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OVERVIEW

Structural Urbanism Contributes To Poorer Health Outcomes For Rural America

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ABSTRACT Rural populations disproportionately suffer from adverse health outcomes, including poorer health and higher age-adjusted mortality. We argue that these disparities are due in part to declining health care provider availability and accessibility in rural communities. Rural challenges are exacerbated by “structural urbanism”—elements of the current public health and health care systems that disadvantage rural communities. We suggest that biases in current models of health care funding, which treat health care as a service for an individual rather than as infrastructure for a population, are innately biased in favor of large populations. Until this bias is recognized, the development of viable models for care across the rural-urban continuum cannot move forward.

The current interest in rural America has multiple roots. The 2016 US presidential election was widely perceived to be influenced by rural voter dissatisfaction, which drew attention to this population.¹ Studies published in the mid-2010s found that rural rates of suicide and overdose mortality among middle-aged non-Hispanic white adults, termed “deaths of despair,” had increased to meet and exceed those rates in urban areas.^{2,3} A widely read memoir published in 2016 purported to illustrate the social, cultural, and economic milieu of rural Appalachia.⁴ In 2017 the Centers for Disease Control and Prevention issued multiple reports that examined rural health and health-related behaviors, including suicide, seat belt use, smoking, and receipt of preventive health services.⁵ Losses in rural health infrastructure were discussed in leading general-interest and medical periodicals in 2018.^{6,7} Across the political spectrum, rural health is anticipated to remain a priority issue.⁸

For this revival of interest in rural issues to yield meaningful change, thoughtful examination of the health disparities experienced by rural populations and potential policy solutions to these disparities is essential. To open the discus-

sion, we suggest that ongoing rural challenges are exacerbated by “structural urbanism”—elements of the current public health and health care systems that disadvantage rural communities as they seek to enhance, maintain, or rebuild health care infrastructure to support population health. We define *structural urbanism* in health care as a bias toward large population centers, stemming from three factors: a market orientation in health care, which necessitates a critical mass of paying customers to make services viable; a public health focus on changing outcomes at the population level, which differentially allocates funding toward large population centers; and the innate inefficiencies of low-population and remote settings, in which even equal funding can never translate into equitable funding. We suggest that a new discussion of rural health care is needed, one in which health care is defined as a public good rather than a product, with ensuing implications for funding.

Characterizing Rural America

DEFINING ‘RURAL’ Rurality is a continuum, with large metropolitan areas at one end of the spectrum and remote frontier areas at the other. How

rurality is measured and thus defined has functional importance, as it influences the reported size and composition of the population of rural America and thus that population's reported health status and health outcomes. (An article by Kevin Bennett and colleagues in this issue of *Health Affairs*⁹ explores issues of definition and measurement in greater detail.)

Some researchers simply ask people to characterize their area of residence as urban, suburban, or rural.¹⁰ While that technique probably comes closest to capturing lived experience, it does not provide a consistent means for reporting public health statistics, making policy decisions, or allocating resources.

Key elements of current classification systems include choice of geographic boundaries, such as county versus census tract, and characteristics used in the definition. There is a trade-off between accuracy and effectiveness: Smaller units such as census tracts provide the greatest accuracy, but larger units such as counties are government entities with the ability to create and implement policy.¹¹

Most county-based classification systems use a combination of population size and work commuting patterns to define *rural*. The metropolitan-nonmetropolitan classification used by the Office of Management and Budget (OMB), for example, defines metropolitan areas as central counties containing an urban area with a population of 50,000 or more, combined with adjacent counties in which at least 25 percent of the population commutes to or from the central counties for work.¹² The six-category structure of the Urban-Rural Classification Scheme for Counties used by the National Center for Health Statistics subdivides the OMB metropolitan and nonmetropolitan categories into four urban and two rural groups.¹³ The Department of Agriculture (USDA) has developed two classification schemes, Rural-Urban Continuum Codes and Urban Influence Codes, which subdivide nonmetropolitan counties into six and ten separate classifications, respectively.¹⁴ Using the OMB's nonmetropolitan county classification, 15 percent of the US population was rural in 2010.¹⁴

The Census Bureau defines urbanicity based on population density, with tracts or blocks having more than 500 people per square mile classified as "urban" and contiguous areas grouped into "urban clusters" (whose population is 2,500–49,999) or "urban areas" (50,000 or more).¹⁵ Measured at the census-tract level, 19 percent of the US population was rural in 2010, as was 97 percent of its land mass.¹⁶

RURAL DEMOGRAPHICS From a demographic perspective, rural counties contain proportionately more residents who identify themselves as

white (80 percent), compared to urban counties (58 percent).¹⁷ However, racial/ethnic population composition varies widely by location. For example, non-Hispanic black people constitute about 8 percent of residents of all rural counties, but southern states house 90 percent of this population.^{18,19} Hispanic people constitute about 9 percent of the rural population, followed by American Indian/Alaska Native (AI/AN) (2 percent) and Asian American (1 percent) people.

RURAL ECONOMICS From an economic perspective, rural America reflects the diversity of the nation as a whole. Agriculture is the dominant industry in only 20 percent of rural counties, principally located in a swath running from the Dakotas south through Texas. Nearly as many rural counties (18 percent) rely heavily on manufacturing for earning and employment.¹⁹ Rural counties as a whole have mixed economic structures.

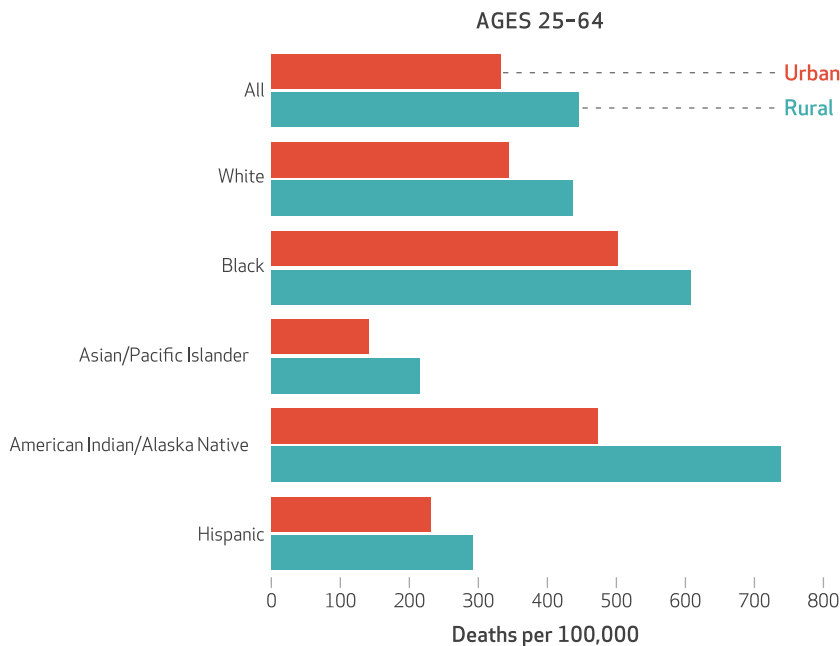
Health Disparities Among Rural Residents

MORTALITY Mortality can be used as a summary metric for all of the factors (such as behavior, demographics, and access to care) that influence health status across the life span. In 2017 age-adjusted death rates were higher for rural than for urban adults of working age (ages 25–64) and older (ages 65 and older), across all racial/ethnic categories (exhibits 1 and 2). (For details, see online appendix exhibits 1 and 2.)²⁰ Rural disadvantage, measured as the percentage by which rural age-adjusted death rates exceed urban rates, was higher among working-age than among older adults and highest among AI/AN adults. Specifically, rural-dwelling AI/AN adults ages 25–64 were 56 percent more likely to die than their urban counterparts, while those ages 65 and older were 34 percent more likely to die (appendix exhibits 1 and 2).²⁰ Available trend analyses are not encouraging: For the five leading causes of death across all ages, rural mortality disparities did not diminish from 1999 to 2014.^{21,22}

During the 1970s rural and urban death rates were similar, but mortality disparities between white rural and urban residents emerged in the mid-1980s and those between black rural and urban residents emerged in the mid-1990s.²³ Compositional differences between rural and urban populations, such as race/ethnicity, age, and economic distributions, have been used to explain mortality disparities,²⁴ and rural populations do differ from their urban counterparts. A greater proportion of rural than urban residents have incomes below the federal poverty level (16.4 percent versus 12.9 percent in 2017),

EXHIBIT 1

Age-adjusted death rates per 100,000 population among adults ages 25–64, by rurality of county of residence and race/ethnicity, 2017



SOURCE Authors' analysis of data from the Centers for Disease Control and Prevention's Wide-ranging Online Data for Epidemiologic Research (WONDER) database for 2017, using Multiple Cause of Death files. **NOTES** Urban counties included those classified as large central metro, large fringe metro, medium metro, and small metro counties, as defined by the National Center for Health Statistics (NCHS). Rural counties included those classified as micropolitan nonmetro and noncore nonmetro counties as defined by the NCHS. "Hispanic" includes all persons classified as Hispanic, regardless of race. All other categories include only non-Hispanic persons.

for example, with disparities present across all racial/ethnic categories.²⁵ While rural educational attainment has improved over time, in 2017, 50 percent of rural adults had a high school education or less, versus 38 percent of urban adults.²⁶

POVERTY AND EDUCATION Population differences alone are not sufficient to explain trends in rural-urban disparities, however. For example, the poverty gap between rural and urban counties has been declining steadily. Rural poverty rates were 44 percent higher than urban rates during the 1970s, on average, and the differential had dropped to 18 percent by the 2010s.²⁷ Similarly, the proportion of rural adults with a college degree, while remaining lower than the rate in urban areas, increased from 15.5 percent in 2000 to 19.0 percent in 2015.²⁶

RECEIPT OF HEALTH CARE Gaps in the timeliness and equitability of health care experienced by rural residents may contribute to excess mortality. In 2016 rural adults were 23 percent more likely to report delaying medical or dental care due to costs and 53 percent more likely to report a delay in obtaining prescription medications,

compared to their urban counterparts (exhibit 3). Delays in care seeking²⁸ and poor medication adherence²⁹ are both associated with increased mortality. In 2016 dental visits and preventive health procedures were less likely to be received by rural residents than by urban residents (exhibit 3). A higher proportion of rural adults and children had made emergency department visits during the previous twelve months, which potentially indicates poor access to high-quality primary care.³⁰

Rural Health Care Shortfalls

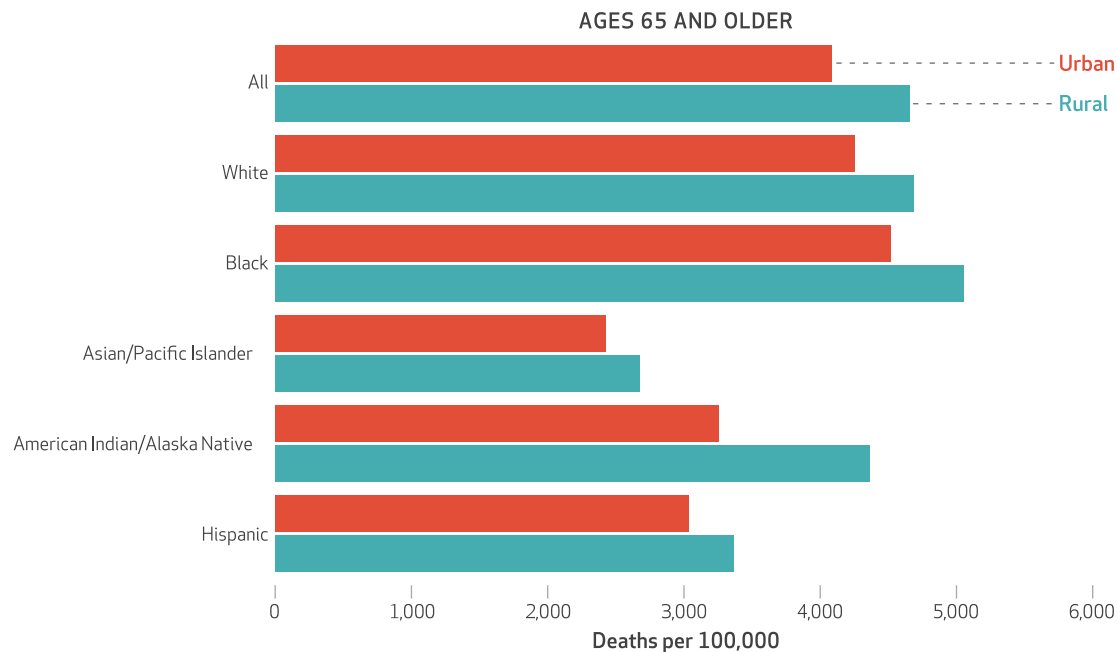
While acknowledging the importance of socioecological determinants of health, we posit that inadequate health care infrastructure is an ongoing contributor to rural health disparities. Attempts to allocate proportional causality to factors that affect health often ascribe only a small level of influence to health care (20 percent in the Robert Wood Johnson Foundation's County Health Rankings).¹⁸ However, it has been argued that these assessments suffer from the inherent flaw of failing to recognize the synergistic nature of health outcomes.³¹

One-fifth of the US population lives in rural areas, yet only 11 percent of physicians practice there.³² Only 9.9 percent of rural counties are fully served for primary care, with no shortage areas within the county.³³ About one in five rural counties (21.8 percent) are whole-county dental shortage areas, while nearly all rural counties (84.3 percent) are whole-county mental health shortage areas.³⁴ Relatedly, 52 percent of rural counties do not have a single general surgeon, 61 percent have no obstetrician/gynecologist, and nearly 58 percent have no pediatrician.³⁴

Shortages of practitioners both contribute to and stem from the closure of rural hospitals.³⁵ For example, the availability of general surgeons affects the financial viability of rural hospitals.³⁶ Rural hospital closures have accelerated in the past decade, with 118 hospitals having closed since 2010 and 430 (21 percent) rural hospitals now at financial risk.^{37,38} An estimated 4.4 million rural residents live in a county without a hospital.³⁹ Similarly, access to obstetric services in rural counties is in decline.⁴⁰ Factors associated with risk of hospital closure include the rural payer mix, which includes more Medicare, Medicaid, and uninsured patients than is the case in urban areas; absence of expansion of eligibility for Medicaid; models of care that deemphasize inpatient services; and patients' choosing urban facilities for care.³⁸

EXHIBIT 2

Age-adjusted death rates per 100,000 population among adults ages 65 and older, by rurality of county of residence and race/ethnicity, 2017



SOURCE Authors' analysis of data from the Centers for Disease Control and Prevention's Wide-ranging Online Data for Epidemiologic Research (WONDER) database for 2017 using the Multiple Cause of Death files. **NOTE** Urban and rural counties and race-ethnicity categories are defined in the notes to exhibit 1.

Structural Problems In The Provision Of Rural Services

The loss of rural hospitals and related services does not stem solely from bad management or population loss. Structural urbanism in public health and health care funding, which we see as emerging from a market-based approach to pro-

vider funding, public health emphasis on large populations, and inherent rural inefficiencies, systematically shortchanges rural areas. Here we present several illustrative examples.

FUNDING INDIVIDUALS OVER INFRASTRUCTURE

The initial federal interest in rural health care targeted infrastructure rather than individuals.

EXHIBIT 3

Delays in care due to cost, dental and ED visits in the past year, and preventive services use, by rurality of residence, 2016

	All US		Rural		Urban		Rural as percent of urban
	%	SE	%	SE	%	SE	
Delays in care due to cost							
Medical care	9.8	0.2	11.7	0.6	9.5	0.2	123
Prescription drugs	6.7	0.2	9.5	0.6	6.2	0.6	153
Dental care	11.0	0.3	13.2	0.9	10.7	0.3	123
Dental and ED visits in past year							
Dental visit	68.7	0.4	61.3	1.0	69.9	0.4	88
ED visit, ages 18 and older	19.4	0.3	23.4	1.0	18.9	0.3	124
ED visit, younger than age 18	17.5	0.5	22.2	1.5	16.7	0.5	133
Preventive services use							
Colorectal cancer screening, ages 50–75 ^a	62.4	0.6	58.5	0.8	63.2	0.7	93
Pneumovax vaccination, ages 65 and older	66.9	0.7	65.8	1.7	67.2	0.8	98

SOURCE Authors' analysis of data from National Center for Health Statistics. Health, United States, 2017 (note 51 in text). **NOTES** SE is standard error. ED is emergency department. ^a2015.

The Hill-Burton program, which operated in the period 1946–97, gave states funds to assess their health needs and construct or expand hospital facilities where appropriate, with priority going to rural areas.⁴¹ Since the program's end, with the exception of funding through business loans provided by the USDA, the federal role in the financing of health care has focused principally on providing health insurance to needy people.

Medicare and Medicaid ensure that individuals, not communities, have financial resources for care.⁴² As a result, communities with large populations that can yield revenue have flourishing health care institutions, while those with fewer residents have lost ground. A wave of rural hospital closures in the 1980s led to the adjustment of rural hospital payment mechanisms through the development of multiple specialized reimbursement categories, such as critical access hospitals and sole community hospitals.⁴³ However, these tweaks to per unit payment structures were insufficient to prevent the most recent round of rural hospital closures.

The distribution of diabetes self-management education programs similarly illustrates the problems with per unit funding. Diabetes affects an estimated 9.0 percent of urban and 9.9 percent of rural adults.⁴⁴ Outcomes are principally managed by the patient, through diet and medication routines that must be learned and sustained. For this reason, diabetes self-management programs are generally reimbursable by insurers such as Medicare.⁴⁵ However, under the current paid service model, 62 percent of rural counties lack any diabetes self-management program, and existing programs tend to be located in rural counties whose populations have higher incomes and more education.⁴⁶

The diabetes example could be repeated across multiple disease intervention programs, as well as hospital payment structures. Put simply, service unit- or person-based funding models do not translate into financial stability at the small population scale of many rural health care facilities. There are fixed costs associated with operating any health care service. Even modest primary care services, such as single-physician offices, require an estimated 2,000 patients for financial viability.⁴⁷ The current health care funding model, whether targeting high-need (and high-number) populations or focusing on more efficient payment arrangements, is still focused on individual patients, which creates an implicit bias toward large, generally urban, populations and institutions.

The Ryan White HIV/AIDS Program, which supports treatment of people with HIV, offers an additional example of funding design that disqualifies small communities. Ryan White

funding is substantial, with \$2.3 billion allocated for fiscal year 2019. Nearly 30 percent of this amount (Part A; \$656 million) is allocated by statute to urban areas with high numbers of residents (a minimum of 1,000 cases) with AIDS, the final stage of untreated HIV.⁴⁸ Because the metric used to define need is the number of cases, rural areas are defined out of the funding stream—even though the rates of HIV infection in those areas may be high. For example, the HIV outbreak in Scott County, Indiana, which also called national attention to rural opioid use and its links to communicable disease, involved only 215 cases. Estimates suggest that an earlier intervention could have reduced the eventual disease burden.⁴⁹

SCALE AND EFFICIENCY Public health agencies, motivated to bring change to the largest number of people possible, can offer interventions that inadvertently disqualify rural communities. Numeric goals are present in many grant programs, such as the Community Transformation Grants previously offered by the Centers for Disease Control and Prevention—which called for a minimum service population of 500,000.⁵⁰ When outcomes among rural populations are not tracked, the rural disparities that result from targeting large populations can remain unobserved. For example, *Health, United States*, an annual federal report that tracks multiple health care access and health status measures, offers rural-urban comparisons in only 27 of 144 (19 percent) tables in the 2017 edition.⁵¹

The nature of rural communities—few inhabitants over large spaces—creates inescapable inefficiencies in the delivery of certain types of services, over and beyond the small population base. Home health care personnel who serve rural residents have longer drive times, which limits the number of patients who can be served daily. Tellingly, home health agencies designated as “efficient” by the Medicare Payment Advisory Commission “provide fewer episodes [of care] in rural areas.”⁵² Inefficiencies are present in areas beyond health care as well. Rural school districts have higher transportation expenses than urban districts do, which becomes problematic when all districts are funded using a single per student formula.⁵³ In general, rural states have higher per person costs for road systems than urban states do.⁵⁴ Despite inefficiencies, certain services are deemed necessary across locations. All state constitutions include provisions that require the legislature to fund a public school system that is free to students, regardless of their residence.⁵⁵

Changing The Paradigm For Funding Rural Health Care

Identifying the influence of structural bias in rural health services moves the onus for rural institutional failure, such as the closure of a hospital, from the community that “couldn’t support” a hospital to the funding structures that prohibit local institutions from surviving. Recognizing the role of structural disadvantage also allows conceptualizing the difference between “equal support” and “equitable support.”⁵⁶ Equal treatment of different groups—specifically because it fails to recognize differences—can result in inequitable results.⁵⁷ We argue that structural urbanism, as defined above, is gradually draining rural America’s health care system and endangering the health of the US rural population.

NEW FUNDING STRUCTURES Alternative funding structures are needed, and there is already some movement in that direction. Global budgeting for hospitals has been implemented in Maryland, although its goal is to remove per patient incentives for admission.⁵⁸ The explicit intention of the global budget experiment for hospitals in rural Pennsylvania is maintaining access to care.^{59,60} For new funding structures to emerge, however, new ways of conceptualizing health care—seeing it as infrastructure instead of product—need to be considered. Encouragingly, a recent commentary compared global budgeting for hospitals to “the way U.S. cities fund fire departments.”⁶¹ Examining the funding of other public services to find parallels to health care can be instructive.

PARALLELS WITH EDUCATION Schools have some parallels to health services: Both are necessary human services that experience inefficiencies in rural areas. However, there are two areas in which schools and health care are fundamentally different. First, the provision of public education is provided in the constitution of all states, providing a basis for seeking equitable funding for rural schools.⁵⁵ This is not the case for health care. Second, unlike health care, schools have competitive rivals. A parent can obtain the same product—education—from at least three sources: public schools, private schools, and home schooling. Ever since the technical triumph of allopathic medicine in the late nineteenth century,⁶² however, there has been no alternative to medicine itself. Competition may exist within certain areas, as when multiple physicians compete with one another for patients, and similar services can be delivered across multiple settings (such as hospital, outpatient surgery center, and telehealth). However, there is no substitute for health care writ large: There is no home-school equivalent for an appendectomy. When dealing with conse-

quential illness or injury, the consumer cannot ignore the health care system and self-cure.

PARALLELS WITH ROADS Roads might offer an analogy to health care that points to solutions to structural urbanism. Roads have three key characteristics that parallel those of local health care systems: They are economically necessary, use designs that vary based on local need, and are interconnected. These three principles—support as essential infrastructure, variety in design, and connectedness—could underlie the evolution of a new approach to rural health care. Roads are considered a public good: They are both non-excludable and nonrivalrous and are therefore subsidized. Financial support is provided for rural roads, rural electricity,⁶³ and rural telecommunications⁶⁴ in recognition of the failure of a market-based structure to serve small populations. If population health is considered a public good, then maintenance of some form of public health and health care services is necessary infrastructure for rural America.

Moving from person-based to community-based funding for health care infrastructure would not be simple. Roads are funded through a mixture of federal, state, and local taxes, depending on the system-level importance of each route,⁵⁵ with occasional private participation.⁶⁵ How parallels could be developed for health system funding, particularly given the revenue-neutral requirements for any Medicare or Medicaid changes, remains to be determined. In addition, as demonstrated by the experience of the British National Health Service, reallocation of funds to achieve geographic equity even within a single health system can be contentious and difficult.⁶⁶ However, this difficult debate cannot be resolved unless it is first initiated. In the interim, there should be recognition that existing mechanisms that help support rural health care, such as low volume and distance payments, are not frivolous or anticompetitive.

While roads are almost ubiquitous, the type of road varies with the size and vehicle composition of anticipated traffic, from scraped dirt to a multilane, multilevel interstate highway. Within health care, there are a multitude of needs but a fairly small number of types of institutions—hospital, skilled nursing facility, ambulatory surgery center, and so on—and very little leeway to evolve new structures without changes in licensing and accreditation. Efforts to develop new types of facilities, such as the experiment with frontier extended stay clinics, have been rare and limited to very distinct locations.⁶⁷ Freestanding emergency departments and microhospitals (institutions with ten or fewer beds and a limited range of services) have been suggested as mechanisms for retaining care in rural communities,

although research regarding their effectiveness is still lacking.⁶⁸

The value of a mile-long piece of highway lies in its connections to other roads. Health care remains fundamentally local, or within the purview of single institutional providers with multiple sites. The concept of community health information networks, widely touted in the 1990s, has generally disappeared from view.⁶⁹ The unique advantage of electronic connectedness for small rural communities lies in access to clinical expertise that could never be supported at the local level. Telemedicine, which has the potential to bring needed this expertise to rural communities,⁷⁰ has never flourished without grant support. Current efforts to expand telemedicine still rely on a person-based funding model,⁷¹ which will not provide a path to sustainability in small communities. **Conceptualizing connectedness as infrastructure**, similar to electricity or telecommunications, may provide a path for permanent funding, through whatever mechanisms can be designed.

Caring About Rural Populations

Structural urbanism has deep roots and may be impossible to eliminate completely. However,

one way to begin is by assigning value to rural communities and the people who live there. Given greater flexibility, as well as better funding models, rural communities would be able to invent new types of facilities for size-appropriate rural health care hubs.⁷ As these new models are developed, the traditional use of the term *scalability* should be turned on its head. Instead of asking, “Can this model handle more?,” communities could raise the opposite question: “Which system elements can be scaled down while still providing safe and effective care and improving population health?”

At a national level, the health of rural residents can be monitored responsibly. More research into lagged effects of changes in local health care systems on health outcomes would then be possible, to document which communities are most at risk when service levels fall below a necessary minimum. Research and demonstration projects can be used to define the service mix needed to maintain the health of specific types of rural communities. Conceptualizing rural health care as infrastructure, similar to electricity or telecommunications, may provide a path for permanent funding, through whatever mechanisms can be designed. ■

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NOTES

- Monnat SM, Brown DL. More than a rural revolt: landscapes of despair and the 2016 presidential election. *J Rural Stud*. 2017;55:227–36.
- Case A, Deaton A. Rising morbidity and mortality in midlife among white non-Hispanic Americans in the 21st century. *Proc Natl Acad Sci U S A*. 2015;112(49):15078–83.
- Mack KA, Jones CM, Ballesteros MF. Illicit drug use, illicit drug use disorders, and drug overdose deaths in metropolitan and nonmetropolitan areas—United States. *MMWR Surveill Summ*. 2017;66(19):1–12.
- Vance JD. Hillbilly elegy: a memoir of a family and culture in crisis. New York (NY): HarperCollins Publishers; 2016.
- Centers for Disease Control and Prevention. *MMWR Rural Health Series* [Internet]. Atlanta (GA): CDC; [last reviewed 2017 Nov 27; cited 2019 Oct 8]. Available from: https://www.cdc.gov/mmwr/rural_health_series.html
- Frakt A. A sense of alarm as rural hospitals keep closing. *New York Times*. 2018 Oct 29.
- Iglehart JK. The challenging quest to improve rural health care. *N Engl J Med*. 2018;378(5):473–9.
- Daschle T, Snowe O. Rural health could be a powerful issue in the 2020 election. *The Hill* [serial on the Internet]. 2019 Jun 12 [cited 2019 Oct 8]. Available from: <https://thehill.com/opinion/healthcare/448198-rural-health-could-be-a-powerful-issue-in-the-2020-election>
- Bennett KJ, Borders TF, Holmes GM, Kozhimannil KB, Ziller E. What is rural? Challenges and implications of definitions that inadequately encompass rural people and places. *Health Aff (Millwood)*. 2019;38(12):1985–92.
- AARP Public Policy Institute, National Alliance for Caregiving. *Caregiving in the U.S. 2015* [Internet]. Washington (DC): AARP; 2015 Jun [cited 2019 Oct 9]. (Research Report). Available from: <https://www.aarp.org/content/dam/aarp/ppi/2015/caregiving-in-the-united-states-2015-report-revised.pdf>
- Hart LG, Larson EH, Lishner DM. Rural definitions for health policy and research. *Am J Public Health*. 2005;95(7):1149–55.
- Office of Management and Budget. 2010 standards for delineating Metropolitan and Micropolitan Statistical Areas. *Federal Register* [serial on the Internet]. 2010 Jun 28 [cited 2019 Oct 9]. Available from: <https://www.federalregister.gov/documents/2010/06/28/2010-15605/2010-standards-for-delineating-metropolitan-and-micropolitan-statistical-areas>
- National Center for Health Statistics. *NCHS Urban-Rural Classification Scheme for Counties* [Internet]. Hyattsville (MD): NCHS; 2013 [last reviewed 2017 Jun 1; cited 2019 Oct 25]. Available from: https://www.cdc.gov/nchs/data_access/urban_rural.htm
- Department of Agriculture, Economic Research Service. *Rural clas-*

- sifications: overview [Internet]. Washington (DC): ERS; [last updated 2019 Sep 23; cited 2019 Oct 9]. Available from: <https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/>
- 15 Census Bureau. 2010 census urban and rural classification and urban area criteria [Internet]. Washington (DC): Census Bureau; [last revised 2018 Nov 26; cited 2019 Oct 9]. Available from: <https://www.census.gov/programs-surveys/geography/guidance/geo-areas/urban-rural/2010-urban-rural.html>
 - 16 Census Bureau [Internet]. Washington (DC): Census Bureau; 2016. Press release, New census data show differences between urban and rural populations; 2016 Dec 8 [cited 2019 Oct 7]. (Release No. CB16-210). Available from: <https://www.census.gov/newsroom/press-releases/2016/cb16-210.html>
 - 17 Cromartie J. Rural America at a glance: 2018 edition [Internet]. Washington (DC): Department of Agriculture, Economic Research Service; 2018 Nov [cited 2019 Oct 9]. (Economic Information Bulletin No. 200). Available from: <https://www.ers.usda.gov/webdocs/publications/90556/eib-200.pdf>
 - 18 Authors' analysis of population data from Robert Wood Johnson Foundation. 2017 County Health Rankings national data [Internet]. Princeton (NJ): RWJF; 2017 [cited 2019 Oct 24]. Available for download from:017 edition) <https://www.countyhealthrankings.org/explore-health-rankings/rankings-data-documentation/national-data-documentation-2010-2017>.
 - 19 Authors' analysis of data from Department of Agriculture, Economic Research Service. County typology codes: description and maps [Internet]. Washington (DC): ERS; [last updated 2019 Aug 20; cited 2019 Oct 9]. Available from: <https://www.ers.usda.gov/data-products/county-typology-codes/descriptions-and-maps/>
 - 20 To access the appendix, click on the Details tab of the article online.
 - 21 Moy E, Garcia MC, Bastian B, Rossen LM, Ingram DD, Faul M, et al. Leading causes of death in non-metropolitan and metropolitan areas—United States, 1999–2014. *MMWR Surveill Summ.* 2017;66(1):1–8.
 - 22 Probst J, Zahnd WE, Breneman C. Declines in pediatric mortality fall short for rural US children. *Health Aff (Millwood).* 2019;38(12):2069–76.
 - 23 James W, Cossman JS. Long-term trends in black and white mortality in the rural United States: evidence of a race-specific rural mortality penalty. *J Rural Health.* 2017;33(1):21–31.
 - 24 Spencer JC, Wheeler SB, Rotter JS, Holmes GM. Decomposing mortality disparities in urban and rural U.S. counties. *Health Serv Res.* 2018;53(6):4310–31.
 - 25 Department of Agriculture, Economic Research Service. Rural education at a glance, 2017 edition [Internet]. Washington (DC): ERS; 2017 Apr [cited 2019 Oct 9]. (Economic Information Bulletin No. 171). Available from: <https://www.ers.usda.gov/publications/pub-details/?pubid=83077>
 - 26 Department of Agriculture, Economic Research Service. Rural education [Internet]. Washington (DC): ERS; [last updated 2019 Aug 20; cited 2019 Oct 9]. Available from: <https://www.ers.usda.gov/topics/rural-economy-population/employment-education/rural-education/>
 - 27 Authors' analysis of data from Department of Agriculture, Economic Research Service. Poverty rates by metro/nonmetro residence, 1959–2017 [Internet]. Washington (DC): ERS; [cited 2019 Oct 9]. Available from: https://www.ers.usda.gov/webdocs/charts/56286/poverty-ratesbyresidence2017_d.html?v=6364.9
 - 28 Moser DK, Kimble LP, Alberts MJ, Alonzo A, Croft JB, Dracup K, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on Cardiovascular Nursing and Stroke Council. *Circulation.* 2006;114(2):168–82.
 - 29 Chowdhury R, Khan H, Heydon E, Shroufi A, Fahimi S, Moore C, et al. Adherence to cardiovascular therapy: a meta-analysis of prevalence and clinical consequences. *Eur Heart J.* 2013;34(38):2940–8.
 - 30 Greenwood-Erickson MB, Kocher K. Trends in emergency department use by rural and urban populations in the United States. *JAMA Netw Open.* 2019;2(4):e191919.
 - 31 Krieger N. Health equity and the fallacy of treating causes of population health as if they sum to 100. *Am J Public Health.* 2017;107(4):541–9.
 - 32 Wells R, Cody M, Alpino R, Van Dyne M, Abbott R, King N. Physician assistants: modernize laws to improve rural access [Internet]. Washington (DC): National Rural Health Association; 2017 Jul [cited 2019 Oct 9]. (Policy Brief). Available from: https://www.ruralhealthweb.org/NRHA/media/Emerge_NRHA/Advocacy/Policy%20documents/04-09-18-NRHA-Policy-Physician-Assistants-Modernize-Laws-to-Improve-Rural-Access.pdf
 - 33 Health Resources and Services Administration. Health Professional Shortage Areas (HPSAs) [Internet]. Rockville (MD): HRSA; [last reviewed 2019 May; cited 2019 Oct 9]. Available from: <https://bhwh.hrsa.gov/shortage-designation/hpsas>
 - 34 Probst JC, Eberth JM, Crouch EL. Rural America: public health challenges and opportunities. In: Boulton ML, Wallace RB, et al., editors. *Wallace/Maxcy-Rosenau-Last public health and preventive medicine.* 16th ed. New York (NY): McGraw-Hill. Forthcoming 2020.
 - 35 Germack HD, Kandrack R, Martsof GR. When rural hospitals close, the physician workforce goes. *Health Aff (Millwood).* 2019;38(12):2086–94.
 - 36 Doty B, Zuckerman R, Finlayson S, Jenkins P, Rieb N, Heneghan S. General surgery at rural hospitals: a national survey of rural hospital administrators. *Surgery.* 2008;143(5):599–606.
 - 37 Cecil G. Sheps Center for Health Services Research. 160 rural hospital closures: January 2005–present (118 since 2010) [Internet]. Chapel Hill (NC): University of North Carolina at Chapel Hill; [cited 2019 Oct 9]. Available from: <https://www.shepscenter.unc.edu/programs-projects/rural-health/rural-hospital-closures/>
 - 38 Mosely D, DeBehnke D. Rural hospital sustainability: new analysis shows worsening situation for rural hospitals, residents [Internet]. Chicago (IL): Navigant; 2019 Feb 22 [cited 2019 Oct 9]. Available from: <https://www.navigant.com/insights/healthcare/2019/rural-hospital-sustainability>
 - 39 Clawar M, Randolph R, Thompson K, Pink GH. Access to care: populations in counties with no FQHC, RHC, or acute care hospital [Internet]. Chapel Hill (NC): University of North Carolina at Chapel Hill, North Carolina Rural Health Research Program; 2018 Jan [cited 2019 Oct 9]. (Findings Brief). Available for download from: <https://www.ruralhealthresearch.org/alerts/211>
 - 40 Hung P, Henning-Smith CE, Casey MM, Kozhimannil KB. Access to obstetric services in rural counties still declining, with 9 percent losing services, 2004–14. *Health Aff (Millwood).* 2017;36(9):1663–71.
 - 41 Clark LJ, Field MJ, Koontz TL, Koontz VL. The impact of Hill-Burton: an analysis of hospital bed and physician distribution in the United States, 1950–1970. *Med Care.* 1980;18(5):532–50.
 - 42 CMS.gov. History [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; [last modified 2019 Aug 5; cited 2019 Oct 9]. Available from: <https://www.cms.gov/About-CMS/Agency-information/History/>
 - 43 Kaufman BG, Thomas SR, Randolph RK, Perry JR, Thompson KW, Holmes GM, et al. The rising rate of rural hospital closures. *J Rural Health.* 2016;32(1):35–43.
 - 44 O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart dis-

- ease. *Public Health*. 2012;126(10):813–20.
- 45 Medicare.gov. Diabetes self-management training [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; [cited 2019 Oct 9]. Available from: <https://www.medicare.gov/coverage/diabetes-self-management-training>
 - 46 Rutledge SA, Masalovich S, Blacher RJ, Saunders MM. Diabetes self-management education programs in nonmetropolitan counties—United States, 2016. *MMWR Surveill Summ*. 2017;66(10):1–6.
 - 47 6 keys to profitability. *Medical Economics* [serial on the Internet]. 2013 Feb 25 [cited 2019 Oct 9]. Available from: <https://www.medical-economics.com/modern-medicine-now/6-keys-profitability>
 - 48 Health Resources and Services Administration. Ryan White HIV/AIDS Program funding: FY 2011–FY 2019 appropriations by program [Internet]. Rockville (MD): HRSA; [last reviewed 2019 Feb; cited 2019 Oct 9]. Available from: <https://hab.hrsa.gov/program-grants-management/ryan-white-hiv-aids-program-funding>
 - 49 Gonsalves GS, Crawford FW. Dynamics of the HIV outbreak and response in Scott County, IN, USA, 2011–15: a modelling study. *Lancet HIV*. 2018;5(10):e569–77.
 - 50 Centers for Disease Control and Prevention. Community Transformation Grants (2011–2014) [Internet]. Atlanta (GA): CDC; [page last reviewed 2017 Mar 7; cited 2019 Oct 25]. Available from: <https://www.cdc.gov/nccdphp/dch/programs/communitytransformation/index.htm>
 - 51 National Center for Health Statistics. Health, United States, 2017: with special feature on mortality [Internet]. Hyattsville (MD): NCHS; 2018 [cited 2019 Oct 8]. Available from: <https://www.cdc.gov/nchs/health/index.htm>
 - 52 Medicare Payment Advisory Commission. Report to the Congress: Medicare payment policy [Internet]. Washington (DC): MedPAC; 2017 Mar [cited 2019 Oct 9]. p. 248. Available from: http://medpac.gov/docs/default-source/reports/mar17_entirereport.pdf
 - 53 Gutierrez D. Little school on the prairie: the overlooked plight of rural education. *Harvard Political Review* [serial on the Internet]. 2016 Feb 10 [cited 2019 Oct 9]. Available from: <https://harvardpolitics.com/united-states/little-school-prairie-state-rural-education-twenty-first-century-america/>
 - 54 Urban Institute. State and Local Finance Initiative: highway and road expenditures [Internet]. Washington (DC): Urban Institute; [cited 2019 Oct 9]. Available from: <https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/state-and-local-backgrounders/highway-and-road-expenditures>
 - 55 National Conference of State Legislatures. The state role in education finance [Internet]. Denver (CO): NCSL; c 2019 [cited 2019 Oct 9]. Available from: <http://www.ncsl.org/research/education/state-role-in-education-finance.aspx>
 - 56 Braveman P, Gruskin S. Defining equity in health. *J Epidemiol Community Health*. 2003;57(4):254–8.
 - 57 Stone D. Health equity in a Trump administration. *J Health Polit Policy Law*. 2017;42(5):995–1002.
 - 58 Roberts ET, Hatfield LA, McWilliams JM, Chernew ME, Done N, Gerovich S, et al. Changes in hospital utilization three years into Maryland's global budget program for rural hospitals. *Health Aff (Millwood)*. 2018;37(4):644–53.
 - 59 CMS.gov. Pennsylvania Rural Health Model [Internet]. Baltimore (MD): Centers for Medicare and Medicaid Services; [last updated 2019 Sep 20; cited 2019 Oct 9]. Available from: <https://innovation.cms.gov/initiatives/pa-rural-health-model/>
 - 60 Meyer H. Pa. taps hospitals, payers for rural global budget experiment. *Modern Healthcare* [serial on the Internet]. 2019 Mar 5 [cited 2019 Oct 7]. Available from: <https://www.modernhealthcare.com/payment/pa-taps-hospitals-payers-rural-global-budget-experiment>
 - 61 Woolhandler S, Himmelstein DU. Single-payer reform—“Medicare for all.” *JAMA*. 2019;321(24):2399.
 - 62 Starr P. The social transformation of American medicine: the rise of a sovereign profession and the making of a vast industry. New York (NY): Basic Books; 1982.
 - 63 Department of Agriculture. Electric programs: powering sustainable rural communities [Internet]. Washington (DC): USDA; [cited 2019 Oct 9]. Available from: <https://www.rd.usda.gov/programs-services/all-programs/electric-programs>
 - 64 Snider M. 1.7 million rural Americans may get broadband after FCC auction. *USA Today* [serial on the Internet]. 2018 Aug 28 [cited 2019 Oct 9]. Available from: <https://www.usatoday.com/story/tech/news/2018/08/28/verizon-others-win-fcc-auction-bring-broadband-1-7-million-rural-americans/1119091002/>
 - 65 Corbett J. Pence's Indiana “cautionary tale” for privatizing infrastructure projects. *Common Dreams* [serial on the Internet]. 2017 Aug 9 [cited 2019 Oct 9]. Available from: <https://www.commondreams.org/news/2017/08/09/pences-indiana-cautionary-tale-privatizing-infrastructure-projects>
 - 66 Gorsky M, Millward G. Resource allocation for equity in the British National Health Service, 1948–89: an advocacy coalition analysis of the RAWP. *J Health Polit Policy Law*. 2018;43(1):69–108.
 - 67 Burwell SM. Evaluation of the Medicare Frontier Extended Stay Clinic Demonstration: report to Congress [Internet]. Washington (DC): Department of Health and Human Services; 2014 [cited 2019 Oct 9]. Available from: <https://innovation.cms.gov/Files/reports/MFESCD-RTC.pdf>
 - 68 Medicare Payment Advisory Commission. Report to the Congress: Medicare and the health care delivery system [Internet]. Washington (DC): MedPAC; 2018 Jun [cited 2019 Oct 9]. Chapter 2. Available from: http://medpac.gov/docs/default-source/reports/jun18_medpac_reporttocongress_sec.pdf
 - 69 King RJ, Garrett N, Kriseman J, Crum M, Rafalski EM, Swise D, et al. A community health record: improving health through multisector collaboration, information sharing, and technology. *Prev Chronic Dis*. 2016;13:E122.
 - 70 Health Resources and Services Administration. Telehealth programs [Internet]. Rockville (MDC): HRSA; [last reviewed 2019 Aug; cited 2019 Oct 9]. Available from: <https://www.hrsa.gov/rural-health/telehealth/index.html>
 - 71 Wicklund E. Telehealth, telemedicine reimbursement score big in new budget deal. *mHealth Intelligence* [serial on the Internet]. 2018 Feb 9 [cited 2019 Oct 9]. Available from: <https://mhealthintelligence.com/news/telehealth-telemedicine-reimbursement-score-big-in-new-budget-deal>