



Broadband capacity in rural communities: Results from the Telehealth Broadband Pilot Program

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Background

Telehealth is a promising tool to promote healthcare access for underserved populations, including rural populations.¹⁻⁶ However, if access to high-speed internet—henceforth, broadband—is not accessible, reliable, and/or affordable for such populations, many telehealth services with demonstrated benefits for patients may not be feasible, such as audio-video visits.^{7,8} Knowing where broadband connections are accessible for residents has been a difficult challenge to overcome. For many years, the Federal Communications Commission (FCC) published data generated from its administrative Form 477, which was collected from any internet service provider (ISP) advertising connections at speeds of at least 200 kilobits per second.⁹ The data published from these forms contained information at the level of a census block, including unique ISPs and the maximum download and upload speeds they offered within that census block. However, there are several limitations to these data. First, broadband access data published at the level of a census block may obscure important variation within that census block and mask broadband access for the least well-served residents. Second, although information on the maximum advertised download and upload speeds available from ISPs within a census block is useful, it does not reflect the experience of broadband for users.

To address this first concern, the FCC worked with experts, ISPs, other stakeholders, and members of the public to generate and refine broadband access data at the level of individual Broadband Serviceable Locations (BSLs) in a map and a data source referred to as the BSL Fabric

Key Findings:

- Many publicly-available broadband data sources do not capture the user experience of broadband over time.
- The Telehealth Broadband Pilot (TBP) Program collected longitudinal broadband measurements in 25 target counties across healthcare, non-healthcare Community Anchor Institution, business, and consumer locations.
- Results from these data revealed highly variable broadband connections for many location types.
- Consistent, high-quality broadband is still lacking in many locations within the 25 target counties of the TBP Program. Additional investigation is needed to support access to online services such as telehealth within these communities.

(or simply the Fabric).^{10,11} The FCC defines a BSL as “a business or residential location in the United States (U.S.) at which mass-market fixed broadband internet access service is, or can be, installed.”¹² The resulting data provides much more precise information, and variation within small geographic areas can now be examined. However, the second limitation is not currently addressed by existing FCC data, as the Fabric contains information solely regarding advertised broadband availability. Missing from these existing data sources are direct measurements of broadband as experienced by users, as well as measurements of broadband over time to assess variability in broadband access *within* a BSL (although see the FCC’s Thirteenth Measuring Broadband America Fixed Broadband Report for a summary of some longitudinal measurement of service delivered to consumer homes, which does not include measurements in Alaska¹³). Several additional sources of broadband information existing outside of what is shared by the FCC, including Measurement Labs (M-Lab) and Ookla for Good user-generated speed test data.^{14,15} These data sets do include direct measurements of broadband but are limited to users opting into the process of taking a speed test, which biases the sample toward individuals who know how to conduct an internet speed test and those who are inherently driven to test their broadband (perhaps due to suspected broadband issues). Another important data set of broadband access comes from Microsoft, which has published county-level estimates of broadband access based on speeds observed when users download Microsoft updates.^{16,17} These data are not biased by users opting into a speed test but are limited to Windows users and, although they are based on directly-measured broadband speeds, contain only county-level percentages of users experiencing download speeds of at least 25 Megabits per second (Mbps). Additionally, these data have not been updated since October 2020. Thus, there is a need for up-to-date, longitudinal, and direct measurements of broadband access, particularly for rural communities that may disproportionately experience poor broadband access.^{8,18}

On September 1, 2020, the Federal Communications Commission (FCC), the U.S. Department of Health and Human Services (HHS), and U.S. Department of Agriculture (USDA) signed a Memorandum of Understanding, launching the Rural Telehealth Initiative (RTI). The RTI is a multi-Department initiative collaborating and sharing information to address health disparities, resolve service provider challenges, and promote broadband services and technology to rural areas in America. The Memorandum of Understanding and RTI collaboration resulted in the creation of the Telehealth Broadband Pilot (TBP) Program that aimed to address gaps in broadband service that limit access to telehealth services in rural communities. In January 2021, the U.S. Department of Health and Human Services (HHS), through the Health Resources and Services Administration (HRSA), awarded \$8 million to fund the TBP Program through December 31, 2024. The goal of the TBP Program was to assess the broadband capacity available to rural health care providers and patient communities to improve their access to telehealth services. The National Telehealth Technology Assessment Resource Center (TTAC), based out of the Alaska Native Tribal Health Consortium, received \$6.5 million to implement the TBP Program, and the Telehealth-Focused Rural Health Research Center, through the University of Arkansas for Medical Sciences, received \$1.5 million to evaluate the TBP Program.

The TBP Program was implemented in 25 target counties/county-equivalents (henceforth, counties) across four states: Alaska, Michigan, Texas and West Virginia. Those counties and their 2020 populations¹⁹ were:

Alaska

1. Aleutians West Census Area (2020 Population: 5,232)
2. Bristol Bay Borough (2020 Population: 844)
3. Dillingham Census Area (2020 Population: 4,857)

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4. Nome Census Area (2020 Population: 10,046)
 5. North Slope Borough (2020 Population: 11,031)
 6. Northwest Arctic Borough (2020 Population: 7,793)

Michigan

7. Gladwin County (2020 Population: 25,386)
8. Manistee County (2020 Population: 25,032)
9. Missaukee County (2020 Population: 15,052)
10. Montmorency County (2020 Population: 9,153)
11. Osceola County (2020 Population: 22,891)
12. Oscoda County (2020 Population: 8,219)

Texas

13. Crosby County (2020 Population: 5,133)
14. Fisher County (2020 Population: 3,672)
15. Haskell County (2020 Population: 5,416)
16. Jones County (2020 Population: 19,663)
17. Lamb County (2020 Population: 13,045)
18. Mitchell County (2020 Population: 8,990)

West Virginia

19. Calhoun County (2020 Population: 6,229)
20. Clay County (2020 Population: 8,051)
21. Jackson County (2020 Population: 27,791)
22. Kanawha County (2020 Population: 180,745)
23. Nicholas County (2020 Population: 24,604)
24. Ritchie County (2020 Population: 8,444)
25. Roane County (2020 Population: 14,028)

In March 2024, the Federal Communications Commission (FCC) changed the threshold for broadband speeds from at least 25 Mbps download, 3 Mbps upload, and 100 millisecond (ms) latency or better (henceforth 25/3/100) to 100 Mbps download, 20 Mbps upload, and 100 ms latency or better (henceforth 100/20/100).²⁰ These benchmark measurements will also be used in prioritizing Broadband Equity, Access, and Deployment (BEAD) funding allocations.²¹ In 2023, the BEAD Program announced state-level funding allocations for the \$42.45 billion intended to support broadband infrastructure development and maintenance throughout the U.S. and its territories.²² For the four TBP Program target states, these funding allocations were:

- Alaska: \$1.02 billion (19th largest allocation of all states/territories)
- Michigan: \$1.56 billion (4th largest allocation of all states/territories)
- Texas: \$3.31 billion (largest allocation of all states/territories)
- West Virginia: \$1.21 billion (11th largest allocation of all states/territories)

Data from the FCC's BSL Fabric were generated and reviewed by experts and members of the public as part of the BEAD funding allocations. BSLs are classified as "unserved" if they lack access to connections meeting the 25/3/100 threshold and are assigned the highest priority for broadband investment through BEAD funding.²³ BSLs with access to connections that meet or exceed the 100/20/100 new broadband definition threshold are classified as "served" and are not prioritized by

BEAD for broadband investment. BSLs with access to connections that fall between these two thresholds are classified as “underserved” and have second-highest priority for BEAD funding after unserved locations. If all unserved and underserved locations have received investments that bring them up to the served threshold, then BEAD prioritizes funding to be spent improving connections at Community Anchor Institutions (CAIs) with service below 1 Gigabit per second (Gbps), download and upload. CAIs are defined by the FCC as entities such as “schools, libraries, health clinics, health centers, hospitals or other medical providers, public safety entities, institutions of higher education, public housing organizations, or community support organizations that facilitate greater use of broadband service by vulnerable populations.”²³

The percentage of residential BSLs in each TBP Program target county according to the FCC’s BSL Fabric as of June 2024 can be found in Table 1.

Table 1. Percentage of Broadband Serviceable Locations (BSLs) meeting download/upload speed thresholds for all wired and licensed fixed wireless residential connections in each of the 25 TBP Program target counties (data from June 2024).

State	TBP Target County/ County-Equivalent	Total BSLs	Percentage of BSLs with speeds at or above __ download (in Mbps) and __ upload (in Mbps)					
			.02/ .02	10/ 1	25/ 3	100/ 20	250/ 25	1000/ 100
Alaska	Aleutians West Census Area	1,557	60.0	59.1	40.0	40.0	40.0	0.0
	Bristol Bay Borough	1,186	85.9	85.9	0.0	0.0	0.0	0.0
	Dillingham Census Area	2,590	59.0	58.8	6.0	6.0	6.0	6.0
	Nome Census Area	4,625	81.9	42.9	36.5	31.7	31.7	0.0
	North Slope Borough	3,442	73.7	65.2	59.2	59.2	51.1	0.0
	Northwest Arctic Borough	2,655	85.1	32.2	32.2	32.2	32.2	0.0
Michigan	Gladwin County	19,706	86.5	75.1	72.1	68.2	63.7	1.2
	Manistee County	18,014	89.5	78.6	75.0	61.3	60.2	11.8
	Missaukee County	10,063	74.9	66.4	50.9	43.5	42.4	19.0
	Montmorency County	10,144	89.5	81.4	69.3	59.7	59.0	39.3
	Osceola County	14,774	67.1	45.0	43.4	39.3	30.1	21.3
	Oscoda County	8,685	86.9	76.8	64.5	59.3	59.2	47.2
Texas	Crosby County	3,806	97.2	96.2	95.5	95.0	89.0	74.3
	Fisher County	3,218	69.0	63.4	58.0	52.7	36.2	9.4
	Haskell County	4,706	90.8	89.5	88.0	79.3	78.6	78.6
	Jones County	9,796	85.7	77.7	58.3	55.4	53.4	25.8
	Lamb County	7,778	95.4	93.6	92.5	91.0	85.1	85.1
	Mitchell County	4,932	82.7	82.5	82.5	80.4	80.4	51.4
West Virginia	Calhoun County	4,367	44.5	35.2	24.3	20.8	1.2	1.2
	Clay County	5,129	65.4	53.5	27.7	16.9	15.6	3.7
	Jackson County	15,958	77.0	66.1	63.7	56.7	55.2	47.7
	Kanawha County	103,585	92.1	90.8	89.9	88.0	79.5	18.0
	Nicholas County	15,596	79.7	77.9	57.4	48.3	46.9	3.3
	Ritchie County	6,529	88.4	86.9	83.8	83.0	69.6	69.6
	Roane County	9,204	62.8	54.0	40.4	27.1	26.0	2.7

According to June 2024 data from the FCC's BSL Fabric, the percentage of residential BSLs across the 25 TBP Program target counties with access to advertised download speeds of at least 25 Mbps download speed and 3 Mbps upload speed for all wired and licensed fixed wireless connections ranges from 0.0% (Bristol Bay Borough, Alaska) to 95.5% (Crosby County, Texas). The percentage of residential BSLs across the 25 TBP Program target counties with access to advertised download speeds of at least 100 Mbps download speed and 20 Mbps upload speed for all wired and licensed fixed wireless connections ranges from 0.0% (Bristol Bay Borough, Alaska) to 95.0% (Crosby County, Texas) for residential connections.

The recent speed threshold change in the definition of broadband by the FCC from a 25/3/100 threshold to a 100/20/100 threshold demonstrates recognition for higher quality broadband for activities such as work, education, and telehealth.²⁰ In a report describing the rationale for this definition change, the FCC highlighted telehealth as an activity that may not be feasible with upload speeds of 3 Mbps or lower.²⁴ Thus, in the evaluation of data collected by the TBP Program, not only are aggregate broadband measures calculated (i.e., medians), but each individual speed test was assessed and categorized as to whether the observed download speed, upload speed, and latency fell below the 25/3/100 threshold, met or exceeded the 100/20/100 threshold, or fell between the two thresholds. Mobile speed tests were collected using an Android-based application and were evaluated using the 7 Mbps download / 1 Mbps upload / 100 ms latency (7/1/100) and 35 Mbps download / 3 Mbps upload / 100 ms latency (35/3/100) thresholds, as these thresholds are used by the FCC when evaluating mobile broadband data quality (note that latency is not included in mobile broadband benchmarks but is included throughout this report). These thresholds are used throughout this report because they are important benchmarks for broadband stakeholders to consider. However, the use of these benchmarks by the FCC at the level of a BSL (fixed and licensed wireless) is not specific to individual speed tests, as is the case in these reports, but rather to the download speeds, upload speeds, and latencies that are advertised to a BSL. Additionally, use of the mobile broadband data thresholds (7/1 and 35/3) is also not specific to individual speed tests, as is the case in this report, but rather to advertised speeds specific to an area of the United States (U.S.). Direct comparison between the TBP Program results and the FCC Fabric data is not intended or warranted, as the Fabric reports vender advertised speed and the TBP Program measured end user speeds.

Methods

To evaluate telehealth readiness for consumers or patients and healthcare providers within the 25 TBP Program target counties/county-equivalents (henceforth, counties), the TBP Program sought a method to measure longitudinal key broadband measurements at locations including healthcare Community Anchor Institutions (henceforth, healthcare), consumer homes, other non-healthcare Community Anchor Institutions (henceforth, non-healthcare CAs), and businesses. Each participating state in the TBP Program faced unique implementation challenges. To successfully implement the TBP Program, community lead partners (CLPs) in each state adopted tailored strategies to recruit participants and gather data from pod deployments. Physical Raspberry Pi devices were developed by a contracted software consultant firm to implement automatic broadband speed testing throughout the day, including automated measurements of download speed, upload speed, and latency. These devices, referred to as "pods," could be shipped to users with instructions for self-installation by plugging the pods into their home modems, or they could be installed by a CLP team member. Later in the implementation of the TBP Program, a software version of a pod was developed as a solution to several barriers encountered by some potential TBP Program participants with privacy or security

concerns (see the white paper, [An examination of the implementation and effectiveness of the Telehealth Broadband Pilot \[TBP\] Program in the United States](#), for more detail).

In a default pod deployment, both NDT7 (M-Lab) and Ookla speed test protocols were scheduled to run once an hour while the pod or software was connected to the network. These two testing protocols differ in a number of technical ways. One key difference between the two is that Measurement Labs tests are run on dedicated Measurement Labs servers on the open internet and Ookla speed tests can run on any servers.²⁵ In some cases, this data collection schedule was modified to accommodate preferences of an IT manager, business owner, etc. The primary outcome measures evaluated were download speed, upload speed, and latency, as these are some of the key measures used to define broadband for communities, such as by the Federal Communications Commission (FCC) as part of the BEAD funding allocation. Advertised upload and download speed were also recorded by the CLP teams, if known to the participant. Importantly, the pods deployed were only able to measure download and upload speeds to 1,000 Mbps (or 1 Gbps). Thus, any connections receiving speeds faster than 1 Gbps would not be recorded accurately by pods deployed for the TBP Program.

For the purposes of analysis, broadband data collected by the pods were aggregated at individual locations within the target TBP Program target counties/county-equivalents. Some locations had more than one internet service provider (ISP), such as a healthcare site with both a primary broadband connection and a back-up failover connection. In cases where a location had more than one internet service provider, data were analyzed separately, as each ISP may be delivering different services to the same locations. Locations with fewer than 100 speed tests or fewer than 14 unique days of data collection were excluded from analysis. Additionally, locations were grouped into the following four categories: healthcare, consumer, non-healthcare CAI, and business.

This evaluation project was determined non-human subjects research by the University of Arkansas for Medical Science’s Institutional Review Board (#262566).

Results

The number of locations where pods were deployed, the number of locations meeting the evaluation inclusion criteria (recording at least 100 speed tests over at least 14 unique days of data collection), and the total number of tests conducted in each of the four TBP Program target states can be found in Table 2.

Table 2. Number of locations with pods deployed, number of locations included for analysis, and total speed tests included for analysis within the 25 TBP target counties across the four TBP Program target states.

State	Number of locations with pods deployed	Number of locations included for analysis	Total speed tests included for analysis
Alaska	59	52	194,183
Michigan	83	78	340,218
Texas	179	168	2,483,847
West Virginia	104	80	591,346
OVERALL	425	378	3,609,594

The number of locations, total speed tests, median download speed (in Mbps), median upload speed (in Mbps), and median latency (in ms) for locations meeting the program evaluation inclusion criteria are reported in Table 3.

Table 3. Total locations with pod deployments, total speed tests, median download speed (in Mbps), median upload speed (in Mbps), and median latency (in ms).

State	TBP Target County/ County-Equivalent	Total Locations with Pod Deployments	Total Speed Tests	Median Download Speed (Mbps)*	Median Upload Speed (Mbps)*	Median Latency (ms)*
Alaska	Aleutians West Census Area	8	60,873	36.3	8.1	68.5
	Bristol Bay Borough	3	6,783	25.3	25.2	47.3
	Dillingham Census Area	14	68,186	27.2	19.1	47.8
	Nome Census Area	16	44,079	25.4	16.5	55.8
	North Slope Borough	1	176	86.9	9.4	78.1
	Northwest Arctic Borough	10	14,086	43.2	10.9	61.1
Michigan	Gladwin County	9	35,990	20.6	2.8	31.3
	Manistee County	20	70,046	339.5	11.3	11.0
	Missaukee County	16	82,642	114.0	11.1	15.8
	Montmorency County	13	50,786	18.8	1.5	21.7
	Osceola County	7	48,755	341.6	11.1	23.3
	Oscoda County	13	51,999	357.2	11.5	18.5
Texas	Crosby County	29	495,198	91.2	42.1	19.7
	Fisher County	33	452,143	30.1	7.6	20.0
	Haskell County	28	362,445	91.8	91.5	7.1
	Jones County	31	534,846	92.2	92.9	18.3
	Lamb County	26	442,785	520.2	539.4	13.0
	Mitchell County	21	196,430	245.1	101.3	12.8
West Virginia	Calhoun County	4	51,030	387.3	329.7	20.7
	Clay County	17	82,968	21.4	1.7	27.7
	Jackson County	2	44,991	528.9	51.5	26.9
	Kanawha County	29	216,463	304.3	36.7	20.6
	Nicholas County	4	13,508	19.5	6.9	30.2
	Ritchie County	4	70,514	89.5	91.4	19.2
	Roane County	20	111,872	15.3	2.6	29.6

*Medians reported are medians of all median values calculated for each location.

The number of locations with pods deployed that recorded at least 100 speed tests on 14 unique days collecting measurements throughout the 25 target counties of the TBP Program by location category (healthcare, consumer, non-healthcare CAI, and business) can be found in Table 4.

Table 4. Number of locations conducted speed tests for the TBP Program included for analysis by TBP Program target state and category.

State	Healthcare	Non-Healthcare CAI	Business	Consumer	Total
Alaska	42	4	1	5	52

Michigan	0	3	11	64	78
Texas	13	78	56	21	168
West Virginia	21	4	13	42	80

Across the 25 TBP Program target counties, a total of 3,609,594 speed tests were conducted as of September 2024. The median download speed, upload speed, and latency was first calculated for each location. Then, the median of these location medians was calculated by county and by location category (see Table 5). Medians were chosen to reduce the influence of locations with extremely high or low values.

Table 5. Total locations, speed tests, median download speed, median upload speed, and median latency for all locations in the four TBP Program target states by category of location.

State	Category	Total Locations with Pod Deployments	Total Speed Tests	Median Download Speed (Mbps)	Median Upload Speed (Mbps)	Median Latency (ms)
Alaska	Business	1	2,242	4.3	3.9	37.1
	Consumer	5	30,203	14.2	2.9	52.6
	Healthcare	42	124,974	27.1	14.4	53.2
	Non-healthcare CAI	4	36,764	77.6	67.3	68.1
Michigan	Business	11	79,932	123.5	11.1	12.2
	Consumer	64	220,653	107.1	11.2	19.0
	Non-healthcare CAI	3	39,633	18.8	11.4	25.0
Texas	Business	56	649,495	52.1	24.6	15.4
	Consumer	21	196,827	21.6	7.6	19.7
	Healthcare	13	117,950	81.3	80.5	18.3
	Non-healthcare CAI	78	1,519,575	372.5	210.9	12.8
West Virginia	Business	13	49,449	30.8	3.6	27.7
	Consumer	42	264,839	71.0	5.3	27.3
	Healthcare	21	258,417	101.0	50.8	22.5
	Non-healthcare CAI	4	18,641	17.7	8.7	24.1

*Medians reported are medians of all median values calculated for each location.

In general, broadband connections in Alaska were of some of the poorest quality, with median measurement speeds falling below the 100/20/100 threshold for all location categories. Consumer connections across all four states were also of relatively low quality. The median measurements for consumer locations in all four states fell below the 100/20/100 threshold. In Michigan, the median consumer download speed exceeded the 100 Mbps benchmark, but the median upload speed for consumers in Michigan fell well below the 20 Mbps threshold at 11.2 Mbps. These results suggest that many consumers across the TBP Program target counties currently lack sufficient broadband to support consistent and reliable access to important broadband-enabled services, such as telehealth. Although healthcare locations across the TBP Program had higher-quality broadband relative to other connection categories within those states, only healthcare locations across West Virginia produced median measurements meeting the 100/20/100 benchmark. In Texas, 54 out of 78 non-healthcare CAIs participating in the TBP Program (69.2%), the median download speed, upload speed, and

latency all exceeded the 100/20/100 threshold. However, aggregating median measurements across many categories and locations does not show the complete picture or the experience of broadband for users at these locations.

To examine variability of the user experience of broadband at participating TBP Program locations, the percentage of speed tests that fell below the 25/3/100 threshold, fell between the 25/3/100 and 100/20/100 threshold, and met or exceeded the 100/20/100 threshold was also calculated for each location category (healthcare, non-healthcare CAI, consumer, and business) and by state. In these aggregated calculations, each location was equally weighted, such that locations with more speed tests had the same weight as locations with fewer speed tests (although all included locations met the inclusion criteria of having at least 100 speed tests). The number of speed tests conducted at a single location included in our analysis ranged from 103 to 79,519. The percentages of tests meeting these thresholds for all location types across the TBP Program area can be found in Figure 1. Location categories with 1 or fewer locations within a state are not presented.

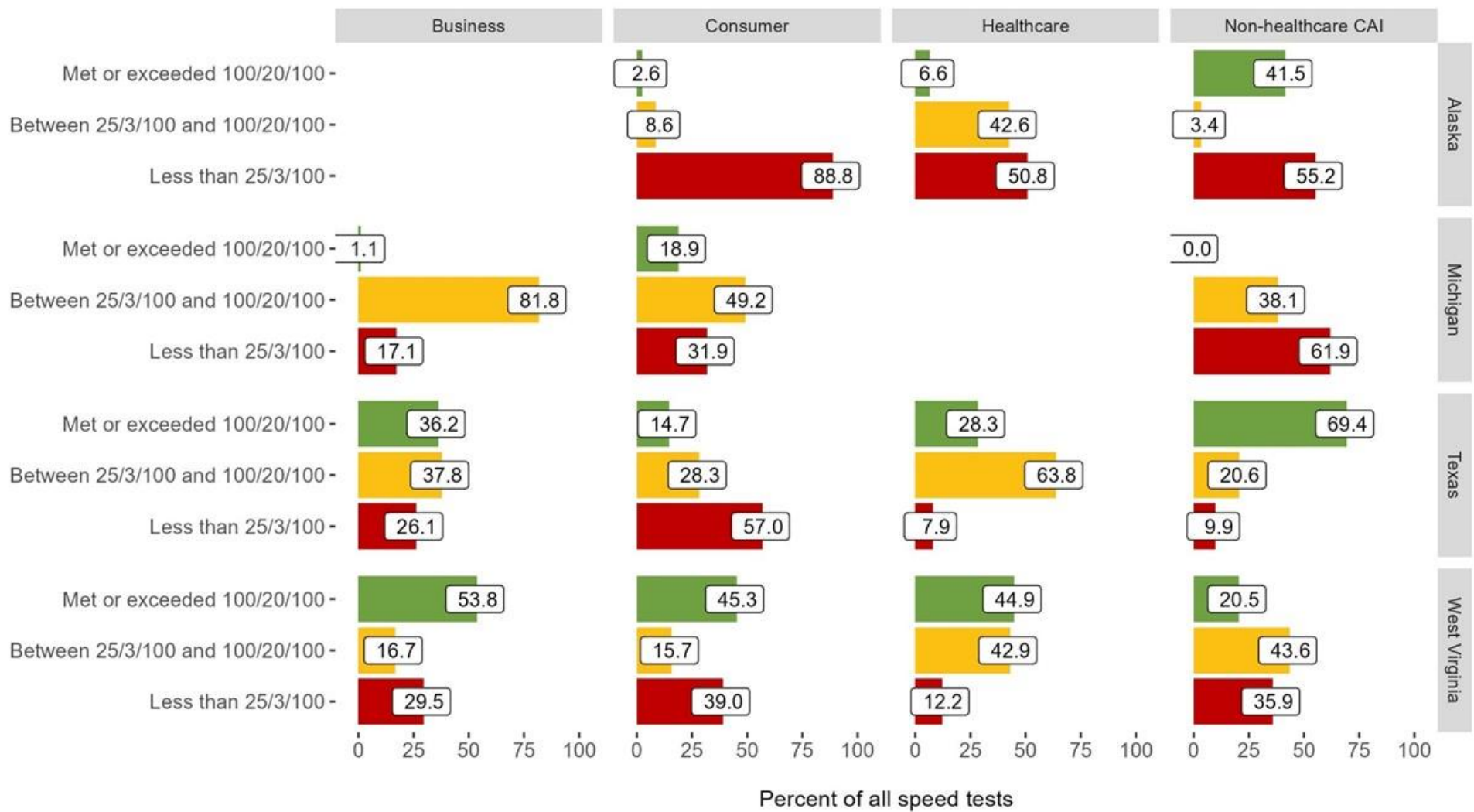


Figure 1. Percentage of speed tests recorded at less than 25/3/100, between 25/3/100 and 100/20/100, and met or exceeded 100/20/100 for business, consumer, healthcare, and non-healthcare CAI locations in the four TBP Program target states (each location equally weighted).

In general, broadband connections in Alaska were of the poorest quality, with median speeds falling below the 100/20/100 threshold for all location categories. Median speeds for consumer connections across all 4 states also fell below the 100/20/100 threshold. In Alaska—the state with lowest median download and upload speed for consumers—88.8% of all consumer speed tests fell below the 25/3/100 threshold. In Texas, more than half (57.0%) of consumer speed tests fell below the same threshold. In Michigan, the median consumer download speed exceeded the 100 Mbps benchmark, but the median upload speed fell well below the 20 Mbps threshold. These results suggest that many consumers across the TBP target counties lack sufficient broadband to consistently and reliably access important services, such as telehealth.

When evaluating by location type, healthcare locations had the highest-quality broadband, but only healthcare locations in West Virginia produced median speeds meeting the 100/20/100 benchmark. In Texas, non-healthcare CAIs showed high-quality speeds, well above the 100/20/100 threshold, but the data aggregation across many locations may cloud the complete experience of broadband capacity for users at these locations.

The percentage of speed tests by state and location category show a large degree of variability across the target counties that the median measurements may have masked. For instance, although the median download speeds for consumers in West Virginia (71.0 Mbps) and Michigan (107.1 Mbps) appeared to be high-quality or close to that threshold, approximately a third of all speed tests (31.9% in Michigan and 39.0% in West Virginia) fell below the 25/3/100 threshold. However, an examination of the percentage of all speed tests meeting these thresholds show that the experience of broadband for consumers in these states varies, with broadband sometimes meeting the high-quality threshold (18.9% of all consumer speed tests in Michigan and 45.3% of consumer speed tests in West Virginia), but frequently falling well below even the outdated broadband benchmarks of 25/3/100.

Pod measurements from healthcare locations across the target states showed similar variability. Most healthcare speed tests fell below the high-quality, 100/20/100 threshold. West Virginia was the only state where the median results met the 100/20/100 threshold, although only 44.9% of individual tests did. In the other 2 states with participating healthcare locations (Alaska and Texas), only 6.6% and 28.3% of all healthcare location speed tests met or exceeded the 100/20/100 threshold.

Even the best served location categories across the TBP Program target counties still demonstrated significant issues with consistency and reliability of broadband connections. Across 78 non-healthcare CAI locations in Texas, aggregated measurements showed very high-quality broadband, with a median download speed of 372.5 Mbps, a median upload speed of 210.9 Mbps, and a median latency of 12.8 ms. However, nearly a third of all non-healthcare CAI observations in Texas fell below the 100/20/100 threshold. This variability suggests that non-healthcare CAIs in Texas may have access to the highest quality connections but can still experience poor quality broadband for a significant amount of time.

Discussion

When examining median download speeds, upload speeds, and latencies for locations participating in the TBP Program across Alaska, Michigan, Texas, and West Virginia, important variations occurred in broadband quality and reliability across states and location categories (including healthcare, consumer, non-healthcare CAI, and business locations). Across more than 3.6 million speed tests conducted across the 25 TBP Program target counties, consumers across all four TBP Program target states demonstrated broadband quality—at least in

aggregate, as determined using medians—below the new 100/20/100 threshold newly defined by the FCC.²⁰ In Michigan, consumers demonstrated median upload speeds slower than 20 Mbps, but download speeds exceeding 100 Mbps. However, consumers in both Alaska and Texas TBP Program target counties demonstrated median download speeds below 25 Mbps, falling below the outdated broadband speed benchmark previously set by the FCC nearly 10 years ago in 2015. When further examining consumer speed tests across the TBP Program target states, a more concerning experience of consumer broadband within these 25 target counties emerged. Even though median broadband download speeds in Michigan (107.1 Mbps) and West Virginia (71.0 Mbps) well exceeded the 2015 broadband download speed threshold of 25 Mbps, the percentage of individual speed tests that fell below the 25/3/100 threshold in these states was approximately one-third. In Alaska and Texas, where median measures of consumer broadband were slower, more than half of the observed speed tests at consumer homes fell below the 25/3/100 threshold. Indeed, results from interviews conducted with consumers living in TBP Program communities reflected that a lack of quality broadband service availability and poor-quality broadband connections were barriers to obtaining and maintaining broadband.

The quality of broadband at healthcare locations participating in the TBP Program was relatively higher than that of consumers. However, there was still significant variability in the reliability and quality of broadband at healthcare locations, with only 44.9% (West Virginia), 28.3% (Texas), and 6.6% (Alaska) of healthcare locations recording broadband measurements meeting the 100/20/100 threshold. Healthcare provider broadband quality, as measured by pods deployed in the TBP Program, was not reliable or consistent. In a separate study, results of interviews with healthcare stakeholders support this finding. Healthcare stakeholders in TBP target counties described how broadband issues delayed patient care and increased risk to patients. Interviews also revealed that poor broadband quality and outdated hardware were barriers to more widespread adoption of telehealth services, among other influences (see the white paper, [Healthcare stakeholder perceptions of broadband and telehealth influences in Telehealth Broadband Pilot Program communities](#), for more detail).

The recent speed threshold change in the definition of broadband by the FCC from a 25/3/100 threshold to a 100/20/100 threshold demonstrates recognition for higher quality broadband for activities such as work, education, and telehealth.²⁰ In a report describing the rationale for this definition change, the FCC highlighted telehealth as an activity that may not be feasible with upload speeds of 3 Mbps or lower.²⁴ Many areas of the TBP target counties have healthcare gaps that telehealth could reasonably fill. Thus, the results from the TBP Program evaluation raise concerns for telehealth stakeholders who may champion telehealth services as a way to increase healthcare access in rural communities, such as the 25 target counties participating in the TBP Program. In 24 of the 25 TBP Program target counties, no specialty hospitals exist. In 7 of these counties, no acute care hospitals exist. With limited access to healthcare delivery locations, telehealth could provide a mechanism to increase healthcare access for the people in these communities. However, if a consumer home only has broadband at or above the 100/20/100 less than half of the time (as was the case for consumer locations in all TBP Program target states), the feasibility of some telehealth services is in question.

It is important to note that pods deployed by the TBP Program were intended to collect longitudinal broadband data over time and are not directly comparable to speeds reported in the latest Federal Communications Commission's Broadband Serviceable Location (BSL) Fabric, which report advertised speeds available at locations where broadband may be delivered.¹² Data from the FCC's BSL Fabric demonstrates broadband access at the level of individual BSLs, which is the most comprehensive data set of broadband access to date. However, data

collected by the TBP Program are an important complement to the Fabric data, as they demonstrate more closely the experience of broadband to an individual user, not the general quality of services that may be available to them.

The results from this analysis demonstrate that even when broadband connections can produce download speeds, upload speeds, and latencies meeting the 100/20/100 threshold, they do not always do so consistently. It is beyond the scope of the TBP Program evaluation to determine the cause of every individual poorer quality speed test, which can be influenced by many factors within and outside of a location. However, these results do highlight the need to consider broadband reliability and consistency in addition to broadband connection access.

If broadband is, in fact, a super determinant of health necessary for activities such as work, education, and healthcare, it is important and worth the investment to have uninterrupted access to those activities. Without consistent reliable broadband in consumer homes and healthcare locations, the feasibility of telehealth diminishes. If a consumer home only has broadband at or above the 100/20/100 threshold less than half of the time (as was the case for consumer locations in all TBP target states), telehealth services become harder to reliably operate.

Recommendations

In light of results from the data collected in the 25 target counties across the TBP Program, this evaluation supports the following recommendations to improve the user experience of broadband for those communities:

- A. Provide support for *consistent*, high-quality broadband connections for healthcare, consumer, non-healthcare CAI, and business connections to facilitate broadband-dependent critical services, such as telehealth.
- B. Consider how frequently speeds meet broadband thresholds for high-quality experiences to ensure that services such as telehealth are reliably accessible to healthcare providers and patients.
- C. Further investigate the causes of the variability in the user experience of broadband.
- D. Create a centralized resource to help consumers, businesses, non-healthcare CAIs, and healthcare organizations provide broadband education, navigate locally available broadband options, and troubleshoot technical connectivity challenges.

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