An examination of the implementation and effectiveness of the Telehealth Broadband Pilot Program in the United States

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Executive Summary

The Telehealth Broadband Pilot (TBP) Program aimed to address gaps in broadband service that limit access to telehealth services in rural communities. To achieve this aim, the TBP Program measured broadband access for healthcare providers, consumers, non-healthcare Community Anchor Institutions throughout 25 target counties or county-equivalents in four states: Alaska, Michigan, Texas, and West Virginia. An easy-to-install device (henceforth, "pod") was developed to automatically collect key broadband metrics at regular intervals (e.g., hourly) over time, including download speed, upload speed, and latency. An implementation study was conducted using the RE-AIM framework, which contains the following domains: Reach, Effectiveness, Adoption, Implementation, and Maintenance. Metrics and data sources for each RE-AIM domain were identified to describe the successful strategies utilized in the TBP Program implementation and improve future, similar programs. The evaluation of the TBP Program included analysis of 1) TBP Program records to measure Reach; 2) TBP pod data to measure Adoption and Maintenance; and 3) semi-structured qualitative interviews with TBP Program staff (including TBP Program leaders, Community Lead Partner staff, and contracted staff to support the TBP Program) to measure Effectiveness and Implementation. Results from the study included facilitators and barriers to program implementation, as well as summaries of key program activities, including costs. TBP Program records revealed the overall cost of the hardware, build, shipping, support, and replacements of a TBP pod was $111.53. Reach varied considerably by state and strategy. Maintenance of pods (defined as a deployed device that collected at least 100 speed tests over at least 14 unique days) by state was:

- Alaska: 52 total pods
- Michigan: 78 total pods
- Texas: 168 total pods
- West Virginia: 80 total pods

Results from semi-structured qualitative interviews with TBP Program staff revealed that the perception of a direct benefit to the potential TBP Program participant (i.e., perceived value proposition) and trust between TBP Program staff and potential TBP Program participants were key facilitating influences for TBP Program Effectiveness and Implementation, among several other program organizational influences and outreach and marketing strategies. Several factors for consideration in future broadband program implementation are proposed, based on the results of the evaluation of the TBP Program.

Background

Telehealth is an effective healthcare delivery modality, demonstrating high patient satisfaction that has the potential to increase healthcare access among the patient population in rural and other underserved communities.[1–3] However, telehealth is feasible for healthcare service delivery only when broadband internet is accessible to patients, healthcare providers, and other stakeholders supporting patients residing within those communities.[4] Conducted between 2021 and 2024, the Telehealth Broadband Pilot (TBP) Program aimed to address gaps in broadband service that limited access to telehealth services in rural and other underserved communities. To achieve this aim, the TBP Program sought to identify broadband needs to serve telehealth utilization within 25 specific target counties in Alaska, Michigan, Texas, and West Virginia. TBP Program efforts were led by the National Telehealth Technology Assessment Resource Center (TTAC), housed at the Alaska Native Tribal Health Consortium (ANTHC), which identified Community Lead Partners (CLPs) in each of the four TBP Program target states to lead the efforts to measure internet download speed, upload speed, and latency at regular intervals at locations throughout these communities. Additionally, staff at an external software consultancy firm were contracted to support TBP Program implementation. Henceforth, the term "TBP Program staff" refers to individuals across these organizations and teams. A physical device (henceforth, "pod") and a software implementation of the pod was developed to measure key broadband metrics hourly, including download speed, upload speed, and latency using two different speed testing protocols. The CLPs were tasked with deploying, installing, and maintaining pods throughout the TBP Program target counties, aiming to deploy pods to at least 250 locations throughout the program area.

As part of the evaluation of the TBP Program, a systematic evaluation of the pod deployment efforts was conducted to identify effective implementation strategies and inform any potential future broadband initiatives. Standardized metrics based on the RE-AIM Framework were developed to assess programmatic Reach, Effectiveness, Adoption, Implementation, and Maintenance.[5,6] These metrics help to identify and describe the successful strategies utilized in the TBP Program implementation. These metrics, along with their associated RE-AIM domains and the data source used for each, can be found in Table 1.

Table 1. Evaluation metrics for the TBP Program as mapped to the domains of the RE-AIM framework.

RE-AIM Domain	Metrics	Data Source
Reach	Number of individuals and organizations identified for TBP Program outreach	TBP Program records
Effectiveness	Successful strategies for TBP Program implementation	Semi-structured qualitative interviews with TBP Program staff
Adoption	Number of pods deployed and connected	TBP pod database
Implementation	Facilitators and barriers to TBP Program implementation	Semi-structured qualitative interviews with TBP Program staff
Maintenance	Number of pods collecting at least 100 speed tests over at least 14 unique days of observation	TBP pod database

Methods

Eight semi-structured, qualitative interviews were conducted via video conferencing with TBP Program staff, including staff from TTAC and ANTHC, contractors, and CLP teams to identify TBP Program implementation facilitators and barriers. Interviewees included individuals representing CLP teams from all four TBP Program target states, TBP Program leaders, and multiple contractors who supported TBP Program implementation. Interviews lasted an average of 82.1 minutes (range: 64 and 108 minutes). The interview guide was developed to assess the Effectiveness and Implementation domains of the RE-AIM framework.

Interviews were audio-recorded and transcribed verbatim. Transcripts were uploaded into MaxQDA qualitative analysis software for inductive coding to identify emergent themes and sub-themes regarding facilitators and barriers to the TBP Program implementation. Coding was conducted collaboratively among three coders to establish an initial codebook. Later stages of coding were conducted independently by two of the coders, and discrepancies were resolved through discussion among all three coders. The final codebook emerged through collaborative discussion. A process of member checking was implemented by sharing a draft of initial results with interviewees, and information shared in this process was included in the final reporting of the results.

Additionally, information from the TBP Program records was collected, including records from TTAC, contractors, and CLP teams, to quantify process outcomes and to assess the Reach, Adoption, and Maintenance domains of the RE-AIM framework. Successful deployments (Adoption domain of the RE-AIM framework) and sustained deployments (Maintenance domain of the RE-AIM framework) were assessed using data collected directly from the TBP pods. The study was determined non-human subjects research by the University of Arkansas for Medical Sciences' Institutional Review Board (#262566).

Results

Development of the TBP pods

A decision to build pods was made after a careful review of existing, off-the-shelf technologies that did not meet the needs of the TBP Program. These included the need for pods to be capable of measuring data longitudinally, as well as being secure, highly usable, cost-

effective, and trustworthy. The goal was to create pods that were easy to install, set-up correctly, and support. One option considered was an open source project. However, that project was no longer actively developed or supported at the time of the TBP Program implementation. Additionally, devices supported by that project did not allow for remote management of devices, which would have impeded timely technical support to TBP Program participants. Another option considered was a device developed by a private company for the purpose of longitudinal broadband testing for consumers. The design of this device required all internet traffic at the location to route through the device, which TBP Program leadership anticipated would have created many additional security concerns for healthcare locations, other non-healthcare Community Anchor Institutions (CAIs), and businesses. As a result, the TBP Program developed the open source project Radar which met all of the Program's needs and goals and could be made open source to be shared with others interested in future broadband measurement programs, providing an enduring legacy of the TBP Program. The resulting Radar technology suite included pods, speed testing, and a mobile app.

In-depth security information was provided to potential TBP Program participants, given the known security requirements for healthcare, education, and other sensitive organizational data. As part of TBP Program activities, a pod-specific, web-based interface was also developed where participants could visit to view the data being collected by their installed pod to build and establish trust. Finally, a software version of the pod was developed to address barriers that emerged during program implementation (see Facilitators: TBP Program organization for more information about the software deployment).

Costs of pod deployments

The costs of a pod deployment split by hardware and build, shipping and support, replacement accessories (needed in only some cases, approximately 20%), and overall total can be found in Table 2.

Table 2. Approximate per pod costs for the TBP Program.

Equipment and Services	Unit Cost (without tax)
Hardware and Build	
Raspberry Pi 4B 2GB	$45.00
FLIRC Case	$15.25
Power Supply	$7.15
SD Card	$4.33
Network Cable	$1.25
Build Time Cost	$10.00
Total Cost of Hardware and Build	**$82.98**
Shipping and Support	
USPS Small Flat Rate Shipping Box	$9.55
Average approximate cost of support and replacement (needed in only some cases)	$15.00
Total Cost of Shipping and Support	**$24.55**
Total Cost of Hardware, Build, Shipping, and Support	**$107.53**
Additional Equipment Required for ~20% of Deployments	
Switch	$16.00
Router	$35.00
Power Strip	$9.00
Average cost of additional required accessories required for ~20% of cases	*$4.00*
OVERALL TOTAL Approximate Cost of Hardware, Build, Shipping, Support, and Replacement	**$111.53**

The average overall cost to build a TBP pod, including parts and staff time to build the pod, was $82.98 (taxes excluded). Supply chain issues during late 2022 created challenges in having a stable source of Raspberry Pi devices, and the initial cost of these devices was approximately tripled. This was a major concern for the Program in its early stages; however, ultimately this issue was resolved early in the TBP Program, and higher pricing affected only pods built in the initial stages. As TBP Program staff experienced stable pricing throughout the rest of the TBP Program, the current, standard cost of the Raspberry Pi device is provided. The average cost of shipping and supporting a TBP pod was $24.55. In approximately 20% of TBP pod deployments, additional accessories were required for the pod to successfully connect, record, and transmit data, including switches ($16.00), routers ($35.00), and power strips ($9.00). Assuming the average costs of these accessories across 20% of deployments, the overall total cost of a TBP pod, including hardware, build time, shipping, support, and accessories was $111.53.

Contracted CLP costs of TBP Program implementation

CLP staffing costs include activities such as, but not limited to, identifying and testing individual implementation strategies, outreach and travel to recruit TBP Program participants, pod deployment and follow-up, as well as project administration and support. The pilot nature of the TBP Program allowed TBP staff to explore multiple outreach strategies across all TBP states and target counties. Organizations seeking to replicate the TBP Program based on listed

findings and best practices will likely have a more reduced staffing cost. As can be seen in Table 3, even for CLP teams that traveled extensively to implement an in-person, door-to-door outreach strategy, the largest overall cost to TBP Program implementation was staffing and services.

Table 3. Contracted CLP costs of TBP Program implementation by year, category of expense, and CLP team.

State	Year	Category of expense	Cost
Alaska	2023	Staff, Fringe, Indirect, Services	$102,875.00
		Supplies, Maintenance, Operations, Communications	$0.00
		Travel	$1,363.93
		TOTAL	$104,238.93
	2024	Staff, Fringe, Indirect, Services	$140,250.00
		Supplies, Maintenance, Operations, Communications	$0.00
		Travel	$0.00
		TOTAL	$140,250.00
		OVERALL	**$244,488.93**
Michigan	2022	Staff, Fringe, Indirect, Services	$47,460.70
		Supplies, Maintenance, Operations, Communications	$231.46
		Travel	$0.00
		TOTAL	$47,692.16
	2023	Staff, Fringe, Indirect, Services	$96,271.54
		Supplies, Maintenance, Operations, Communications	$538.47
		Travel	$2,098.61
		TOTAL	$98,908.62
	2024	Staff, Fringe, Indirect, Services	$102,544.10
		Supplies, Maintenance, Operations, Communications	$3,373.35
		Travel	$4,632.29
		TOTAL	$110,549.74
		OVERALL	**$257,150.52**
Texas	2022	Staff, Fringe, Indirect, Services	$160,383.04
		Supplies, Maintenance, Operations, Communications	$13,781.21
		Travel	$1,984.49
		TOTAL	$176,148.74
	2023	Staff, Fringe, Indirect, Services	$405,774.42
		Supplies, Maintenance, Operations, Communications	$12,444.12
		Travel	$12,573.59
		TOTAL	$430,792.13
	2024	Staff, Fringe, Indirect, Services	$120,081.92
		Supplies, Maintenance, Operations, Communications	$1,328.40
		Travel	$914.56
		TOTAL	$122,324.88
		OVERALL	**$729,265.75**
West Virginia	2023	Staff, Fringe, Indirect, Services	$46,257.34
		Supplies, Maintenance, Operations, Communications	$14,133.00
		Travel	$3,247.91
		TOTAL	$63,638.25
	2024	Staff, Fringe, Indirect, Services	$102,766.21
		Supplies, Maintenance, Operations, Communications	$6,510.62
		Travel	$8,375.95
		TOTAL	$117,652.78
		OVERALL	**$181,291.03**
		GRAND TOTAL OVERALL	**$1,412,196.23**

Implementation Strategies and Reach

Alaska Implementation Strategies and Reach

The six TBP Program target county-equivalents for the state of Alaska were the Aleutians West Census Area, Bristol Bay Borough, Dillingham Census Area, Nome Census Area, North Slope Borough, and Northwest Arctic Borough. A map of the Alaskan TBP Program target counties and the location of the organization contracting the Alaska CLP team can be found in Figure 1.

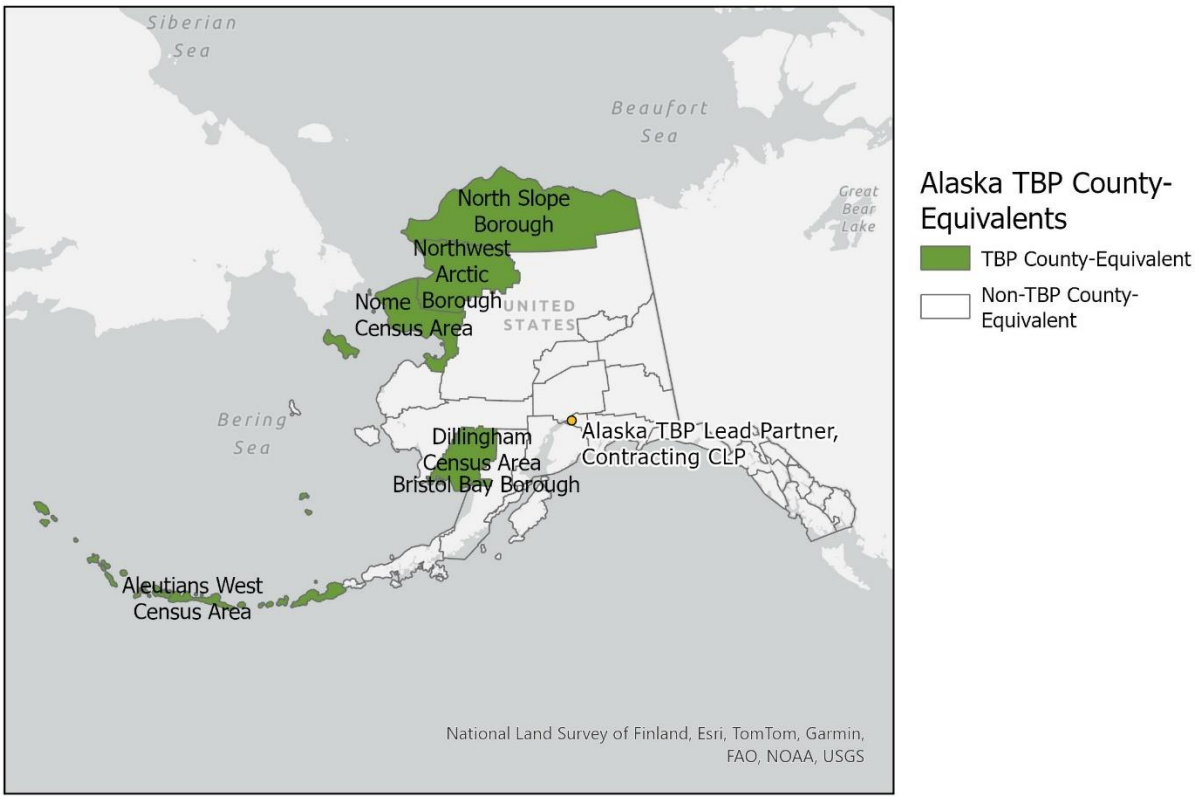

Figure 1. Map of the six Alaska TBP target county-equivalents and the TBP lead organization that contracted the Alaska CLP team.

The Alaska CLP team was contracted through the lead TBP Program implementation organization TTAC, which is affiliated with ANTHC, located in Anchorage, Alaska. TTAC, ANTHC, and the contracted Alaska CLP team all had existing relationships, networks, and partners located throughout the state and within the TBP target geographies. The Alaska CLP team had previously lived and worked in Alaska, including in some of the Alaska TBP target county-equivalents. Additionally, TTAC had strong existing relationships and networks in healthcare throughout Alaska, including some located in the TBP target county-equivalents.

For TBP Program implementation, the Alaska CLP team was not able to travel directly to the Alaska TBP Program target county-equivalents because of the high cost of travel required due to the geography and remoteness of the state (e.g., by plane), so they worked closely with TTAC to identify and recruit existing partner organizations and other potential Program participants. These efforts involved approximately 140 meetings, 4,400 phone calls, and more

than 600 emails, resulting in contact with more than 350 businesses, 10 school districts, and 12 Tribal Health Organizations (THOs) (Reach). An estimated 2,200 CLP person-hours were spent on TBP Program implementation. These efforts led to successful pod deployments at 59 locations (Adoption), with 52 of those locations recording at least 100 observations across 14 unique days of data collection (Maintenance), including:

- 49 healthcare locations (42 with ≥ 100 tests and ≥ 14 days of data collection)
- 5 consumer locations (5 with ≥ 100 tests and ≥ 14 days of data collection)
- 4 non-healthcare CAI locations (4 with ≥ 100 tests and ≥ 14 days of data collection)
- 1 business location (1 with ≥ 100 tests and ≥ 14 days of data collection)

Michigan Implementation Strategies and Reach

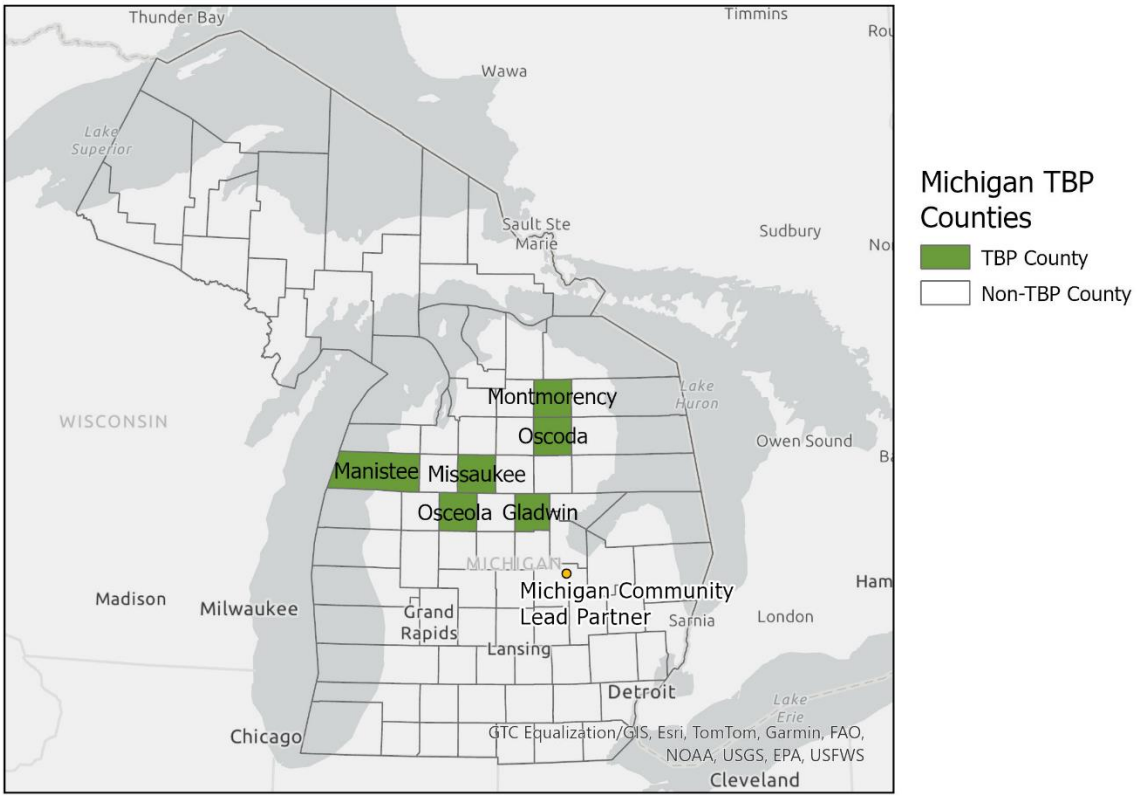

Figure 2. Map of six Michigan TBP Program target counties and the Michigan CLP organization.

The six Michigan TBP Program target counties were: Gladwin County, Manistee County, Missaukee County, Montmorency County, Osceola County, and Oscoda County. The Michigan CLP team was established through a collaboration between the Office of Information Technology and the Rural Health Equity Institute at Central Michigan University, an academic institution located south of the Michigan TBP program's target counties. A map of the Michigan TBP Program target counties and the location of the Michigan CLP organization location can be found in Figure 2. The Michigan CLP team had few existing relationships and networks with organizations that had sites located in the TBP Program target counties. The nearest TBP Program community to the Michigan CLP organization was Beaverton in Gladwin County

(approximately 54 miles away, or a 49-minute drive), and the farthest community was Manistee in Manistee County (approximately 154 miles away, or a two-hour and 28-minute drive).

The Michigan CLP team used a variety of implementation strategies over the course of the TBP Program, resulting in multiple metrics to assess Reach. Initially, the Michigan CLP team leveraged existing relationships and networks to recruit participants for the TBP Program. The team also contacted chambers of commerce and library associations to connect with members working in 1 of the 6 Michigan target counties. Later, the team conducted targeted outreach to 63 non-healthcare CAIs, including chambers of commerce, libraries, library associations, schools, and non-profit organizations. The team also attended 10 rural health and other health-related conferences, where 10 potential participants expressed interest. Despite these efforts, no healthcare organizations in the six TBP target counties in Michigan agreed to participate in the TBP Program.

Several strategies used by the Michigan CLP team took the form of direct or indirect outreach to participants. In total, the team conducted 6 outreach campaigns:

1. Direct outreach to targeted healthcare organizations located in TBP target counties, including 17 healthcare organizations, all of which were contacted multiple times.
2. Online outreach to consumers located in TBP target counties, yielding 16 users expressing interest in the Program from 1 social media post (Link to social media post 1).
3. Social media recruitment, which reached 7,378 users, generating 257 visits to the Michigan TBP Program website and 12 users expressing interest in Program participation.
4. Email outreach to a CLP organization alumni list with primary residence addresses located in TBP target counties, which included 1,776 individuals.
5. Two stories on local public radio stations (Link to story 1 in June 2023; Link to story 2 in February 2024), 1 of which was further covered by several local news outlets with coverage in Manistee County (Link to story 1 in June 2023; Link to story 2 in November 2023).
6. Promotion through a CLP organizational newsletter, yielding 11 individuals expressing interest in participating.

Additionally, the CLP team conducted a week-long, intensive in-person recruitment drive, first examining possible business locations within TBP communities using an online mapping application, and assessing recruitment potential by evaluating the number of business reviews. Once on site, the team spoke to staff and patrons to identify business locations that were frequented by residents, such as coffee shops and ice cream parlors. This approach helped identify the best locations to encounter locals as opposed to tourists, as only individuals with a primary residence in a TBP target county were eligible to participate in the Program. The Michigan CLP team then worked with those businesses to set up an outreach station to recruit potential participants. A one-week field visit implementing these strategies in Manistee, Missaukee, Montmorency, and Oscoda Counties identified 44 consumer prospects (Reach) who expressed interest in the Program. Thirty-nine of the 44 participants (89%) accepted and activated a pod (Adoption). Throughout all in-person recruitment, the Michigan CLP team drove 1,601 miles.

An additional small business cold-calling campaign was conducted, targeting 332 small businesses (Reach) located in Missaukee County that were identified using an online mapping

application. TBP staff made 428 contact attempts to these businesses via phone, yielding 18 potential participants (Reach).

Across the 6 Michigan TBP counties, these combined efforts yielded successful pod deployments at 83 locations (Adoption). Of these, 78 had at least 100 observations across 14 unique days of data collection (Maintenance):

- 0 healthcare locations (0 with ≥ 100 tests and ≥ 14 days of data collection)
- 67 consumer locations (64 with ≥ 100 tests and ≥ 14 days of data collection)
- 4 non-healthcare CAIs (3 with ≥ 100 tests and ≥ 14 days of data collection)
- 12 business locations (11 with ≥ 100 tests and ≥ 14 days of data collection)

Texas Implementation Strategies and Reach

The six Texas TBP Program target counties were: Crosby County, Fisher County, Haskell County, Jones County, Lamb County, and Mitchell County. The CLP team in Texas was contracted to Texas Tech University Health Sciences Center in Lubbock, TX. The Texas CLP team did not have pre-existing close relationships, networks, or partnerships with individuals or organizations located in the six Texas TBP Program target counties. A map of the Texas TBP Program target counties and the location of the Texas CLP organization location can be found in Figure 3. The nearest TBP Program community to the Texas CLP organization was Lorenzo, TX, in Crosbyton County (approximately 23 miles away, or a 25-minute drive), and the farthest community was Lueders, TX, in Jones County (approximately 168 miles away, or a two-hour and 34-minute drive).

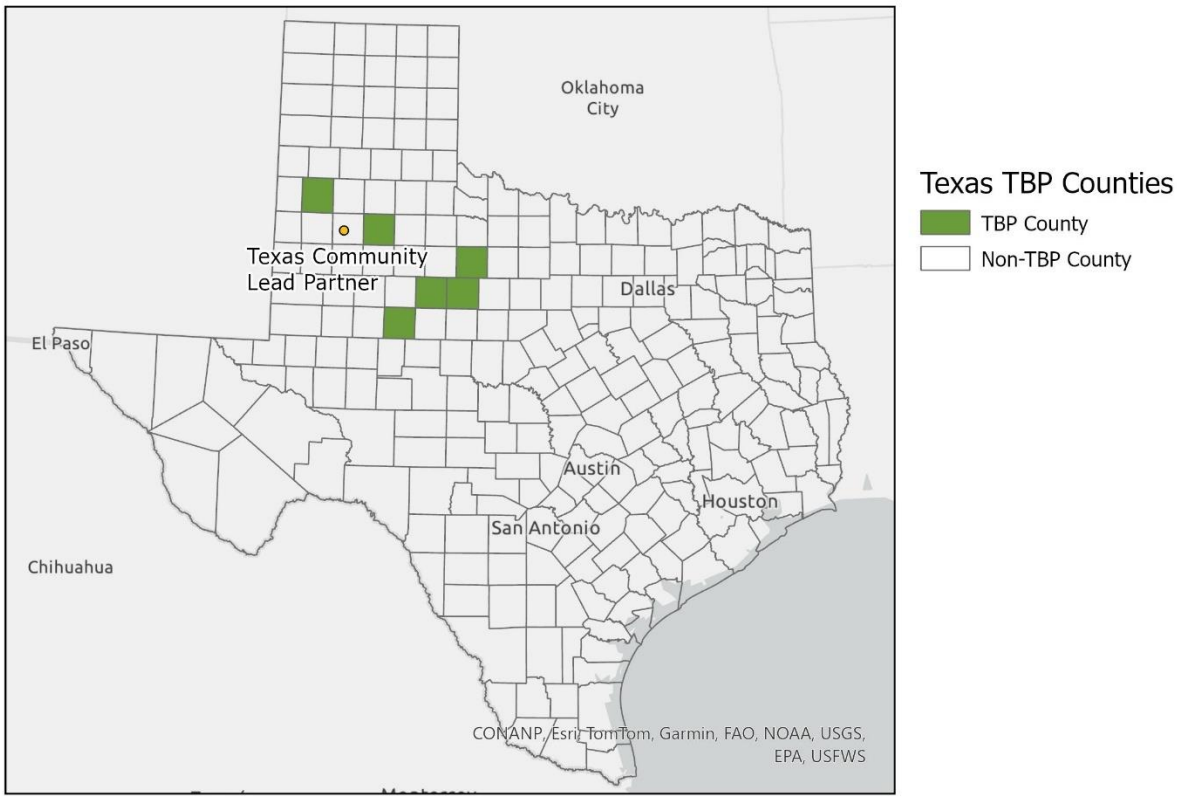

Figure 3. Map of six Texas TBP Program target counties and the Texas CLP organization.

The Texas CLP team used an initial approach of identifying possible pod outreach sites using an online mapping application to identify potential sites for pod deployment outreach within specific communities, focusing on one of the six Texas TBP Program target counties at a time, including healthcare organizations, non-healthcare CAIs, and business locations. The Texas CLP team found that a snowball recruitment strategy was effective within the TBP Program communities, allowing them to leverage successful pod deployments to facilitate additional deployments. Focusing outreach efforts within one TBP Program target county at a time proved to be the most effective and efficient strategy to yield additional deployment sites. After reaching saturation, the Texas CLP team would move to another TBP Program community and restart this outreach strategy.

Through this process, the Texas CLP team identified the following potential locations for TBP Program recruitment (Reach):

- 24 healthcare sites
  - Such as hospitals, family medicine clinics, nursing homes, rehabilitation centers, home health organizations, pharmacies, and dental practices
- 105 non-healthcare CAIs
  - Such as schools, churches, community organizations, museums, radio stations, and government offices
- 201 businesses

All 330 of these locations were contacted about participating in the TBP Program using a variety of strategies including email, phone, and in-person outreach. Initially, the CLP team contacted identified sites via email or phone, then driving to the communities if a site committed to learn more about the TBP Program. However, the CLP team later modified this policy when they discovered that a boots-on-the-ground, door-to-door outreach approach worked well in these communities even without initial email or phone contact. These strategies proved effective in reaching healthcare sites, businesses, and non-healthcare CAIs in the six TBP target counties in Texas (see Facilitators: Outreach and marketing strategies section for additional information). In total, throughout all in-person, door-to-door recruitment, the Texas CLP team drove approximately 8,900 miles.

Across the six Texas TBP Program target counties, these efforts yielded successful pod deployments at 179 locations (Adoption). Of these, 168 had at least 100 observations across 14 unique days of data collection (Maintenance):

- 14 healthcare locations (13 with ≥ 100 tests and ≥ 14 days of data collection)
- 21 consumer locations (21 with ≥ 100 tests and ≥ 14 days of data collection)
- 86 non-healthcare CAI locations (78 with ≥ 100 tests and ≥ 14 days of data collection)
- 58 business locations (56 with ≥ 100 tests and ≥ 14 days of data collection)

West Virginia Implementation Strategies and Reach

The seven West Virginia TBP Program target counties were: Calhoun County, Clay County, Jackson County, Kanawha County, Nicholas County, Ritchie County, and Roane County. A map of the seven West Virginia TBP Program target counties and the location of the West Virginia CLP organization location can be found in Figure 4.

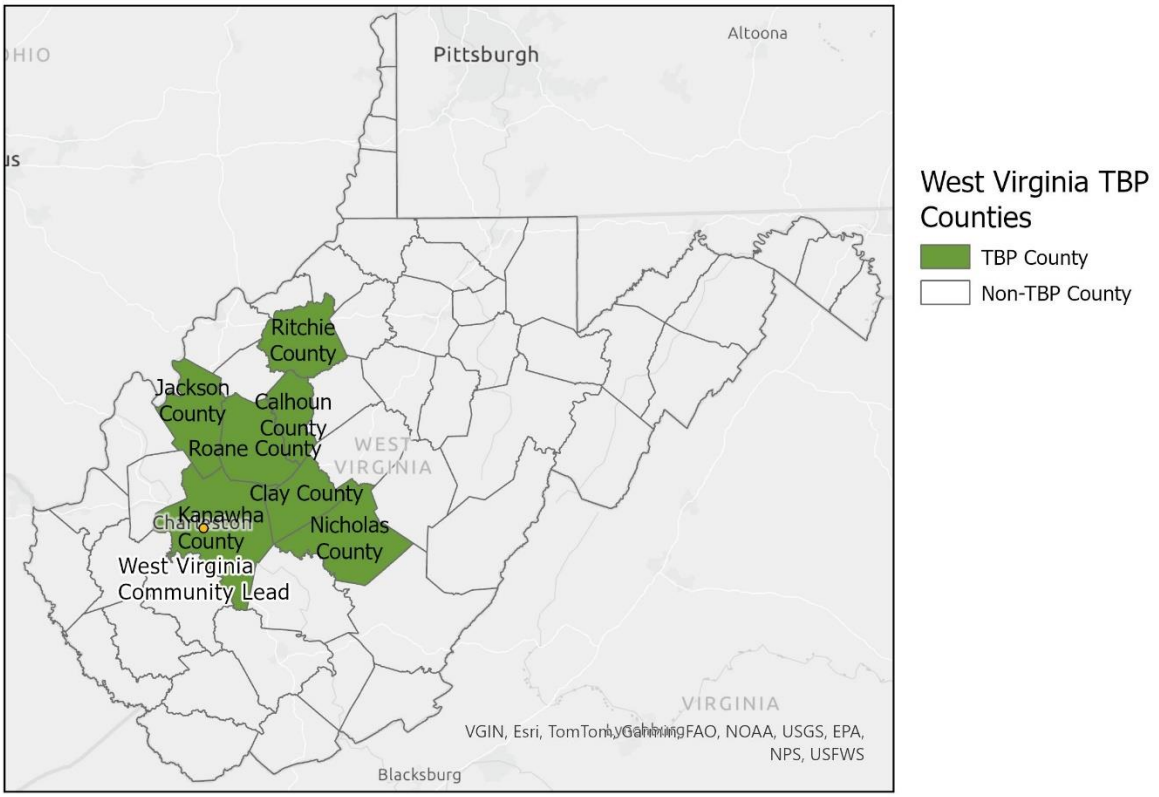

Figure 4. Map of seven West Virginia TBP Program target counties and the West Virginia CLP organization.

In West Virginia, TTAC contracted the West Virginia Primary Care Association, a provider-focused, non-profit healthcare organization, as the CLP team. This team had existing relationships and networks with many healthcare organizations throughout the state, including:

- Calhoun County: 4 health centers or clinics, 4 School-Based Health Centers
- Clay County: 1 health center or clinic, 5 School-Based Health Centers
- Jackson County: 2 health centers or clinics, 1 School-Based Health Center
- Kanawha County: 25 health centers or clinics, 10 School-Based Health Centers
- Nicholas County: 6 health centers or clinics, 6 School-Based Health Centers
- Roane County: 1 health center or clinic, 0 School-Based Health Centers
- Ritchie County: 1 health center or clinic, 4 School-Based Health Centers

The West Virginia CLP team leveraged existing relationships and networks with these and other known healthcare locations to recruit organizations to participate in the TBP Program as their primary recruitment strategy. Across the seven West Virginia TBP Program target counties, these efforts yielded successful pod deployments at 104 locations (Adoption). Of these, 80 had at least 100 observations across 14 unique days of data collection (Maintenance):

- 28 healthcare locations (21 with ≥ 100 tests and ≥ 14 days of data collection)
- 53 consumer locations (42 with ≥ 100 tests and ≥ 14 days of data collection)
- 6 non-healthcare CAI locations (4 with ≥ 100 tests and ≥ 14 days of data collection)

- 17 business locations (13 with ≥ 100 tests and ≥ 14 days of data collection)

Centralized Implementation Strategies and Reach

To supplement efforts to reach individual consumer homes for pod deployments, the TBP Program lead organization and its contracted staff developed and utilized several additional implementation strategies that were implemented across multiple TBP Program target states. First, a target of 25 locations per target county or county-equivalent was set as a pod deployment goal for all CLP teams. Additionally, mailers were developed and sent out to residents of the TBP Program target counties, with an invitation to learn more about participating in the TBP Program by scanning a QR code or by reaching out directly to the CLP team. In both Texas and West Virginia, CLP teams conducted their own mailing campaigns for TBP Program recruitment, using their own internally-developed strategies, which is also reported here. These efforts resulted in the following Reach:

- Alaska: 1,374 mailers printed (2 QR code scans, 0.1%)
- Michigan: 7,022 mailers printed (34 QR code scans, 0.5%)
- Texas
  - Phase 1 (CLP-led implementation): 3,000 mailers printed (98 QR code scans, 3.3%)
  - Phase 2 (centralized implementation): 1,372 mailers printed (5 QR code scans, 0.4%)
- West Virginia
  - Phase 1 (CLP-led implementation): 3,500 mailers printed (2 responses, 0.06%)
  - Phase 2 (centralized implementation): 2,002 mailers printed (7 QR code scans, 0.3%)

A speed test widget designed to collect one-time speed test measurements was also developed and embedded in multiple online locations. Users who completed a speed test were invited to complete a contact form to facilitate follow-up and recruitment to participate in the TBP Program. These efforts yielded the following Reach:

- TTAC (Alaska-based) website: 20 speed tests, 6 participation interest forms completed (30.0%)
- Alaska radio station: 19 speed tests, 9 participation forms completed (47.4%)
- Michigan CLP TBP Program website: 96 speed tests, 54 participation interest forms completed (56.3%)
- Northwest Regional Telehealth Resource Center (which serves a seven-state region, including Alaska) website: 22 speed tests, 1 participation interest form completed (4.5%)
- Texas CLP TBP Program website: 10 speed tests, 1 participation interest form completed (10.0%)
- Software contractor (based out of Washington state) website: 312 speed tests, 13 participation interest forms completed (4.2%)

An initial, externally-led cold calling campaign was initiated for TBP Program recruitment. This campaign piloted cold calling campaign to recruit consumers located within the 25 TBP Program target counties of the TBP Program and to set a benchmark for cold calling campaign performance. These learnings informed the building of an internal TBP Program cold calling campaign, which yielded the following Reach and Adoption metrics (note that the number of calls made during this campaign was unavailable to TBP Program staff, due to the external nature of those records):

- Michigan
  - Pod requests: 23 (Reach)
  - Confirmed pod activations: 5 (Adoption)
- Texas
  - Pod requests: 3 (Reach)
  - Confirmed pod activations: 0 (Adoption)
- West Virginia
  - Pod requests: 44 (Reach)
  - Confirmed pod activations: 2 (Adoption)

The subsequent internally-led cold calling campaign informed by the externally-led campaign was conducted across all four TBP Program target states. This cold-calling campaign involved systematic outreach to known residents of the 25 TBP Program target counties by phone to discuss potential participation in the TBP Program. These efforts yielded the following Reach measures:

- Alaska: 494 contacts called, 6 receptive to program participation (1.2%)
- Michigan: 1,033 contacts called, 11 receptive to program participation (1.1%)
- Texas: 140 contacts called, 1 receptive to program participation (0.7%)
- West Virginia: 2,595 contacts called, 64 receptive to program participation (2.5%)

Overall Number of Pods Deployed and Included for Analysis

The overall 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 (i.e., measures of Maintenance).

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

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**
OVERALL	76	89	81	132	**378**

TBP Program Facilitators

A summary of the emergent facilitators of TBP Program Implementation and Effectiveness can be found in Table 5.

Table 5. Emergent facilitators of TBP Program Implementation and Effectiveness identified through qualitative interviews with TBP Program staff.

Category	Theme	Sub-Theme
Perceived Value Proposition	Generating data and information	
	Providing participation incentives	
	Addition of an intervention component	
Program Organization	Centralizing the approach	
	Building diverse CLP teams and skill sets	
	Designing easy-to-use and adaptable technology	Creating technologies that were easy for a user to set-up
		Developing a software implementation of the TBP pod
	Setting clear, achievable goals	
Outreach and Marketing Strategies	Finding community champions	
	Snowballing participation within communities	
	Identifying and recruiting large CAI participants	
	Persistence among staff implementers	
	Including a value proposition in outbound messaging	
	Utilizing multiple outreach and marketing strategies	Adapting outreach strategies to resolve challenges
		Tailoring outreach strategies depending on the audience
		Tailoring implementation (e.g., testing schedule) to address participant concerns
	Leveraging existing relationships and networks for program recruitment	
	Utilizing an in-person, door-to-door approach	
	Conducting an expert-led cold-calling campaign	
Trust	Establishing trust with potential participants	
	Recognition of CLP organization brand	
	Providing evidence of legitimacy to combat privacy and security concerns	

Facilitators: Perceived value proposition

All TBP Program staff interviewees identified the **perception of a value proposition** (i.e., a direct benefit to the individual or organization participating) among TBP Program participants as a facilitating influence on TBP Program Implementation and Effectiveness. Examples of a value proposition to potential participants included **generating data and**

information, **providing participation incentives**, and the **addition of an intervention component**. TBP Program staff recognized that when potential TBP Program participants perceived value in participating in the TBP Program, they were more likely to be interested and participate in the TBP Program. For example, providing home broadband or subsidizing the cost of a consumer's home broadband for a fixed duration likely would have been perceived as a direct benefit to potential TBP Program participants and facilitated recruitment. **Generating data and information** from participation was another example of this value proposition described by TBP Program staff as facilitating program implementation. For example, one TBP Program staff member described an instance when TBP Program participants perceived value in collecting regular broadband measurements. In this case, TBP Program collected data were used to assess and document a perceived issue with a broadband connection. Participants at the TBP Program location perceived poorer broadband quality when it was raining, but by the time ISP support could visit the site to investigate, the rain had stopped, and the issue was no longer present. In this example, having pod measurements allowed this participant to more accurately demonstrate their broadband issues. Other TBP Program staff described **providing participation incentives** as an example of a value proposition with a facilitating influence, motivating more individuals and organizations to participate. Finally, the **addition of an intervention component** to the TBP Program was described by TBP Program staff as an example of value proposition that facilitated TBP Program Implementation and Effectiveness. One TBP Program staff member described how the added TBP Program intervention component created value for potential participants. Beginning in July 2024, the TBP Program staff began identifying sites in need of technical assistance and tailored intervention approaches based on the identified needs. TBP staff assisted with such issues as excessive outages, high retransmission, high speed test variance, slower than average latency, rate limiting, speeds too slow for telehealth, and unexpectedly slow available speeds. TBP Program staff noted that offering direct intervention not only engaged and motivated potential participants but also encouraged their participation in the TBP Program.

Facilitators: TBP Program organization

Several **structural components of the TBP Program** were identified by TBP Program staff as facilitating TBP Program Implementation and Effectiveness. **Centralizing the approach to TBP Program implementation** was identified by staff as facilitating program Implementation and Effectiveness. TBP Program staff described how centralizing resources and tools reduced the CLP teams' workload and increased the quality of public-facing outreach materials, particularly after CLP teams had exhausted recruitment of TBP Program participants through their existing relationships and networks. Another facilitating influence on the TBP Program Implementation and Effectiveness identified by TBP Program staff was **building diverse CLP teams and skill sets**. One TBP Program staff member described how TBP Program implementation teams needed not only technical broadband expertise but also experience in marketing and outreach. Another example of this influence came from a TBP Program staff member who described the importance of a diverse skill set among CLP teams based on Program needs, such as challenges in simultaneously handling both new participant recruitment and follow-up with current participants whose pods had gone offline. Another facilitating influence identified by TBP Program staff on program implementation at the level of the TBP Program structure involved **designing an easy-to-use and adaptable technology**, including *creating technologies that were easy for a user to set-up* and *developing a software implementation of the TBP pod*. TBP Program staff described how *creating technologies that*

were as easy as possible for a user to set-up was a key facilitating influence among technical decisions made at the level of the structure of the program, particularly for pods, as it minimized troubleshooting needs for TBP Program participants. *Developing a software implementation of the TBP pod* also facilitated TBP Program Implementation and Effectiveness. The software implementation was developed in response to several observed challenges to TBP Program implementation, such as delays in shipping of physical devices in Alaska and difficulty of identifying individuals able to plug in a device at many remote locations. The software implementation solved both challenges by eliminating the need for physical shipping and allowing for remote deployment by individuals outside of the remote locations. The software implementation was particularly successful at Alaskan healthcare locations. In another example of this influence, some sites identified for possible TBP Program implementation had concerns about privacy and security (see Barriers: Lack of trust section), and the software implementation allayed those concerns for some potential TBP Program participants. Another facilitating influence on TBP Program Implementation and Effectiveness described by TBP staff was **setting clear, achievable goals. T**BP Program staff emphasized the importance of ensuring that all partners were aware of and agreed upon TBP Program goals, even if adjustments became necessary over time.

Facilitators: Outreach and marketing strategies

TBP Program staff identified several TBP Program **outreach and marketing strategies** that facilitated TBP Program Implementation and Effectiveness. **Finding a community champion** was identified by some TBP Program staff as a facilitator for TBP Program Implementation and Effectiveness. For example, one CLP team described how finding the right person in one community facilitated multiple pod deployments within a TBP community. Additionally, identifying a possible participant at the right level of a hierarchical organization was also identified as a facilitator of TBP Program Implementation and Effectiveness. Lower-level staff within organizations considering TBP Program participation did not always have sufficient decision-making power to consent to TBP Program participation. In contrast, high-level organization staff sometimes had too many competing priorities to have sufficient time to learn about the TBP Program and consider participation. **Snowballing participation within a community** was also described by TBP Program staff as a facilitator for TBP Program Implementation and Effectiveness. For example, TBP Program staff described leveraging new local relationships within a TBP community to engage potential TBP Program participants, particularly if they knew other TBP Program participants. TBP Program staff also described **identifying and recruiting large CAI organization participants** as facilitating TBP Program Implementation and Effectiveness. For example, one CLP team engaged school districts as program participants, which increased TBP Program participation early on as pods were deployed to multiple schools. Additionally, TBP Program staff described **persistence among staff implementers** as a key facilitating influence in TBP Program success, as TBP Program staff were repeatedly told “no” when reaching out to potential TBP Program participants.

Another outreach and marketing facilitator for TBP Program Implementation and Effectiveness identified by TBP Program staff was **including a value proposition in outbound messaging**. As discussed above, the perception of a value proposition (see Facilitators: Perceived value proposition) was a facilitating influence in TBP Program Implementation and Effectiveness; thus, the communication of the value proposition for participating in the TBP Program was key. TBP Program staff also described how **utilizing multiple outreach and marketing strategies** facilitated TBP Program Implementation and Effectiveness, including

adapting outreach strategies to resolve challenges, *tailoring outreach strategies depending on the audience*, and *tailoring TBP implementation to address participant concerns*. TBP staff described needing to *adapt outreach strategies to resolve multiple implementation challenges*. For example, one TBP Program staff member described finding information available online about TBP communities frequently out of date, such as businesses that had permanently closed or new businesses without an online presence. The lack of accurate information available online hindered the process of identifying potential TBP Program participants, making outreach conducted over the phone or email less effective. TBP Program staff also described several examples of improvements made to the language of outreach materials, which improved TBP Program recruitment. TBP Program staff also described how *tailoring outreach strategies depending on the target audience* facilitated TBP Program participation. For example, one TBP Program staff member described tailoring their recruitment strategies to potential TBP Program participants, explaining the importance of bringing down the cost of local broadband when speaking to business owners and highlighting the importance of making tele-mental health services more widely available when talking to leaders of a school district. Another facilitator identified by TBP Program staff for using multiple outreach and marketing strategies was *tailoring the implementation to address participant concerns*. Specifically in Alaska, some potential TBP Program participants were interested in the program but had concerns about deploying a pod on their network that would run hourly speed tests, given their limited bandwidth.

Another facilitating influence in outreach and marketing strategies identified by TBP Program staff on TBP Program Implementation and Effectiveness was **leveraging existing relationships and networks for TBP Program recruitment**. Virtually all TBP Program implementers described leveraging existing relationships they had in TBP Program target counties to facilitate TBP Program recruitment. For example, the West Virginia CLP organization's existing relationships with health centers, clinics, and school-based health centers facilitated recruitment of healthcare location participants. However, although this strategy generated an initial surge in TBP Program participation, these networks were quickly exhausted, and other recruitment strategies had to be pursued. However, the level of influence this facilitator had for each CLP team varied depending on the natural overlap of their existing networks and the TBP Program target geographies, which were not identical in any CLP case (see Barriers: Outreach and marketing strategies). TBP Program staff also identified **utilizing an in-person, door-to-door approach** as facilitating TBP Program Implementation and Effectiveness, particularly for business location participants. For example, one TBP Program staff member described the need to recruit TBP Program participants in-person, explaining how the members of the TBP communities preferred face-to-face interactions. However, the in-person, door-to-door approach was described by TBP Program staff as most effective in recruiting small businesses and consumers to participate but less effective in recruiting healthcare locations. **Conducting an expert-led cold-calling campaign** was also used in TBP Program implementation, and this approach was described as facilitating TBP Program participation in some instances. TBP Program staff described how a targeted call center staffed by individuals with outreach experience was successful in recruiting TBP Program participants. However, additional challenges with the call center implementation for the TBP Program are later described in Barriers: Outreach and marketing strategies.

Facilitators: Trust

According to TBP Program staff, TBP Program Implementation and Effectiveness was heavily influenced by **trust**. **Establishing trust with potential participants** was described by nearly all TBP Program staff as facilitating TBP Program Implementation and Effectiveness. This influence included trust between potential TBP Program participants and the members of the CLP team, as well as between the participants and the CLP team's organization. An in-person approach to outreach and marketing (also identified above in Facilitators: Outreach and marketing strategies as a facilitator to TBP Program implementation) also helped facilitate trust with potential TBP Program participants. TBP Program staff described how many potential TBP Program participants had concerns about falling victim to scams, explaining that speaking to an individual in-person reduced those concerns. In another example of this influence, TBP Program staff explained how they established trust with potential participants by demonstrating what TBP Program data were collected. **Recognition of a CLP organization brand** was also described by TBP Program staff as a facilitating influence that built trust with potential TBP Program participants and facilitated TBP Program Implementation and Effectiveness. For example, one TBP Program staff member described how using their CLP organization's brand on the vehicles they drove helped to establish trust, confirm who they were and who they worked for, and ultimately facilitate TBP Program participation. TBP Program staff also identified how **providing evidence of legitimacy to combat privacy and security concerns** among potential TBP Program participants—consumers, business owners, and Chief Information Officers (CIOs) of healthcare systems alike—facilitated TBP Program Implementation and Effectiveness. For example, TBP Program staff described how addressing privacy and security concerns was critical for participation from healthcare organizations in the TBP Program, whose Information Technology (IT) professionals must ensure their networks remain secure. TBP Program staff also described how having high-quality outreach materials inspired confidence and trust in the TBP Program among potential participants.

TBP Program Barriers

A summary of the emergent barriers for TBP Program Implementation and Effectiveness can be found in Table 6.

Table 6. Emergent barriers to TBP Program Implementation and Effectiveness identified through qualitative interviews with TBP Program staff.

Category	Theme	Sub-Theme
Perceived Lack of Value Proposition	Lack of a perceived benefit for TBP Program participation	
	Lack of interest in participating	
Program Structure	Geographic limitations of counties included in TBP Program scope	Participant pool limited in TBP target counties
		Participants in TBP target counties not necessarily representative of all rural broadband and telehealth challenges in TBP target states
		Interested potential participants outside of TBP target counties unable to participate
		Long travel times required to reach some TBP target counties

	Reprioritization based on changes in allowable program activities	Reprioritization of recruitment efforts with addition of TBP expansion counties Late reprioritization from measurement to intervention focus for the TBP Program
	Perceived lack of clarity in program goals	
	Urgent priorities for state broadband offices deprioritizing connection with TBP Program	
	Variation in organizational approval and review processes	
Program Organization	De-centralized approach	Each CLP team creating their own tools and resources
	Staffing challenges	Difficulty identifying staff and CLP teams with access to the correct balance of necessary skill sets Staffing changes TBP staff being spread too thin
	Low digital literacy among existing TBP Program participants	Participants lacking technical knowledge to install a pod on their own
	Delays in identifying and implementing effective solutions	
Outreach and Marketing Strategies	General resistance to program participation	
	Low digital literacy among potential TBP Program participants	Participants lacking technical knowledge to understand their broadband challenges and needs
	Lack of centrally-developed and tested language and materials for outreach and marketing	
	Ineffectiveness of some strategies across participants and communities	In-person, door-to-door approach being less effective for healthcare deployments
	Lack of a community champion	Anti-champions hindering program participation
	Insufficient existing relationships and networks to maximize participation	Existing relationships and networks not always facilitating TBP Program participation CLP teams quickly exhausting existing relationships and networks
	Non-expert cold-calling center yielding few participants	
	Resource intensiveness of program recruitment and follow-up	In-person outreach being effective but resource intensive CLP teams investing resources into TBP Program recruitment with little or no result
Lack of Trust	Concerns from potential TBP Program participants about privacy and security	

Barriers: Perceived lack of value proposition

All TBP Program staff interviewees identified **a perceived lack of a value proposition** for potential TBP Program participants as a barrier to TBP Program Implementation and Effectiveness. Most TBP Program staff members described instances of **a lack of a perceived benefit for TBP Program participation** in the TBP Program as a barrier to TBP Program Implementation and Effectiveness. TBP Program staff described how potential TBP Program participants did not perceive a direct benefit to themselves for participating and were thus uninterested in TBP Program participation. Despite efforts from CLP teams to describe the benefit of TBP Program participation to their overall community, the lack of a perceived direct benefit to the participant was identified as a barrier. Providing home broadband or subsidizing the cost of home broadband to consumers was identified by TBP Program staff as a possible strategy that would have demonstrated a value proposition for some potential TBP Program participants and facilitated recruitment. Additionally, TBP Program staff also identified a general **lack of interest in participating** in the TBP Program as a barrier to TBP Program Implementation and Effectiveness. For example, one TBP Program staff member described this barrier, saying, “A lot of people are just not engaged in this problem. They are content with the level of service they receive.”

Barriers: TBP Program structure

TBP staff members described several barriers to TBP Program Implementation and Effectiveness related to TBP Program structure. **Geographic limitations of counties included in TBP Program scope** was one such barrier identified by TBP staff, including the *participant pool being limited in TBP Program target counties*. Because most of the TBP Program target counties were rural, many of these counties had few communities, organizations, and residents to contact, limiting the potential participant pool. Another influence described by TBP Program staff related to geographic limitation barriers was that *participants in TBP Program target counties were not necessarily representative of all rural broadband and telehealth challenges in TBP Program target states*. For example, one TBP Program staff member described how one of the TBP Program target counties had only one health center. Although the health center’s participation in the TBP Program provided valuable insights, it did not fully represent the state of broadband and healthcare in that county. According to the interviewee, additional healthcare locations were needed to better serve that county’s residents. Another TBP Program staff member noted that although broadband challenges varied across their state, data collected from only six counties could not capture the full scope of statewide broadband issues. In another example of this barrier, a TBP Program staff member described how willing participants in one TBP Program target county did not represent those in the state with the biggest broadband needs. This interviewee expressed concerns that TBP Program participants from one target county were heavily recruited from more affluent areas of the county, and that some county residents could not participate in the TBP Program because they could not receive broadband service at their home, and thus had no connection to measure. Another geographic barrier identified by TBP Program staff was that many *interested potential TBP Program participants outside of TBP Program target counties were unable to participate*. TBP Program staff members described interest from individuals and organizations in TBP Program participation who were not able to participate because they were located outside of the 25 TBP Program target counties (see Box 1 for an example).

TBP Program staff also described how they felt they would have been able to increase TBP Program participation by leveraging their existing relationships and networks (identified as a facilitating influence in the Facilitators: Outreach and marketing strategies section) more if individuals and organizations outside of the TBP Program target counties could have participated. A final geographic barrier identified by TBP Program staff was that there were *long travel times required to reach some TBP Program target counties*. As described in the Facilitators: Outreach and marketing strategies section, an in-person, door-to-door approach was identified by some CLP teams as effective at recruiting participants to the TBP Program. However, this facilitator was influenced by the CLP team's ability to travel to these target counties. For example, many communities in TBP Program target counties required a multi-hour drive one-way, limiting how much recruitment could be conducted between the drive to and from the community within a workday. This barrier of long and expensive travel times to TBP Program target counties was such an issue in Alaska that it prevented implementation of in-person TBP Program implementation strategies, as all of the TBP communities were inaccessible by larger road systems and required an expensive charter flight to reach.

Box 1. Example quote—Geographic limitations of counties included in TBP Program scope, interested potential TBP participants outside of TBP target counties were unable to participate

"In [TBP target county], we placed one [pod] in a business, and they were wanting to place one in [the owner's] home. And it was down in a canyon, and it was just…outside our [target] county. But they said they get terrible reception down there, and he says…because he does all his finance for the business at home, he has to do it 6:00 AM or 10:00 PM. Because in between 6:00 and 10:00—it's not zero, but it's so slow and so laggy, he can't even operate a simple [payroll] software on his computer."

Reprioritization based on changes in allowable program activities was also identified as a barrier to TBP Program implementation by TBP Program staff, including specifically *reprioritization of recruitment efforts with addition of TBP Program expansion counties* and *late reprioritization from measurement to intervention focus for the TBP Program*. The *reprioritization of recruitment efforts with the addition of TBP Program expansion counties* was identified by TBP Program staff as a barrier to program implementation. During the course of TBP Program implementation, the counties included in the program scope expanded to include not just the original 25 target counties, but any places within the four TBP Program target states designated rural by the Health Resources and Services Administration (HRSA).[7] For example, one TBP Program staff member described shifting recruitment efforts more evenly across all HRSA-designated rural places, but then shifting back to targeting activities specifically within the 25 TBP Program target counties. Another TBP Program staff member described a further example of this barrier, explaining that the de-prioritization of TBP Program activities within all of the expanded HRSA-designated rural areas also hurt TBP Program participation in the TBP Program target counties, as interest from statewide organizations was reduced because not all counties were able to participate. Another barrier identified by TBP Program staff related to reprioritization in allowable TBP Program activities *was late reprioritization from measurement to intervention focus for the TBP Program*. TBP Program staff began technical assistance intervention activities in the final 6 months of the TBP Program. Several TBP staff members described their perception of how intervention activities implemented earlier in the TBP Program would have facilitated pod deployments by providing a direct benefit to potential

TBP Program participants (a known facilitating influence, see Facilitators: Perceived value proposition).

TBP Program staff also identified a **perceived lack of clarity in program goals** as a barrier to program implementation. For example, TBP Program staff described not always understanding the goals of the TBP Program, particularly as allowable program activities and goals seemed to change, such as the priority of expansion area implementation, the eligibility and priority of non-healthcare location participants, and the shift to providing direct TBP Program participant broadband interventions. Another barrier identified by TBP Program staff relating to the structure of the program was **urgent priorities for state broadband offices deprioritized the connection with the TBP Program**. The timing of TBP Program implementation coincided with the implementation of the Broadband Equity, Access, and Deployment (BEAD) Program.[8] On November 6, 2021, Congress passed the Infrastructure Investment and Jobs Act, which allocated billions of dollars to broadband infrastructure investment through the subsequent BEAD Program.[9] During this period, state broadband offices were tasked with drafting applications and plans for statewide BEAD funding allocation and spending. TBP Program staff described several examples of how the TBP Program could have benefitted from connecting more closely to state broadband offices and the BEAD process more broadly, but competing priorities for the state broadband offices during this time of BEAD application and implementation was a challenge. Another barrier identified by TBP Program staff related to program structure was **variation in organizational approval and review processes**. This barrier included such examples as disruptions in activities due to delayed contracting processes and an inability to hire additional outreach staff due to burdensome organizational hiring processes.

Barriers: TBP Program organization

TBP Program staff identified **program organization barriers** for TBP Program Implementation and Effectiveness. One such barrier was a **de-centralized approach**, including *each CLP team creating their own tools and resources*. TBP Program staff described greater program Implementation and Effectiveness using tools and strategies that were informed by CLP learnings but developed and implemented centrally. For example, one TBP Program staff member described creating their own TBP Program materials and processes for participant recruitment but further explained that centrally-developed, professional materials and organizational tools, such as project management software, facilitated TBP Program Implementation and Effectiveness.

TBP Program staff also identified **staffing challenges** as barriers to TBP Program implementation, including *difficulty identifying staff and CLP teams with access to the correct balance of necessary skill sets* and *TBP Program staff being spread too thin*. As an example of *difficulty identifying staff and CLP teams with access to the correct balance of necessary skill sets*, the identification and ultimate contracting with a CLP organization located in each TBP Program target state took months or even years in some cases. CLP organizations were selected based on knowledge of and relationships with individuals and organizations in the TBP Program target counties, as well as having staff with technical expertise to support the TBP Program and the inter-personal skills to successfully conduct outreach for TBP Program recruitment. This set of combined criteria limited the number of potential CLP organizations and delayed implementation of the TBP Program in some states. In another example of this influence, the identification of a software development team that had both broadband measurement expertise and technical expertise to assess and develop measurement devices

was described by TBP Program staff as a significant challenge. Few identified vendors possessed both skill sets, which were both necessary for TBP Program implementation. In a further example, TBP Program participant cold-calling recruitment was more successful when conducted by TBP Program staff with marketing experience, which not all cold callers had. TBP Program staff also identified *staffing changes* as another barrier to TBP Program implementation, particularly after TBP Program leadership staff changed, which was described by TBP Program staff as affecting the culture of, and communication within, the TBP Program. Another staffing challenge barrier identified by TBP Program staff to TBP Program Implementation and Effectiveness was *TBP Program staff being spread too thin*. For example, one TBP Program staff member described an example of this barrier by explaining how some strategies that had demonstrated success in other TBP Program target counties were difficult to implement because they lacked additional staff hours dedicated to TBP Program implementation. Another TBP Program staff member also provided an example of this barrier by explaining how the in-person, door-to-door approach could not feasibly be conducted in Alaska TBP Program target county-equivalents without dedicated TBP Program staff working in these target counties.

In interviews, TBP Program staff also identified how **low digital literacy among existing TBP Program participants** was a barrier to TBP Program implementation. Despite the efforts of TBP Program staff to create the easiest possible pod installation process for a TBP Program participant, many *TBP Program participants still lacked sufficient technical knowledge to install a pod on their own*. TBP Program staff members described examples of this barrier by explaining how potential TBP Program participants sometimes did not know how an internet modem worked and struggled to plug a TBP pod into their router. TBP Program staff identified a further barrier to TBP Program Implementation and Effectiveness: **delays in identifying and implementing effective solutions**. For example, the assessment of existing broadband measurement technologies and the subsequent development the TBP pods took place over approximately six months, which delayed TBP Program recruitment and participation. Although the solution of the pods and Radar technologies was ultimately well equipped to achieve TBP Program goals, the amount of time required to reach the solution—as well as the additional time required to identify a software development team to assess and develop the technology—delayed program implementation. Additionally, as described in the Facilitators: TBP Program organization, the software implementation of a TBP pod was a successful Program pivot that facilitated TBP Program participation from several organizations. However, in an example of this barrier, one TBP Program staff member explained that TBP Program Implementation and Effectiveness would have benefited from this solution much earlier and led to more healthcare location deployments. Another example of this barrier was identified by TBP Program staff members who described some early TBP Program recruitment successes through online marketing that should have been pursued further.

Barriers: Outreach and marketing strategies

Interviews with TBP Program staff revealed several **barriers to TBP Program Implementation and Effectiveness related to outreach and marketing strategies**. One such barrier was **general resistance to program participation**. In an example of this barrier, one TBP Program staff member described multiple efforts undertaken to address the security concerns from a healthcare organization CIO, who ultimately declined to participate. TBP Program staff also described a further example of this barrier by explaining how potential TBP Program participants who initially expressed interest in the program never actually plugged in

the TBP pods delivered to them. TBP Program staff expressed confusion and frustration with such outcomes, particularly when the interested potential TBP Program participants were part of the CLPs' existing relationships and networks. Additionally **low digital literacy among potential TBP Program participants** was also identified as a barrier to TBP Program outreach and marketing, including *TBP Program participants lacking the technical knowledge to understand their broadband challenges and needs*. For example, one TBP Program staff member described an example of *participants lacking technical knowledge to understand their broadband challenges and needs*, explaining how some individuals in the TBP Program target counties did not understand their own home broadband or did not use broadband because they did not understand the benefit of using broadband-enabled services or how to use them (such as telehealth and services that enable connection to their social communities). A quote illustrating this theme can be found in Box 2.

TBP Program staff also identified **a lack of centrally-developed and tested language and materials for outreach and marketing** as a barrier to TBP Program Implementation and Effectiveness. As described above briefly in Barriers: TBP Program organization, some CLP teams lacked the necessary resources and skill sets to create professional, trust-inspiring outreach materials to facilitate TBP Program participation. However, a lack of such language materials (particularly including a value proposition in outbound messaging, see Facilitators: Outreach and marketing strategies above) was described by TBP Program staff as a barrier to TBP Program recruitment because, without them, potential TBP Program participants did not understand the TBP Program or the direct benefit to themselves for participating. The **ineffectiveness of some implementation strategies across participants and communities** was also identified as a barrier to TBP Program Implementation and Effectiveness. For example, one TBP Program staff member described not understanding why outreach strategies that had proven to be successful in five of the six TBP Program target counties in their state were not successful in the sixth county. In another example of this influence, one TBP Program staff member described how a cold calling campaign would only be successful in some rural Alaskan communities if staff had additional cultural training on working with Alaska Native populations. TBP Program staff also described a sub-theme of this barrier, explaining that *the in-person, door-to-door approach was less successful for healthcare deployments*. For example, one TBP Program staff member described attempts to recruit healthcare organizations to the TBP Program at healthcare conferences but found that interest in the TBP Program from healthcare providers at these conferences rarely yielded TBP Program participation without pre-existing relationships (described as a facilitator in Facilitators: Outreach and marketing strategies). **A lack of a**

Box 2. Example quote—Low digital literacy among potential participants, participants lacking technical knowledge to understand their broadband challenges and needs.

"I drove…directly to someone's house to go get a pod plugged in. And that took, unfortunately, a lot of time. It should've been a 15-minute drop in, but they had other challenges going on with their setup…We probably spent about three hours trying to get his pod active…His modem was actually an older modem, so it didn't automatically refresh the connection…He [had] basically said to the internet company, 'I don't want wireless.' And then [the ISP] took it literally and gave him an old modem that can't do wireless…But what he meant was different than what he said. What he meant was, 'Don't give me cellular wireless internet.'"

community champion was also identified as a barrier to TBP Program Implementation and Effectiveness by TBP Program staff, aligning with the finding that the identification of a community champion facilitated TBP Program participation (see Facilitators: TBP Outreach and marketing strategies). Additionally, as a sub-theme to this barrier, several *anti-champions hindering program participation* have emerged as a barrier during TBP Program Implementation and Effectiveness, typically local Internet Service Providers (ISPs) or IT contractors who misunderstood the goal of the TBP Program. For example, one TBP Program staff member described how a specific ISP provider in one TBP Program target county had concerns about how data from the TBP Program would be used, which prevented several organizations contracted with that ISP provider within the county from participating. In another example of an anti-champion serving as a barrier to TBP Program Implementation and Effectiveness, TBP Program staff members described how a non-local IT organization that served multiple locations within TBP communities perceived no value to themselves or their organization for participating in the TBP Program (see also Barriers: Perceived lack of value proposition). TBP Program staff described multiple instances of individuals willing to participate in the TBP Program but relied on the same local IT organization to manage their network. For some individuals, participating in the TBP Program required the local IT organization to consent to connecting the pods to the potential participant's network, which the local organization was unwilling to do. TBP Program staff members described how the local IT organization having a fundamental misunderstanding of the intent of the TBP Program (see also Barriers: Perceived lack of value proposition), creating a barrier to greater TBP Program participation within that region, explaining that the local IT organization believed data collected by the pods would be used to report on their business in a potentially negative way.

Another outreach and marketing strategy barrier identified by TBP Program staff was that CLP teams had **insufficient existing relationships and networks to maximize TBP Program participation**, including *existing relationships and networks not always facilitating TBP Program participation* and *CLP teams quickly exhausting existing relationships and networks*. As discussed in Facilitators: Outreach and marketing strategies, leveraging existing relationships and networks facilitated TBP Program participation. However, TBP Program recruitment through existing relationships alone was insufficient for successful and effective TBP Program implementation. An example of *existing relationships and networks not always facilitating TBP Program participation* was shared by TBP Program staff members, who described their confusion and frustration when leveraging their established relationships with individuals and organizations did not result in greater TBP Program participation. TBP Program staff explained that although they were initially optimistic about recruiting these organizations, they often encountered resistance and were hesitant to push too hard for participation to avoid jeopardizing partnerships needed for other projects. TBP Program staff also identified *CLP teams quickly exhausting existing relationships and networks* as a barrier to TBP Program Implementation and Effectiveness. As described in Facilitators: Outreach and marketing strategies, TBP Program staff identified leveraging existing relationships and networks as an initial facilitator of TBP Program participation, but these existing relationships and networks could only generate so many program participants before saturation was reached. TBP staff also described how a **non-expert cold-calling center yielding few TBP Program participants** was a barrier to TBP Program implementation. Again, as described in Facilitators: Outreach and marketing strategies, TBP Program staff identified an expert-led cold-calling campaign as a successful strategy for TBP Program recruitment. However, when led by inexperienced cold-calling staff who struggled to explain the TBP Program and the value

proposition to potential TBP Program participants quickly via phone, this strategy was less successful.

TBP Program staff also identified the **resource-intensiveness of TBP Program recruitment and follow-up** as a barrier to TBP Program Implementation and Effectiveness. One sub-theme that emerged under this barrier was how *in-person outreach was effective* [see Facilitators: Outreach and marketing strategies] *but resource-intensive*. For example, a TBP Program staff member described one successful TBP pod deployment requiring an entire day of work. TBP Program staff also described the long travel times to reach TBP Program communities (see Barriers: TBP Program structure for a description of travel to specific TBP Program target counties as a separate barrier) leading to fewer deployments when utilizing this strategy if many hours of a work day were dedicated solely to travel rather than active TBP Program recruitment. Another sub-theme identified under this barrier was *CLP team investing resources into TBP Program recruitment with little or no result*. For example, one TBP Program staff member described repeated efforts at TBP Program recruitment with a school district in a TBP Program target county that ultimately did not lead to any TBP Program participation. In another example, a TBP Program staff member described challenges with organizations that agreed to participate in the TBP Program but then did not follow-through on connecting their pod, necessitating additional resources from TBP Program staff to get their pod online.

Barriers: Lack of trust

Nearly every TBP Program staff member interviewed identified a **lack of trust** between TBP staff and potential Program participants as a key barrier to TBP Program Implementation and Effectiveness, particularly **concerns from potential TBP Program participants about privacy and security**. For example, TBP Program staff members described this barrier as particularly acute in healthcare and non-healthcare CAI settings, where non-local security firms were responsible for compliance with the Health Insurance Portability and Accountability Act (HIPAA) and were uninterested in participating in the TBP Program because of the perceived risk to their system and lack of perceived benefits for participating in the TBP Program. TBP Program staff described experiencing this barrier particularly when IT services were not located on site and were instead contracted through a non-local, third-party organization (see Box 3 for an example). TBP Program staff also described additional examples of this barrier outside of healthcare settings, including concerns from individual consumers regarding what kind of information would be collected by a TBP pod and how that data would be used.

Box 3. Example quote—Lack of trust, Concerns from potential TBP Program participants about privacy and security

"Every time I talked to a higher-level IT person, you could tell almost immediately, once I started talking about the project, they…already are shutting me down because they're like, 'It's just not worth the potential security risk,' because they've got a million other security risks that they've got to evaluate and try to take care of that they just don't want another one on their plate.'"

Discussion

As part of an evaluation of the TBP Program implemented in 25 target counties in Alaska, Michigan, Texas, and West Virginia, the RE-AIM framework was utilized to assess Reach, Effectiveness, Adoption, Implementation, and Maintenance of the TBP Program. Information on Reach was obtained using TBP Program records, while Effectiveness and Implementation were evaluated through semi-structured qualitative interviews with TBP

Program staff. Adoption and Maintenance were assessed using data collected directly from TBP pods. Both the perception of a value proposition for participating in the TBP Program and the establishment of trust played a key role in facilitating the Implementation and Effectiveness of the TBP Program. Additionally, centralizing the approach; building diverse CLP teams and skill sets; designing easy-to-use and adaptable technology; and setting clear, achievable goals were all found to facilitate TBP Program Implementation and Effectiveness. Finally, several outreach and marketing strategies that facilitated TBP Program recruitment and participation were identified, including finding community champions; snowballing participation within communities; identifying and recruiting large CAIs; including a value proposition in outbound messaging; utilizing multiple outreach and marketing strategies; leveraging existing relationships and networks for program recruitment; utilizing an in-person, door-to-door approach (where feasible); and conducting an expert-led cold-calling campaign.

Conversely, a lack of a perceived value proposition for participating in the TBP Program and a lack of established trust were reported by TBP staff as barriers to TBP Program participation. Several structural challenges to TBP Program Implementation and Effectiveness were also identified, such as geographic limitations of target counties included in the TBP Program scope, reprioritization of program activities, a perceived lack of clarity in program goals, urgent priorities with state broadband offices deprioritizing connection with the TBP Program, and variation in organizational approval and review processes. Barriers to TBP Program implementation at the level of program organization included a de-centralized approach, staffing challenges, low digital literacy among existing Program participants, and delays in identifying and implementing successful strategies. Finally, several outreach and marketing barriers to TBP Program Implementation and Effectiveness were identified, such as a general resistance to TBP Program participation, low digital literacy among potential Program participants, a lack of centrally-developed outreach materials, ineffectiveness of some strategies across participants and communities, insufficient existing relationships and networks to maximize program participation, a non-expert cold-calling center yielding few participants, and resource intensiveness of TBP Program recruitment and follow-up.

These findings support a flexible, adaptable approach to TBP Program implementation, including the use of multiple strategies depending on the community of implementation. Although the in-person, door-to-door approach worked well in several TBP Program communities in Texas for business and non-healthcare CAI deployments, this approach was not successful in all TBP Program counties, including one county within Texas. Additionally, implementation at healthcare sites was found to be most successful when trust was established, particularly when leveraging existing relationships and networks. Concerns with privacy and security were a major barrier to TBP Program Implementation and Effectiveness, and many of the outreach and marketing strategies that were most successful were predicated upon established trust. For example, an in-person approach to TBP Program recruitment helped demonstrate the program's legitimacy, showed it was staffed by real individuals, and alleviated potential participants' fears about their information being stolen. However, for healthcare sites with important privacy and security concerns, an in-person approach was insufficient to build this trust and relied more heavily on existing relationships and networks where trust had already been established long-term.

In an analysis of interviews with TBP Program staff, the perception of a value proposition emerged as a key factor in successful program implementation, and a lack of a perceived value proposition was a reported barrier to program participation. All interviewed TBP Program staff identified these influences of a presence and absence of a value proposition influencing TBP

Program implementation. Without delivering a concrete benefit to TBP Program participants, recruitment to the TBP Program outside of existing relationships and networks was very difficult for TBP Program staff. When an interventional approach was added as a priority activity for the TBP Program, the potential benefit to potential TBP Program participants was much more salient.

Factors for consideration in future broadband program implementations

For those interested in measuring the user experience of broadband in communities, the findings of the TBP Program implementation study have generated several factors to consider for any similar future broadband program implementations:

1. Identify direct benefits of participation for potential participants and communicate this benefit clearly in outreach materials so that these benefits are understood by all potential participants, including those with low digital literacy who may lack specific broadband knowledge.
2. Include additional geographies in allowable program locations to encourage greater participation, especially among people with regional or statewide interests.
3. Identify and communicate clear program goals and strategies with program leadership, the funding agency, program partners, and across all program implementation staff and teams.
4. Create a centralized repository of materials, resources, strategies, and ideas for all implementation teams to use, adapt, and learn from (such as flyers, mailers, website copy, digital forms, project management tools, call centers).
5. Recruit dedicated program staff members who share the program's identified value proposition, possess diverse skill sets, and have sufficient time to address program needs.
6. Use multiple outreach strategies, including an in-person, door-to-door approach for business, consumer, and non-healthcare CAI locations, and leverage existing relationships and networks for healthcare site deployments.
7. Identify community champions to facilitate program participation.
8. Prioritize building trust in outreach strategies and interactions with potential program participants and ensure all outreach strategies and materials inspire trust.

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