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Digital Redlining and the Endless Divide: Philadelphia's COVID-19 Digital Inclusion Efforts

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The COVID-19 pandemic precipitated attention to the public consequences of digital exclusion and to local, state, and federal emergency digital inclusion efforts. In this case study, we examine private sector, municipal government, and nonprofit efforts to close the divide during the pandemic in Philadelphia, which has one of the worst urban connectivity rates in the United States. Drawing on news accounts, policy documents, and interviews with city staff, we assess Philadelphia's digital inclusion efforts during the pandemic. Our findings show that inclusion efforts faced challenging logistics, limited data on the unconnected, funding concerns, and sometimes pushback from Internet service providers (ISPs). The latter were by necessity crucial partners in connectivity efforts but failed to address basic digital access gaps without significant public and governmental pressure, signaling the need for public alternatives. Our analysis foregrounds the disconnect among well-resourced ISPs, connectivity gaps marked by digital redlining in the poorest communities, and political constraints on robust public broadband policy.

Keywords: COVID-19, digital divide, digital inclusion, digital redlining, municipal broadband

The digital divide has been an enduring problem in the United States. Both the private sector and federal policies have repeatedly failed to solve it, and significant disparities in digital connectivity continue unabated as ICTs require increasingly higher bandwidth and speed. Concurrently, fundamental policy disagreements have persisted, particularly regarding the government's role in closing the digital divide. Over the years, incumbent Internet service providers (ISPs) have lobbied successfully to pass state-level legislation restricting municipal broadband projects, claiming the private sector is uniquely suited to provide superior Internet services (Hetrick, 2021b). Yet, ISPs have consistently failed to guarantee affordable and reliable service to all Americans (Crawford, 2018). In urban areas, such digital exclusion—via high costs,

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lack of investment in network upgrades, and slow speeds—disproportionately impacts communities of color, resulting in "digital redlining," which reflects long-standing patterns of social exclusion.

In 2021, partly in response to the economic crisis amid the paralyzing COVID-19 global pandemic, the Biden administration advocated for empowering municipal broadband projects, and Congress passed infrastructure legislation allocating significant funding for broadband infrastructure. Concurrently, the pandemic convinced many Americans that broadband Internet access is an essential public service, crucial to everything, from ordering groceries and seeking medical attention to signing up for vaccinations. By revealing the growing stakes of digital connectivity to modern life and the disparate consequences the digital divide holds for marginalized communities, the pandemic highlighted the structural obstacles for the under- and unconnected.

Examining emergency connectivity efforts during the pandemic can illuminate both the mechanisms underpinning digital redlining and the challenges in overcoming them. In this case study, we investigate public and private efforts to close the divide during the pandemic in Philadelphia, one of the most populous U.S. cities with a history of one of the worst urban connectivity rates in the nation (Fernandez, 2018). Suffering from significant poverty levels that disproportionately afflict the city's Black communities, Philadelphia is also home to Comcast, the largest ISP in the United States, and the site of an early municipal broadband effort, which resulted in a state law effectively banning future efforts.

Drawing on news accounts, primary documents detailing city, nonprofit, and private initiatives, and interviews with city staff, we assess Philadelphia's digital inclusion efforts during the COVID-19 pandemic. Our findings show that these initiatives prioritized access and cost, particularly for households with students, and digital literacy, sometimes at the expense of speed and quality. Moreover, while private ISPs are by necessity crucial partners in connectivity efforts, without significant civil society pressure they fail to address basic connectivity gaps, signaling the need for strong policy intervention, such as establishing public alternatives. Our analysis foregrounds the disconnect between well-resourced ISPs, connectivity gaps marked by persistent digital redlining in the poorest communities, and political constraints on robust public broadband policy. We begin by outlining the disparities characterizing the digital divide, particularly digital redlining. Then we survey Philadelphia's connectivity initiatives preceding the pandemic and situate our case study within the growing research on COVID-19 emergency urban connectivity efforts. We describe our methodology and outline the salient socioeconomic dimensions of Philadelphia's digital divide going into the pandemic before assessing the connectivity initiatives of the city and other actors. We conclude with a discussion of the policy implications of our findings and recommendations for necessary reforms.

Literature Review

Disparities in ICT access and use often map onto and intensify inequalities associated with income, education, and race since ICTs are central to everyday necessities, including education, health, social status, economic standing, self-expression, and political participation (Bauer, 2018). These disparities register in various ways, including access/connectivity, affordability (in terms of both services and the necessary devices), and a lack of Internet skills and digital literacy (Scheerder, van Deursen, & van Dijk, 2017). Such barriers are exacerbated by broadband market concentration, resulting in fewer consumer options; a lack

of ISP investment in broadband buildout and upgrades; high costs of deployment; geographical disparities (e.g., the urban-rural divide); and socioeconomic factors like income, education, and race (Reddick, Enriquez, Harris, & Sharma, 2020).

Although the digital divide is prevalent in rural areas due to low rates of return on expensive infrastructure buildout (Ali, 2020), it also persists in major metropolitan areas, particularly those with high rates of poverty and income inequality (e.g., Reddick et al., 2020). Indeed, disparities along racial and class lines, such as lower computer ownership rates among Black students than their White counterparts (Hoffman & Novak, 1998), have defined the digital divide since the phenomenon was first identified (National Telecommunications and Information Administration, 1995). While over time Internet infrastructure expanded, predominantly Black geographic areas often faced a dearth of broadband providers, high costs, and low speeds (Li, Turner-Lee, Gambhir, & Baek, 2011; Prieger & Hu, 2008). Such inequalities map onto historically segregated areas that were "redlined" (essentially cut off from procuring insured mortgages). For instance, in Los Angeles, both broadband competition and fiber access are less likely in formerly redlined, low-income, and minority neighborhoods (Galperin, Le, & Wyatt, 2021). This lack of infrastructure in marginalized communities (Cooper, 2000; Prieger & Hu, 2008) causes "digital redlining," defined as a "failure to provide service, or the provision of inferior service, to communities of color" (Baynes, 2004, p. 268) because of profitability concerns, racial bias, or both. Similar patterns of digital redlining have been documented in Fresno and Oakland (Le & Moya, 2020). Increasingly, such redlining manifests not necessarily as lack of service, but rather as expensive and poor-quality services stemming from a lack of infrastructure upgrades, which are likelier in wealthy communities (Falcon, 2021). For example, a study of AT&T's network upgrades reveals systematic redlining of lower-income households across 21 states (Communications Workers of America & National Digital Inclusion Alliance, 2020). Such divides are fueled at least partly by broadband policy that allows incumbent ISPs to raise prices without expanding and upgrading infrastructure. These same ISPs stave off competition by fighting public municipal broadband projects that can increase digital connectivity (Chao & Park, 2020; Crawford, 2018; Talbot, Hessekiel, & Kehl, 2018; Whitacre & Gallardo, 2020). This regulatory deference to ISPs has long characterized the Federal Communications Commission's (FCC) oversight of telecommunications (Popiel, 2020a, 2020b), exemplified by the 2018 repeal of net neutrality protections (Pickard & Berman, 2019).

The COVID-19 pandemic only exacerbated digital inequities. One striking example is the "homework gap" of 15% of U.S. students, who lack computer and Internet access for remote learning at home, particularly in marginalized communities (Santillana, Sraubhaar, Schrubbe, Choi, & Strover, 2020). Research shows that students of color spent less time on remote learning, even with publicly subsidized access devices, which are often less functional than those in White communities (Francis & Weller, 2021). Such disparities negatively impact future income and wealth generation, further entrenching socioeconomic inequalities. Moreover, students without home Internet access were forced to seek it elsewhere, including public spaces, which increased risks of COVID-19 exposure (Robinson et al., 2020).

As an essential infrastructure for civic engagement, broadband access is increasingly seen as key to maintaining healthy democratic processes. For instance, Internet access correlates with higher political knowledge (Lelkes, 2020) and greater political participation (Poy & Schüller, 2020). According to one report (Horrigan & Schement, 2021), the digital divide "threatens to undermine the ability of Americans to

participate in their economy, their communities, and in their democracy" (p. 2). Consequently, promoting digital inclusion and equity has become a policy imperative for responding to the pandemic-induced crisis.

COVID-19 and Municipal Digital Inclusion

In the absence of a coordinated federal response to the COVID-19 pandemic, the responsibility for managing the crisis fell on states and local governments. An early analysis suggests that local and state-level digital inclusion initiatives resulted in patchwork solutions tending to privilege short-term responses; insufficient funds for longer-term interventions; and reliance on the private sector for help (Kim, 2021). Efforts to address basic connectivity needs during the pandemic appear especially fraught with significant inequality in poorer cities (Reddick et al., 2020), yet the research on city digital inclusion initiatives remains incipient.

Existing research suggests that specific factors influence municipal governments' ability to respond to pandemic-related connectivity crises. In their study of Calgary's response to pandemic-induced stresses on digital infrastructure, Taylor, Anderson, and Cramer (2021) emphasize the importance of the city's fiber network, operated by third-party ISPs, to quickly meet growing data demands. Additionally, federal subsidies for private ISPs' low-income programs helped ensure service to the city's marginalized communities, including public WiFi hotspots and increased bandwidth for healthcare and other necessities, which were bolstered by "a general culture of support" (Taylor et al., 2021, p. 139) between government and ISPs. While this case study represents a pandemic connectivity success story—buttressed by a two-decade-old municipal fiber network buildout policy in a relatively well-resourced and generously subsidized Canadian city—how poorer, less well-connected cities lacking their own municipal networks responded to the crisis is unclear. To address this gap in our understanding of best practices and policy implications based on cities' responses to the pandemic, our study assesses digital inclusion efforts during this period in Philadelphia, a major urban area with significant levels of poverty and economic inequality.

Digital Inclusion in Philadelphia

Home to Comcast, the nation's largest ISP, Philadelphia has one of the country's worst urban connectivity rates (Hetrick & Purcell, 2020) despite being almost entirely covered by fiber optic infrastructure (Sanchez, 2020). The U.S. Census Bureau's (2019b) American Communities Survey (ACS) notes that Philadelphia County's broadband subscription rate is just 76.8%, below the 82.7% U.S. average, as is the county's computer ownership rate (85% versus the 90.3% U.S. average; U.S. Census Bureau, 2019a).

Philadelphia has long grappled with its digital divide. An early pioneer in municipal Internet provision, in 2004 the city launched its "Wireless Philadelphia" project to construct the largest municipal WiFi grid in the United States, aimed especially to connect low-income residents. Yet Earthlink, the private ISP that won the bid to build and operate the network, pulled out before completion, dooming the initiative. Although the city was criticized for ceding network ownership to a private ISP, the failure of "Wireless Philadelphia" became political ammunition against future municipal broadband efforts (Breitbart, Lakshmipathy, & Meinrath, 2007). ISPs like Verizon invoked it to successfully lobby

Pennsylvania's state legislature to erect barriers to future municipal networks (Hetrick, 2021b; Meinrath et al., 2019). The Pennsylvania legislature subsequently passed, like many state initiatives across the country, HB30, which prevents municipalities from providing broadband if already served by a private ISP or if one agrees to build infrastructure within 14 months of being requested to do so in an unserved area[2] (Cooper, 2021). Essentially giving private ISPs the "right of first refusal," the law effectively banned municipal broadband initiatives in Philadelphia since the state was already—at least in theory—served by private providers.

Although Philadelphia's subsequent broadband efforts rely on limited public funding and partnerships with private companies, public ventures have filled important access gaps. For instance, Free Library of Philadelphia Hot Spots, funded by the Knight Foundation, provided public Internet spaces for those lacking at-home access (Rhinesmith, 2012). Similarly, the federally funded KEYSPOT program—a partnership between the city's Office of Innovation and Technology and several nonprofit community organizations—opened free public computing centers throughout the city (Abraham, 2015). The city also championed private-sector initiatives, such as the 2011 launch of Comcast's Internet Essentials program, to provide basic affordable Internet access to Philadelphia's low-income residents (Dzenis, 2011), and the Drexel University-led Philadelphia Digital On-Ramps, which promoted a social media app to train low-literacy residents for ICT jobs. However, the latter initiative was critiqued for not addressing underlying structural barriers, such as significant unemployment among marginalized residents or underfunded schools (Wiig, 2016).

Informed by these previous initiatives and prior research, our study takes the following approach. First, we trace out Philadelphia's digital divide before the pandemic. Then, we assess the city's response to the pandemic-induced connectivity emergency. Following Taylor and colleagues (2021), we then examine what municipal governments can do "to safeguard resiliency for digital networks during a crisis in a way that ensures inclusivity for all urban citizens" (p. 139). Specifically, we ask the following research questions:

RQ1: What steps did the city of Philadelphia take to address the digital divide during the COVID-19 pandemic?

RQ2: What stakeholders did the city engage?

RQ3: What steps did private ISPs take to extend access to the city's unconnected residents during the pandemic?

RQ4: What challenges and opportunities emerged during these digital inclusion initiatives?

RQ5: What policy implications can be drawn from these experiences?

[2] Importantly, this requirement only applies to municipal networks that charge a fee, so theoretically offering subsidized municipal services for free falls outside its scope.

Research Design and Methodology

Our study relied on a mixed methodological approach. First, to trace the city's digital divide we drew on the U.S. Census Bureau's (2019b) ACS data for the demographic makeup of Philadelphia communities by census tract and zip code (e.g., race and education), average household incomes, and computer ownership and reported broadband subscriptions. To assess average broadband speeds in Philadelphia zip codes, we used MLab data, which aggregated individual user upload/download speed test results by zip code. We supplemented these sources with FCC Form 477 data for Philadelphia, namely ISP disclosures of their service offerings and advertised speeds by census block (which often diverged from the MLab speed test data[3]), which we aggregated to the tract level for comparison with the ACS data. We also drew on ISPs' own websites for the costs of advertised broadband plans throughout Philadelphia.[4]

Second, to examine how the city and other actors responded to the connectivity crisis during the pandemic, we turned to local news accounts from prominent outlets, such as *The Philadelphia Inquirer*, official documents, press releases, and reports about digital inclusion initiatives by actors ranging from the municipal government and school boards to local ISPs. We also interviewed three city officials who had insight into Philadelphia's digital inclusion efforts during the pandemic. The interview was conducted in May 2021 over Zoom with all three participants and focused on: (1) the city's connectivity strategy and programs; (2) the city's nonprofit and private partners in these efforts; (3) the challenges and opportunities in connecting residents, particularly in marginalized communities; and (4) sources of support, including private, state, and federal funding. A follow-up Zoom call was made in October 2021 for respondent validation of the initial write-up of the findings. Per interviewees' request, the interview data have been anonymized. Together, these sources shed light on the dimensions of Philadelphia's digital divide and the city's efforts to ensure access during the pandemic for its most disadvantaged residents.

Philadelphia's Digital Divide

Per 2019 FCC data (Table 1), prepandemic Philadelphia had total broadband coverage and five ISPs offering satellite, cable, and fiber Internet in various parts of the city. The range of broadband plans meeting the existing FCC broadband definition varied, from as low as $19.99 for a fiber connection to $149.99 for a satellite connection (Table 2). However, the lowest-cost options, from Hotwire, were available in only two census tracts (Table 1). For fixed wireline high-speed broadband services, most Philadelphia residents had to choose between an effective duopoly of either Comcast or Verizon.[5] These ISPs' cheaper cable and fiber options were significantly costlier once the promotional period (typically two years) ended. For instance, Comcast's lowest-priced broadband plans more than doubled, jumping from $39.99 to $95.95. Given near-total broadband coverage in Philadelphia, these steep costs likely presented a larger barrier to adoption than to availability.

[3] Also see Meinrath et al. (2019)

[4] The price data were pulled from ISP websites in March 2021.

[5] HughesNet and ViaSat also have total coverage of the city, but their satellite Internet is much slower than Comcast's and Verizon's offerings, with restrictive data caps, and ViaSat's offerings are significantly more expensive (see Table 2).

Table 1. Philadelphia ISP Broadband (At Least 25 Mbps Download and 3 Mbps Upload) Coverage.

Philadelphia Coverage	Comcast	Hotwire	Hughes	Verizon	ViaSat
Tracts served (of 382)	380	2	382	379	382
Percentage served	99.48%	0.52%	100.00%	99.21%	100.00%

Note: Availability by Philadelphia Census Tract (data source: FCC Form 477).

Table 2. Philadelphia ISP Broadband Plans by Cost, Speed, and Type.

ISP*	Price Per Month[6]	Regular Rate	Speed (Max Advertised)	Type
Comcast	$39.99	$95.95	200Mbps	Cable
Comcast	$59.99	$100.95	400Mbps	Cable
Comcast	$79.99	$110.95	1200Mbps	Fiber
Hotwire	$19.99	N/A	250Mbps	Fiber
Hotwire	$29.99	N/A	500Mbps	Fiber
Hotwire	$49.99	N/A	1000Mbps	Fiber
Verizon	$39.99	N/A	200Mbps	Fiber
Verizon	$59.99	N/A	400Mbps	Fiber
Verizon	$79.99	N/A	940Mbps	Fiber
HughesNet	$49.99	$59.99	25Mbps (10GB cap)	Satellite
HughesNet	$59.99	$69.99	25Mbps (20GB cap)	Satellite
HughesNet	$89.99	$99.99	25Mbps (30GB cap)	Satellite
HughesNet	$139.99	$149.99	25Mbps (50GB cap)	Satellite
ViaSat	$99.99	$149.99	25Mbps (60GB cap)	Satellite
ViaSat	$149.99	$199.99	30Mbps (100GB cap)	Satellite

Note. Data source: ISP websites; regular rate data for Hotwire and Verizon were not publicly available.

The census and MLab data show that the city's digital divide fell along economic, educational, and racial lines. As Figure 1 illustrates, the city's median family incomes closely correlated with the percentage of broadband subscriptions by zip code. Figure 2 reveals a similar relationship for Internet subscription speed—the higher the median family income, the faster the broadband speed. The pattern held for education as well: The greater a Philadelphia zip code's percentage of residents with a bachelor's degree or higher education, the stronger the likelihood that a household within that zip code had a broadband subscription (Figure 3). Figures 4 and 5 show that Black majority zip codes were less likely to have a broadband subscription, indicating that the city's digital divide reflected deeper structural inequalities and potential digital redlining. The city's persistent racial inequality also structured Internet access: only 50% of Black households had a broadband subscription versus 74% White households going into the pandemic (Graham, 2020b). These patterns evidence deep disparities in Philadelphia's Internet access, even before the pandemic.

[6] The price data do not include the cost of renting a modem.

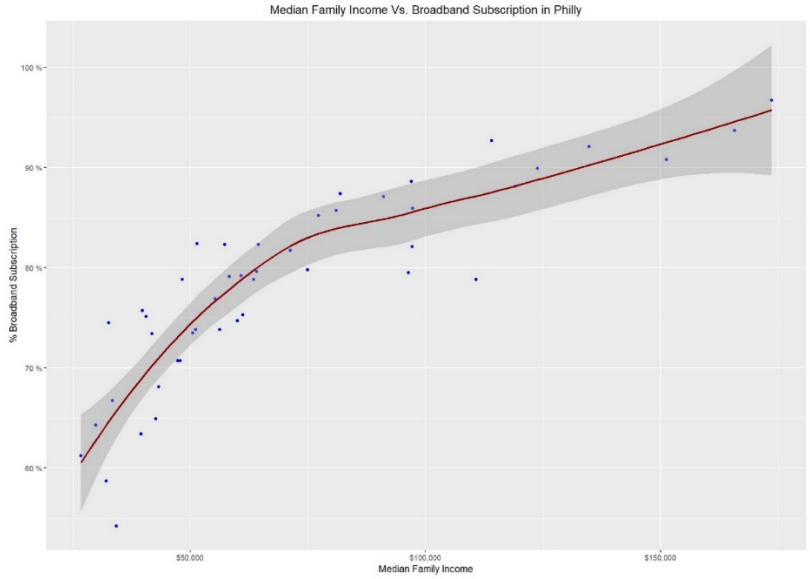

Figure 1. Philadelphia median family income versus percentage of broadband subscriptions reported by zip code (ACS, 2019).[7]

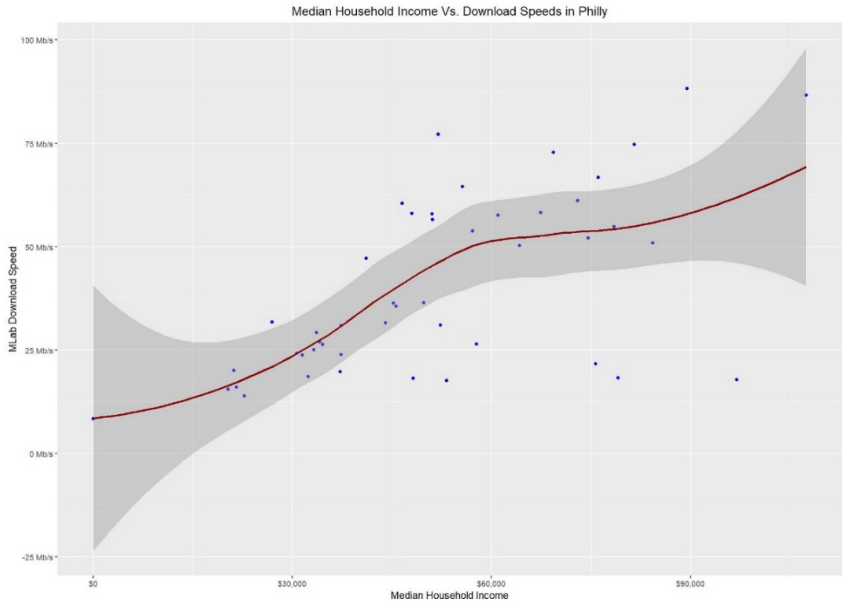

Figure 2. Philadelphia median family income versus reported download speed by zip code (ACS, 2019; MLab speed test data).

[7] In Figures 1–4, the red line shows a Loess regression between the variables and the shaded area shows the 95% confidence interval.

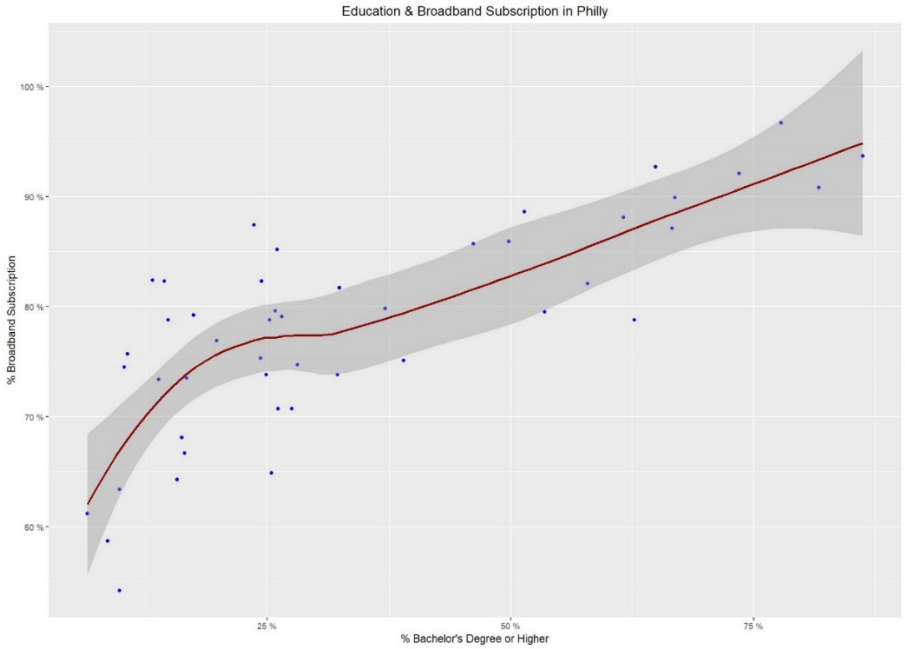

Figure 3. Percentage of Philadelphia residents with bachelor's degree or higher education versus percentage of broadband subscriptions reported by zip code (ACS, 2019).

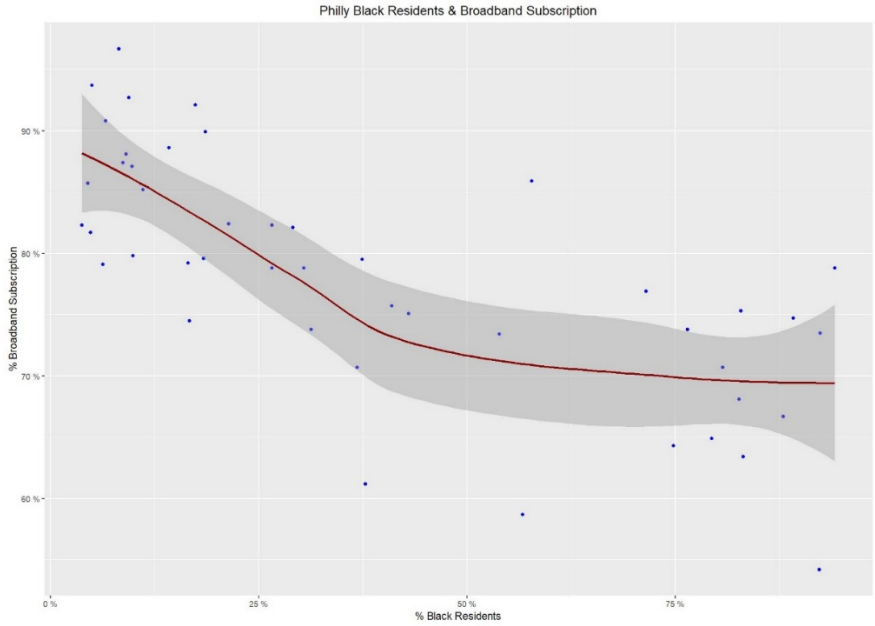

Figure 4. Percentage of Philadelphia Black residents versus percentage of reported broadband subscriptions by zip code (ACS, 2019).

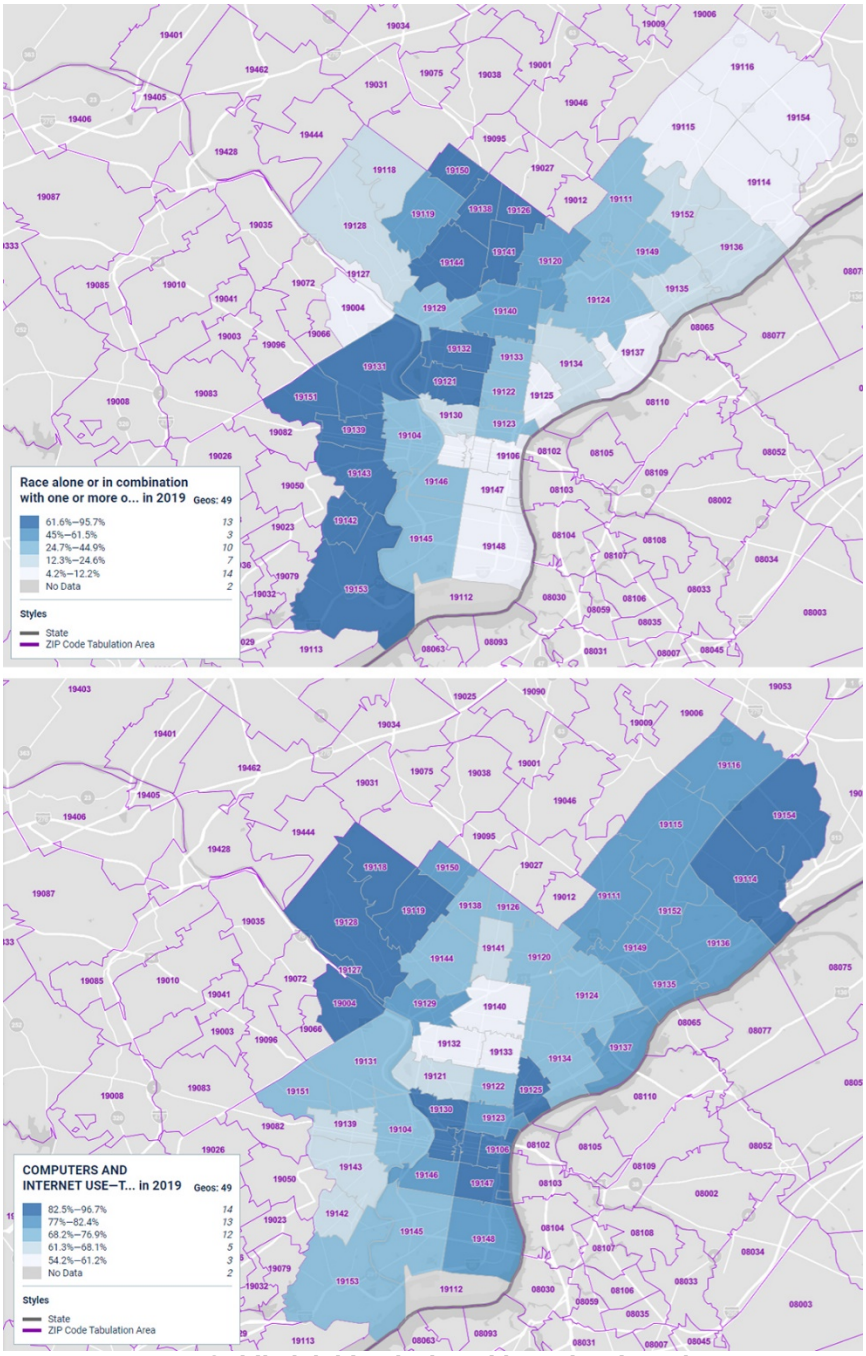

Figure 5. Top: Percentage of Philadelphia Black residents by zip code; Bottom: Percentage of reported Philadelphia broadband subscriptions by zip code (ACS, 2019).

Against this backdrop, the pandemic presented a series of crises exacerbated by lack of broadband connectivity. Census data show that going into the pandemic, 30% of Philadelphia households with schoolchildren lacked Internet access, and nearly 60% of households with an average income of $70,000 lacked broadband connectivity (Graham, 2020b). With schools rapidly shifting from in-person instruction to remote learning, approximately 14,700 Philadelphia kids did not own a computer, and more than 21,500 lacked home Internet access (Hetrick & Purcell, 2020). A 2019 Philadelphia School District survey found less that than half of students in grades three through five accessed the Internet from a home computer, with only 58% high school students reporting home Internet access (Hetrick & Purcell, 2020).

The pandemic also precipitated an economic crisis with unemployment levels not seen since the Great Depression, leading to rent defaults and evictions. Since court proceedings also shifted online, those lacking Internet access could not attend eviction hearings, which disproportionately hurt poor residents (Mazzone & Fretwell Wilson, 2021). Philadelphia's connectivity problems also complicated the city's early vaccination efforts, with 16 of the city's lowest-vaccination zip codes having lower levels of Internet access, likely preventing residents from receiving adequate information regarding vaccination sites and procedures (Laughlin & Lai, 2021). Indeed, the city introduced a digital registry for vaccine appointments, which presupposed digital connections. Using digital tools to coordinate a mass public health effort while contending with a significant digital access gap underscores the challenges of pandemic-era digital inclusion.

Pandemic Digital Inclusion Efforts

Philadelphia's digital divide during the COVID-19 pandemic challenges the myth of full urban connectivity, highlights the intersection between the divide and long-standing socioeconomic inequalities, and sharpens the contrast with cities like Calgary whose robust public broadband funding facilitated emergency efforts to connect the unconnected. In response to the pandemic-induced crisis, which disproportionately affected the city's poorest communities, Philadelphia city government—in partnership with the Philadelphia School District, community and nonprofit organizations, ISPs, and other actors—scrambled to bridge digital access gaps left unaddressed by private providers such as Comcast and Verizon. Concurrently, the pandemic often stymied public resources intended to alleviate such access gaps. For example, Philadelphia libraries (which provide free computer and Internet access) and KEYSPOT public computing centers (created to provide Internet access and digital literacy training) were closed during much of the pandemic. Financially constrained and forced to respond rapidly to multiple crises, the city prioritized education-related connectivity to facilitate the shift to remote learning. We examine Philadelphia's digital inclusion efforts in the rest of this section.

Subsidizing Access

In response to the pandemic, the city partnered with T-Mobile to provide high-speed mobile hotspots for the homeless and housing-insecure, and it launched its flagship PHLConnectED program to subsidize "no cost internet service to K–12 student households in need" (City of Philadelphia, 2021, para. 1) over several years. Aiming to provide high-speed wired home Internet via Comcast's Internet Essentials service for those lacking broadband access or having only mobile phone connectivity, the

Philadelphia School District complemented the effort by distributing Internet access devices, including Chromebooks, tablets, and computers to assist students without devices to engage in remote learning (City of Philadelphia, 2020).

With a planned price tag of $17 million, PHLConnectED funding came from a mix of private and public sources, including school funds, $2 million from the city, and $7 million from Comcast, the largest donor. Additionally, in August 2020, the city allocated funds from the federal The Coronavirus Aid, Relief, and Economic Security (CARES) Act passed in response to the burgeoning economic crisis during the pandemic. The city estimated PHLConnectED would pay for Internet access for 35,000 low-income families[8] by subsidizing the costs of Internet Essentials subscriptions over two years and purchasing T-Mobile wireless MiFi devices (mobile Wi-Fi; Graham, 2020b). The city also earmarked funding for various PHLConnectED initiatives, like the Digital Navigator Program, which supports nonprofit organizations assisting eligible families with technical connectivity support. As an emergency measure, PHLConnectED provided key subsidies for the unconnected (Horrigan, 2021).

Early reviews of the program were cautiously positive but noted significant limitations. Movement Alliance Project, a Philadelphia-based nonprofit activist organization, lauded the program as "a notable win for Philly's students, educators, and . . . community members" (Graham, 2020b, para. 28), but also emphasized that the initiative fell short of providing all Philadelphia students with reliable Internet access. Indeed, in March 2021, a year into PHLConnectED, the city conducted an assessment, estimating the program created more than 15,000 Internet connections, short of its original 35,000 goal (City of Philadelphia, 2021).[9] The shortfall was compounded by significant logistical challenges. First, as our interviewees emphasized, identifying families lacking Internet access at home required close collaboration with the school district because of federal restrictions on sharing educational records. Moreover, schools often lacked such data, which were collected via extensive school outreach and publicity efforts. One of our interviewees stated that "currently seven community-based orgs [serve as outreach teams] making individual calls to district households."

Second, the collaboration with Comcast yielded mixed results. The company's multimillion-dollar investment in PHLConnectED incentivized other philanthropic donations to the program. However, in part because the program was new, the rollout was fraught with issues. For instance, Comcast staff told some early applicants they were not eligible due to outstanding balances, thus prioritizing short-term debt collection over facilitating emergency access. Although the problem was addressed eventually, it delayed potential connections because Comcast's nonlocal call-center staff lacked information about the local specifics of PHLConnectED. While significant in providing emergency connectivity, these interventions revealed both resource and logistical obstacles to closing a stark digital divide during an escalating pandemic.

[8] The city used 2018 ACS data to estimate the number of families with students lacking an Internet connection, later increasing this estimate to approximately 20,000.

[9] To date, there have been no independent assessments of the initiative although the nonprofit organization Resolve Philly has launched an informal survey of users' experiences.

Providing Devices

As a crucial complement to PHLConnectED, the School District of Philadelphia subsidized connections, provided MiFi devices, and launched the Chromebook Loaning Program to all K–12 district students who lacked access devices for remote learning. The Philadelphia School Board paid for the Chromebooks, with $5 million donated by Comcast Chief Executive Officer Brian Roberts and $11 million of its own funds (Hetrick & Purcell, 2020). Within a month, with instrumental logistical help from Comcast, the School District of Philadelphia distributed more than 81,000 devices to students (Graham, 2020a). One of our interviewees called the company's donation and rapid delivery of Chromebooks to students "a huge, huge deal."

However, the distribution of access devices outpaced connectivity efforts, revealing the challenges of accelerated digital inclusion, compounded by the school district's missteps. School officials seemed to lack full understanding of Philly's connectivity crisis early on in the pandemic, telling students who lacked home Internet access at home to engage in remote learning in parking lots with available Wi-Fi (Winberg, 2020). They later retracted the comment as the school district's own data, from May 2020, showed only 57% of students participated in any form of remote learning, revealing a widespread lack of access that required comprehensive solutions. Moreover, as school district Superintendent Hite conceded, the MiFi devices the district purchased under PHLConnectED were glitchy, expensive, costing nearly as much as the Chromebooks, and a short-term solution (Graham, 2020a). Council member Cindy Bass put it more starkly: "It becomes sort of futile to provide the Chromebooks if we're not providing the Internet access. We might as well give [students] a piece of paper and a pencil and . . . tell them to figure it out" (Graham, 2020a, para. 4). Nevertheless, one of our interviewees stressed that "for our folks who don't have that stable housing or they're moving from place to place, that fixed wire solution is just not going to work for them," and therefore the MiFi devices arguably served as an important stopgap given the broader connectivity crisis, exacerbated by poverty and attendant housing insecurity.

Leveraging Existing Infrastructure

Although lacking in resources available to wealthier, well-connected cities like Calgary (Taylor et al., 2021), Philadelphia also leveraged existing infrastructure and relationships with private and nonprofit actors to aid the under- and unconnected. For example, the city bolstered its quasi-public initiative called the Digital Literacy Alliance (DLA; The Mayor's Fund for Philadelphia, n.d.). Launched in 2017 to support the city's digital literacy and inclusion programs with a startup fund of $850,000 largely from Comcast and Verizon (Torres, 2017), the DLA was a key player in pandemic-related efforts to bridge the digital divide. In mid-2020, the city launched a fast-track grant cycle (Islam, 2020), awarding nearly $250,000 to three nonprofit organizations to help Philadelphia residents "find and apply for affordable Internet connectivity, obtain low-cost or free computers, get support with simple online tasks, and link to online digital literacy training" (Islam, 2021, para. 4). A second, larger round of grants went to six more organizations in 2021 (Islam, 2021).

To supplement these efforts, especially amid library and KEYSPOT closures, the city designated 77 access centers located throughout Philadelphia. These typically nonprofit-run centers, like the Germantown Boys & Girls Club, were community anchor institutions outfitted to provide Internet access and assistance to parents working outside the home, who could not supervise their children or afford childcare. The centers

offered spots by registration only, capped attendance to limit in-person contact, and limited eligibility to families with elementary school children (City of Philadelphia, n.d.). Additionally, the city also highlighted public Wi-Fi kiosks as a connectivity stopgap. Almost exclusively available in the city's wealthy downtown area (Link, 2021), the kiosks are operated by LinkPHL, a private company, which subsidizes the connections with advertising and invasive user-data collection (Shapiro, 2019). Early assessments of these interventions suggest that existing infrastructure and partnerships with public- and private-sector actors played a key role in the city's pandemic response to address its significant connectivity gaps.

Private-Sector Initiatives

In addition to their philanthropic support for certain targeted interventions, Philadelphia-serving ISPs provided limited aid by waiving late fees, overage charges, and data caps for two months; by not cutting off service for delinquent accounts; by promoting free public Wi-Fi hotspots; and by offering low-income programs such as Verizon's Lifeline. However, discounted services often lacked sufficient bandwidth for pandemic-related needs. For example, T-Mobile's Connect and AT&T's Cricket programs cost $15 per month but allowed only 2GB of data (School District of Philadelphia, 2020). Similarly, at the beginning of the pandemic, Comcast offered free two-month subscriptions to its Internet Essentials service (typically $9.95 per month) for low-income subscribers (Comcast, 2021d). However, the 15/2 Mbps speed was found insufficient for remote learning (Chandra et al., 2020), falling even below the FCC's conservative broadband definition of 25/3 Mbps. Philadelphia students with Internet Essentials connections were reportedly often disconnected and had trouble reestablishing connections during class. One parent described the disruptions as "an everyday occurrence," explaining: "You would see their square freeze . . . I would hear my kids saying, 'Jonathan's trying to get back into class'" (Hanna, 2020, para. 18). Consequently, student participation rates saw significant attrition (Hanna, 2020).

Despite these challenges, Comcast emerged as a key actor in the city's digital inclusion initiatives. As Mark Wheeler, Philadelphia's chief information officer, put it, "We don't have another provider who has complete 100% [broadband] coverage" (Graham, 2020b, para. 12). Wielding immense political-economic power in both local Philadelphia politics and in national policy (McGuigan & Pickard, 2016), Comcast's 2020 revenues totaled $103.6 billion (Comcast, 2021a). With its successful acquisition of NBC-Universal in 2009, Comcast is the largest pay-TV, cable TV, and ISP in the United States. This political-economic power notwithstanding, Comcast's interventions often were insufficient given the scope and scale of the problems, revealing incumbent providers' reluctance and inability to close the digital divide despite immense public pressure during a connectivity crisis.

Comcast did eventually increase the speeds for all Internet Essentials customers at no charge to meet the definitional qualification of broadband, but it left unaddressed the problem of insufficient bandwidth for remote learning. In May 2020, two months into the expanding quarantine, school district officials reached out to Comcast and other Philly ISPs to open residential hotspots for public use so that students without Internet access could use them for remote learning (Mezzacappa, 2020a). Bundled with a broadband subscription and broadcasting an additional Wi-Fi signal entirely separate from the subscriber's private home connection, residential hotspots provided access to anyone nearby with a subscription to that ISP's service. All the ISPs refused to open these residential hotspots on the grounds that they were not intended for public

use, with Comcast also citing technological impracticality, including possible service downgrades and potential privacy concerns. Instead, it opened its small business hotspots, pitching them as a digital inclusion solution (Mezzacappa, 2020b).

Comcast's refusal to open residential hotspots and the paltry speeds of its Internet Essentials program spurred sharp criticism among Philadelphia-based activists (Hanna, 2020). Education activist Zachary Wright excoriated the company's Internet Essentials program for being slower than nearly 89% of U.S. cable offerings, dismissing it as a ploy to expand Comcast's customer base (Wright, 2020). He also emphasized the disjuncture between Comcast's refusal to open residential hotspots during the pandemic to assist financially stretched schools and the company's $12.7 billion windfall from the Trump administration's 2018 tax reform bill, $18 million in Pennsylvania state tax allowances between 2007 and 2012, and a 20% property tax break from the city (Wright, 2020). Comcast's massive revenue, only marginally impacted by the pandemic, contrasted sharply with the struggle many Philadelphians, particularly in Black communities, faced in paying even the $9.95 monthly subscription to Internet Essentials.

Affordability posed a significant obstacle to broadband adoption, a fact recognized even by Comcast itself, which told its own investors in August 2020 that at least 600,000 customers nationally either defaulted on their Internet bill payments or were at high risk of doing so (Hanna, 2020). While Comcast claimed it would not shut off service for some of these users for at least two months, in November 2020 the company announced it would start charging subscribers for heavy usage (Hetrick, 2020). Such actions led to growing criticism; in early 2021, former Comcast employee Chase Roper took to Twitter to indict the insufficient speeds of Internet Essentials, imposed data caps, and growing costs of broadband packages (Roper, 2021).

Finally, in February 2021, almost a year into the pandemic and in response to growing public pressure, Comcast doubled Internet Essentials' customers' download speeds to 50Mbps and increased the upload speeds—crucial to virtual learning—to 5Mbps (Comcast, 2021c; Rizzo, 2021). The timing was significant because February 2021 marked the 10th anniversary of Internet Essentials. In its promotional literature, Comcast celebrated the program as a key effort in tackling the digital divide during the pandemic, emphasizing how the company increased speeds for subscribers and waived late payment fees (Comcast, 2021b). The company noted the 40 community centers it created with free Wi-Fi access for qualifying students and its $40-million investment in digital literacy programs throughout the country (Rizzo, 2021), while claiming to have connected 9,000 residents through the PHLConnectED program (Hetrick, 2021a). Missing from the story were the repeated city requests and immense civil society pressure that motivated these initiatives, often materializing late into the pandemic.

Our interviewees pointed to broadband market concentration as contributing to the challenge of connecting its most marginalized residents and to dependence on Comcast's Internet Essentials program: "The challenging situation in Philadelphia is that we don't have a lot of home broadband options that are everywhere else." Comcast waiving late fees and extending the Internet Essentials' free sign up likely helped a significant number of Philadelphia's residents get connected as did its donations to PHLConnectED. No other entity was able to offer such help, and yet Comcast's interventions were relatively circumscribed, presumably by the imperative to minimize potential revenue loss during the pandemic.

Without having a robust public alternative, Philadelphia's strategy to address the digital divide relied on a multipronged approach that sought support from whomever was offering it. Aside from community partners and necessary collaboration with the private sector, the city tapped existing resources and leveraged federal funding streams where possible. Despite receiving federal funding for pandemic-related recovery efforts, the Republican-controlled Pennsylvania government did not allocate those funds for municipal connectivity. For its part, the school district used existing federal E-Rate and Emergency Connectivity Fund subsidies to provide temporary hotspots. Nonetheless, absent sustained public funding, as one of our interviewees put it,

> there's not going to be one end-all and be-all solution around it. It's probably going to have to be a mix of subsidy, large scale connectivity programs and some small individual-based programs as well to meet the needs [of the poorest communities].

The Endless Divide

Comcast's PR for Internet Essentials coincided with another anniversary: In March 2021, the U.S. pandemic had spanned one year, leaving in its wake immeasurable social costs. The intractable digital divide had left cities like Philadelphia ill-prepared to rapidly shift to remote activity to protect their residents, especially in the poorest communities. Though 100% served according to FCC data, Philadelphia broadband's suboptimal speeds and exorbitant costs were powerful barriers to adoption, disproportionately affecting the city's Black households. The low-income Internet plans pitched as private-sector solutions could not support necessities, such as remote learning, intensifying patterns of digital redlining for communities of color (Pickard & Berman, 2019).

Furthermore, given the urgency of maximizing pandemic connectivity, inclusion efforts by the city, the school district, community anchor organizations, and private ISPs sometimes prioritized access and cost over broadband speeds, which served as a secondary divide. These initiatives also faced challenging logistics, limited data on the unconnected, funding concerns, and sometimes pushback from ISPs themselves. These findings align with those of Reddick and colleagues (2020) and similar research examining the intersection of digital inequalities with the COVID-19 pandemic. However, our research contrasts with the study by Taylor and associates (2021) of the successful pandemic digital inclusion efforts in Calgary. Certainly, private–public initiatives in Philadelphia provided crucial connections for low-income pre-K–12 households: A 2021 City of Philadelphia survey found a near 15% increase in households with high-speed Internet access, with more than half owing to free or discounted connectivity programs (Horrigan, 2021). The pandemic incentivized new assessments of the scale of the city's under- and unconnected while cost subsidies and city partnerships emerged as key mechanisms in connecting them. Yet, the efforts were overall insufficient given the scope of the city's pronounced digital divide going into the pandemic, with one-third of Philadelphia's households, particularly in the city's Black communities, experiencing "subscription vulnerability" and unable to afford connections without ongoing discount or subsidy, in addition to lacking the necessary devices and digital skills (Horrigan, 2021). These shortcomings reflect a legacy of broadband policy deferring to private provision with limited competition and therefore little incentive to reduce prices.

Our case study casts doubt on the belief that the private market is sufficiently malleable and responsive to public connectivity needs, and thus uniquely suited to closing the U.S. digital divide without significant external oversight. The recent crisis revealed the inadequacies of market-based provision, even with municipal and civil society pressure. The pandemic exposed both the necessity of reliable and affordable Internet access and the persistently high costs that put such services beyond reach for many Americans. Indeed, a 2021 Pew Research survey found that 34% of low-income users struggled to pay for high-speed Internet during the pandemic (McClain, 2021). While access to low-income broadband plans has spread during the pandemic, with more than 75% of U.S. households having access to them, only 31% have access to low-cost high-speed options, with 100/25 Mbps speeds (Cooper & Tanberk, 2021).

Despite the unyielding rhetoric of market superiority over public efforts to connect communities (e.g., Yoo & Pfenninger, 2017), the success and resilience of municipal broadband networks around the country in terms of access, quality, and affordability raises key questions about public broadband's potential to fill gaps left by private ISPs (e.g., Chao & Park, 2020; Mitchell, 2017; Talbot et al., 2018; Whitacre & Gallardo, 2020). The Biden administration's Infrastructure Investment and Jobs Act sought to remove barriers for municipal broadband and cooperative networks (such as Philadelphia's incipient Philly Community Wireless) to create competition for the private ISP oligopoly, but these provisions were scrapped from the final bill (Wilcox, 2021). Nonetheless, the administration's early move to privilege public and nonprofit broadband provision tapped into growing support for local governments administering Internet service (Sabin, 2021). Likewise, a growing number of state and local policymakers have become more critical of ISP oligopolies (Gonsalves & Mitchell, 2021), as private provisioning leaves significant access gaps, failing to connect less-profitable areas, especially low-income and BIPOC communities (Francis & Weller, 2021). Additionally, many low-income areas with broadband have not had infrastructure upgrades in more than 15 years despite often paying as much for services as suburban residents who enjoy higher speeds (Gonsalves & Mitchell, 2021). For instance, Comcast's prominent infrastructure upgrades have focused on Philadelphia's well-connected Center City and University City neighborhoods (Torres, 2016; Winslow, 2021). As Philadelphia's experience reveals, the market incentivizes such digital redlining: private ISPs have lower rates of return and therefore are less willing to invest in quality infrastructure in Black communities because of high rates of poverty resulting from historically discriminatory financial lending and other types of socioeconomic marginalization. Ending this redlining requires disrupting the market logic that powers it.

This case study demonstrates not only a systemic market failure, but also a policy failure. Currently 18 states including Pennsylvania have legislation that presents legal barriers to municipal broadband (Cooper & Tanberk, 2021). While states like Washington have passed bills to strike down such restrictions, Pennsylvania's HB30 remains on the books and thwarts cities like Philadelphia from building its own network to ensure all residents have affordable broadband access. Unless such laws are removed, cities will continue to struggle connecting their most marginalized residents, especially during public emergencies. Without sustainable funding for robust public networks, overcoming second-tier divides such as high costs, inadequate speeds and quality, and digital literacy will remain beyond reach for millions of Americans, and the most vulnerable communities will pay the highest price.

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