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Broadband Affordability and the BEAD Program: Analysis and Policy Recommendations

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Background and context

The digital divide represents one of the most persistent infrastructure challenges for the U.S. in the 21st century, with millions of Americans lacking access to reliable, affordable broadband service. The challenge is most severe in rural and Tribal areas, where close to a third of the population remains cut off from the opportunities afforded by high-speed Internet.[1] In response to this challenge, the federal government created the Broadband Equity, Access, and Deployment (BEAD) program, established under the Infrastructure Investment and Jobs Act (IIJA) of 2021. Administered by the National Telecommunications and Information Administration (NTIA), the program provides $42.45 billion to states and U.S. territories to expand high-speed Internet, primarily through direct grants to service operators. To ensure the affordability of federally funded networks, Congress established that BEAD recipients must offer at least one low-cost service option for eligible subscribers throughout the network's lifespan.[2]

Originally, key parameters of this affordability requirement - such as the target price of low-cost service, price indexing rules and cost benchmarks - were left for states to determine in their BEAD proposals to NTIA. Following NTIA guidance, most states set ambitious price targets, with many choosing to align maximum prices for low-cost service with the $30/month benefit of the ACP program (despite the program being discontinued in early 2024). However, in June 2025 the NTIA rescinded all non-statutory requirements related to low-cost broadband for BEAD recipients.[3] According to the NTIA June 2025 BEAD Restructuring Policy Notice, by providing states detailed guidelines and low-cost model options, the previous policy guidance amounted to rate regulation, which is explicitly prohibited in the IIJA.[4]

The new NTIA guidelines prohibit states from "explicitly or implicitly" setting target prices or other parameters for low-cost service. BEAD recipients must still offer a low-cost service option as required by

[1] FCC (2024). In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion (Section 706 Report). GN Docket No. 22-270, released March 18, 2024.
[2] Infrastructure Investment and Jobs Act of 2021, 42 U.S.C. §60102, 135 Stat. 1129. The low-cost service option must meet the minimum quality parameters established for all BEAD-funded services (100Mbps download/20 Mbps upload with latency below 100ms).
[3] NTIA (2025). Broadband Equity, Access, and Deployment (BEAD) Program: BEAD Restructuring Policy Notice. Available at www.ntia.gov/sites/default/files/2025-06/bead-restructuring-policy-notice.pdf. Accessed: July 2025.
[4] "Nothing in this title may be construed to authorize the Assistant Secretary or the National Telecommunications and Information Administration to regulate the rates charged for broadband service" (IIJA Section 60102, subsection (h)(5)(D)).

the IIJA, but it is now up to each operator to determine pricing and other parameters for this service option. Another significant change is the lowering of the income threshold for low-cost service eligibility. Previously, NTIA guidelines established that households at or below 200% of the federal poverty line (FPL) or those enrolled in qualifying safety net programs were eligible for low-cost service, thus matching the Affordable Connectivity Program (ACP) eligibility criteria. The new NTIA guidelines lower the income threshold to 135% of the FPL, which now matches the eligibility criteria of the federal Lifeline program. Finally, the new guidelines eliminate the existing requirement for states to develop a middle-class affordability service option.

Despite major changes to the BEAD program, the new NTIA guidelines adhere to the requirement that all BEAD recipients offer at least one low-cost service option to eligible subscribers. By preempting states from defining their own parameters for low-cost offerings, the new guidelines will require states to more thoroughly monitor service affordability and the uptake of low-cost services in BEAD-funded networks. This policy brief seeks to support states in their assessment and monitoring of low-cost services offered by BEAD grantees. The brief proposes concrete affordability benchmarks and provides evidence-based recommendations to help strike the appropriate balance between service affordability and the long-term sustainability of BEAD recipients.

To maximize the impact of the BEAD program, establishing baseline conditions in areas designated by states as BEAD-eligible is critical for multiple reasons. First, understanding current market conditions - including pricing, service quality, and provider availability - is essential for assessing whether federal investments are being directed towards areas with genuine service gaps rather than areas with adequate market provisioning. Second, establishing baseline measurements enables rigorous evaluation of program impact by distinguishing changes attributable to BEAD investments from broader market trends driving broadband accessibility. Third, comprehensive pre-deployment data informs implementation strategies by revealing the specific nature of service deficiencies that federal investments must address, whether primarily infrastructure gaps, affordability barriers, or competition limitations.

In sum, this policy brief aims to: (1) establish comprehensive baseline measurements of service quality and pricing conditions in BEAD-eligible areas, and (2) provide evidence-based insights into how policy changes, demand patterns, and market conditions interact to shape program outcomes. These insights can help inform implementation strategies as states begin selecting and monitoring the performance of BEAD subgrantees. Although the analysis is limited to four states, it offers a scalable framework for future data collection efforts that are critical for effective oversight and management of the BEAD program.

Methodology and data

It is well established that reliable data about broadband pricing and service quality remains limited.[5] Existing federal data collection efforts rely primarily on self-reported information from Internet Service Providers (ISPs), while price surveys focus on urban markets that differ substantially from the rural and underserved areas targeted by BEAD. This data gap hampers both program design decisions and the development of appropriate monitoring frameworks as the largest federal broadband investment in U.S. history proceeds toward implementation. To address this gap, this policy brief is based on the large-scale collection of broadband prices and service quality information in BEAD-eligible locations in four states: California, Michigan, Oklahoma, and Virginia. A novel dataset is created by querying a representative

[5] Humphrey, C., Mack, E., & Horrigan, J. (2025). Moving toward a continuum model of broadband affordability for low-income households. *Telecommunications Policy*. https://doi.org/10.1016/j.telpol.2025.103027.

sample of BEAD-eligible addresses in these four states using the Broadband-plan Querying Tool (BQT), an automated tool that takes a street address as input and returns the broadband plans (i.e., maximum upload speeds, download speeds, and corresponding prices) offered by major ISPs at that address.

BQT is a data collection platform specifically designed to address the lack of reliable, comprehensive data on residential broadband prices and availability through the automated collection of broadband plan information directly from ISP websites. Taking a residential address as input, BQT mimics a human user's behavior and programmatically navigates an ISP website to gather information about available plans, including speeds, prices, and the type of broadband service available. This approach provides independent verification of advertised broadband service while achieving scalability across large geographic areas and multiple ISPs. The methodology enables researchers to collect comprehensive pricing and speed data at scale without relying on ISP cooperation or self-reported data.

BQT has demonstrated its policy relevance through applications to major federal broadband programs, providing independent assessment capabilities that complement traditional regulatory oversight tools. More concretely, it has supported three major studies that: (1) enabled the contextualization of crowdsourced speed test data, leading the FCC to update its BEAD program challenge process;[6] (2) enabled the collection of broadband plan data for over 1 million addresses across thirty cities and exposed disparities in broadband plans and monopolistic practices, providing evidence used by policymakers to address digital discrimination;[7] and (3) facilitated the evaluation of the FCC's multi-billion dollar Connect America Fund (CAF) program, revealing that only 33% of targeted addresses actually received the promised service levels and demonstrating the need for independent verification of ISP claims in federal broadband programs.[8]

BQT's unique ability to collect real-time pricing and availability data at scale offers researchers and policymakers unprecedented opportunities to monitor market conditions, assess program effectiveness, and identify areas where policy interventions may be needed to achieve broadband equity objectives. Further, by relying on address-level data, it enables the identification of granular changes in market conditions that other tools are unable to capture.

This policy brief integrates BQT with the following data sources:

- National Broadband Serviceable Location (BSL) Fabric. Compiled by CostQuest Associates, the National Broadband Serviceable Location Fabric is a dataset of all residential and business locations within the U.S. where fixed broadband internet is or can be installed.[9]

- National Broadband Map. The FCC's National Broadband Map displays the locations, at a street address level granularity, where broadband service is available in the U.S. This information is self-

[6] Paul, U., Liu, J., Gu, M., Gupta, A., & Belding, E. (2022). *The Importance of Contextualization of Crowdsourced Active Speed Test Measurements*. In 22nd ACM Internet Measurement Conference (IMC) (IMC '22). Association for Computing Machinery, Nice, France, 274–289.
[7] Paul, U., Gunasekaran, V., Liu, J., Narechania, T., Gupta, A., & Belding, E. (2023). *Decoding the Divide: Analyzing Disparities in Broadband Plans Offered by Major US ISPs*. In Proceedings of the ACM SIGCOMM Conference (SIGCOMM '23). Association for Computing Machinery, New York, United States, 578–591.
[8] Manda, H., Srinivasavaradhan, V., Koduru, L., Zhang, K., Zhou, X., Paul, U., Belding, E., Gupta, A., & Narechania, T. (2024). *The Efficacy of the Connect America Fund in Addressing US Internet Access Inequities*. In Proceedings of the ACM SIGCOMM Conference (SIGCOMM '24). Association for Computing Machinery, Sydney, Australia, 484–505.
[9] CostQuest Associates LLC. 2025. National Broadband Serviceable Location Fabric Resource Center. https://www.costquest.com/broadband- serviceable-location-fabric/. Accessed: July 2025.

reported by ISPs through the FCC's Broadband Data Collection (BDC) program, which requires ISPs to file data with the FCC twice a year about locations where broadband service is offered. We use the FCC National Broadband Map to identify the corresponding ISPs associated with each BSL in our sample.[10]

- American Community Survey (ACS). Demographic and income data are sourced from the American Community Survey (ACS) 2019-2023 5-year estimates. Crucially, this data contains estimates of household income for households at the 20th income percentile (upper limit of the bottom income quintile) for each Census Block Group (CBG).[11] Based on this data, we calculate a broadband affordability benchmark based on 2 percent of the monthly income for households at the 20th income percentile. Though not part of statutory law, this benchmark has been used by the FCC and several states to monitor broadband service affordability, and is also commonly used in the research literature.[12]

- BEAD-Eligible locations. Each state has published lists of location IDs that are characterized as unserved (lacking access to 25/3 Mbps service) or underserved (lacking access to 100/20 Mbps service). The identification of BEAD-eligible locations in our sample relies on merging the National Broadband Serviceable Location Fabric data with the list of BEAD-eligible locations published by the four states under study.

Data collection was conducted across two levels of spatial resolution in order to understand variations in service conditions between the most concentrated areas of need and the broader universe of locations that may receive BEAD funding. The first level are CBGs where at least 80% of BSLs are BEAD-eligible. These are the highest-need areas most likely to receive BEAD funding. This threshold follows earlier NTIA guidance, which defines a BEAD project as "a grouping of broadband-serviceable locations in which not less than 80 percent of broadband-serviceable locations served by the project are unserved locations or underserved locations."[13] The second level includes CBGs where at least 50% of locations are BEAD-eligible. This represents a larger sample of areas with potential BEAD investments, which by definition also includes those in the first level of spatial resolution.

We further distinguish between two sets of results: Phase 1 results are based on the original lists of BEAD-eligible locations published by states prior to the June 2025 BEAD Restructuring Policy Notice (which required states to revise and resubmit their lists in accordance with the updated program guidelines). This formed the basis for the data collection that spanned February to June 2025. Phase 2 results are based on a restricted sample of locations that are included in the revised lists of eligible BSLs published by states following the new program guidelines.

The sampling strategy within target CBGs is as follows: given computational constraints and the need for statistically meaningful results, we employ stratified random sampling within each CBG. More specifically,

[10] FCC National Broadband Map. https://broadbandmap.fcc.gov/about. Accessed: July 2025.
[11] A census block group is a subdivision of a census tract. It is the smallest area for which the Census Bureau reports demographic data from the American Community Survey. Block groups are designed to contain a population between 600 and 3,000 people.
[12] FCC (2016). *In the Matter of Lifeline and Link Up Reform and Modernization. Third Report and Order*. WC Docket No. 11-42. https://docs.fcc.gov/public/attachments/FCC-16- 38A1.pdf. Accessed: July 2025. As an example, California has an ongoing broadband affordability proceeding that monitors prices for households in the 20th income percentile (see CPUC Affordability Rulemaking).
[13] NTIA (2022). Notice of Funding Opportunity (NOFO). Available at https://broadbandusa.ntia.gov/sites/default/files/2022-05/BEAD%20NOFO.pdf (p. 14). Accessed: July 2025.

we randomly select 10% of BSLs per CBG to query with BQT, with a minimum threshold of 30 queried locations per CBG to ensure statistical significance for any aggregation within a CBG. This sampling approach has been validated in prior studies (see footnotes 6-8) and balances computational feasibility with analytical rigor.

In the next step, BQT query results are classified into three broad categories: (1) Serviceable, (2) No Service, or (3) Unknown. An address is classified as Serviceable if BQT successfully navigates to the broadband plans page on an ISP's web interface, enabling us to extract broadband plan information for a specific address. Within the Serviceable category, we distinguish between addresses with advertised plans and those without.[14] If BQT can enter an address into an ISP's website but the ISP indicates that the address is not within their service area, we classify the ISP/address combination as "No Service." Finally, if BQT cannot reach the broadband plans page, either because the address is not listed in the ISP's dropdown menu (rendering it invalid) or because the ISP may claim to serve the address but offers no specific speed tier or pricing information, we classify the ISP/address combination as "Unknown."

Results

Descriptive statistics

Tables 1A and 1B show a detailed breakdown of the data collected from Phase 1 (original list of eligible BSLs), including the number of BSLs queried, CBGs covered, and ISPs serving these addresses. Table 1A corresponds to the first level of spatial resolution (CBGs where at least 80% of locations are BEAD eligible), whereas Table 1B corresponds to wider level of 50% BEAD-eligible locations. Note that the CBGs and addresses in Table 1A are, by definition, a subset of CBGs and addresses in Table 1B. The tables distinguish between BSLs that are found to be Serviceable by at least one ISP (whether or not information about the advertised plans was effectively collected), those that have No Service, and those that offered no conclusive information about service status (Unknown).

Table 1A: Total number of queried BSLs, CBGs, and ISPs by state in Phase 1 (80% BSLs eligible)

State	Total Addresses	CBGs	ISPs	Serviceable BSLs (with plans)	Serviceable BSLs (no plans)	No Service BSLs	Unknown BSLs
CA	7,994	239	14	64.32%	4.44%	10.02%	21.22%
MI	11,786	200	18	58.36%	0%	10.51%	31.13%
OK	575	19	7	68.35%	2.96%	12.17%	16.52%
VA	577	13	8	56.50%	2.95%	5.89%	34.66%
Total	20,932	471	47	—	—	—	—

[14] Some ISPs do not display plans for an address on their website and instead recommend that customers call for more information about the plans offered at the address. Although we cannot extract specific plan details in these cases, we still classify the address as Serviceable with no plans, since the ISP confirms that service is available at that location.

Table 1B: Total number of queried BSLs, CBGs, and ISPs by state in Phase 1 (50% BSLs eligible)

State	Total Addresses	CBGs	ISPs	Serviceable BSLs (with plans)	Serviceable BSLs (no plans)	No Service BSLs	Unknown BSLs
CA	20,135	454	19	52.68%	6.91%	9.40%	31.01%
MI	35,768	479	18	54.59%	0%	9.49%	35.92%
OK	2,488	60	11	33.52%	12.50%	11.01%	42.97%
VA	3,969	58	16	20.26%	7.84%	7.0%	64.90%
Total	62,360	1,051	64	—	—	—	—

The tables indicate that a significant majority of queried addresses are served by at least one ISP, and that in most cases BQT was able to collect plan information for these addresses. In certain cases, BQT returned confirmation that the address is served, however the ISP does not offer plan information through its web interface. This category ("Serviceable BSLs - no plans") represents a small share of BSLs except in Virginia, where BQT was unable to collect plan information for the majority of sampled addresses. As a result, until further data is collected, results for Virginia must be interpreted only as indicative.

Table 2 shows the same data for Phase 2, in which locations are restricted to those included in the revised lists of locations published by states following the June 2025 BEAD Restructuring Notice. Table 2A corresponds to CBGs where 80% of BSLs are BEAD-eligible, whereas Table 2B corresponds to 50% BEAD-eligible. As shown, the sample becomes significantly smaller, particularly for Michigan and Oklahoma. This is likely due to the removal of locations following deduplication (removal of locations due to existing network deployment commitments through other programs) and new NTIA guidelines regarding the eligibility of locations already served by unlicensed fixed wireless providers.

Table 2A: Total number of queried BSLs, CBGs, and ISPs by state in Phase 2 (80% BSLs eligible)

State	Total Addresses	CBGs	ISPs	Serviceable BSLs (with plans)	Serviceable BSLs (no plans)	No Service BSLs	Unknown BSLs
CA	4,029	128	10	69.78%	3.23%	8.04%	18.95%
MI	359	12	6	65.74%	0%	3.62%	30.64%
OK	62	3	3	50.01%	8.06%	6.45%	35.48%
VA	0	0	0	—	—	—	—
Total	4,450	143	19	—	—	—	—

Table 2B: Total number of queried BSLs, CBGs, and ISPs by state in Phase 2 (50% BSLs eligible)

State	Total Addresses	CBGs	ISPs	Serviceable BSLs (with plans)	Serviceable BSLs (no plans)	No Service BSLs	Unknown BSLs
CA	10,135	228	16	60.08%	4.88%	8.67%	26.37%
MI	3,323	53	8	58.08%	0%	5.9%	36.02%
OK	159	7	3	32.7%	15.09%	7.55%	44.65%
VA	363	5	2	38.57%	6.61%	3.31%	51.51%
Total	13,980	293	29	—	—	—	—

Following data collection, we compute a representative price and (download) speed for each CBG. We proceed as follows: for each BSL, we select the plan closest to the BEAD requirement of at least 100 Mbps download speed.[15] More specifically, for locations with multiple available plans of more than 100 Mbps download speed, we select the plan that is closest to 100 Mbps. If no plan meets the 100 Mbps BEAD requirement, we select the highest-speed plan. Based on this information we compute the median speed for each CBG, and next calculate the median price of plans available in the median speed tier. This yields a representative plan for each CBG in our sample with two key parameters: download speed and price.

The final step involves comparing prices for the representative plan at the CBG level against the 2 percent of monthly income affordability benchmark. More specifically, we use the latest American Community Survey data (2019-2023 ACS 5-year) to calculate 2 percent of the monthly income for households at the 20th income percentile (upper limit of bottom income quintile) for each CBG.[16] It is worth noting that income data for the 20th percentile is available in the ACS at the census tract rather than the CBG level. We approximate income for each CBG by imputing the data uniformly to all CBGs within a census tract.

Overview of findings

Overall, the analysis reveals significant affordability and service speed gaps in the areas most likely to receive BEAD funding. The results demonstrate that a substantial fraction of BSLs in BEAD-eligible areas stand to benefit from federal investment, but the nature of these benefits varies considerably across states. While some states primarily face affordability challenges, others confront fundamental service quality deficiencies alongside high service prices. This suggests that benefits from BEAD investments will result from different mechanisms for different areas, depending on baseline market conditions.

To assess baseline conditions in BEAD-eligible areas, the analysis employs two complementary metrics. First, an income-based affordability benchmark that determines what percentage of representative plans in a CBG exceeds 2 percent of monthly income for households at the 20th income percentile. Second, a service quality benchmark that determines the share of representative plans in a CBG that falls below the 100 Mbps minimum performance requirement for BEAD-funded networks. These results are presented in Table 3A (Phase 1: original list of BSLs) and Table 3B (Phase 2: revised list of BSLs).

Table 3A: Summary of baseline conditions by state (Phase 1: original list of BSLs)

	≥80% BEAD-eligible		*≥50% BEAD-eligible*	
	CBGs >2% income threshold	CBGs < speed threshold (100 Mbps)	CBGs >2% income threshold	CBGs < speed threshold (100 Mbps)
California	65%	40%	60%	36%
Michigan	84%	18.5%	77%	19.3%
Oklahoma	85%	85%	74%	50%
Virginia	86%	0%	61%	0%

[15] Most advertised plans that satisfy the 100 Mbps download speed threshold also satisfy the upload speed threshold of at least 20 Mbps. Thus, we use download speed only to identify the representative plan for each BSL.
[16] The benchmark often refers to 2 percent of the disposable (after tax) income. However, low-income households typically have higher post-tax than pre-tax incomes due to tax credits and refunds, though this will vary by household.

Table 3B: Summary of baseline conditions by state (Phase 2: revised list of BSLs)

	≥80% BEAD-eligible		≥50% BEAD-eligible	
	CBGs >2% income threshold	CBGs < speed threshold (100 Mbps)	CBGs >2% income threshold	CBGs < speed threshold (100 Mbps)
California	75.4%	40.5%	69.5%	40.8%
Michigan	90.0%	60.0%	76.6%	29.8%
Oklahoma	100%	100%	100%	50%
Virginia	-	-	-	-

To facilitate interpretation, we present a series of figures that summarize these results. Each figure displays a scatterplot where each dot represents a CBG, with dot size indicating the fraction of BSLs in each CBG from which plan information was collected (therefore the larger the dot the more accurate the information). The figures plot two axes in the same scale (US$): the representative price is plotted in the horizontal (x) axis while the 2 percent of monthly income for the 20th percentile is plotted in the vertical (y) axis. Therefore, dots below the 45-degree (or identity) dashed line indicate CBGs where the representative price exceeds the 2 percent affordability threshold, while dots above the line are CBGs where observed prices are below the 2 percent benchmark. In addition, the color coding reveals information about service quality: green dots represent CBGs where the representative plan meets or exceeds the 100 Mbps download speed requirement, while red dots indicate CBGs where the representative plan falls below 100 Mbps.

Comparison of findings across states

In California, the results indicate that service affordability is the main challenge in areas that are most likely to receive BEAD funding. In the highest-need areas (>80% BEAD-eligible BSLs), between 65% (original BSL list) and 75% (revised BSL list) of representative prices observed exceed the 2 percent income benchmark. In other words, at existing prices, low-income households in at least two-thirds of these areas will need to spend more than 2 percent of their monthly income to subscribe to high-speed broadband. These results are illustrated in Figures 1 and 2.

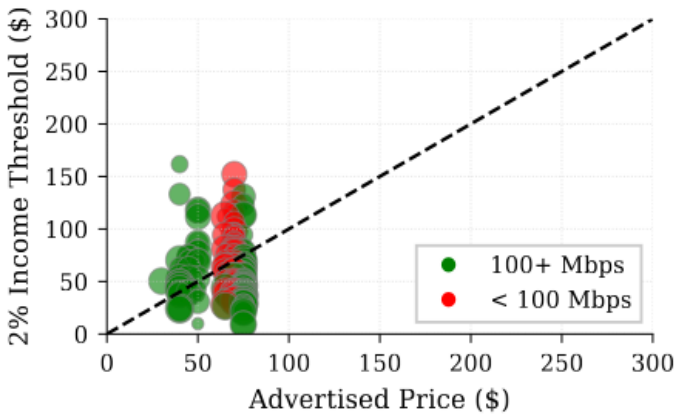

Figure 1: Representative price and 2 percent of income threshold for CBGs in California in areas where at least 80% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

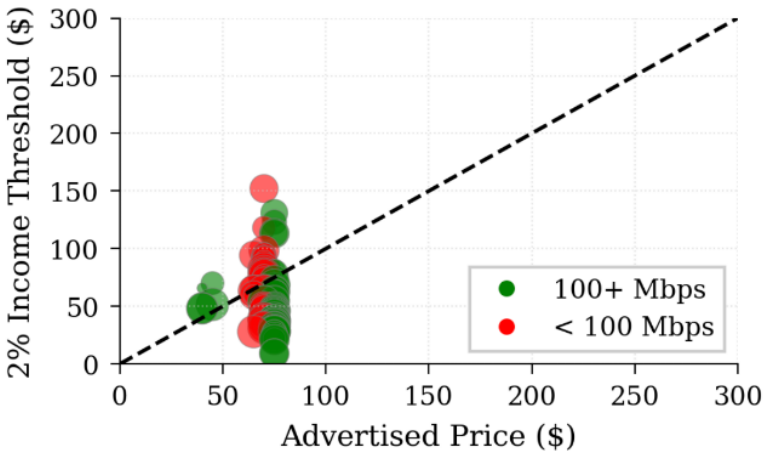

Figure 2: Representative price and 2 percent of income threshold for CBGs in California in areas where at least 80% of BSLs are BEAD eligible (revised list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

When the sample is extended to areas where at least 50% of BSLs are BEAD eligible, there is only a modest decrease to between 60% (original BSL list) and 70% (revised BSL list) of CBGs that exceed the 2 percent of income benchmark. In other words, affordability remains a primary barrier to access when considering a broader set of locations that are likely to benefit from BEAD funding. These results are illustrated in Figures 3 and 4.

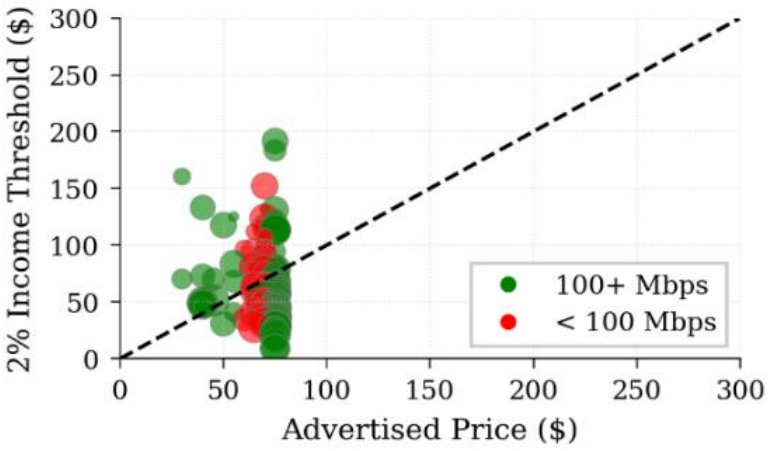

Figure 3: Representative price and 2 percent of income threshold for CBGs in California in areas where at least 50% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

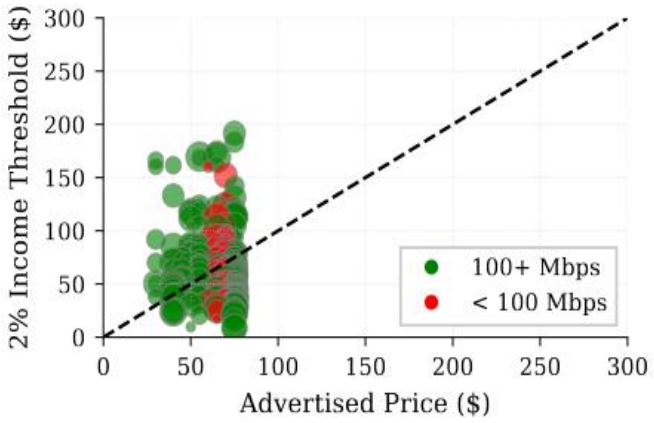

Figure 4: Representative price and 2 percent of income threshold for CBGs in California in areas where at least 50% of BSLs are BEAD eligible (revised list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

Baseline conditions in Michigan also reveal significant affordability challenges, with between 84% (original BSL list) and 90% (revised BSL list) of representative plans in the highest need areas (>80% locations BEAD eligible) exceeding the 2 percent income benchmark. In addition, the results for Phase 2 (revised list of eligible BSLs) point to service quality gaps when considering the areas of highest need, where 60% of representative plans fall below the 100 Mbps speed threshold. These results are illustrated in Figures 5 and 6.

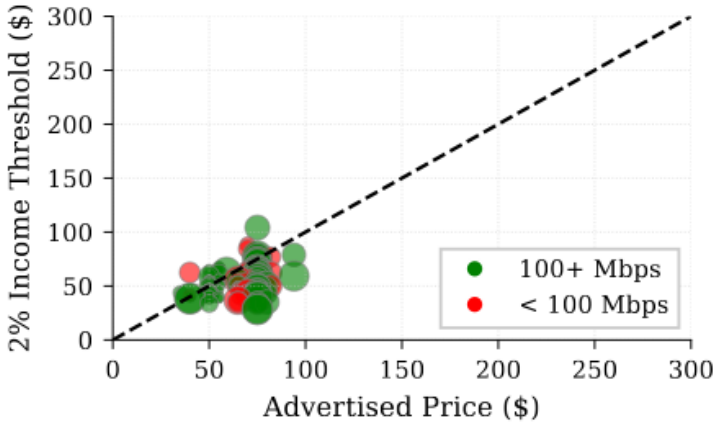

Figure 5: Representative price and 2 percent of income threshold for CBGs in Michigan in areas where at least 80% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

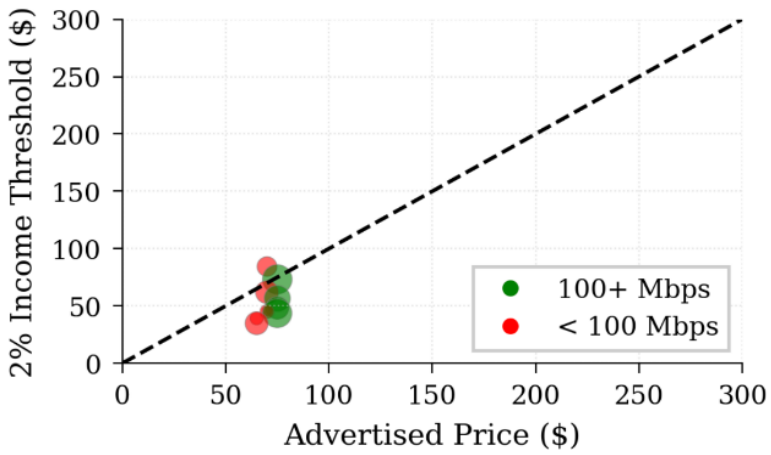

Figure 6: Representative price and 2 percent of income threshold for CBGs in Michigan in areas where at least 80% of BSLs are BEAD eligible (revised list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

Expanding the sample to areas where at least 50% of CBGs are BEAD eligible yields only small improvements in affordability, with about 77% of representative prices exceeding the 2 percent income benchmark (Figures 7 and 8). By contrast, a significant improvement in service quality is observed, with fewer than 30% of plans below the 100 Mbps speed benchmark. Overall, these patterns suggest baseline conditions of low affordability as well as limited availability of higher-speed services in Michigan areas that are likely to receive BEAD funding.

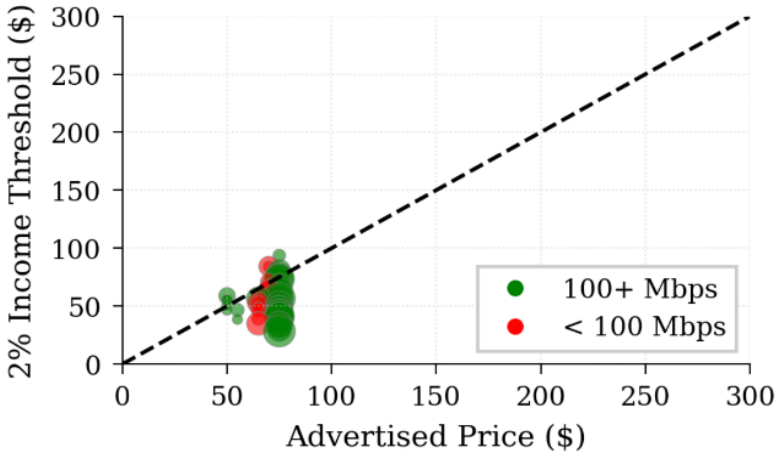

Figure 7: Representative price and 2 percent of income threshold for CBGs in Michigan in areas where at least 50% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

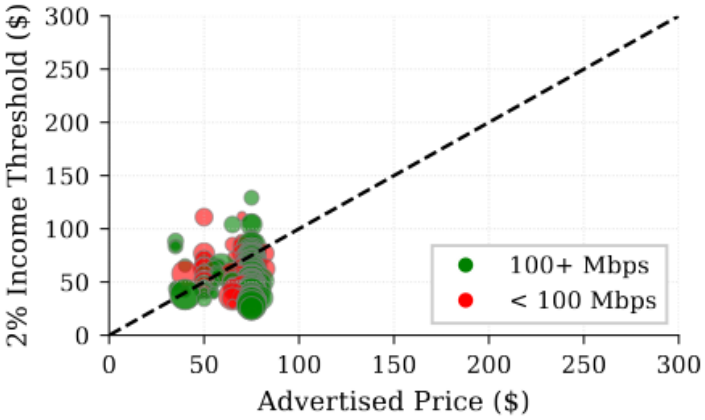

Figure 8: Representative price and 2 percent of income threshold for CBGs in Michigan in areas where at least 50% of BSLs are BEAD eligible (revised list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

Baseline market conditions in Oklahoma point to a distinct set of challenges. In the areas of greatest need, the vast majority of representative plans (between 85% and 100%) fall below the minimum 100 Mbps speed threshold. In addition, the results indicate that existing services are generally unaffordable. In the areas most likely to receive BEAD investments (at least 80% BEAD-eligible BSLs), between 85% (original BSL list) and 100% (revised BSL list) of representative prices exceed the 2 percent income benchmark, signaling the severity of affordability barriers faced by low-income households in Oklahoma. These results are illustrated in Figures 9 and 10.

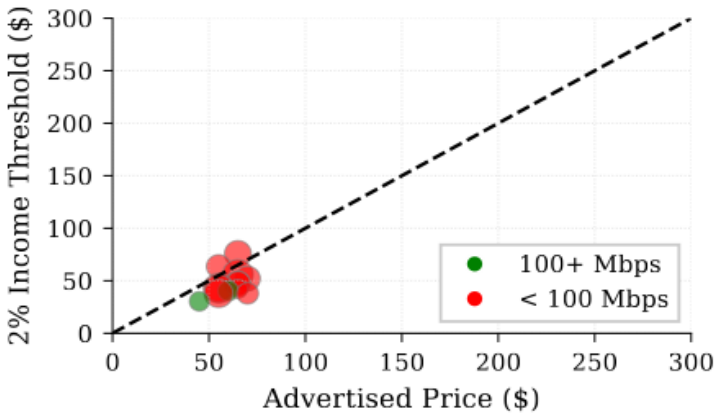

Figure 9: Representative price and 2 percent of income threshold for CBGs in Oklahoma in areas where at least 80% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

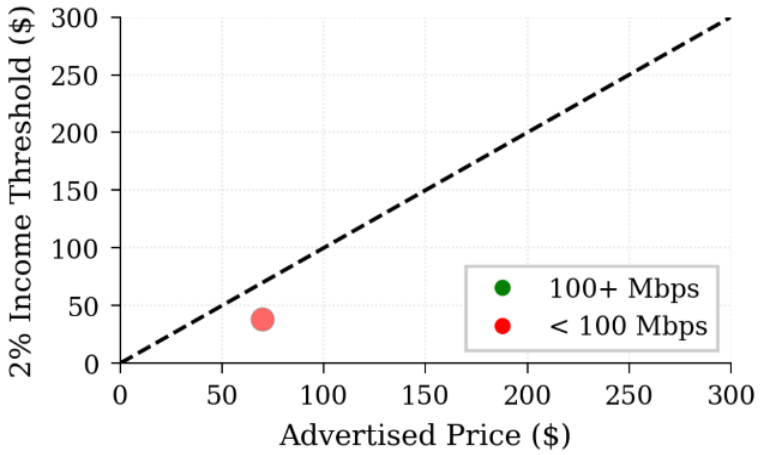

Figure 10: Representative price and 2 percent of income threshold for CBGs in Oklahoma in areas where at least 80% of BSLs are BEAD eligible (revised list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

When a broader set of areas is considered (Figures 11 and 12), baseline service quality conditions exhibit a small improvement to 50% of plans below the minimum 100 Mbps speed threshold, though this figure remains substantially higher than in California or Michigan. A likely explanation lies in Oklahoma's demographic characteristics, as about a third of its population resides in rural areas, where network deployment costs are considerably higher (by contrast the share of rural population is only 2% in California and 17% in Michigan).[17] On the one hand, these results indicate that Oklahoma's BEAD program is properly targeting areas where high-speed services are currently unavailable; on the other hand, it points to the magnitude of the gap that new infrastructure investments will need to address.

By contrast, when using the original list of eligible BSLs, results show only a modest decline to 74% of plans priced above the 2% affordability threshold in the expanded sample (areas with at least 50% BEAD-eligible BSLs). However, this increases to 100% when the revised list of eligible BSLs is considered. Overall, considering the baseline market conditions observed, Oklahoma appears to be the state best positioned to benefit from new infrastructure investments funded through the BEAD program among those examined in this study.

[17] Source: USDA Fact Sheets (available at https://data.ers.usda.gov).

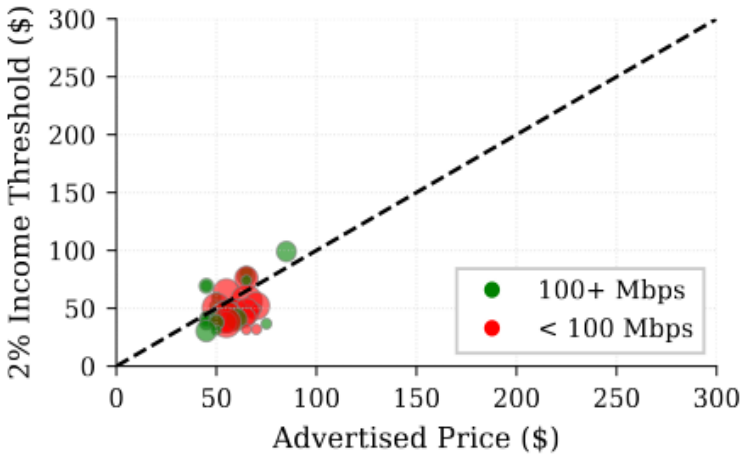

Figure 11: Representative price and 2 percent of income threshold for CBGs in Oklahoma in areas where at least 50% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

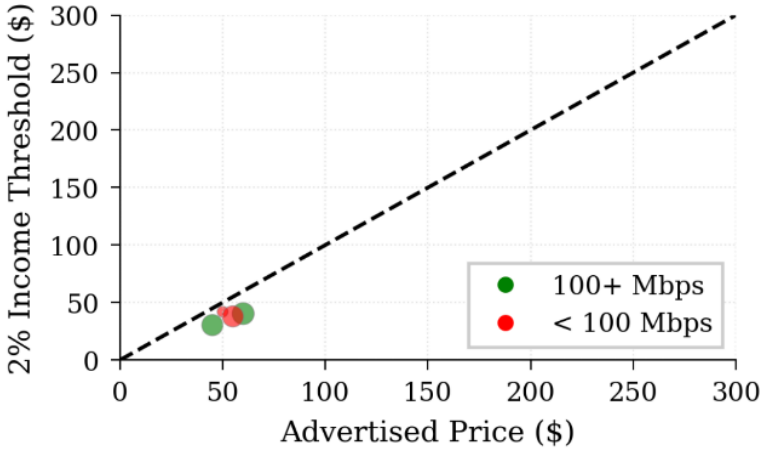

Figure 12: Representative price and 2 percent of income threshold for CBGs in Oklahoma in areas where at least 50% of BSLs are BEAD eligible (revised list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

Finally, in the Virginia case, the results are based on a limited sample of addresses due to the absence of plan information on the web interface of the main ISP serving the areas most likely to benefit from BEAD. Consequently, the analysis relies solely on the original list of BSLs prior to the June 2025 Policy Restructuring Notice and therefore should be interpreted as indicative only. As summarized in Figures 13 and 14, the results suggest that service affordability is the primary challenge, with 86% of representative plans priced above the 2% income threshold in the areas of highest need. This decreases to 61% in the expanded sample, which is line with California and slightly lower than Michigan (77%) and Oklahoma

(74%). Although all the observed plans meet the minimum 100 Mbps speed requirement - suggesting potential issues with program targeting - this preliminary finding will need validation once data from a larger set of addresses is collected.

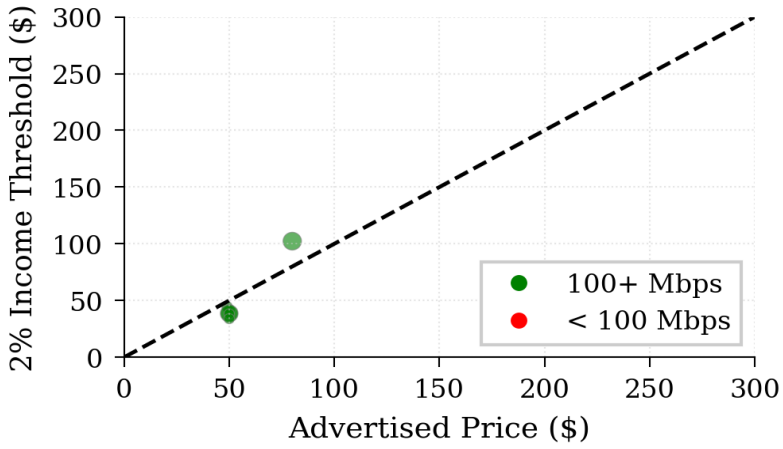

Figure 13: Representative price and 2 percent of income threshold for CBGs in Virginia in areas where at least 80% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

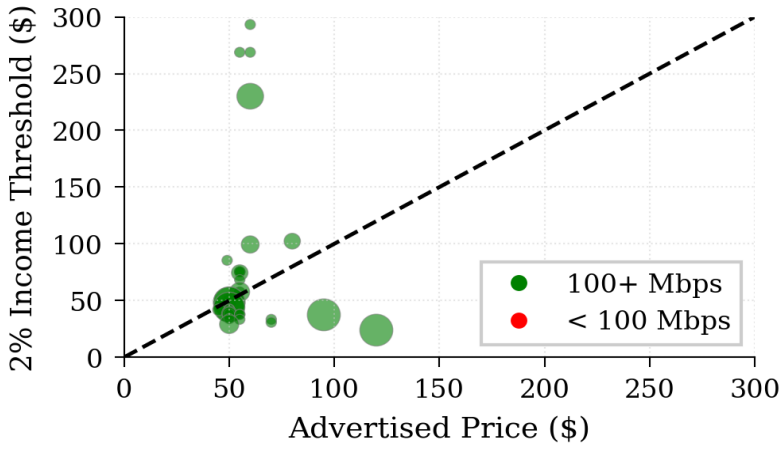

Figure 14: Representative price and 2 percent of income threshold for CBGs in Virginia in areas where at least 50% of BSLs are BEAD eligible (original list of BSLs). Each dot represents a CBG, with green indicating representative plans ≥100 Mbps and red indicating representative plans <100 Mbps. Dot size reflects data quality (fraction of BSLs in each CBG from which plan information was collected).

Discussion and policy recommendations

The limited availability of data on broadband pricing and service quality poses significant challenges for effective targeting of the BEAD program, as well as for monitoring program progress and compliance, and ultimately evaluating program outcomes. This study provides a blueprint for addressing these challenges through the results of a large-scale data collection initiative conducted in four selected states during the early stages of the BEAD program (at the time of writing, states had not yet designated the areas and providers that would receive BEAD funding).

The evidence reveals that achieving BEAD's objective of facilitating access to reliable and affordable high-speed broadband represents a complex challenge. Our findings confirm that, in BEAD-eligible areas, market incentives alone are insufficient to deliver either adequate speeds at affordable prices or affordable services at adequate speeds. While this finding is likely generalizable to most other states, the specific mix of availability and affordability challenges in each state will need to be determined through future studies that replicate this analysis.

The evidence further points to a diversity of baseline conditions across states, suggesting the need for different criteria in the evaluation of BEAD funding proposals as well as different monitoring and evaluation tools. Put differently, while all states are poised to benefit from BEAD investments, the nature of these benefits varies considerably depending on baseline conditions. These variations underscore the importance of state-specific program design that addresses local market conditions rather than applying uniform national standards across diverse geographic and economic contexts.

The results also raise concerns about the adequacy of program targeting in California and especially Michigan. Although targeting improved following the June 6 NTIA Restructuring Notice (which substantially reduced the share of eligible locations already served by plans offering speeds above 100 Mbps) there remains considerable scope for improving the identification of CBGs most in need of new infrastructure investments. The evidence further suggests that the main challenge in these states lies in addressing affordability barriers within BEAD-eligible areas. Accordingly, evaluating and monitoring the low-cost plans offered by BEAD grantees will be critical to achieving the program's objectives.

The case of Oklahoma highlights the difficulty of reconciling BEAD's dual objectives of improving service quality while reducing affordability barriers. The evidence points to high-need geographic clusters where broadband services are both inadequate and unaffordable for low-income households. Given these baseline conditions and the constraints on BEAD resources, state policymakers will need to strategically target BEAD investments toward the areas of greatest need, while also seeking to generate positive spillover effects in neighboring communities.

More broadly, this study establishes an empirical foundation for systematically monitoring results of the BEAD program. BQT's methodology provides a replicable framework for tracking changes in service availability, pricing, and advertised quality over time as federally funded networks become operational. It also offers policymakers, researchers, and civil society organizations an independent tool for assessing program outcomes, thereby strengthening accountability and transparency around BEAD's historic investment in network infrastructure.

Future monitoring efforts should prioritize three key dimensions: (1) changes in service quality (speed and latency) within targeted areas; (2) changes in both overall pricing and affordability, with particular attention to low-cost plans offered by BEAD grantees; and (3) changes in market conditions, including competition and provider diversity, as BEAD investments mature. Importantly, monitoring should extend beyond

funded areas to capture potential spillover effects, while also incorporating state-specific approaches that reflect the distinct market conditions identified in baseline analyses.

The results of the study establish baseline market conditions in areas likely to benefit from BEAD funding, offering benchmarks to refine program targeting, strengthen compliance monitoring, and assess program impact over time. At the same time, automated data collection tools such as BQT face two fundamental challenges. First, data collection with BQT - developed and maintained by the research group at the University of California Santa Barbara - requires persistent human oversight to operate the tool, ongoing engineering effort to debug occasional failures, and network infrastructure costs to support the proxy systems that are essential for successful querying. This issue could be mitigated through greater investment in the effort, allowing BQT to provide more user-friendly interfaces for non-technical users and to be offered as a Software-as-a-Service (SaaS) platform. Such a transition would, in turn, help establish a more robust and reliable public infrastructure for broadband pricing data collection. The BQT team is already pursuing this roadmap for future deployment. This study further underscores the importance of supporting that transformation to enable the development of meaningful data infrastructure for effective policymaking, particularly in the context of BEAD.[18]

[18] It is also worth noting that BQT is currently ineffective at querying ISPs that deliberately obscure their speed tier and pricing information, requiring customers to call the provider directly. We observed this issue in particular with a large ISP in Virginia. This limitation could be mitigated by extending BQT's capabilities from automated web-based querying to automated teleservice querying. The feasibility of such an extension has improved significantly with recent advancements in agentic systems and large language models (LLMs).

About the project

This study is part of the Measuring the Effectiveness of Digital Inclusion Approaches (MEDIA) project (Phase 3), a research program that seeks to analyze broadband inclusion initiatives and provide evidence-based recommendations on how best to connect low-income households to broadband on a sustainable basis. The project is supported by The Pew Charitable Trusts. The views expressed herein are those of the author(s) and do not necessarily reflect the views of The Pew Charitable Trusts.

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