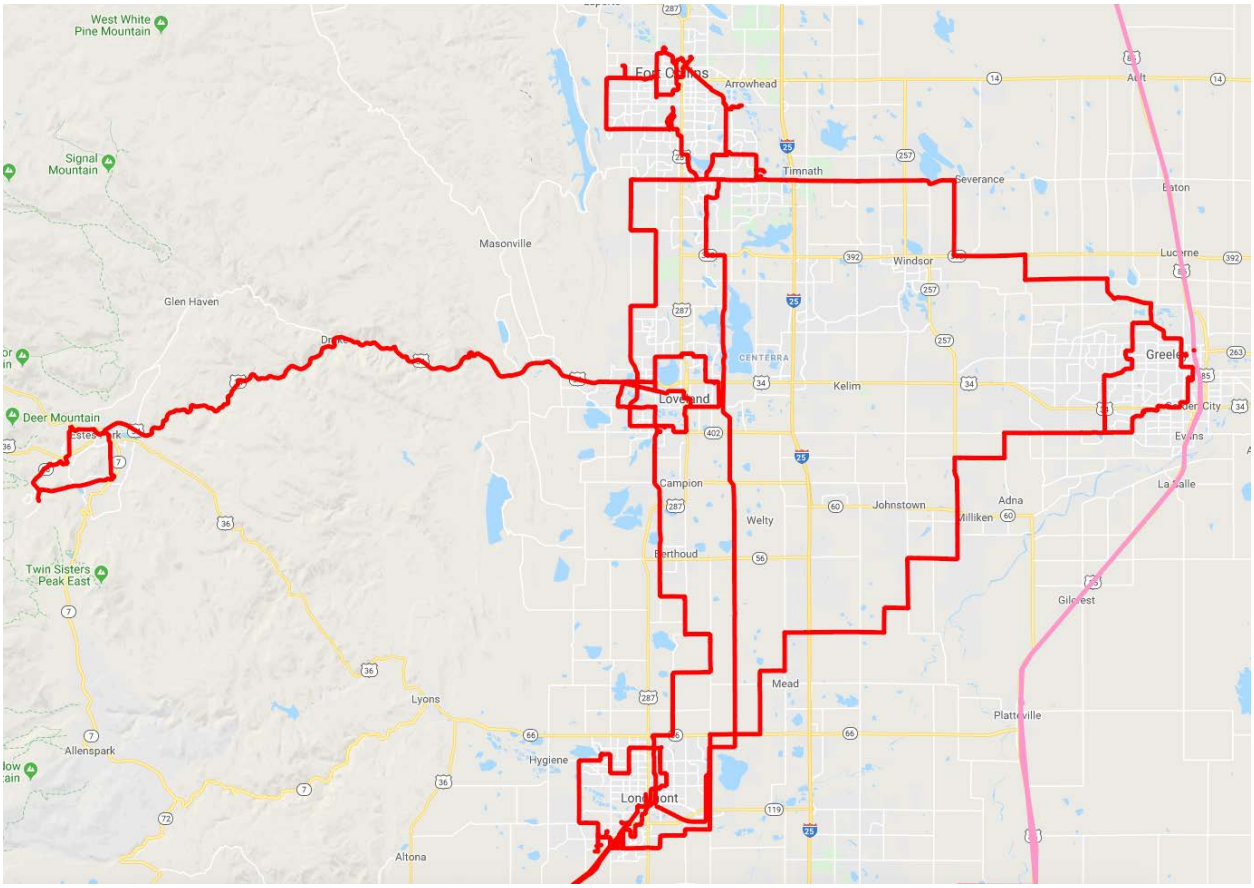
Figure 4: Comcast Fiber Routes



Level (3)'s Metro Ethernet dedicated service is available in 3 Mbps to 1 Gbps and its Ethernet Virtual Private Line (VPL) offers speeds ranging from 3 Mbps to 10 Gbps.[13] It is an end-to-end, Layer 2, switched Ethernet service delivered via an MPLS backbone. Internet services are available in a range of speeds up to 10 Gbps with 100 Gbps service additionally offered in some areas.[14] Level (3)'s network in the region is depicted in Figure 5, below.

[11] Increments lower than 10 Mbps are not available for "off-net" services. http://business.comcast.com/ethernet/products/ethernet-private-line-technical-specifications, accessed March 2018.
[12] http://business.comcast.com/about-us/our-network, accessed March 2018.
[13] http://www.level3.com/en/products/private-line-services/, accessed March 2018.
[14] http://www.level3.com/en/products/secure-internet-services/, accessed March 2018.

Figure 5: Level(3) Metro Network[15]



Based out of Fort Collins, Front Range Internet (FRII) offers carrier Ethernet and DIA services in the region by leveraging other Tier 1 carrier networks. FRII's standard metro Ethernet solution offers speeds ranging from 3 Mbps to 1 Gbps.[16] They also offer service over a fiber ring capable of speeds from 10 Mbps to 10 Gbps.[17]

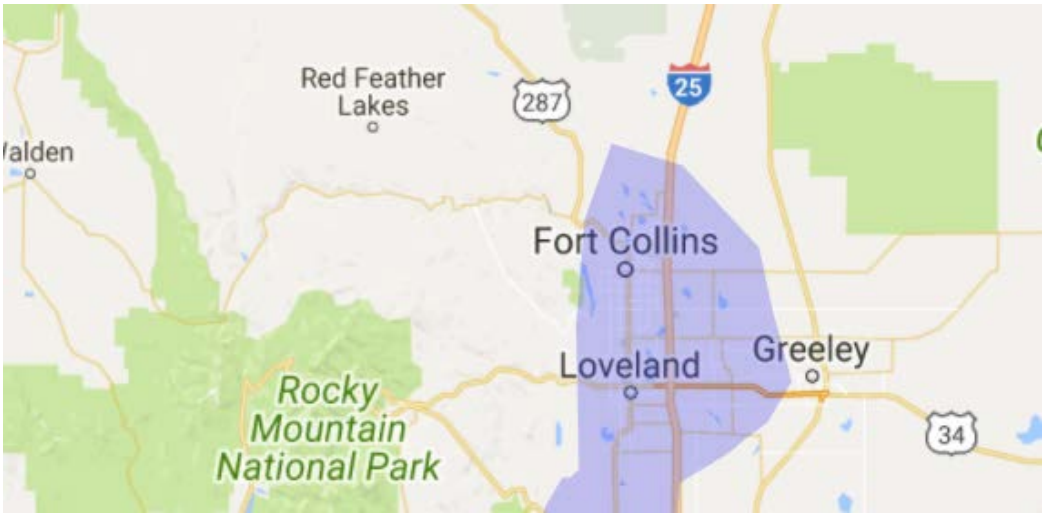
MegaPath offers Ethernet, DSL, T1, and cable services with speeds of up to 1 Gbps symmetric for business customers in certain parts of the County.[18] The lowest plan offered is for 1.5 Mbps download speeds at $45 per month. Higher speeds are available on a case-by-case basis.[19]

MHO Networks provides DIA and Ethernet services in the County, as shown in the figure below. It primarily serves small to medium-size businesses but also offer services to carriers and

[15] Obtained from FiberLocator, March 2018. See footnote 6.
[16] https://frii.com/commercial/ethernet, accessed March 2018 .
[17] https://frii.com/10-gb-fiber/, accessed March 2018.
[18] http://www.megapath.com/services/, accessed March 2018.
[19] http://www.megapath.com/data/ethernet/, accessed March 2018.

enterprises. DIA speeds from 10 Mbps up to 4 Gbps are available. Their Metro Ethernet service provides connectivity within the area with speeds from 10 Mbps to 1 Gbps.[20]

Figure 6: MHO Business Services Coverage Map[21]

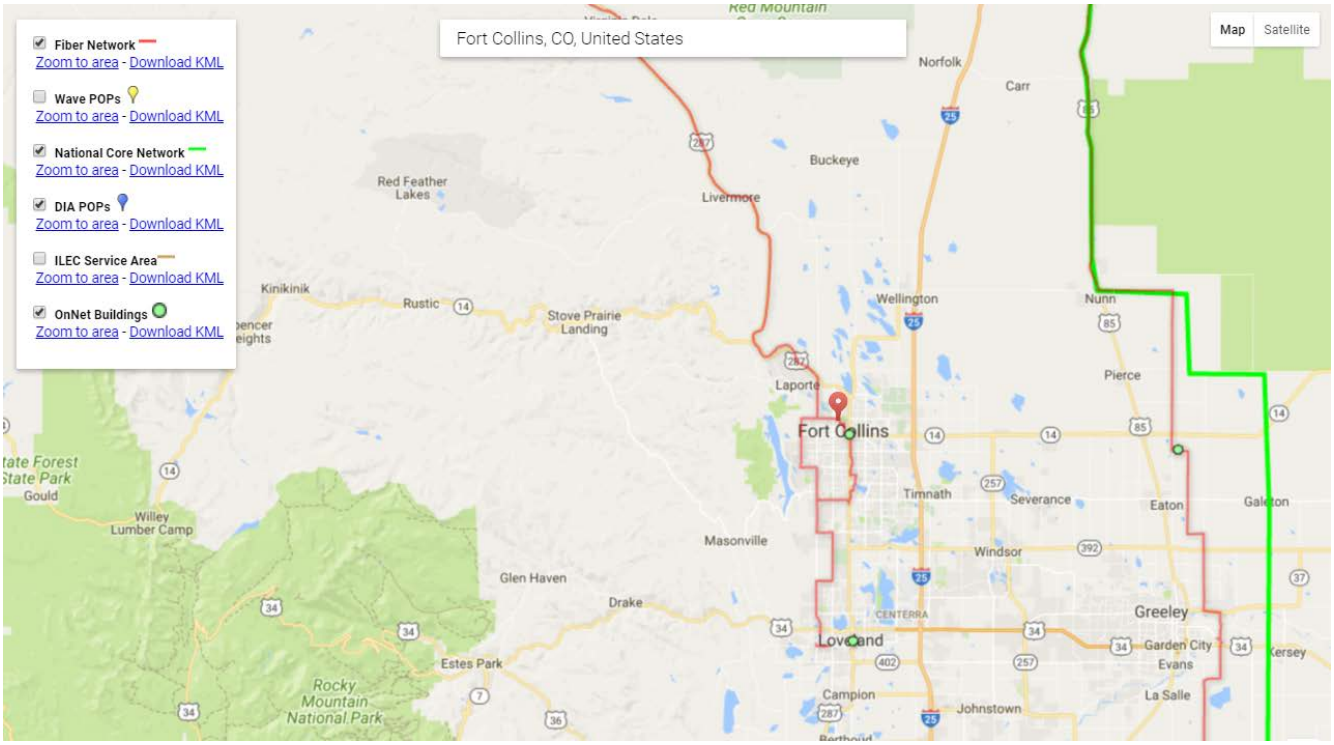


TDS Telecom offers Metro Ethernet services in speeds scalable from 2 Mbps to 10 Gbps in the region.[22]

Windstream Communications has a nationwide presence serving major metropolitan areas. In the County, it offers speeds up to 1 Gbps.[23] A 1 Gbps DIA service in the County would cost around $3,000, based on the location. Figure 7, below, shows the Windstream network in the region.[24]

[20] http://www.mho.com/services, accessed March 2018.
[21] https://www.mho.com/coverage-co/, accessed March 2018.
[22] https://tdsbusiness.com/carrier-wholesale.html, March 2018.
[23] https://www.windstreambusiness.com/shop/products/co/fort-collins, accessed March 2018.
[24] Obtained from FiberLocator and http://carrier.windstreambusiness.com/interactive-map/, accessed March 2018. See footnote 6.

Figure 7: Windstream Network Map (with Points-of-Presence)[25]

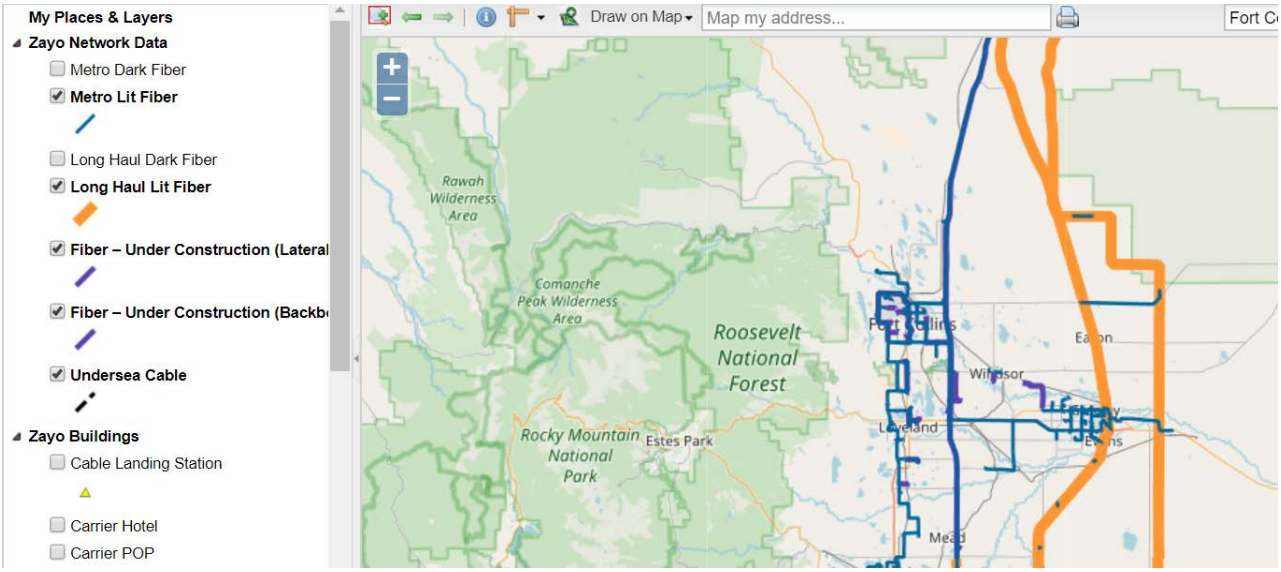


XO Communications offers carrier Ethernet and DIA services at multiple bandwidth options, from 3 Mbps to 100 Gbps, over its Tier 1 IP network.[26,27]

Zayo delivers Ethernet in three service types, with bandwidths ranging from 100 Mbps to 10 Gbps and optional quality of service (QoS) guarantees and route protection, based on customer needs. Service options include Ethernet-Line, which provides point-to-point and point-to-multipoint configurations with reserved bandwidth availability; Ethernet-LAN, with multipoint configurations having a guaranteed service level; and Ethernet Private Dedicated Network (E-PDN)—a completely private, managed network operated by Zayo, with dedicated fiber and equipment.[28] The Zayo network map illustrating its long-haul and metro fiber in the region is provided in the figure below.[29]

[25] Obtained from FiberLocator, March 2018. See footnote 6.
[26] http://www.xo.com/carrier/transport/ethernet/, accessed March 2018
[27] http://www.xo.com/network-services/internet-access/ip-transit/100G/, accessed March 2018.
[28] http://www.zayo.com/ethernet, accessed March 2018.
[29] http://www.zayo.com/solutions/global-network/, accessed March 2018.

Figure 8: Zayo Network Map[30]



Zayo's pricing for 1 Gbps and 10 Gbps point-to-point Ethernet circuits between two on-net locations in Denver is provided in the table below.

Table 1: Zayo 1 and 10 Gbps Ethernet Transport On-Net Pricing in Denver

Speed	60-Month Contract	12-Month Contract
1 Gbps	$1,165	$1,596
10 Gbps	$2,745	$3,760

Pricing for a 1 Gbps and 10 Gbps DIA service for an on-net location in Denver is provided in the table below.

Table 2: Zayo 1 and 10 Gbps DIA pricing in Denver

Speed	60-Month Contract	12-Month Contract
1 Gbps	$3,083	$5,138
10 Gbps	$14,666	$24,444

[30] Obtained from FiberLocator, March 2018. See footnote 6.

3.2 Residential and Small Business Services in the County

Residential and small business customers in Larimer County have access to a range of services, though individual service options are largely dependent on location. Table 3 lists the service providers and minimum price for each type of service that is available in at least some part of the County. These prices were reported by the carriers, and were accurate at the time of this report. We note these prices may have changed.

Table 3: Overview of Residential and Small Business Data Services in Larimer County

Service Type	Provider	Minimum Price (per month)
Cable	Comcast	$29.99
	TDS	Case-by-case
DSL	Birch	$39.95
	CenturyLink	$45
Satellite	HughesNet	$49.99
	Viasat[31]	$59.99
Mobile/Wireless Internet Service Provider	AT&T	$14.99
	Sprint	$15
	T-Mobile	$20
	Verizon	$20
	Airbits	$29
	Cricket	$30
	Estes Valley Networks	$35
	Rise Broadband	$42.95
	Colorado Wireless Exchange	$45
	FRII	$64.95

3.2.1 Cable

Comcast offers download speeds from 15 Mbps up to 1 Gbps starting at $29.99 per month, as shown in Table 4. Discounted prices are available if bundled with another service like voice or TV, or with a one-year agreement.[32] Comcast recently launched gigabit-speed service in the County. With a two-year agreement, gigabit service is available for $89.99 per month; 2 Gbps service is $299.99 per month.

[31] Formerly Exede Internet.

[32] http://www.comcast.com/internet-service.html, accessed March 2018.

Table 4: Comcast Residential Internet – Internet Only

Package	Internet Speed	Monthly Price
Performance Starter	Up to 15 Mbps download	$29.99
Performance Plus	Up to 60 Mbps download	$29.99
Performance Pro	Up to 150 Mbps download	$39.99
Blast! Pro	Up to 250 Mbps download	$49.99
Gigabit Internet	Up to 1 Gbps download	$89.99
Gigabit Internet Pro	Up to 2 Gbps download	$299.95

For small business customers, multiple options are available with 150 Mbps download speed service at $249.50 per month with a two-year agreement.[33] A 1 Gbps service may also be available in some locations.[34]

Table 5: Comcast Small Business Internet – Internet Only

Package	Internet Speed	Monthly Price
Starter Internet	Up to 25 Mbps download	$69.95
Deluxe 50 Internet	Up to 50 Mbps download	$109.95
Deluxe 75 Internet	Up to 75 Mbps download	$149.95
Deluxe 100 Internet	Up to 100 Mbps download	$199.95
Deluxe 150 Internet	Up to 150 Mbps download	$249.95
Gig Internet	Up to 1 Gbps download	Site-specific

TDS offers business internet speeds of up to 100 Mbps in the area.[35]

3.2.2 DSL

Birch provides DSL-based business services in the region starting at $39.95 per month for 3 Mbps download speeds and 512 Kbps upload speeds. For an increased price, speeds up to 24 Mbps are available.[36]

CenturyLink offers DSL service for residential customers starting at $45 per month for unbundled, or "standalone" internet service with download speeds between 1.5 Mbps and 25 Mbps. Speeds from 40 Mbps start at $55 per month, and range up to 200 Mbps at $85 per month.

3.2.3 Satellite

Satellite internet access is available in the area as well. HughesNet has four residential packages available and four geared toward businesses. With uniform download and upload speeds, plans

[33] https://business.comcast.com/internet/business-internet, accessed March 2018.
[34] https://business.comcast.com/gig, accessed March 2018.
[35] http://hellotds.com/business/internet, accessed March 2018.
[36] http://www.birch.com/products/birchnetwork/birchnet-broadband, accessed March 2018.

are differentiated by their monthly data allowances. Residential offerings include an "anytime" allowance, plus a larger 50 GB "bonus bytes" allowance, which can be used from 2 a.m. to 8 a.m. Business offerings include a "business period" allowance to be used between 8 a.m. and 6 p.m., plus a smaller 25 GB "anytime" allowance. All packages require a two-year agreement. Details and pricing are listed in the tables below.

Table 6: HughesNet Satellite Residential Plans[37]

Package	Internet Speed	Monthly Data Allowance (Anytime + Bonus Bytes)	Monthly Price
Gen5 10 GB	25 Mbps down/3 Mbps up	10 GB + 50 GB	$49.99
Gen5 20 GB	25 Mbps down/3 Mbps up	20 GB + 50 GB	$59.99
Gen5 30 GB	25 Mbps down/3 Mbps up	30 GB + 50 GB	$79.99
Gen5 50 GB	25 Mbps down/3 Mbps up	50 GB + 50 GB	$129.99

Table 7: HughesNet Satellite Business Plans[38]

Business Package	Internet Speed	Monthly Data Allowance (Business Period + Anytime)	Monthly Price
Business 25	25 Mbps down/3 Mbps up	25 GB + 25 GB	$69.99
Business 50	25 Mbps down/3 Mbps up	25 GB + 25 GB	$89.99
Business 75	25 Mbps down/3 Mbps up	50 GB + 25 GB	$129.99
Business 150	25 Mbps down/3 Mbps up	100 GB + 50 GB	$239.99

Viasat (formerly Exede Internet) also offers residential and business satellite services in the County. Residential plans provide between 12 Mbps and 30 Mbps download and 3 Mbps upload for all plans. A 12 Mbps down/3 Mbps up plan starts at $30 per month for 10 GB of data. Data used between 3 a.m. and 8 a.m. are not counted toward the monthly total. The other plans provide unlimited data starting at 12 Mbps down and 3 Mbps up for $50 per month and go up to 30 Mbps down and 3 Mbps up for $100. After reaching 150 GB in a month, a customer's traffic may be de-prioritized behind other customers for the remainder of the month. Viasat's business-class product provides 15 Mbps download speeds and 4 Mbps upload.[39]

[37] https://www.hughesnet.com/get-started accessed March 2018.
[38] https://business.hughesnet.com/get-started accessed March 2018.
[39] https://www.exede.com/business-order-availability, accessed March 2018.

Table 8: Viasat Satellite Residential Plans[40]

Download Speed	Upload Speed	Monthly Data Allowance (Anytime + Bonus Bytes)	Monthly Price for 3 Months	Standard Monthly Price
12 Mbps	3 Mbps	10 GB	$30.00	$50.00
12 Mbps	3 Mbps	Unlimited	$50.00	$70.00
25 Mbps	3 Mbps	Unlimited	$70.00	$100.00
30 Mbps	3 Mbps	Unlimited	$100.00	$150.00

3.2.4 Wireless

Verizon offers two 4G LTE data packages with multiple choices for data allowances and pricing, depending on the desired mobility and equipment chosen. The data-only mobile plan offers monthly prices that range from $20 for a 2 GB data allowance to $710 for a 100 GB data cap. A connected device can be added for $5 per month.[41]

Verizon's LTE Internet (Installed)[42] plan is a data-only 4G LTE service used on a fixed home device with Wi-Fi connectivity and wired Ethernet for up to four devices. Available download speeds are 5 Mbps to 12 Mbps and upload speeds are 2 Mbps to 5 Mbps. Monthly prices range from $60 for a 10 GB data allowance to $150 for a 40 GB data cap. Overages are charged at $10 per additional GB. A two-year contract is required, with a $350 early termination fee. Verizon offers a $10 monthly deduction for every month completed in the contract.

AT&T offers three tiers of 4G Long-Term Evolution (LTE) wireless data service in the area:

- 250 MB per month download allowance for $14.99 per month
- 3 GB per month download allowance for $30 per month
- 5 GB per month download allowance for $50 per month

Each of these plans has an overage fee: $14.99 per 250 MB on the 250 MB plan and $10 per 1 GB on the 1 GB, 3 GB, and 5 GB plans. There are also equipment charges, with or without a contract, and an activation fee up to $45.[43]

Sprint offers 4G LTE wireless data in the County. The three data packages offered are $15 per month for a 100 MB data allowance, $50 per month for a 6 GB data allowance, and $110 per

[40] https://www.exede.com/plan-results/unlimited-basic, accessed March 2018.
[41] https://www.verizonwireless.com/plans/data-only-plan/, accessed March 2018.
[42] https://www.verizonwireless.com/home-services/lte-internet-installed/, accessed March 2018.
[43] https://www.att.com/shop/wireless/plans/planconfigurator.html, accessed March 2018.

month for a 30 GB data allowance. Sprint charges $.05 for each MB over the limit. A two-year contract is required, as well as an activation fee of $36 and equipment charges. There is an early termination fee of $200.

T-Mobile offers month-to-month wireless data options for mobile hot spots or tablet devices. Pricing is based on the total amount of data needed per month; plans with 6 GB of data or more allow the customer to carry over unused data into subsequent months (up to 22 GB). The 2 GB plan costs $20 per month; increased data limits are available at incremental costs in a total of six packages, up to $85 per month for up to 22 GB of data. Depending on current promotions, the $35 activation fee is sometimes waived.[44]

Cricket Wireless offers 4G LTE wireless service with a download speed of up to 8 Mbps with five options for data allowance packages. Starting at $30 per month for 2 GB of allowed data, options increase to an unlimited data allowance for $60 per month. There is a $15 activation fee, but no contract or early termination fees.[45]

Airbits offers wireless internet service in the County with three speed options. Service starts at 1 Mbps for $29 per month up to 12 Mbps for $79 per month.[46]

Colorado Wireless Exchange offers wireless internet service with speeds from 5 Mbps at $45 per month to 10 Mbps at $65 per month. There is also a membership fee of $100 or $150 that includes the installation fees.[47]

Estes Valley Networks offers wireless broadband service in the County with three residential speed options. Plans are available at $29 per month at 1 Mbps speeds, $49 per months at 6 Mbps speeds, and $79 per months for 12 Mbps.[48] Business-class services are also available. A 6 Mbps download speed service is available at $49 and a 12 Mbps service is priced at $79 per month.[49]

Rise Broadband is a wireless internet service provider (WISP) that provides services in some parts of the County with speeds up to 25 Mbps for residential customers at $29.95 per month (12-month promotional price). Speeds up to 5 Mbps are available for $19.95 per month. After the first 12 months, prices increase by $10 per month. Business-class 35 Mbps service is $79.95 per month, while 50 Mbps service is $99.95 per month with a one-year agreement. Business

[44] http://www.t-mobile.com/cell-phone-plans/mobile-internet.html, accessed March 2018.
[45] https://www.cricketwireless.com/support/plans-and-features/cricket-plans-and-features/customer/plans.html accessed March 2018.
[46] https://www.airbits.com/airbits-high-speed-internet/,accessed March 2018.
[47] http://www.cwx.net/, accessed March 2018.
[48] http://www.estesvalley.net/residential.html, accessed March 2018.
[49] http://www.estesvalley.net/business.html, accessed March 2018.

customers can reduce their monthly cost by $5 by signing a two-year agreement and by $10 by signing a three-year agreement.[50]

Front Range Internet (FRII) offers its WiFRII wireless service to both residential and business customers. Residential customers can receive speeds between 20 Mbps and 60 Mbps starting at $64.95 per month while business customers can receive speeds between 25 Mbps and 60 Mbps with plans starting at $149.95 per month.[51] Table 9 details residential service plans and Table 10 details business plans. All plans require a one-time setup fee of $99 and include a static IP address and the required wireless equipment.

Table 9: FRII Wireless Residential Plans

Download Speed	Upload Speed	Monthly Price
20 Mbps	10 Mbps	$64.95
40 Mbps	15 Mbps	$79.95
60 Mbps	20 Mbps	$99.95

Table 10: FRII Wireless Business Plans

Download Speed	Upload Speed	Monthly Price
25 Mbps	5 Mbps	$149.95
50 Mbps	10 Mbps	$199.95
60 Mbps	15 Mbps	$249.95

FRII also offers custom commercial wireless solutions including point-to-point, point-to-multipoint, and mesh configurations.[52] Pricing for these custom solutions varies.

[50] https://www.risebroadband.com/small-business/packages/, accessed March 2018.
[51] https://frii.com/wifrii/, accessed March 2018.
[52] https://frii.com/commercial/custom-wireless/, accessed March 2018.

4 Residential Survey

As part of an effort to evaluate and improve high-speed communications services across the region, especially in more sparsely-populated areas, the County conducted a mail survey of randomly selected residences within specific areas of the County in January 2018. The survey captured information about residents' current communications services, satisfaction with those services, desire for improved services, willingness to pay for faster internet speeds, and opinions regarding the role of the County regarding internet access and service. A copy of the survey instrument is included in Appendix A. Maps of selected survey responses are included in Appendix B.

Although the conclusions contained in this report are statistically valid, we note that the information gathered by the survey is the opinions of those who responded to the survey at the time of their response. It should not be assumed that the opinions discussed below represent the entirety of residents in the unincorporated areas of the County.

4.1 Survey Process Overview

Larimer County acquired the services of Columbia Telecommunications Corporation (CTC) to help assess internet access in the region and evaluate options to improve service in select areas of the County. CTC and its partner market research firm, Clearspring Research (together, the "Consultant"), coordinated and managed the survey project, including development of the draft questionnaire, sample selection, mailing and data entry coordination, survey data analysis, and reporting of results. CTC and Clearspring have substantial experience conducting similar surveys for municipalities and utilities nationwide.

4.1.1 Coordination and Responsibilities

A project of this magnitude requires close coordination between the County and the Consultant managing the project. This section briefly describes the project coordination and responsibilities.

In the project planning phase, County management and the Consultant discussed the primary survey objectives, the timing of the survey and data needs, and options for the survey process. The project scope, timeline, and responsibilities were developed based on those discussions.

The Consultant developed the draft survey instrument (questionnaire) based on the project objectives and provided it to County staff for review and comment. County staff provided revisions and approved the final questionnaire, selected specific geographies for survey sampling and analysis, and provided the names and addresses of residents within those geographies from which the list of recipients was selected. The Consultant randomly selected 8,375 households across six separate geographic regions to receive the survey packet, coordinated all printing, mailing, and data entry efforts, and provided regular updates regarding survey responses. The

Consultant performed all data coding and cleaning, statistical analyses, response summaries, and reporting of results.

The primary responsible party at Larimer County was the Broadband Program Manager, guided by the Broadband Steering Committee. The primary responsible parties at Consultant were the Principal Engineer, the Principal Research Consultant, and the Research Director.

4.1.2 Survey Mailing and Response

A total of 8,375 survey packets were mailed first-class in January 2018. The survey sample was designed to provide statistically valid results using minimum criteria within each of six specific regions in the unincorporated areas of the County. The sample was obtained by identifying residential locations in each survey area, identifying the appropriate mailing address for the parcel owner of each location (to ensure the survey reached the owner of any seasonal homes), and removing duplicates from the list. Then, a random sampling of each area was selected.

The goal of the survey was to receive at least 200 valid responses within each of the six separate geographical areas. Reaching this level would provide statistically valid responses with a confidence interval of approximately ± 7.0 percent at the 95 percent probability level for each individual area. That is, responses would provide a valid representation of the total households within that region within a 7.0 percent margin 19 times in 20. At the aggregate level across all six regions, the designed confidence interval was within ± 3.0 percent.

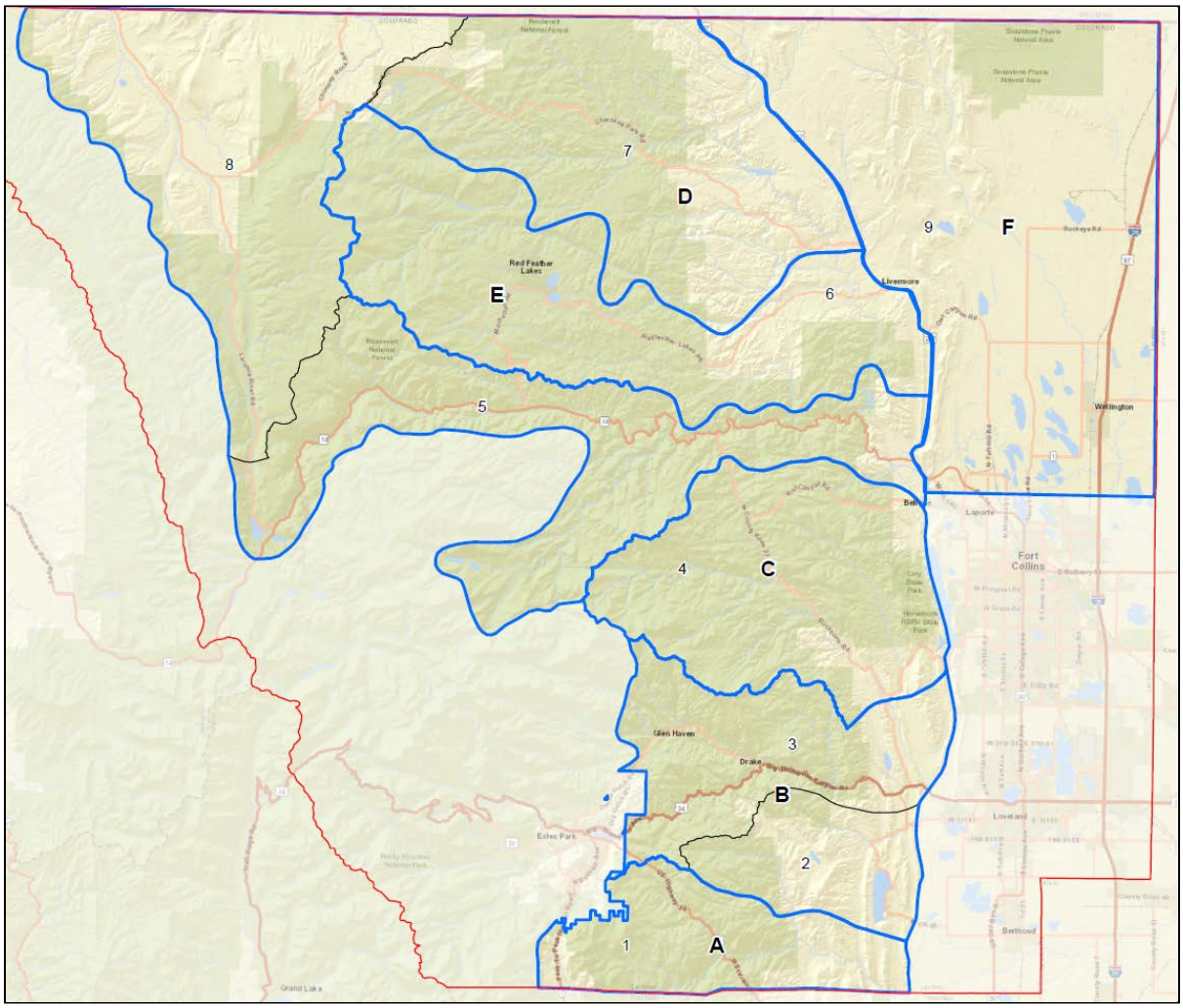
The number of households, the number of survey packets mailed, and responses in each geographic area is summarized in Table 11. The areas with lower estimated response rates have higher concentrations of non-permanent residences (seasonal dwellings, etc.) and it was therefore assumed that fewer would respond to the survey. As is evident in Table 11, the actual response rate was much higher than estimated.

Table 11: Survey Areas and Response

Area	Households	Survey Packets Mailed	Estimated Response %	Actual Responses	Actual Response %
A	1,222	1,178	15%	393	33.4%
B	2,515	1,340	15%	473	35.3%
C	1,673	1,340	15%	392	29.3%
D	1,215	1,177	10%	375	31.9%
E	3,479	2,000	10%	555	27.8%
F	2,446	1,340	15%	470	35.1%
Missing				12	
Total	12,550	8,375		2,670	31.9%

Areas A, B, and C are generally in southern portions of the County while areas D, E, and F are in northern portions of the County. The geographic areas are illustrated in Figure 9.

Figure 9: Survey Areas



Recipients were provided with a postage-paid business reply mail envelope in which to return the completed questionnaire. A total of 2,670 useable questionnaires were received by the date of analysis,[53] providing a gross response rate of 31.9 percent. The margin of error for aggregate results at the 95 percent confidence level for 2,670 responses is ±1.7 percent across the entire region in aggregate. 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 ±1.7 percent of the population as a whole (all households within each region). The confidence intervals for each region vary between ±3.8 percent and ±4.3 percent based on the number of households

[53] At least 53 responses were received after analysis had begun, and are not included in these results.

and responses, as show in Table 12. These are well within the initial sample design, since response rates were much higher than anticipated.

Table 12: Confidence Intervals by Area

Area	Households	Responses	Confidence Interval ±
A	1,222	393	4.1%
B	2,515	473	4.1%
C	1,673	392	4.3%
D	1,215	375	4.2%
E	3,479	555	3.8%
F	2,446	470	4.1%
Missing ID		12	
Total	12,550	2,670	1.7%

4.1.3 Data Analysis

The survey responses were entered into SPSS[54] software and the entries were coded and labeled. SPSS databases were formatted and cleaned, and a comprehensive verification process for a sample of responses was completed prior to the data analysis. Address information was merged with the survey results using the unique survey identifiers printed on each questionnaire such that results could be mapped, if desired. 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 data were weighted to compensate for disproportionate sampling stratification and response among some area and age groups. The data were weighted to match the area distribution and the age distribution in the population according to the database and 2010 US Census[55] counts.

Since older persons are more likely to respond to surveys than younger persons, the age-weighting corrects for the potential response bias based on the age of the respondent. In this manner, the results more closely reflect the opinions of the Larimer County adult population within the survey region. The age distribution for the adult population and for survey respondents is summarized in Table 13. Note that the Census age population represents the non-City (i.e. excluding Ft. Collins and Loveland) portion of Larimer County as a proxy for the survey region.

[54] Statistical Package for the Social Sciences (http://www-01.ibm.com/software/analytics/spss/)
[55] https://www.census.gov/data/datasets/2010/dec/demographic-profile-with-geos.html

Table 13: Age Distribution

Age Cohort	Census Pop'In (Adult, 2010)	% Adult Population	**Survey Responses	% Responses
18-44	25,017	36.2%	276	10.6%
45-64	31,113	45.0%	1,229	47.1%
65+	13,023	18.8%	1,104	42.3%
Total	69,153	100.0%	2,609	100.0%
**Not all respondents provided their age.				

In addition to the age weighting used to mitigate age bias in the responses, all results for the aggregate area are weighted to reflect the different sizes and number of responses within each of the six geographic areas. Table 14 summarizes the number and distribution of households in the database for each area, as well as the sample response distribution by area.

Table 14: Area Distribution

Area	Households	% Households	Responses	% Responses
A	1,222	9.7%	393	14.8%
B	2,515	20.0%	473	17.8%
C	1,673	13.3%	392	14.7%
D	1,215	9.7%	375	14.1%
E	3,479	27.7%	555	20.9%
F	2,446	19.5%	470	17.7%
Missing ID			12	
Total	12,550		2,670	

The survey weights were created by taking the ratio of the distribution of each area-age combination in the population to the distribution in the survey sample. Table 15 shows the percentage of the total population that falls within each area-age combination; Table 16 shows the same distribution for the survey sample.

Table 15: Area by Age Distribution for Adult Population

	Age 18 44	Age 45 64	Age 65+	TOTAL
Area A	3.5%	4.4%	1.8%	**9.7%**
Area B	7.2%	9.0%	3.8%	**20.0%**
Area C	4.8%	6.0%	2.5%	**13.3%**
Area D	3.5%	4.4%	1.8%	**9.7%**
Area E	10.0%	12.5%	5.2%	**27.7%**
Area F	7.1%	8.8%	3.7%	**19.5%**
TOTAL	**36.2%**	**45.0%**	**18.8%**	**100%**

Table 16: Area by Age Distribution for Survey Sample

	Age 18 44	Age 45 64	Age 65+	TOTAL
Area A	1.6%	7.3%	6.0%	**14.9%**
Area B	1.8%	8.9%	7.2%	**17.9%**
Area C	2.0%	7.2%	5.4%	**14.7%**
Area D	.8%	5.5%	7.8%	**14.0%**
Area E	1.9%	9.6%	9.3%	**20.8%**
Area F	2.5%	8.5%	6.6%	**17.6%**
TOTAL	**10.6%**	**47.1%**	**42.4%**	**100%**

The survey weight for each cell equals the population percentage divided by the sample percentage. Through the weighting process, any reporting of aggregate results is reflective of the population across the entire survey area based on the age of the respondents and the area from which the response was received.

The following sections summarize the survey findings.

4.2 Survey Results

The results presented in this report are based on analysis of information provided by 2,670 respondents from an estimated 12,550 households in the portion of the County being surveyed. Results are representative of the set of households within this entire region with a confidence interval of ±1.7 percent at the aggregate level. Breakouts within the six different survey regions are provided for key questions, and results for each individual region are generally available with confidence intervals between ±3.8 and ±4.3 percent, as discussed previously.

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.

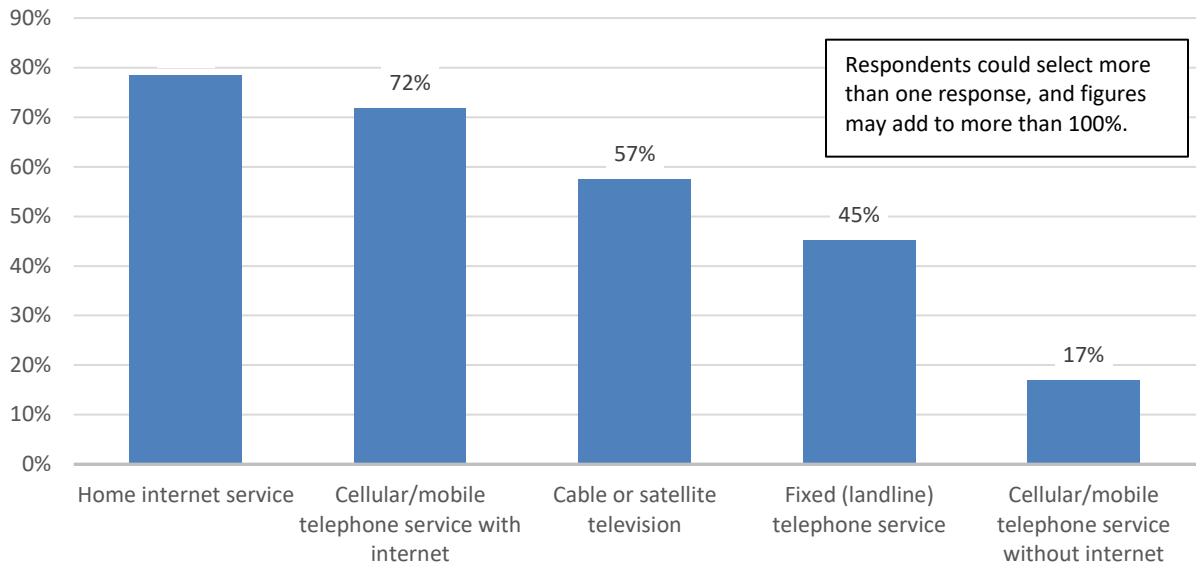
4.2.1 Home Internet Connection and Use

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.

4.2.1.1 Communications Services

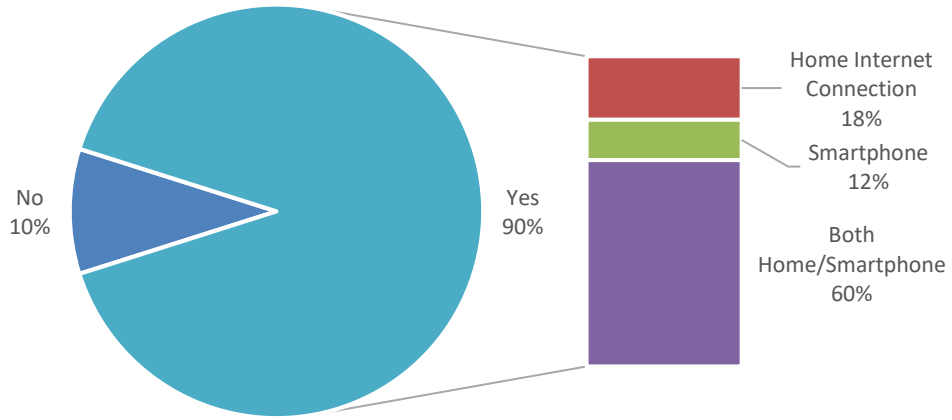
Respondents provided information about the communication services currently purchased for their household. As illustrated in Figure 10, 78 percent of respondents purchase home internet service, and 72 percent purchase cellular/mobile telephone service with internet.

Figure 10: Communications Services Purchased



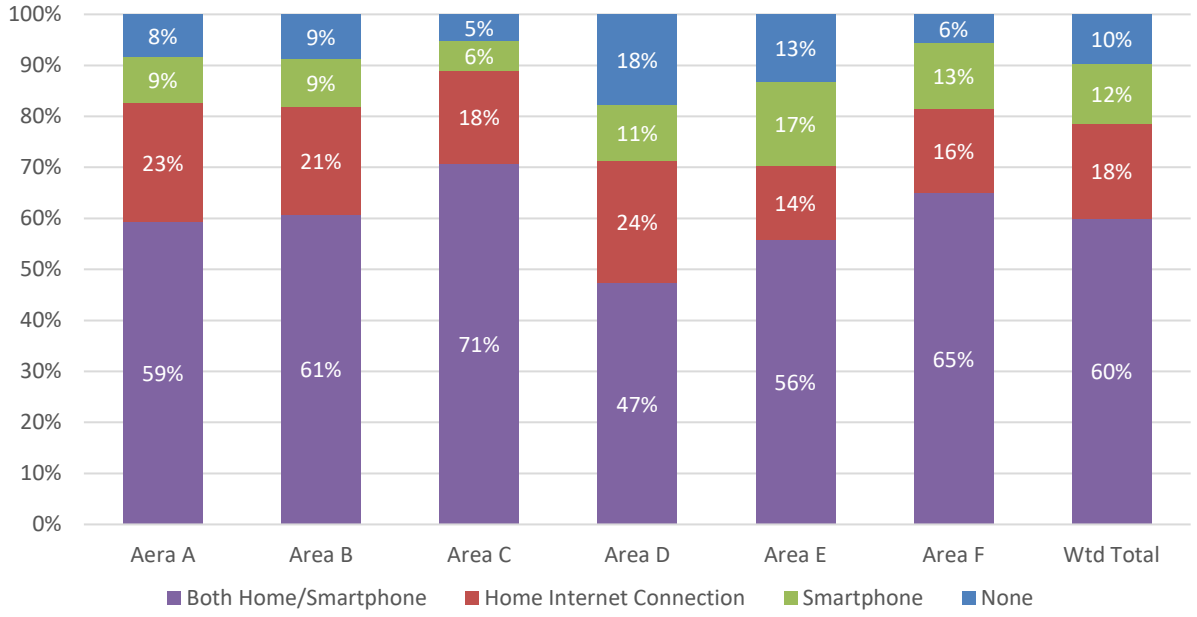
Nine in 10 respondents have some internet access, including 60 percent who have both home internet service and a cellular/mobile telephone service with internet (smartphone), as illustrated in Figure 11. Another 18 percent of respondents have a home connection only (no smartphone), and 12 percent have a smartphone only (no home internet).

Figure 11: Purchase Internet Services



As shown in Figure 12, residents of Area C appear to be well-connected, with seven in 10 having both a home internet connection and a smartphone. Just five percent do not have internet access. In comparison, nearly one-fifth of Area D residents do not purchase internet services for the household.

Figure 12: Internet Services Purchased by Area of Residence



Total internet access by demographics is illustrated in Table 17. Older respondents, those with a lower household income, and those with a lower level of education are among those who are somewhat less likely to have internet, although saturation is high among all demographic groups.

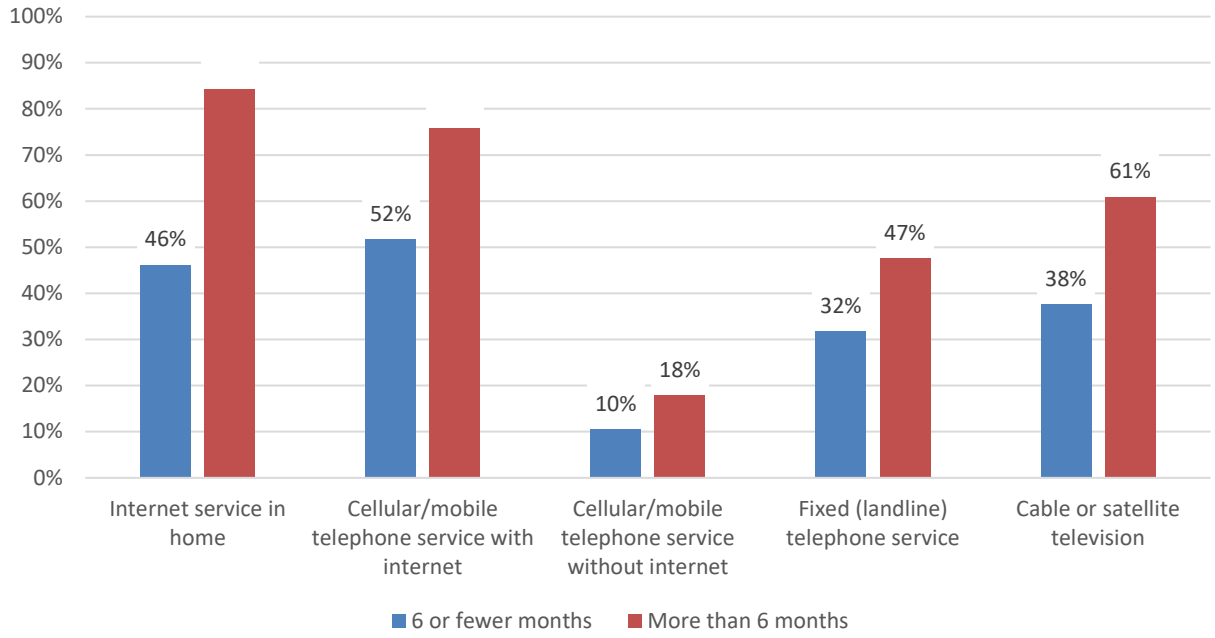
Table 17: Internet Access by Key Demographics

		Home Internet Connection	Smartphone	Both Home/ Smartphone	Total Internet Access	No Internet Access	Weighted Count
Area	A	23%	9%	59%	**92%**	8%	258
	B	21%	9%	61%	**91%**	9%	528
	C	18%	6%	71%	**95%**	5%	356
	D	24%	11%	47%	**82%**	18%	262
	E	14%	17%	56%	**87%**	13%	734
	F	16%	13%	65%	**94%**	6%	519
Gender	Female	17%	13%	60%	**91%**	9%	1279
	Male	20%	10%	61%	**91%**	9%	1326
Age group	18 to 34 years	21%	14%	63%	**97%**	3%	203
	35 to 44 years	8%	12%	76%	**96%**	4%	738
	45 to 54 years	20%	9%	65%	**93%**	7%	338
	55 to 64 years	21%	12%	55%	**88%**	12%	837
	65 years and older	28%	12%	43%	**83%**	17%	493
Race/Ethnicity	Other race/ethnicity	16%	10%	61%	**87%**	13%	210
	White/Caucasian only	19%	12%	61%	**91%**	9%	2325

		Home Internet Connection	Smartphone	Both Home/ Smartphone	Total Internet Access	No Internet Access	Weighted Count
Race/Ethnicity	No response	20%	12%	50%	**82%**	18%	135
Education	HS education or less	19%	15%	51%	**84%**	16%	342
	Two-year college or technical degree	18%	11%	60%	**90%**	10%	463
	Four-year college degree	19%	10%	63%	**92%**	8%	961
	Graduate degree	17%	14%	62%	**93%**	7%	834
Income	Less than $50,000	28%	16%	40%	**84%**	16%	351
	$50,000 to $74,999	23%	14%	50%	**88%**	12%	391
	$75,000 to $99,999	16%	14%	63%	**92%**	8%	432
	$100,000 to $149,999	14%	10%	70%	**94%**	6%	596
	$150,000 to $199,999	13%	10%	69%	**92%**	8%	345
	$200,000 or more	15%	7%	71%	**94%**	6%	319
Children in HH	No Children in HH	21%	13%	55%	**89%**	11%	1837
	Children in HH	13%	9%	74%	**96%**	4%	762
Total Household Size (Adults + Children)	1	22%	13%	44%	**79%**	21%	257
	2	21%	13%	55%	**90%**	10%	1348
	3	18%	11%	67%	**95%**	5%	360
	4 or more	11%	9%	76%	**95%**	5%	632
Own/rent residence	Own	18%	12%	61%	**90%**	10%	2540
	Rent	20%	19%	59%	**98%**	2%	61
Time at Residence in past year	6 or fewer months	16%	22%	30%	**68%**	32%	360
	More than 6 months	19%	10%	66%	**95%**	5%	2243
Number of years lived at current address	Less than 1 year	11%	21%	61%	**93%**	7%	199
	1 to 2 years	9%	16%	66%	**92%**	8%	256
	3 to 4 years	19%	9%	69%	**97%**	3%	412
	Five or more years	20%	11%	58%	**89%**	11%	1739

About one-third of those who lived in the home for fewer than six months out of the past year have no internet, and another 22 percent have a smartphone only. Just under one-half of this subsegment has a home internet connection other than a smartphone. This group of residents is also less likely to purchase other communication services, as shown in Figure 13.

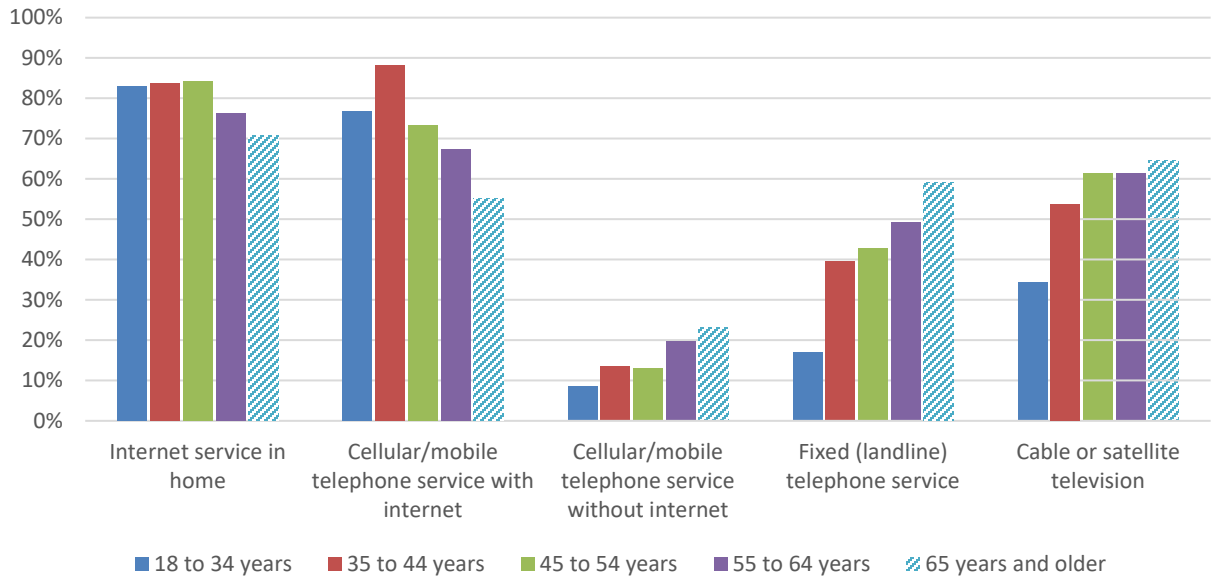
Figure 13: Services Purchased by Length of Time at Residence in Past Year



Other communication services are used less widely in households, compared with purchase of internet services. More than one-half of respondents purchase cable or satellite television service, 45 percent have fixed (landline) telephone service, and 17 percent have cellular/mobile service without internet.

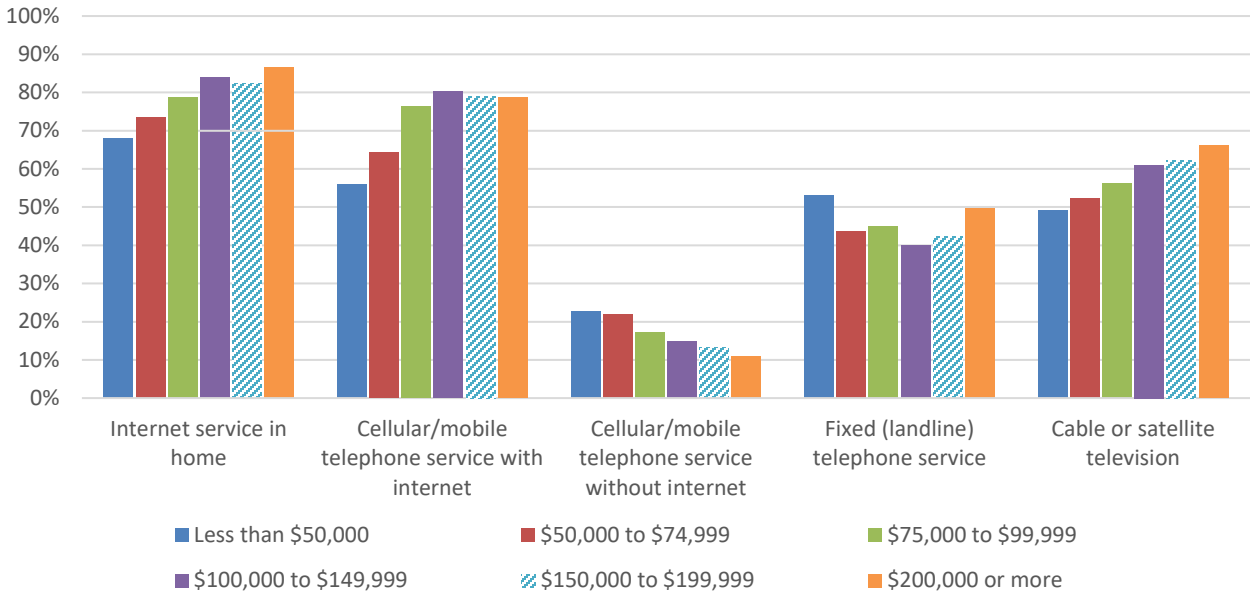
Purchase of these other communication services is correlated with age of the respondent, as illustrated in Figure 14, and is particularly low for those ages 18 to 34. Just one-third of respondents in the 18 to 34 age cohort purchase cable or satellite television service, and just 17 percent have fixed (landline) telephone service.

Figure 14: Services Purchased by Age of Respondent



The use of communication services is also associated with household income. In particular, respondents who earn under $50,000 per year are less likely to purchase internet services, and they are somewhat more likely to purchase landline telephone service (see Figure 15).

Figure 15: Services Purchased by Household Income



4.2.1.2 Importance of Communication Services

Respondents were asked to indicate the importance of various communications services to their household, using a scale where 1 is “Not at All Important” and 5 is “Very Important.” The mean

importance of various service aspects is illustrated in Figure 16, while detailed responses are illustrated in Figure 17. Cellular/mobile telephone service, high-speed internet connection, and internet connection of any speed are the most important communications service aspects, while fixed (land-line) telephone service, basic cable telephone service, and premium cable television service are significantly less important.

Figure 16: Importance of Communications Service Aspects (Mean Ratings)

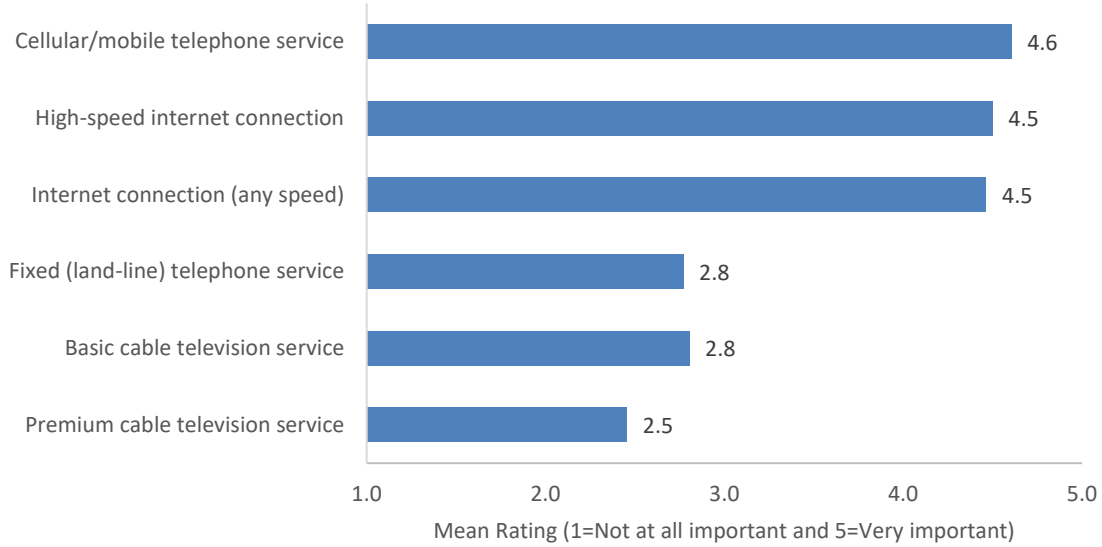
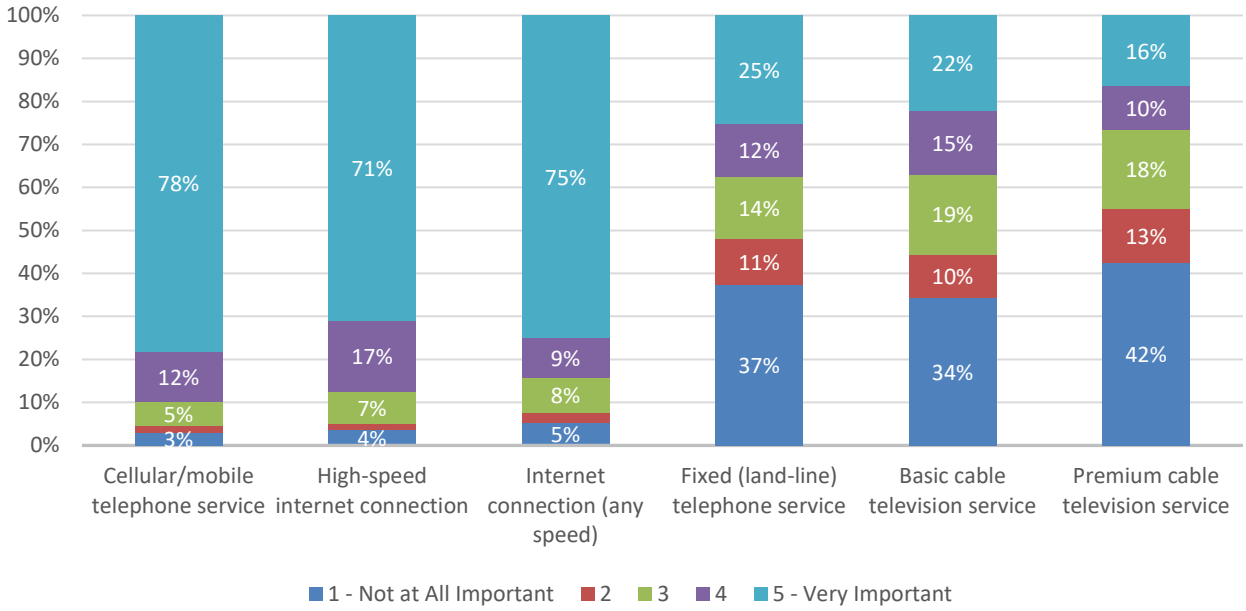


Figure 17: Importance of Communications Service Aspects



As would be expected, those who purchase internet services (either home internet connection or cellular/mobile internet) place more importance on having internet services compared with

non-users. However, it is notable that almost four in 10 non-users say that internet service (either high-speed or any speed) is very important (see Figure 18). One-half of these individuals lived in the home for fewer than six months out of the past year. They cited lack of availability and high costs as barriers to having internet.

Figure 18: Importance of Internet Service Aspects by Purchase of Internet Services

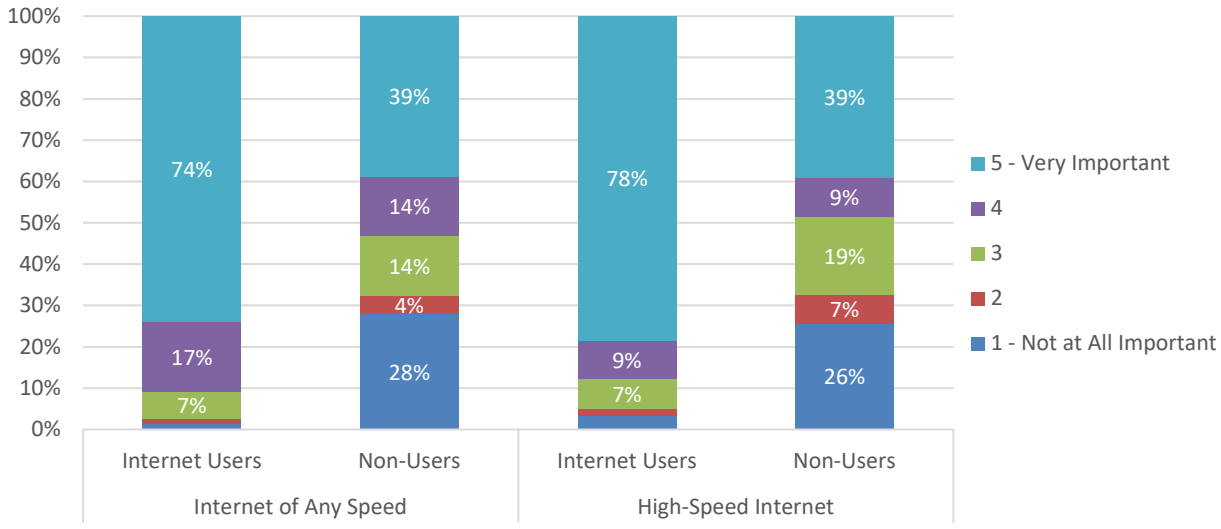
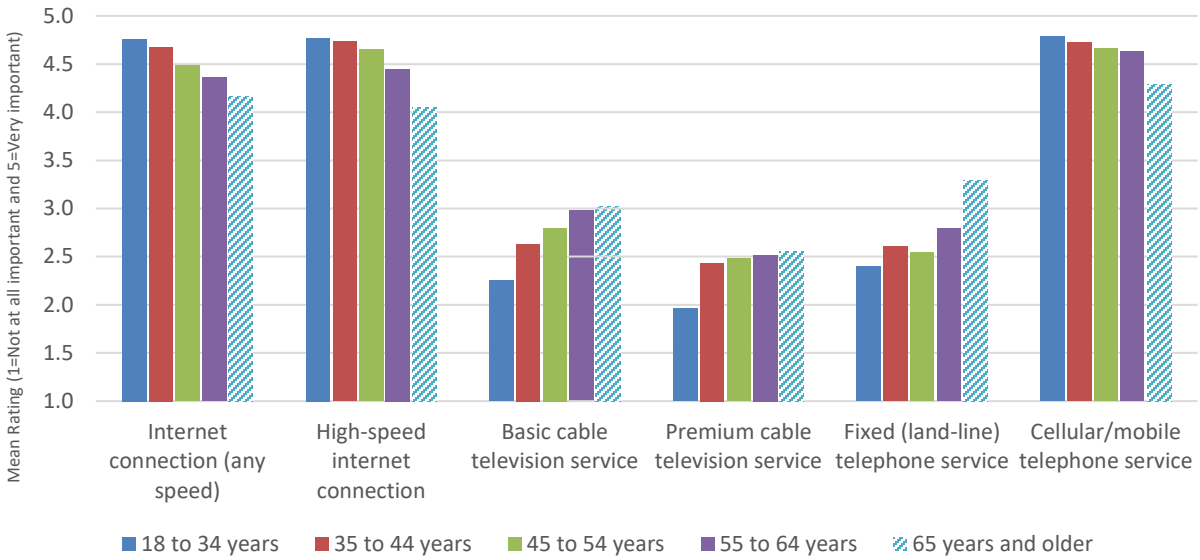


Figure 19 illustrates the mean ratings given to importance of communications services by the age of the respondent. The importance of internet connection (high speed or any speed) and cellular/mobile telephone service is lower for those ages 65 and older.

Figure 19: Importance of Communication Services by Age of Respondent



4.2.1.3 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 (100 percent) respondents with internet access (either home connection or smartphone) have at least one personal computing device. Additionally, 69 percent of respondents without internet access have a personal computing device.

About six in 10 respondents have five or more personal computing devices. Another 24 percent have three or four devices, and 12 percent have one or two devices (see Figure 20).

As illustrated in Figure 21, residents of Area D are somewhat less likely to have internet connection and to have computing devices in the home.

Figure 20: Number of Personal Computing Devices

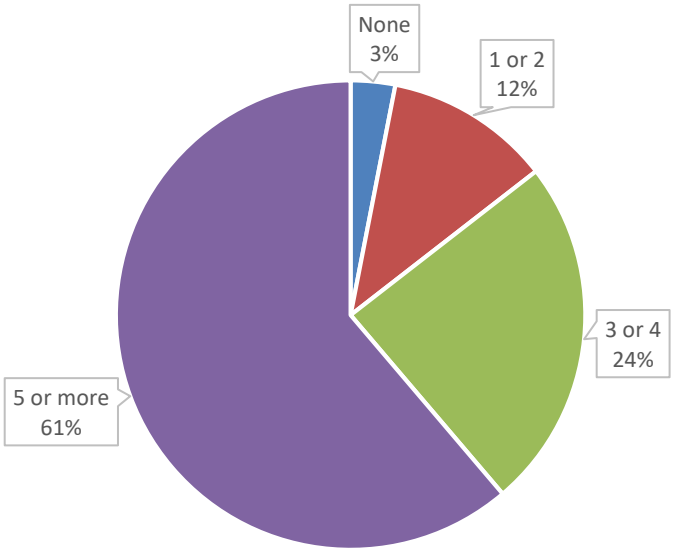
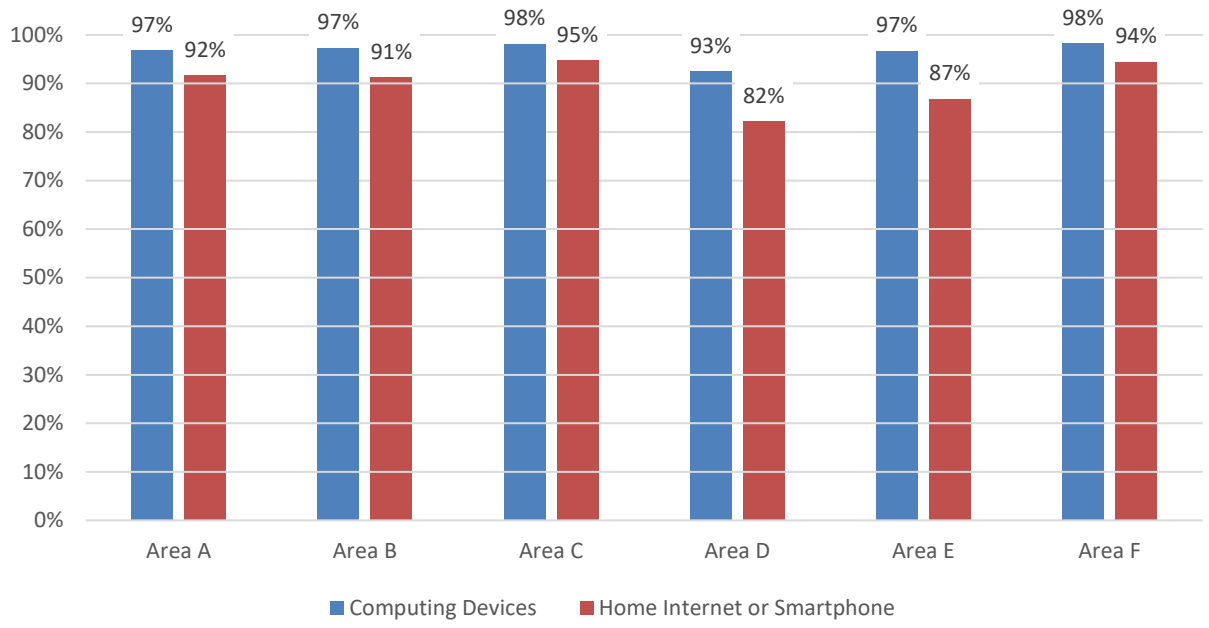
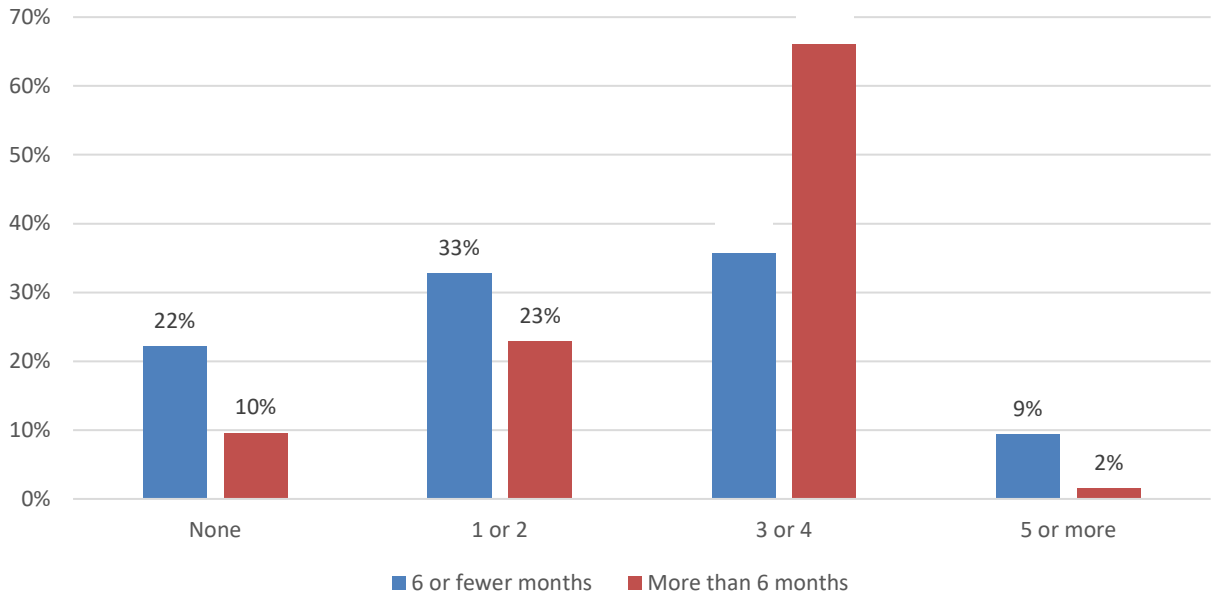


Figure 21: Internet Connection and Computing Devices in Home by Area of Residence



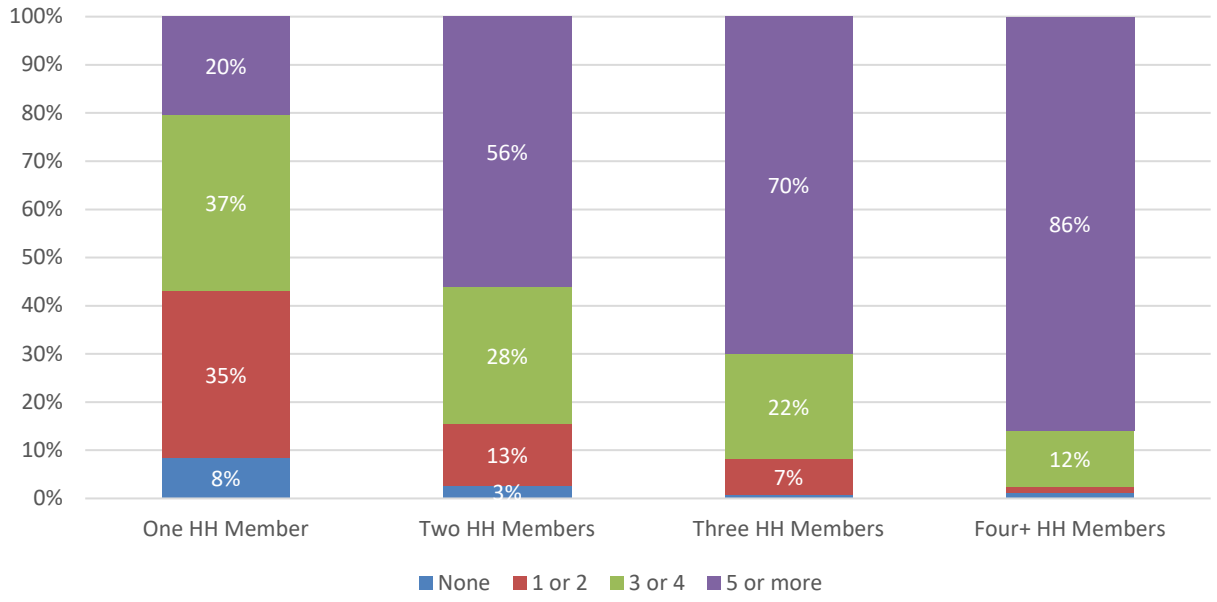
Additionally, those who have lived in their residence for more than six months in the past year are also more likely to have computing devices in the home (see Figure 22).

Figure 22: Number of Personal Computing Devices in Home by Length of Time at Residence



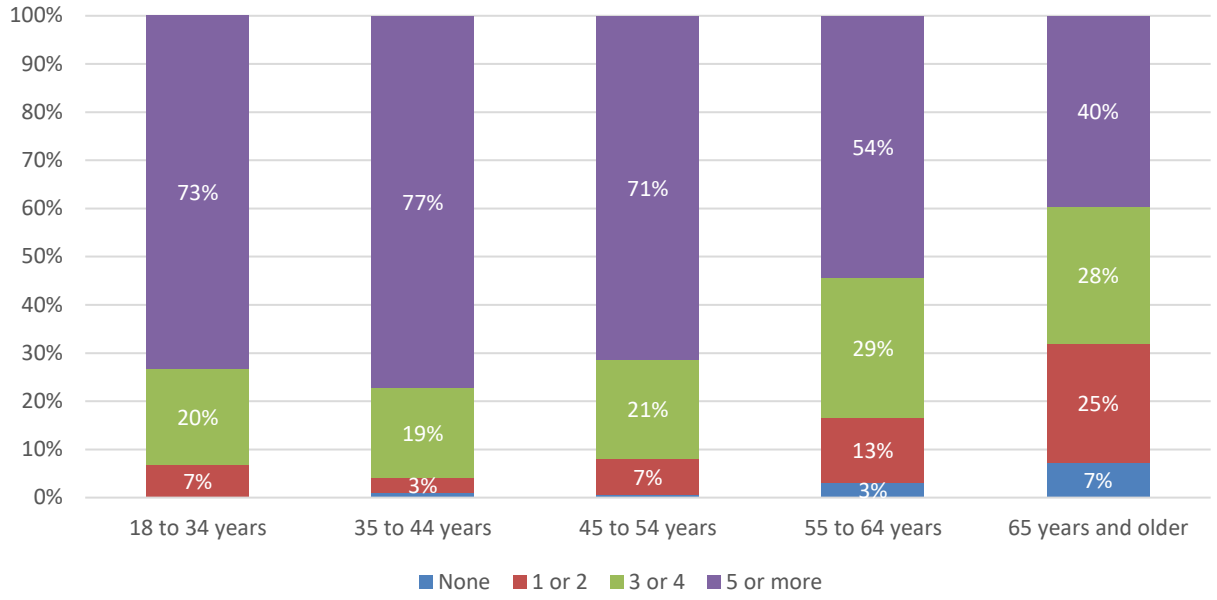
The number of personal computing devices in the home correlates with the number of people residing in the home. 86 percent of households with four or more residents have at least five personal computing devices (see Figure 23).

Figure 23: Number of Personal Computing Devices in Home by Household Size



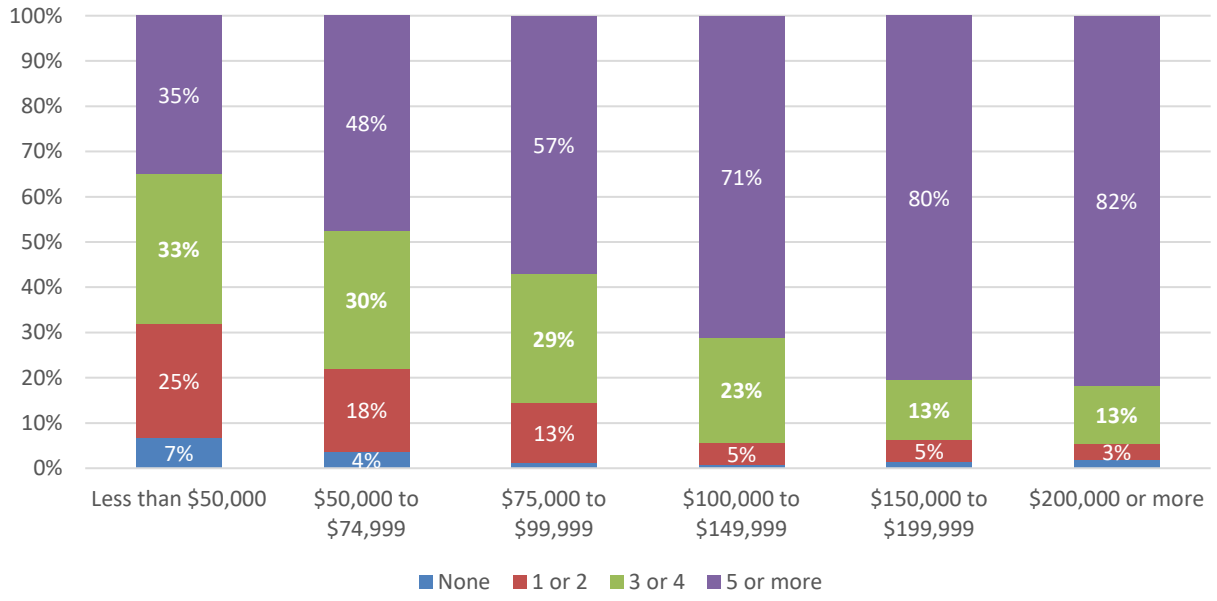
Respondents ages 55+ have fewer personal computing devices in the home compared with younger respondents, as illustrated in Figure 24.

Figure 24: Have Computing Device(s) and Internet in Home by Age of Respondent



The number of computing devices in the home is also correlated with household income. Eight in 10 of those earning $150,000 or more per year have at least five computing devices (see Figure 25).

Figure 25: Have Computing Device(s) and Internet in Home by Household Income



4.2.1.4 Internet Services Purchased

Respondents were asked about their purchase of internet services for their home, as well as the cost and speed of services purchased.

As shown in Figure 26, a majority of homes (92 percent) reported having home internet service. Fixed wireless, satellite, DSL, and cable modem have almost equal shares of the market at approximately one-fifth each. Cellular/mobile (six percent), and fiber (three percent) represent smaller shares of the study area.

Figure 26: Primary Home Internet Service

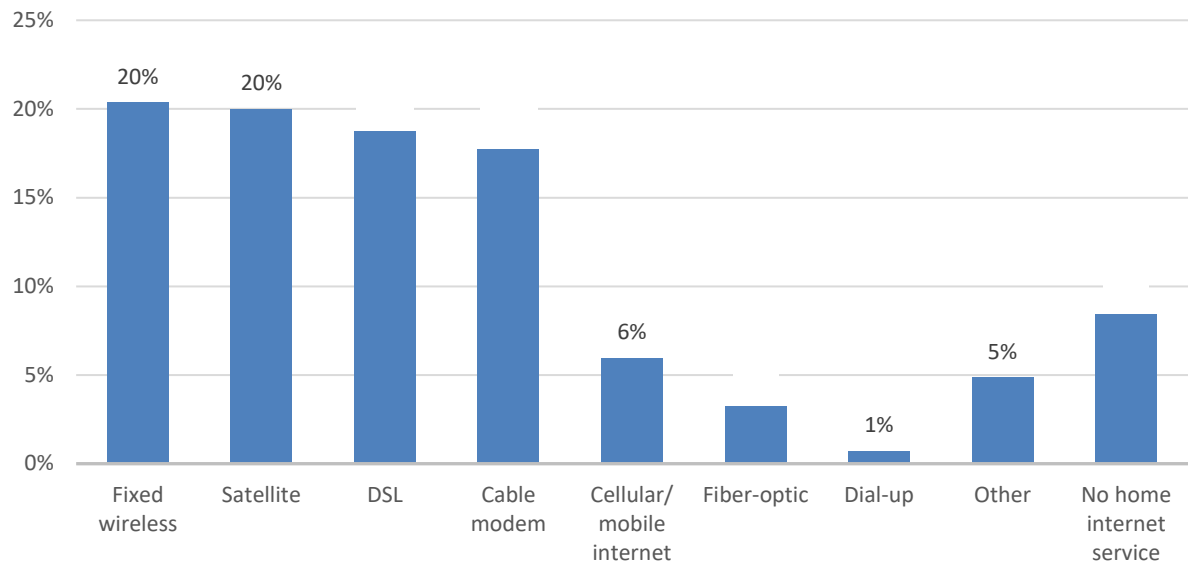
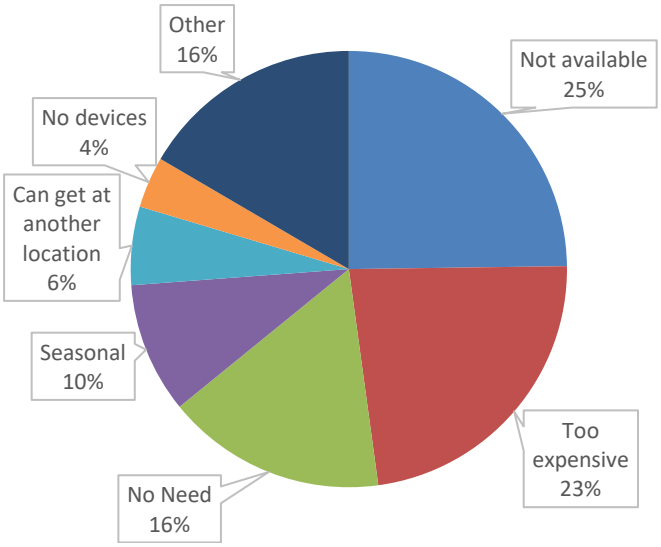


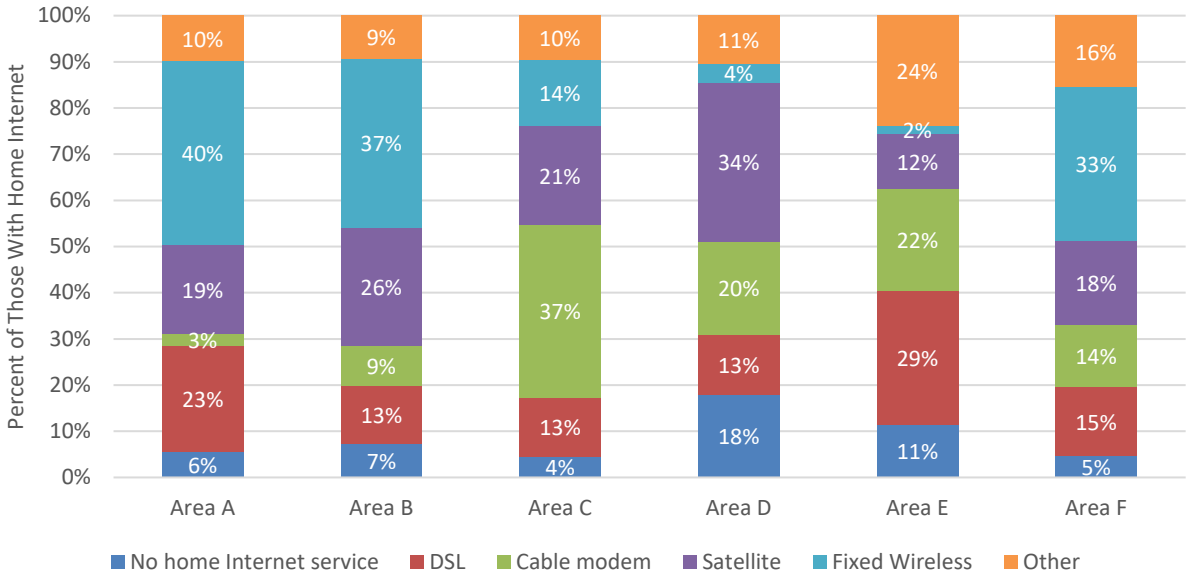
Figure 27: Primary Reason To Not Have Internet



One-fourth of responding households without internet access (and who provided a response) said that lack of availability at the location is the main reason for not purchasing home internet service, and another 23 percent cited expensive costs as the primary barrier to home internet usage.

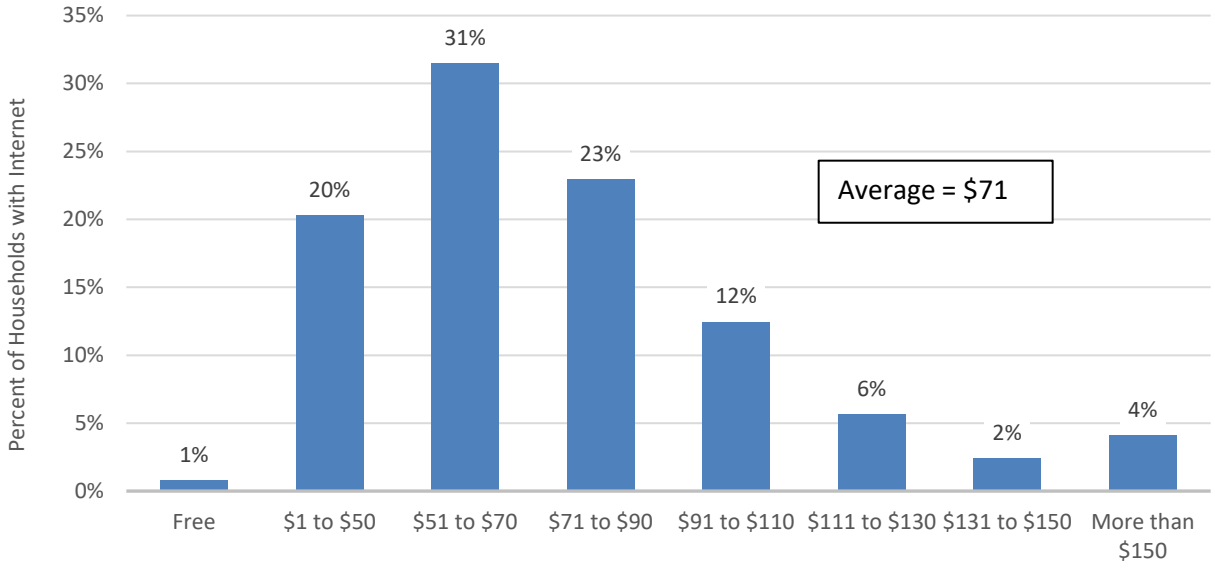
As indicated earlier, residents of Area D are less likely to have a home internet connection. Use of a fixed wireless connection is higher in Areas A, B, and F compared with other areas, while use of a cable modem connection is highest in Area C, and use of a satellite connection is highest in Area D (see Figure 28).

Figure 28: Primary Home Internet Service by Area of Residence



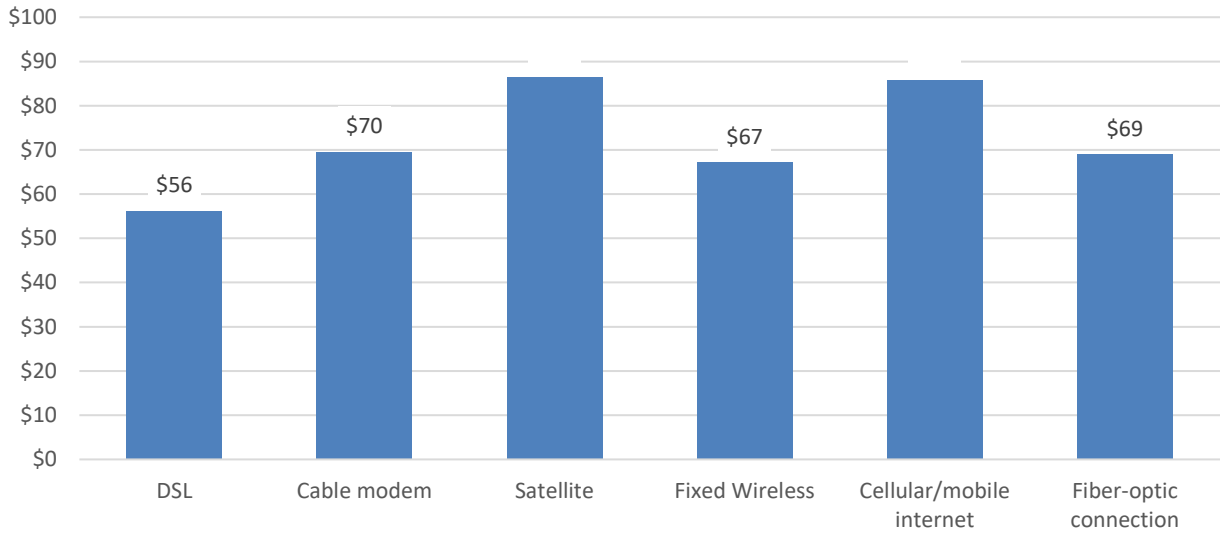
Respondent households pay approximately $71 per month for internet service, on average. Approximately one-fourth of respondents with home internet pay over $90 per month (see Figure 29).

Figure 29: Monthly Price for Internet Service



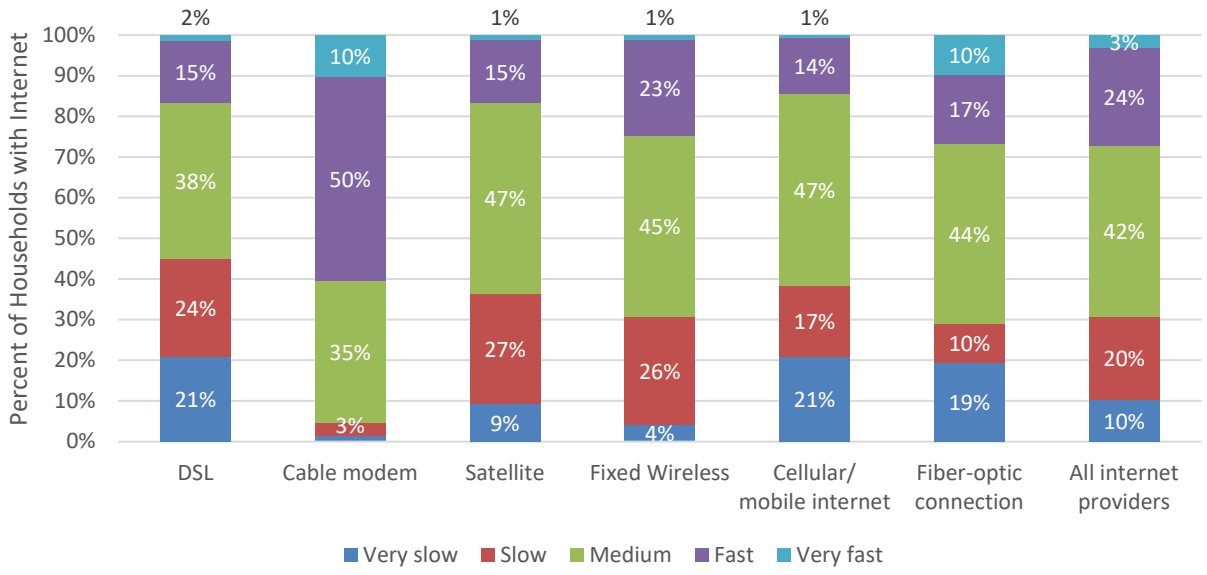
The estimated average monthly price for internet service is highest for satellite and cellular/mobile internet, at $86. Average costs for cable modem, fixed wireless, and fiber-optic internet service are very similar at around $70, while the estimated average monthly price for DSL service is slightly lower (see Figure 30).

Figure 30: Estimated Average Monthly Price for Internet Service



Most internet subscribers described their internet speed as “medium” (42 percent) or “fast” (24 percent), while only three percent said it was “very fast.” Three in 10 respondents described their connection as “slow” (20 percent) or “very slow” (10 percent), as illustrated in Figure 31. Cable modem subscribers rated their connection faster than did those with other types of internet connections.

Figure 31: Internet Speed (Respondent Opinion) by Connection Type



4.2.1.5 Internet Service Aspects

Respondents were also asked about the importance of, and satisfaction with, a number of internet service aspects. The importance and satisfaction levels are compared in the following tables and graphs.

4.2.1.5.1 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, followed by connection speed, as shown in Table 18. The ability to bundle with television service is relatively unimportant compared with other service aspects.

Table 18: Importance of Internet Service Aspects

Service Aspect	Mean	Percentages
Speed of Connection	4.6	7% 24% 68%
Reliability of Connection	4.9	9% 90%
Price of Services	4.4	14% 26% 58%
Overall Customer Service	4.3	16% 30% 51%
Ability to Bundle with TV service	2.6	32% 18% 24% 13% 13%
		1 - Not at All Important, 2, 3, 4, 5 - Very Important

4.2.1.5.2 Satisfaction

Overall, respondents were moderately satisfied with aspects of their internet service, as shown in Table 19. Respondents rated the reliability and speed of their connection as the aspects with which they are most satisfied. The lowest satisfaction aspect was for the price of service, which

is typical in satisfaction surveys.

Specifically, 35 percent are somewhat or very satisfied with the speed of their internet connection, while 35 percent expressed some dissatisfaction. Approximately 43 percent are satisfied with reliability of their internet connection, and 28 percent are dissatisfied. Only a small segment of subscribers is very satisfied with these services.

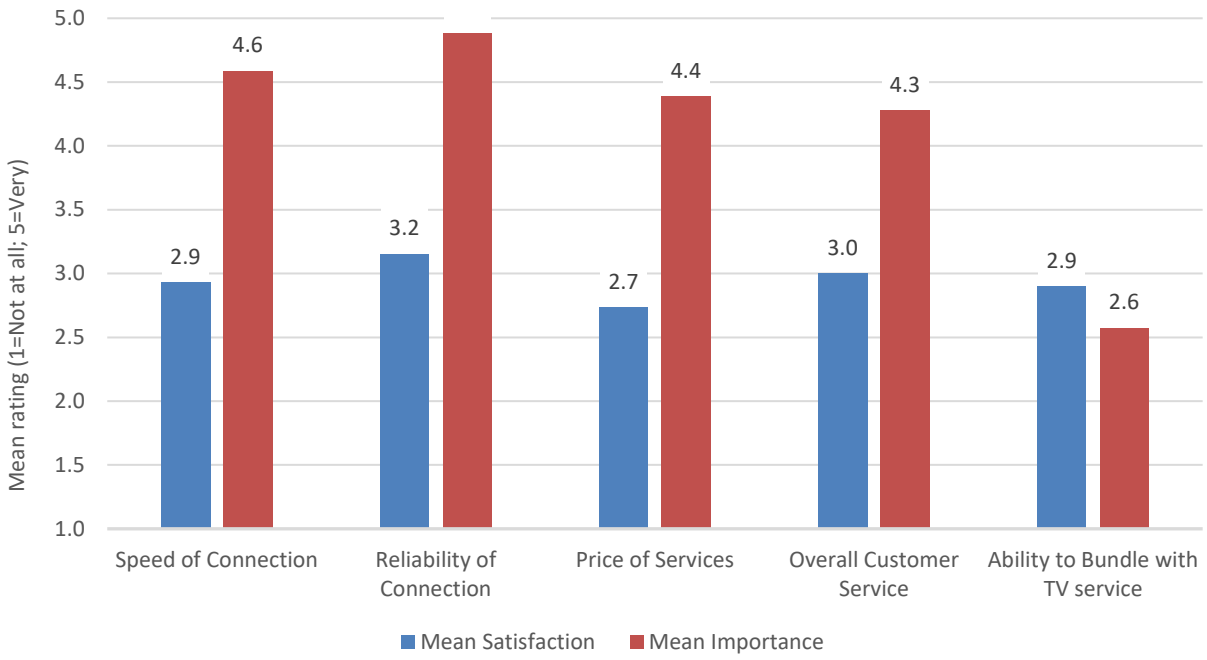
Table 19: Satisfaction with Internet Service Aspects

Service Aspect	Mean	Percentages
Speed of Connection	3.2	17% 18% 30% 25% 10%
Reliability of Connection	3.2	13% 15% 30% 30% 13%
Price of Services	2.4	16% 23% 38% 16% 7%
Overall Customer Service	2.7	14% 17% 35% 23% 11%
Ability to Bundle with TV service	2.8	16% 11% 48% 18% 8%
		1 - Very Dissatisfied 2 3 4 5 - Very Satisfied

4.2.1.5.3 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 32). 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 32: 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 20). This analysis demonstrates the “gap” between respondent’s satisfaction with a service attribute, and the importance of the attribute. As shown, the average respondent reported that the price of service, overall customer service, reliability of connection, and speed of connection were either “important” or “very important”. However, the average respondent was either neutral or reported “not satisfied” with these service attributes. The “gap” between importance and satisfaction demonstrates that respondents are not satisfied with the service attributes they find important. The largest gap between importance and performance is for price, overall customer service, and reliability of connection.

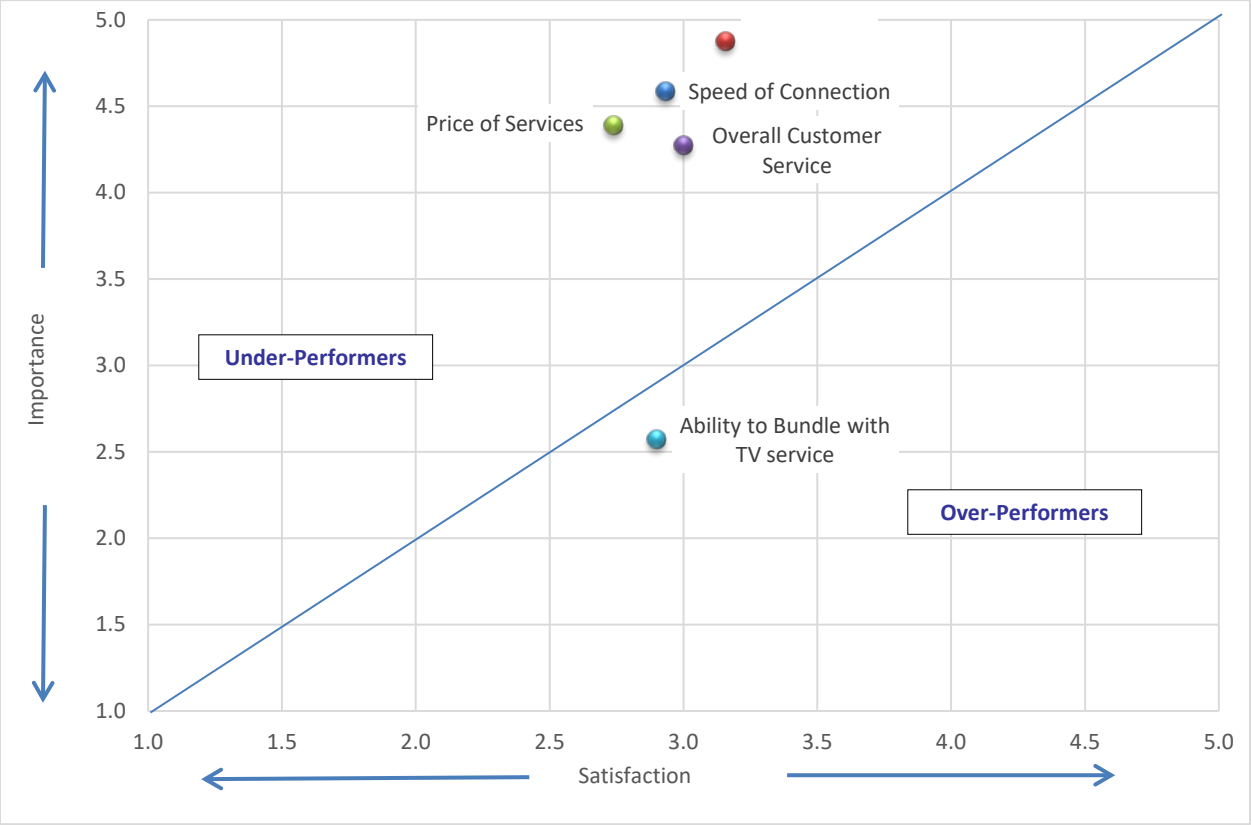
Table 20: Internet Service Aspect “Gap” Analysis

	Mean Satisfaction	Mean Importance	GAP < = >	Customer Expectations
Price of Services	2.9	4.6	-1.7	Not Met
Overall Customer Service	3.2	4.9	-1.7	Not Met
Reliability of Connection	2.7	4.4	-1.7	Not Met
Speed of Connection	3.0	4.3	-1.3	Not Met
Ability to Bundle with TV service	2.9	2.6	0.3	Exceeded

The importance scores and performance scores were plotted to help visually determine areas in which internet service providers are doing well and areas that might need improvement. Figure

33 compares the importance and satisfaction in a "quadrant" analysis. Those aspects for which importance is higher than satisfaction are above the equilibrium line and are defined as "underperformers." As is typical, the cost of internet service is well off the line, as satisfaction with costs is typically low. Reliability, connection speed, and overall customer service are other under-performing service areas. The mediocre satisfaction levels could indicate a willingness to switch internet service providers if these needs are not being met.

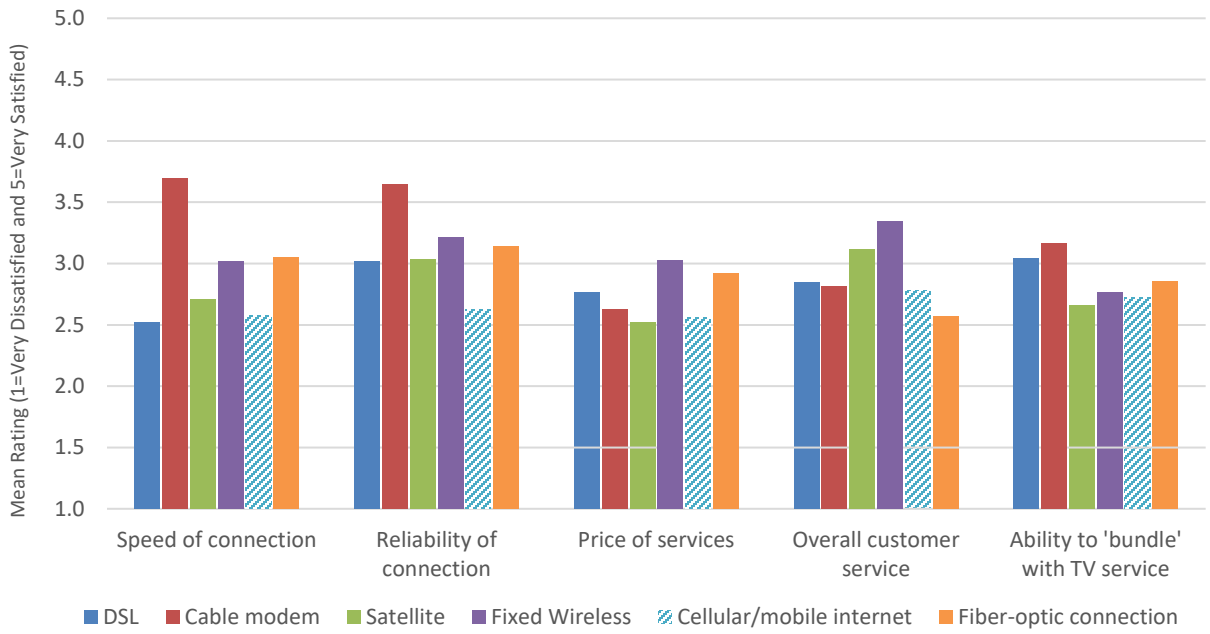
Figure 33: Internet Service Aspect "Quadrant" Analysis



4.2.1.5.4 Connection Type

Only slight differences in importance of internet service aspects by connection type were found (most notably that ability to bundle is somewhat less important for those with fixed wireless). However, there are significant differences in satisfaction by connection type for some key aspects of service, as illustrated in Figure 34. Cable modem users have a higher level of satisfaction with speed and reliability of service, compared with those who have other types of internet connections. Fixed wireless users are more satisfied with price of service and overall customer service compared with others.

Figure 34: Satisfaction with Internet Service Aspects by Connection Type



The gap between importance and satisfaction for the leading connection types was converted to an index score for each service aspect. This illustrates "the percentage of expectations fulfilled." Gap index scores are shown in Table 21. Cable modem internet providers are better meeting expectations (high ratio of satisfaction to importance) for connection speed and connection reliability compared with other provider types, as discussed previously. Fixed wireless providers are better meeting expectations for price of service and customer service compared with others. DSL, cable modem, and fixed wireless providers are over-performing for ability to bundle services (high satisfaction compared with relatively low importance).

Table 21: Gap Index Score by Internet Service Provider

	Satisfaction / Importance Gap Index*				
	Speed of connection	Reliability of connection	Price of service	Customer service	Ability to bundle
DSL	56%	62%	64%	67%	118%
Cable modem	80%	75%	59%	67%	123%
Satellite	59%	62%	57%	73%	96%
Fixed Wireless	65%	65%	71%	78%	126%
Cellular/mobile internet	57%	54%	56%	66%	97%
Fiber-optic connection	66%	64%	63%	59%	102%
ISP Average	64%	65%	62%	70%	113%
Percent of expectations met = Satisfaction / Importance					

4.2.1.6 Willingness to Pay for Faster Internet

Respondents were asked if they would be willing to switch to high-speed internet service (10+ times faster than DSL) for various price levels. The mean willingness to switch across this array of questions is illustrated in Figure 35, while detailed responses are illustrated in Figure 36.

Figure 35: Willingness to Switch to High-Speed Internet at Price Levels (Mean Ratings)

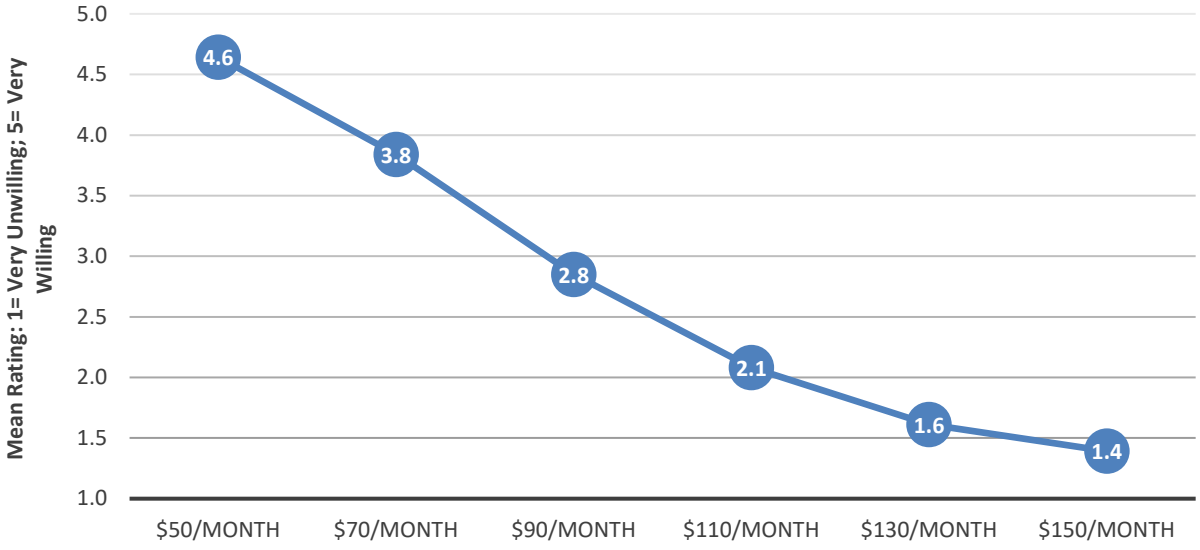
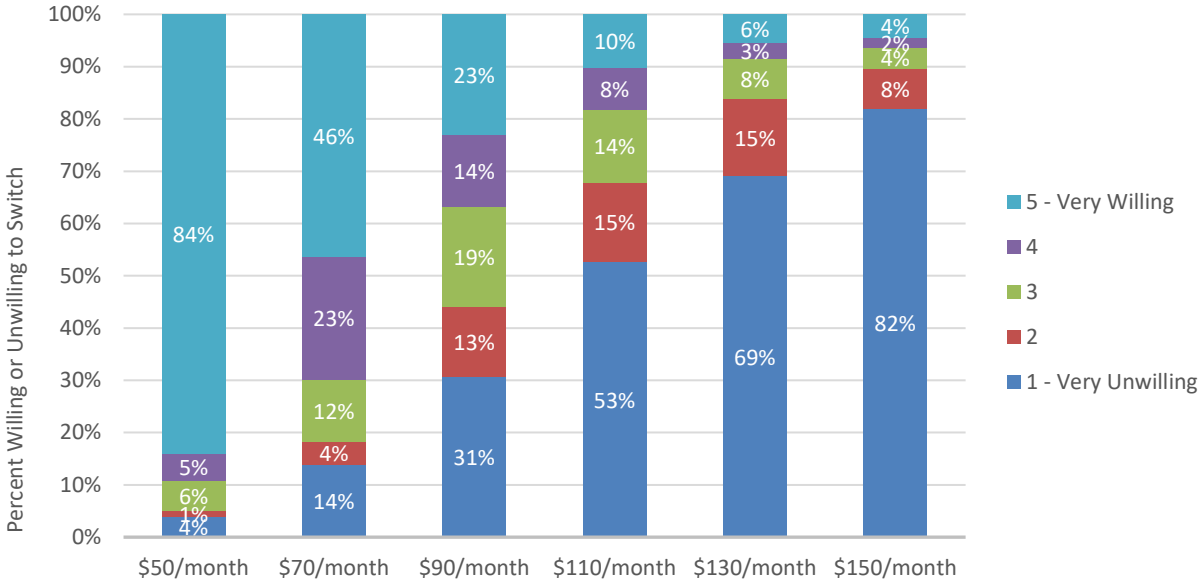


Figure 36: Willingness to Switch to High-Speed Internet at Various Price Levels

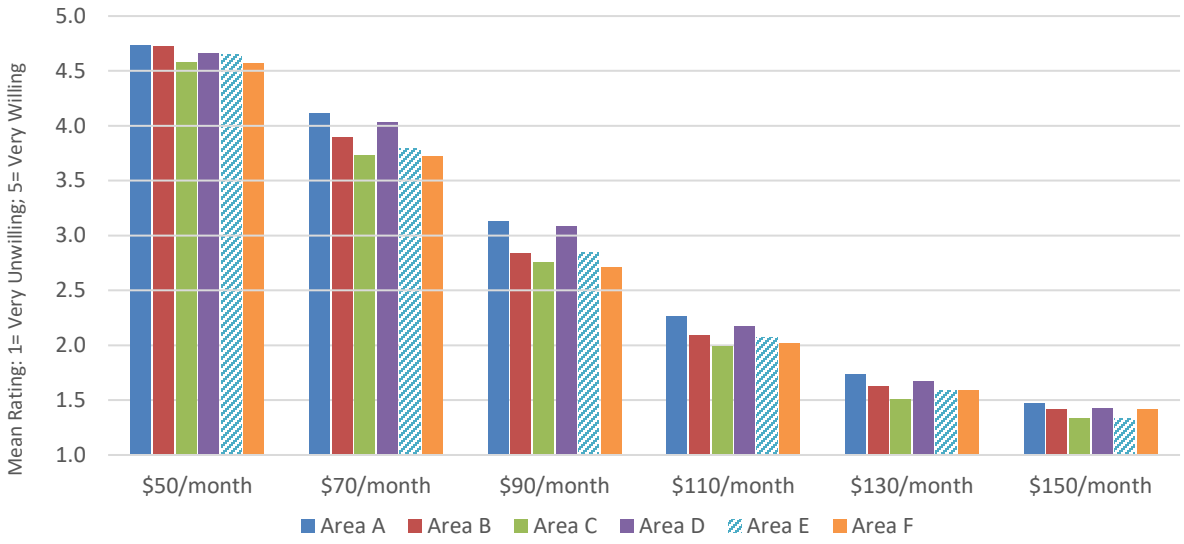


As depicted in Figure 35 and in Figure 36, respondents' willingness to switch to high-speed internet service (defined at 10+ times faster than DSL in the survey) is very high at $50 per month, but drops considerably as the price increases. At a price of approximately $90 per month, the

mean rating falls below 3.0 (neither willing nor unwilling). From another perspective, 89 percent are somewhat or very willing to switch to high-speed internet for $50 per month, dropping to six percent at $150 per month.

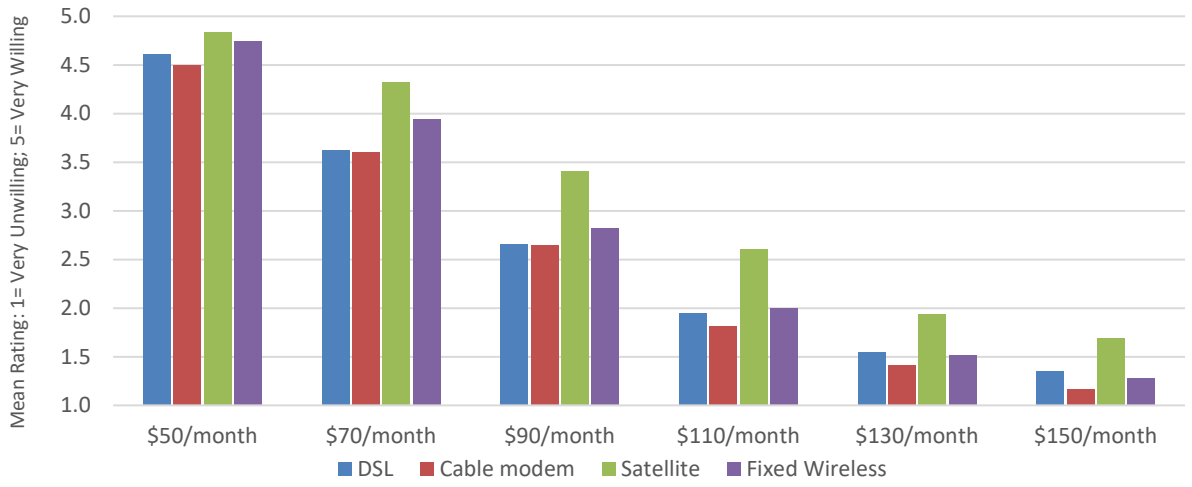
The willingness to switch to high-speed internet does not vary strongly by area of residence (see Figure 37). Those in Areas A and D would be somewhat more likely than residents of other areas to switch at the $70 and $90 per month price points.

Figure 37: Willingness to Switch to High-Speed Internet by Price and Area of Residence



The willingness to switch to very fast internet service is correlated with connection type. Specifically, those who subscribe to satellite internet service would be more likely to switch to a high-speed connection at various price points (see Figure 38).

Figure 38: Willingness to Switch to High-Speed Internet by Price and Connection Type



Internet users ages 65+ would be less likely than younger subscribers to switch to high-speed internet at various price points. Additionally, high income households, particularly those earning $150,000 or more per year, would be more willing than lower income households to switch to high-speed internet (see Figure 39 and Figure 40).

Figure 39: Willingness to Switch to High-Speed Internet by Price and Age of Respondent

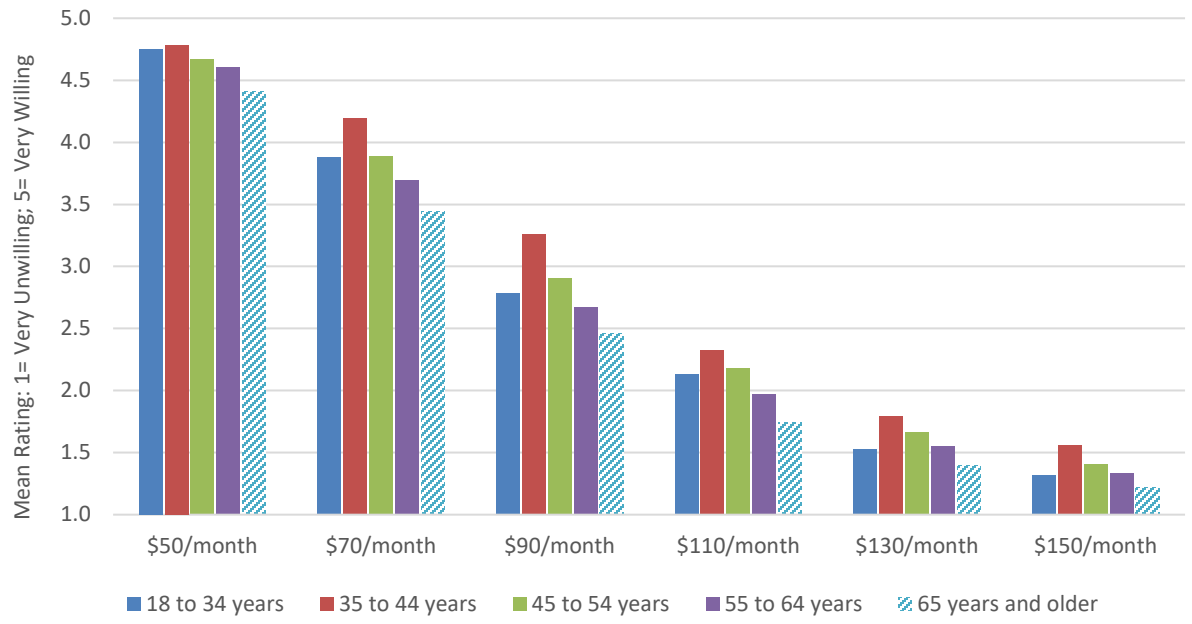
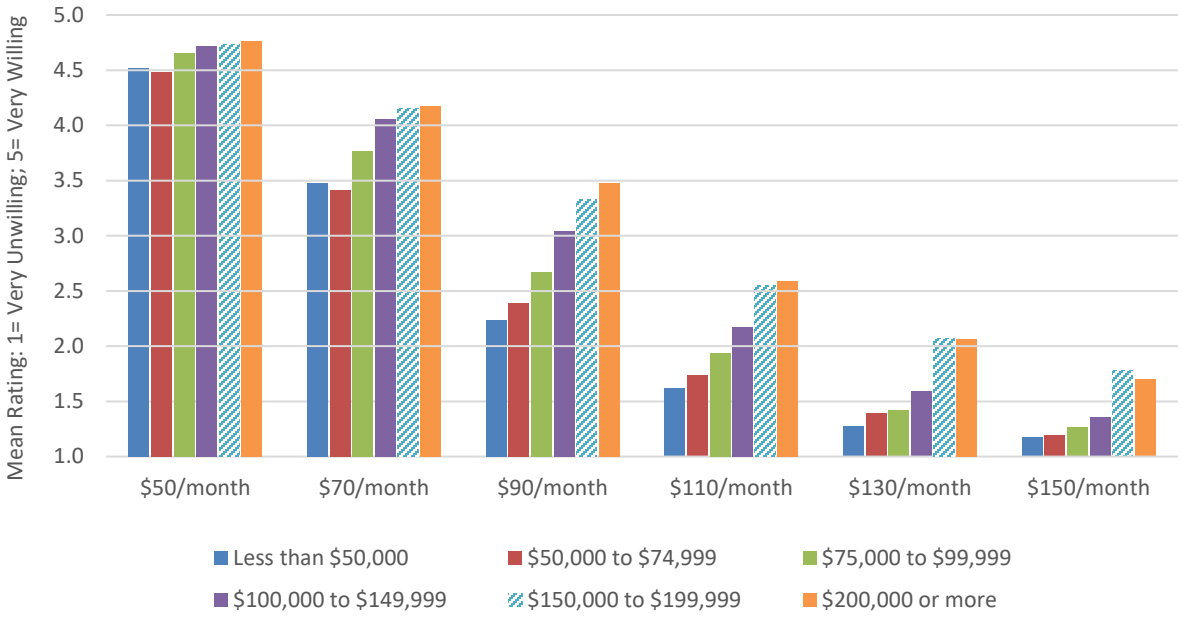


Figure 40: Willingness to Switch to High-Speed Internet by Price and Household Income

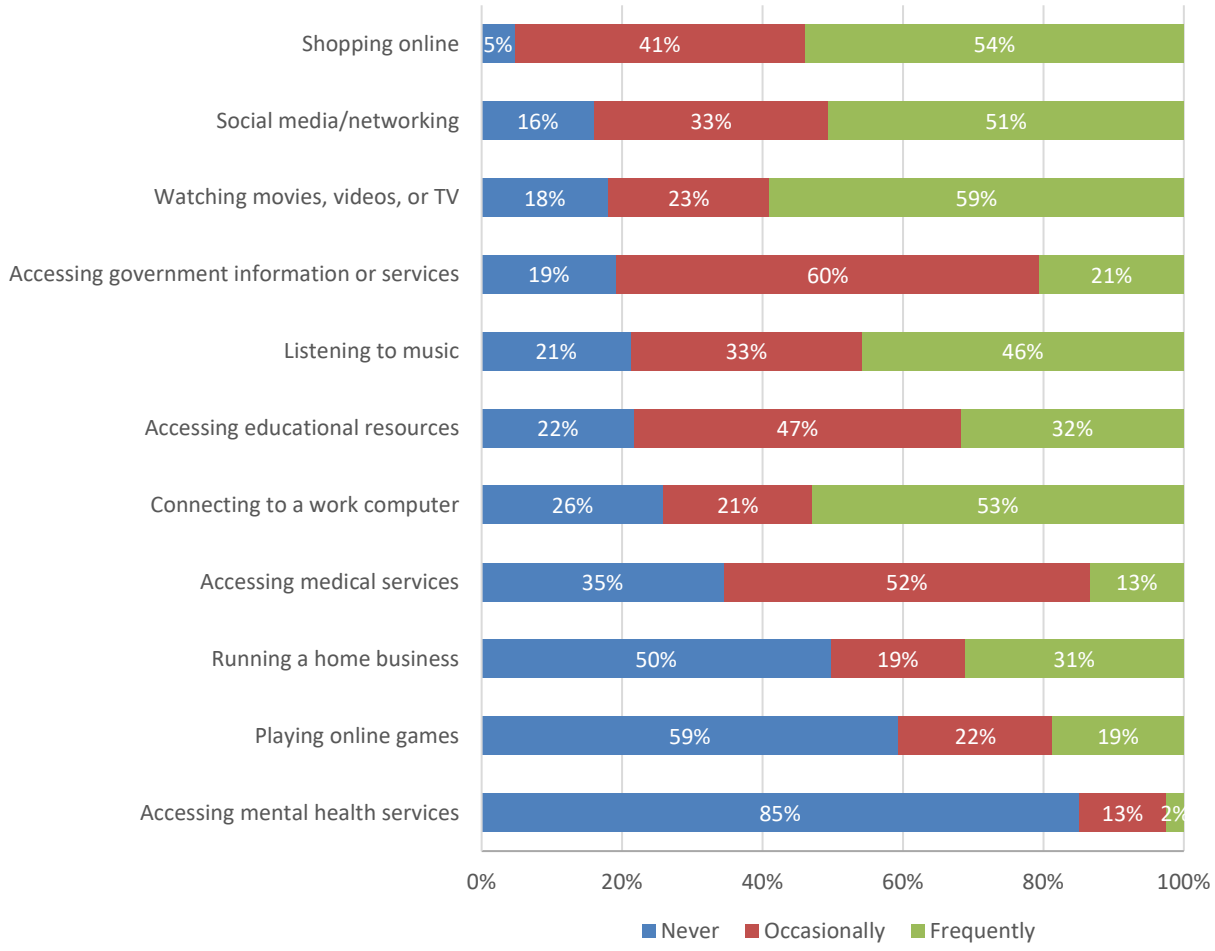


4.2.1.7 Internet Uses and Importance

Respondents were asked about their use of the internet for various activities, as illustrated in Figure 41. Among those items listed, the internet is most frequently used for shopping online, social media/networking, and watching movies, videos, or TV.

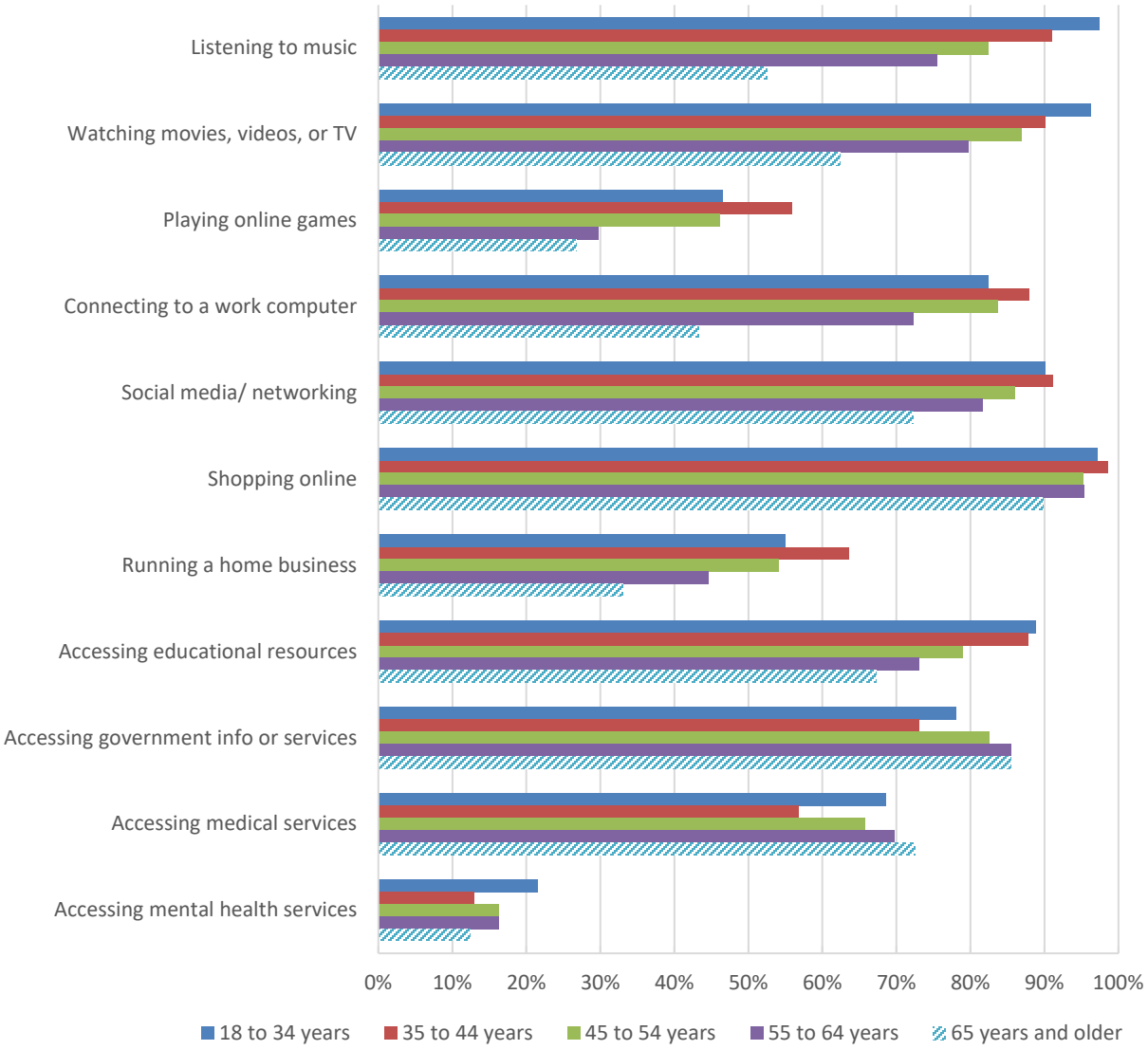
Eight in 10 respondents use the internet to access government information/services or to access educational resources at least occasionally. Use of the internet for running a home business, playing online games, or accessing mental health services is less frequent than the other activities included in this question.

Figure 41: Frequency of Home Internet Activities



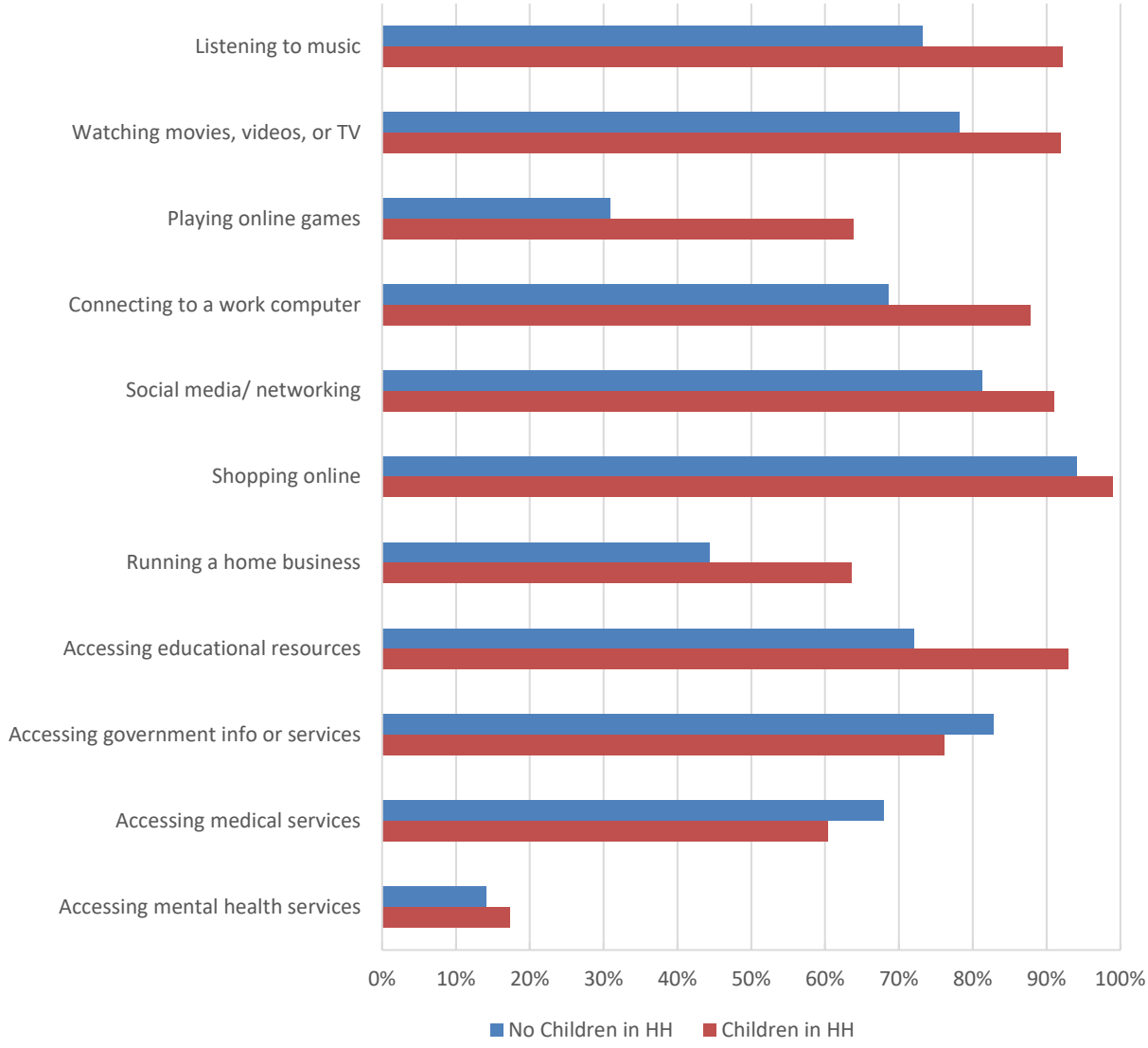
The use of the internet for some activities varies by age, as illustrated in Figure 42. Younger respondents are much more likely to use the internet for many applications, especially listening to music and watching videos or movies. Internet subscribers ages 65+ are less likely to ever use the internet for many of the various activities evaluated, with the exception of accessing government information/services and accessing medical services.

Figure 42: Home Internet Activity by Age of Respondent (Percent Ever Using)



Similarly, respondents with children age 18 and under in the household are more likely to use the internet for various activities, with the exception of accessing government information/ services and accessing medical services (see Figure 43).

Figure 43: Home Internet Activity by Children in Household (Percent Ever Using)



Respondents were asked to rate the importance of aspects when selecting a home internet provider. The mean importance of various service aspects is illustrated in Figure 44, while detailed responses are illustrated in Figure 45.

Figure 44: Importance of Aspects in Selecting Home Internet Service (Mean Ratings)

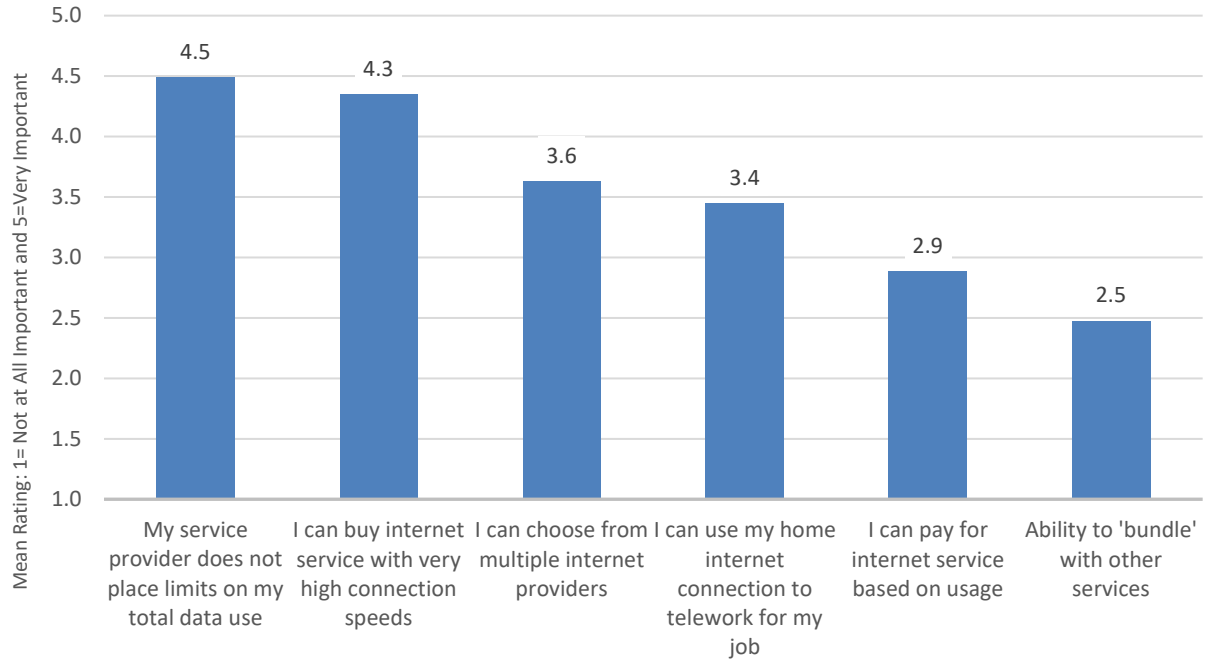
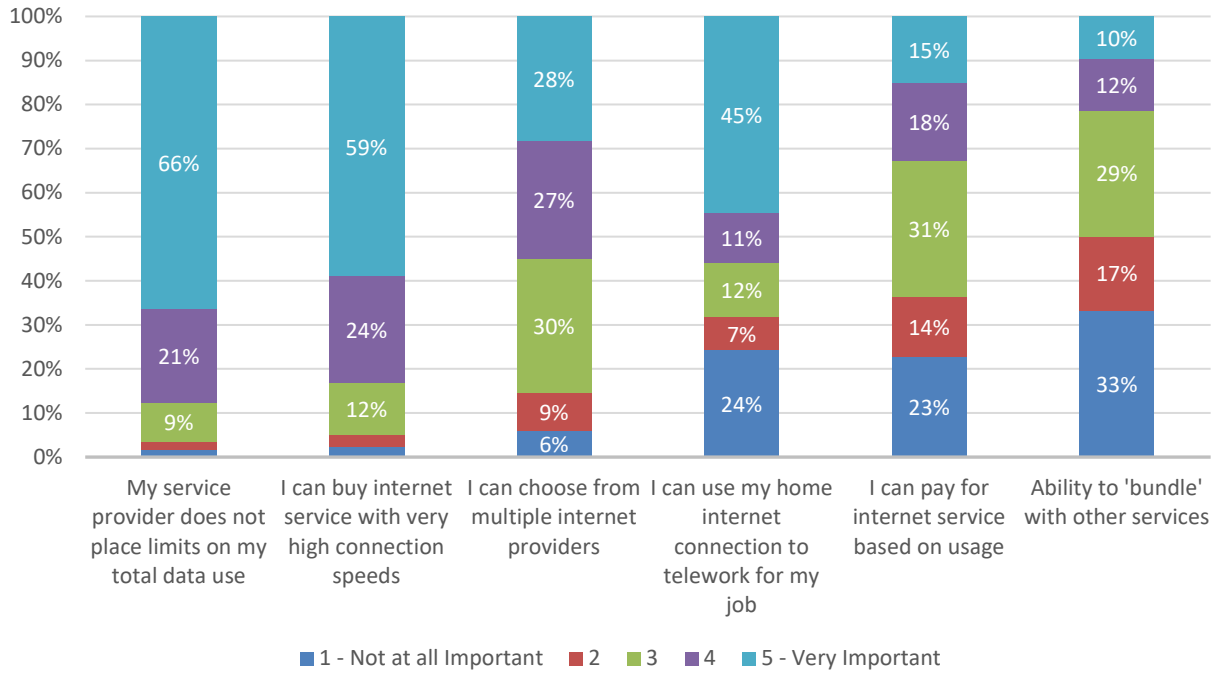


Figure 45: Importance of Aspects in Selecting Home Internet Service

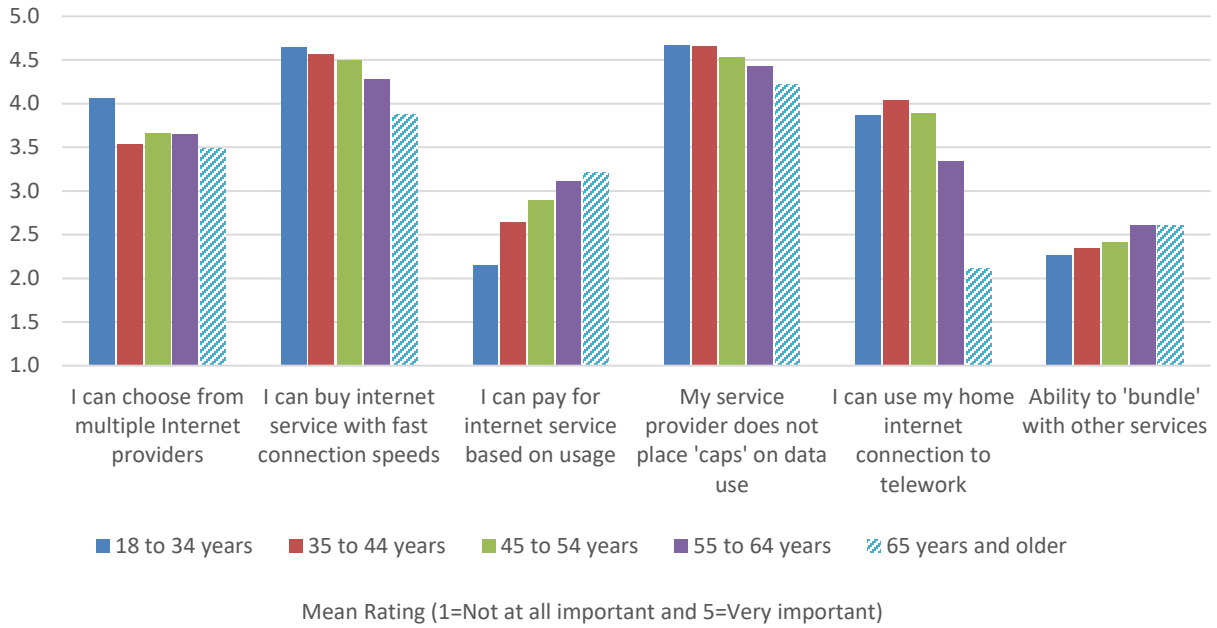


The most important aspects are the service provider not placing "caps" on data use and having the ability to buy internet service with very high connection speeds, with at least six in 10 saying these aspects are “very important.” The ability to choose from multiple internet providers is

somewhat important to respondents. The least important aspect of home internet service is having the ability to bundle with other services.

In general, the importance placed on buying internet service with fast connection speeds, not having "caps" on data use, and using a home internet connection to telework is less important to respondents ages 65 and older, while being able to pay for service based on usage is somewhat more important to this group. Additionally, respondents ages 18 to 34 placed more importance on the ability to choose from multiple internet providers, compared with older respondents (see Figure 46).

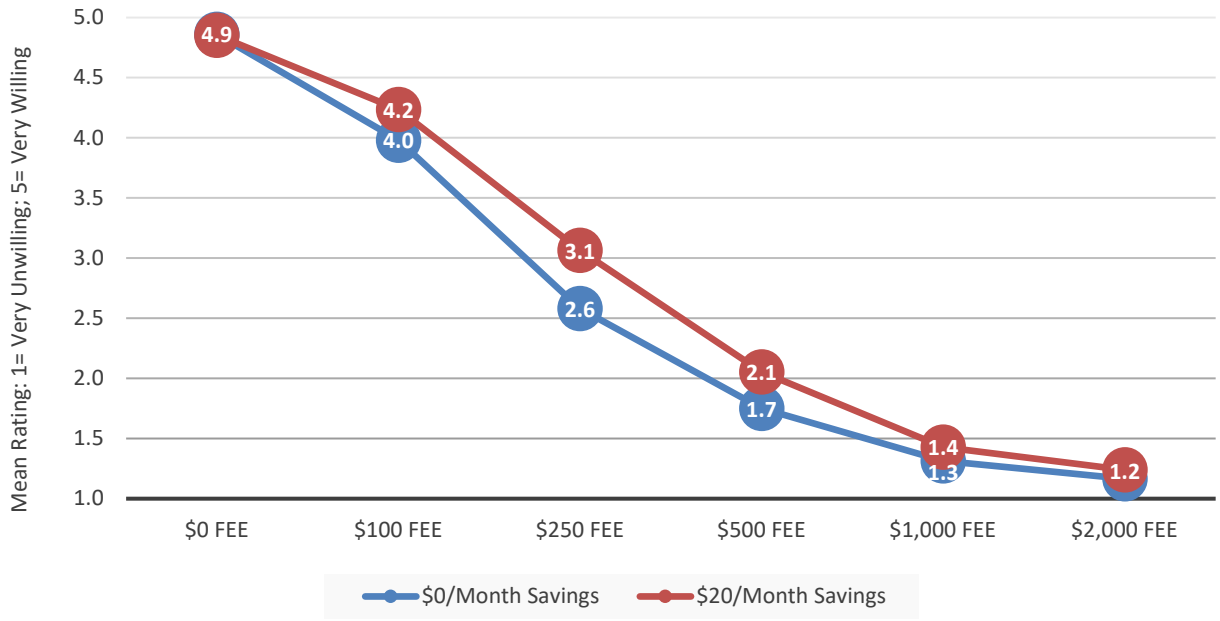
Figure 46: Importance of Aspects in Selecting Home Internet Service by Age of Respondent



4.2.1.8 Willingness to Pay Installation Fee for High-Speed Internet Service

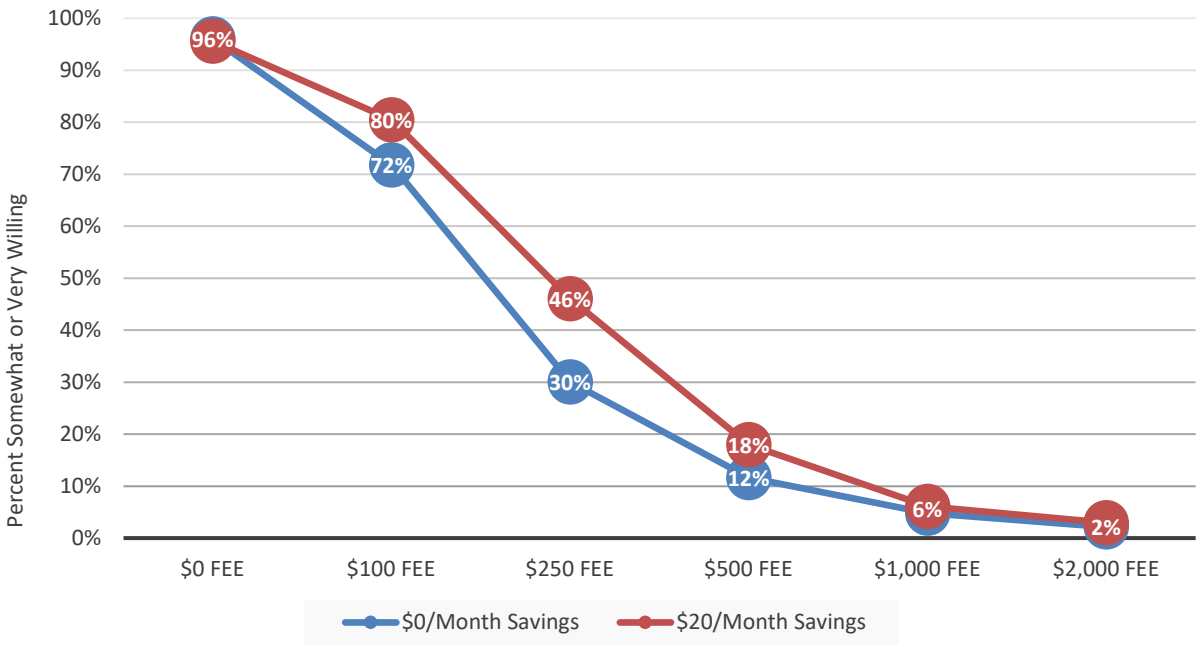
Respondents were asked if they would be willing to pay a one-time installation fee in exchange to having access to a high-speed internet connection, for either no savings per month or for $20 savings per month. Almost all respondents would be very willing to switch to the network for no installation fee (for $0 savings and for $20 savings), as would be expected. Additionally, they would be more willing to pay the fee for some savings on their monthly communications bill. Respondents are somewhat willing to pay a $100 installation fee, particularly for $20 per month savings, but willingness to pay an installation fee falls sharply at higher price points, as shown in Figure 47.

Figure 47: Willingness to Pay Installation Fee for High-Speed Internet Service (Mean Ratings)



Almost all respondents are somewhat or very willing to pay no fee to connect to the network. The majority would pay a $100 installation fee for no savings (72 percent) or a $20 savings per month (80 percent). Approximately 46 percent would be at least somewhat willing to pay a $250 installation fee for a $20 per month savings, but this falls to 30 percent if there were no monthly savings on their bill, as illustrated in Figure 48.

Figure 48: Willingness to Pay Installation Fee for High-Speed Internet Service



Only slight differences in the willingness to pay an installation fee by area of residence were found, as illustrated in Figure 49 and Figure 50. Residents of Area D are somewhat more likely to pay an installation fee at higher price points, compared with residents of other areas, particularly for $20 per month savings.

Figure 49: Willingness to Pay Installation Fee by Area of Residence

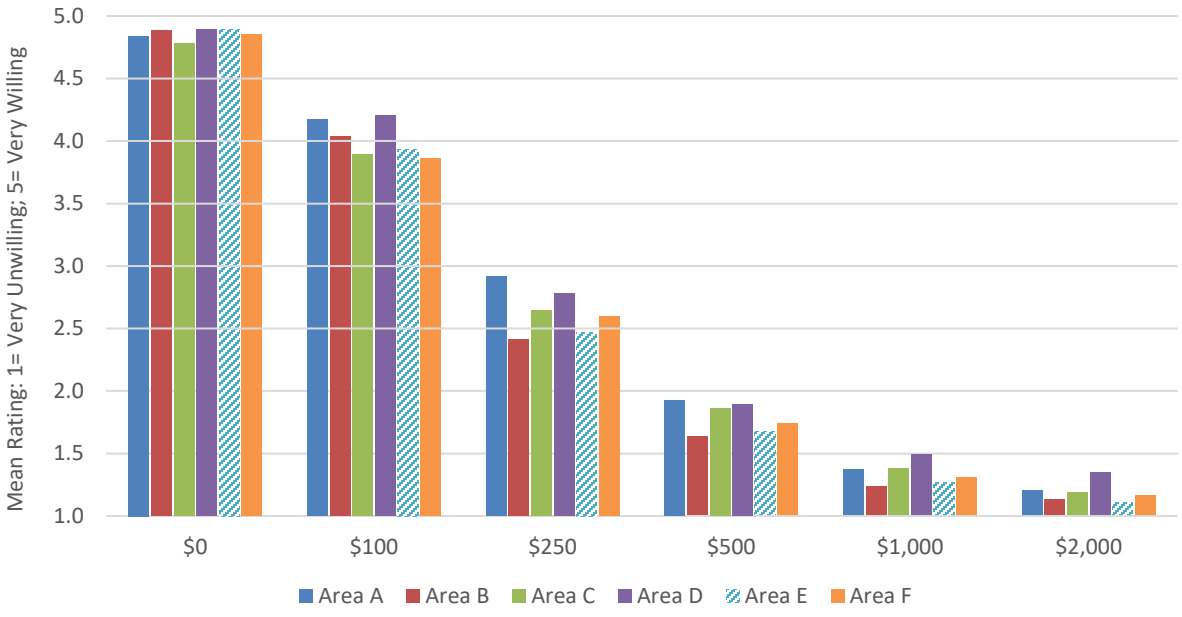
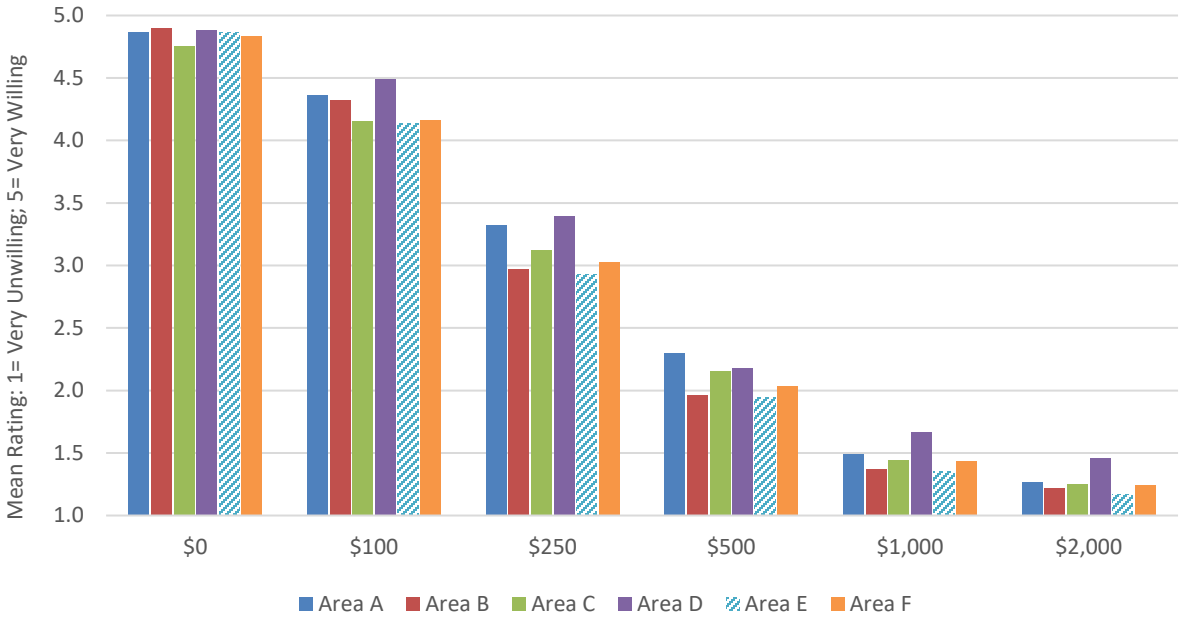


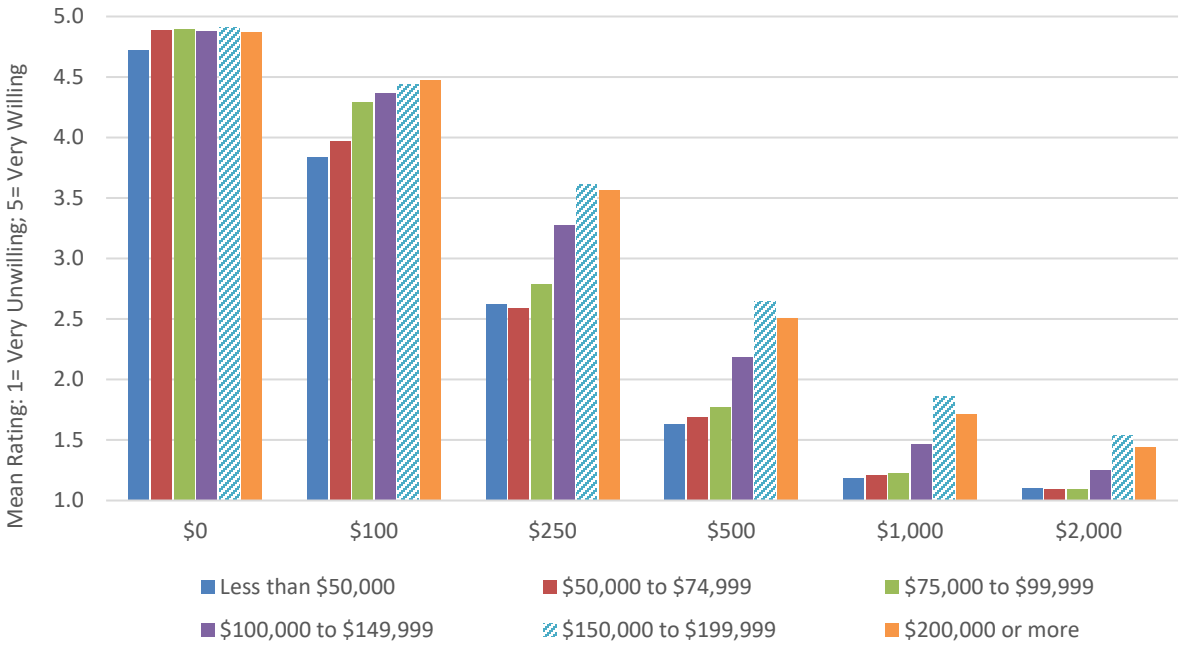
Figure 50: Willingness to Pay Installation Fee for $20/Month Savings by Area of Residence



For most price points, the willingness to pay an installation fee (for either no monthly savings or for a $20 per month savings) is correlated with household income (see Figure 51 and Figure 52). In particular, those earning $150,000 or more per year would be more likely than lower income households to pay an installation fee in exchange for high-speed internet.

Figure 51: Willingness to Pay Installation Fee by Household Income

Figure 52: Willingness to Pay Installation Fee for $20/Month Savings by Income



4.2.2 Television and Telephone Service

Respondents were asked to evaluate the importance of television programming features. The most important television programming aspects are local programming and news programming, while the least important is children's programming, as illustrated in Figure 53 and Figure 54.

Figure 53: Importance of Television Programming Features

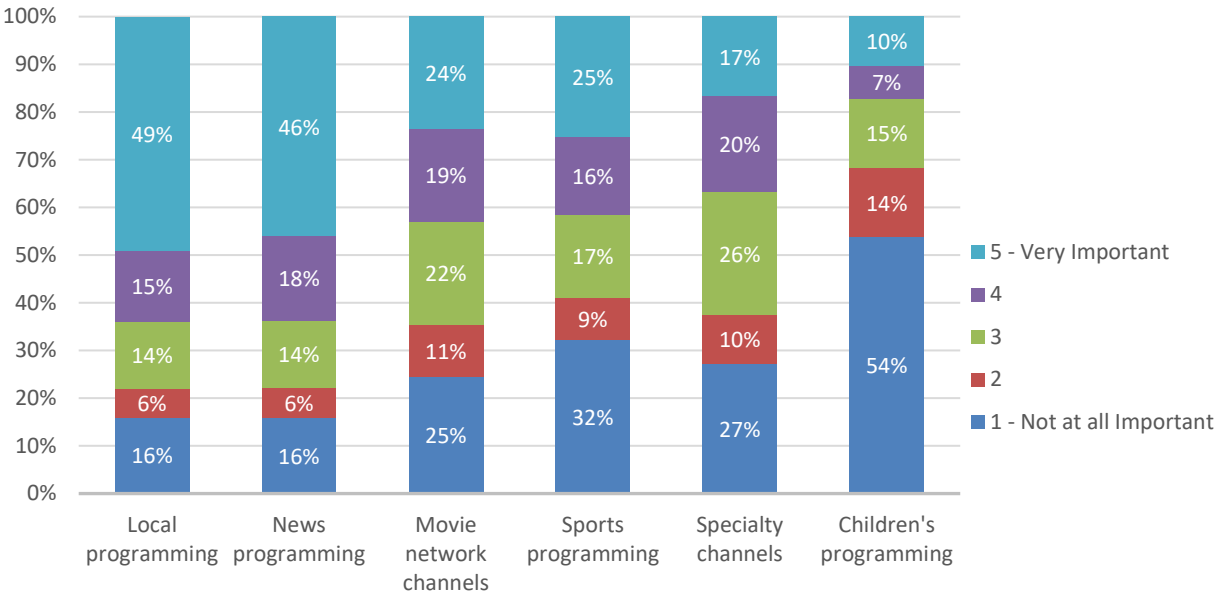
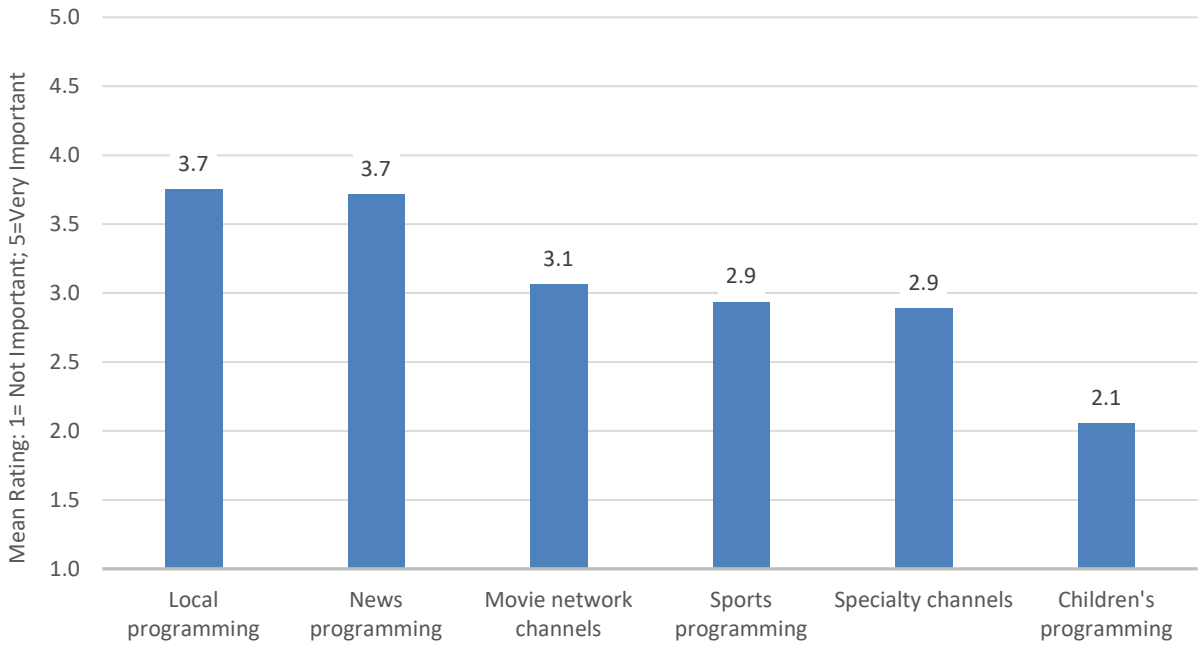
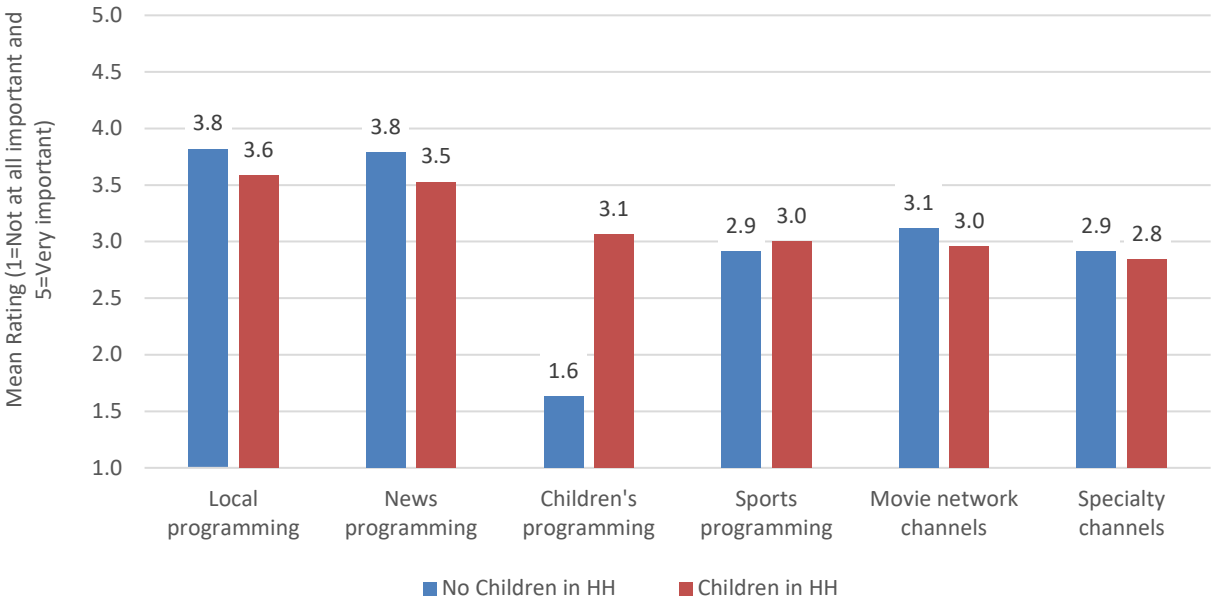


Figure 54: Importance of Television Programming Features (Mean Ratings)



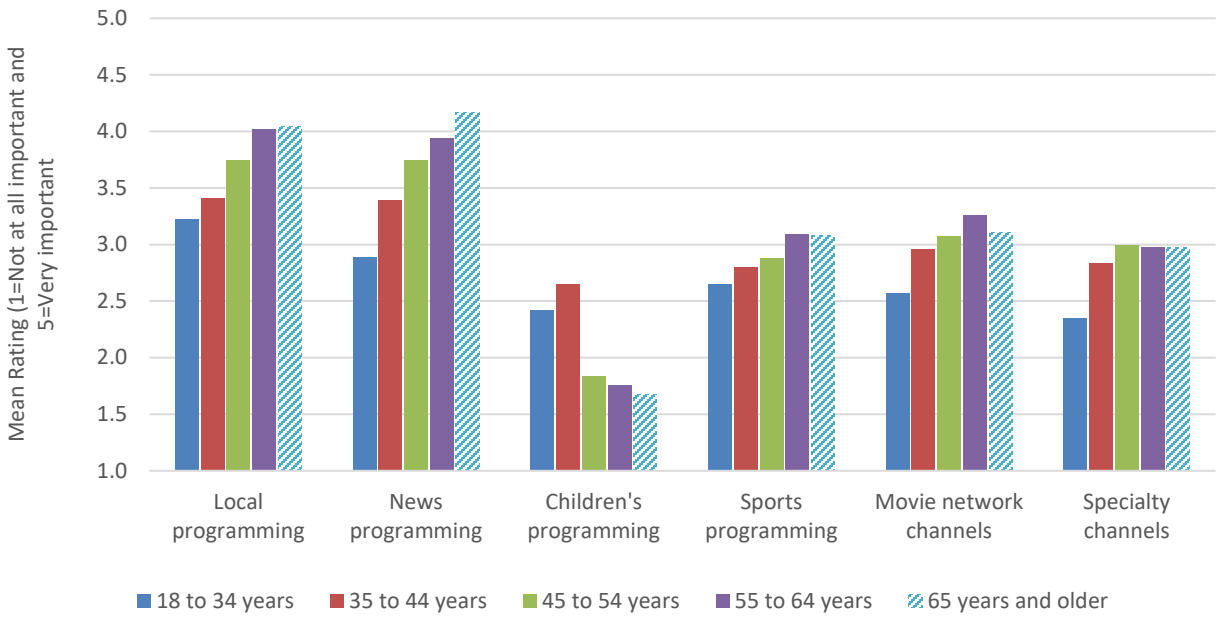
However, those with children in the household placed significantly more importance on children's programming, as shown in Figure 55.

Figure 55: Importance of Television Programming Aspects by Children in Household



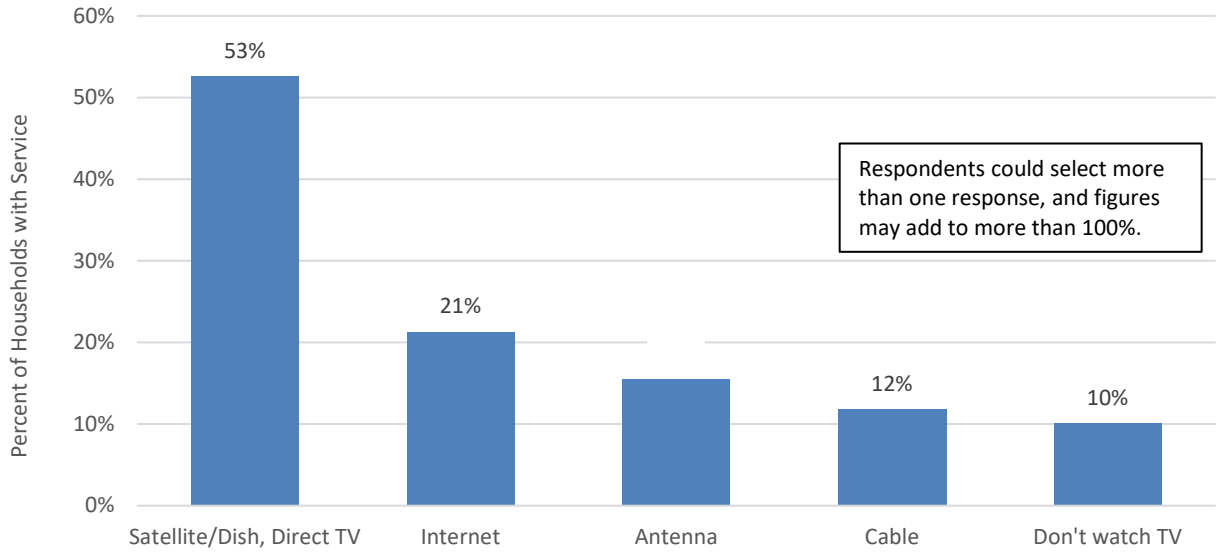
Additionally, the importance placed on most types of programming is lower for those ages 18 to 34, compared with older respondents, with the exception of children's programming (please see Figure 56).

Figure 56: Importance of Television Programming Aspects by Age of Respondent



More than one-half of respondents purchase satellite television service. Market share is much lower for internet-based, antenna (over-the-air), or cable television. One in 10 respondents do not watch television (see Figure 57).

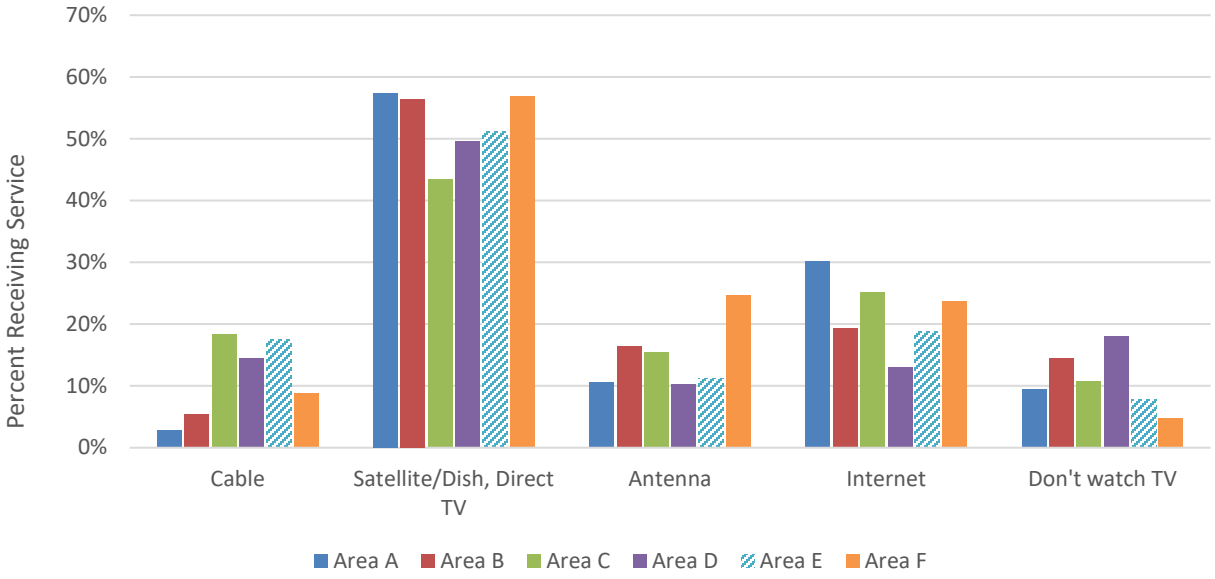
Figure 57: Types of Television Service in Home



Satellite is the leading television service across all areas but has a somewhat higher market share in Areas A, B, and F. Area F residents are more likely to have over-the-air service compared with residents of other areas. Internet-based television is highest in Area A, with three in 10 households subscribing. Nearly one-fifth of residents of Area D do not watch television (see

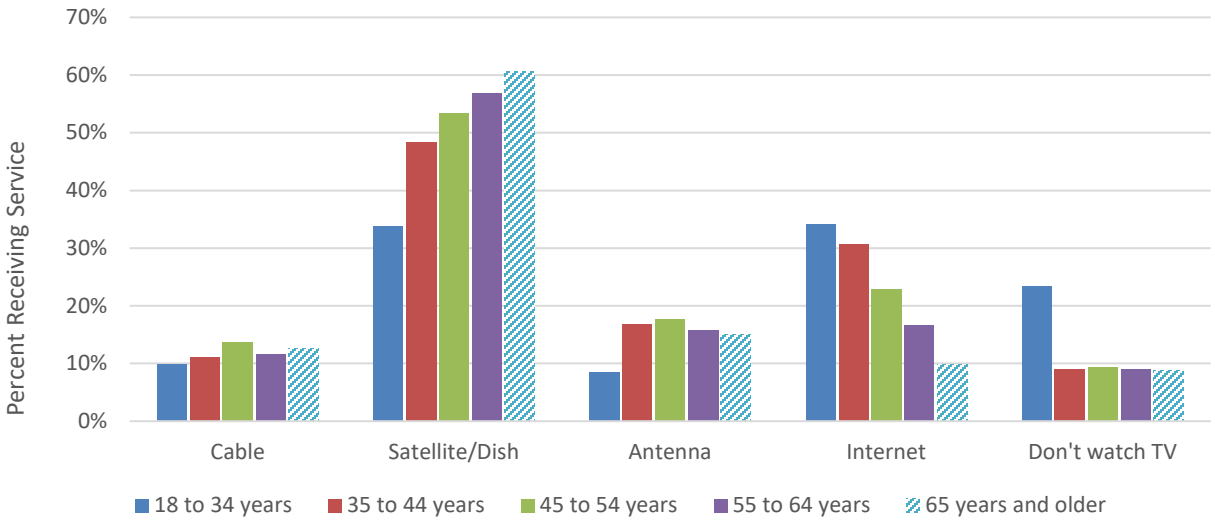
Figure 58).

Figure 58: Types of Television Service in Home by Area of Residence



Subscription to television services varies significantly by age of respondent. Specifically, the use of internet television decreases as age of respondent increases, while the use of satellite increases with age. Nearly one-fourth of respondents age 18 to 34 do not watch television (see Figure 59).

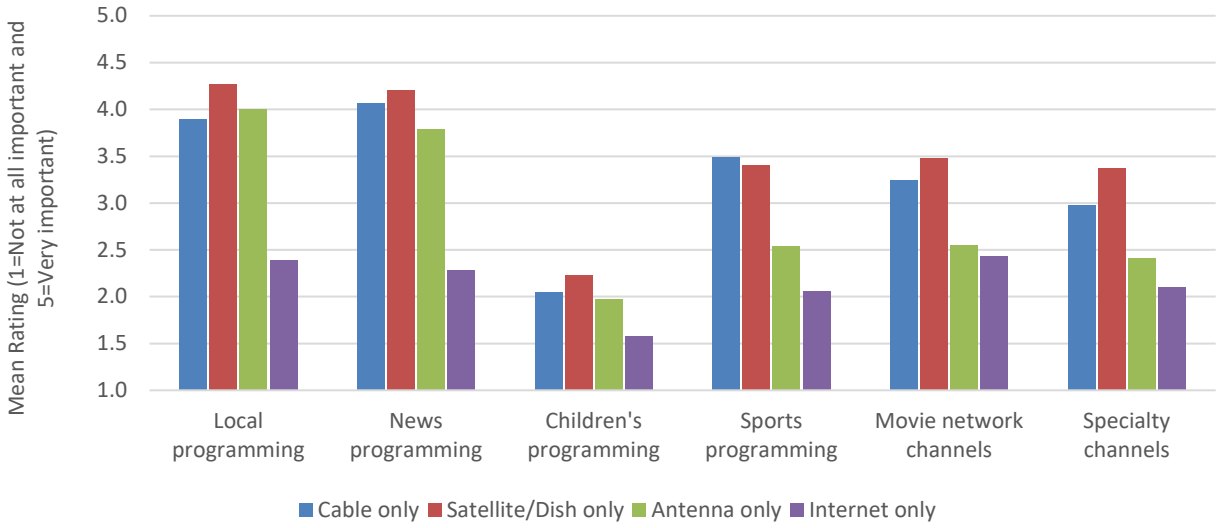
Figure 59: Types of Television Service in Home by Age of Respondent



Additionally, one in 10 respondents (and 26 percent of those under age 35) exclusively use internet-based television service. Two-thirds of internet-only users are under age 45. In comparison, roughly three in 10 cable and satellite TV subscribers are under age 45. Internet-

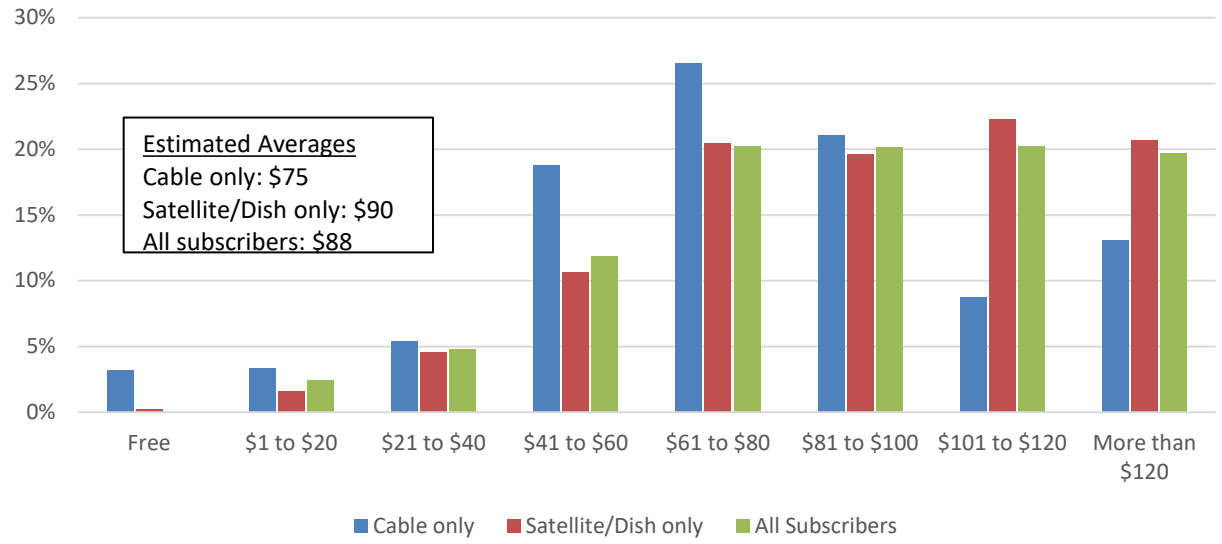
only users place less value on various types of programming content, as might be expected (see Figure 60).

Figure 60: Importance of Television Programming Aspects by Television Service



The estimated average monthly price for cable or satellite television service is $88, with four in 10 respondents paying over $100 per month, as illustrated in Figure 61. The estimated cost per month is higher for satellite television compared with cable television.

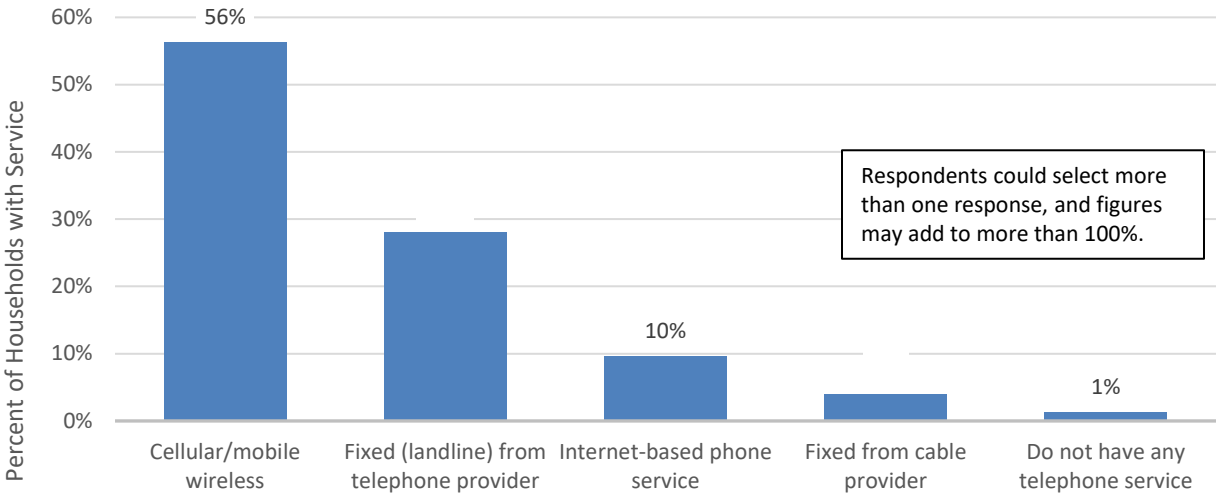
Figure 61: Monthly Price of Cable or Satellite TV Service



Respondents were asked about their home and mobile telephone services. As illustrated in Figure 62, 56 percent of respondents have a cellular/mobile telephone. About one-third of respondents have a landline, including 28 percent from a traditional telephone provider and four percent from

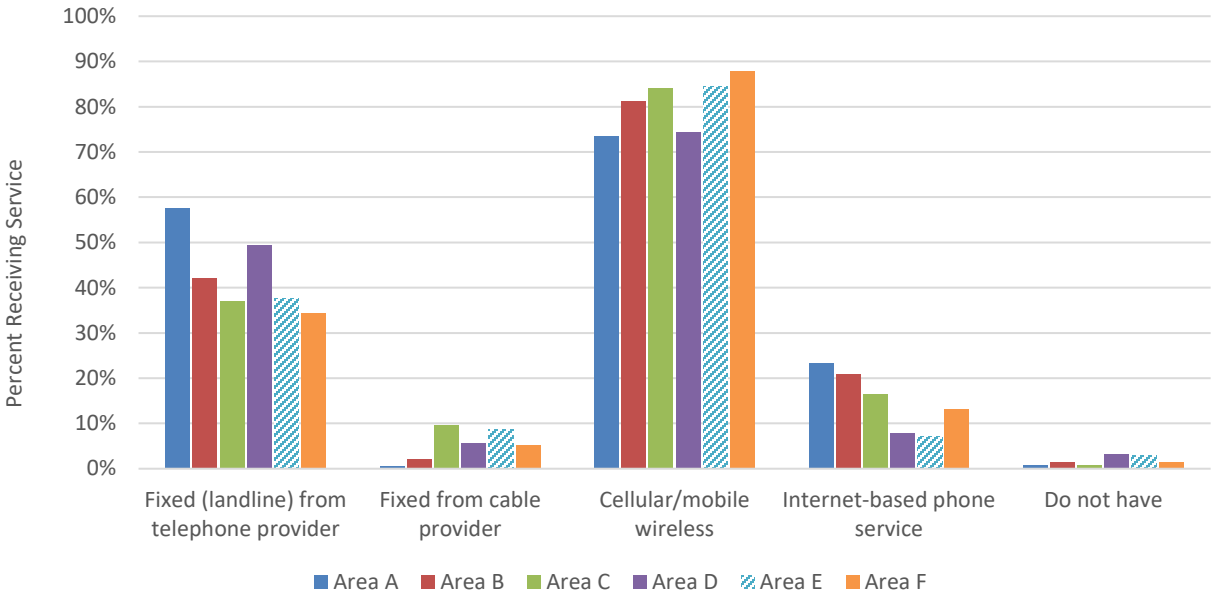
a cable provider. One in 10 have internet-based telephone service.

Figure 62: Home Telephone Service(s)



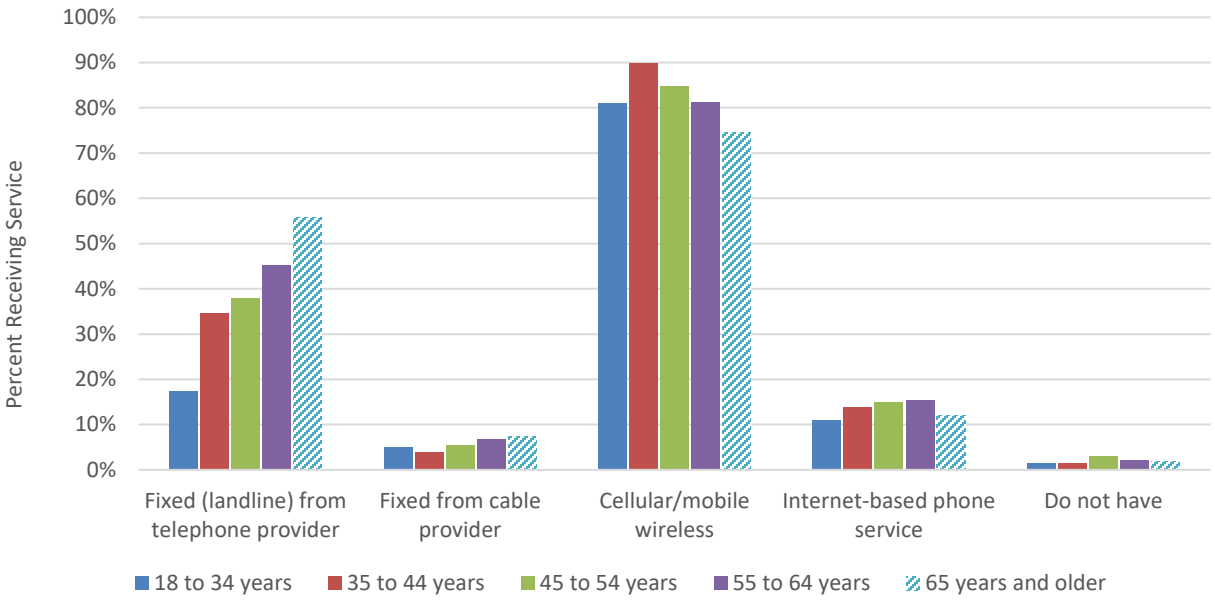
The use of cellular/mobile wireless service is somewhat lower in Areas A and D, while the use of landline service from a telephone provider is somewhat higher in these areas (see Figure 63).

Figure 63: Home Telephone Service(s) by Area of Residence



As illustrated in Figure 64, use of landline telephone service tends to increase as the age of the respondent increases, while use of cellular/mobile wireless telephone tends to decrease with age.

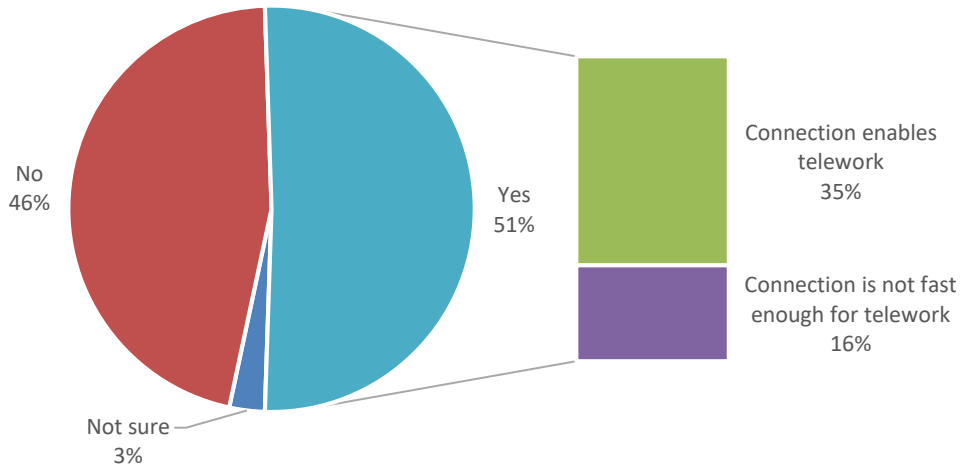
Figure 64: Home Telephone Service(s) by Age of Respondent



4.2.3 Internet Use for Jobs/Careers/Education

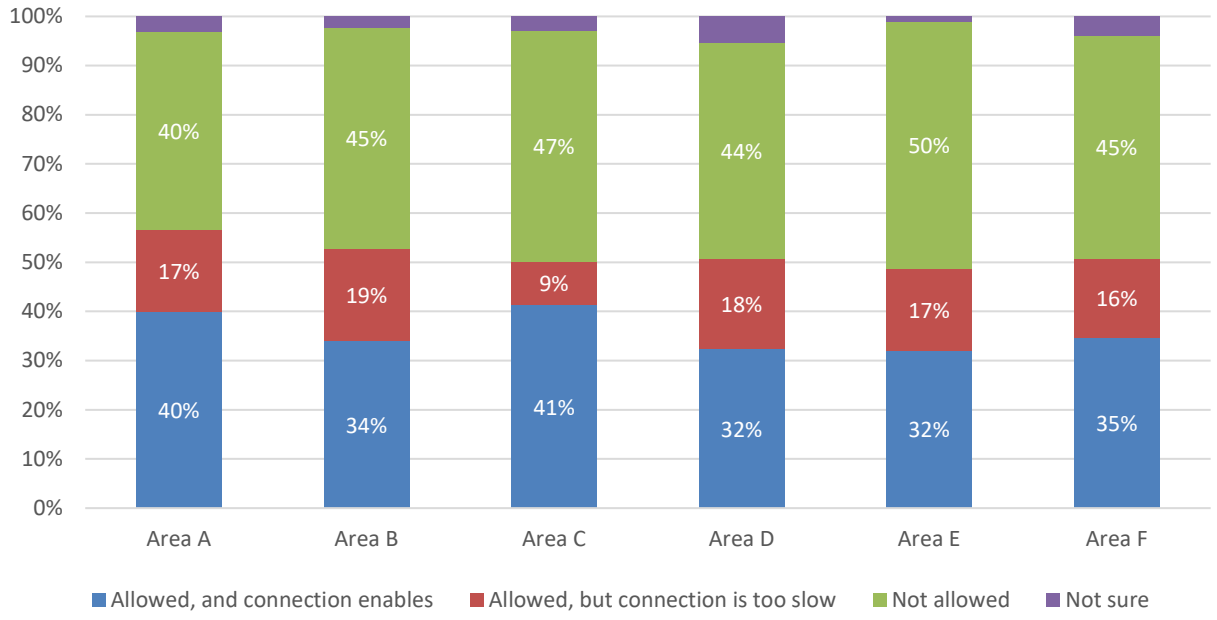
One-half of respondents indicated that a member of their family is allowed by their employer to telework, including 35 percent who said their internet connection enables telework. Another 16 percent said their internet connection was not fast enough to allow telework (see Figure 65).

Figure 65: Employer Allows Teleworking



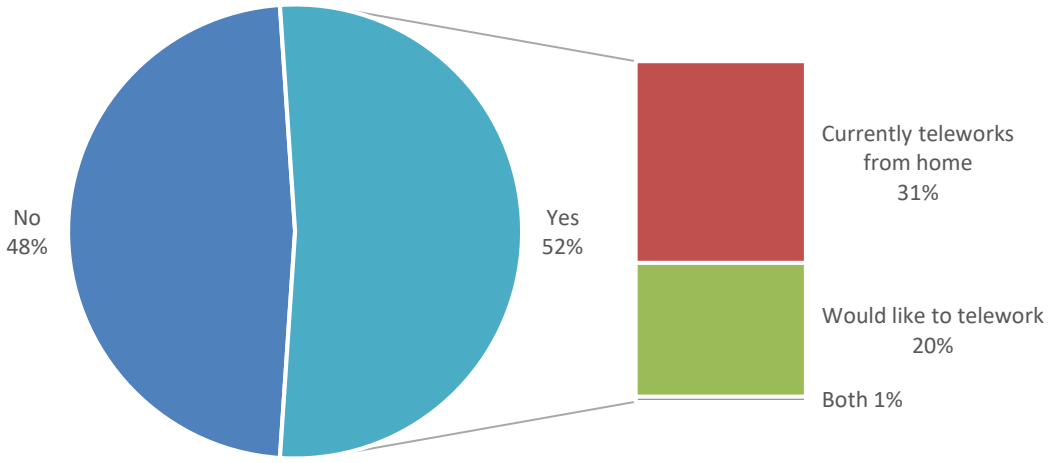
The proportion of respondents who are allowed to telework and who have a fast-enough internet connection is slightly higher in Areas A and C, as shown in Figure 66.

Figure 66: Employer Allows Teleworking by Area of Residence



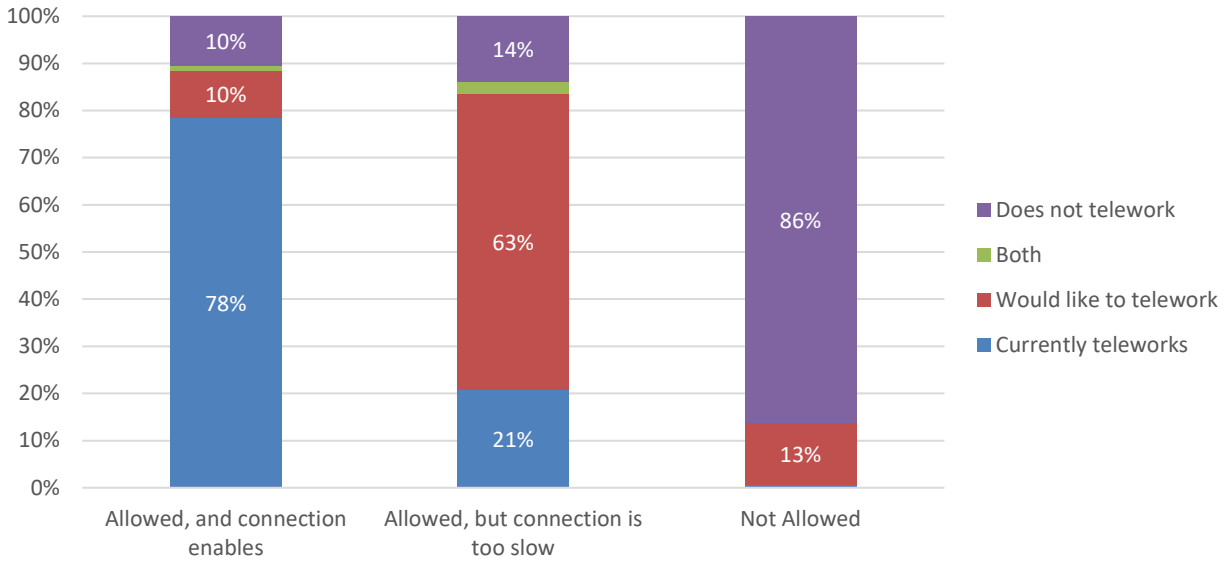
As shown in Figure 67, approximately 31 percent of respondents indicated that someone in their family already teleworks from home and another 20 percent would like to telework.

Figure 67: Household Member Teleworking Status



Three-fourths (78 percent) of household members who are allowed to telework and who have a fast-enough home internet connection do indeed telework from home. Additionally, 63 percent of those who are allowed to telework but have a slow connection indicated that someone in their household would like to telework (see Figure 68). This indicates that a substantial additional share may telework if feasible, allowed by their employer, and if their connection were fast enough to enable telework.

Figure 68: Teleworking Status by Ability to Telework



Those under age 55 and those with a higher estimated household income are more likely to have a household member who teleworks or would like to telework, as shown in Figure 69 and Figure 70.

Figure 69: Teleworking Status by Age of Respondent

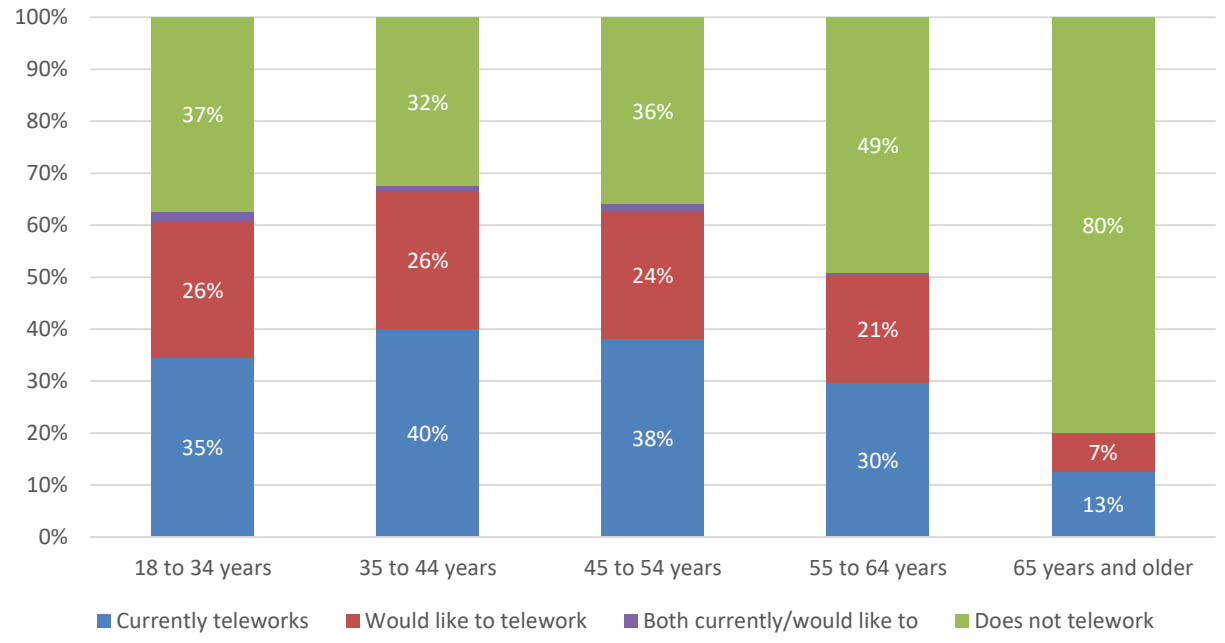
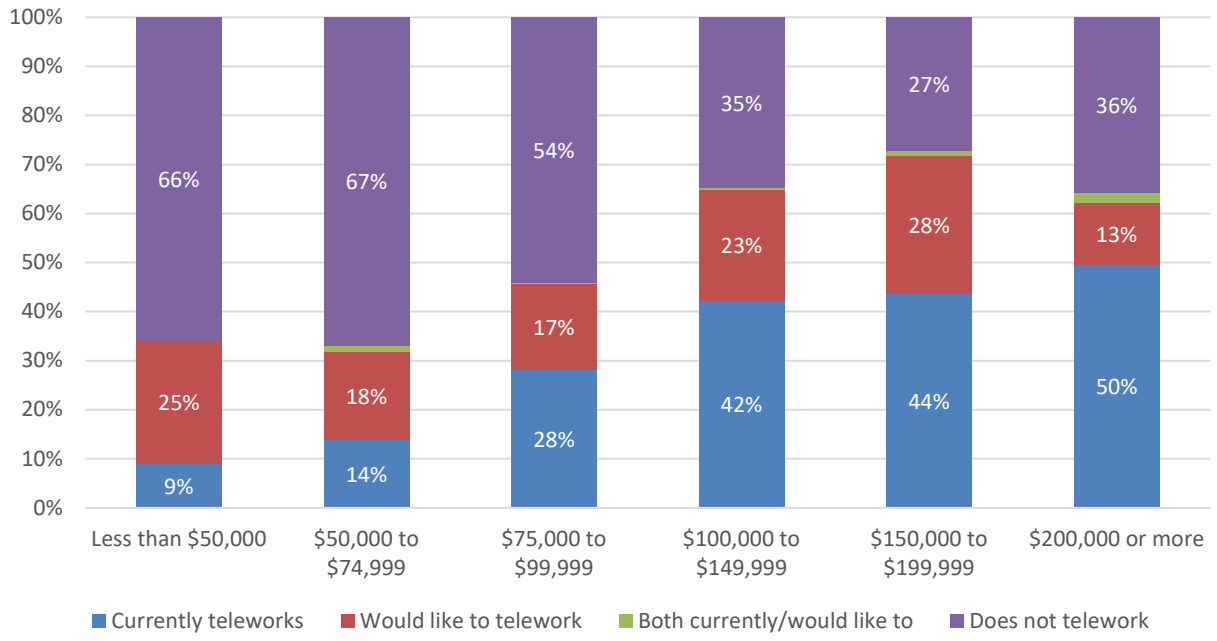


Figure 70: Teleworking Status by Household Income



One-third of respondents have a home-based business, and another 11 percent are planning to start one within the next three years, as illustrated in Figure 71. Of those who operate or are planning to start a home-based business, 75 percent indicated that a high-speed internet connection is (or would be) very important to this business, and 18 percent said it would be somewhat important (see Figure 72).

Figure 71: Own or Plan to Start a Home-Based Business

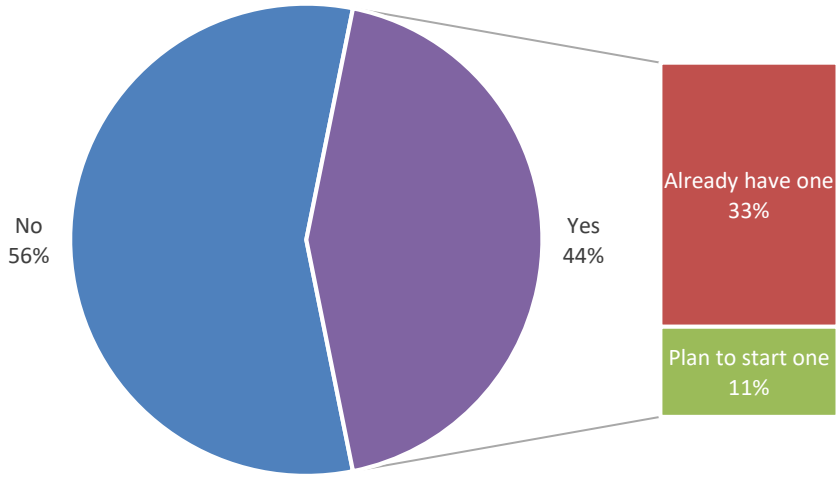
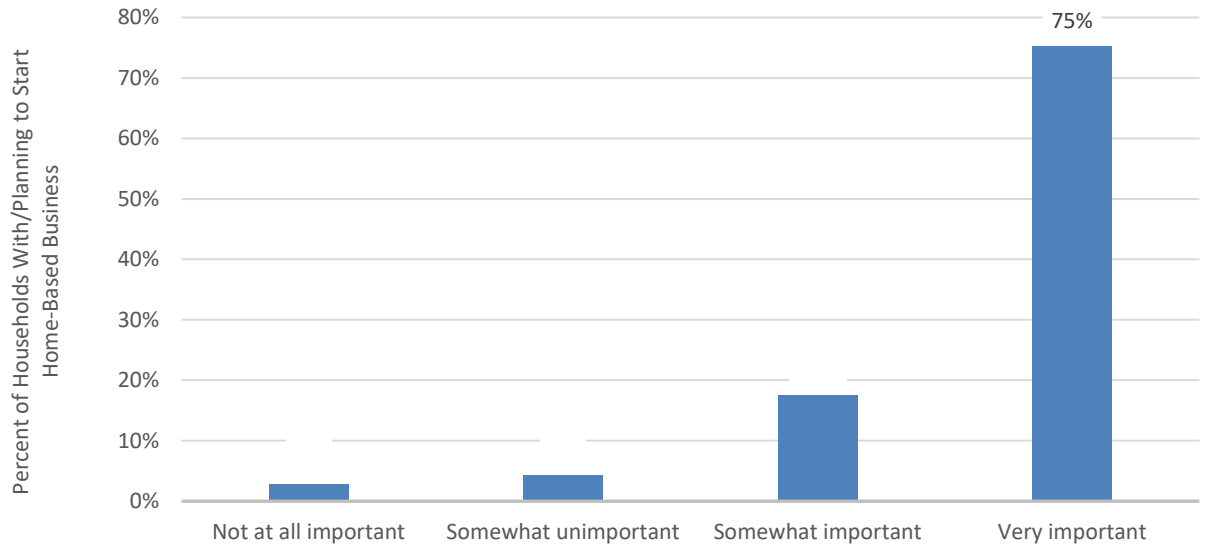
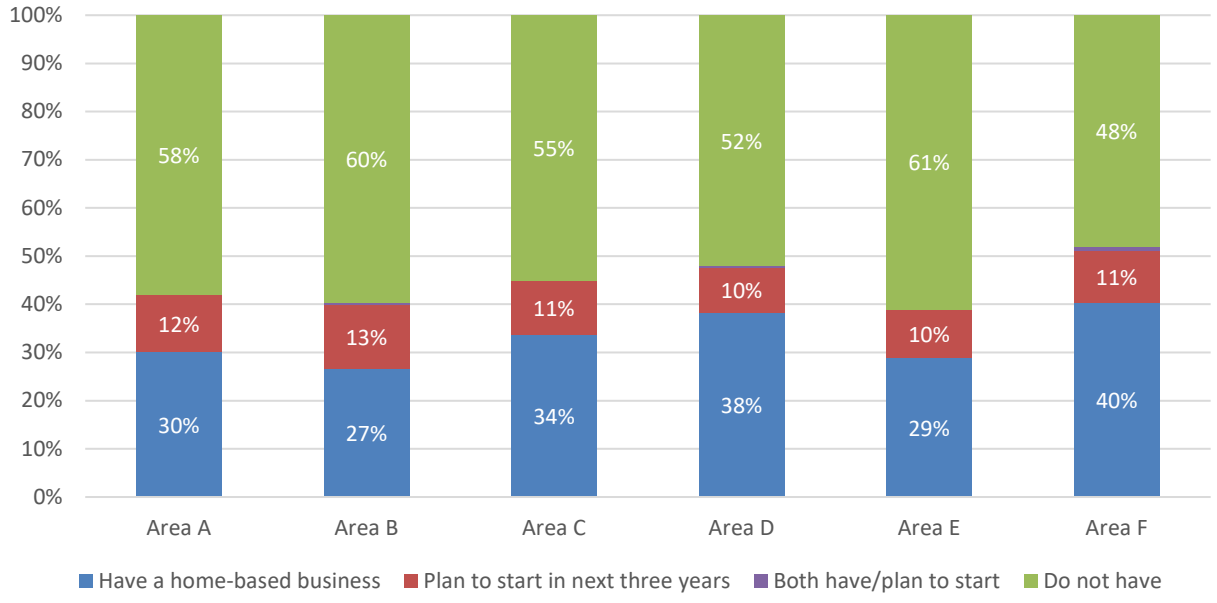


Figure 72: Importance of High-Speed Internet to Existing or Potential Home-Based Business



Slight differences in saturation of home-based business by area of residence were found. As shown in Figure 73, Area D and Area F residents are among the most likely to either have or plan to start a home-based business in the next three years.

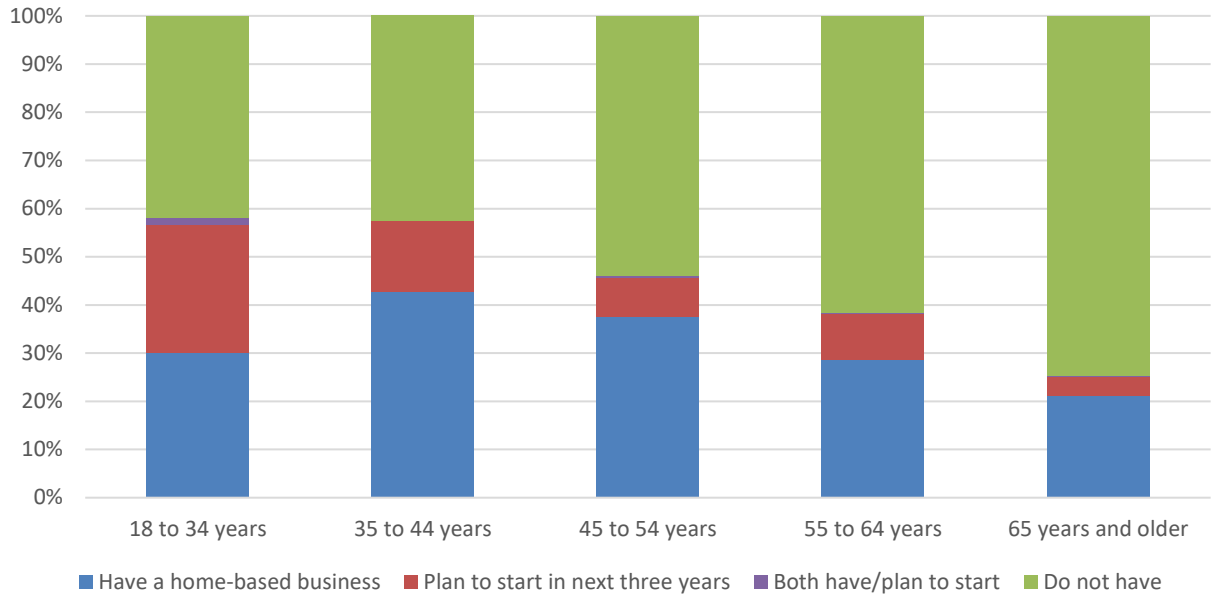
Figure 73: Own or Plan to Start a Home-Based Business by Area of Residence



As might be expected, the likelihood of having or planning to start a home-based business tends to decline as age increases (see Figure 74). Those ages 35 to 44 are more likely than others to already have a home-based business, while those ages 18 to 34 are more likely to plan to start a

home-based business in the next three years.

Figure 74: Own or Plan to Start a Home-Based Business by Age of Respondent



In addition, 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, 58 percent reported using the internet for educational reasons (compared with approximately eight in 10 who earlier reported using the internet at least occasionally to access education resources). Residents of Area A and Area D are somewhat less likely to use the internet for educational purposes (see Figure 75).

Figure 75: Use of Internet for Educational Purposes by Area of Residence

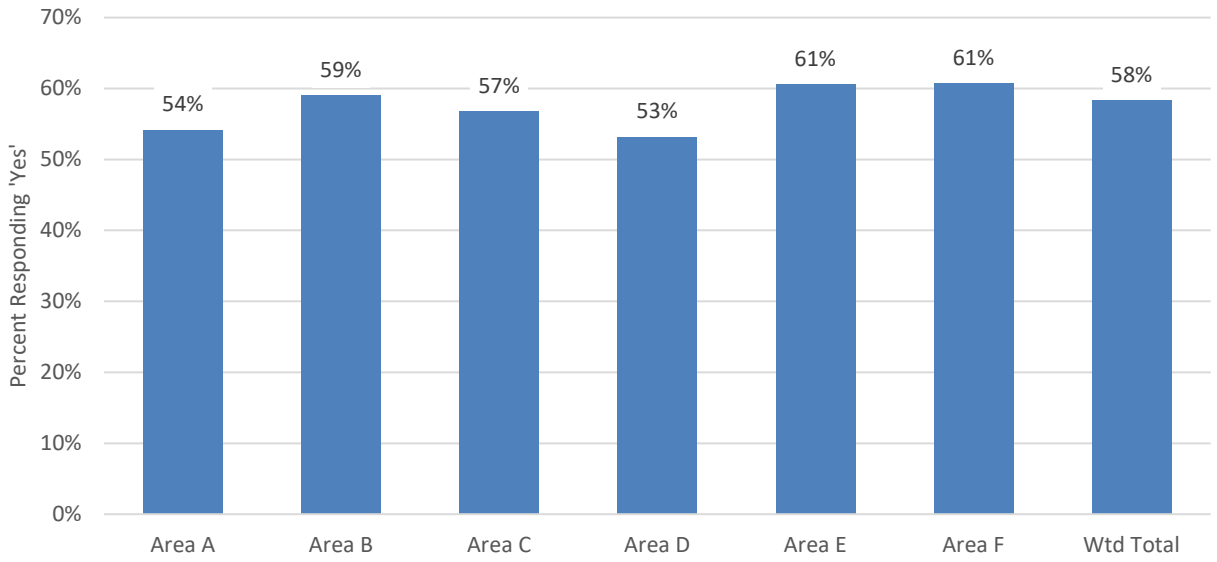
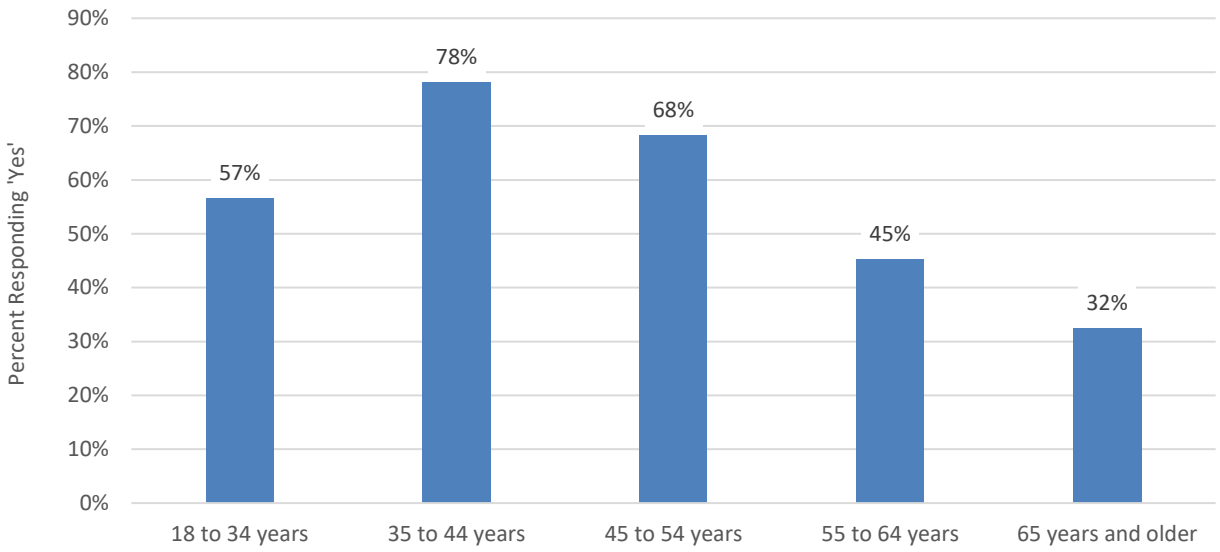


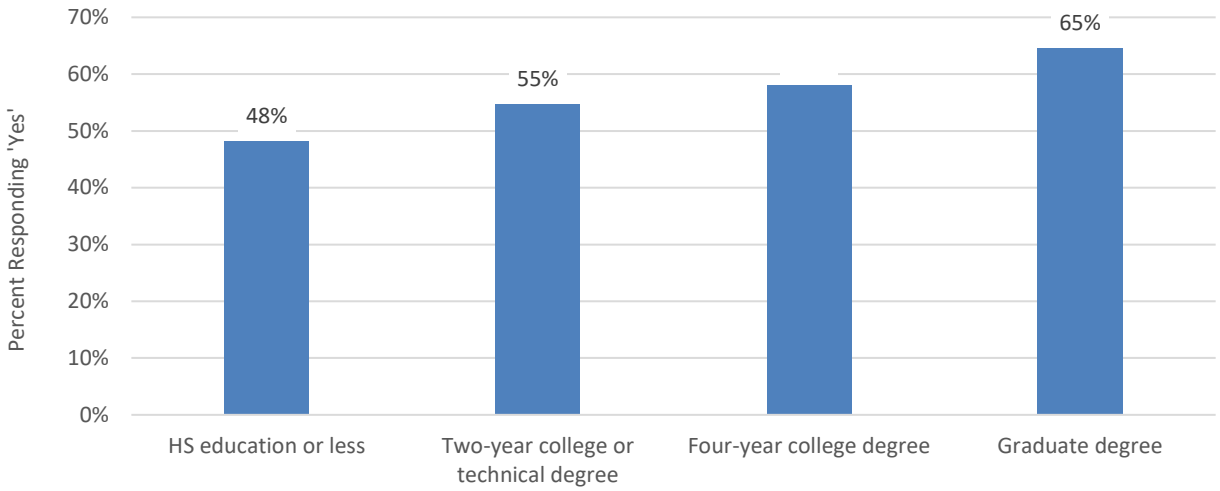
Figure 76: Use of Internet for Educational Purposes by Age of Respondent



Respondents ages 35 to 44 are more likely than older and young respondents to have a household member who uses the internet for educational purposes (see Figure 76); they are also more likely to have children age 18 and under in the household. (Two-thirds of respondents ages 35 to 44 have children in the household.) Approximately 84 percent of those with children in the household use the internet for educational purposes, compared with 45 percent of those without children in the home.

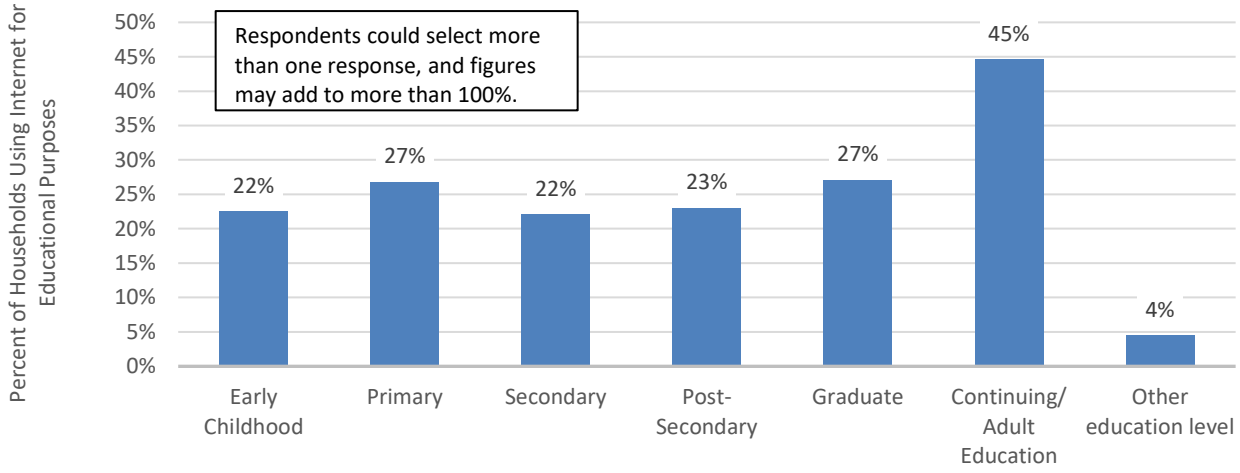
Additionally, use of the internet for educational purposes is also correlated with level of education completed. About one-half of those with a high school education or less use the internet for educational purposes, compared with roughly two-thirds of those with a graduate degree (see Figure 77).

Figure 77: Use of Internet for Educational Purposes by Education Completed



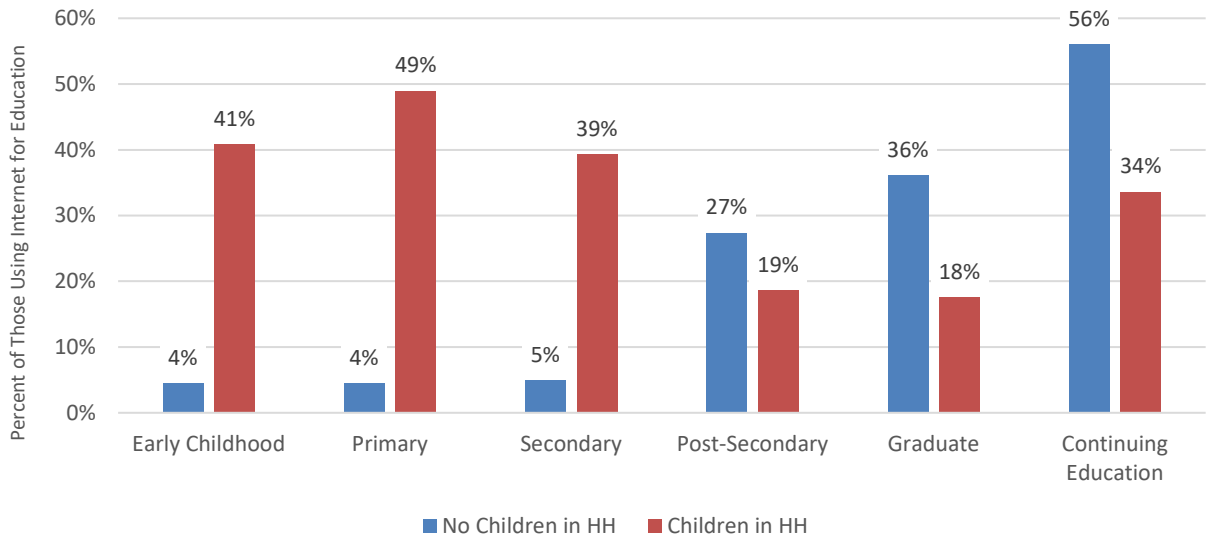
Among those who use the internet for educational purposes, 45 percent indicated it is used for continuing and adult education, while fewer use it for other education levels (see Figure 78).

Figure 78: Education Level for Which Internet Connection Is Used



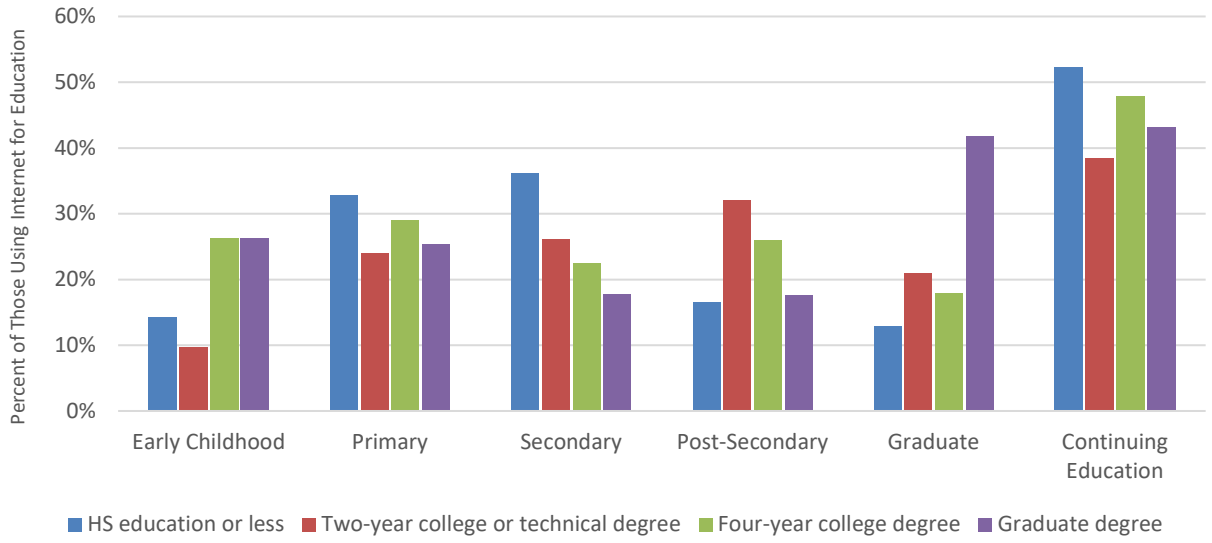
Use of the internet for educational purposes is related to presence of children in the household, as might be expected, particularly for early childhood, primary, and secondary education needs. Those without children in the household are more likely to use the internet for post-graduate, graduate, or continuing education (see Figure 79).

Figure 79: Education Level for Which Internet Connection Is Used by Children in Household



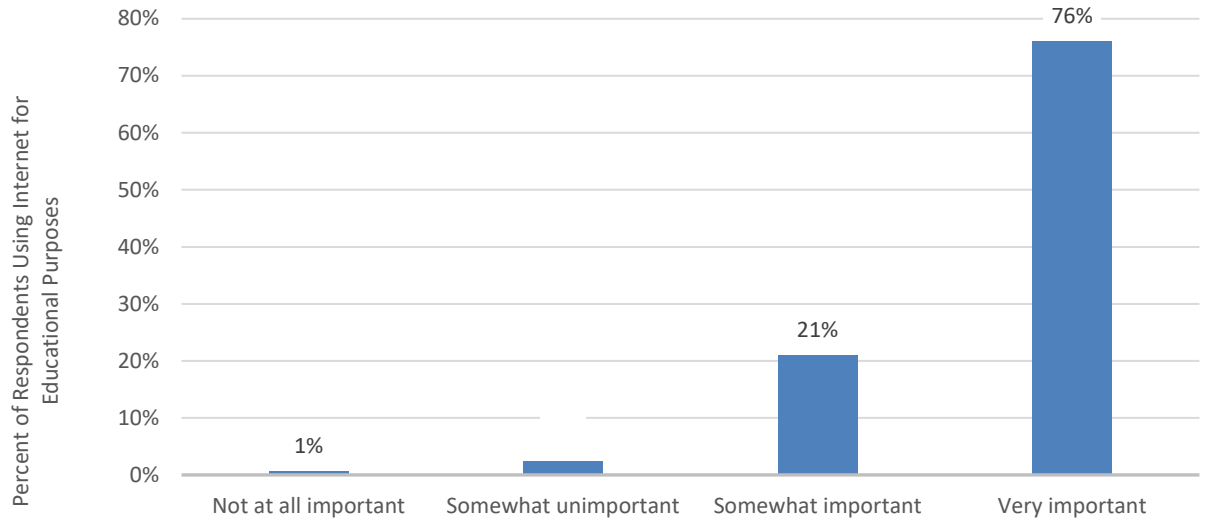
The education level for which an internet connection is used is also correlated with the education level completed by respondents, which is intuitive. For example, those with a graduate degree are more likely than others to use the internet for graduate level educational purposes (see Figure 80).

Figure 80: Education Level for Which Internet Connection Is Used by Education Completed



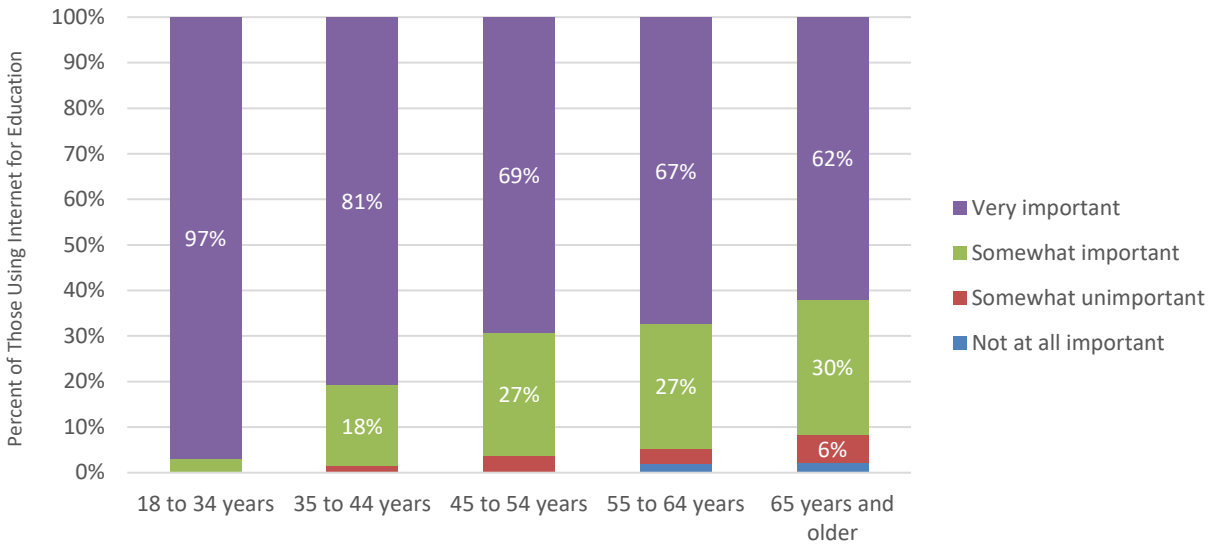
Among those who use the internet for educational purposes, three-fourths said that a high-speed internet connection is very important. Another one-fifth said it is somewhat important for their education needs (see Figure 81).

Figure 81: Importance of High-Speed Internet for Education Needs



The importance placed on high-speed internet for educational needs tends to decline as age increases, as indicated in Figure 82. Nearly all (97 percent) of those ages 18 to 34 who use the internet for educational purposes said a high-speed connection is very important, compared with 62 percent of those 65 years and older.

Figure 82: Importance of High-Speed Internet for Education Needs by Age of Respondent



4.2.4 Respondents' Perception of Larimer County's Role

Respondents were asked their opinions about Larimer County's role in providing or promoting broadband communications services within the area. The most favorable opinions were for the County to help ensure that all residents, students, and teachers have access to competitively-priced broadband services, with over one-half strongly agreeing. There is less agreement that the

County should build a publicly-financed network (to either offer services to the public OR for private sector companies to offer network services); more than one-third of respondents strongly agreed with these statements. Figure 83 illustrates the mean ratings, while Figure 84 provides detailed responses to each portion of the question.

Figure 83: Opinions About the Role(s) for Larimer County (Mean Ratings)

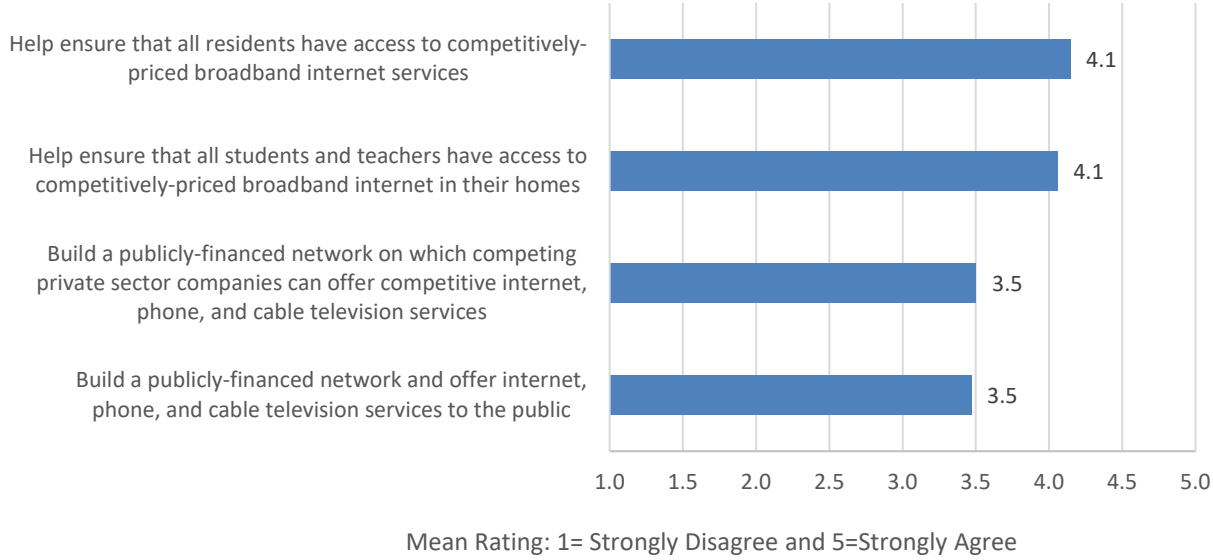
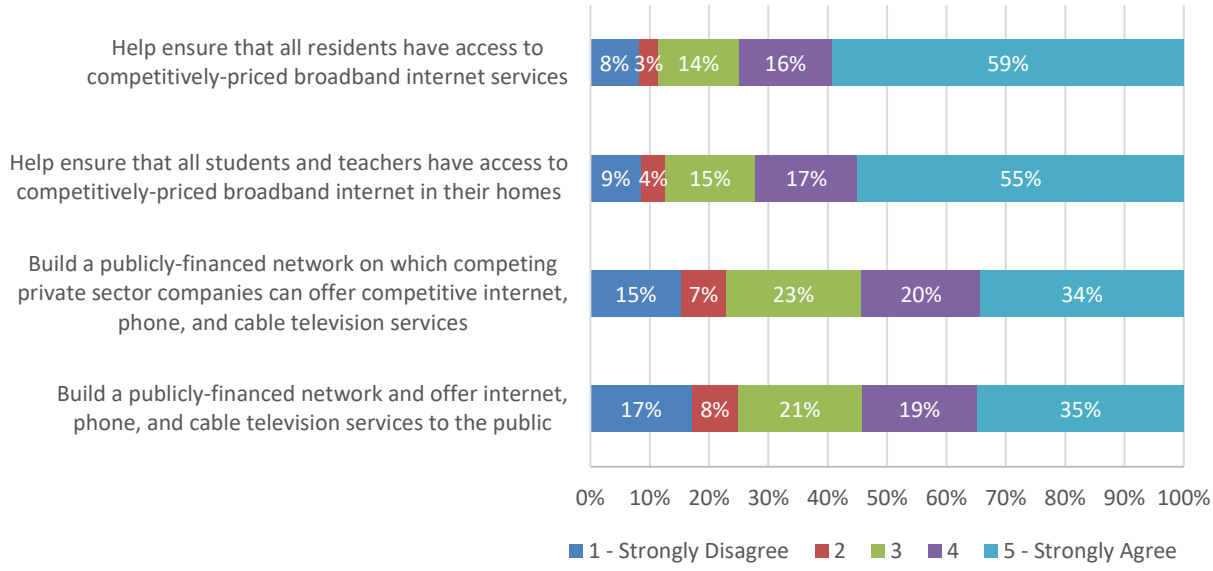


Figure 84: Opinions About the Role(s) for Larimer County



Younger respondents and newer residents showed greater support for the County's role in providing or promoting broadband internet service, as illustrated in Figure 85 and Figure 86.

Figure 85: Opinions About the Role(s) for Larimer County by Age of Respondent

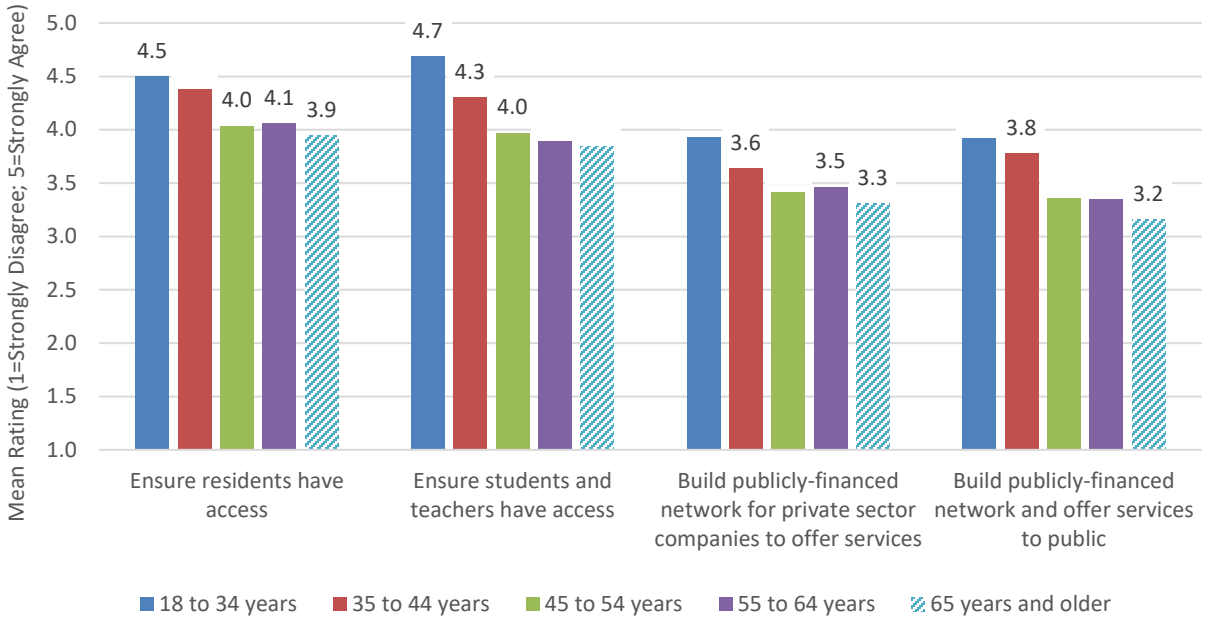
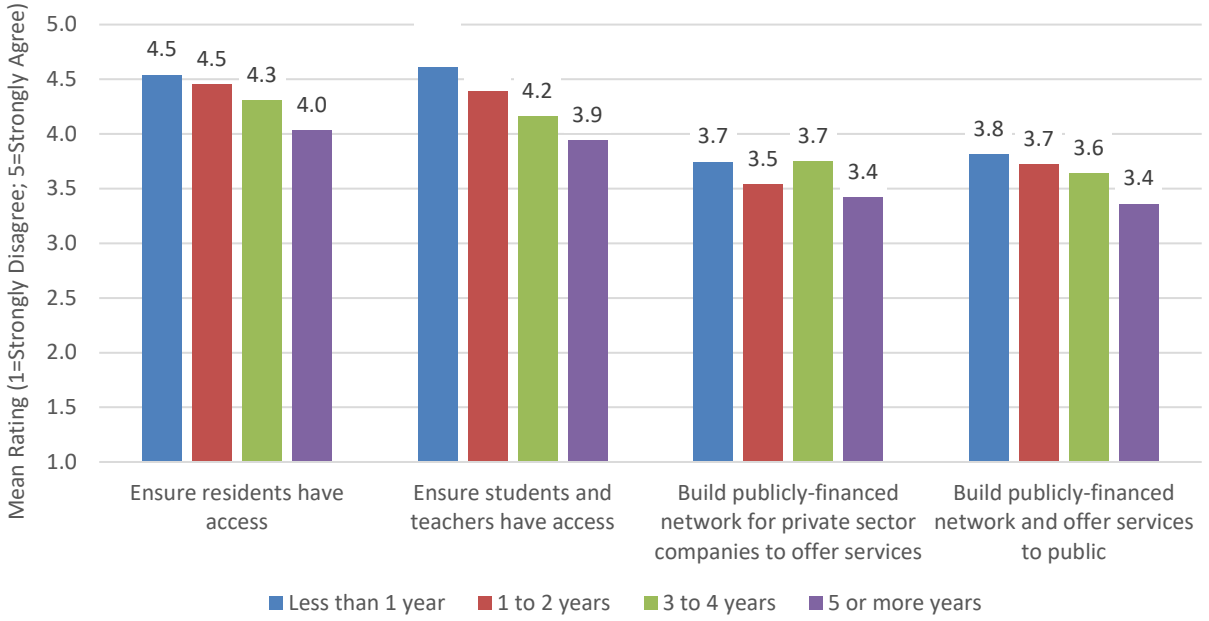


Figure 86: Opinions About the Role(s) for Larimer County by Length of Residence



Respondents were also asked their opinion of the current broadband market. More than one-half somewhat or strongly agreed that high-speed internet is an essential service, and four in ten agreed that availability is a factor in deciding where to live. Three in 10 somewhat or strongly agreed that the market currently provides high-speed internet at prices they can afford (see

Figure 87). Overall agreement about the broadband internet market is moderate, as shown in Figure 88.

Figure 87: Opinions About the Broadband Internet Market

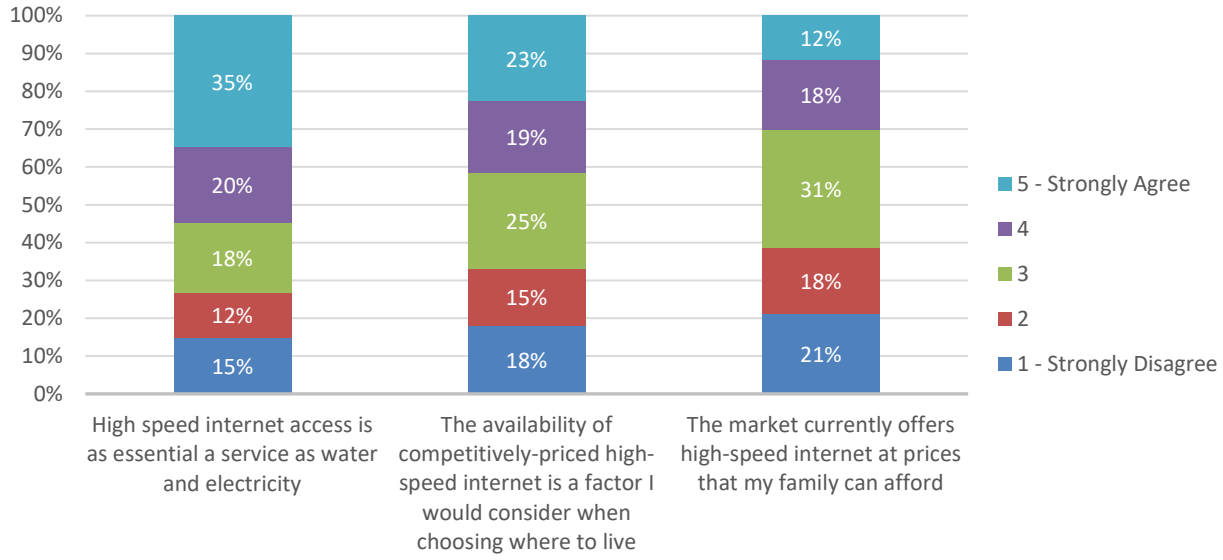
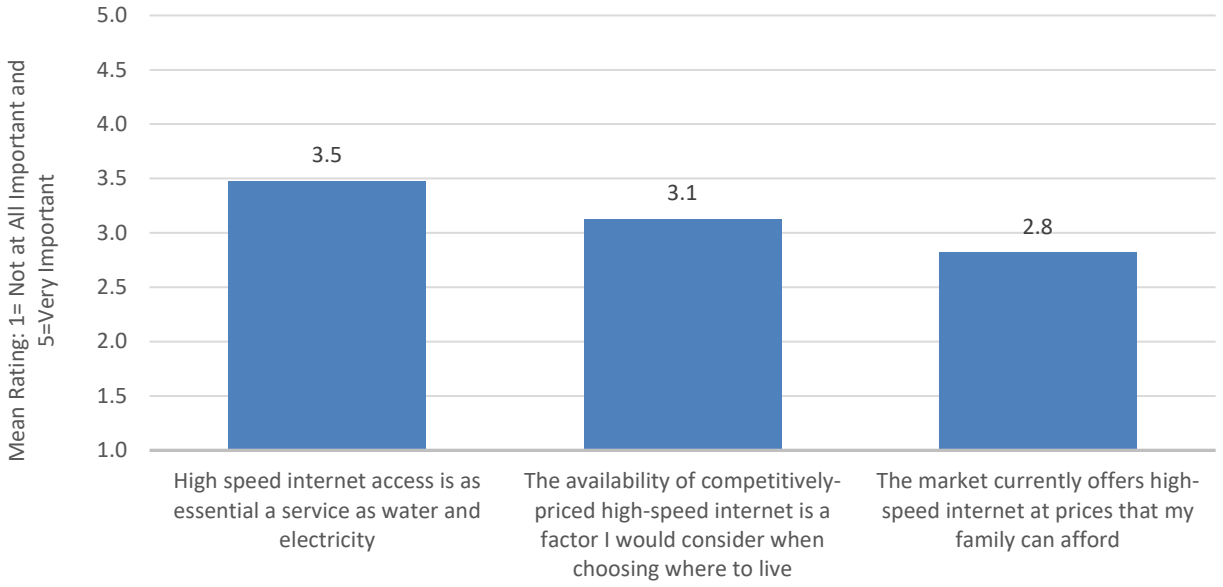


Figure 88: Opinions About the Broadband Internet Market (Mean Ratings)



Respondents ages 65 years and older are less likely than younger respondents to perceive high speed internet access as an essential service or to agree that availability of high-speed internet is a factor when deciding where to live (see Figure 89). Similarly, agreement with these statements declines somewhat as length of residence increases, as shown in Figure 90.

Figure 89: Opinions About the Broadband Internet Market by Age of Respondent

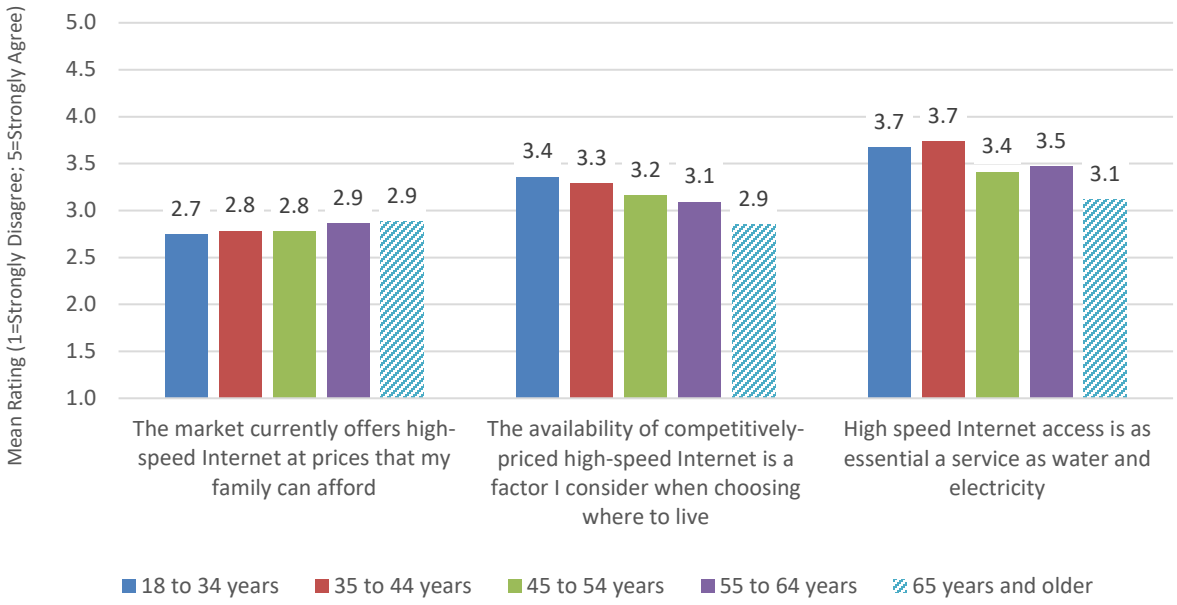
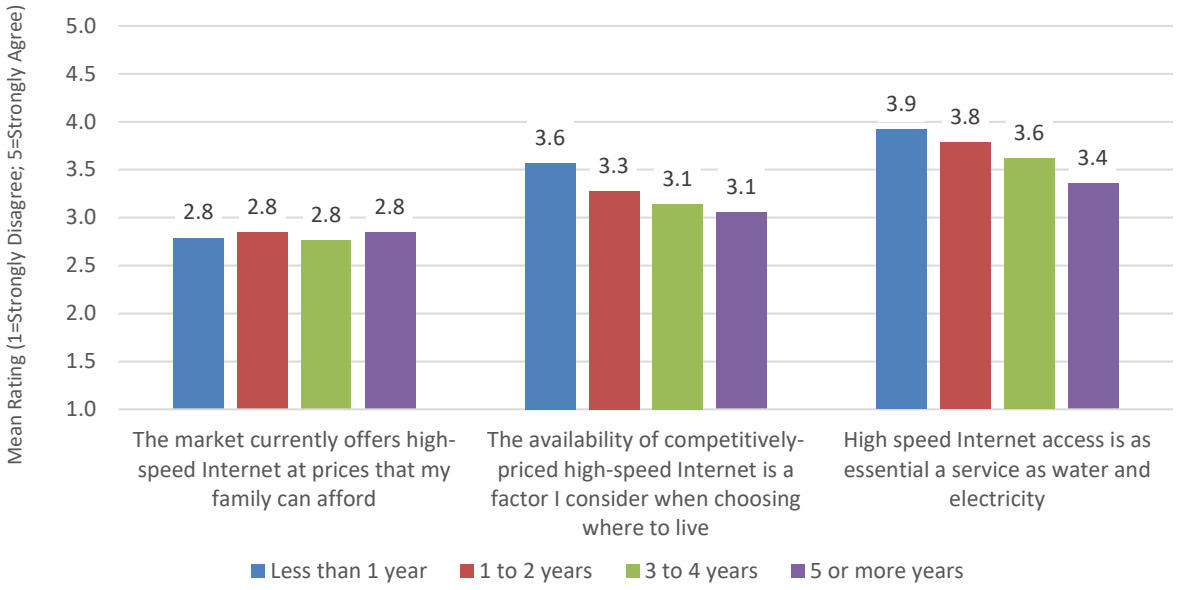
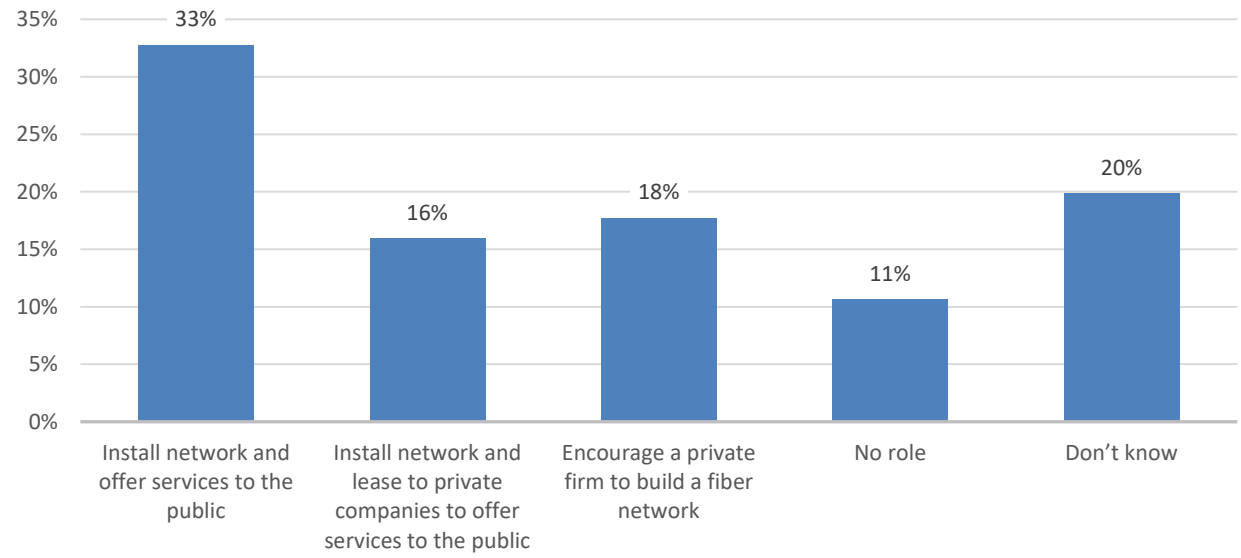


Figure 90: Opinions About the Broadband Internet Market by Length of Residence



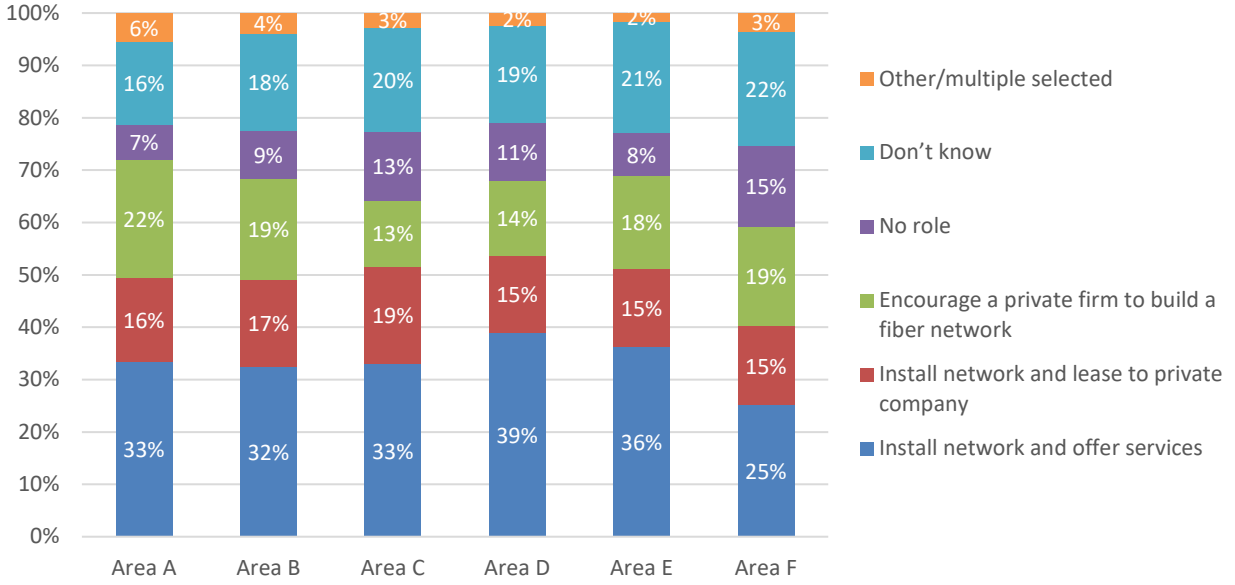
Respondents were asked what should be the ***main*** role of the County with regards to internet infrastructure and services. About one-half of respondents indicated that the County should install a state-of-the-art network, including 33 percent who indicated that the County should offer services directly. Only 11 percent said the County should play no role, and 20 percent of respondents were unsure, as illustrated in Figure 91.

Figure 91: MAIN Role of Larimer County in Broadband Access



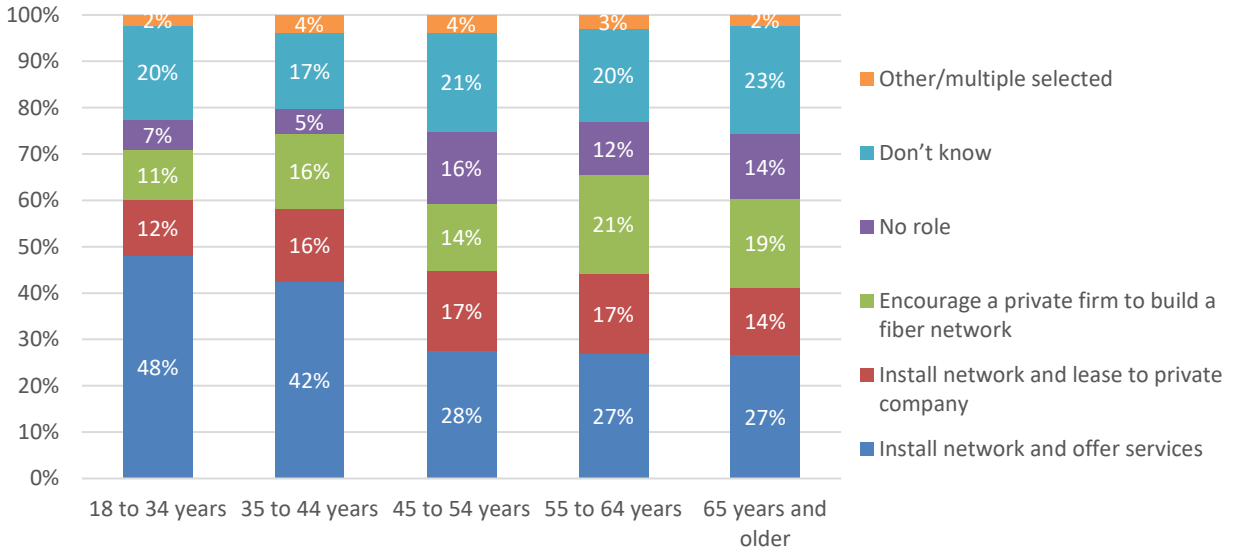
Residents of Area F were somewhat less likely to indicate that the County should install a broadband network and offer services to the public, as shown in Figure 92.

Figure 92: MAIN Role of Larimer County in Broadband Access by Area of Residence



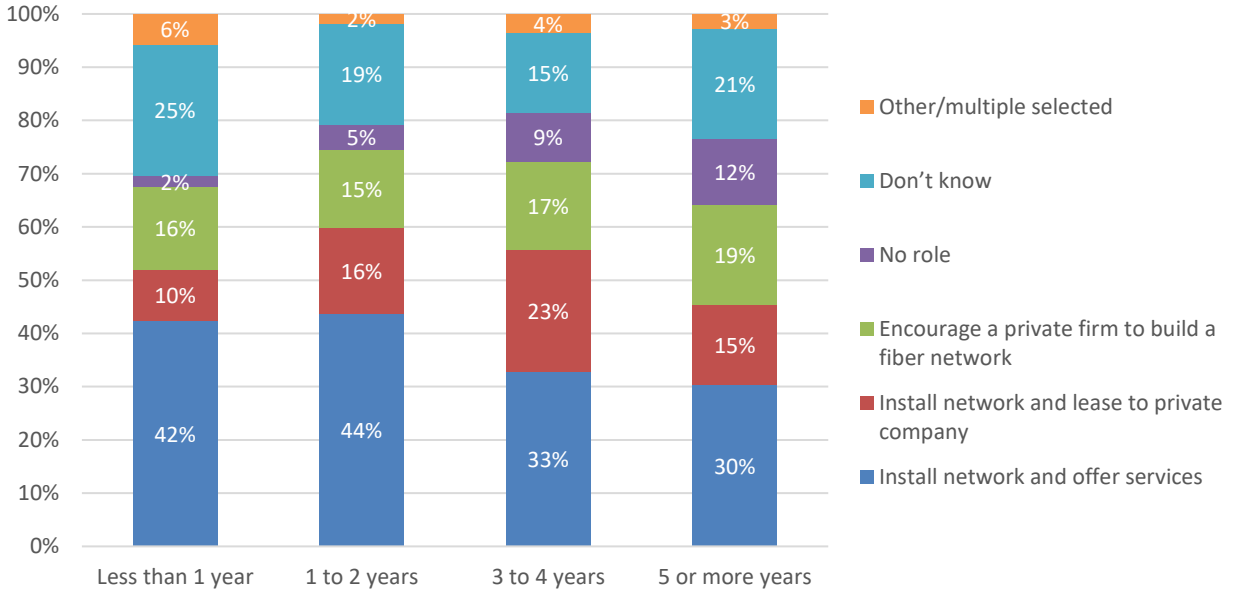
Support for installation of a state-of-the-art network tends to be higher among those ages 18-44, compared with older respondents. Approximately six in 10 said the County should install the network, including 48 percent of 18- to 34-year-olds and 42 percent of 35- to 44-year-olds who said the County should offer services directly (see Figure 93).

Figure 93: MAIN Role of Larimer County in Broadband Access by Age of Respondent



Similarly, support for installation is higher for newer residents (who tend to be younger), compared with those who have been residing in the area for five or more years (see Figure 94).

Figure 94: MAIN Role of Larimer County in Broadband Access by Years Lived at Residence



These responses indicate some desire to have a state-of-the-art communications network and for the County to play some role in its installation. It should be noted that this question did not specifically ask about how that network should be financed or funded. Questions regarding consumers' willingness to pay monthly fees or installation costs for access to that network were presented previously.

4.2.5 Respondent Information

Respondents were asked their opinions about Larimer County's role in providing or promoting broadband communications services within the area. The most favorable opinions were for the County to help ensure that all residents, students, and teachers have access to competitively-priced broadband services, with over one-half strongly agreeing. There is less agreement that the County should build a publicly-financed network (to either offer services to the public OR for private sector companies to offer network services); more than one-third of respondents strongly agreed with these statements. Figure 95 illustrates the mean ratings, while Figure 96 provides detailed responses to each portion of the question.

Figure 95: Opinions About the Role(s) for Larimer County (Mean Ratings)

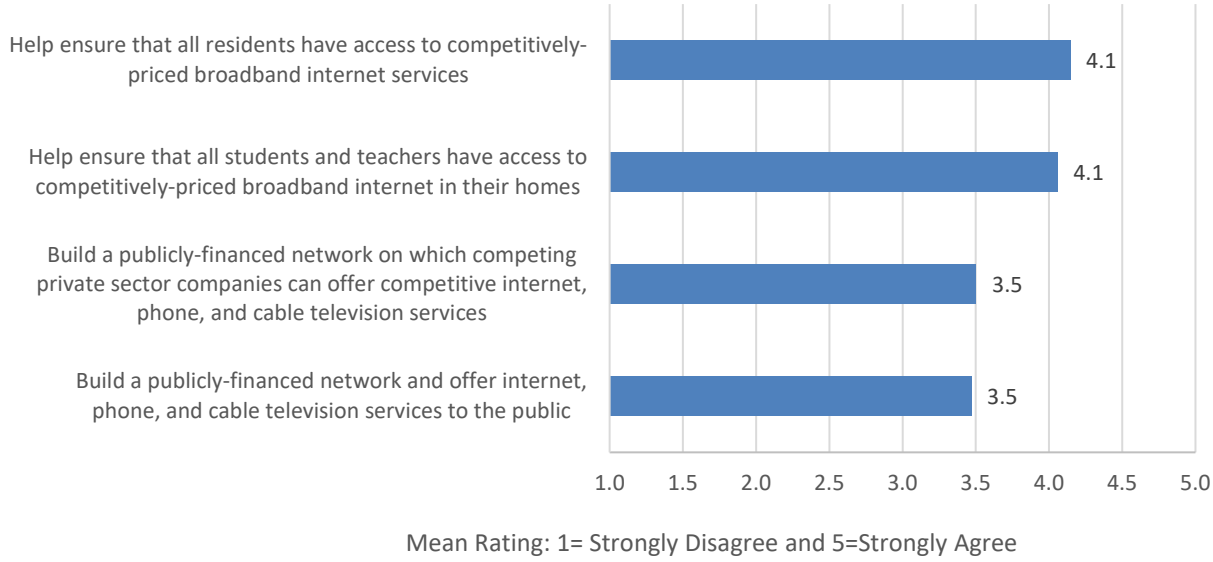
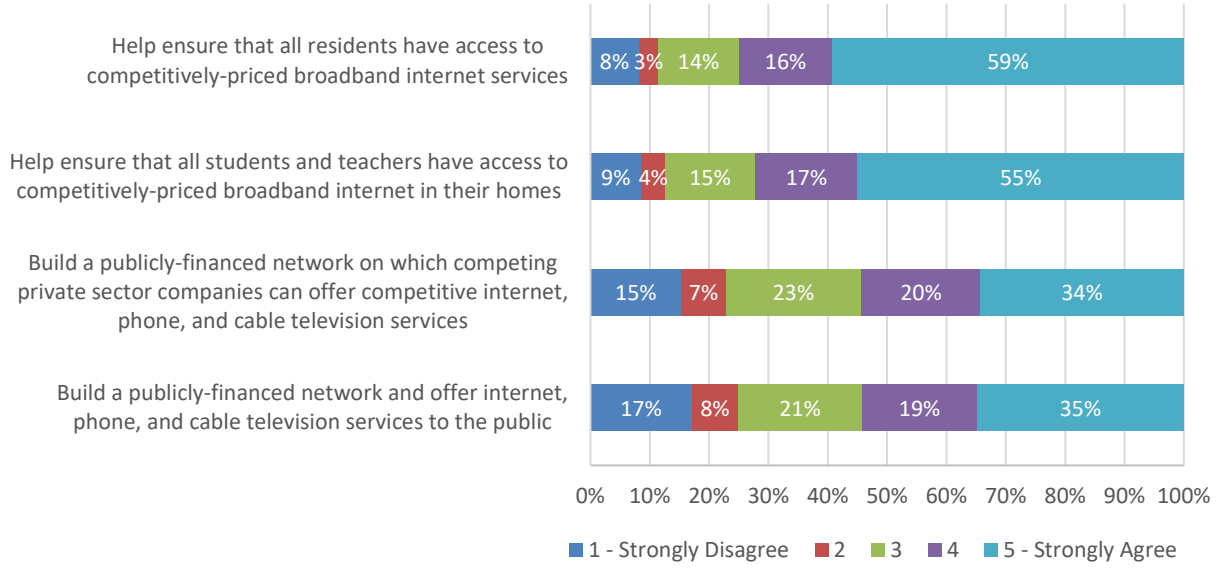


Figure 96: Opinions About the Role(s) for Larimer County



Younger respondents and newer residents showed greater support for the County's role in providing or promoting broadband internet service, as illustrated in Figure 97 and Figure 98.

Figure 97: Opinions About the Role(s) for Larimer County by Age of Respondent

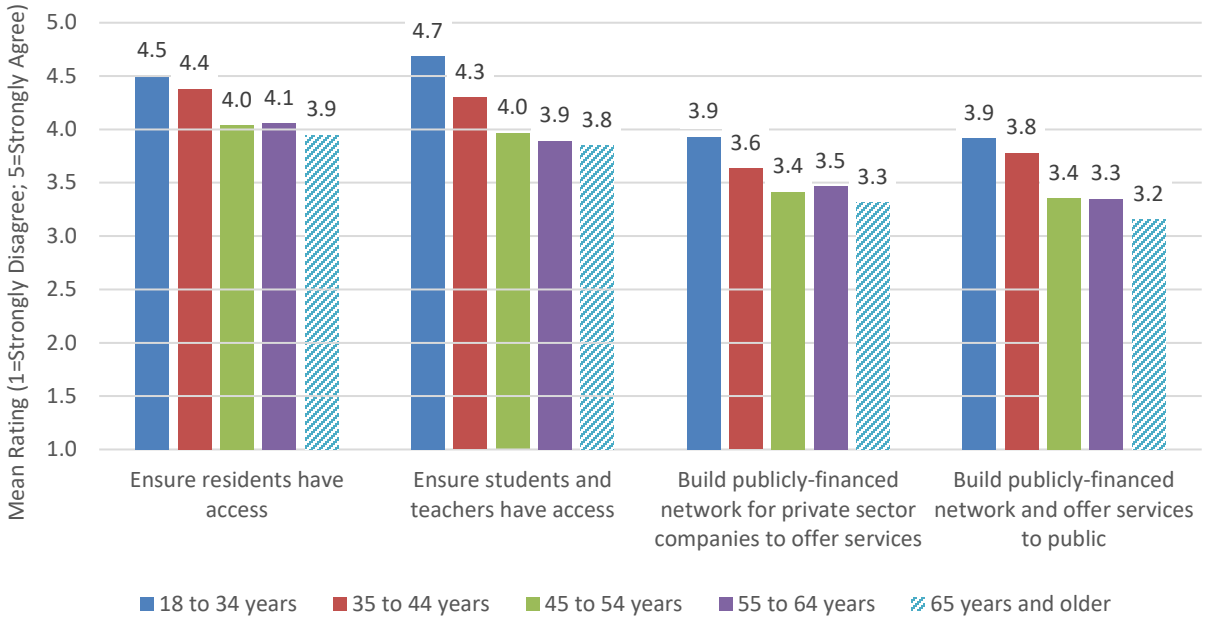
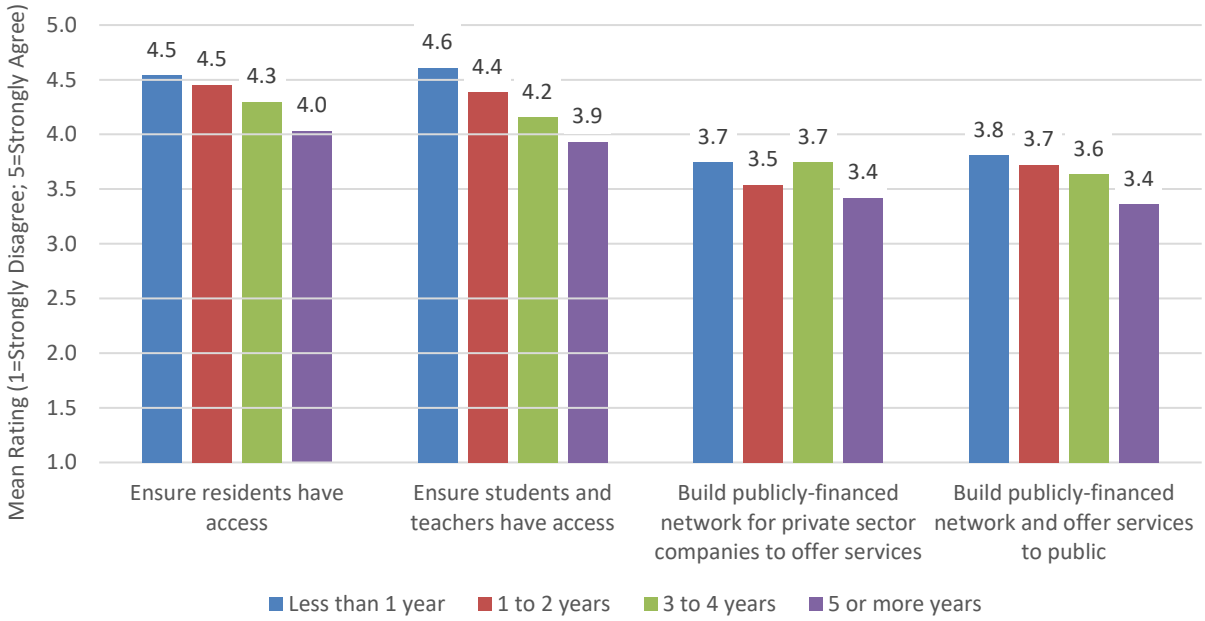


Figure 98: Opinions About the Role(s) for Larimer County by Length of Residence



Respondents were also asked their opinion of the current broadband market. More than one-half somewhat or strongly agreed that high-speed internet is an essential service, and four in ten agreed that availability is a factor in deciding where to live. Three in 10 somewhat or strongly agreed that the market currently provides high-speed internet at prices they can afford (see Figure 99). Overall agreement about the broadband internet market is moderate, as shown in Figure 100.

Figure 99: Opinions About the Broadband Internet Market

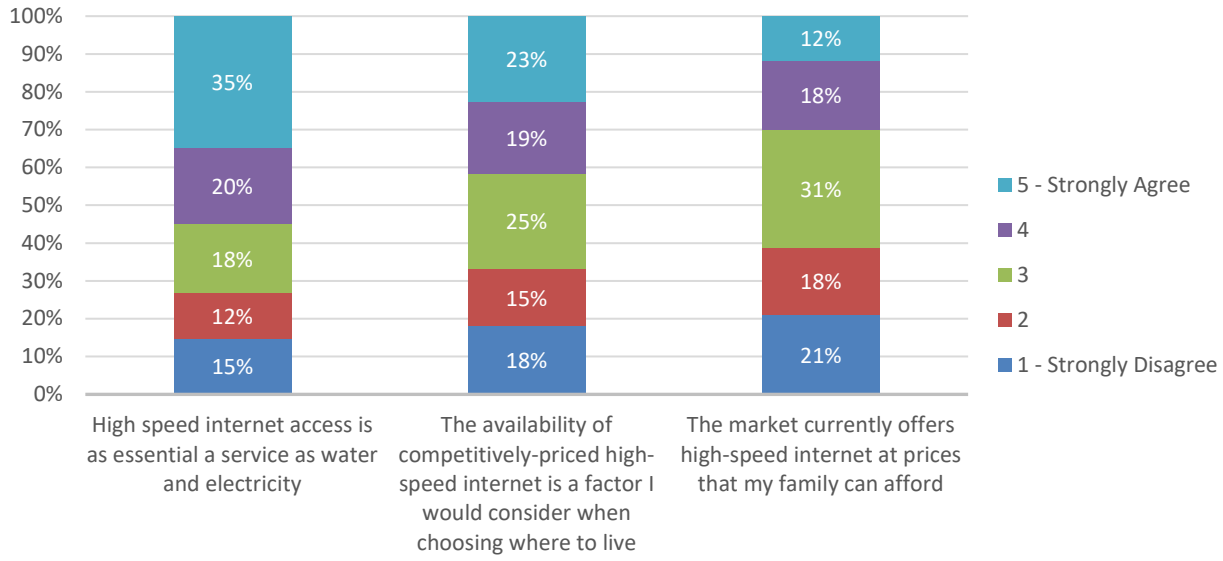
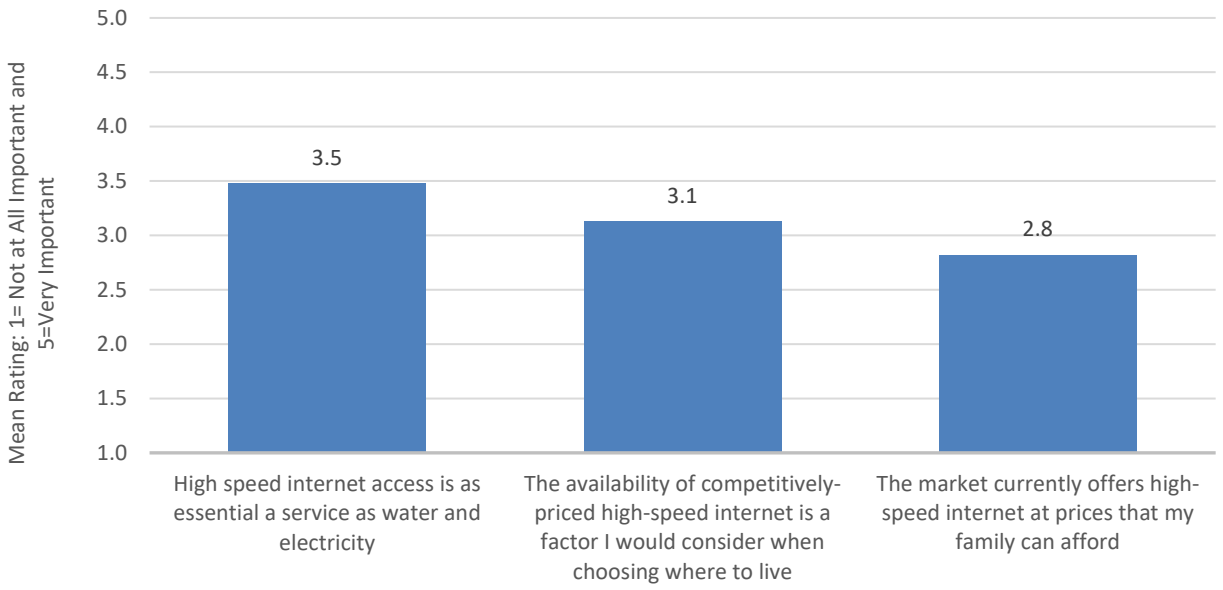


Figure 100: Opinions About the Broadband Internet Market (Mean Ratings)



Respondents ages 65 years and older are less likely than younger respondents to perceive high speed internet access as an essential service or to agree that availability of high-speed internet is a factor when deciding where to live (see Figure 101). Similarly, agreement with these statements declines somewhat as length of residence increases, as shown in Figure 102.

Figure 101: Opinions About the Broadband Internet Market by Age of Respondent

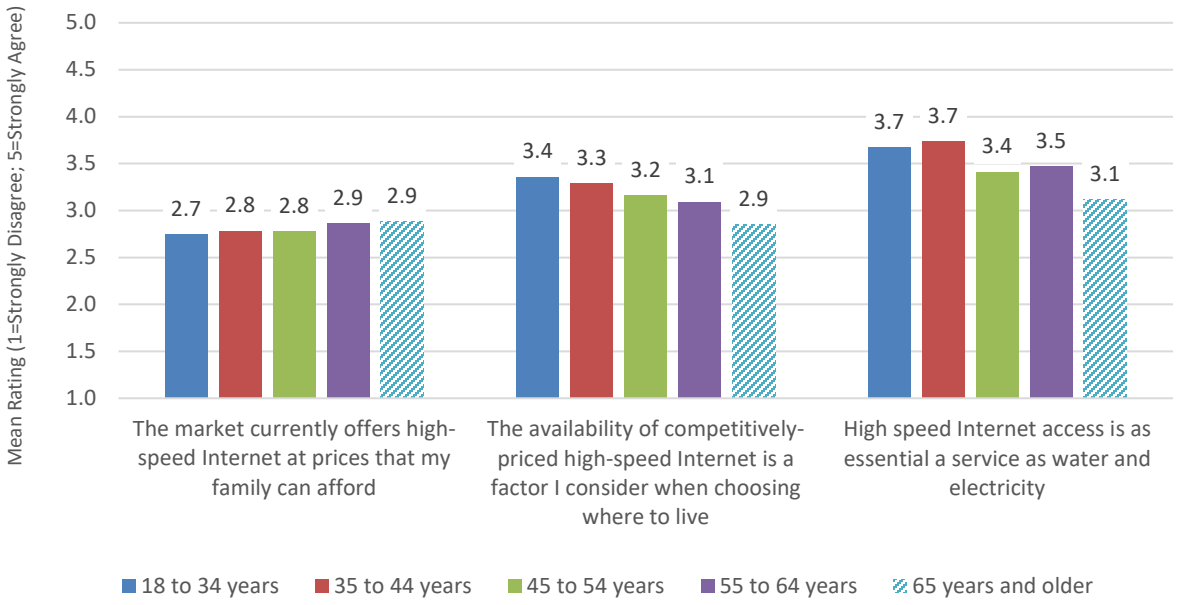
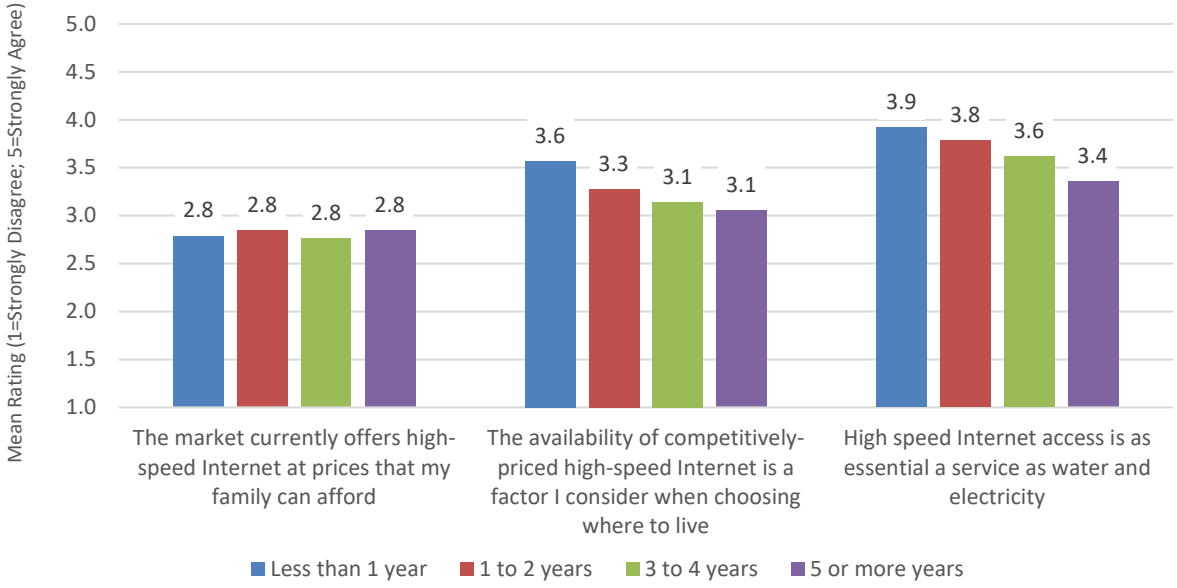
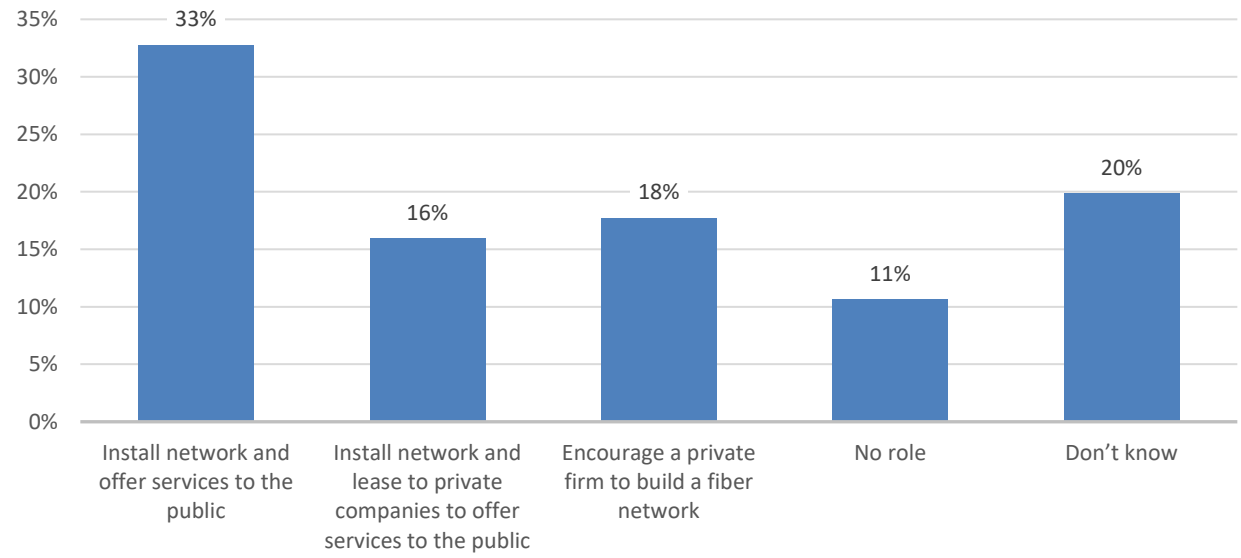


Figure 102: Opinions About the Broadband Internet Market by Length of Residence



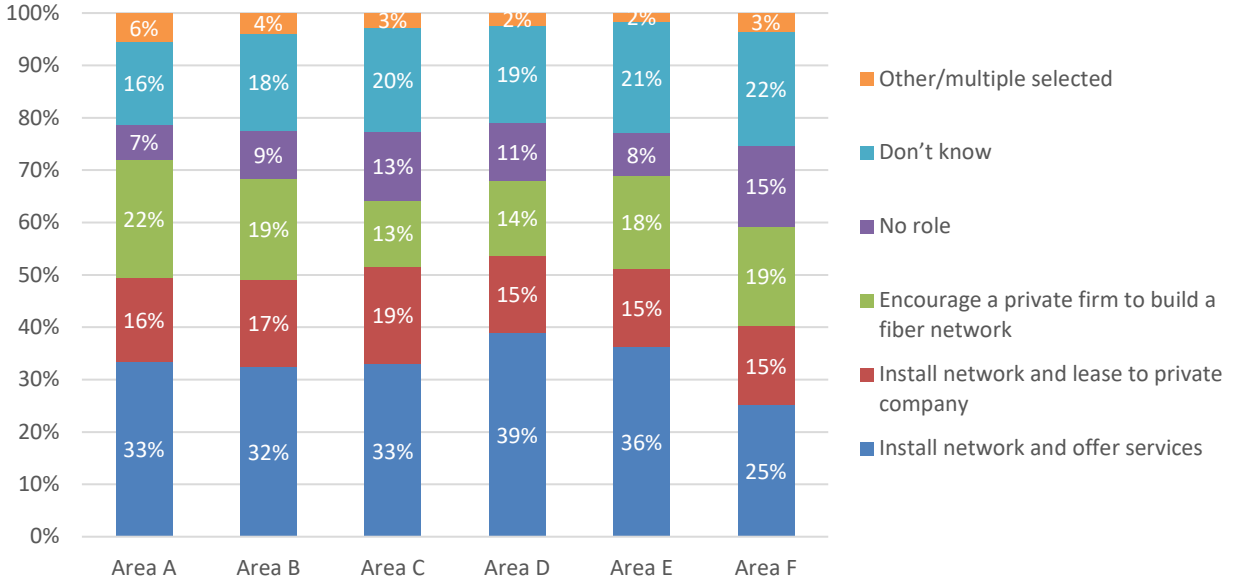
Respondents were asked what should be the ***main*** role of the County with regards to internet infrastructure and services. About one-half of respondents indicated that the County should install a state-of-the-art network, including 33 percent who indicated that the County should offer services directly. Only 11 percent said the County should play no role, and 20 percent of respondents were unsure, as illustrated in Figure 103.

Figure 103: MAIN Role of Larimer County in Broadband Access



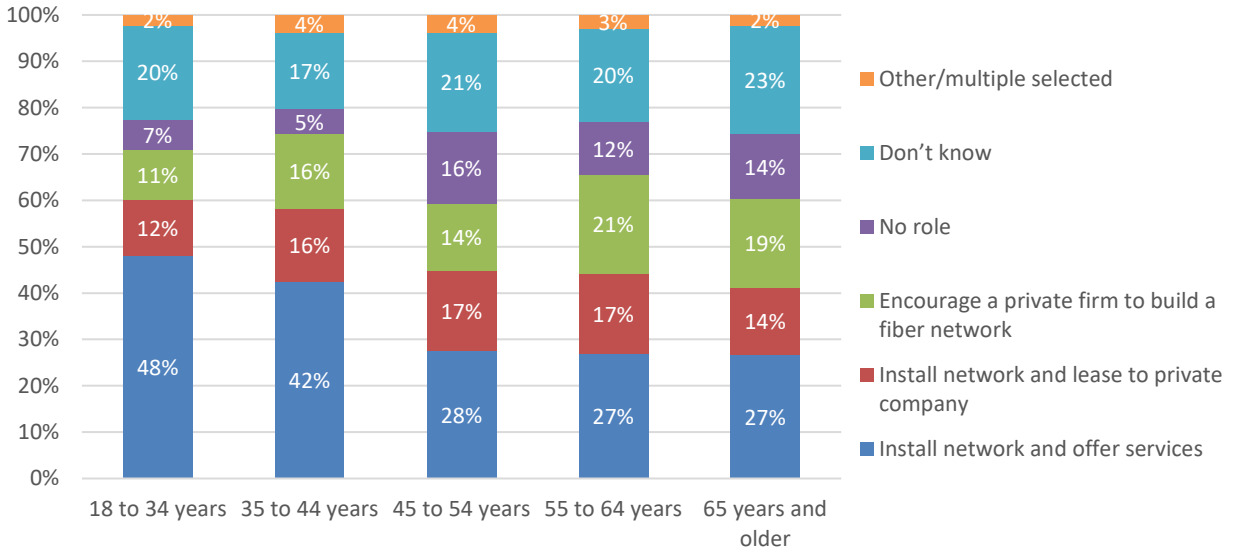
Residents of Area F were somewhat less likely to indicate that the County should install a broadband network and offer services to the public, as shown in Figure 104.

Figure 104: MAIN Role of Larimer County in Broadband Access by Area of Residence



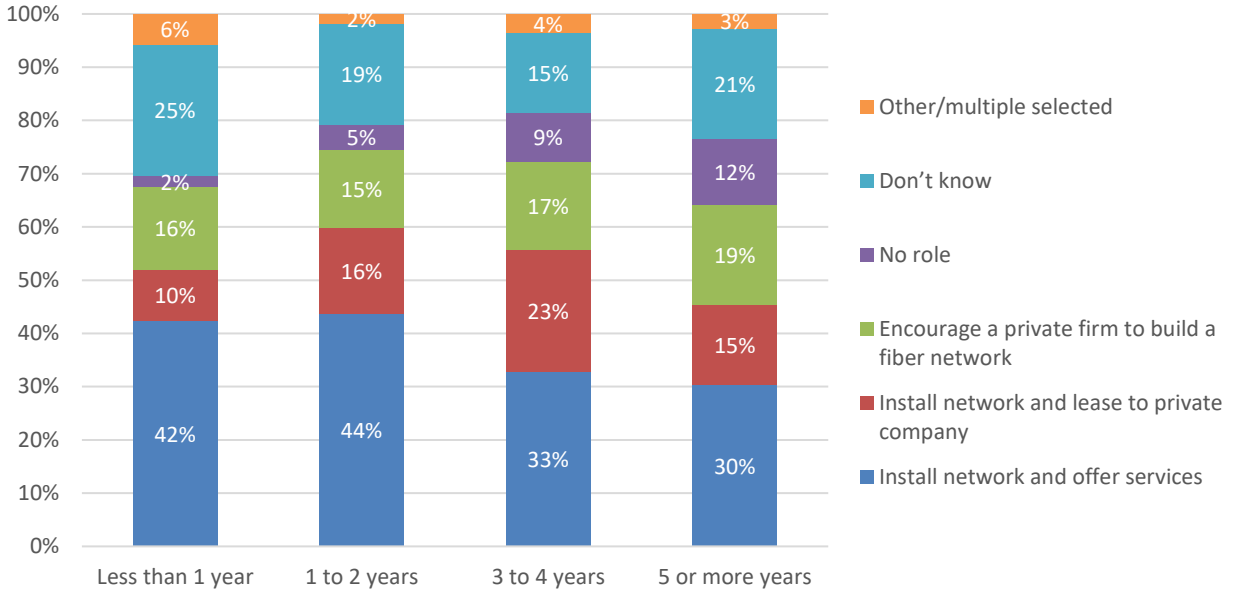
Support for installation of a state-of-the-art network tends to be higher among those ages 18-44, compared with older respondents. Approximately six in 10 said the County should install the network, including 48 percent of 18- to 34-year-olds and 42 percent of 35- to 44-year-olds who said the County should offer services directly (see Figure 105).

Figure 105: MAIN Role of Larimer County in Broadband Access by Age of Respondent



Similarly, support for installation is higher for newer residents (who tend to be younger), compared with those who have been residing in the area for five or more years (see Figure 106).

Figure 106: MAIN Role of Larimer County in Broadband Access by Years Lived at Residence



These responses indicate some desire to have a state-of-the-art communications network and for the County to play some role in its installation. It should be noted that this question did not specifically ask about how that network should be financed or funded. Questions regarding consumers' willingness to pay monthly fees or installation costs for access to that network were presented previously.

Appendix A – Residential Survey

This Appendix is included as a separate PDF attachment.

Appendix B – Maps of Selected Survey Responses

The maps included in this Appendix illustrate the location of various responses. For clarity, responses have been shifted so that each response data point is visible. As such, the locations of each response are not accurate to scale, rather, they illustrate the general area of each response.

Figure 107: Internet Adoption in Larimer County

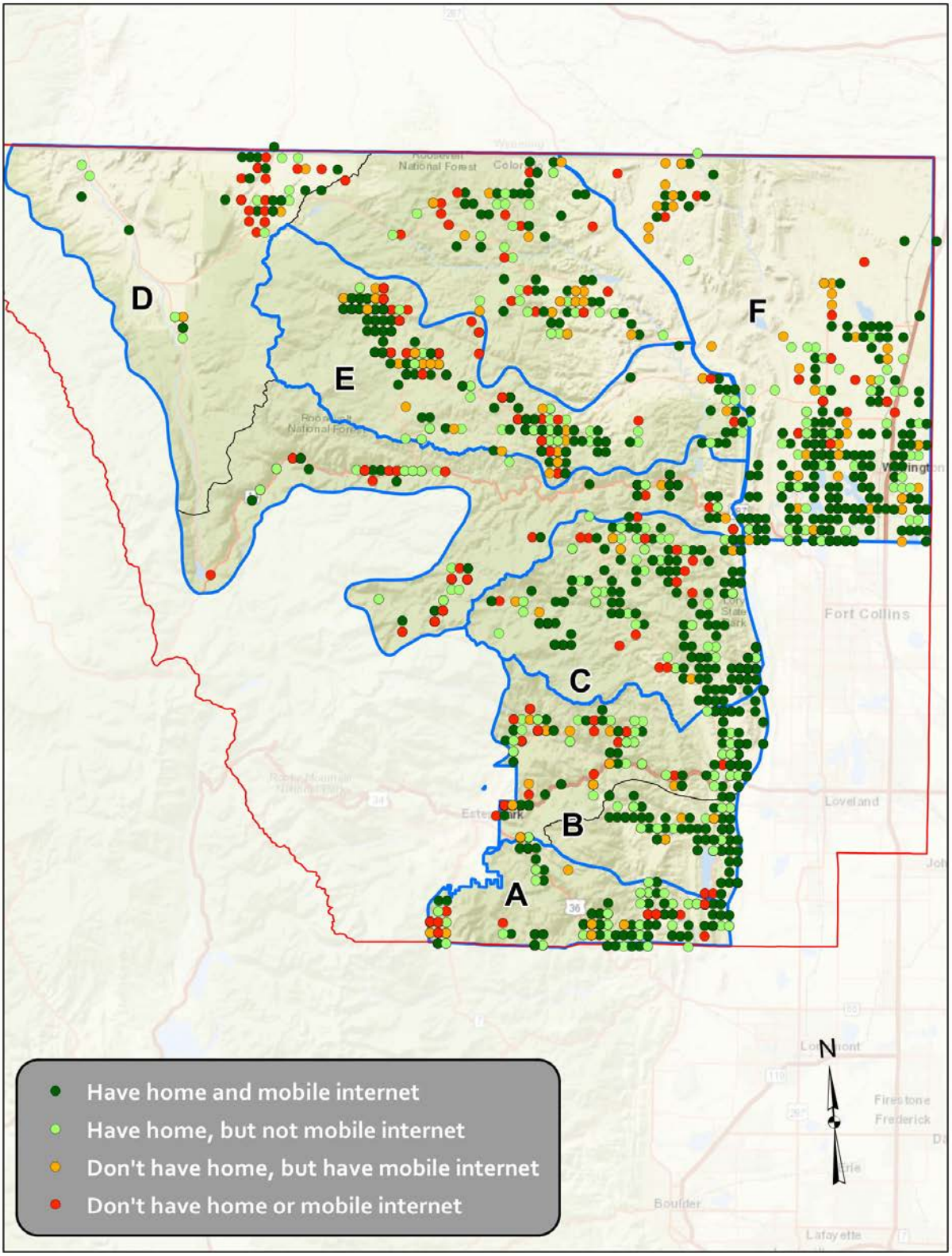


Figure 108: Primary Internet Technology in Larimer County

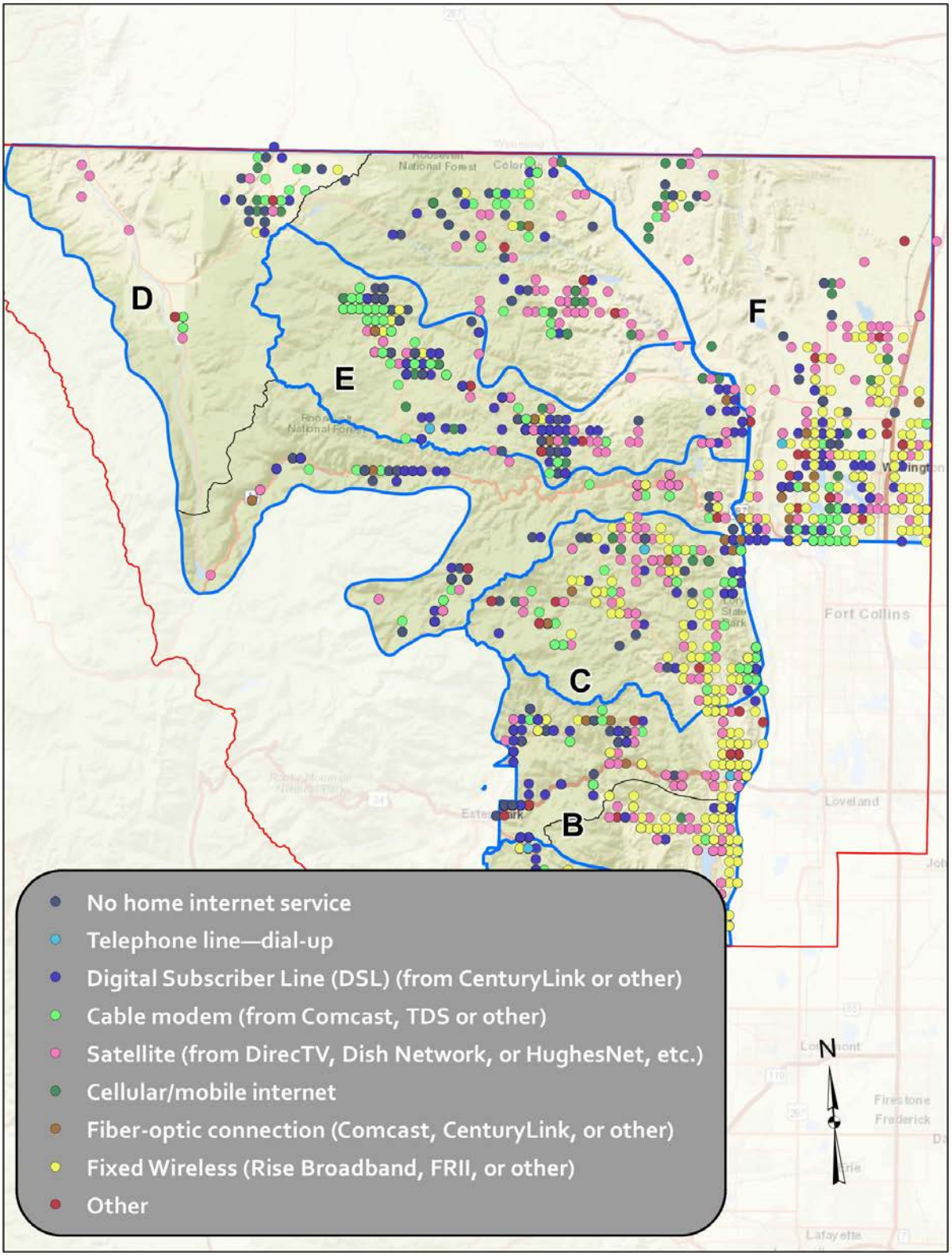


Figure 109: Reason for Not Subscribing to Internet in Larimer County

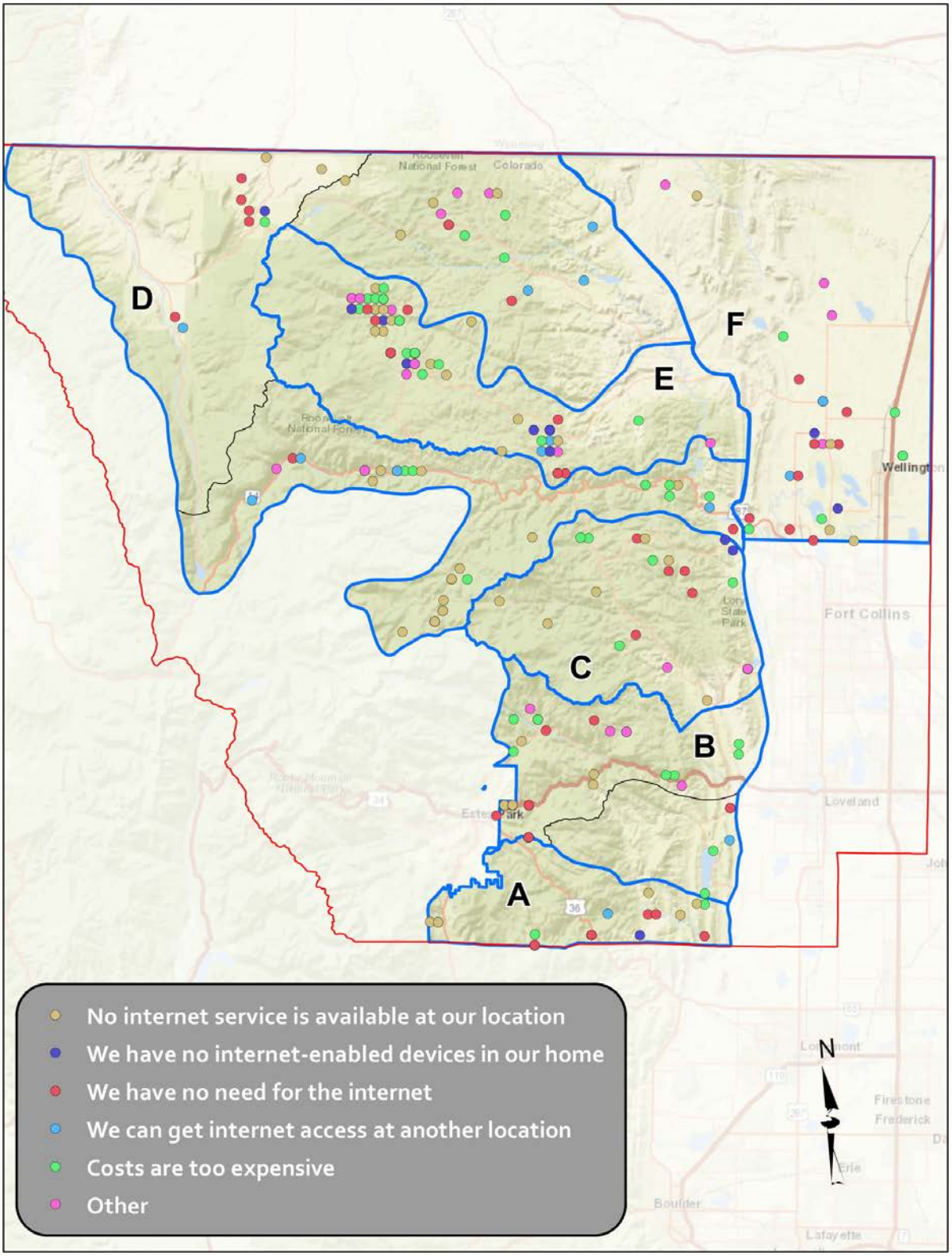


Figure 110: Agreement that Larimer County Should Help Ensure that All Residents Have Access to Competitively Priced Broadband Internet Services

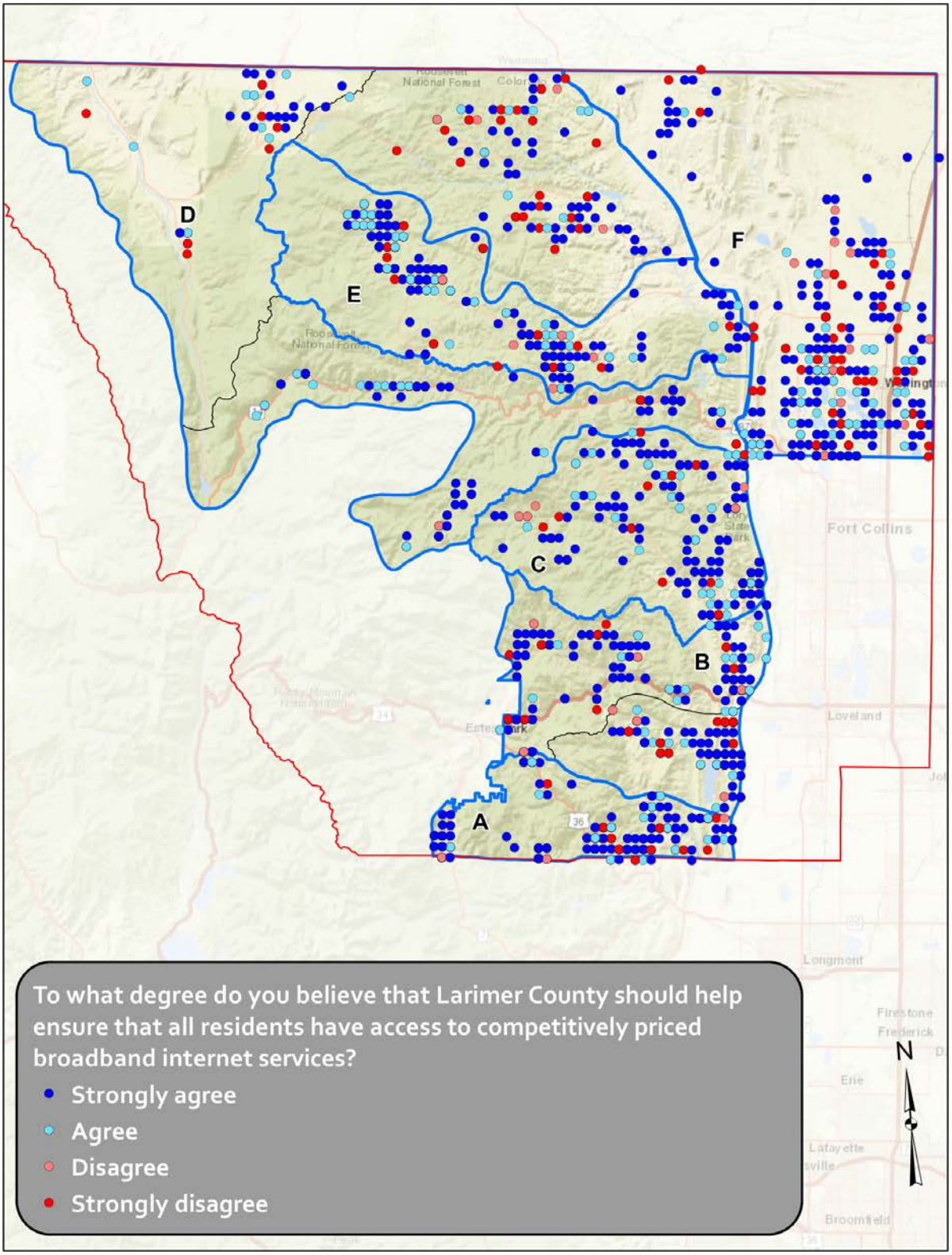


Figure 111: Agreement that Larimer County Should Help Ensure that All Students and Teachers Have Access to Competitively Priced Broadband Internet in Their Homes

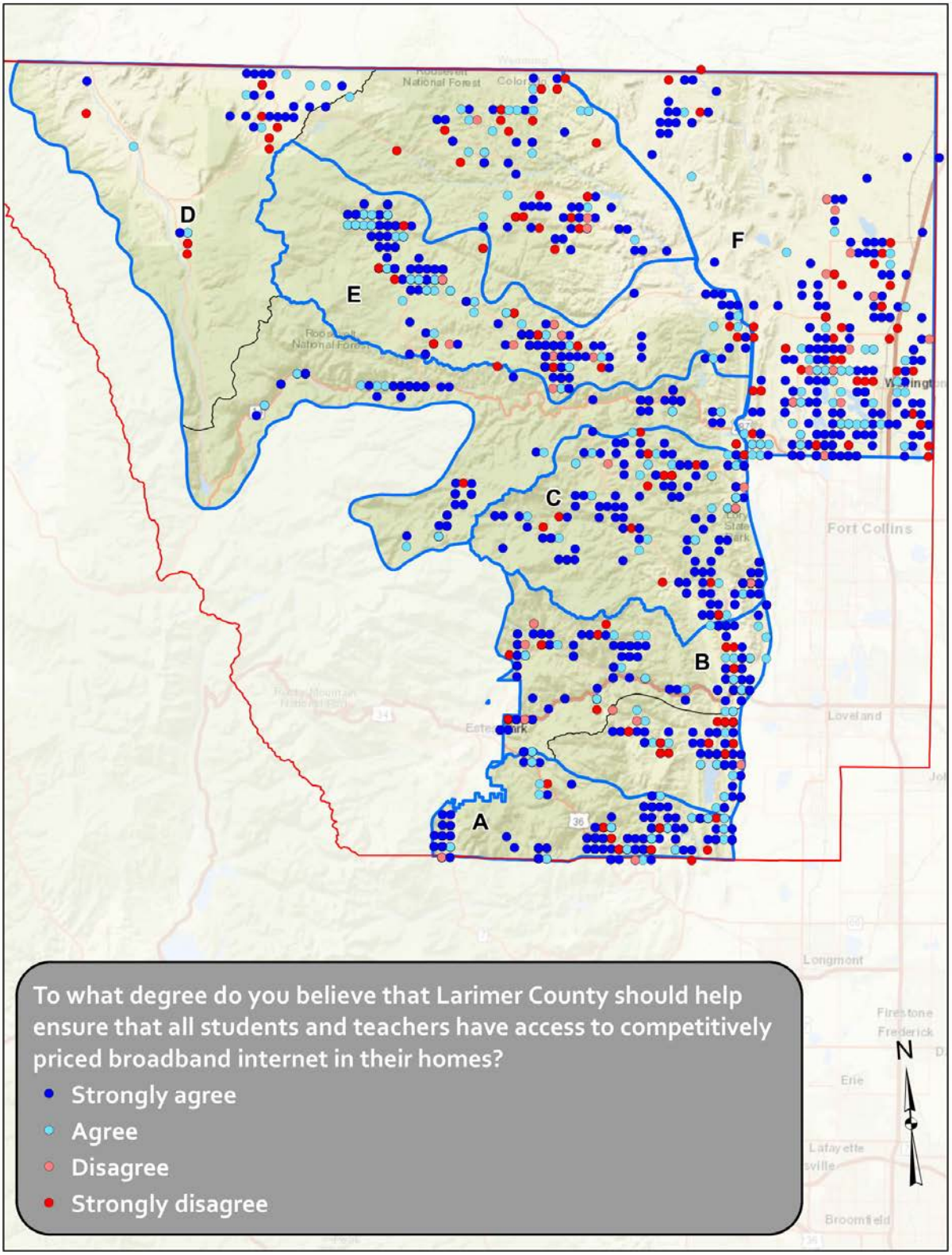


Figure 112: Agreement that Larimer County Should Build a Publicly Financed Network on which Competing Private Sector Companies Can Offer Competitive Internet, Phone, and Cable Television Services

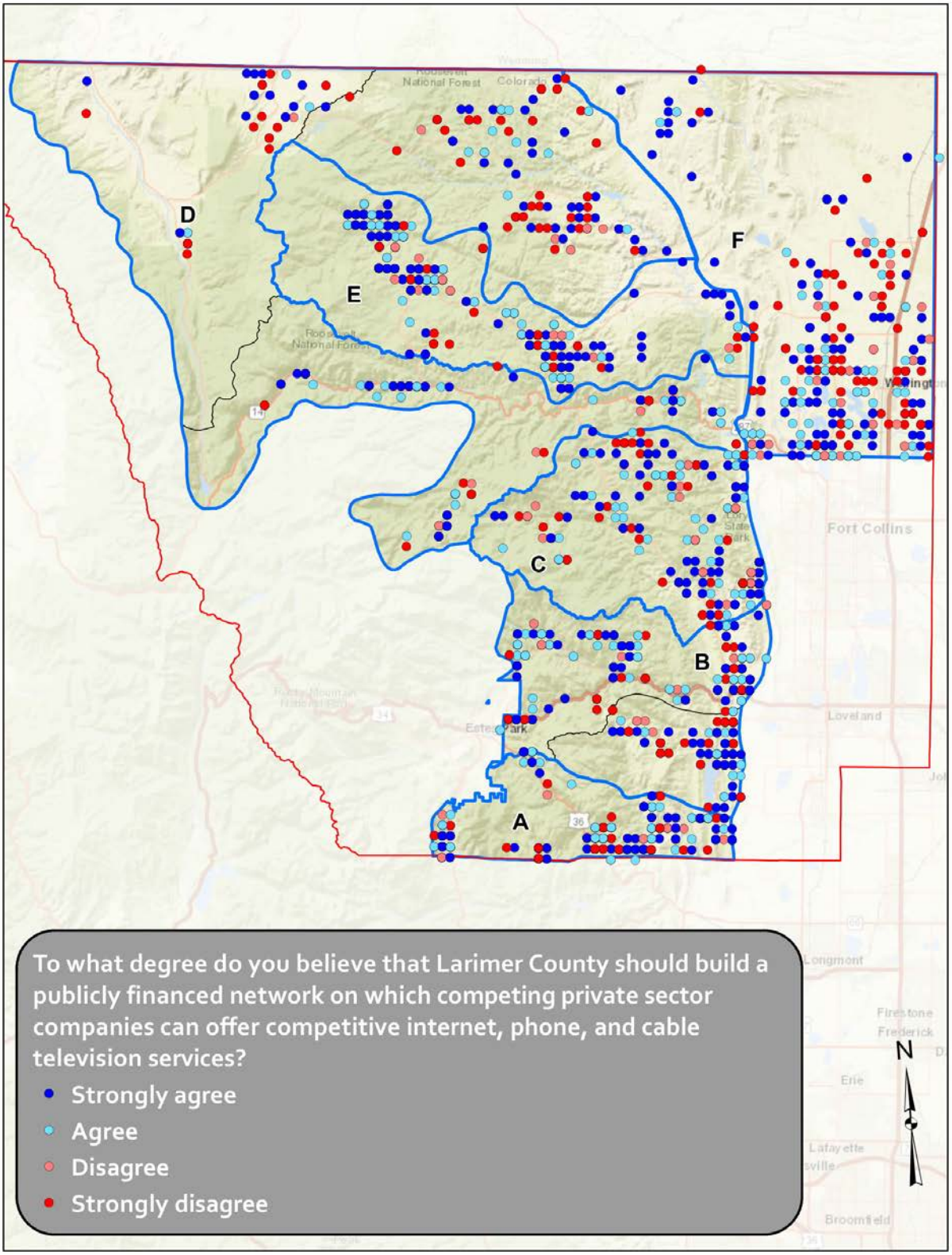


Figure 113: Agreement that Larimer County Should Build a Publicly Financed Network for the County to Offer Internet, Phone, and Cable Services to the Public

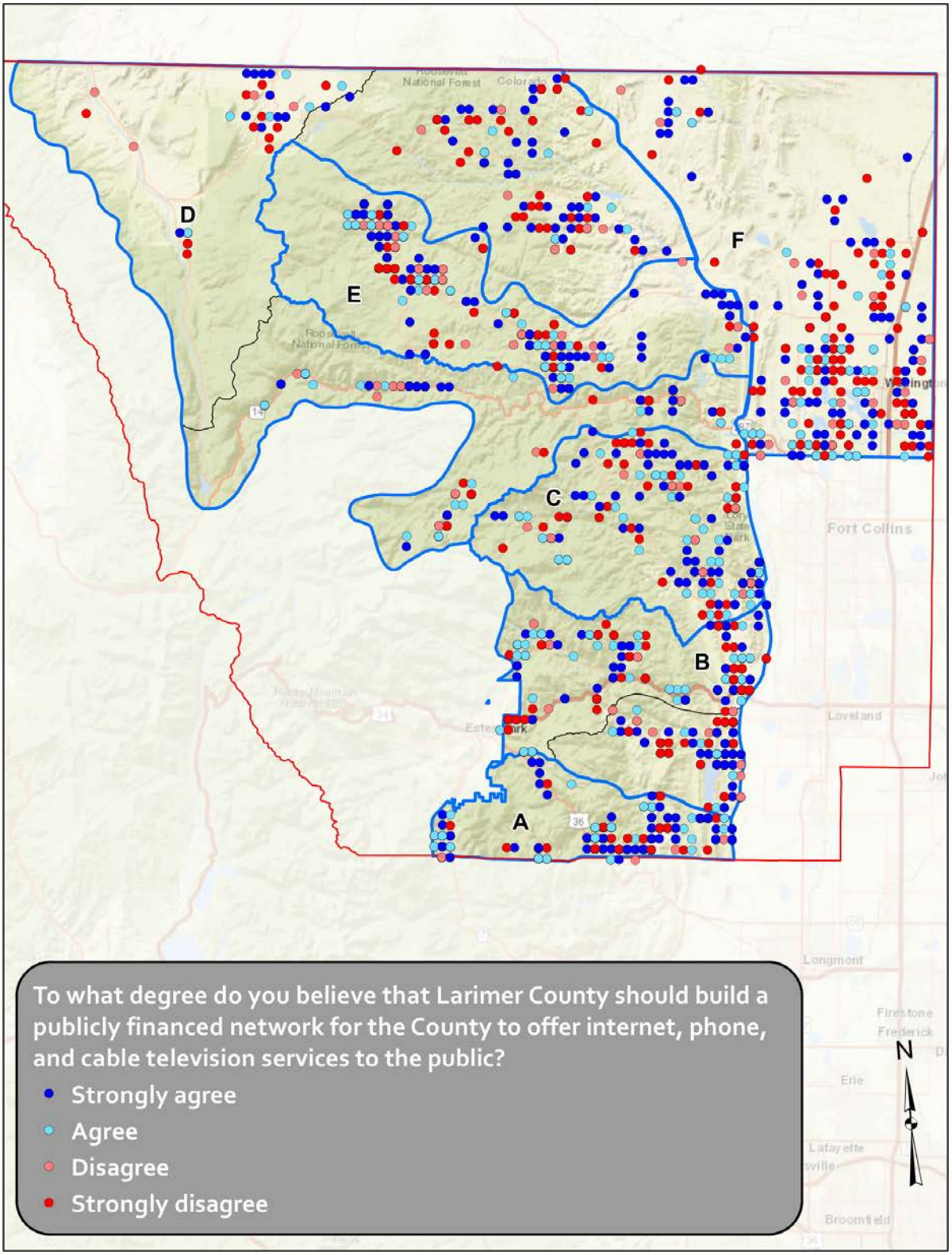


Figure 114: Belief that the Market Currently Offers High-Speed Internet at Affordable Prices

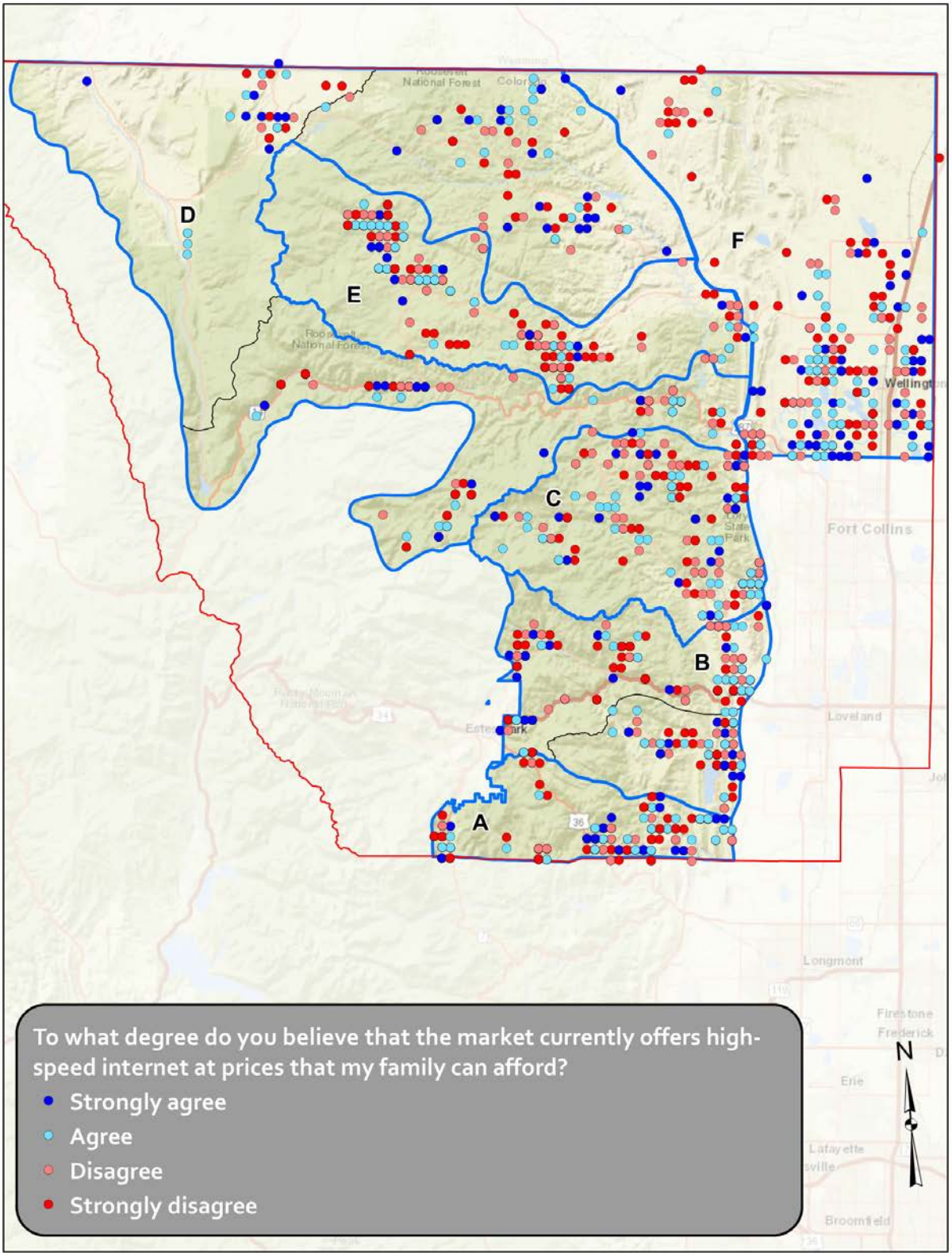


Figure 115: Belief that the Availability of Competitively Priced High-Speed Internet Is a Factor to Consider When Choosing Where to Live

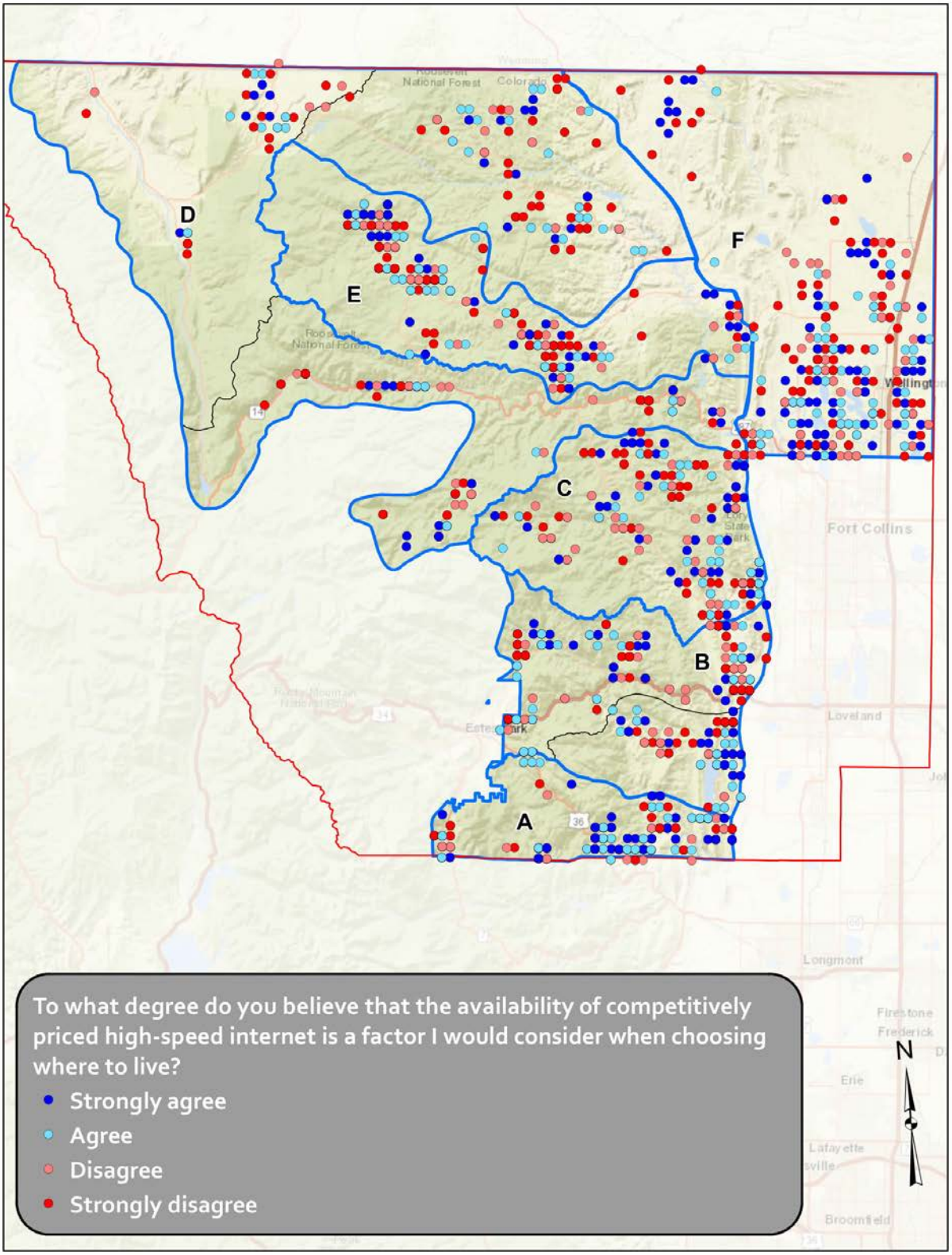
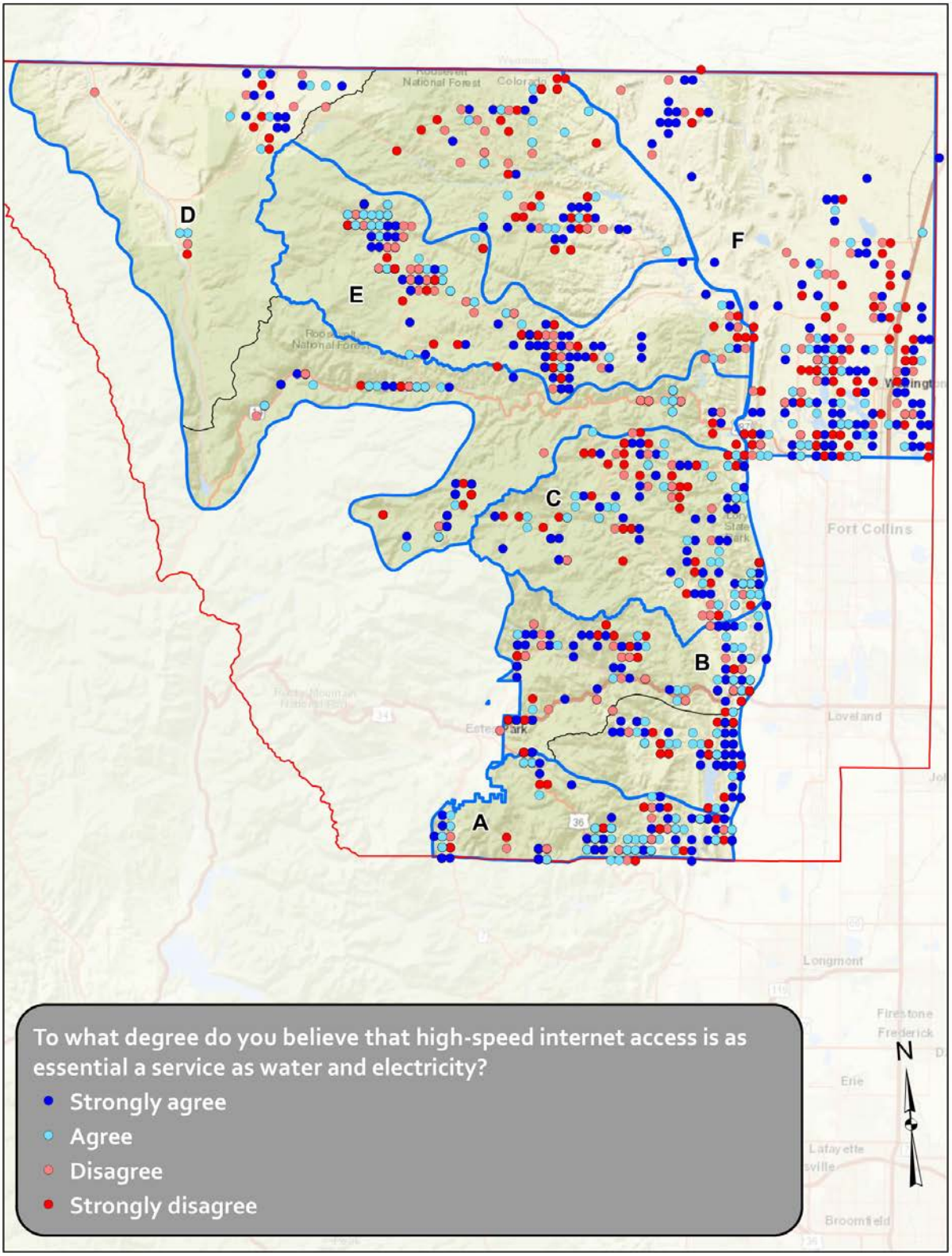



Figure 116: Belief that High-Speed Internet Access Is as Essential a Service as Water and Electricity