



Broadband Adoption and Population Health Outcomes in the United States





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Introduction

Over the past decade, a growing consensus has recognized the importance of broadband internet beyond its impact on economic development and opportunities. Researchers, practitioners, and regulators increasingly describe connectivity as a structural condition that shapes access to employment, education, housing, social services, and health care itself.

Writing during the early months of the COVID-19 pandemic, one study advanced one of the most-cited formulations of this view, arguing that broadband internet functions as a social determinant of health (SDOH) and that disparities in connectivity warrant treatment as a public health concern.¹ A follow-up study extended this framing, characterizing digital inclusion as a “super social determinant of health” — a determinant whose influence operates through its effect on many other aspects of health care.²

The case for treating connectivity as health infrastructure has since gained traction in high-profile clinical and policy venues. Researchers have positioned broadband as essential health care infrastructure and call for infrastructure investments comparable to those historically directed towards physical health care facilities.³ Taken together, this body of work overwhelmingly supports the argument that home broadband connectivity and access to affordable computing devices shape health outcomes.

This report examines whether county-level household internet and device adoption is associated with county-level health outcomes across a broad set of measures. The analysis pairs data from the American Community Survey (ACS) from rural and urban American counties to capture the percentage of households with both a computer and an internet subscription with the 2025 County Health Rankings outcomes data to investigate the relationship between home broadband adoption and nine key health outcomes:

- | | |
|---|--|
| • Years of potential life lost | • Percent of low-birth-weight births |
| • Population in fair or poor health | • Number of preventable hospitalizations |
| • Average number of physically unhealthy days | • Influenza vaccination rates among Medicare beneficiaries |
| • Average number of mentally unhealthy days | • Mammography rates among Medicare beneficiaries |
| • Injury death rates | |

¹Benda, N. C., Veinot, T. C., Sieck, C. J., & Ancker, J. S. (2020). Broadband internet access is a social determinant of health! *American Journal of Public Health*, 110(8), 1123–1125.

²Sieck, C. J., Sheon, A., Ancker, J. S., Castek, J., Callahan, B., & Siefer, A. (2021). Digital inclusion as a social determinant of health. *npj Digital Medicine*, 4, 52.

³Rodriguez, J. A., Shachar, C., & Bates, D. W. (2022). Digital inclusion as health care — supporting health care equity with digital-infrastructure initiatives. *New England Journal of Medicine*, 386(12), 1101–1103.

AMONG THE KEY FINDINGS FROM THIS RESEARCH

- **Internet and device adoption is associated with better health outcomes across eight of the nine measures examined.** Every significant coefficient runs in the expected direction. Preventable hospitalization is the sole exception, returning no significant association in any of the 12 model specifications estimated for that outcome.
- **The strongest and most consistent associations appear in self-reported health and premature mortality.** Fair or poor health and physically unhealthy days are the only outcomes significant in all twelve specifications, and years of potential life lost holds in eleven. A one standard deviation increase in adoption (equal to 5.87 percentage points of households) corresponds to a 1.26 percentage point decline in the share of adults reporting fair or poor health and 1,011 fewer years of life lost per 100,000 residents.
- **Preventive care utilization tracks adoption in the expected direction, though less reliably.** Influenza vaccination rises with adoption in ten of twelve specifications. At the same time, mammography screening holds across the full sample but fails in six of the eight models estimated on the urban and rural subsets. Adoption accounts for a smaller share of county-level variation in these outcomes than in the mortality and self-reported health measures.
- **Associations are generally larger in urban-majority counties than in rural-majority counties.** Controlling for median household income, a one standard deviation increase in adoption corresponds to a 2.23 percentage point decline in fair or poor health among urban-majority counties compared with 1.05 among rural-majority counties. This pattern runs counter to hypothesized expectations, which anticipated stronger associations in rural counties, though it does not hold uniformly: mental health outcomes and, under the education control, influenza vaccination show the reverse.
- **Economic conditions exhibit a stronger relationship with health outcomes than adoption does.** Median household income exceeds adoption in magnitude in nearly every model, and the gap is widest in rural-majority counties, where income accounts for roughly three times the effect size of adoption for premature mortality. Urban-majority counties are the sole subset in which adoption exceeds income for any outcome.

Background

The discussion surrounding the internet and health unfolds against three decades of policy attention given to closing the Digital Divide. Tracking studies underscore that disparities have persisted even as aggregate connectivity has grown.

Connected Nation estimates that, overall, 15.7 million Americans lack broadband access and roughly 81 million Americans have not adopted household internet.⁴ Recent benchmarks from the Pew Research Center survey confirm that broadband adoption continues to vary by income, education, age, race and ethnicity, and geography, with gaps narrowing along some dimensions and persisting along others⁵

This lack of connectivity has important implications for Americans' daily lives. One recent study focuses on these disparities within the context of the COVID-19 pandemic, documenting how the rapid pivot to remote work, schooling, and care exposed and deepened preexisting digital inequities.⁶ The pandemic did not create the Digital Divide, but it made the consequences harder to ignore. As health care, education, and public services moved online, households without reliable broadband or capable devices experienced a compounding loss of access to providers, schools, government, and information more broadly.

This study represents a follow-up to the Connect2HealthFCC Task Force's landmark 2016 and 2018 studies, which assessed the relationship between local connectivity and diabetes prevalence.^{7,8} To expand that work, we focus on nine different

county-level health outcomes using data from the 2025 County Health Ranking and household data from the United States Census Bureau's 2019-2023 American Community Survey to see whether internet adoption is associated with better health outcomes and how those associations differ between urban and rural households.



⁴Connectednation.org

⁵Pew Research Center. (2025). Internet, broadband fact sheet. <https://www.pewresearch.org/internet/fact-sheet/internet-broadband/>

⁶Early, J., & Hernandez, A. (2021). Digital disenfranchisement and COVID-19: Broadband internet access as a social determinant of health. *Health Promotion Practice*, 22(5), 605–610.

⁷<https://www.fcc.gov/ecfs/document/109020780702729/1>

⁸<https://www.fcc.gov/ecfs/document/1011661269597/1>

What the evidence has shown

The extant literature relevant to this study falls into three general categories: evaluating the landscape of digital access, adoption, and device ownership; telehealth as a means of relying on connectivity for health care access; and the direct link between internet and device adoption and health outcomes.

Access, adoption, and device ownership disparities

The Connect2HealthFCC Task Force provided one of the first population-level treatments of this distinction. Its analysis found that internet connectivity strongly correlated with health outcomes and, more specifically, diabetes prevalence. Choi and DiNitto reached a similar conclusion in an earlier study of low-income homebound older adults: access alone does not ensure meaningful engagement with online health resources, foreshadowing what later researchers would describe as the “second Digital Divide” of skills and effective use.⁹

An important revelation in the recent literature is that device ownership — and the type of device owned — has an independent effect from internet access itself. Drawing on data from Project PLACE, a cancer survivor cohort, researchers found that smartphone ownership and home internet adoption were independently associated with health literacy and health care access.¹⁰ Another study examined smartphone, tablet, and basic phone ownership among U.S. adults with hypertension and linked device type to health-goal achievement and provider communication, illustrating that device heterogeneity matters: not all mobile users are equally equipped for

digital health engagement, but device ownership matters overall.¹¹

Broadband adoption tracks closely with the same factors that structure other social determinants of health. By looking at electronic health records, researchers found that broadband access was associated with patient portal use.¹² Another study documented that poor broadband infrastructure in rural areas posed a direct barrier to telemedicine use in primary care, demonstrating that broadband gaps translate into measurable reductions in health care access.¹³ Other researchers assessed the impact of COVID-19 on the Digital Divide and showed that the pandemic-era shift to telehealth and online services systematically excluded populations already facing barriers to broadband access and usage.¹⁴

Researchers at the US Department of Health and Human Services (HHS) offer the closest analytic precedent for the present study. Using county-level data, the authors documented disparities in computer and broadband use across the United States and linked these disparities to a broad set of health outcomes, including life expectancy, mental distress, hospitalization rates, smoking, physical inactivity, and chronic-disease mortality.¹⁵

⁹Choi, N. G., & DiNitto, D. M. (2013). Internet use among older adults: Association with health needs, psychological capital, and social capital. *Journal of Medical Internet Research*, 15(5), e97.

¹⁰Oshima, S. M., Tait, S. D., Thomas, S. M., et al. (2021). Association of smartphone ownership and internet use with markers of health literacy and access: cross-sectional survey study of perspectives from Project PLACE.” *Journal of Medical Internet Research*, 23(6), e24947.

¹¹Langford, A. T., Solid, C. A., Scott, E., et al. (2019). Mobile phone ownership, health apps, and tablet use in U.S. adults with a self-reported history of hypertension: cross-sectional study. *JMIR mHealth uHealth*, 7(1), e12228.

¹²Perzynski, A. T., Roach, M. J., Shick, S., et al. (2017). Patient portals and broadband internet inequality. *Journal of the American Medical Informatics Association*, 24(5), 927–932.

¹³Drake, C., Zhang, Y., Chaiyachati, K. H., & Polsky, D. (2019). The limitations of poor broadband internet access for telemedicine use in rural America. *Annals of Internal Medicine*, 171(5), 382–384.

¹⁴Ramsetty, A., & Adams, C. (2020). Impact of the digital divide in the age of COVID-19. *Journal of the American Medical Informatics Association*, 27(7), 1147–1148.

¹⁵Singh, G.K., Girmay, M., Allender, M., & Ramey, C. T. (2020). Digital divide: marked disparities in computer and broadband internet use and associated health inequalities in the United States. *The International Journal of Translational Medical Research and Public Health*, 4(1), 1–16.

DIRECT ASSOCIATIONS WITH HEALTH OUTCOMES

The most consequential body of evidence for this work directly links internet access and use to measurable health outcomes — including mortality.

One study conducted a prospective cohort study of 21,481 middle-aged and older adults, examining whether regular internet use predicts survival.¹⁶ After adjusting for age, education, and income, regular internet users showed substantially lower hazard ratios for all-cause and cardiovascular mortality compared to non-users. A similar study demonstrated a parallel pattern at the state level, finding a strong inverse relationship between broadband internet access and cardiovascular mortality rates across the United States.¹⁷ These two studies, taken together, provide convergent evidence that connectivity is associated with reduced mortality from the leading cause of death in the United States.

Another recent study provides strong evidence linking broadband and health outcomes. Using county-level analyses, the author examined COVID-19 incidence and mortality between July and October 2020 and found that counties with the highest internet access had less than half the COVID-19 mortality of those with the lowest access — a reduction of 48% to 53%.¹⁸ The study also identified a significant positive association between internet access and mask-wearing, suggesting information access as one operative mechanism. This finding is relevant because it establishes that pandemic-era county-level associations are large enough to detect in cross-sectional ecological data analyses.



¹⁷Moorhead, J. B., Herbert, B. M., Abebe, K. Z., Harrington, C., Miller, E., Lindau, S. T., Magnani, J. W., & Johnson, A. E. (2022). Internet access and cardiovascular death in the United States. *American Heart Journal Plus: Cardiology Research and Practice*, 21, 100200.

¹⁸Allen, S. (2025). Broadband internet access as a social determinant of health in the early COVID-19 pandemic in U.S. counties. *SSM – Population Health*, 29, 101747.

CONCEPTUAL FRAMEWORK AND MECHANISMS

The pathways linking internet access to health outcomes operate at multiple levels.

Information access and health literacy. Connectivity enables health information seeking, which improves health literacy and supports better health decisions. Allen’s study provides direct evidence for this mechanism in the COVID-19 context, identifying information access as one operative pathway. Oshima et al.’s study demonstrated the same mechanism at the individual level for cancer survivors, showing that smartphone and internet use were independently associated with health literacy markers.

Health care access and utilization. Telehealth is the primary channel; broadband enables virtual visits, remote monitoring, and patient portal use, each expanding the reach of health care. The Perzynski et al. study established broadband as a strong predictor of patient portal engagement — a gateway to coordinated care that may influence outcomes well beyond individual visits.

Social and economic participation. The Sieck et al. study frames digital inclusion as a “super social determinant” because it mediates access to so many other social determinants of health — employment, education, housing, and social participation — amplifying the pathways through which internet access may influence health.

An underlying theme across these three pathways is the distinction between the first and second Digital Divides. The first divide, access, is narrowing and will continue to as the FCC’s Broadband Equity, Access, and Deployment (BEAD) program begins to dole out funds for deployment. The second divide, adoption and effective use, persists today.



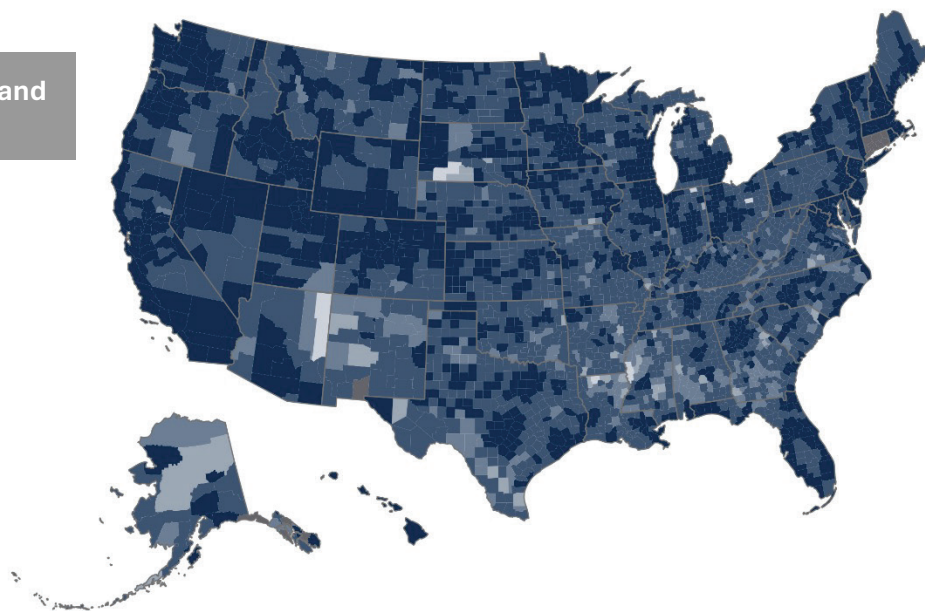
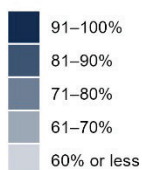
Overview of our analytic approach

This report examines whether county-level household computer and internet adoption is associated with county-level health outcomes across a broad set of measures and whether that association differs between predominantly urban and rural counties.

The analysis pairs three primary data sources: the ACS for the internet measures, the County Health Rankings & Roadmaps data for the health outcome measures, and the 2020 US Decennial Census for urban-rural county classification. The section that follows details each data source and the specific measures drawn from it, their operationalizations, and the regression models used to test proposed relationships.

The independent variable in each model comes from the ACS 2019-2023 five-year data. The ACS is an annual survey conducted by the U.S. Census Bureau that collects detailed demographic, social, economic, and housing information from a rotating sample of approximately 3.5 million U.S. households each year.¹⁹ The five-year averages provide reliable estimates at the county level — including for counties whose populations are too small to report reliable annual estimates. In particular, this study uses the percentage of households that have both a computer and a broadband internet subscription. The measure is constructed at the household level: a household is counted as having computer and broadband access if any household member reports owning a desktop, laptop, smartphone, tablet, or other computing device and if the household subscribes to a broadband internet service. To be classified as having broadband, the household must subscribe — infrastructure availability alone does not qualify. However, the type of internet connection is not taken into consideration.

Figure 1: Households with a broadband subscription and a computer



Source: American Community Survey 2019-2023 five-year estimates, table S2802. Counties are grouped on fixed thresholds of household broadband adoption. Deeper shading indicates higher values. Counties shaded dark grey are not included in the analysis sample.

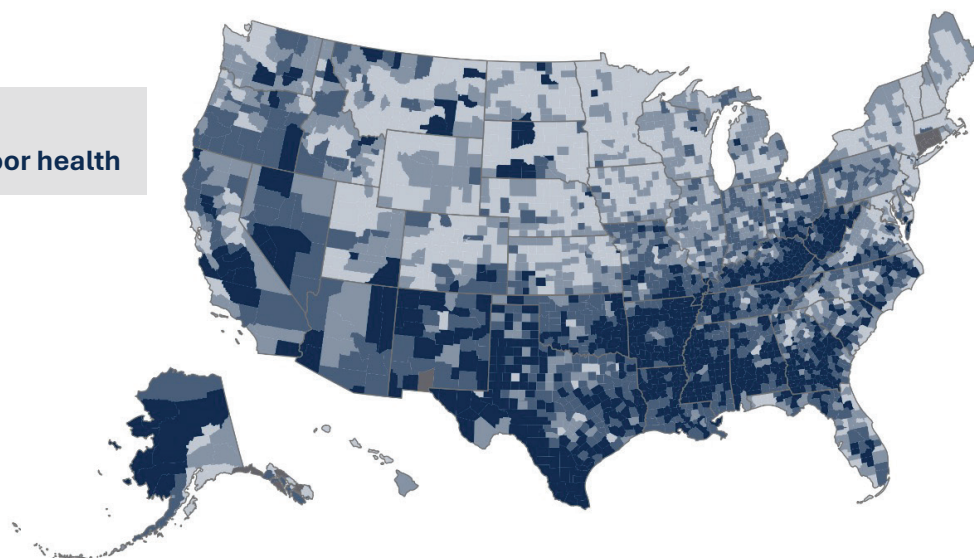
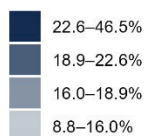
¹⁹Connecticut is excluded from the analysis. In 2022, the Census Bureau retired the state's eight counties as statistical geographies and replaced them with nine Planning Regions, which the American Community Survey adopted for its 2019–2023 five-year estimates. The County Health Rankings continue to report Connecticut on the retired county boundaries, and because Planning Regions do not nest within the former counties, the two sources cannot be reconciled without a town-level crosswalk. The state's omission is unlikely to affect the national estimates reported here.

Overview of our analytic approach

This analysis uses nine outcomes from the County Health Rankings outcome set, selected to capture a broad cross-section of health domains — premature mortality, self-reported health, morbidity, maternal and infant health, preventive care utilization, and injury mortality. The nine outcomes used are summarized below.

- **Years of potential life lost (YPLL) rate** measures the number of years of life lost before age 75 per 100,000 residents, weighted by years of life lost. YPLL captures premature mortality more sensitively than the overall mortality rate because it places greater weight on deaths at younger ages.
- **Percentage of residents reporting fair or poor health** is drawn from BRFSS and represents the share of adults who self-report their general health status as fair or poor on a five-point scale.
- **Average physically unhealthy days** measures the mean number of days in the past 30 days during which adults report their physical health was not good. The measure is also drawn from BRFSS.
- **Average mentally unhealthy days** measures the mean number of days in the past 30 days during which adults report their mental health was not good. The measure is also drawn from BRFSS.
- **Percentage of low-birth-weight births** is drawn from the National Vital Statistics System and represents the share of live births in which the infant weighed less than 2,500 grams at birth.
- **Preventable hospitalization rate** measures the number of hospital stays for ambulatory-care-sensitive conditions per 100,000 Medicare beneficiaries. The measure is drawn from the CMS and reflects hospitalizations that could potentially have been prevented through timely outpatient care.
- **Percentage of Medicare beneficiaries with an annual mammogram** measures the share of female Medicare beneficiaries aged 65 to 74 who received at least one mammography screening in the past two years. The measure is drawn from CMS.
- **Percentage of Medicare beneficiaries vaccinated against influenza** measures the share of fee-for-service Medicare beneficiaries who received an annual influenza vaccination. The measure is drawn from CMS.
- **Injury death rate measures the number of deaths from injury** per 100,000 residents, adjusted for age. The measure captures deaths from all causes of injury, including motor vehicle crashes, unintentional falls, suicide, and drug overdose.

Figure 2: Percent of adults who self-identify as being in fair or poor health



Source: American Community Survey 2019-2023 five-year estimates, table S2802. Counties are grouped on fixed thresholds of household broadband adoption. Deeper shading indicates higher values. Counties shaded dark grey are not included in the analysis sample.

Overview of our analytic approach

Some outcomes are unavailable for a subset of counties due to small population sizes or unreliable underlying estimates. The sample for each model is restricted to counties with non-missing values on both the independent and dependent variables.

Control variables are also drawn from the ACS 2019-2023 five-year data. This paper assesses the impact of median household income and education levels (percent of respondents with a bachelor's degree or higher). Both controls are likely moderator variables in the proposed relationships as they impact both the percent of households with broadband and a computer and many of the health variables. Studies have suggested that both education levels²⁰ and income²¹ have meaningful impacts on health outcomes. In line with those findings, the authors expect that wealthier and more educated counties will have higher adoption rates and better health outcomes.

The table below depicts summary statistics for all the variables under consideration:

The second research question hinges on a county-level urban-rural classification. This study categorizes that distinction based on the 2020 Decennial Census using household counts. Counties where most households are within urban areas are classified as urban-majority. All other counties are classified as rural-majority.

The relationships between computer and internet adoption and health outcomes are evaluated using ordinary least squares (OLS) linear regression models. Standard errors are clustered at the state level, as counties within the same state share Medicaid rules, broadband subsidy programs, and public health infrastructure. For each outcome variable, eight models are estimated: controlling for median household income, controlling for education, an urban subset, a rural subset, and each of these models with state-level fixed effects.²²

Table 1: Summary Statistics

Mean (standard deviation). Counties are classified rural-majority where the rural population exceeds the urban population.				
VARIABLE	MEAN (SD)	N	URBAN	RURAL
Households with computer and broadband(%)	87.8 (5.9)	3,130	91.0 (4.1)	86.0 (6.0)
Median household income (\$10k)	6.60 (1.73)	3,128	7.39 (1.99)	6.15 (1.37)
Bachelor's degree or higher(%)	24.0 (10.2)	3,130	30-4 (11.5)	20.4 (7.1)
Years of potential life lost (per 100,000)	10,503 (3,832)	2,894	9,269 (3,074)	11,294 (4,055)
Physically unhealthy days (avg. per month)	4.46 (0.66)	3,130	4.24 (0.58)	4.58(0.68)
Low birth weight (% of live births)	8.42 (2.13)	3,032	8.38 (1.81)	8.45 (2.30)
Mentally unhealthy days (avg. per month)	5.64 (0.61)	3,130	5.52 (0.56)	5.72 (0.62)
Fair or poor health (% of adults)	19.6 (4.8)	3,130	18.3 (4.5)	20.3 (4.8)
Flu vaccination (% of Medicare enrollees)	41.2 (10.4)	3,114	46.7 (8.8)	38.0 (10.0)
Preventable hospital stays (per 100,000 enrollees)	2,828 (1,081)	3,058	2,697 (847)	2,904 (1,191)
Mammography screening (% of eligible enrollees)	42.8 (8.3)	3,110	44.5 (7.7)	41.8 (8.5)
Injury deaths (per 100,000)	99.9 (30.1)	3,031	89.7 (27.1)	105.9 (30.1)

Sources: American Community Survey 2019-2023 five-year estimates (tables S2802, S1901, and S1501) and the 2025 County Health Rankings.

N = 3,130 counties (1,133 urban-majority, 1,997 rural-majority). Counts vary across health outcomes because the County Health Rankings suppress reliable county estimates.

²⁰Zajacova, A., & Lawrence, E. M. (2018). The relationship between education and health: Reducing disparities through a contextual approach. *Annual Review of Public Health*, 39(1), 273-289. <https://doi.org/10.1146/annurev-publhealth-031816-044628>

²¹Chetty, R., Stepner, M., Abraham, S., et al. (2016). "The Association Between Income and Life Expectancy in the United States, 2001-2014." *JAMA*, 315(14), 1750-1766. doi:10.1001/jama.2016.4226

²²Clustered standard errors and fixed effects address different problems. Clustering corrects how precisely the relationship is estimated, acknowledging that counties in the same state are not independent observations, but it leaves the estimated relationship itself unchanged. State fixed effects instead change what is being compared, restricting the analysis to differences among counties within the same state and thereby removing the influence of state-level conditions that were not measured directly. Together they account for shared state circumstances both in the estimate and in the uncertainty surrounding it.

Results

The findings are presented in this section in four categories, summarized by the outcome measure. The overall results address the first research question, while the urban/rural results illustrate whether the broadband-health association differs between urban-majority and rural-majority counties.

1: MORTALITY AND ACUTE CARE

2: SELF-REPORTED HEALTH AND MORBIDITY

3: MATERNAL AND INFANT HEALTH

4: PREVENTATIVE CARE UTILIZATION



Results

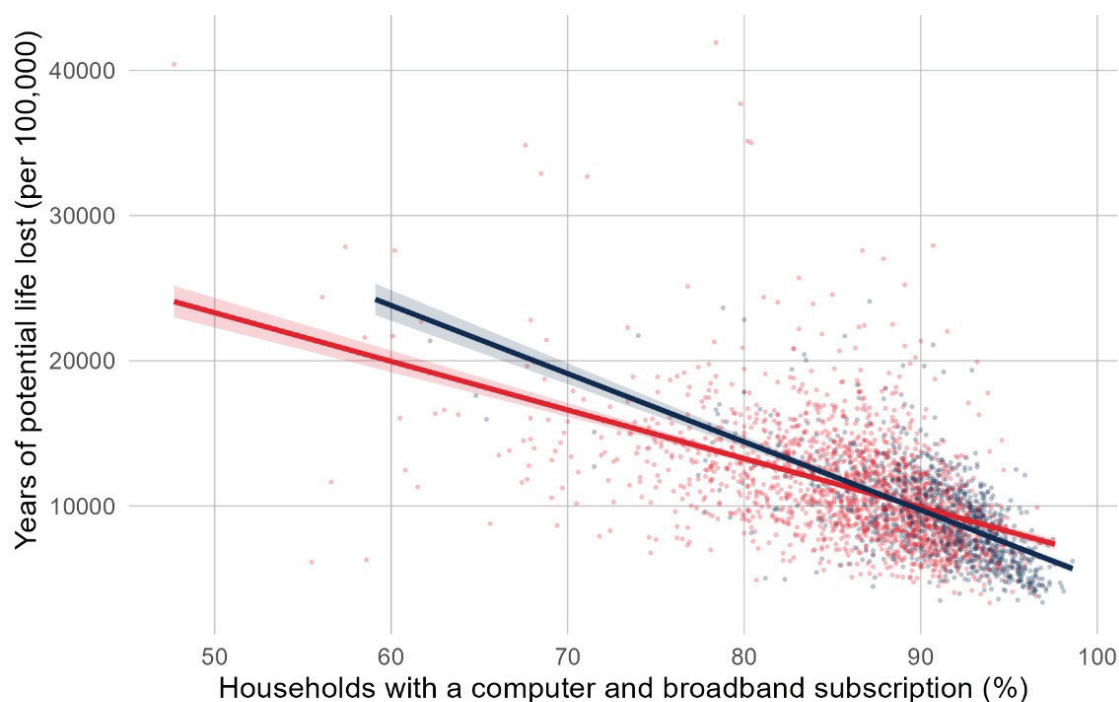
MORTALITY AND ACUTE CARE

YPLL is the most comprehensive mortality measure in the County Health Rankings outcome set, capturing premature deaths under age 75 weighted by years of life remaining.

Our analysis illustrates a negative and significant relationship between broadband adoption and years of potential life lost in 11 of the 12 model specifications. Counties where more households have a computer and a broadband subscription record fewer premature deaths: a one standard deviation increase in adoption, equal to 5.87 percentage points, corresponds to 1,011 fewer years of life lost per 100,000 residents. This relationship holds when controlling for median household income and, in separate models, for educational attainment.

The association is stronger in urban counties than in rural ones. Among urban-majority counties, adoption remains significant across every specification, including those with state fixed effects, which restrict comparisons to counties within the same state. Among rural-majority counties, adoption emerges as insignificant once the model controls for median household income and state fixed effects. The urban coefficient is also larger in magnitude, at 1,242 fewer years of life lost against 861 in rural counties. This relationship between broadband adoption and premature mortality appears to operate more strongly where population density and service infrastructure are greatest.

Figure 3: Scatterplot of households with a broadband subscription and a computer against years of potential life lost (per 100,000 adults)



Sources: American Community Survey 2019-2023 five-year estimates, table S2802; 2025 County Health Rankings. Each point is a county. Lines are ordinary least squares with 95% confidence bands, shown separately for urban- and rural-majority counties. These fits are unadjusted and do not correspond to the controlled estimates reported in the tables.

Results

MORTALITY AND ACUTE CARE (continued)

Injury deaths capture fatalities from both unintentional and intentional causes, including motor vehicle crashes, falls, overdoses, and suicides.

Broadband adoption emerges as significant in 7 of the 12 model specifications, but those results fall almost entirely among the models that control for educational attainment. All six education-controlled models return a negative and significant coefficient – across all counties, a one standard deviation increase in adoption corresponds to 6.49 fewer injury deaths per 100,000 residents. Among the six models that control for median household income, only one reaches significance.

Table 2: OLS regression results (DV: years of potential life lost)

Outcome measured as years of potential life lost (per 100,000). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-1,011** (308)	-725* (321)	-1,457*** (292)	-971** (309)
Control variable	-1,805*** (192)	-1,722*** (139)	-1,251*** (128)	-1,300*** (86.8)
Counties	2,894	2,894	2,894	2,894
R ²	0.458	0.566	0.396	0.533
URBAN-MAJORITY COUNTIES				
Broadband adoption	-1,242*** (232)	-831*** (218)	-1,822*** (229)	-1,230*** (173)
Control variable	-1,357*** (101)	-1,446*** (128)	-1,064*** (83.7)	-1,265*** (136)
Counties	1,130	1,130	1,130	1,130
R ²	0.535	0.686	0.504	0.686
RURAL-MAJORITY COUNTIES				
Broadband adoption	-861* (363)	-559 (328)	-1,379*** (352)	-881** (327)
Control variable	-2,462*** (292)	-2,242*** (245)	-1,845*** (222)	-1,843*** (174)
Counties	1,764	1,764	1,764	1,764
R ²	0.397	0.530	0.315	0.487

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$.

One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Results

MORTALITY AND ACUTE CARE (continued)

This divergence warrants caution. Median household income exhibits a considerably stronger relationship with injury deaths than adoption does, at 12.0 fewer deaths per standard deviation across all counties, and its inclusion absorbs most of the variation that adoption otherwise explains. While the education-controlled coefficients run larger in urban counties than rural ones, at 8.41 against 5.69, the more conservative income-controlled specification provides no evidence of a relationship in either subset. The association between broadband adoption and injury deaths is therefore substantially less robust than the corresponding result for premature mortality.

Table 3: OLS regression results (DV: injury death rate)

Outcome measured as injury deaths (per 100,000). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-3.60 (1.89)	-3.66* (1.72)	-6.49*** (1.79)	-5.18** (1.78)
Control variable	-12.0*** (1.37)	-12.4*** (1.11)	-8.35*** (1.12)	-9.86*** (0.696)
Counties	3,031	3,031	3,031	3,031
R ²	0.235	0.420	0.191	0.399
URBAN-MAJORITY COUNTIES				
Broadband adoption	-3.19 (3.21)	-2.65 (2.33)	-8.41** (3.07)	-6.18* (2.50)
Control variable	-10.5*** (1.11)	-11.3*** (1.15)	-7.38*** (1.04)	-9.49*** (0.911)
Counties	1,133	1,133	1,133	1,133
R ²	0.253	0.479	0.215	0.472
RURAL-MAJORITY COUNTIES				
Broadband adoption	-2.34 (2.15)	-2.29 (1.83)	-5.69** (2.01)	-4.36* (1.97)
Control variable	-13.1*** (2.35)	-13.4*** (1.97)	-7.54** (2.40)	-10.4*** (1.75)
Counties	1,898	1,898	1,898	1,898
R ²	0.155	0.389	0.096	0.356

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$. One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Results

MORTALITY AND ACUTE CARE (continued)

Preventable hospital stays measure hospitalizations for conditions that timely outpatient care could have addressed calculated among Medicare enrollees.

Broadband adoption emerges insignificant in all 12 model specifications, making this the only outcome in the study for which no model returns a significant coefficient. The estimates are unstable in sign as well as magnitude. Both control variables, by contrast, retain strong and significant relationships throughout. The data provides no evidence that broadband adoption is associated with preventable hospitalization once economic or educational conditions are accounted for.

Table 4: OLS regression results (DV: preventable hospitalization rate)

Outcome measured as preventable hospital stays (per 100,000 enrollees). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-75.7 (51.6)	-11.4 (39.0)	-78.8 (52.4)	5.63 (41.6)
Control variable	-262*** (61.4)	-191*** (37.9)	-292*** (48.3)	-233*** (28.1)
Counties	3,058	3,058	3,058	3,058
R ²	0.085	0.288	0.100	0.300
URBAN-MAJORITY COUNTIES				
Broadband adoption	-101 (79.0)	-29.3 (45.4)	-109 (68.4)	3.77 (40.5)
Control variable	-162*** (43.5)	-151*** (22.9)	-196*** (39.4)	-219*** (25.0)
Counties	1,131	1,131	1,131	1,131
R ²	0.080	0.406	0.103	0.439
RURAL-MAJORITY COUNTIES				
Broadband adoption	-48.1 (61.6)	10.7 (44.8)	-57.9 (57.4)	9.79 (45.6)
Control variable	-414*** (102)	-253*** (70.8)	-559*** (80.8)	-363*** (52.6)
Counties	1,927	1,927	1,927	1,927
R ²	0.089	0.271	0.120	0.282

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$. One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Results

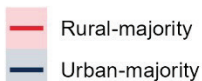
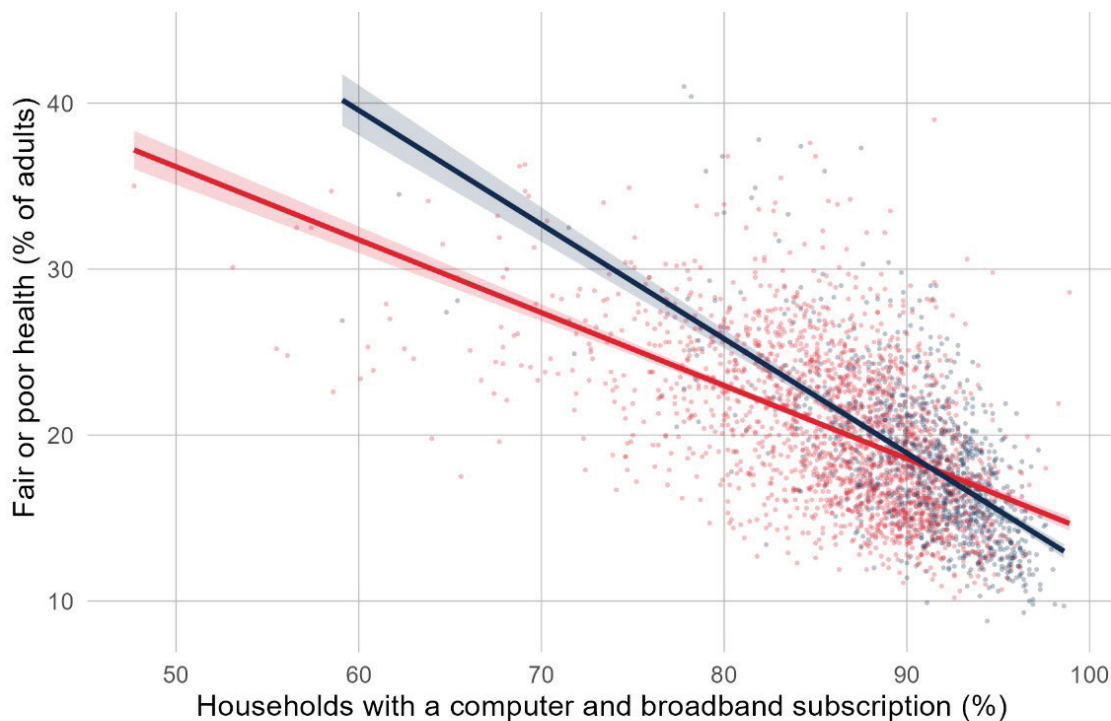
SELF-REPORTED HEALTH AND MORBIDITY

The share of adults reporting fair or poor health emerges as one of the outcomes most strongly associated with broadband and device adoption.

Adoption returns a negative and significant coefficient in all 12 model specifications – the only outcome in the study to do so, and every estimate clears the $p < 0.001$ threshold. Across all counties, a one standard deviation increase in adoption corresponds to 1.26 fewer percentage points in the share reporting fair or poor health. The models also account for more explained variation than most other outcome variables, with R^2 values ranging from 0.493 to 0.755.

The association is roughly twice as strong in urban-majority counties as in rural-majority counties. Controlling for median household income, a one standard deviation increase in adoption corresponds to a 2.23 percentage point decline among urban-majority counties compared with 1.05 among rural-majority counties. Urban-majority counties are also the only subset in which adoption exceeds its control variable in magnitude, at 2.23 against 1.62 for median household income. Self-reported health status in rural counties appears more closely tied to economic conditions than to connectivity; while in urban counties, the two operate at comparable scale.

Figure 4: Scatterplot of households with a broadband subscription and a computer against percent of adults identifying as being in fair or poor health



Sources: American Community Survey 2019-2023 five-year estimates, table S2802; 2025 County Health Rankings. Each point is a county. Lines are ordinary least squares with 95% confidence bands, shown separately for urban- and rural-majority counties. These fits are unadjusted and do not correspond to the controlled estimates reported in the tables.

Results

SELF-REPORTED HEALTH AND MORBIDITY (continued)

Physically unhealthy days measure the average number of days per month that adults report poor physical health, drawn from self-reported survey responses.

Broadband adoption returns a negative and significant coefficient in all 12 model specifications, matching the consistency observed for fair or poor health. Across all counties, a one standard deviation increase in adoption corresponds to 0.127 fewer physically unhealthy days per month. These models account for more variation than any others in the study, with R^2 reaching 0.848 among urban-majority counties under state fixed effects.

Table 5: OLS regression results (DV: percent identifying as fair or poor health)

Outcome measured as fair or poor health (% of adults). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-1.26*** (0.125)	-0.954*** (0.126)	-1.61*** (0.158)	-1.21*** (0.144)
Control variable	-2.48*** (0.273)	-2.22*** (0.185)	-2.21*** (0.208)	-1.88*** (0.131)
Counties	3,128	3,128	3,130	3,130
R^2	0.508	0.734	0.493	0.718
URBAN-MAJORITY COUNTIES				
Broadband adoption	-2.23*** (0.503)	-1.56*** (0.333)	-2.49*** (0.359)	-2.01*** (0.325)
Control variable	-1.62*** (0.170)	-1.79*** (0.132)	-1.77*** (0.194)	-1.63*** (0.110)
Counties	1,133	1,133	1,133	1,133
R^2	0.499	0.746	0.548	0.755
RURAL-MAJORITY COUNTIES				
Broadband adoption	-1.05*** (0.155)	-0.771*** (0.145)	-1.49*** (0.173)	-1.09*** (0.165)
Control variable	-3.49*** (0.358)	-2.69*** (0.212)	-3.53*** (0.312)	-2.65*** (0.170)
Counties	1,995	1,995	1,997	1,997
R^2	0.523	0.744	0.506	0.726

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$. One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R -squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

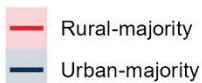
Results

SELF-REPORTED HEALTH AND MORBIDITY (continued)

The urban-rural pattern holds and is more pronounced here than for most outcomes. Controlling for median household income, a one standard deviation increase in adoption corresponds to 0.205 fewer unhealthy days among urban-majority counties compared with 0.094 among rural-majority counties, a difference of more than twofold. Median household income exceeds adoption in magnitude across all counties, and the gap widens considerably among rural-majority counties, where income accounts for 0.513 unhealthy days against 0.094 for adoption. As with self-reported health status, physical health in rural counties appears more closely tied to economic conditions than to connectivity.

Coefficients here remain stable under state fixed effects. Among all counties, the income-controlled estimate moves only from 0.127 to 0.116, retaining more than 90% of its magnitude, and the urban education-controlled estimate is nearly unchanged at 0.269 and 0.266. This stability indicates that the association reflects differences among counties within the same state rather than differences between states.

Figure 5: Scatterplot of households with a broadband subscription and a computer against number of physically unhealthy days (average per month)



Sources: American Community Survey 2019-2023 five-year estimates, table S2802; 2025 County Health Rankings. Each point is a county. Lines are ordinary least squares with 95% confidence bands, shown separately for urban- and rural-majority counties. These fits are unadjusted and do not correspond to the controlled estimates reported in the tables.

Results

SELF-REPORTED HEALTH AND MORBIDITY (continued)

Mentally unhealthy days measures the average number of days per month that adults report poor mental health, drawn from the same self-reported survey instrument as physically unhealthy days.

Broadband and device adoption emerge as significant in eight of the 12 model specifications, and the pattern of which models succeed differs from the outcomes above. All six education-controlled models return a negative and significant coefficient, while among the six income-controlled models only two do so — and both of those include state fixed effects. Across all counties, the education-controlled estimate indicates that a one standard deviation increase in adoption corresponds to 0.107 fewer mentally unhealthy days per month.

Table 6: OLS regression results (DV: number of physically unhealthy days)

Outcome measured as physically unhealthy days (avg. per month). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-0.127*** (0.027)	-0.116*** (0.018)	-0.175*** (0.029)	-0.157*** (0.021)
Control variable	-0.378*** (0.044)	-0.356*** (0.022)	-0.342*** (0.030)	-0.298*** (0.016)
Counties	3,128	3,128	3,130	3,130
R ²	0.498	0.822	0.486	0.797
URBAN-MAJORITY COUNTIES				
Broadband adoption	-0.205*** (0.047)	-0.170*** (0.028)	-0.269*** (0.046)	-0.266*** (0.028)
Control variable	-0.266*** (0.027)	-0.301*** (0.015)	-0.266*** (0.020)	-0.251*** (0.012)
Counties	1,133	1,133	1,133	1,133
R ²	0.519	0.848	0.560	0.835
RURAL-MAJORITY COUNTIES				
Broadband adoption	-0.094** (0.032)	-0.083*** (0.023)	-0.153*** (0.032)	-0.134*** (0.026)
Control variable	-0.513*** (0.064)	-0.408*** (0.028)	-0.525*** (0.062)	-0.383*** (0.023)
Counties	1,995	1,995	1,997	1,997
R ²	0.477	0.818	0.463	0.789

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$. One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Results

SELF-REPORTED HEALTH AND MORBIDITY (continued)

The urban-rural pattern departs from the study's general tendency. Among urban-majority counties, adoption is insignificant under both income-controlled specifications, including the model without fixed effects. In contrast, among rural-majority counties, adoption attains significance in three out of four specifications. The impact of median household income again exceeds adoption in every comparison at 0.282 against 0.055 across all counties and 0.348 versus 0.052 among rural-majority counties. The evidence linking broadband adoption to mental health outcomes is therefore considerably weaker than the evidence for physical health measures, and it largely depends on which socioeconomic control the model applies.

Table 7: OLS regression results (DV: number of mentally unhealthy days)

Outcome measured as mentality unhealthy days (avg. per month). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-0.055 (0.030)	-0.047** (0.015)	-0.107** (0.036)	-0.085*** (0.017)
Control variable	-0.282*** (0.036)	-0.264*** (0.010)	-0.225*** (0.027)	-0.203*** (0.011)
Counties	3,128	3,128	3,130	3,130
R ²	0.275	0.836	0.240	0.808
URBAN-MAJORITY COUNTIES				
Broadband adoption	-0.056 (0.043)	-0.019 (0.018)	-0.179*** (0.047)	-0.151*** (0.024)
Control variable	-0.244*** (0.028)	-0.273*** (0.011)	-0.172*** (0.023)	-0.175*** (0.014)
Counties	1,133	1,133	1,133	1,133
R ²	0.306	0.839	0.256	0.776
RURAL-MAJORITY COUNTIES				
Broadband adoption	-0.052 (0.033)	-0.040* (0.018)	-0.092* (0.037)	-0.070*** (0.020)
Control variable	-0.348*** (0.066)	-0.253*** (0.019)	-0.356*** (0.064)	-0.240*** (0.018)
Counties	1,995	1,995	1,997	1,997
R ²	0.245	0.838	0.238	0.826

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$. One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Results

MATERNAL AND INFANT HEALTH

Low birth weight measures the share of live births under 2,500 grams. Broadband and device adoption emerges as significant in nine of the 12 model specifications.

Across all counties, a one standard deviation increase in adoption corresponds to a decline of 0.329 percentage points while controlling for income. That estimate falls to 0.060 with state fixed effects specified, a retention of less than one-fifth of its original magnitude.

The three insignificant results share a common feature: each occurs in an income-controlled model with state fixed effects. This finding indicates that the association operates largely between states rather than within them. States differ in the prevalence of low birth weight for many reasons, including Medicaid eligibility, prenatal care access, and demographic composition. Once those differences are absorbed, adoption retains little explanatory power in the income-controlled models.

Educational attainment performs poorly as a control variable for this outcome. Across all counties, it emerges as insignificant without fixed effects, and among urban-majority counties, it is insignificant under both specifications. Median household income, by contrast, remains significant throughout and reaches a 1.22 percentage point decline among rural-majority counties. Taken together, these results suggest that the relationship between broadband and device adoption and low birth weight is real at the national level but substantially confounded by state-level factors and the economic conditions of the counties themselves.

Table 8: OLS regression results (DV: low birth weight rate)

Outcome measured as years of potential life lost (per 100,000). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	-0.055 (0.030)	-0.047** (0.015)	-0.107** (0.036)	-0.085*** (0.017)
Control variable	-0.282*** (0.036)	-0.264*** (0.010)	-0.225*** (0.027)	-0.203*** (0.011)
Counties	3,128	3,128	3,130	3,130
R ²	0.275	0.836	0.240	0.808
URBAN-MAJORITY COUNTIES				
Broadband adoption	-0.056 (0.043)	-0.019 (0.018)	-0.179*** (0.047)	-0.151*** (0.024)
Control variable	-0.244*** (0.028)	-0.273*** (0.011)	-0.172*** (0.023)	-0.175*** (0.014)
Counties	1,133	1,133	1,133	1,133
R ²	0.306	0.839	0.256	0.776
RURAL-MAJORITY COUNTIES				
Broadband adoption	-0.052 (0.033)	-0.040* (0.018)	-0.092* (0.037)	-0.070*** (0.020)
Control variable	-0.348*** (0.066)	-0.253*** (0.019)	-0.356*** (0.064)	-0.240*** (0.018)
Counties	1,995	1,995	1,997	1,997
R ²	0.245	0.838	0.238	0.826

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model: the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$. One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Results

PREVENTATIVE CARE UTILIZATION

Influenza vaccination and annual mammography are the two outcomes for which we expect adoption to exert a positive influence: counties with higher computer and internet adoption may also exhibit higher rates of preventive care uptake, driven by patient portal use, online appointment scheduling, and health-information seeking.

Both measures are drawn from Medicare enrollee records rather than survey responses, and both return positive coefficients throughout, consistent with that expectation. The two diverge, however, in how reliably that relationship holds.

Table 9: OLS regression results (DV: flu vaccination rate)

Outcome measured as flu vaccination (% of medicare enrollees). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	1.50*** (0.388)	1.90*** (0.315)	1.33*** (0.395)	1.49*** (0.358)
Control variable	3.53*** (0.408)	3.62*** (0.573)	4.26*** (0.338)	4.51*** (0.341)
Counties	3,112	3,112	3,114	3,114
R ²	0.196	0.415	0.241	0.462
URBAN-MAJORITY COUNTIES				
Broadband adoption	2.17** (0.752)	1.55** (0.500)	1.07* (0.513)	0.702 (0.410)
Control variable	2.13*** (0.386)	2.33*** (0.490)	3.95*** (0.403)	3.77*** (0.307)
Counties	1,132	1,132	1,132	1,132
R ²	0.173	0.494	0.314	0.594
RURAL-MAJORITY COUNTIES				
Broadband adoption	0.198 (0.458)	0.652* (0.256)	0.982* (0.422)	1.10*** (0.313)
Control variable	3.80*** (0.646)	4.48*** (0.648)	2.65*** (0.689)	4.28*** (0.454)
Counties	1,980	1,980	1,982	1,982
R ²	0.097	0.407	0.061	0.392

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model; the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$.

One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

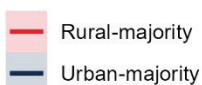
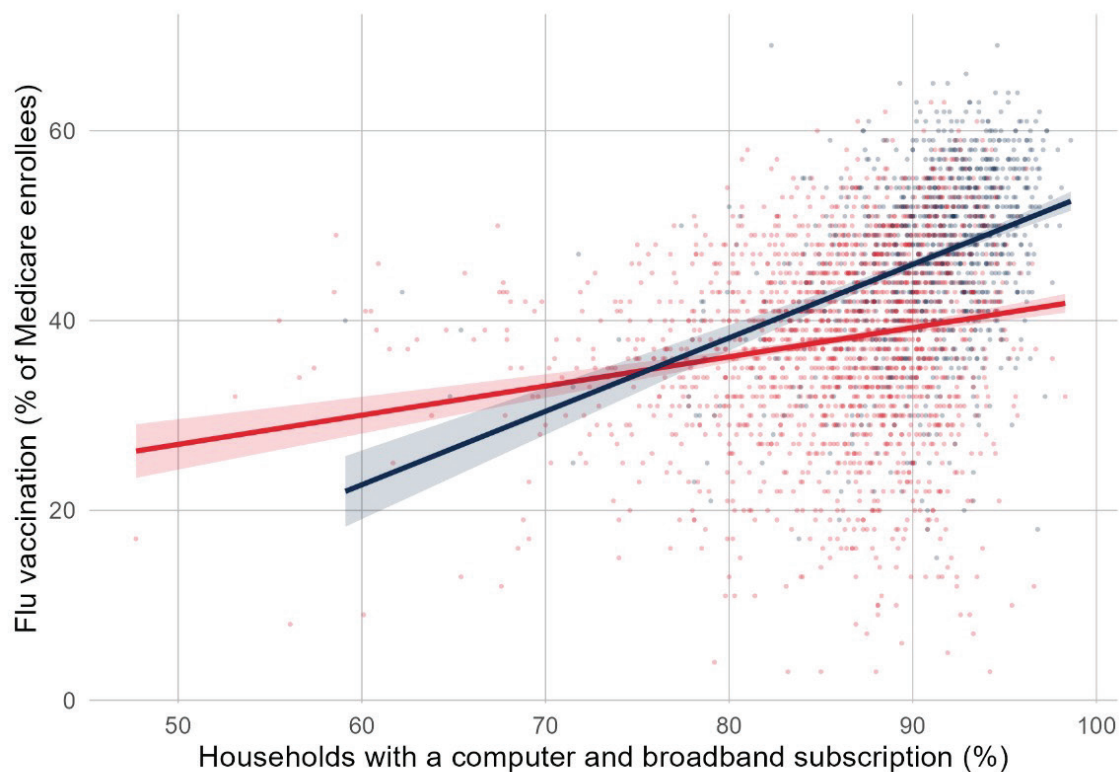
Results

PREVENTATIVE CARE UTILIZATION (continued)

Flu vaccination emerges as the stronger of the two variables. Adoption returns a positive and significant coefficient in 10 of the 12 model specifications, and all four models estimated on the full sample clear the $p < 0.001$ threshold. Across all counties, a one standard deviation increase in adoption corresponds to a 1.50 percentage point increase in vaccination. This is also the only outcome in the study for which the full-sample coefficient grows under state fixed effects, rising from 1.50 to 1.90, which indicates that the association is stronger among counties within the same state.

Mammography screening, by contrast, holds only at the national level. Adoption attains significance in all four full-sample models but in just two of the eight estimated on the urban and rural subsets, and in both cases the estimate becomes insignificant once state fixed effects are accounted for. The pooled result therefore depends more on variation between urban and rural counties than within them, and it warrants more caution than the vaccination finding.

Figure 6: Scatterplot of households with a broadband subscription and a computer against flu vaccination rate (percent of Medicare enrollees)



Sources: American Community Survey 2019-2023 five-year estimates, table S2802; 2025 County Health Rankings. Each point is a county. Lines are ordinary least squares with 95% confidence bands, shown separately for urban- and rural-majority counties. These fits are unadjusted and do not correspond to the controlled estimates reported in the tables.

Results

PREVENTATIVE CARE UTILIZATION (continued)

The two measures also differ in which control specification sustains the relationship in each subset. For flu vaccination, adoption attains significance in three of four specifications in both subsets, but the urban estimates run larger while controlling for income, at 2.17 and 1.55, while the rural estimates run larger while controlling for education, at 0.982 and 1.10. For mammography, the single surviving rural estimate appears when controlling for education, while the single surviving urban estimate appears when controlling for income. Preventive care uptake appears to be shaped by different combinations of economic and educational conditions in urban and rural settings.

Taken together, these results offer qualified support for the proposed mechanism. The evidence is reasonably strong for influenza vaccination, which requires a single low barrier encounter that scheduling tools and reminder systems can plausibly facilitate, and considerably weaker for mammography, which depends on imaging facilities and referral pathways that household connectivity does not address. Both control variables outperform adoption in nearly every specification, indicating that preventive care uptake remains more closely tied to economic conditions and educational attainment than to connectivity.

Table 10: OLS regression results (DV: mammography screening)

Outcome measured as mammography screening (% of eligible enrollees). Coefficients express the change per one standard deviation increase in the predictor. Standard errors clustered by state in parentheses.				
	CONTROL: MEDIAN HOUSEHOLD INCOME		CONTROL: EDUCATIONAL ATTAINMENT	
	INCOME	INCOME + STATE FE	EDUCATION	EDUCATION + STATE FE
ALL COUNTIES				
Broadband adoption	1.04** (0.344)	0.989** (0.335)	0.954* (0.429)	0.773* (0.363)
Control variable	1.78*** (0.488)	1.66*** (0.487)	2.16*** (0.482)	2.16*** (0.345)
Counties	3,109	3,109	3,110	3,110
R ²	0.095	0.470	0.113	0.490
URBAN-MAJORITY COUNTIES				
Broadband adoption	2.42* (1.15)	1.44 (0.801)	0.901 (0.923)	0.729 (0.698)
Control variable	0.215 (0.421)	0.780 (0.516)	2.00*** (0.466)	1.76*** (0.345)
Counties	1,132	1,132	1,132	1,132
R ²	0.060	0.499	0.121	0.533
RURAL-MAJORITY COUNTIES				
Broadband adoption	0.345 (0.381)	0.439 (0.362)	0.937* (0.472)	0.604 (0.392)
Control variable	3.26*** (0.617)	2.42*** (0.435)	2.60*** (0.736)	2.77*** (0.351)
Counties	1,977	1,977	1,978	1,978
R ²	0.106	0.483	0.079	0.488

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Each column within a panel is a separate ordinary least squares model; the panel defines the estimation sample. The control variable row reports median household income in the first two columns and the share of adults holding a bachelor's degree in the last two: the two are entered separately because they correlate at $r = 0.72$.

One standard deviation equals 5.87 percentage points of broadband adoption, \$17,327 of median household income, and 10.2 percentage points of educational attainment, computed across all counties. R-squared is not comparable between the fixed-effects and non-fixed-effects columns, because the state dummies absorb variance directly. County counts range from 1,130 to 2,894 because the County Health Rankings suppress unreliable estimates.

Conclusion

This study finds that digital connectivity – measured using household broadband and device adoption rates – is consistently associated with better county-level health outcomes. The relationship, however, varies across health measures and geographies.

Across 12 model specifications, broadband and device adoption exhibits its strongest negative associations with general physical morbidity and premature mortality. Lower shares of adults reporting fair or poor health, reduced numbers of physically unhealthy days, and fewer years of potential life lost represent the clearest national-level patterns as they retain statistical significance under state fixed effects and while controlling for socioeconomic confounders. These are also the broadest measures examined, capturing general health status rather than any single condition or service.



Conclusion

However, the strength and stability of these associations vary when examining outcomes tied to specialized clinical care, specific causes of death, or mental health. While broadband and device adoption is associated with low-barrier preventative care (like influenza vaccination), the association weakens under different conditions for each of the remaining outcomes. Income controls eliminate the significance for injury deaths; income controls and state fixed effects eliminate it for low birth weight, and mammography screening holds nationally but not within urban or rural counties considered separately.

Mentally unhealthy days follows the same pattern as injury deaths, reaching significance with education controls, but in only two of the six models controlling for median household income. Preventable hospital stays did not achieve a significant relationship across any of the model specifications. These divergences suggest that while adoption may support health information seeking, online appointment scheduling, and routine patient communication, it cannot replace accessible health care infrastructure, clinical capacity, or fundamental economic security.

Another key finding from this study is the pronounced urban-rural asymmetry. Broadband and device adoption shows substantially larger and more consistent health associations in urban-majority counties than in rural-majority counties for most outcomes examined. In urban settings, where physical health care infrastructure is more robust and population density is higher, digital connectivity may amplify preexisting health resources. In contrast, across rural counties, median household income consistently absorbs the variation that adoption otherwise explains, outperforming adoption on nearly every model specification. Physical health outcomes in rural areas seem to depend far more heavily on baseline economic conditions than on connectivity alone.



Conclusion

This asymmetry highlights what connectivity alone cannot accomplish and points toward what might close the gap. Where physical infrastructure is scarce, expanding broadband establishes the foundation for telehealth delivery, allowing rural health systems to build community telehealth hubs and remote specialist networks. Connecting rural residents to off-site specialists through virtual care centers offers a direct means of mitigating local provider shortages and bridging geographic barriers to complex care. The evidence presented here suggests that connectivity and clinical capacity function as complements rather than substitutes: if adoption yields smaller health returns where clinical capacity is thinnest, then expanding connections without expanding the services those connections reach is unlikely to close the divide.

These findings are timely as the Rural Health Transformation Program moves from its design phase into implementation. All fifty states received awards in December 2025, and every state plan includes initiatives to expand rural health technology.²³ Implementation has proceeded unevenly, and with annual funding continuing through 2030, states have discretion over subaward design and program sequencing.

The evidence presented here suggests two priorities for states as they make these decisions.

First, virtual care investments should be targeted towards counties where household adoption is already sufficient to support them since telehealth cannot be used by households without a preexisting connection.

Second, digital literacy should be treated as health infrastructure rather than as an adjacent concern.

Absent such measures, the states with the greatest rural health needs risk building capacity their residents are ill-equipped to access.



²³[cms.gov/newsroom/press-releases/cms-announces-50-billion-awards-strengthen-rural-health-all-50-states](https://www.cms.gov/newsroom/press-releases/cms-announces-50-billion-awards-strengthen-rural-health-all-50-states)



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