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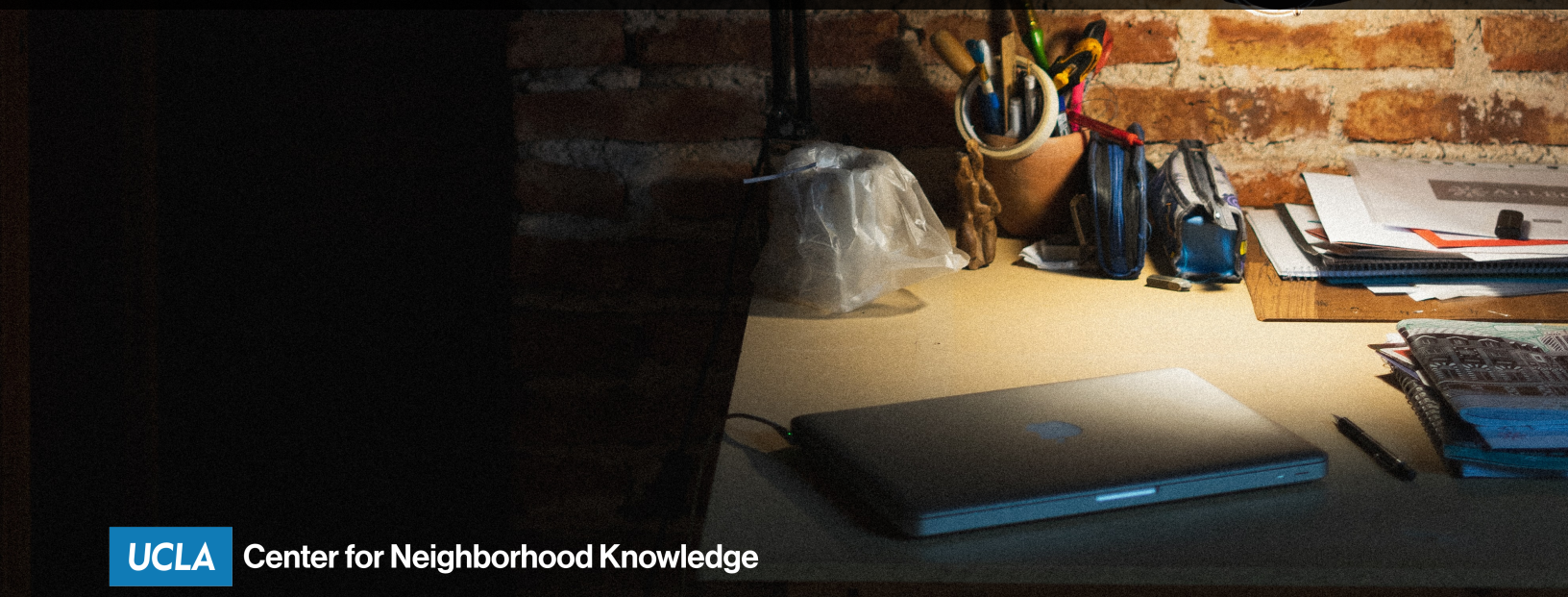
December 9, 2020

COVID-19 AND THE DIGITAL DIVIDE IN VIRTUAL LEARNING

Fall 2020



UCLA Center for Neighborhood Knowledge

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DISCLAIMER

The views expressed herein are those of the author and not necessarily those of the University of California, Los Angeles. The author alone is responsible for the content of this report.

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The Digital Divide, Education and Social Justice

In this timely report, Paul Ong at the Center for Neighborhood Knowledge at the UCLA Luskin School of Public Affairs shows a disturbing trend with respect to computer availability and internet connectivity during the COVID-19 pandemic months. Using data from the U.S. Census Household Pulse Survey (HPS) he shows a persistent and probable digital divide amongst Asian, White, Hispanic and Black households where Hispanic and Black families lag far behind. In addition, the data also show a clear digital divide along income levels. These technological digital disparities have far reaching implications for educational access. They point to new challenges for realizing the ideal of equal educational opportunity enshrined in constitutional jurisprudence over six decades ago.

Last year, in May 2019, we celebrated the 65th anniversary of Brown v. Board of Education. The landmark Supreme Court case overturned Plessy in asserting that "separate but equal" educational facilities were inherently unequal and violated the equal protection of the laws guaranteed by the Fourteenth Amendment. Equal educational opportunity henceforth was not only desirable but lawfully obligatory.

The court determined that states must provide all students an education "on equal terms" and hence could not establish separate school facilities for different races. The court spoke of the "intangible" differences associated with segregated schools. While prescient, in the court's mandate for education on equal terms, it could never have imagined cyber space, let alone inequalities in cyber space.

These are the phenomena of a markedly different era. But though recent, inequities in the digital realm are not new—they predate the pandemic as the bulletin acknowledges. The Obama administration's ConnectAll initiative squarely recognized these inequities when it noted in 2016 that "families earning under $25,000 a year are about half as likely to have the Internet at home as families that are the most well-off."

But what the pandemic brought into focus, through mandated remote learning, is the intimate connection between education and technological connectivity and, with it, the connection between connectivity and social justice. The battleground for educational equity has now, and perhaps forever, shifted into a new space. As COVID-19 cases rise and fall, schools will open and close. But remote learning, in some form, is now permanent. It is forever an integral feature of our educational landscape.

Hence, it is the dynamics in this landscape and in the now expanded notion of "school space," that deserve our full study, commitment and moral resolve. The negative consequences of inequitable access to computers and connectivity are substantial and not just for educational attainment but for psychological health and social wellbeing. The stakes are extraordinarily high.

New efforts toward alleviating inequities will require joint endeavors as the bulletin intimates. The REACT initiative and the former president's ConnectEd program are cases in point where educational institutions, government agencies and the private sector collaborate toward solutions. What might be other innovative, transformative and holistic responses? What might be some policy or legal considerations? For example, might we consider broadband a fundamental right for all students, given its indispensability for learning, as the recent report from UCLA's Institute for Democracy, Education and Access (IDEA) suggests?

This is an invitation to all readers of this bulletin, to think alongside us and perhaps partner with us as we strive towards that noble ideal where education is not just for some but for all.

Given UCLA School of Education & Information Studies' social justice mission and resolute commitment to equity we are honored in partnering with the Center for Neighborhood Knowledge in the distribution and wide dissemination of this vital study.

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Introduction

COVID-19 has massively disrupted people's lives and livelihoods, and one of the most profound impacts is upending K-12 education. To slow the spread of infections, states and school districts have abandoned traditional in-class teaching and moved to remote teaching, which relies on computers and the internet to connect students to instructors and educational resources. The unprecedented and swift reconfiguration fundamentally transformed the role of technology[i], resulting in a paradigm shift with grave implications for marginalized students. Of course, the digital divide (a systematic inequality in access to technology) is not new. Before the pandemic, in-home differences in available technology had contributed to the achievement gap along race and income-class lines.[ii] Since mid-March 2020, when shelter-in-place mandates began, the pandemic-induced reliance on technology-based schooling has exacerbated the academic consequences of the digital divide. What was previously considered private extracurricular resources has become essential tools for core schooling activities. A lack of meaningful and full access to a computer or the internet translates into missed lessons, inability to access materials, and difficulties completing assignments.

To understand and quantify the pattern and magnitude of the pandemic's effect on young students, this research brief examines the digital divide in virtual learning by analyzing survey data from the U.S. Census Bureau. A previous report from UCLA's Center for Neighborhood Knowledge assessed the impacts during the Spring 2020 semester.[iii] The researchers found that a significant number of households where children have limited access to a computer and the internet, with the rates increasing over time.[iv] Equally important, low-income, African American, and Latino[v] students were disproportionately affected. This brief updates those findings, focusing on the Fall 2020 semester, with additional comparisons to the pre-pandemic digital divide. The major findings include:

1. At the state level, the pandemic digital divide mirrors the technological gap prior to COVID-19, revealing that systematic inequalities are being reproduced across time.
2. Limited technological access persists during the Fall 2020 semester, but is less severe than the Spring 2020 semester, indicating that schools have been better able to adapt to new realities.
3. The problem has increased in recent weeks, due perhaps to re-closing as some schools respond to coronavirus infections.
4. Inaccessibility is associated with fewer virtual contacts with teachers and fewer hours spent on learning and studying.
5. During the Fall 2020 semester, racial inequality is significant, with African Americans and Hispanics being 1.3 to 1.4 times as likely to experience limited accessibility as non-Hispanic Whites.
6. Low-income households are most impacted by unavailability, with over two-in-five households having limited access to a computer or the internet.
7. The lack of access to technology is tied to parents' educational attainment, affecting nearly two-in-five households where the respondents have no more than a high school education.
8. Students in younger households are most likely to experience technological barriers.

The observed disparities in limited technological resources for virtual learning is not just today's education crisis. Falling behind increases the achievement gap, which has long-term social and economic implications. The digital inequality threatens to widen the racial and income gap as children become adults, thus contributing to an intergenerational reproduction of inequality. To avoid this tragedy, we must act immediately and decisively to close the digital divide.

Data and Empirical Approach

This research brief uses data from the U.S. Census Bureau's weekly Household Pulse Survey (HPS), a multi-agency collaboration to collect information on COVID-19's social and economic effects. HPS is a rapid response demonstration project and a part of the Experimental Data Product series. Although HPS has some limitations because it is new and not extensively tested, it nonetheless provides useful insights.[vi] Phase 1 of the survey (April 23 to July 21) and Phase 2 of the survey (August 19 to October 26) roughly correspond to the 2020 Spring semester and the early part of 2020 Fall semester, respectively. While the U.S. Census Bureau publishes tabulated aggregated statistics, we use the micro-samples (individual level responses). This provides flexibility to customize the analysis to better assess the pandemic's impact on the digital divide and remote learning. We restrict the Pulse subsample to households with children attending public or private schools, and with valid responses to key questions. Our summary statistics are not always identical to those in the published tables, but the differences are minimal.

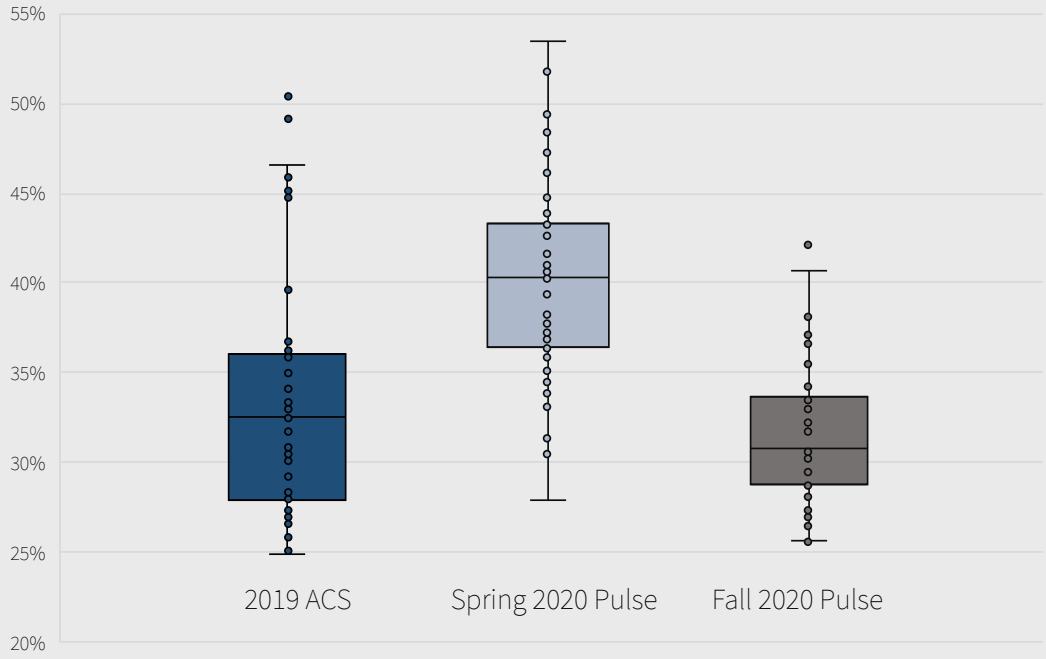
The analysis uses two key Pulse questions: "How often is a computer or other digital devices available to children for educational purposes?" and "How often is the Internet available to children for education purposes?" There are five possible responses for each question: (1) always available, (2) usually available, (3) sometimes available, (4) rarely available, or (5) never available. We focus on households where technology is not always available.[vii] Our primary indicator (criterion) denotes when a computer or the internet is not always available to a student for educational activities. The absence of full availability to either can hamper remote learning. We use the following information for the demographic and socioeconomic analysis: race/ethnicity (non-Hispanic White, Black, Asian, or Hispanic), household income (ranging from less the $50,000 to more the $100,000), the respondents' highest level of educational attainment (ranging from no more than a high school degree to a bachelor's degree or higher), and adult respondent's age.

We also use the American Community Survey (ACS), a continuous effort by the U.S. Census Bureau to collect social, economic, and housing data. The 2019 ACS micro-sample provides background information on the availability of computers and broadband in households with children between the ages of 5 to 17. We define limited access to technology as not having a computer or not having access to broadband. This criterion is not identical to the limited-access definition based on HPS; nonetheless, the analysis of the ACS indicator captures key aspects of the pre-pandemic digital divide.

Temporal and State-Level Patterns of Availability

Graph 1 provides an overview of state-level temporal changes in limited digital access for households. (See Appendix for details.) The unit of observation are states based on weighted summations of the Pulse micro-sample. Each "box and whisker" bar reports the distribution by the percent of households with limited access. The ends of the "whisker" (narrow vertical line) denote the range (minimum and maximum state rates), the box reports the segment containing states in the middle range (from the 25th percentile to the 50th percentile), and the horizontal line inside the box is the unweighted average. While the 2019 ACS statistics are based on a different metric (percent of households with computer or broadband) than for the Pulse statistics (percent of households where students do not always have access to a computer or the internet), the ACS data nonetheless provides an insightful reference point. The first two bars suggest a significant jump in limited digital access from 2019 (weighted and unweighted mean of 33%) to Spring 2020 (unweighted and unweighted mean of 40%), which is probably due to schools caught unprepared for the pandemic's chaos and shutdowns.

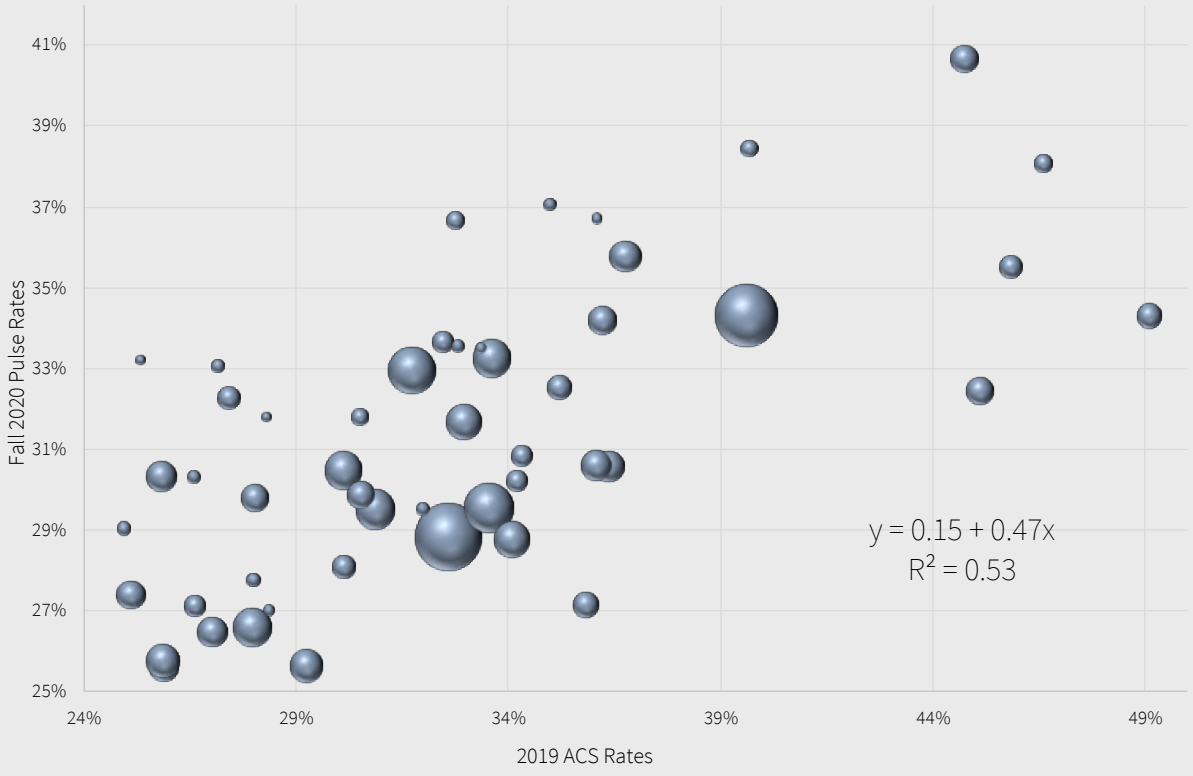
Graph 1: Limited Digital Access



The rates declined significantly between the Spring and Fall semesters (unweighted mean of 42% and unweighted mean of 31%, respectively), which is probably due to several factors. The drop indicates that schools learned from the disastrous Spring semester and utilized the summer to modify the curriculum and improve technological connectivity.[viii] Perhaps equally important is the reopening of school, which reduces reliance on technology-based remote learning. Some schools reinstituted full in-class instruction and others offered a hybrid model that gives parents the choice of online or in-person schooling. The consequence of this shift can be seen in a lower proportion of parents reporting distance-learning utilizing online resources. During the Spring about three-quarters (73%) of households fell into this category but decreased to only two-thirds (65%) by Fall. The magnitude of this drop could account for much of the "improvement" in digital access by reducing the number of students requiring a computer and the internet, largely because it is no longer needed or needed as intensely.

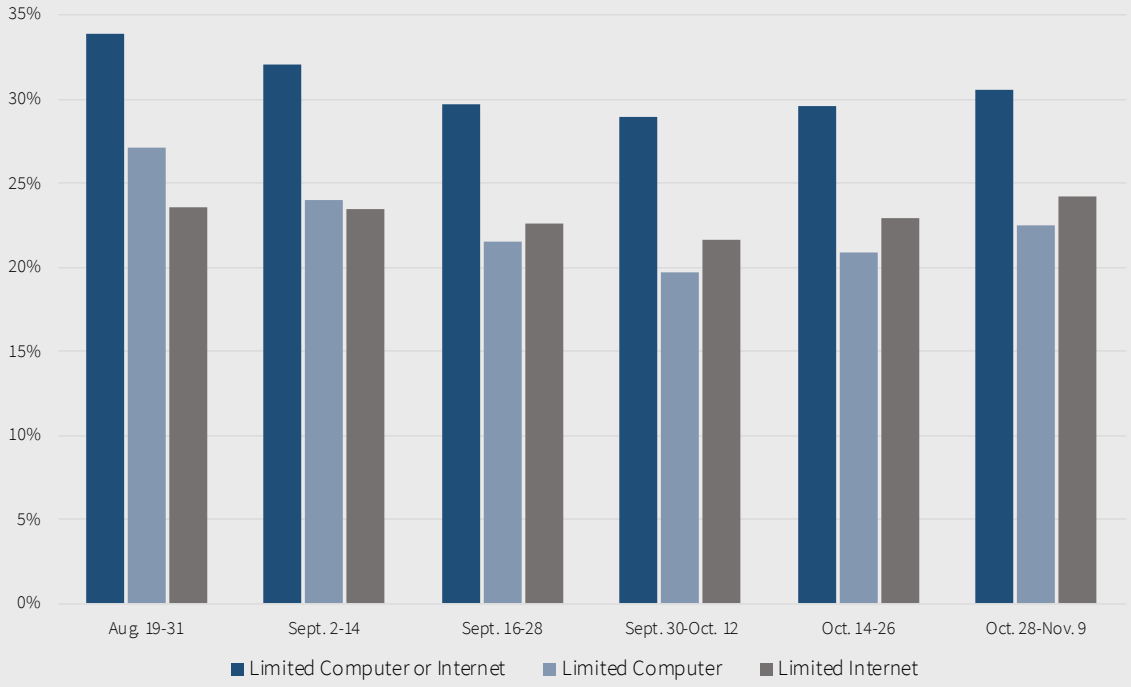
Analyzing state-level changes between time periods produces results consistent with the assertion that the pandemic differences across geographies are partly anchored in differences in 2019. The limited-access rates by state are highly correlated and statistically significant for both the ACS 2019 and Spring 2020 Pulse rates ($r = 0.84$ and < 0.0001) and for the ACS 2019 and Fall 2020 Pulse rates ($r = 0.76$ and < 0.0001). The first correlation is not surprising because households without digital resources prior to the pandemic were less prepared for remote learning during Spring 2020. What is troubling is that the limited-access rates during Fall 2020 still parallel the 2019 rates. Graph 2 plots the ACS 2019 rates (horizontal or x axis) against the Fall 2020 Pulse rates (vertical or y axis). The size of the bubble is proportional to the number of households in a state. A positive association between the two time periods is visually apparent and a weighted ordinary-least square regression shows that the relationship is statistically significant, explaining over half of the variation in the Fall 2020 rates. This means that the most disadvantaged states before COVD-19 tend to remain disadvantaged today. At the same time, the bubbles do not fall on a single straight line, indicating that some states are better at offsetting the digital barriers than others.

Graph 2: Limited Digital Access - 2019 and Fall 2020



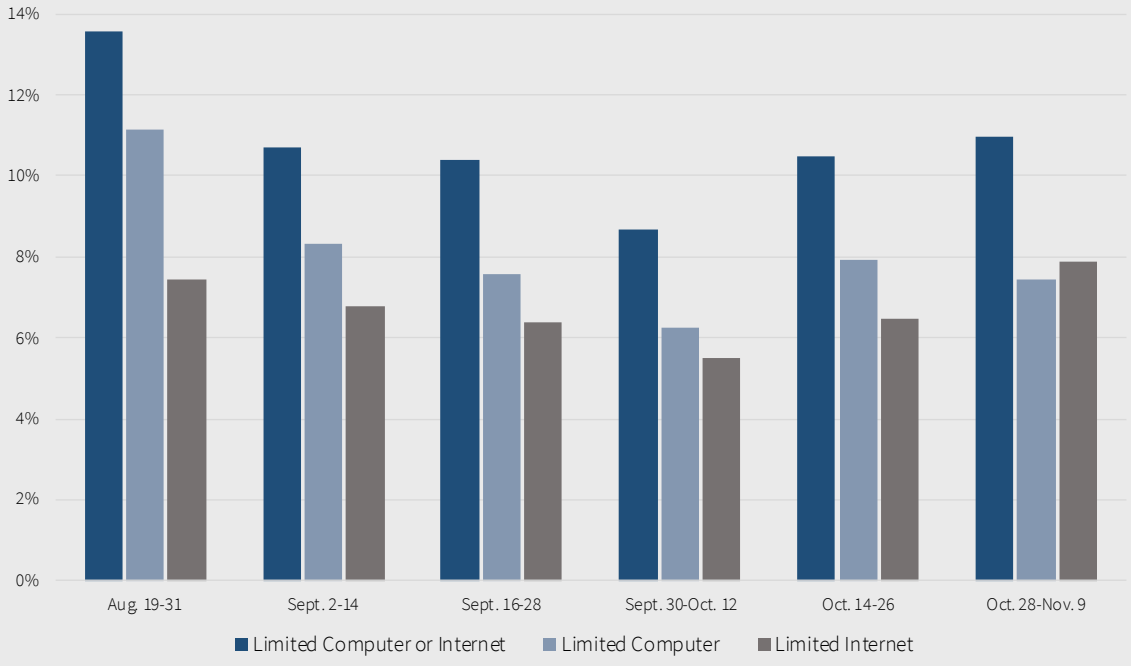
While the Fall 2020 semester was better overall than the Spring semester, Graph 3 shows troubling signs of deteriorating conditions toward the end of the survey period.[ix] There was a steady decline in the limited-access rates from late August to early October, particularly for computers. (This suggests it is easier for schools and others to provide computers than pay for access to the internet.) Since mid-October, however, the inaccessibility rates have increased slowly but unmistakably.

Graph 3: Limited Access by Weeks



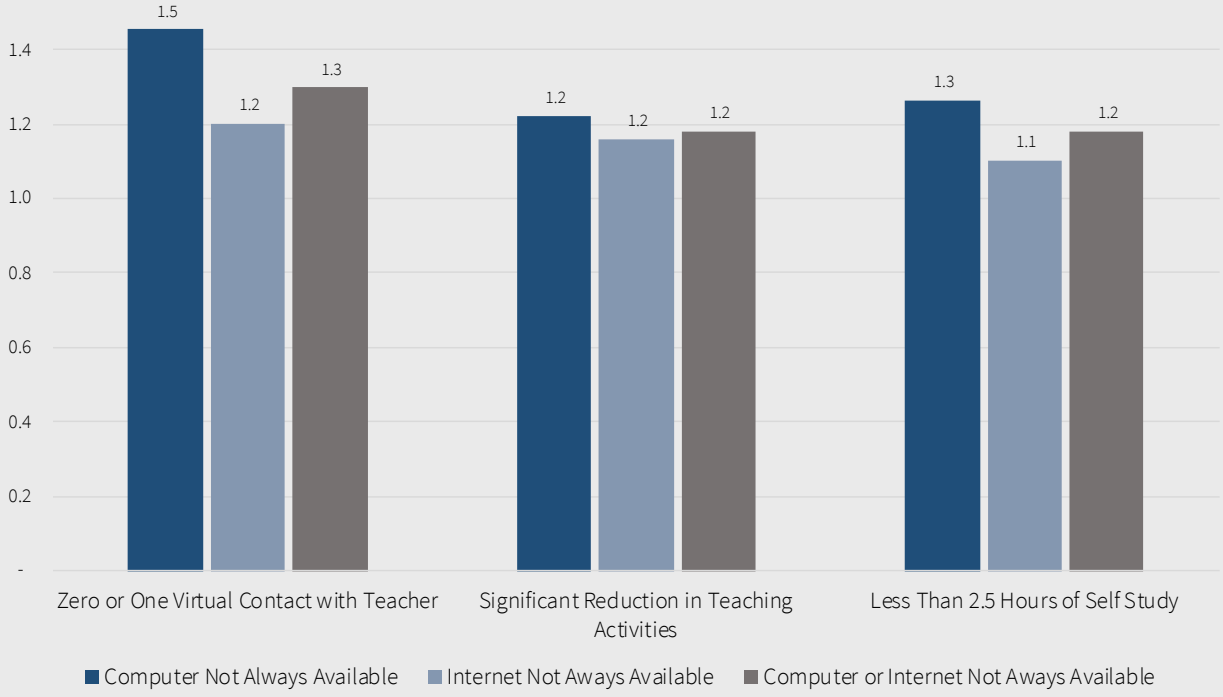
Graph 4 shows a similar disturbing temporal pattern. These statistics are based on a more restrictive definition for limited technological access – households where a computer or the internet is not "always" or "usually" available to children.[x] The bars show noticeable improvement during the early parts of Fall 2020, followed by a noticeable deterioration. The reversal in Graphs 3 and 4 may be due to temporary closures associated with COVID-19 infections among staff, teachers, and students at some schools.[xi] This operational disruption, in turn, forced many households to again experience digital barriers to learning.

Graph 4: Severe Limited Access by Weeks



While it is beyond this project's scope to calculate the impact of the digital divide on educational achievement, the Pulse data show that technological constraints are associated with decreases in school-related activities. Graph 5 reports the relative likelihood of falling into a state of low-activity for students in limited-access households relative to students with access. The first set of bars shows students with no more than one virtual contact with a teacher over the last seven days. For all households, 26% fall into this category, but those limited-access households are up to 1.5 times more likely to fall into this category than those in other households. The second set of bars shows students receiving a significant reduction in teaching-activity hours from before the pandemic. For all households, 32% fall into this category, and limited-access households are 1.2 times more likely than their counterparts. The final set of bars refers to students with less than 2.5 hours of self-study time. For all households, 31% fall into this category, and limited-access households are 1.1 to 1.3 times more likely to experience this than their counterparts. The reduction in school-related activities is likely to lead to lower educational achievement and less human capital.

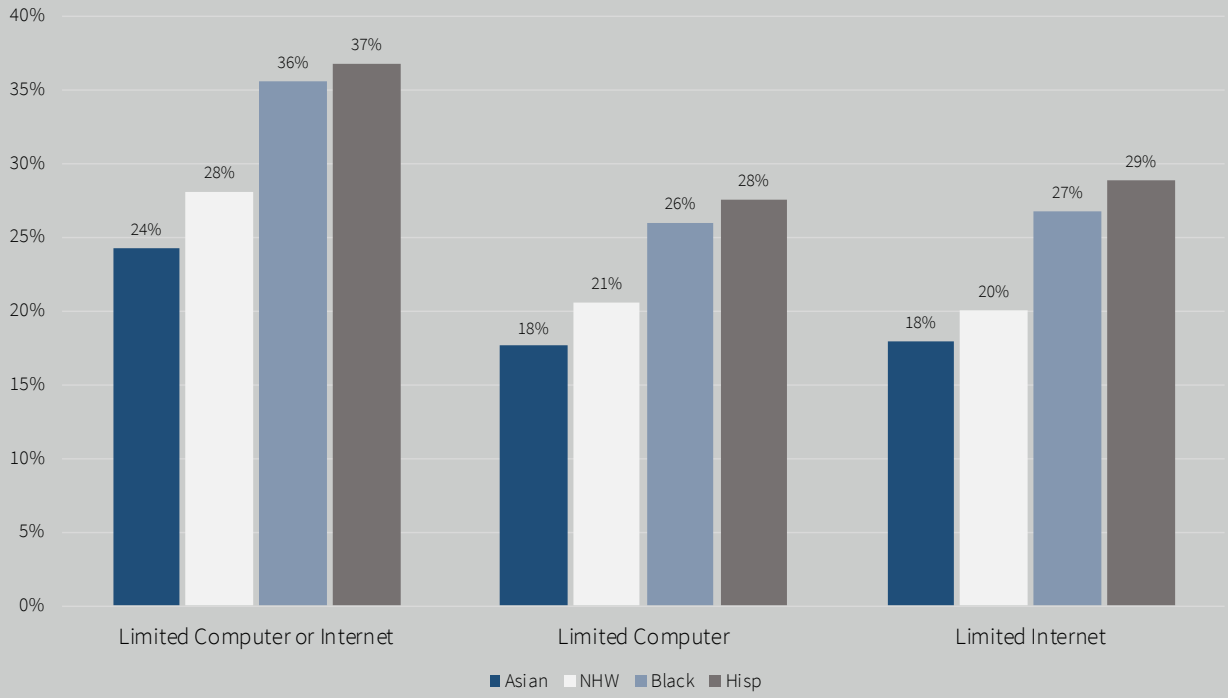
Graph 5: Digital Inaccessibility and Low School Activities



Digital Divide by Race/Ethnicity, Income, Education, and Age

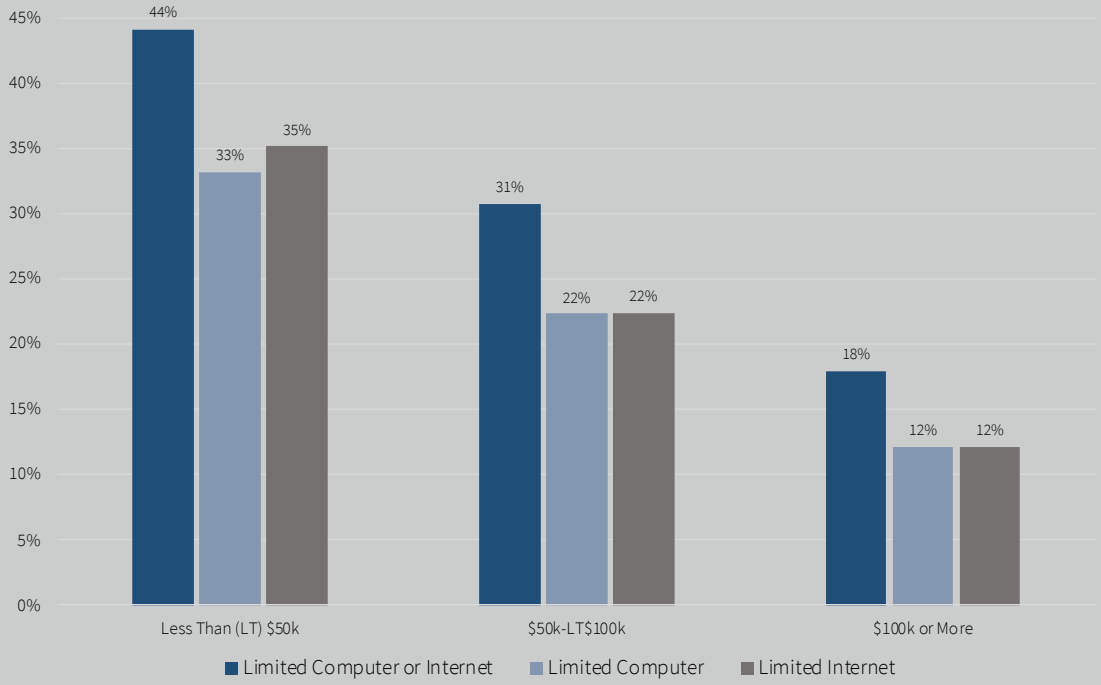
There are systematic and sizable differences in connectivity to virtual learning based on respondents' race/ethnicity, household income, education attainment, and age. Graph 6 presents limited access by race/ethnicity. These findings show that Black and Hispanic households are significantly more likely (1.3 to 1.4 times) to experience limited access to technology as compared to non-Hispanic Whites (NHWs). Asians fared better than NHWs.

Graph 6: Limited Access by Race



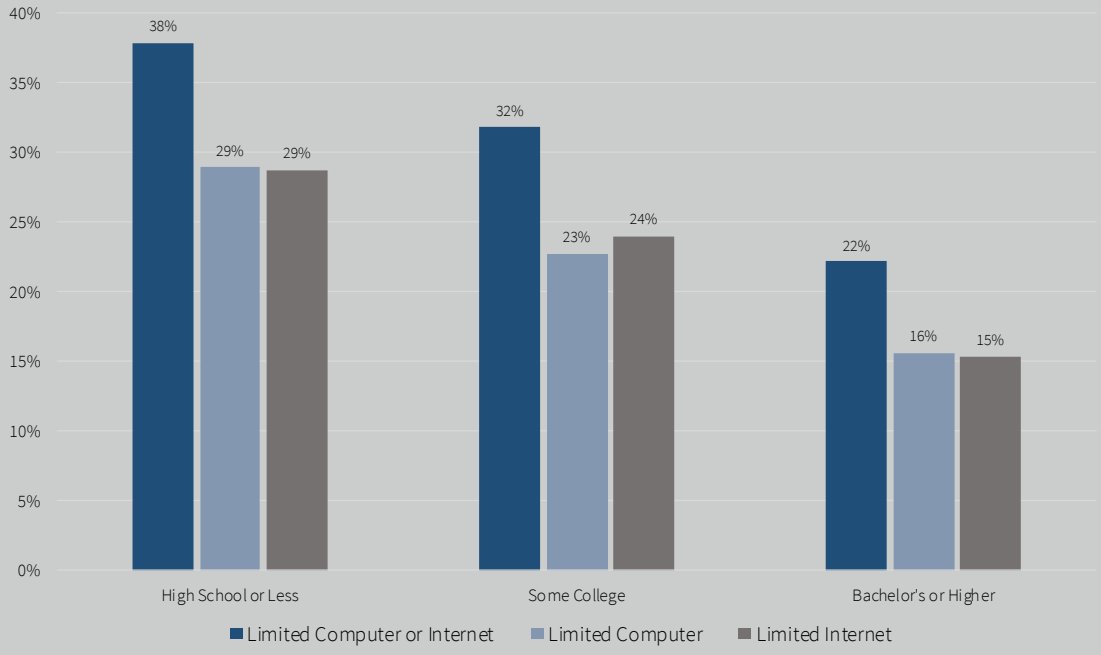
Graph 7 presents differences by 2019 household income categories: less than $50,000, $50,000-$99,999, and $100,000 or more. (The 2019 income does not necessarily indicate income at the time of the survey. Even workers who were previously in the high-income households could suffer unemployment and other financial losses during the pandemic.) The findings show a systematic inverse relationship; that is, higher income is negatively correlated with experiencing limited access to technology. Low-income households fared the worst, with over two-in-five households having limited access to a computer or the internet for their children. This is well over 2.5 times as high as affluent households.

Graph 7: Limited Access by Income



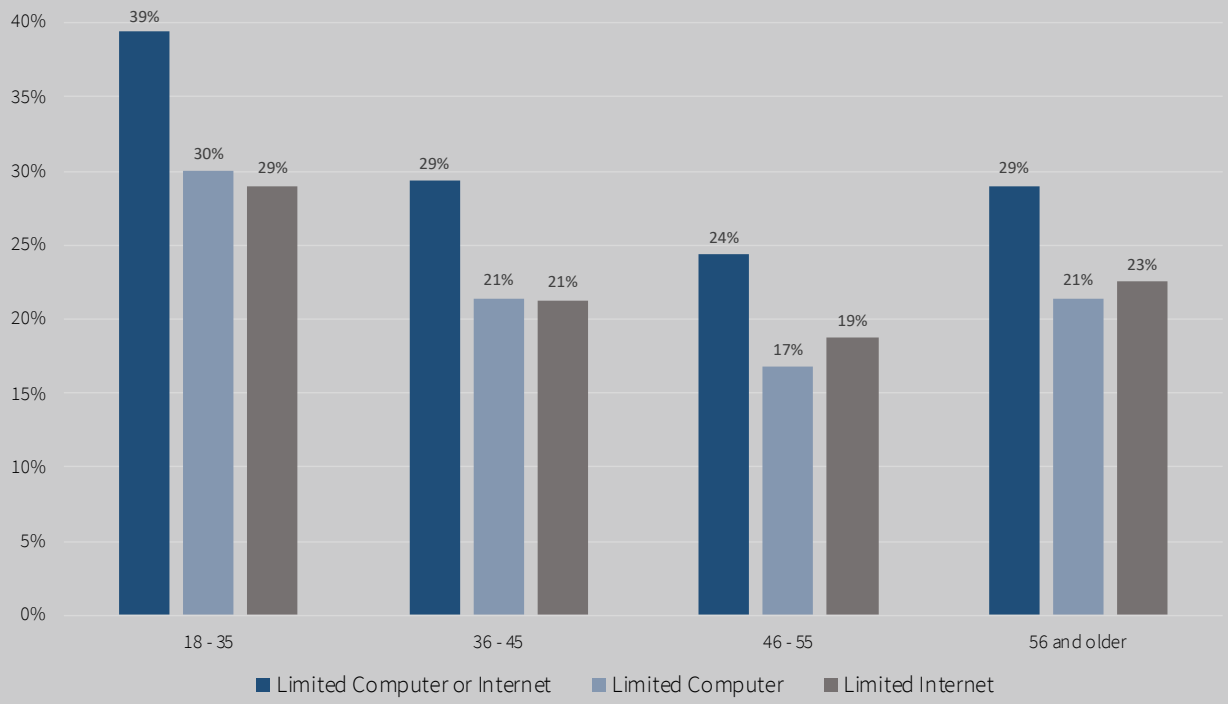
Graph 8 plots the lack of access to technology by educational attainment of the adult respondent to the survey using three categories: high-school degree or less, some college education without a bachelor's degree, and a bachelor's degree or higher. Over a third of households in the lowest educational bracket experience limited access to a computer or the internet for their children, which is nearly twice as prevalent as those in the highest educational category.

Graph 8: Limited Access by Educational Attainment



Graph 9 presents the proportion of households with limited technology access by the survey respondent's age. The bars reveal a partial U-shape pattern, with the rates declining from households with younger adults (18-35 years old) to households with older adults (46-55 years old) and then increasing among households in the oldest bracket. This may be due to an increase in the relative number of grandparents assuming primary responsibility for their children. These findings are consistent with the observation that younger adults likely face greater challenges paying for technology because of lower earnings and higher pandemic job displacement. Students in these younger households are between one and three-quarter as likely not to have full access to a computer than students in households with older adults (46-55 years old).

Graph 9: Limited Access by Age of Respondent



The above bivariate results (limited access by household characteristics) are robust. A multivariate model using the Fall 2020 Pulse data finds that income class, education, and age independently contribute to the digital divide.[xii] The higher rate for African Americans works largely through having lower income and educational attainment. Being Hispanic has an independent effect in increasing the rate after controlling for the other factors, and being Asian has an independent effect in decreasing the rate after controlling for the other factors. We also find similar systematic disparities for Fall 2020 when using the more restrictive definition for limited technology access (less than full or usual access to a computer or the internet). The same inequality patterns also exist in an analysis of the 2019 ACS data and Spring 2020 Pulse data. These consistent results indicate that the digital divide is, unfortunately, a persistent and durable feature of our society and educational system.

Concluding Remarks

The brief's empirical findings reveal a reproduction and probably a widening of the digital divide along racial/ethnic and income lines during the pandemic. This conclusion is consistent with other research.[xiii] In response to this educational crisis, businesses and schools have been providing computers to students,[xiv] and local governments are offering or plan to offer free internet connections.[xv] These efforts help but only prevent a deteriorating situation from becoming even far worse. As California Governor Newsom acknowledged that, the responses are "still inadequate."[xvi] The challenges will become even more daunting over the next few months if COVID-19 infections and deaths spike again, leading to a greater reliance on virtual schooling. When this happens, students and teachers will return to levels of disconnection not seen since Spring 2020. There is a critical need to monitor near-future developments in a timely fashion and use the information to mount effective and targeted policy responses. Equally important is empirically assessing the long-term damages, the lingering consequences of a widening achievement gap, and the corresponding loss in human capital. To avoid this dystopian future, we must provide relief to minimize immediate problems and plan for a just and fair recovery. Policies and actions must go beyond remedying the pandemic's negative effects to eliminating the digital divide entirely.

Endnotes

[i] There were also massive changes to K-12 education during the 1918 pandemic. See for example: Charlotte Jackson, Emilia Vynnycky, Jeremy Hawker, Babatunde Olowokure, and Punam Mangtani. "School closures and influenza: systematic review of epidemiological studies." BMJ open 3, no. 2 (2013).

[ii] https://www.igi-global.com/dictionary/resource-sharing/7562; Fairlie, Robert (2014). "Race and the Digital Divide," UC Santa Cruz working paper series; https://www.pewresearch.org/internet/2015/12/21/home-broadband-2015/; The White House, Office of the Press Secretary (June 2015). "Fact Sheet: President Obama Announces ConnectAll initiative," https://obamawhitehouse.archives.gov/the-press-office/2015/06/25/fact-sheet-connected-two-years-delivering-opportunity-k-12-schools; and Goldberg, Rafi, Robinson, Amy, and Carlson, Edward (October 2019). "Digital Divide Is Shrinking for America's Hispanic Population, NTIA Data Show," https://www.ntia.doc.gov/blog/2019/digital-divide-shrinking-america-s-hispanic-population-ntia-data-show

[iii] Spring and Fall are capitalized to denote reference to the school terms rather than the seasons.

[iv] Peoples, James H., Jr., Ong, Paul M, Mar, Don, Larson, Tom. October 28, 2020. "COVID-19 and the Digital Divide in Virtual Learning". UCLA Center for Neighborhood Knowledge, 2020.

[v] While racial/ethnic coding for this study categorizes individuals as non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, Hispanic, and other non-Hispanic minorities. For ease of exposition these groups are listed as White, Black, Asian, Hispanic, and other minorities in this report brief.

[vi] For discussion on the Household Pulse Survey limitations and usefulness, see Ong, Paul M., Mar, Don, Larson, Tom, and Peoples, James H., Jr. (September 9, 2020). "Inequality and COVID-19 Job Displacement." UCLA Center for Neighborhood Knowledge and Ong & Associates,
https://drive.google.com/file/d/1JE0kWRggo8zvYOdP5r1bsviDimyLPxg7/view?usp=sharing

[vii] Where the response to either of the two key Pulse questions is not (1), but is either (2), (3), (4) or (5).

[viii] For information on how schools responded to the pandemic during the Spring and prepared for the Fall, see reports and data from the Center on Reinventing Public Education, https://www.crpe.org/current-research/covid-19-school-closures.

[ix] At the time the analysis was conducted, the micro-sample was not available for October 28 to November 9, so statistics for that time period is based on aggregated data reported by the U.S. Census Bureau, which were adjusted to match the statistics using the micro-sample for prior weeks.

[x] Where the response to either of the two key Pulse questions is either (3), (4) or (5).

[xi] See for example, Valerie Strauss. (November 14, 2020). "Schools start closing — or delay reopening — as covid-19 cases jump across the country." Washington Post, https://www.washingtonpost.com/education/2020/11/14/schools-start-closing-or-delay-reopening-covid-19-cases-jump-across-country/

[xii] This is based on a logit model, which also includes fixed-effects for survey week and respondents' location by state.

[xiii] See for example: Laura Stelitano, Sy Doan, Ashley Woo, Melissa Diliberti, Julia H. Kaufman, Daniella Henry. "The Digital Divide and COVID-19, Teachers' Perceptions of Inequities in Students' Internet Access and Participation in Remote Learning." RAND Corporation. 2020; John Lai Nicole O. Widmar. "Revisiting the Digital Divide in the COVID−19 Era," Applied

Economic Perspectives and Policy. October 3, 2020. https://doi.org/10.1002/aepp.13104; Chandra, S., Chang, A., Day, L., Fazlullah, A., Liu, J., McBride, L., Mudalige, T., Weiss, D., (2020). Closing the K–12 Digital Divide in the Age of Distance Learning. San Francisco, CA: Common Sense Media. Boston, Massachusetts, Boston Consulting Group.

[xiv] "Free computers to help marginalised children learn during coronavirus school closures," April 23, 2020. https://theirworld.org/news/free-computers-american-children-low-income-homes-coronavirus-schools-shutdown;

[xv] Brown, Madeline, Ezike, Richard, and Stern, Alena, "How Cities Are Leveraging Technology to Meet Residents' Need during the Pandemic," (June 9, 2020) https://edsource.org/2020/thousands-of-california-students-to-get-free-wifi-and-chromebooks-for-distance-learning/627823; Avi Asher-Schapiro. (November 6, 2020). "U.S. cities back broadband projects as COVID-19 exposes digital divide," Reuters, https://www.reuters.com/article/us-usa-tech-broadband-trfn/u-s-cities-back-broadband-projects-as-covid-19-exposes-digital-divide-idUSKBN27M1RY

[xvi] Johnson, Sydney, and Burke, Michael (May, 1, 2020). "More California Students Are Online, but Digital Divide Runs Deep with Distance Learning," https://edsource.org/2020/more-california-students-are-online-but-digital-divide-runs-deep-with-distance-learning/630456

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Appendix A: State-Level Statistics on Limited Technology Access

State	FIPS Code	2019 ACS: Household with No Computer or Broadband	Spring 2020: Computer or Internet Not Aways Available	Fall 2020: Computer or Internet Not Aways Available
Alabama	1	45%	43%	32%
Alaska	2	36%	45%	37%
Arizona	4	36%	46%	31%
Arkansas	5	46%	49%	36%
California	6	33%	40%	29%
Colorado	8	28%	34%	30%
Connecticut	9	27%	31%	27%
Delaware	10	32%	40%	30%
District of Columbia	11	28%	38%	32%
Florida	12	34%	40%	30%
Georgia	13	34%	44%	33%
Hawaii	15	28%	41%	28%
Idaho	16	33%	42%	37%
Illinois	17	31%	40%	30%
Indiana	18	36%	41%	31%
Iowa	19	32%	38%	34%
Kansas	20	34%	41%	31%
Kentucky	21	35%	41%	33%
Louisiana	22	45%	52%	41%
Maine	23	27%	37%	33%
Maryland	24	25%	37%	27%
Massachusetts	25	26%	34%	30%
Michigan	26	33%	43%	32%
Minnesota	27	26%	36%	26%
Mississippi	28	50%	53%	42%
Missouri	29	36%	42%	34%

State	FIPS Code	2019 ACS: Household with No Computer or Broadband	Spring 2020: Computer or Internet Not Aways Available	Fall 2020: Computer or Internet Not Aways Available
Montana	30	35%	48%	37%
Nebraska	31	30%	40%	32%
Nevada	32	34%	41%	30%
New Hampshire	33	25%	30%	29%
New Jersey	34	26%	33%	26%
New Mexico	35	47%	47%	38%
New York	36	32%	35%	33%
North Carolina	37	34%	36%	29%
North Dakota	38	28%	36%	27%
Ohio	39	30%	40%	30%
Oklahoma	40	49%	46%	34%
Oregon	41	30%	35%	28%
Pennsylvania	42	28%	37%	27%
Rhode Island	44	27%	28%	30%
South Carolina	45	36%	43%	27%
South Dakota	46	33%	39%	34%
Tennessee	47	37%	46%	36%
Texas	48	40%	45%	34%
Utah	49	27%	37%	32%
Vermont	50	25%	34%	33%
Virginia	51	29%	37%	26%
Washington	53	27%	36%	26%
West Virginia	54	40%	48%	38%
Wisconsin	55	31%	40%	30%
Wyoming	56	33%	43%	34%

Appendix B: UCLA CNK Briefs on COVID-19

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