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Challenges and Opportunities for Digital Divide in Rural Tennessee

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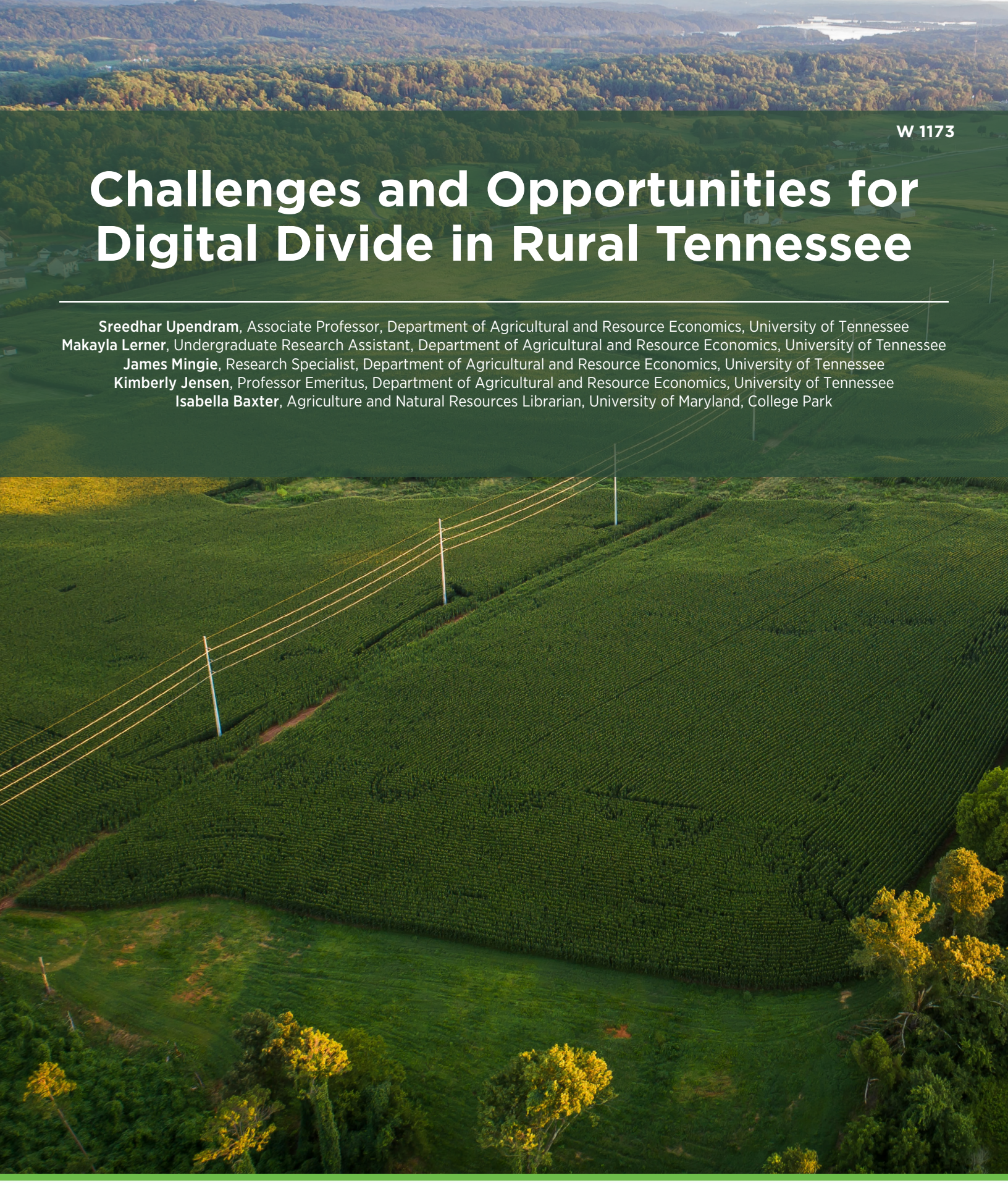

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UTEXTENSION
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THE UNIVERSITY OF TENNESSEE

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Abstract

Broadband remains inaccessible for many rural residents in Tennessee. This study details the process of assessing rural broadband needs and providing a library mobile hotspot lending program and downtown internet program to help ameliorate the digital divide in selected rural areas of Tennessee. Broadband needs were assessed based on county socioeconomic characteristics, community surveys regarding broadband needs and through broadband speed tests we conducted in cooperation with local agencies. Two programs were then offered in selected rural areas of Tennessee to help meet broadband needs. The first was a hotspot lending program offered in eight counties (Bledsoe, Bradley, Cannon, Grundy, Hancock, Morgan, Polk and Wayne) by University of Tennessee Extension in cooperation with local libraries. The second was a downtown program offered in Pikeville, Tennessee (Bledsoe County). Based on experiences with needs assessment and program implementation, a set of recommendations for assessing rural broadband needs incentives, subsidies and vouchers for consumers, recommendations when implementing programs to help address rural broadband needs through a public-private partnership to reduce barriers for broadband expansion, and a list of state, local and community resources to assist with building broadband capacity and use are provided.

Keywords: Digital Divide, Broadband, Rural

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Background and purpose:

In an increasingly digital world, broadband has become a necessary tool to for conducting business, offering educational programs, communicating with family and friends, and carrying out at-home research or entertainment pursuits. However, both broadband coverage and ability to pay for broadband have made this resource unattainable for citizens of many rural areas in Tennessee. The COVID-19 pandemic further highlighted the potential consequences of the so- called "digital divide" between those with broadband access and those without, as many rural Tennesseans either had to work from home online or had students in virtual school (Office of Tennessee Governor, 2020). While many federal and state broadband initiatives have been enacted in response to the digital divide, it may take years to install the infrastructure needed to provide reliable, fast and affordable internet to rural residents, especially lower-income residents.

According to the 2021 Federal Communications Commission (USFCC, 2021a) Broadband report, for broadband internet (minimum of 25 mbps download and 3 mbps upload speeds), 98.8 percent of the population in urban areas had access, but in rural areas of the US, access was only 82.7 percent (USFCC, 2021b). Data from Microsoft indicates that 157.3 million people do not use the internet at broadband speeds (Hegle and Wilding, 2019).

Purpose

This paper details the process of assessing rural broadband needs and programs offered in rural areas by University of Tennessee Extension in cooperation with local agencies in addressing broadband challenges, specifically a hotspot lending program and a downtown internet program. Based on these experiences, a set of recommendations for assessing rural broadband needs, recommendations regarding programs to help address rural broadband needs, and a list of state, local and community resources to assist with building broadband capacity and use is provided. While this paper is focused on rural communities in

Tennessee, the methods of seeking data on rural broadband needs, example data and experiences from hotspot lending programs, and efforts to partner with local rural communities to improve broadband access can likely be adapted to other areas.

An overview of Tennessee's broadband situation and the state's broadband challenges are first presented. Following this overview, the paper is divided into three parts. The first part provides information about how a needs assessment was conducted and target counties (Bledsoe, Bradley, Cannon, Grundy, Hancock, Morgan, Polk and Wayne) were identified based on economic status for broadband programs assistance. The second part provides a summary and analysis of two programs (library mobile hotspot lending and a downtown wireless program in a rural community) offered by University of Tennessee Extension to help address broadband needs in rural communities. The third section provides a set of recommendations, lessons learned and potential sources of assistance for improving broadband coverage.

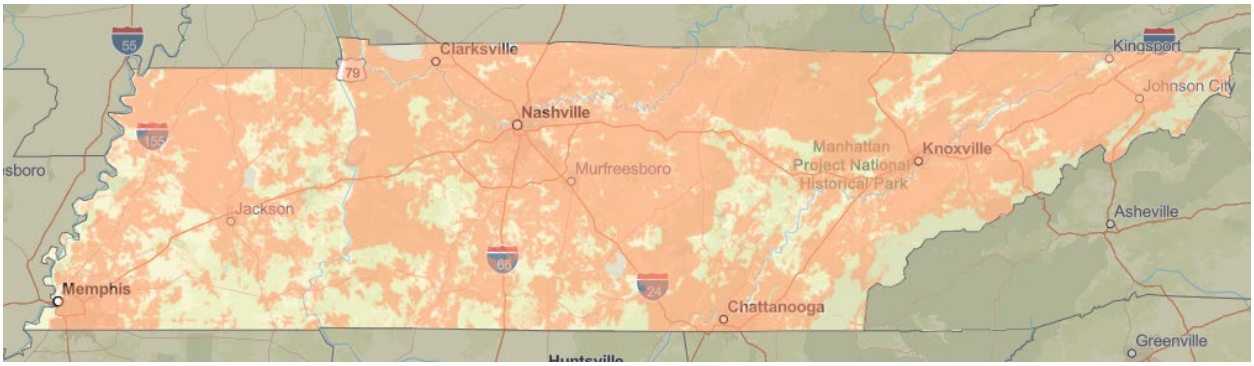
Part I: Needs assessment: This part of the paper discusses the digital divide across Tennessee and how target communities were identified for broadband assistance initiatives. A discussion is included on how (1) questionnaire data from households was collected regarding broadband needs and integrated into program development, and (2) broadband speed testing was conducted in selected counties to help identify broadband service providers for the mobile hotspot lending programs. While data was strictly used for internal programming purposes, a copy of the questionnaires is provided in Appendix C.

Part II: Programs to address broadband needs: This part of the paper provides details on two programs to help address broadband needs — a library hotspot lending program and a downtown wireless program. A program description is provided for both programs. The methods of collecting survey data from participants in the hotspot lending program and a summary of results are presented. A questionnaire used to collect perceptions about the downtown wireless program is also provided. Copies of the hotspot lending survey and the internal downtown internet program participant questionnaires are provided in Appendix C.

Part III: Conclusions and recommendations: At the end of this paper, a set of recommendations for assessing rural broadband needs is provided, experiences of and lessons learned from offering broadband assistance programs in rural communities are detailed and a set of resources that rural communities might access in trying to improve their broadband access are offered.

Tennessee's broadband situation

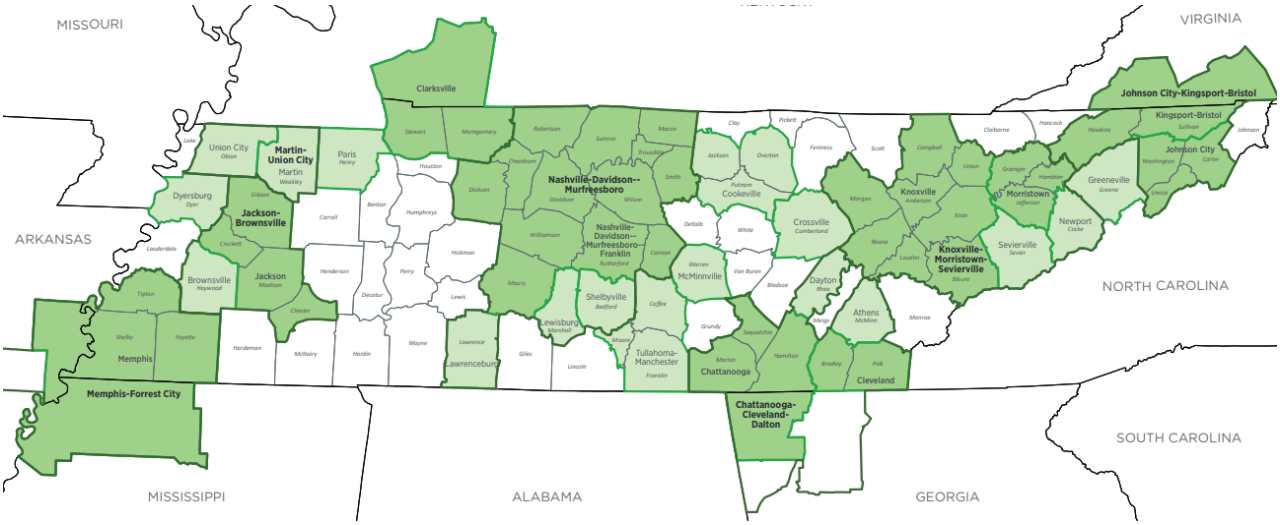
The Tennessee Department of Economic and Community estimates that 27 percent of Tennesseans do not have broadband subscriptions (TNECD, 2021a). Figure 1 illustrates differences in broadband coverage across the state, with peach areas indicating areas having broadband service at 25 mbps download/3 mbps, the minimum considered for broadband (TNECD, 2022). As can be seen from Figure 1, a significant area of Tennessee still does not have coverage that meets the criteria of minimum broadband requirements set by the FCC. For purposes of comparison, a map with the county names is provided in Appendix A.



(Source: TNECD, 2022)

Figure 1. Areas of broadband served at 25 mbps download/3 mbps upload in Tennessee (all fixed technologies)

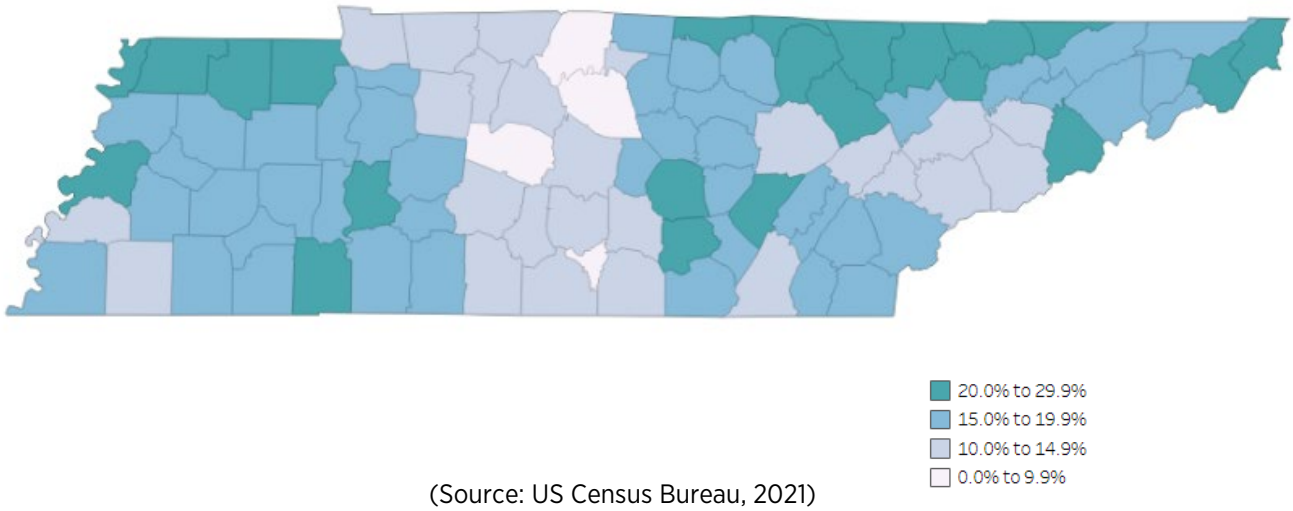
Figure 2 displays metropolitan (darker green) and micropolitan (lighter green) areas of Tennessee as designated by the US Census Bureau. Comparing Figures 1 and 2, it can be noted that many lower broadband coverage areas in Tennessee coincide with those that are outside metropolitan or micropolitan areas. (The cream-colored areas in Figure 1 show areas that are not served, while the white areas in Figure 2 show the more rural areas of the state.)



(Source : US Census Bureau, 2020)

Figure 2. 2020 core statistical areas for Tennessee

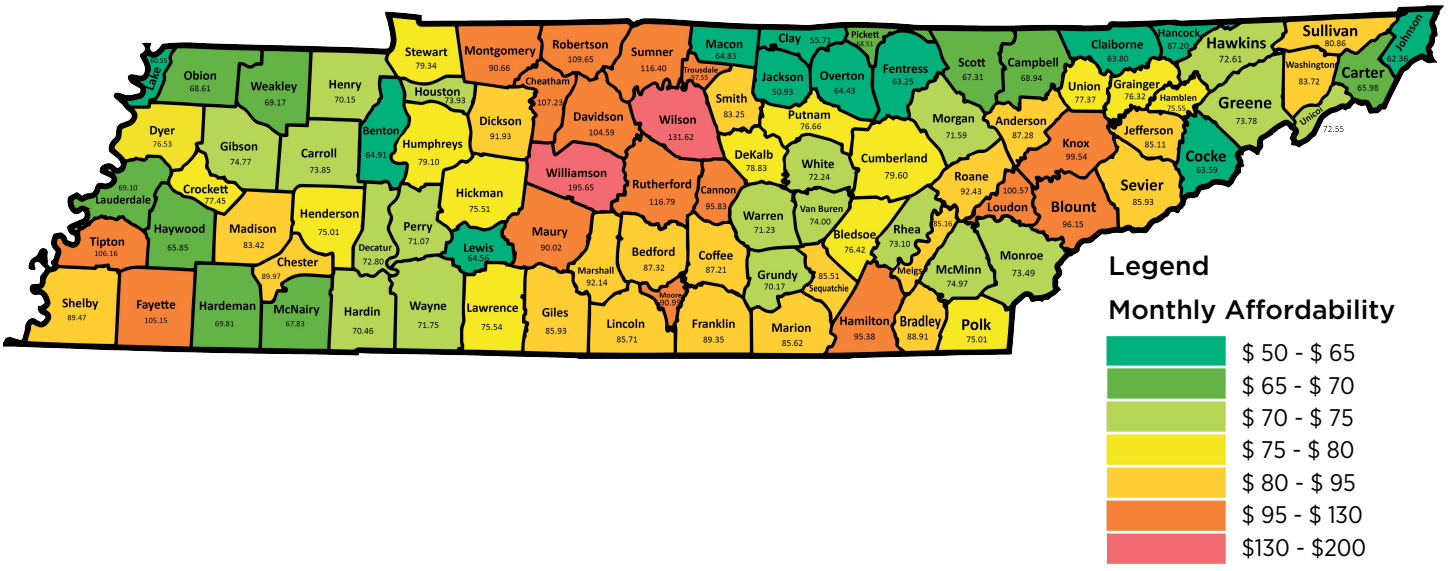
Figure 3 shows the percentage of people in poverty across Tennessee. By comparing Figures 1 and 3, it can also be noted that several areas of low broadband coverage encompass higher poverty rate areas. The counties that are green have poverty rates of 20 percent or higher.



(Source: US Census Bureau, 2021)

Figure 3. Percentage of people in poverty by county, Tennessee, 2015-2019.

Given that counties with low broadband coverage tend to be more rural, lower-income counties, the issue of affordability of broadband services arises. One potential measure to use as a proxy for affordability of broadband services is the Environmental Protection Agency's (EPA) guidance for water systems. In this guidance criteria, water systems with a monthly service cost above 2 percent of median household income is considered a higher burden for low-income households (EPA, 1997). As a proxy for broadband affordability, since broadband is a necessary utility for communities, the EPA guidance system of 2 percent of median household income (2019 expressed in 2021$) was used. Figure 4 illustrates the broadband affordability proxy measure (listed inside each county) with the map colors and legend reflecting broadband affordability ranges. These values range from $50 to as high as $200 monthly in more metro areas. As a point of reference, the average cost of broadband for 30 mbps or lower download speeds was $75/month from the 2022 FCC Urban Rate Survey (USFCC, 2022). In Figure 4, this would translate to 43 green counties having lower affordability than the average rate in the FCC Urban Rate Survey. A listing of these counties is provided in Table 2 along with measures of urbanization, poverty and broadband coverage.



(Source: Median Household Income, 5-year American Community Survey 2015-2019, US Census Bureau 2020)

Figure 4. Map of Tennessee counties by monthly cost of broadband and affordability proxy measure based on median household income.

A table of the affordability proxy measures, and other socioeconomic characteristics of Tennessee counties is shown in Appendix B Table 1. These measures include population, poverty rate, unemployment rate and educational attainment, as well as percent with computers and broadband internet subscriptions. A total of 52 counties had affordability proxy measures of at least $75 per month, while the values of 43 counties fell below $75 per month. In Appendix B Table 1, the green shaded rows reflect those counties that had broadband affordability proxy values below $75. Several measures were compared across counties meeting the $75 value, versus those that did not. T-tests of means across the two groups were conducted. The measures included county population, poverty rate, unemployment rate, college graduation rates, percent of households having a computer and those having a broadband internet subscription. The means and t-tests for these measures are shown in Table 1.

As can be seen in Table 1, counties that would potentially have a lower affordability than $75 per month tended to have lower populations, higher poverty rates, higher unemployment rates and lower percentages of college graduates. The population differences illustrate that broadband affordability is generally lower in more rural areas. The latter measures are of importance since two uses for the household internet may be related to educational purposes or work/employment purposes. The results in Table 1 also show that counties with lower broadband affordability levels tended to have lower rates of computers in the household and also lower broadband subscription rates.

Table 1. Tennessee county characteristics, computer use and broadband subscription for counties with at least $75 broadband affordability and without

	Means for counties with broadband affordability proxy measure			
Measures[a]	≥ $75	< $75	t[b]	
Population	104,953	26,947	2.93	***
Poverty rate	19.04%	13.65%	6.65	***
Unemployment rate	5.35%	6.62%	3.20	***
Percent college graduates	21.17%	13.83%	4.84	***
Have a computer	87.59%	81.11%	8.25	***
Have a broadband subscription	78.08%	70.44%	6.57	***

[a] Sources: US Census Bureau, American Community Survey 5-Year Estimates (2015-2019) for median household income and US Census Bureau, American Community Survey 5-Year Estimates (2016-2020) for the other measures.

[b] *** denotes means significant different at the 99 percent confidence level.

Tennessee's broadband challenges

Several broadband challenges faced by rural communities are presented below; some of them are specific to Tennessee, and other challenges are common to other parts of the United States:

1. Tennessee is among 17 states in the US that have legislative barriers to developing municipally owned broadband networks, such as deployment moratoria, excessive fees, unreasonable conditions and bad faith negotiation processes (USFCC, 2018; Casper, 2021). However, recent legislative changes under the Tennessee Broadband Accessibility Act (State of Tennessee General Assembly, 2017) have allowed electric cooperatives to work with local communities to expand broadband access.
2. As can be seen from Figure 1, provision of full broadband coverage across the state would require many more miles of expensive fiber optic cable.
3. In certain areas, the presence of hills, valleys and dense tree coverage makes it difficult to maintain reliable signal strength.
4. Obtaining right-of-way agreements, permits and easements to lay fiber optic cable is often a difficult and time-consuming process for internet service providers (ISPs).

5. Lower-income rural residents likely have not adopted broadband due to a lack of devices and an inability to afford subscription plans.
6. During the COVID-19 pandemic, lack of broadband access was a significant challenge for many students to access schoolwork and virtual schooling and for workers in the labor force to work remotely (Office of Tennessee Governor, 2020).

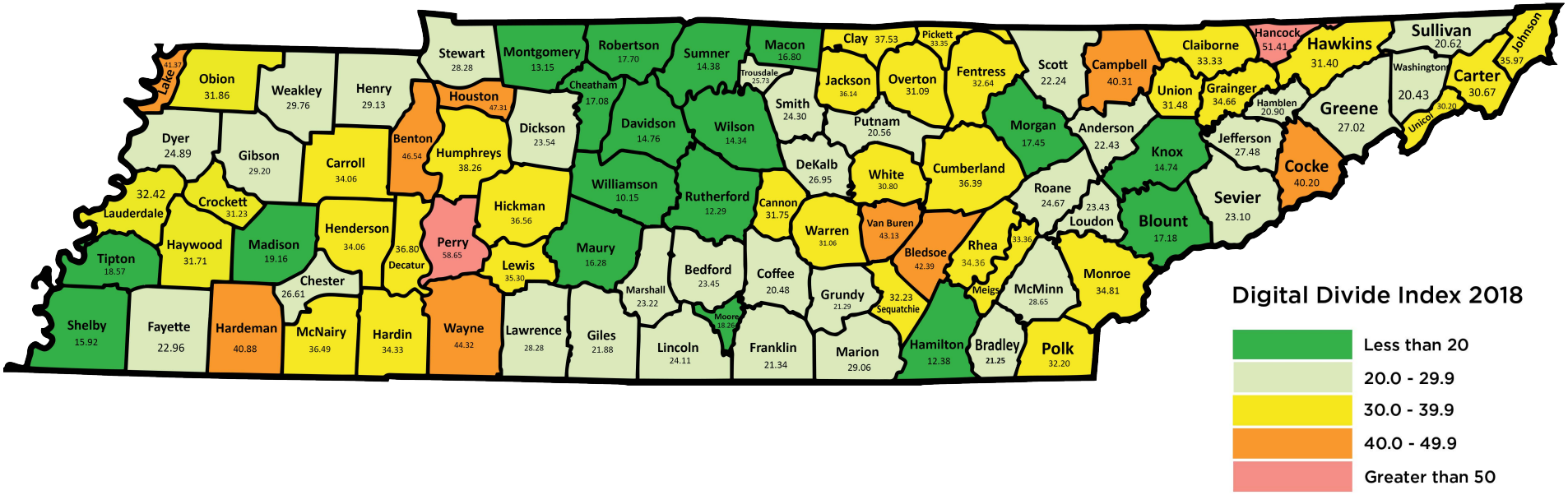
To help address some of the issues related to broadband access, the University of Tennessee Extension collaborated with communities across the state to study the need for broadband access through (1) questionnaires with results being used for internal programming decisions and through (2) speed tests to identify speed quality in the study area and potential providers for the mobile hotspot lending program. Further, to address the digital divide, a library mobile hotspot lending program was supported at public libraries across several communities through grant funding. This program was followed up with a user survey regarding the mobile hotspot lending program. Another project secured funding from the Appalachian Regional Commission (ARC) to provide broadband for one year in a rural downtown area to promote economic development. Follow-up questionnaires of downtown hotspot program participants were conducted for internal program evaluation purposes.

Part I: Needs assessment

I.1. The digital divide index across Tennessee and identifying target communities

Target communities were identified using a 2018 digital divide index (DDI) created in partnership with Purdue University where values of 0 to 100 are given on a county basis to measure both broadband access and adoption utilizing infrastructure and socioeconomic data (Gallardo, 2020). The digital divide index includes data for all counties in the United States. For Tennessee counties, index values range from 10.15 to 58.65 (Upendram et al., 2020). A lower digital divide score indicates relatively better broadband access (typically around metropolitan areas) whereas a higher score indicates poor or limited broadband

access (typically in rural areas). Figure 5 illustrates the county digital divide index scores across Tennessee at the time counties were selected for each program.



Source: Upendram, et al., 2020; data source Gallardo, 2020.

Figure 5. Digital divide index for Tennessee counties, 2018

The digital divide index and the socioeconomic characteristics of the eight counties that were selected for broadband interventions in Tennessee are presented in Table 2. The Tennessee Department of Economic Development classifies Bledsoe, Grundy and Hancock Counties as economically distressed counties; Morgan and Wayne Counties as at-risk; and Bradley, Cannon and Polk Counties as transitional (TNECD, 2021b). With the exception of Cannon County, all other counties had an adjusted median household income below the state average of $55,411. All counties had an unemployment rate at or above the state average with the exception of Cannon County, and all, except Polk County, had higher than the state average poverty rates. Six of the seven counties had county populations below 25,000. Only Bradley County had a larger population. In terms of percentage of the population having a four-year college degree, none of the counties exceeded the state average of 28.2 percent. Notably, these counties also had challenges in broadband connectivity. In terms of the digital divide, all counties had values above 20, except Morgan County. Several of the counties had a monthly affordability proxy measure below $75, while only Bradley and Cannon Counties had values that were much greater at $88.91 and $95.83. Each of the counties had below the state average of 81.5 percent of the population with a broadband subscription with the exception of Cannon County, which was only 82.04 percent.

I.2. Methods for assessing broadband needs

One approach to addressing the digital divide in Tennessee involved developing questionnaires to ascertain demand for broadband and associated devices. Questionnaires were conducted in three counties (Wayne, Cocke and Bradley Counties) that approached the University of Tennessee Extension and expressed an explicit interest in addressing the digital divide in their communities. Internet speed tests were conducted in six counties (Bradley, Bledsoe, Cocke, Hancock, Morgan and Wayne Counties) with the goal of identifying the ISP with the least gaps in broadband coverage.

Table 2. Socio-economic characteristics and broadband adoption rates

County name	2019 median household income	Monthly affordability proxy measure	2018 digital divide values	2020 total population	2020 have computer	2020 dial-up subscription only	2020 broadband internet subscription	2020 poverty Rate	2020 unemployment %	2020 BS or higher education
Bledsoe	$45,852	$76.42	42.39	14,961	81.13%	0.33%	74.55%	20.5%	7.5%	11.4%
Bradley	$53,344	$88.91	21.25	106,924	90.05%	0.38%	82.04%	15.6%	5.4%	23.5%
Cannon	$57,500	$95.83	31.75	14,374	87.61%	0.38%	70.14%	16.5%	3.0%	16.3%
Grundy	$42,105	$70.17	40.09	13,371	80.52%	0.12%	69.90%	19.1%	8.0%	13.4%
Hancock	$31,318	$52.20	51.41	6,568	75.14%	0.00%	56.87%	31.1%	12.0%	10.7%
Morgan	$42,954	$71.59	17.48	21,538	82.50%	0.13%	73.21%	22.6%	7.7%	11.4%
Polk	$45,004	$75.01	32.20	16,807	82.40%	0.20%	74.73%	12.4%	6.3%	12.6%
Wayne	$43,051	$71.75	44.32	16,638	79.31%	0.61%	71.00%	16.1%	6.0%	10.6%
State	$55,411	NA	NA	6,772,268	89.1%	0.20%	81.50%	14.6%	5.3%	28.2%

Sources: 5-year American Community Survey 2015-2019 and 2016-2020 Estimates, US Census Bureau. NA= not applicable

School questionnaires for program planning

Paper questionnaires on broadband access were sent home with children at elementary, middle and high schools in Wayne, Cocke and Bradley Counties to be completed by parents and returned to teachers. The purpose of the questionnaires was to determine where broadband services were needed. Questions included whether the households had access to broadband, their primary use for broadband (schoolwork, work, connecting with family, entertainment, information and other uses) and whether they would participate in a mobile hotspot lending program at a local public library. An example questionnaire is provided in the Appendix C. A total of 1,532 questionnaires were distributed in Wayne County, 3,014 were distributed in Cocke County and 10,329 in Bradley County in June 2018, February 2019 and October/November 2019, respectively. While the data from these questionnaires were used for internal planning purposes, from the results it was ascertained that wider access to broadband internet was needed in the counties studied. Therefore, these counties were among those chosen to participate in the hotspot lending program.

Internet speed tests

Speed tests were conducted at several locations in Wayne, Hancock, Bledsoe, Bradley and Morgan Counties using mobile hotspots from two broadband providers to validate the data on broadband access and availability. Further, the speed tests helped communities select a broadband provider for the hotspot lending program that was relatively faster and had the most access across the community. These speed tests were conducted in spring of 2018.

As stated earlier in this paper, FCC standards for broadband are a minimum of 25 megabytes per second (mbps) download and 3 mbps upload (FCC, 2015). As shown in Table 3, the broadband speed tests did not exceed current FCC requirements for downloads for any of the counties but did for uploads. For student work or telecommuting, the FCC recommends download speeds of 5 to 25 mbps (FCC, 2020). While Bradley and Bledsoe Counties were toward the higher end of this download speed range, other counties such as Wayne and Morgan Counties were at the lower end.

Table 3. Broadband speed test results

County	Average download speed (mbps)	Average upload speed (mbps)
Bledsoe County	24	12.5
Bradley County	24	8.5
Cocke County	24	7.9
Hancock County	12	6.8
Morgan County	8.5	10.6
Wayne County	6	4

Part II: Programs to address broadband needs

II.1. Library mobile hotspot lending program

The mobile hotspot lending program was initiated as a pilot study in three broadband program counties (Hancock, Bledsoe and Wayne Counties). A second phase, due to increased interest and additional grant funding, expanded the program to public libraries in six counties (Cannon, Hancock, Grundy, Morgan, Polk and Wayne Counties) and one elementary school in Bradley County.

Following Whitacre (2019), mobile hotspots were provided to several public libraries and elementary schools across six rural counties for patrons to check out for two to three days free of charge. Some public libraries have used the Federal E-rate[1] program to support the mobile hotspot lending program. Upon returning the device to the library, participants were asked to complete a survey regarding hotspot usage, experience and willingness to pay for internet (See the survey instrument in the Appendix C). This program was administered by local public libraries in collaboration with University of Tennessee Extension.

[1] The Federal Communication Commission's E-Rate program offers funds for telecommunication and information services as discounts (20-90 percent) for eligible schools and libraries across the United States.

A total of 184 participants responded to the hotspot user survey distributed at three public libraries in Wayne, Bledsoe and Hancock Counties. The survey responses on hotspot and internet usage are presented in Figure 6. Nearly 77 percent used the hotspots for entertainment purposes, while just over 68 percent used the hotspot for work, school or research purposes. Note that these responses were collected prior to the COVID-19 pandemic (that resulted in a large increase in telecommuting and internet-based schooling). Just under 67 percent used the hotspot to connect with family and friends. Just over 14 percent used the hotspot for other purposes, with several indicating they used it for online shopping. Nearly 40 percent of the respondents used the hotspots for all three main purposes.

(N=184)

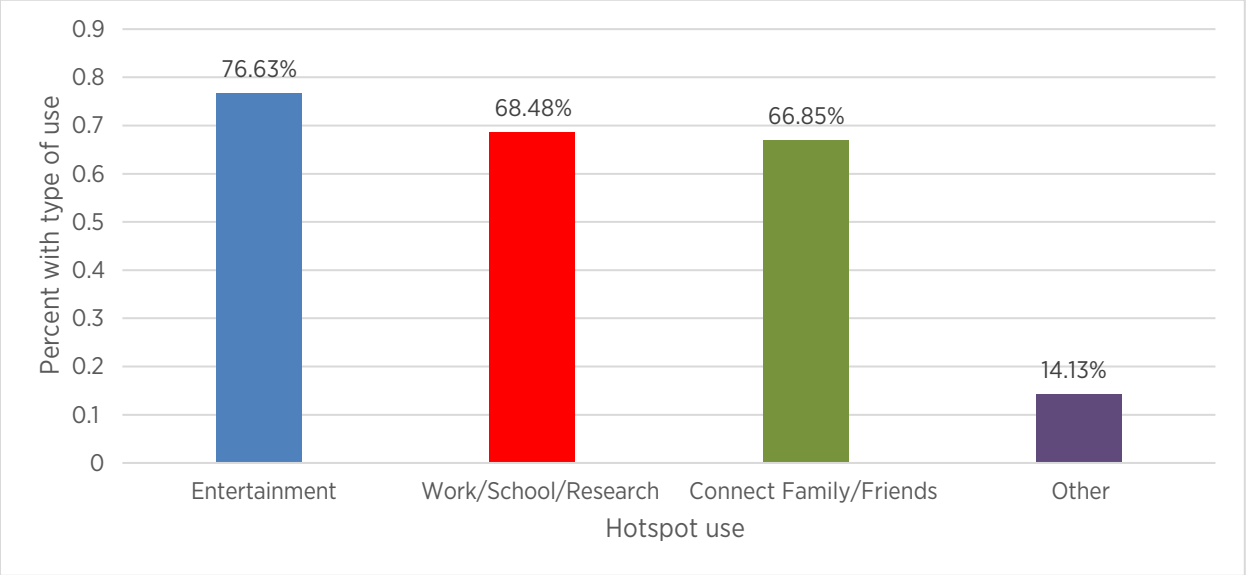


Figure 6. Hotspot lending program survey responses on broadband usage among hotspot borrowers

Participants in the program indicated a high degree of satisfaction with the hotspot lending program. On a scale of 1 (extremely dissatisfied) to 10 (extremely satisfied), respondents rated their experience on average at 9.5 (N=175). With respect to self-described internet skills before and after participation in the hotspot lending program, skills level increased as shown in Figure 7. The responding participants stated they gained 0.80 in skill level on average, indicating just over a 10 percent gain.

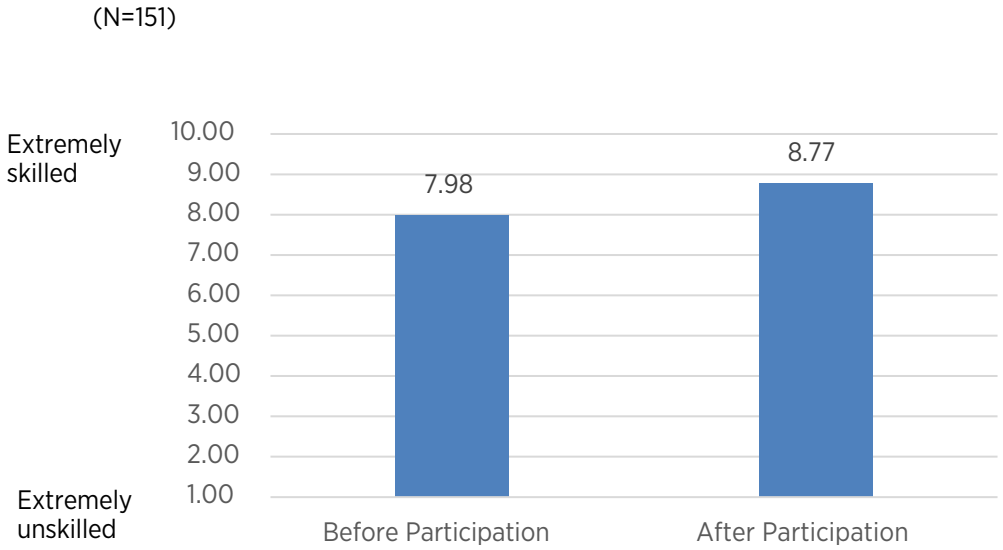
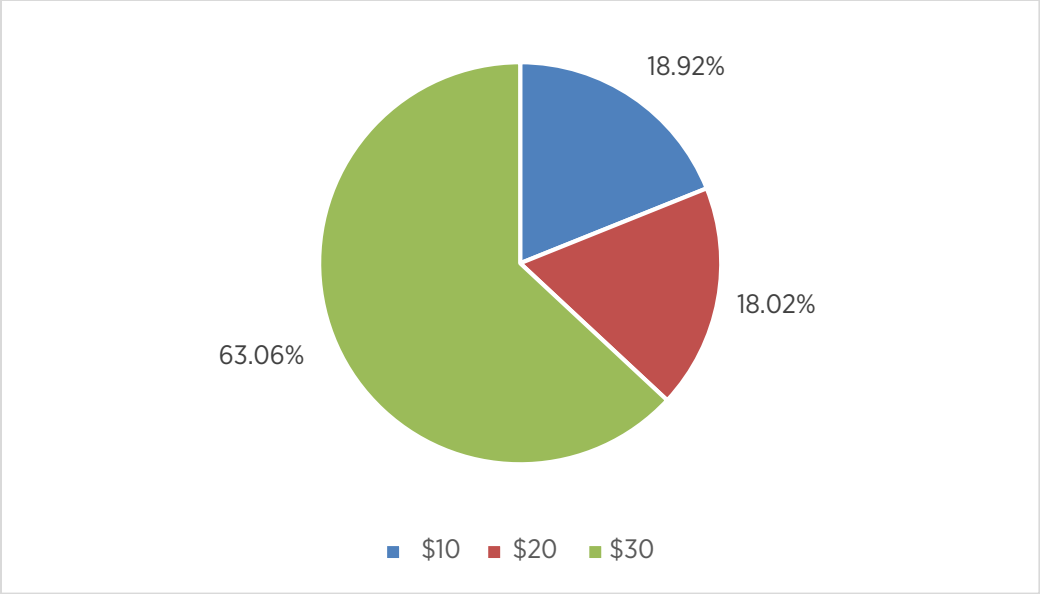


Figure 7. Self-described internet skills level before and after participation in the hotspot lending program among hotspot borrowers

While participants in the program were satisfied with their experience and felt they gained internet skills as a result, when prompted about whether the hotspot program participants planned to subscribe to the internet, the majority did not plan to do so or not within the coming year. Out of 161 responses, 17 were planning to subscribe within 1 to 2 months, 18 within the next 3 to 6 months, 29 within a year and 34 in the next 1 to 2 years. Another 63 respondents were not planning on subscribing to broadband. When asked about their willingness to pay for an internet subscription, 111 out the 184 respondents were willing to pay for a monthly broadband subscription. As shown in Figure 8, among those willing to pay, 63.06 percent were willing to pay $30, while 18.02 percent were willing to pay $20, and 18.92 percent were willing to pay $10. This gives a weighted average of around $24 among those willing to pay. Notably, willingness to pay for a monthly broadband subscription fell well below the average rates of around $75 per month. Some noted

that broadband internet was not available to them yet, while others reported they could not afford to pay for broadband. These reasons could explain the discrepancy between satisfaction and skill building with the program versus future plans to subscribe to broadband.



(N=111)

Figure 8. Amounts willing to pay for monthly broadband subscriptions among those hotspot borrowers willing to pay some subscription.

Of the respondents, 121 answered the question regarding household income in 2020. Among these respondents, 66.12 percent, or nearly two thirds, reported their household income to be less than $25,000. These results suggest that the majority of the participants in the hotspot program fell into the low-income range. This could likely be a factor in many respondents not being willing to subscribe or pay for broadband internet.

In addition, of the 184 respondents who participated in the mobile hotspot lending program and answered questions about distance to the library, about one in five lived at least 20 miles from the library where they borrowed the hotspot. This result suggests that about one fifth of the participants live in more distant rural areas since library hotspots were located in towns within each county.

A total of 158 participants responded about their educational attainment. While 10 participants attended some school, 89 attended a high school or obtained a GED, 42 had some college experience, 42 earned an associate's degree, 4 earned a bachelor's degree, and 13 earned a graduate or professional degree. Hence, only 10.76 percent had earned a four-year degree or higher, considerably lower than the state average shown in Table 2. In addition, the majority, about 63.22 percent of the participating households, had children in the household (N=174).

Based on the demographics discussed above, the results suggests that the hotspot lending program participants tended to have a lower educational attainment on average than the overall population, were lower income, and lived in more distant areas. Further, the results suggest that the hotspot served households with children. In many cases, as indicated by the hotspot uses, the borrowers used the hotspots for work, education or research purposes.

In 2021, a follow-up survey was conducted as the program was suspended during COVID-19. A total of 60 responded to this second round of hotspot borrower surveys. In some cases, these respondents had answered the earlier survey. However, two additional questions of interest were asked related to the respondents' experiences with COVID-19 impacts on the educational experiences of their children and their workplace experiences. Of the 60 responding, 10 had worked virtually during the pandemic, while 23 had children attend virtual school. Some hotspot borrowers in 2021 had experienced either virtual work or schoolwork with their children. When asked how the pandemic had affected their work or children's academic experience, the respondents were prompted to provide ratings of 1 (no impact) to 10 (significant impact). Among those who worked virtually, the average rating was 5.9, while among those who had not the average rating was 3.4. Those who had to work virtually felt their work was impacted much more by the pandemic than those who did not. As for perceptions of children's school performance, among those who had children attend virtual school, the average rating was 8.6, reflecting a significant impact. These results suggest that connectivity was likely particularly important during the pandemic as more households needed the internet for work and school. While not asked, the quality of connectivity likely would have impacted user experiences for work and for school.

II.2. Pikeville downtown wireless program

Through grant funds secured from the Appalachian Regional Commission (ARC), University of Tennessee Extension provided free wireless internet to residents in downtown Pikeville, located in Bledsoe County, who visit local businesses, farmers markets and government offices in downtown Pikeville, in Bledsoe County for one year. After the completion of the program, local farmers market vendors, government office visitors and business owners were provided questionnaires at their premises on the success of the program, accessibility, usage, reliability and whether the broadband contributed to the economic development of the downtown area. Thirty-two community members provided questionnaire responses. While the results were for internal programming purposes only, the results from the downtown wireless users suggested a high degree of satisfaction with the program. For the purposes of potential future use in similar programs evaluation, a copy of the questionnaire is provided in Appendix C.

Part III: Conclusions and recommendations

Based on experiences gained from assessing broadband needs and administering a hotspot lending program with follow-up user surveys, several lessons were learned. This section of the paper outlines lessons learned and limitations, recommendations for assessing future rural broadband needs and recommendations when implementing programs to help address rural broadband needs. This part of the paper also provides state, local and community resources to assist with building broadband capacity and use.

III.1. Lessons learned from broadband initiatives and limitations

With limited resources to provide hotspot lending programs, it is important to target counties as high priority candidates for programs based on need. Information about counties, such as broadband subscription percentages, poverty rates, unemployment and education levels are helpful in identifying potential hotspot lending program counties. A proxy for broadband affordability in comparison with average broadband subscription prices can also be an important piece of information in identifying higher need counties. By using this county information, potential priority counties for a hotspot program could

include more rural areas and those with lower-than-average rates of subscribing to broadband, lower incomes, lower education levels and higher unemployment.

Internet speed tests can serve as a measure to help identify carriers and geographic areas that may be good candidates for a hotspot lending program. Household questionnaires about the need for broadband can also be helpful to further inform decisions about where to offer a mobile hotspot lending program. The pre-program questionnaires and evaluation of county characteristics were important in identifying counties in need of hotspot lending programs and speed tests helped further identify potential service providers. While having this information is important to identify counties for the program, community buy-in is also an important element to successfully administer a mobile hotspot lending program.

Hotspot borrower follow-up surveys are important to identify user experiences with the program, how lending program impacted internet skills, uses of the hotspots and borrower characteristics. The results from these surveys suggest that borrowers found the program very useful and that users were often lower income, less educated, and from more rural areas. The program was likely filling a need for those who could not afford or obtain broadband subscriptions. Follow-up user surveys can be helpful not only in assessing user experiences, but also in identifying socioeconomic and demographic characteristics of the users and how they are using the hotspots.

As was learned from the user surveys, while users had a good experience and on average felt they gained skills in using the internet as a result of their participation, the program did not appear to foster a high increase in those stating they would, as a result, obtain a broadband subscription. This result is likely due to a variety of reasons, but two primary limitations were identified, (1) the affordability of subscriptions for many households and (2) geographic barriers to rural areas. Many lower-income households participating in the lending program did not feel they could afford a subscription. Potential policy implications of this result might be that the lending program could be expanded and/or programs to subsidize broadband connectivity for lower-income, rural households might be considered. In addition, to serve rural areas, especially those in more mountainous or hilly areas, geographic barriers will have to be overcome. This likely means more expensive services to lower critical masses of customers.

Limited ability by lower-income counties to implement grant cost sharing to improve broadband access will likely continue to be problematic. While librarians can apply to the Federal E-rate program to ensure sustainability of the mobile hotspot lending program, they reported difficulties and reluctance mainly due to the large amount of paperwork involved in the process of applying for federal aid. Limited time-resources at the local level can be problematic and should be considered. Additionally, local buy-in from County Commissions and local governments can help secure financial resources to ensure the sustainability of mobile hotspot lending programs.

III.2. Future recommendations

Each county involved with a program had significant digital divide concerns and tended to have populations with lower educational attainment and are at least somewhat economically distressed. A number of other counties in Tennessee could benefit from a mobile hotspot lending program, given sufficient funding. Challenges in broadening the scope of the lending program include finding sufficient funding to support additional hotspot lending programs. Some grant programs require local matching and more economically distressed areas may find this to be an insurmountable financial barrier. Successful hotspot lending programs also require commitment of labor time to manage the lending program. When administered through local libraries, this can mean mobile hotspot lending program implementation may be added to an already busy library staff. Future program administration might include funding to help pay for implementation of the mobile hotspot lending program at the local library level.

As noted earlier, mobile hotspot participants study results reflect that, despite participation in a hotspot lending program and a positive experience with the program, many participants did not plan to subscribe to broadband internet in the future. This was often due to participants not being able to afford the monthly subscription rate. A combination of unaffordability and, at times, lack of a critical mass to justify providing broadband in more rural areas helps to sustain the digital divide between more rural and urban areas and lower- and higher-income households. Participants reported a high degree of satisfaction with the program and felt their internet skill sets were improved as a result. Despite this satisfaction with the

program, participation does not necessarily lead to broadband subscription. Significant impediments to residents of counties considered include subscription costs being considered too high to afford. The most underserved, lowest-income, more rural residents are more likely to need a hotspot lending program but are less likely to subscribe. To better meet broadband needs in rural, lower-income areas, future expansion of the mobile hotspot lending program may be indicated. As a stop-gap measure to improve rural, lower-income households' broadband access, mobile hotspot lending programs can be supported through federal, state or local funding that not only uses libraries as established community anchors but also encourages partnerships and resource sharing between Cooperative Extension systems and public libraries. Assistance and educational programs targeted toward helping local librarians apply for grant funding for mobile hotspot lending funding could help more local libraries implement these programs.

Additional research should examine costs and benefits of programs to subsidize subscription rates for lower-income citizens, particularly those in more rural areas. These programs could potentially help expand broadband subscription rates in areas where broadband is available but at subscription rates that can't be afforded by a large percentage of the population. At a community level, downtown Wi-Fi projects can be secured through grants from the Appalachian Regional Commission region that spans 423 counties across 13 states. At a regional level, developing the capacity to address broadband issues, streamlining the mediation and arbitration process between ISPs and local government, and improving transparency on fees, right-of-way easements will improve efficiency in the broadband deployment process.

Currently, the state of Tennessee is working with local electric cooperatives to improve broadband coverage across communities. Library mobile hotspot lending programs and downtown broadband Wi-Fi projects are successful collaborative partnerships at the community level that provide temporary broadband access while infrastructure is built to support communities across Tennessee. Using survey data from communities in need of broadband usage, communities can leverage grant funding from federal, state and private partners. Data on broadband demand, willingness to pay and household income can be used to negotiate affordable subscription plans at the community level.

There are several proposed solutions and further steps to address broadband access issues Tennesseans and residents in other states face. Demand-side management initiatives, such as incentives, subsidies and vouchers for low-income consumers, are possibilities. Competition among ISPs in a community could improve access and lower prices that can improve affordability and thereby access. Incentivizing public and private partnerships in removing broadband barriers and resolving issues can expedite broadband deployment in communities across the United States. A few assistance sources are provided below that may help expand broadband subscription and availability.

III.3. Information and assistance sources

While the listing below is not comprehensive, it does provide information on several programs that may assist communities in providing wider broadband access to their citizens.

Information and guides

1. **The Tennessee Broadband Accessibility Act** lays out a plan using multiple avenues to address broadband gaps in Tennessee including funding, deregulation and education. This program can improve broadband access in digitally unserved and underserved communities. Information about the Act can be found at www.tn.gov/ecd/rural-development/tennessee-broadband-grant-initiative/tennessee-broadband-accessibility-act-article.html.

2. **A portal to information on broadband, resources, and potential funding offered** by the Tennessee Department of Economic and Community Development can be found at www.tn.gov/ecd/rural-development/tnecd-broadband-initiative.html. These resources can be used by communities in improve broadband access and adoption.

3. **The Broadband Ready Community Designation Program** allows political subdivisions to submit documentation to request this designation. Designation requires that a political subdivision adopt an efficient and streamlined ordinance or policy for reviewing applications and issuing permits related to broadband service projects. More information about this program can be found at www.tn.gov/ecd/rural-development/tennessee-broadband-grant-initiative/broadband-ready-community-article.html. This broadband ready designation can demonstrate the communities have engaged the leaders and are willing to address the digital divide.

4. **The Broadband USA's Adoption Toolkit** is designed to support communities in increasing broadband adoption. The toolkit includes success stories as well as issues communities should consider when starting an adoption program. The Adoption Toolkit can be found at www2.ntia.doc.gov/files/NTIA_2013_BroadbandUSA_Adoption_Toolkit.pdf. More communities can gain from hearing success stories by adopting programs that will work for them locally.

5. **The Digital Inclusion Start-Up Manual** provides guidance to individuals looking to increase access and use of technology in disadvantaged communities through digital literacy training, affordable home broadband, affordable devices and tech support. These efforts might take place within a community-based organization, a library, a housing authority, a local government or other community locations. The Manual can be found at startup.digitalinclusion.org/pdfs/NDIA%20Digital%20Inclusion%20Startup%20Manual.pdf. The manual can be a handy guide for communities to develop capacity locally to address digital equity and inclusion.

6. **The National Digital Inclusion Alliance Guidebook** is focused on making community-wide digital inclusion coalitions. Libraries, community-based organizations, local governments, housing authorities and others in cities across the country organize coalitions to cooperatively address equitable access and use of communication technologies. This guidebook can be found at www.digitalinclusion.org/download/17110/. This guidebook can serve as a resource for communities to organize and build local support for broadband activities.

7. **Access and Inclusion in the Digital Age** is a resource guide designed for local governments to support the advancement of digital inclusion. The guide was developed by a team of six cities from across the country (including Chattanooga). The guide can be accessed at nationalresourcenetwork.org/wp-content/uploads/2019/04/NRN-Broadband-Resource-Guide_Oct-2016.pdf. Leaders in local governments can learn from adoption plans from other communities.

8. The US Department of Housing and Urban Development created the **ConnectHome Playbook** to help housing communities build partnerships to narrow the digital divide. A link for the Playbook is: static1.squarespace.com/static/590bfab229687fec92f55513/t/596695a117bffc3563798d8e/1499895210156/c

onnecthomeplaybook+%281%29.pdf. This playbook helps improve partnerships and improve broadband connectivity at home.

9. Nashville Public Library Courses: Search for various courses on topics such as basic computer skills or health information. Courses take 5-20 minutes to complete and can be accessed at npl.digitallearn.org. This resource provides a wide variety of digital skills that can be used for training of local broadband educators.

10. **Tech Goes Home Chattanooga** has compiled video tutorials and modules on a range of topics from social media guides to job search and employment resources. The website is techgoeshomecha.org/for-participants.html. This is a popular program that provides resources to citizens that are interested in improving digital skills. Many communities such as Sequatchie and Decatur Counties have adopted this program.

11. **The Goodwill Community Foundatio**n aims to help communities learn essential skills needed to live and work in the 21st century by offering more than 200 topics, including more than 7,000 lessons, more than 1,000 videos and more than 50 interactives and games, completely free. GCFLearnFree can be accessed at edu.gcfglobal.org/en. This is a free online resource that can be used for training on digital literacy skills.

12. **Techboomers** is a free educational website that teaches older adults and other inexperienced internet users basic computer skills about websites that can help improve quality of life and is found at techboomers.com. This program is beneficial for senior citizens who want to improve digital skills for a more improved quality of life in improving skills and connecting with family as well as friends.

Funding, equipment and services

1. **The Tennessee Broadband Accessibility Grant Program** is designed to offset capital expenses for deployment of broadband in unserved areas. The goal of the program is to facilitate broadband access to all Tennesseans while promoting practices that increase deployment and encourage adoption. These funds are targeted to areas that are unlikely to receive broadband service without grant funding. To access information about information and guidelines for this program, please go to www.tn.gov/ecd/rural-development/tennessee-broadband-grant-initiative/tnecd-broadband-accessibility-grant.html.The Department of Economic and Community Development has a Fiscal Year 2019-2021 Broadband Accessibility

Grant Report, which outlines broadband investments towards increasing broadband availability (www.tn.gov/content/dam/tn/ecd/documents/FY21%20Broadband%20Legislative%20Annual%20Report.pdf).

2. **The BroadbandUSA Funding Guide** provides a list of funding opportunities offered by the federal government and can be found at broadbandusa.ntia.doc.gov/new-fund-search.

3. **Mobile Beacon** was founded by one of the largest Educational Broadband Service (EBS) providers in the United States. Mobile Beacon is dedicated to providing affordable, mobile, high-speed internet access to schools, libraries and nonprofits so they can better carry out their missions. Their website has various funding opportunities offered throughout the year at mobilebeacon.org.

4. **The National Digital Inclusion Alliance** has a listing of free and low-cost offerings from major ISPs that are designed to help low-income households acquire service at no cost or at very affordable prices. Most have eligibility limitations linked to income or program enrollment. The list also includes established, nationally available low-cost plans offered by nonprofit organizations and is found at digitalinclusion.org/free-low-cost-internet-plans.

5. **PCs for People** refurbishes desktop and laptop computers for distribution to eligible recipients. To receive technology from PCs for People, a potential recipient must be below 200 percent poverty level or be currently enrolled in an income-based government assistance program. A description of this program can be found at pcsforpeople.org.

6. **The National Digital Inclusion Alliance Discount Internet Guidebook** describes affordable broadband plans for disadvantaged American households offered by commercial internet providers (or in two cases, nonprofit resellers of a commercial service) and can be accessed at discounts.digitalinclusion.org/pdfs/Discount Internet Guidebook v3.1.pdf.

7. **EveryoneOn** brings low-cost internet and affordable devices to those in need. A listing of potential low-cost services and offers can be found at everyoneon.org/lowcost-offers.

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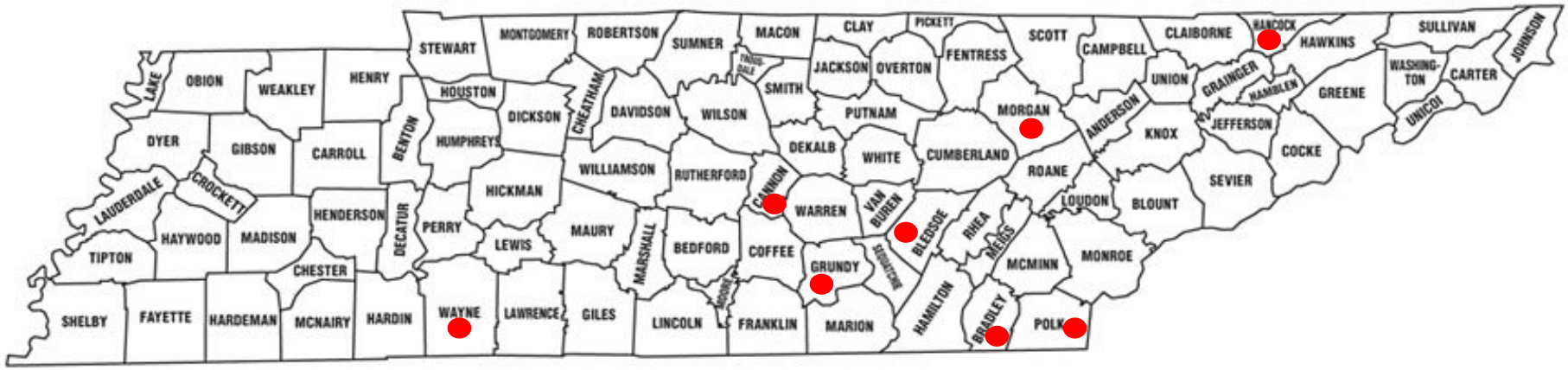
Appendix A: Tennessee county map with intervention counties highlighted



Program county

Figure A.1. Tennessee county map and program intervention counties

Appendix B: Broadband affordability proxy measure and other county characteristics

Table B.1. Broadband affordability proxy measure and other county characteristics for Tennessee counties

County name	2020 median household income	Two percent of median household income	Monthly affordability proxy measure[a]	2020 total population	2020 have computer	2020 dial-up subscription only	2020 broadband internet subscription	2020 poverty rate	2020 Unemployment %	2020 BS or Higher Education
Anderson	$52,367.94	$1,047.36	$87.28	76,513	89.42%	0.33%	83.01%	15.2%	5.5%	22.8%
Bedford	$52,391.85	$1,047.84	$87.32	48,937	87.68%	0.11%	77.56%	13.8%	4.4%	18.1%
Benton	$38,982.90	$779.66	$64.97	16,133	81.76%	0.68%	69.29%	17.0%	7.2%	12.8%
Bledsoe	$45,852.09	$917.04	$76.42	14,961	81.13%	0.33%	74.55%	20.5%	7.5%	11.4%
Blount	$58,889.00	$1,177.78	$98.15	131,641	89.89%	0.15%	80.72%	9.7%	4.8%	24.6%
Bradley	$53,343.76	$1,066.88	$88.91	106,924	90.05%	0.38%	82.04%	15.6%	5.4%	23.5%
Campbell	$41,363.73	$827.27	$68.94	39,818	82.60%	0.22%	66.98%	19.8%	10.2%	13.0%
Cannon	$57,499.57	$1,149.99	$95.83	14,374	87.61%	0.38%	70.14%	16.5%	3.0%	16.3%
Carroll	$44,308.86	$886.18	$73.85	27,841	81.16%	0.79%	70.08%	16.8%	4.0%	18.7%
Carter	$39,585.64	$791.71	$65.98	56,452	83.17%	0.31%	70.22%	19.1%	5.9%	18.5%
Cheatham	$64,340.70	$1,286.81	$107.23	40,539	90.34%	0.00%	81.76%	10.70%	4.3%	20.5%
Chester	$53,982.88	$1,079.66	$89.97	17,260	83.49%	0.50%	76.69%	13.3%	7.3%	15.9%
Claiborne	$38,279.35	$765.59	$63.80	31,827	80.36%	1.01%	62.86%	23.1%	7.2%	17.4%
Clay	$33,428.32	$668.57	$55.71	7,640	77.39%	0.22%	62.19%	25.9%	5.3%	13.0%
Cocke	$38,155.69	$763.11	$63.59	35,797	79.30%	0.25%	68.44%	20.7%	8.6%	11.3%
Coffee	$52,325.34	$1,046.51	$87.21	56,024	86.87%	0.12%	70.80%	14.4%	4.4%	21.2%
Crockett	$46,470.42	$929.41	$77.45	14,310	82.66%	0.53%	76.14%	16.0%	4.2%	15.2%
Cumberland	$47,760.08	$955.20	$79.60	60,016	89.01%	0.29%	81.76%	12.5%	6.2%	17.5%
Davidson	$62,755.90	$1,255.12	$104.59	690,540	93.97%	0.10%	87.69%	14.2%	4.7%	43.3%
Decatur	$43,679.10	$873.58	$72.80	11,663	80.74%	0.54%	73.24%	18.7%	8.0%	14.3%
DeKalb	$47,295.55	$945.91	$78.83	20,104	81.60%	0.86%	71.29%	19.8%	4.9%	18.9%
Dickson	$55,157.19	$1,103.14	$91.93	53,289	87.12%	0.38%	79.16%	11.9%	3.5%	17.2%
Dyer	$45,917.56	$918.35	$76.53	37,201	86.13%	0.32%	80.05%	18.3%	6.2%	18.6%
Fayette	$63,091.57	$1,261.83	$105.15	40,612	88.53%	0.12%	79.68%	12.0%	6.4%	22.5%
Fentress	$37,952.00	$759.04	$63.25	18,405	81.70%	0.16%	73.29%	18.7%	6.3%	16.6%
Franklin	$53,607.72	$1,072.15	$89.35	41,999	85.56%	0.43%	70.44%	15.4%	4.0%	20.8%
Gibson	$44,863.80	$897.28	$74.77	49,193	85.95%	0.28%	77.89%	15.4%	5.8%	17.9%

County name	2020 median household income	Two percent of median household income	Monthly affordability proxy measure[a]	2020 total population	2020 have computer	2020 dial-up subscription only	2020 broadband internet subscription	2020 poverty rate	2020 Unemployment %	2020 BS or Higher Education
Giles	$51,559.44	$1,031.19	$85.93	29,403	87.52%	0.44%	77.00%	13.2%	5.4%	17.9%
Grainger	$45,791.81	$915.84	$76.32	23,268	86.86%	1.48%	72.12%	16.9%	5.2%	12.9%
Greene	$44,265.21	$885.30	$73.78	69,077	83.80%	0.47%	72.19%	19.1%	5.0%	16.1%
Grundy	$42,104.69	$842.09	$70.17	13,371	80.52%	0.12%	69.90%	19.1%	8.0%	13.4%
Hamblen	$45,329.37	$906.59	$75.55	64,479	85.12%	0.24%	77.82%	17.0%	7.7%	18.1%
Hamilton	$57,229.38	$1,144.59	$95.38	364,718	89.81%	0.05%	82.72%	12.6%	4.6%	33.3%
Hancock	$31,317.68	$626.35	$52.20	6,568	75.14%	0.00%	56.87%	31.1%	12.0%	10.7%
Hardeman	$41,884.38	$837.69	$69.81	25,247	83.35%	0.25%	68.21%	18.2%	13.1%	10.5%
Hardin	$42,277.20	$845.54	$70.46	25,665	81.99%	0.34%	76.15%	17.4%	4.6%	16.5%
Hawkins	$43,567.90	$871.36	$72.61	56,735	85.23%	0.36%	73.93%	17.7%	7.6%	16.7%
Haywood	$39,391.31	$787.83	$65.65	17,391	80.69%	0.00%	65.56%	18.0%	5.8%	11.4%
Henderson	$45,003.05	$900.06	$75.01	27,956	81.80%	0.16%	75.48%	19.0%	7.7%	13.6%
Henry	$42,090.14	$841.80	$70.15	32,251	84.81%	0.18%	75.78%	20.7%	4.7%	17.7%
Hickman	$45,305.46	$906.11	$75.51	25,017	80.76%	0.80%	68.14%	14.7%	3.3%	9.4%
Houston	$44,385.76	$887.72	$73.98	8,201	77.01%	0.41%	69.61%	14.8%	5.8%	13.4%
Humphreys	$47,457.67	$949.15	$79.10	18,528	84.39%	0.39%	74.86%	15.5%	9.1%	14.8%
Jackson	$36,587.52	$731.75	$60.98	11,767	76.64%	0.69%	63.07%	16.0%	7.6%	11.6%
Jefferson	$51,065.81	$1,021.32	$85.11	54,162	88.61%	0.17%	76.45%	13.1%	6.2%	17.5%
Johnson	$37,415.77	$748.32	$62.36	17,755	75.54%	0.00%	63.18%	23.7%	3.0%	11.9%
Knox	$59,723.48	$1,194.47	$99.54	466,184	92.19%	0.10%	84.08%	13.2%	4.2%	38.8%
Lake	$36,570.89	$731.42	$60.95	7,273	75.40%	0.32%	65.48%	13.2%	12.4%	10.1%
Lauderdale	$41,460.38	$829.21	$69.10	25,689	84.38%	0.29%	73.85%	19.5%	7.0%	9.6%
Lawrence	$45,324.17	$906.48	$75.54	43,780	83.48%	0.14%	75.45%	16.7%	8.2%	13.9%
Lewis	$38,738.69	$774.77	$64.56	12,131	76.37%	0.35%	64.87%	20.3%	4.5%	10.1%
Lincoln	$51,425.38	$1,028.51	$85.71	34,158	86.67%	0.30%	69.07%	11.7%	3.8%	19.1%
Loudon	$60,341.81	$1,206.84	$100.57	53,169	90.75%	0.01%	81.11%	12.2%	3.6%	27.3%
Macon	$44,982.27	$899.65	$74.97	24,208	81.56%	0.39%	73.85%	16.8%	4.4%	9.0%
Madison	$40,696.56	$813.93	$67.83	97,838	88.15%	0.16%	80.85%	19.7%	6.7%	25.9%
Marion	$38,897.69	$777.95	$64.83	28,639	85.77%	0.18%	74.82%	16.6%	5.2%	12.5%
Marshall	$50,049.46	$1,000.99	$83.42	33,708	90.29%	0.36%	80.89%	16.2%	6.4%	16.2%

County name	2020 median household income	Two percent of median household income	Monthly affordability proxy measure[a]	2020 total population	2020 have computer	2020 dial-up subscription only	2020 broadband internet subscription	2020 poverty rate	2020 Unemployment %	2020 BS or Higher Education
Maury	$51,370.30	$1,027.41	$85.62	94,615	92.67%	0.22%	83.80%	9.0%	3.8%	24.0%
McMinn	$55,282.93	$1,105.66	$92.14	53,392	86.76%	0.36%	78.23%	16.3%	6.2%	17.0%
McNairy	$59,411.72	$1,188.23	$99.02	25,814	83.80%	0.19%	76.56%	18.5%	6.9%	13.1%
Meigs	$51,094.91	$1,021.90	$85.16	12,237	83.86%	0.59%	71.21%	15.4%	8.9%	10.2%
Monroe	$44,092.70	$881.85	$73.49	46,413	83.90%	0.32%	77.99%	16.9%	6.9%	15.3%
Montgomery	$59,797.27	$1,195.95	$99.66	204,992	94.72%	0.18%	88.29%	12.3%	6.0%	29.4%
Moore	$59,970.82	$1,199.42	$99.95	6,396	85.49%	1.15%	66.33%	8.0%	3.9%	19.4%
Morgan	$42,953.73	$859.07	$71.59	21,538	82.50%	0.13%	73.21%	22.6%	7.7%	11.4%
Obion	$41,168.36	$823.37	$68.61	30,343	83.75%	0.44%	75.45%	19.1%	6.2%	15.5%
Overton	$38,655.55	$773.11	$64.43	22,171	78.15%	0.58%	64.58%	19.2%	3.6%	12.5%
Perry	$42,643.00	$852.86	$71.07	8,020	72.52%	2.12%	65.79%	23.6%	8.8%	8.6%
Pickett	$41,104.97	$822.10	$68.51	5,068	78.74%	1.54%	69.24%	19.3%	4.8%	13.5%
Polk	$45,004.09	$900.08	$75.01	16,807	82.40%	0.20%	74.73%	12.4%	6.3%	12.6%
Putnam	$45,994.46	$919.89	$76.66	78,542	87.79%	0.05%	78.98%	17.8%	5.9%	26.4%
Rhea	$43,860.96	$877.22	$73.10	32,964	87.14%	0.11%	79.97%	17.1%	8.8%	16.6%
Roane	$55,459.60	$1,109.19	$92.43	53,331	88.46%	0.08%	80.16%	13.5%	6.0%	19.1%
Robertson	$65,789.36	$1,315.79	$109.65	70,982	89.53%	0.15%	82.02%	11.2%	4.7%	20.4%
Rutherford	$70,072.99	$1,401.46	$116.79	324,139	95.26%	0.09%	88.60%	10.3%	4.2%	32.6%
Scott	$40,387.91	$807.76	$67.31	22,020	79.76%	0.39%	64.60%	22.0%	8.2%	9.2%
Sequatchie	$51,305.87	$1,026.12	$85.51	14,936	88.52%	0.69%	76.21%	21.6%	4.7%	14.7%
Sevier	$51,555.28	$1,031.11	$85.93	98,007	88.72%	0.29%	78.75%	14.2%	4.8%	18.3%
Shelby	$53,682.55	$1,073.65	$89.47	936,611	87.33%	0.18%	78.33%	19.0%	7.4%	32.4%
Smith	$49,952.82	$999.06	$83.25	19,926	86.36%	0.18%	79.49%	14.7%	3.7%	17.2%
Stewart	$47,605.24	$952.10	$79.34	13,553	80.90%	0.19%	70.80%	13.3%	6.0%	18.2%
Sullivan	$48,514.55	$970.29	$80.86	157,707	87.72%	0.15%	79.37%	18.5%	6.5%	24.5%
Sumner	$69,839.17	$1,396.78	$116.40	187,680	92.60%	0.25%	86.55%	9.9%	3.4%	28.6%
Tipton	$63,694.31	$1,273.89	$106.16	61,562	89.71%	0.18%	77.54%	11.6%	5.3%	17.0%
Trousdale	$58,529.43	$1,170.59	$97.55	10,910	79.78%	0.00%	71.28%	9.8%	4.6%	11.6%
Unicoi	$43,532.57	$870.65	$72.55	17,821	81.14%	0.12%	71.85%	17.5%	6.1%	16.4%
Union	$46,422.62	$928.45	$77.37	19,678	87.02%	0.59%	68.10%	18.8%	6.7%	11.1%

County name	2020 median household income	Two percent of median household income	Monthly affordability proxy measure[a]	2020 total popula-tion	2020 have computer	2020 dial-up subscription only	2020 broadband internet subscription	2020 poverty rate	2020 Unemploy-ment %	2020 BS or Higher Education
Van Buren	$44,399.27	$887.99	$74.00	5,813	77.65%	0.40%	73.42%	15.1%	5.0%	8.6%
Warren	$42,737.57	$854.75	$71.23	40,971	83.65%	0.26%	72.68%	20.2%	3.8%	13.7%
Washington	$50,229.25	$1,004.58	$83.72	128,874	89.73%	0.26%	82.21%	15.2%	4.8%	32.3%
Wayne	$43,051.41	$861.03	$71.75	16,638	79.31%	0.61%	71.00%	16.1%	6.0%	10.6%
Weakley	$41,502.99	$830.06	$69.17	33,377	83.43%	0.60%	72.20%	19.9%	4.7%	19.9%
White	$43,644.80	$872.90	$72.74	27,087	83.32%	0.28%	73.51%	14.8%	4.9%	12.7%
Williamson	$117,391.41	$2,347.83	$195.65	232,380	97.22%	0.07%	93.87%	4.7%	2.5%	60.5%
Wilson	$78,970.72	$1,579.41	$131.62	140,604	94.08%	0.10%	86.19%	8.3%	3.5%	34.8%

[a] Green shading reflects counties with an affordability proxy measure of less than $75 per month.

Sources: US Census Bureau, 2015-2019 American Community Survey 5-Year Estimates for median household income and US Census Bureau, 2016-2020 American Community Survey 5-Year Estimates for other measures.

Appendix C: Survey instruments

B.1. Household internet needs questionnaire

The ### County School Board in collaboration with University of Tennessee Extension is conducting a survey to determine the **internet access availability** of our elementary school students.
Please complete this survey and return it to your child's first period teacher by **###.**
The information collected will be used as part of the grant application for providing mobile internet hotspots for free loan from ## County Libraries.

1. Which schools do your children attend? (Select all that apply)

☐ Black Fox Elementary
☐ Charleston Elementary
☐ Hopewell Elementary
☐ Michigan Avenue Elementary
☐ North Lee Elementary
☐ Oak Grove Elementary
☐ Park View Elementary
☐ Prospect Elementary
☐ Taylor Elementary
☐ Valley View Elementary
☐ Waterville Community Elementary

2. Do you have broadband internet access at home?

☐ Yes
☐ No

3. Which of the following devices do you have at home? (Select all that apply)

☐ Smartphone
☐ Laptop
☐ Desktop computer
☐ iPad
☐ Tablet
☐ None

4. Rank the following in order of importance (1-5) for your internet use:

_____For my work/job
_____Research
_____Schoolwork
_____Entertainment
_____Other, please specify:_____

5. If available, would you have the need for the free use of a mobile hotspot to access internet at home?

☐ Yes
☐ No

A hotspot lending program extends access to users who cannot afford in-home internet access of do not have access to internet infrastructure.

Thank you for taking the time to complete the survey, we appreciate your help!

School/Library Mobile Hotspot User Survey

Internet Use Information

1. Have you completed this survey before?
   - ○ Yes
   - ○ No
2. What device do you or your household own? Select all that apply.
   - ○ Personal laptop
   - ○ Desktop computer
   - ○ Smartphone
   - ○ Tablet (e.g., iPad)
   - ○ E-reader (e.g., Kindle)
   - ○ Other_____
3. How often do you use the internet for the following purposes? (On a scale from 1-10, 1 being never and 10 being very often)
   - A. Helping my child with schoolwork: ①②③④⑤⑥⑦⑧⑨⑩
   - B. Learning new skills for work/job application/webinars: ①②③④⑤⑥⑦⑧⑨⑩
   - C. Connecting with family and friends: ①②③④⑤⑥⑦⑧⑨⑩
   - D. Research for personal purposes: ①②③④⑤⑥⑦⑧⑨⑩
   - E. Entertainment: ①②③④⑤⑥⑦⑧⑨⑩
4. Please rate your internet skills before and after checking out the mobile hotspot. (On a scale from 1-10, 1 being poor and 10 being excellent)
   Before checking out the device: ①②③④⑤⑥⑦⑧⑨⑩
   After checking out the device: ①②③④⑤⑥⑦⑧⑨⑩
5. How satisfied are you with the library mobile hotspot lending program? (On a scale from 1-10, 1 being poor and 10 being excellent)
   ①②③④⑤⑥⑦⑧⑨⑩
6. How likely are you to recommend the library mobile hotspot to a friend or family member? (On a scale from 1-10, 1 being highly unlikely and 10 very likely)
   ①②③④⑤⑥⑦⑧⑨⑩
7. Do you plan on purchasing a broadband internet subscription for your household in the next…? Select one option.
   - ○ 1-2 months
   - ○ 3-6 months
   - ○ Less than a year
   - ○ 1-2 years
   - ○ Not planning on purchasing broadband internet
8. If you plan to subscribe to a broadband internet service, what download speed range (Mbps) would you prefer? Select one option.
   - ○ 3-10 Mbps (light use: email, browsing, internet radio)
   - ○ 10-25 Mbps (moderate use: HD video, gaming, telecommuting)
   - ○ More than 25 Mbps (high use: 4k video, 2 or more users online)
   - ○ Not available in my service area
9. What is your willingness to pay for broadband service? Specify price for each speed.
   - ○ 10 mbps download/3 mbps upload: $_____/month
   - ○ 25 mbps download/3 mbps upload: $_____/month
   - ○ More than 25 mbps download/3 mbps upload: $_____/month
   - ○ Not willing to pay for broadband
10. If you are <u>not</u> planning on subscribing to broadband internet service, what factors are preventing you from subscribing to broadband? Select all that apply.
    - ○ Broadband service is too expensive
    - ○ Cost of computer is too expensive
    - ○ Broadband service is unavailable in my area
    - ○ Available broadband download speed is too slow
    - ○ I use wireless plan to connect to internet with smartphone
    - ○ I have other options for internet access outside of home
    - ○ Not interested

Demographic information:

1. What is your year of birth? _____
2. How many children live in your household? _____
3. How many adults live in your household? _____
4. What is the zip code of your current residence? _____
5. How far do you live from the nearest school or public library?
   - ○ Less than 5 miles ○ 5-20 miles
   - ○ 20-50 miles ○ More than 50 miles
6. What is your gender?
   - ○ Male ○ Female
   - ○ Prefer not to answer
7. What is your ethnicity?
   - ○ White/Caucasian ○ American Indian
   - ○ African American ○ Asian
   - ○ Hispanic/Latino ○ Other_____
   - ○ Prefer not to answer
8. What is your employment status?
   - ○ Employed full-time ○ Student
   - ○ Employed part-time ○ Retired
   - ○ Unemployed ○ Other_____
   - ○ Prefer not to answer
9. What is your annual household income?
   - ○ Less than $25,000 ○ $25,000-$50,000
   - ○ $50,001-$75,000 ○ $75,001-$100,000
   - ○ More than $100,000 ○ Prefer not to answer
10. What is the highest level of education attained?
    - ○ Some school ○ High School or GED
    - ○ Some College/Associates Degree ○ Bachelor's degree
    - ○ Graduate/Professional Degree ○ Prefer not to answer
11. Did you primarily work from home in 2020 due to the COVID-19 pandemic?
    - ○ Yes
    - ○ No
    - ○ Not applicable
12. Did your child primarily attend school virtually in 2020 due to the COVID-19 pandemic?
    - ○ Yes
    - ○ No
    - ○ Not applicable
13. Please indicate how the COVID-19 pandemic has impacted the following: (On a scale from 1-10, 1 being no impact and 10 being significant impact)
    Your work productivity: ①②③④⑤⑥⑦⑧⑨⑩
    Your child's academic success: ①②③④⑤⑥⑦⑧⑨⑩

All information collected here is part of a University of Tennessee research project and is completely voluntary. All information will be kept strictly confidential. If you have questions about this survey, please contact Sreedhar Upendram at (865)-974-7410 or UTK IRB staff at (865)-974-7697.

UTEXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

2021 Downtown Pikeville Questionnaire

Circle the Answer

I have or plan to:

I have or plan to:

Do you utilize the Wi-Fi while you are in town?	Yes	No
Are you happy that free reliable Wi-Fi is available?	Yes	No
Do you use Wi-Fi for informational purposes?	Yes	No
Do you use Wi-Fi for social media?	Yes	No
Do you use Wi-Fi for general web browsing?	Yes	No
Do you use Wi-Fi to find locations and info about the area?	Yes	No
Do you have your device set to connect automatically to the Wi-Fi?	Yes	No
Do you find that the coverage area is sufficient?	Yes	No
Would you like to see this project continue in the future?	Yes	No
Do you feel this project is important to businesses, consumers and visitors?	Yes	No
Have you told others about this service or recommended others use it?	Yes	No

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