Measuring the Effectiveness of Digital Inclusion Approaches

Abstract. Expanding access to quality, affordable broadband is an urgent national priority and billions of dollars in new investments are in the pipeline for infrastructure deployment and adoption, including $65B in the infrastructure bill recently passed by the U.S. Senate and pending before the House of Representatives. The literature review to date reveals that despite many existing and new initiatives at the federal, state, and local level, over 76 million Americans remained unconnected or underconnected (connected through a smartphone data plan only) in the first quarter of 2021, most of whom lived in low-income households. This study aims to analyze existing broadband affordability programs and propose recommendations about how best to connect low-income households to high-speed Internet services they can afford and use for today's online activities. To meet the research goal, this study will apply a mixed methods framework to identify and analyze case studies that illustrate best practices and challenges. The cost-effectiveness and efficiency of the programs will be evaluated, and representative stakeholders of these programs will be interviewed.

Keywords: Digital Inclusion; Broadband; Affordability; Policy; Benefit Program.

1 Introduction

Since the start of the COVID-19 pandemic in early 2020, expanding access to Internet connectivity and devices has risen to the top of the national policy agenda. The literature review to date reveals that despite many existing and new initiatives at the federal, state, and local level, over 76 million Americans[1] remained unconnected or underconnected (connected through a smartphone data plan only) in the first quarter of 2021, most of whom lived in low-income households. Multiple studies have shown that, among the various barriers to connectivity, affordability is a critical factor that prevents low-income households from having reliable high-speed Internet access.

To alleviate this issue, Congress appropriated $3.2 billion to establish the Emergency Broadband Benefit (EBB), a temporary program under which eligible low-income households receive a discount off the cost of broadband service and specific devices. The program launched in May 2021 and is set to expire when funds are exhausted, or six months after the Department of Health and Human Services (HHS) declares the end of the COVID-19 health emergency. This opens the question of what will happen next, and more generally, of how best to design a cost-effective, more permanent solution to

[1] Based on results from a Pew Research survey in the first quarter of 2021 stating that 77% of US adults report that they have broadband at home. The remaining 23% are thus "unconnected or underconnected" (i.e. no broadband at home or only via cellphone), or 76 million based on a 331 million population.

the affordability barrier faced by millions of low-income households across the U.S. The proposed successor program to the EBB, the Affordable Connectivity Program (ACP), will be built upon the strengths of EBB, but will be distinct in certain aspects, most notably: the eligibility criteria will be expanded, and the monthly subsidy will be reduced.

This study aims to analyze existing broadband affordability programs and to propose recommendations about how best to connect low-income households sustainably to high-speed Internet services they can afford and use for today's online activities.

2 Literature Review

2.1 Barriers to Broadband Adoption

Research has repeatedly shown that the primary barriers to broadband adoption for low-income households are: (1) cost; (2) lack of perceived relevance; and (3) limited digital literacy.

The cost barrier includes the costs for both home broadband and a device. The Pew Research Center's survey of U.S. adults in the first quarter of 2021 found that 23% of U.S adults do not have broadband at home, and 15% are underconnected. Of the adults without broadband at home, 45% reported that the cost of service is one of the reasons they do not have broadband at home, while 20% said that it is the main reason [1]. Cost of service was the highest among all barriers cited. Similar findings are reported in the CETF-USC Statewide Broadband Adoption Survey, which surveyed 1,650 California residents in February-March of 2021 [2]. Among the unconnected or underconnected, 68% cite service affordability as one among many barriers to connectivity, while nearly 40% cite affordability as the primary reason, far above lack of a device, limited digital literacy, and other reasons. Further, only 38% of eligible unconnected or underconnected households were aware of discounted Internet plans, and only 24% had subscribed. This indicates the need for increased efforts to make eligible households aware of available broadband benefit programs.

Multiple studies have also identified the lack of perceived benefits and limited digital literacy as barriers to broadband adoption [3], [4]. Findings from the literature show that low-income households are unlikely to adopt broadband without understanding how being connected can save them time and money. Insights from prior studies also indicate that low-income households with limited digital literacy are unlikely to subscribe and sustain broadband service. In addition to subsidizing the costs of service and devices, some broadband benefit programs collaborate with community-based organizations (CBOs) to reach unconnected eligible low-income individuals in culture and in language to show them the relevance of broadband to their lives. Some broadband benefit programs also offer digital literacy training to eligible households.

Findings from the literature suggest, however, that these barriers vary across socioeconomic groups. For example, digital literacy is likely a critical factor for senior citizens, while cost is more likely to be a determinant for low-income households [5]. Multiple studies have shown that low-income households are aware of the importance of Internet connectivity but are unable to afford it [6], [7]. For example,

a 2018 study found that low-income households in Detroit had a lower likelihood of having home broadband. Still, the individuals in those households used the Internet regularly through other means such as mobile broadband, open networks, at work, etc. [7]. These findings suggest that developing targeted solutions is essential to closing the digital divide.

2.2 Evaluation of Affordable Broadband Programs

Affordable broadband programs are relatively new and understudied compared to benefit programs in other sectors like nutrition, housing, and childcare. Moreover, despite many digital inclusion initiatives at the federal, state, and local levels, the digital divide persists – with millions of low-income households on the wrong side of the divide. This has led researchers to attempt to answer the question: do these initiatives drive meaningful broadband adoption[2]?

Eight digital inclusion organizations that took part in a study reported that a four-part strategy that includes: offering low-cost broadband; connecting digital literacy with relevant content; providing low-cost computers; and making public access computing available is essential to their efforts to promote meaningful broadband adoption [9]. Reflecting on a decade of grantmaking, the California Emerging Technology Fund (CETF) identified critical factors for successful broadband adoption, categorized into those specific to funders and those specific to grantees of digital inclusion initiatives. For example, it concluded that to pursue sustainability in broadband adoption, grantees should integrate digital literacy, service adoption, support for devices and dissemination strategies that promote take-up [10].

Several studies analyze the success of a digital inclusion initiative by examining its connectivity outputs (e.g., broadband take-up). For example, a study evaluated Comcast's Internet Essentials (IE) by examining its impact on adoption rates between 2012 and 2015 [11]. Using data from the U.S. Census Current Population Survey and the National Broadband Map, they evaluated the program's effect on Internet subscription rates for eligible households. The findings suggest that 66% of IE subscribers represent a true increase in broadband adoption due to the program. Another study applied a different approach by examining the impact of IE availability on Internet use and broader impacts such as employment rates and income [12]. The findings indicate that IE availability was associated with increased employment and earnings.

Another study evaluated the initial rollout of the Federal Communications Commission's Lifeline broadband program across 14 regions in 2013 by using the participation rate as a metric of success [13]. The findings suggest an extremely low participation rate in all regions except Puerto Rico, despite extensive outreach efforts. Other studies administered surveys to program beneficiaries to assess program satisfaction and impact [14].

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[2] Defined as "daily access to the Internet: at speeds, quality, and capacity to accomplish common tasks; with the digital skills necessary to participate online; and on a personal device and secure, convenient network."

Multiple researchers note the lack of cost-benefit assessments in most broadband program evaluations [15], [16] and to the best of the our knowledge, such evaluations remain scarce. A likely factor is that, given that the Internet is a general-purpose technology capable of having a far-reaching impact over a long time span, there are multiple methodological challenges in identifying and quantifying the benefits of broadband connectivity.

This research borrows from the international development literature to create a conceptual framework that distinguishes between: 1) program outputs; 2) program outcomes; and 3) program impacts. Program outputs refer to the activities supported directly such as digital literacy training or distribution of wireless hotspots. Program outcomes refer to the activities made possible for the target population (for example, applying for a job via the internet or taking an on-line class). Program impacts refer to long-term effects on the socioeconomic well-being of the target population that result from such actions, such as increased employment or computer self-efficacy. The main focus of this work will be evaluating the outputs and outcomes of affordable broadband programs.

2.3 Some Lessons from Subsidy Programs in Other Sectors

A preliminary review of the literature on subsidy programs in other policy areas (e.g., nutrition, housing, energy) was conducted in order to identify the conceptual frameworks used in program evaluation studies.

Two metrics that are widely used to assess how well a subsidy program meets its objectives are: 1) cost-effectiveness; and 2) targeting efficiency. Cost-effectiveness refers to the ratio of outputs (e.g., the number of program beneficiaries) to inputs (program cost). This estimation can best be applied directly for programs where all the costs associated with the outputs occur in the same period or for programs with multiple outputs that can be easily converted to a dollar value. However, there are several considerations in specifying the inputs and outputs of a program, such as time lag, mediating variables, and multiple outputs of interest (which may not be easily converted to a dollar value). The literature presents different approaches to resolving these challenges.

In assessing the cost-effectiveness of housing subsidies, Olsen argues that a life cycle approach should be used when high costs incurred in one period contribute to outputs in another period [17]. With this approach, cost-effectiveness is estimated as the ratio of the present value of the outputs to the present value of the costs. Studies have often focused on a single outcome and compared the cost of a program to a single output. Beaton & Moerenhout identified as many outputs as possible in assessing the cost-effectiveness of wind energy subsidies [18]. Their work applied a two-step approach: first, they estimated the extent to which the program achieved its intended outputs and outcomes; and second, they estimated the economic cost of the program to determine if the cost did not exceed the benefits.

Subsidy programs have also been widely evaluated by their "targeting efficiency", defined as the extent to which the actual distribution of a benefit corresponds to the desired distribution [19]–[21]. Studies have evaluated subsidy programs by their vertical targeting efficiency, which refers to the degree to which only the target

recipients receive the benefits [21], and horizontal targeting efficiency, which is the degree of take-up of the program by the eligible recipients [19]–[21].

3 Methods

To meet the research goal, this study will apply a mixed methods framework to identify and analyze case studies that illustrate best practices and challenges.

This work distinguishes between three types of programs: 1) consumer subsidy programs, which includes consumer subsidies given directly to consumers, and consumer subsidies that are administered by providers; 2) Public benefit obligation programs; and 3) Government bulk purchase programs. This offers a complete partition of the programs currently available to alleviate limited broadband affordability. With each of the three types, economic agency is placed with a different actor: consumer, regulator, or bulk purchasing entity. Each leverages a different economic mechanism: subsidies afford consumers greater purchasing power; public benefit obligation programs leverage a regulatory quid-pro-quo; and bulk purchasing takes advantage of scale and scope economies. Finally for each type of program, the administrative burden of qualifying recipients and verifying eligibility falls to different actors.

Further refining this taxonomy, this study identifies the following key features of these programs:

1. What is provided? Internet service, equipment/device, digital literacy training, etc.
2. How is it supported? For example, end-users may receive cash, a voucher (with constraints on how it can be spent), or in-kind goods or services; ISPs may receive a grant or a tax credit in exchange for offering discounted services to qualifying end-users.
3. Who is eligible to receive the benefits? What is the qualifying unit (individual, household, family, housing unit, school/class, public space, etc.), and what are the eligibility criteria? Who determines how the benefit is spent/used?

Using this taxonomy, case studies that span these various categories are identified, including one from California for each category. The matrix in Table 1 summarizes the proposed research framework.

3.1 Analytical Framework

The following metrics will be used to evaluate the broadband affordability programs:

1. Cost-effectiveness of the program: following the approach widely applied in the literature, this study estimates the cost-effectiveness of the broadband affordability programs by comparing the cost of the program to the output generated.
2. Efficiency of the program: three measures to estimate the efficiencies of the programs are identified:

- The proportion of the eligible population that is enrolled in the program, variously referred to in the literature as the coverage of the program, the horizontal target efficiency, or the recall.
- The proportion of the population enrolled in the program that meets the eligibility criteria, variously referred to in the literature as the precision or the vertical efficiency of the program.
- The accuracy of the eligibility criteria in targeting the intended recipients of the benefit, i.e., to what extent does the eligibility criteria include the intended population (e.g., low-income households) and exclude the unintended population?

Table 1. Research Matrix

Program mechanism	**What is provided?**	**How is it supported?**	**Who receives the benefit?**	**Case study**
Consumer Subsidy	Service, equipment, and installation	Voucher	Households with k-12 students – Direct to consumer	Alabama Broadband Connectivity
	Service and laptop/desktop/tablet	Discount	Eligible households – Administered through provider	EBB
	Service (mobile data/broadband)	Discount	Eligible households – Administered through provider	Federal Lifeline
	Service (mobile data/broadband)	Discount	Eligible households – Administered through provider	CA LifeLine
Public Benefit Obligation	Service, Chromebook	Discount	Eligible households – Administered through Frontier	Frontier Fundamental
	Service, laptop, digital literacy training	Discount	Eligible households – Administered through Comcast	Comcast Internet Essentials
Government Bulk Purchase	Hotspots	Free	Eligible households with K-12 students - Administered through schools or the school district	Verizon-LAUSD partnership
	Hotspots, laptops, and tablets	Free	Low-income San Jose residents from low-income areas with children in public schools – Distributed through Libraries and CBOs	San Jose Digital Inclusion Partnership
	Service, laptop, digital literacy training	Discount/free	Households in HUD-assisted housing – Administered through partners e.g. ISPs and device refurbishers	HUD Programs

3.2 Stakeholder Interviews

In addition, the perspectives of representative stakeholders on general obstacles to program implementation, cost efficiency/ effectiveness, outreach strategies, feedback on design, and future challenges will be captured. Constituents from the following key areas will be interviewed: regulators, policymakers, Internet service providers, non-profits/advocates, community spaces, and vendors.

4 Contribution to Knowledge

This study will propose how best to sustainably connect low-income households to broadband, offering a timely contribution to the debate on what happens after the EBB funds get exhausted. Also, to the best of our knowledge, this would be the first research to evaluate different types of broadband affordability programs.

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