Introduction

Telemedicine use has accelerated across the US and has the potential to expand health care access to vulnerable populations and areas with limited health care services (health care deserts).\textsuperscript{1} Reliable internet access remains challenging within many communities, and whether telemedicine will mitigate or widen health disparities is unclear. To assess internet service availability and population demographics in health care deserts, we analyzed 2015 to 2019 American Community Survey data, linking them to national, state, and county-level metrics of health care access. We hypothesized that internet access was poor in areas with limited access to traditional health care resources.

Methods

This cross-sectional study was exempt from review and the informed consent requirement per the Common Rule because the data used were deidentified. We followed the STROBE reporting guideline.

Health care deserts were identified by poor access to domains of pharmacies, hospitals, hospital beds, trauma centers, primary care physicians, and low-cost health centers at the census tract level, with an aggregate score of 0 to 6 (higher scores indicated more deserts across the domains)\textsuperscript{2} (eMethods in the Supplement). Data sources were dataQ and GoodRx databases for 60,249 pharmacies; Health Resources & Services Administration (HRSA) for primary care health professional shortage areas; and Homeland Infrastructure Foundation-Level Data, the Indian Health Service, and HRSA for 7,513 hospitals, 2020 trauma centers, and 11,643 community health centers. State populations were grouped by metropolitan status as defined by the US Census Bureau: metropolitan (urban area with a population of \( \geq 50,000 \)), micropolitan (urban area with a population of \( \geq 10,000 \)), and nonmetropolitan or nonmicropolitan (rural area with a population of \(<10,000\)). The proportion of populations with any internet access and the expected number of health care deserts, representing the population-weighted mean number of health care deserts in a region, were calculated and mapped for each metropolitan status in each state. Population race and ethnicity were obtained from data sources.

All analyses were performed using Python 3.10 (Python). Two-sided \( P < .05 \) indicated significance.

Results

Among 3,140 counties (99.9% of all US counties), health care access and internet service availability were correlated (slope, 4.6 [\( P = .005 \)]; intercept, 0.3 [\( P = .36 \)]) (Figure, A). Mississippi, Arkansas, Louisiana, New Mexico, West Virginia, and Alabama had the largest percentage of households without internet service (>23%) and the highest fitted population-weighted mean number of health care deserts. Washington, New Hampshire, Colorado, Utah, California, and Maryland had the lowest number of households without internet service and the lowest fitted number of health care deserts. Rural counties were more likely to have more health deserts and less internet service availability (slope, 8.1 [\( P < .001 \)]; intercept, 0.0 [\( P = .91 \)]) (Figure, B).
Counties with above-median numbers of health care deserts and proportions of population without internet access were more likely to be rural (78% vs 26%; \( P < .001 \)), have lower income ($47,333 vs $66,139; \( P < .001 \)), and be sparsely populated (20,586 vs 325,206; \( P < .001 \)) compared with counties with below-median numbers (Table). The correlation between expected number of health care deserts and county-level characteristics was the rural population percentage (Pearson \( r^2 = 0.67 \)).

**Discussion**

These findings suggest that telemedicine expansion may have low effectiveness in counties where telemedicine is most needed but health care access is already limited. Expanding telemedicine

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**Figure. Internet Availability and Health Care Deserts in the US**

**A** States by proportion without internet service and health care deserts

**B** Health care deserts and proportion of state population without internet service by county urban-rural status

A, Association between states by proportion of population without any internet access and population-weighted mean number of health care deserts (slope [SE], 4.6 [1.6], \( P = .005 \); intercept [SE], 0.3 [0.3], \( P = .36 \)). B, Association between population-weighted mean number of health care deserts and proportion of population without any internet access (slope [SE], 8.1 [0.9], \( P < .001 \); intercept [SE], 0.0 [0.2], \( P = .91 \)).
without improving internet access and digital literacy, along with mitigating clinician shortages, could contribute to rural-urban health disparities in the US.  

Study limitations include lack of digital literacy data, which could exacerbate urban-rural disparities. Although not meant to show causal association, this study found significant co-occurrence of poor internet and health care access across 6 domains. Public efforts to create community broadband networks and expand low-cost internet service in areas with poor health care access, while providing flexibility for other forms of communication in the short term as infrastructure develops, are critical to equitable access given the uptake and promise of telehealth.

### Table. Comparison of Counties With Below- or Above-Median Proportion of Population With Internet Access and Below- or Above-Median Number of Health Care Deserts

<table>
<thead>
<tr>
<th>Counties with proportion of population</th>
<th>Counties with proportion of population without internet access with expected number of health care deserts above the median (&gt;2)</th>
<th>Counties with proportion of population without internet access with expected number of health care deserts below the median (&lt;2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below median (≤20%)</td>
<td>Above median (&gt;20%)</td>
<td>Below median (≤20%)</td>
</tr>
<tr>
<td>Mean expected No. of health care deserts</td>
<td>3.1</td>
<td>3.3</td>
</tr>
<tr>
<td>Mean percentage</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>Without internet</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td>Without broadband</td>
<td>61</td>
<td>78</td>
</tr>
<tr>
<td>Rural population</td>
<td>50 033</td>
<td>20 586</td>
</tr>
<tr>
<td>Household income, median, US $</td>
<td>64 222</td>
<td>47 333</td>
</tr>
<tr>
<td>Mean percentage</td>
<td>3</td>
<td>10</td>
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<td>Black race and ethnicity</td>
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<td>76</td>
</tr>
<tr>
<td>Non-Hispanic White race and ethnicity</td>
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<td>1234</td>
</tr>
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</table>

### ARTICLE INFORMATION

**Accepted for Publication:** October 13, 2022.

**Published:** November 23, 2022. doi:10.1001/jamanetworkopen.2022.43792

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**Conflict of Interest Disclosures:** None reported.
REFERENCEs


SUPPLEMENT.
eMethods.
eReferences.