Using HRSA's Health Workforce Simulation Model to Estimate the Rural and Non-Rural Health Workforce

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HRSA
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About the National Center for Health Workforce Analysis

The National Center for Health Workforce Analysis (NCHWA) informs public and private-sector decision-making on the U.S. health workforce by expanding and improving health workforce data and its dissemination to the public, and by improving and updating projections of supply of and demand for health workers.

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Contents

Introduction

The Health Resources and Services Administration (HRSA), an operating division within the U.S. Department of Health and Human Services (HHS), provides national leadership in the development, distribution, and retention of a diverse, culturally competent health workforce that can provide quality care for all. In support of this mission, HRSA administers a wide range of training grants, scholarships, loans, and loan repayment programs that strengthen the health workforce and respond to the evolving needs of the U.S. healthcare system. Also in support of HRSA's mission, the National Center for Health Workforce Analysis (the National Center or NCHWA), a Division within HRSA's Bureau of Health Workforce (BHW), informs public and private sector decision-making by collecting, compiling, and analyzing health workforce data and disseminating this information to the public. As part of these broad data collection and analysis responsibilities, NCHWA is statutorily authorized to "conduct or enter into contracts for conduct of analytic and descriptive studies of the health professions, including evaluations and projections of the supply of, and requirements for, the health professions by specialty and geographic location."[1]

Since 2014, HRSA has produced workforce projections for healthcare providers in the following fields: allied health; behavioral health; emergency medicine; geriatrics; internal medicine; long-term care support services; neurology; oral health; pediatrics; primary care; surgical specialties; and women's health. In developing projections of supply and demand for these occupations, HRSA has largely focused its efforts on reporting national-level estimates. However, HRSA has been actively working for several years to develop and refine methods for producing regional and state level estimates, as well as estimates of health workforce supply and demand by rural, suburban, and urban geographies. These advancements have been driven by a well-recognized need to give health workforce planners, policy makers, and stakeholders a better understanding of the distribution of health workforce supply and demand at subnational levels.

[1] 42 U.S.C. § 295k.

These refinements also reflect the general geographic requirements contained in the projections' authorizing statute (42 U.S.C. § 295k).

Health workforce projections at the national level, regional or state level, and even across broad urban/suburban/rural categories, do not necessarily reflect the nuances and challenges in health worker recruitment and retention observed at the level of an individual health system, facility, or community. Therefore, projection findings should always be interpreted solely at the level at which they are analyzed. But NCHWA's aim is to refine its reporting of health workforce projections beyond the national level – to the extent feasible with the data available for analysis – and instead report findings at a geographical level that is more informative for policymakers and others interested in studying and strengthening access to healthcare in the United States. In many cases, data limitations will still require many future NCHWA health workforce projection reports to speak to national-level results.

The purpose of this report is to describe the status of HRSA's ongoing projection improvements specifically with respect to deriving estimates of workforce supply and demand by rural, suburban, and urban geographies. This report begins with an overview of HRSA's Health Workforce Simulation Model. Then, the report discusses approaches to incorporating rurality into HRSA's health workforce projections, and the approach that HRSA is currently using. Two illustrative examples of rurality projections, one for general surgeons and one for psychiatrists, are then presented. The report concludes with a review of key assumptions, current modeling limitations, and future directions.

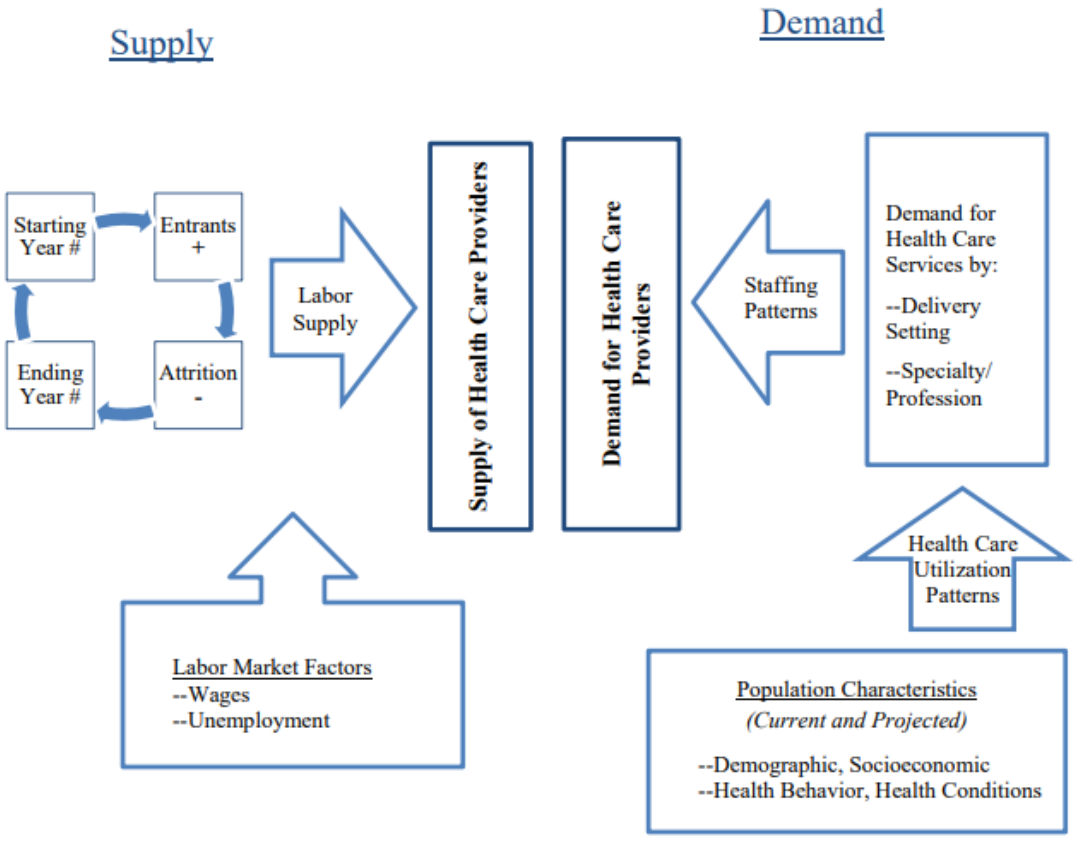
HRSA's Health Workforce Simulation Model

Since 2014, HRSA has utilized its Health Workforce Simulation Model (HWSM) to estimate and project workforce supply and demand across a wide range of healthcare occupations.[2] A

[2] For a complete list of all of HRSA's projections reports, and to review or download specific reports, please visit: HRSA: Projection Reports.

similar "microsimulation" approach is used by others in the health workforce analysis field, as it provides a more granular framework for assessing health provider supply and demand than other possible methodologies, and it can easily be adapted for future changes in healthcare delivery and utilization or as more comprehensive data sets become available.[3,4] While the nuances of modeling may differ for individual occupations and medical specialties, the basic framework used in the HWSM remains the same for all occupations. This framework includes both a workforce supply element and a workforce demand element, as illustrated in Exhibit 1.

Exhibit 1: HRSA's Health Workforce Simulation Model



Get detailed technical documentation for the HWSM.

[3] "The 2019 Update: The Complexities of Physician Supply and Demand: Projections from 2017 to 2032" (The 2019 Update: The Complexities of Physician Supply and Demand: Projections from 2017-2032).

[4] Streeter RA, Zangaro GA, Chattopadhyay A. Perspectives: Using Results from HRSA's Health Workforce Simulation Model to Examine the Geography of Primary Care. Health Services Research 2017;52 Supplement 1(Suppl. 1):481–507.

For supply modeling, the HWSM's major components include common labor-market factors like unemployment and new entrants to the workforce (e.g., newly trained psychiatrists), demographic and geographic characteristics of the existing workforce, and workforce participation decisions (e.g., patterns in retirement and hours per week worked). The HWSM assumes that current supply patterns for a particular health profession remain constant within each demographic group throughout the forecast period, and the model projects forward in one-year increments by aging the existing workforce. Thus, each annual supply estimate for a particular health occupation becomes the starting point for that occupation in the subsequent year, with the process repeated through the last year of a defined projection period (e.g., 2017 to 2030). Changes in supply patterns can occur over a study period, for example if a large number of new medical schools open and produce many more field entrants, and this may affect the assumptions made in a given analysis.

For demand modeling, the HWSM assumes demand equals supply in the base year,[5] and applies current healthcare utilization patterns across future population demographics. The population database used to estimate baseline demand consists of records of individuals' characteristics generated from a representative sample of the entire U.S. population from the U.S. Census Bureau's American Community Survey (ACS). These data are matched by demographic characteristics to data from the Centers for Disease Control and Prevention's (CDC's) Behavioral Risk Factor Surveillance System (BRFSS) and other sources of information related to health behaviors, health risk factors, health status, and health insurance coverage. Projected population demographics come from the U.S. Census Bureau's Population Projections.[6]

Using this detailed information about population characteristics, demand projections for healthcare services in different care settings are produced by applying a set of estimated utilization

[5] The assumption that supply equals demand at baseline is a standard approach in workforce projection modelling. Please refer to: Ono T, Lafortune G, Schoenstein M. "Health workforce planning in OECD countries: a review of 26 projection models from 18 countries." *OECD Health Working Papers, No. 62*. France: OECD Publishing; 2013: 8-11. Available from: Health Workforce Planning in OECD Countries. Accessed December 20, 2019.

[6] U.S. Census Bureau. 2017. Population Projections. Available from: Population Projections. Accessed December 20, 2019.

factors to each defined segment of the projected population. Population segments are based on age group, socioeconomic characteristics, health behaviors, and health conditions. Utilization factors reflect predictor coefficients derived from regression equations that model healthcare use by each population segment. Current staffing patterns by care setting are then applied to forecast the future demand for providers, estimated in Full-Time Equivalents (FTEs), from the predicted population demand estimates.

For all of HRSA's published workforce projections since 2014, the HWSM provides demand projections under a status quo scenario. This scenario assumes that current healthcare use and healthcare delivery patterns for the specific occupation being modeled remain the same as they are in the base year until the end of the projection period. Thus, under the status quo scenario, the HWSM only accounts for shifts in healthcare use and delivery associated with large, predictable population changes, such as aging of the population and the attendant age-related changes in disease burden and health risk behaviors. As a result of these assumptions, the status quo scenario examines whether the nation's future health workforce will be sufficient to provide a level of care that is equivalent to the level of care provided in the base year. This scenario does not address inadequacies related to current levels of care, nor does it reflect future changes in healthcare delivery. Changes in healthcare demand patterns can occur over a study period, for example if the eligibility requirements for Medicaid participation change significantly or if healthcare advances drive increases or decreases in the need for care delivered by a particular type of provider.

Rural/Suburban/Urban Designation

HRSA recognizes that national estimates of workforce supply and demand can obscure geographic imbalances between supply and demand at state and local levels. These imbalances are particularly important to consider when examining how workforce supply and demand may

differ across rural, suburban, and urban geographies.[7,8] For several years, HRSA has been working to enhance the HWSM so that it may be used to reflect geographic rurality when projecting health workforce supply and demand at sub-national levels. In developing its current approach (described in this report), HRSA consulted with a number of stakeholders and subject matter experts, including advisors in the Federal Office of Rural Health Policy (FORHP), the National Center for Health Statistics (NCHS), and the HRSA-funded Health Workforce Research Centers (HWRCs).[9]

In considering the approach described here, it must be emphasized that there is no single, definitive source for assigning rurality to a particular geographic area (e.g., census block, census tract, county, etc.).[10,11] Rather, as several experts emphasized to HRSA, definitions of rurality are highly context dependent, and while definitions of rurality may take into account a range of characteristics (e.g., population density, commuting distance, land use, etc.), rurality definitions do not reflect any single, inherent geographic attribute.[12] For this reason, definitions of rural, suburban, and urban need to reflect the objectives of a particular analysis.

[7] Hempel S, Gibbons MM, Ulloa JG, et al. 2015. Rural Healthcare Workforce: A Systematic Review [Internet]. Washington (DC): Department of Veterans Affairs (US). Available from: Rural Healthcare Workforce: A Systematic Review [Internet].. Accessed December 20, 2019.

[8] Snyder JE, Jensen M, Nguyen NX, Filice CE, Joynt KE. 2017. Defining Rurality in Medicare Administrative Data. *Medical Care*, 55(12):e164:e169.

[9] Health Resources and Services Administration/Bureau of Health Workforce/National Center for Health Workforce Analysis. Health Workforce Research Centers. 2019. Available from: HRSA: Health Workforce Research Centers.

[10] U.S. Census Bureau. 2019. Understanding and Using American Community Survey Data: What Users of Data for Rural Areas Need to Know. Available from: Understanding and Using American Community Survey Data: What Users of Data for Rural Areas Need to Know. Accessed December 20, 2019.

[11] U.S. Department of Agriculture, Economic Research Service. What is Rural? Available from: United States Department of Agriculture. Accessed December 20, 2019.

[12] For a deeper discussion of this topic, please see: (a) National Academies of Sciences, Engineering, and Medicine 2016. Rationalizing Rural Area Classifications for the Economic Research Service: A Workshop Summary. Washington, DC: The National Academies Press. Accessed December 20, 2019. Available from: Rationalizing Rural Area Classifications for the Economic Research Service; and (b) Ratcliffe M, Burd C, Holder K, and Fields A, "Defining Rural at the U.S. Census Bureau," ACSGEO-1, U.S. Census Bureau, Washington, DC, 2016. Available from: Defining Rural at the U.S. Census Bureau.

Recognizing this definitional constraint, HRSA first identified three widely used sources of categorization that may offer a potential basis for developing health workforce projections by rural classification. Each of these three approaches is described below:

2010 Census Urban and Rural Classification and Urban Area Criteria

Unit of Analysis: Census tract and/or census block

The U.S. Census Bureau defines rural as those populations, facilities, and territories that are not within an urban area. The Census Bureau's definition of an urban area is rooted in estimates of population density, as explained below:

> "For the 2010 Census, an urban area will comprise a densely settled core of census tracts and/or census blocks that meet minimum population density requirements, along with adjacent territory containing non-residential urban land uses as well as territory with low population density included to link outlying densely settled territory with the densely settled core. To qualify as an urban area, the territory identified according to criteria must encompass at least 2,500 people, at least 1,500 of [whom] reside outside institutional group quarters."[13]

In addition to this general definition of an urban area, the Census Bureau recognizes two distinct classes of urban areas:

- Urban Clusters (UCs) are areas with at least 2,500 and fewer than 50,000 people.
- Urbanized Areas (UAs) are areas with 50,000 or more people.

2010 OMB Standards for Delineating Metropolitan and Micropolitan Statistical Areas

[13] U.S. Census Bureau. 2019. 2010 Census Urban and Rural Classification and Urban Area Criteria. Available from: 2010 Census Urban and Rural Classification and Urban Area Criteria. Accessed December 20, 2019.

Unit of Analysis: County or county equivalent jurisdiction[14]

The Office of Management and Budget (OMB) standards define two categories of Core-Based Statistical Areas (CBSAs):[15,16]

- A Micropolitan Statistical Area contains a Census Bureau-delineated urban cluster having a population of at least 10,000 people and fewer than 50,000 people.
- A Metropolitan Statistical Area (MSA) contains an urbanized area having a population of at least 50,000 people.

Under OMB's classification, a CBSA is made up of the central county or counties which include the core, together with adjacent outlying counties that have a high degree of social and economic integration with the central county or counties, as measured through commuting. The central county or counties of a CBSA are those counties that:

- Have within their boundaries a population of at least 5,000 people located in a single urban area. – OR –
- Have at least 50 percent of their population in urban areas of at least 10,000 people.

A county qualifies as an outlying county of a CBSA if it meets one of the following commuting requirements:

- At least 25 percent of the workers living in the county work in the central county or counties of the CBSA. – OR –

[14] In this report, the term county refers to both counties and county equivalent entities. For a discussion of county equivalent entities, please see: U.S. Census Bureau. 2013. States, Counties, and Statistically Equivalent Entities. Available from: States, Counties, and Statistically Equivalent Entities . Accessed December 20, 2019.
[15] Office of Management and Budget. 2010. 2010 Standards for Delineating Metropolitan and Micropolitan Statistical Areas. Available from: Part IV: Office of Management and Budget.
[16] Office of Management and Budget. 2018. Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas. OMB Bulletin No. 18-04. Available from: OMB BULLETIN NO. 18-04 . Accessed December 20, 2019.

- At least 25 percent of the employment in the county is accounted for by workers who reside in the central county or counties of the CBSA.

2013 NCHS Rural-Urban Classification Scheme

Unit of Analysis: County or county equivalent jurisdiction[17]

Building on OMB's MSA definition, NCHS has developed a six-level categorization that may be used to evaluate rurality at the county level. In order from the most rural to most urban, these six categories are:

Nonmetropolitan Counties (2 categories):

1. Noncore counties are counties not in an MSA and not in a Micropolitan Statistical Area.

2. Micropolitan counties are counties in a Micropolitan Statistical Area.

Metropolitan Counties (4 categories):

3. Small Metro counties are counties in MSAs of less than 250,000 people.

4. Medium Metro counties are counties in an MSA of 250,000-999,999 people.

5. Large Fringe Metro counties are counties in an MSA of 1 million or more people that do not qualify as Large Central Metro.

6. Large Central Metro counties are counties in an MSA of 1 million or more people that:

(a) Contain the entire population of the largest principal city of the MSA. – OR –

(b) Are completely contained within the largest principal city of the MSA. – OR –

(c) Contain at least 250,000 people in any principal city within the MSA.

[17] In reviewing these definitions and the text that follows, please note that "counties" refers to counties and county equivalents (i.e., parishes in Louisiana; boroughs and census areas in Alaska).

Again, after consulting with stakeholders and subject matter experts, HRSA has elected to employ the NCHS classification system in its current efforts to incorporate rurality into its projections of health workforce supply and demand. The reasoning behind this selection is based on the following considerations:

- NCHS developed and has applied this approach to study associations between urbanization level and health as well as to monitor population health,[18] thus suggesting the suitability of this approach for addressing other population-health-related topics, such as the distribution of the health workforce.
- The NCHS classification allows analysis at the county level of analysis, consistent with the way in which populations are estimated in the HWSM, and recognizing that many health-related variables (e.g., smoking status) are generally not available for geographic units below the county level (e.g., census tract, census block).
- The NCHS scheme has two nonmetropolitan levels and four metropolitan levels, reflective of the fact that the large US metropolitan population (roughly 85% of the total U.S. population in 2010) can support a more granular classification than the smaller non-metropolitan population.[19] Moreover, the additional level of granularity afforded by a total of six defined categories may offer opportunities for greater insight into health workforce distribution patterns.

One additional challenge in producing estimates for geographic areas with similar population sizes and densities is that there is no consensus on how to define suburban. Based on the NCHS classification scheme and in consultation with stakeholders, HRSA has chosen to use the 2013 NCHS' Large Fringe Metro area as the suburban category. This is consistent with the 2014 update to the Urban Rural Chartbook,[20] in which the Rural Health Reform Policy Research

[18] NCHS Urban-Rural Classification Scheme for Counties. Available from: CDC: NCHS Urban-Rural Classification Scheme for Counties. Accessed November 7, 2019.
[19] Ibid. accessed November 7, 2019.
[20] Rural Health Reform Policy Research Center. 2014. The 2014 Update of the Rural-Urban Chartbook. Available from: Rural Health Reform Policy Research Center: The 2014 Update. Accessed December 17, 2019.

Center provided a comprehensive analysis by rural/urban classifications on physician supply, dental supply, and several demand-related measures.[21] In this analysis, Large Fringe Metro counties were shown to be significantly different from Large Central Metro counties. Similar analyses were presented in NCHS' Health, United States 2014 update.[22] Collectively, these findings suggest that breaking out the Large Fringe Metro counties as their own category (i.e., as a suburban category) may be meaningful in estimating health workforce supply and demand.

In addition to the NCHS six-level rural-urban classification scheme, the supply and demand projections that follow are aggregated into three broader categories, using the underlying NCHS framework as outlined in the following bullets:

- Rural counties, which include Noncore and Micropolitan counties.
- Suburban counties, which are equivalent to the Large Fringe Metro counties.
- Urban counties, which include Small Metro counties, Medium Metro counties, and Large Central Metro counties.

HRSA recognizes that there are other possible approaches for utilizing rural, suburban, and urban geographical measures in the agency's workforce analysis efforts, but believes that the methodology ultimately selected here represents a reliable approach that aligns well with federal definitions used for public health policy.

[21] Similar to the HWSM approach to estimating demand, these measures included: a health status measure (report of fair or poor health), a health access measure (lack of health insurance), and a health-related behavior (current cigarette smoking).

[22] National Center for Health Statistics. Health, United States, 2014: With Special Feature on Adults Aged 55–64. Hyattsville, MD. 2015. Available from: CDC: Health, United States, 2014: With Special Feature on Adults Aged 55-64. Accessed December 17, 2019.

Rural/Suburban/Urban Projections for General Surgeons

Using both NCHS' six-category and the less granular three-category frameworks described above, HRSA has developed estimates of supply and demand for general surgeons during the period 2017 to 2030.[23] In deriving supply estimates, general surgeons in the starting year (2017) were assigned to a rurality category based on the rurality category of the county of his/her office location listed in the American Medical Association Masterfile (i.e., the primary data source for HWSM supply estimates for physicians). New surgeons were assigned a rurality category based on the rurality distribution of general surgeons who recently completed training.

Rurality estimates of baseline demand (2017) for general surgeons relied on geographic indicators areas available from the Medical Expenditure Panel Survey data (a data source for HWSM's healthcare utilization estimates),[24] and reflect the following:

- While baseline supply and demand for general surgeons are assumed to be roughly in equilibrium nationwide, a small amount of additional demand (440 FTEs) was added in the base year to reflect the extended scope of work for general surgeons in rural areas due to a lack of specialist surgeons in these areas.
- There is substantial geographic maldistribution in the supply of general surgeons.

[23] For these analyses, physicians' self-identified specialties in the 2017 American Medical Association Masterfile were utilized. General Surgeons are defined as active surgeons who listed "general surgery" as their first specialty and claimed no second specialty. This approach captures physicians who solely practice general surgery, and so may miss a small subset of surgical specialists and subspecialists who may serve in multiple clinical roles for their communities, including surgeons who may provide some part-time level of general surgery services to communities facing physician shortages.

[24] Conducted by the Agency for Healthcare Research and Quality (AHRQ), the Medical Expenditure Panel Survey (MEPS) is a set of large-scale surveys of families and individuals, their medical providers, and employers across the U.S. Additional information is available from: AHRQ: MEPS.

- In rural areas, the maldistribution shortfalls may be exacerbated by additional demands for care provided by general surgeons due to a lack of specialist surgeons and other providers.[25]

Using the supply and demand assumptions described earlier, together with NCHS' six-category scheme, a comparison of general surgeon supply to demand in the base year (2017) suggests that, in Noncore counties, the available supply of general surgeons is only sufficient to provide about 44 percent of a national average level of care to the populations residing in those areas (Exhibit 2). The estimated national shortage of general surgeons in Noncore counties is greater than the assumed 440 FTEs, reflecting that the shortfalls in these areas are made up of two parts: shortages associated with geographic maldistribution, and shortages associated with the lack of specialist surgeons in these areas.

Exhibit 2: U.S. Supply and Demand for General Surgeons by Rurality (6 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Noncore (Rural)	830	1,890	-1,060	44 %
Micropolitan (Rural)	1,900	2,050	-150	93 %
Small Metro (Urban)	2,100	2,380	-280	88 %
Medium Metro (Urban)	4,180	4,270	-90	98 %
Large Fringe Metro (Suburban)	4,060	5,390	-1,330	75 %
Large Central Metro (Urban)	7,050	4,580	2,470	154 %
Total	**20,120**	**20,560**	**-440**	**98 %**

Notes: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] For the HWSM projection for General Surgeons, an additional demand of 440 FTEs was included in the base year (2017) to reflect the extended scope of work for general surgeons in rural areas due to a lack of specialist surgeons in these areas.

Estimated adequacy rises to 93 percent in Micropolitan counties and 88-98 percent in Small Metro and Medium Metro counties. The extent to which supply is adequate to provide the national average level of care in large metro areas is 75 percent for Large Fringe Metro counties

[25] Temple, KM. 2018. The Rural Monitor: Comprehensive Rural Population Health: Where is the General Surgeon? Accessed December 27, 2019. Available from the Rural Health Information Hub: Comprehensive Rural Population Health: Where is the General Surgeon?.

and 154 percent for Large Central Metro counties. Overall, this geographic variation may reflect, in part, that large, teaching hospitals (which often provide care to patients from across an extended referral area) are predominantly located in the central areas of large metropolitan areas.

Collapsing these six categories to a three-category rural-suburban-urban framework, there is an estimated general surgeon shortfall of 1,210 FTEs in rural counties in 2017. This shortfall suggests that the estimated supply of 3,940 FTEs is only sufficient to provide 69 percent of total demand for general surgeon care (Exhibit 3). Adequacy rises to 75 percent in suburban counties, and 119 percent in urban counties. Again, the adequacy estimated for urban counties may reflect that some portion of care is delivered to patients who travel from outside of large metropolitan areas to obtain care. Overall, these estimates suggest that only in urban areas is the supply of general surgeons sufficient to provide a national, average level of care.

Exhibit 3: U.S. Supply and Demand for General Surgeons by Rurality (3 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Rural	2,730	3,940	-1,210	69 %
Suburban	4,060	5,390	-1,330	75 %
Urban	13,330	11,230	2,100	119 %
Total	**20,120**	**20,560**	**-440**	**98 %**

Notes: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] For the HWSM projection for the General Surgeons, an additional demand of 440 FTEs was included in the base year (2017) to reflect the extended scope of work for general surgeons in rural areas due to a lack of specialist surgeons in these areas.

Assuming that current workforce delivery patterns continue unchanged through 2030, the supply of general surgeons is estimated to increase 25 percent to 25,120 FTEs by 2030, and demand is estimated to increase 16 percent to 23,790 (Exhibit 4, Exhibit 5). While the national supply of general surgeons is anticipated to increase faster than demand, the geographic maldistribution of general surgeons is projected to continue. Thus, by 2030, the HWSM estimates that supply will still only be sufficient to provide 79 percent of the national average

level of general surgeon care in rural counties and 77 percent of this level of care in suburban counties (Exhibit 5).

Exhibit 4: U.S. Supply and Demand for General Surgeons by Rurality (6 Levels), 2030

Rural-Urban Classification	Supply	Demand	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Noncore (Rural)	960	1,910	-950	50 %
Micropolitan (Rural)	2,230	2,150	80	104 %
Small Metro (Urban)	2,650	2,660	-10	100 %
Medium Metro (Urban)	5,280	4,950	330	107 %
Large Fringe Metro (Suburban)	4,990	6,470	-1,480	77 %
Large Central Metro (Urban)	9,010	5,650	3,360	159 %
Total	**25,120**	**23,790**	**1,330**	**106 %**

Notes: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).

Exhibit 5: U.S. Supply and Demand for General Surgeons by Rurality (3 Levels), 2030

Rural-Urban Classification	Supply	Demand	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Rural	3,190	4,060	-870	79 %
Suburban	4,990	6,470	-1,480	77 %
Urban	16,940	13,260	3,680	128 %
Total	**25,120**	**23,790**	**1,330**	**106 %**

Notes: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).

Rural/Suburban/Urban Projections for Psychiatrists

HRSA applied the same six-category and three-category frameworks described above to previously-developed estimates of baseline supply and demand for adult psychiatrists, child/adolescent psychiatrists, and both types of psychiatrists collectively[26] (Exhibits 6-8). Like the general surgeon projections, the estimates for psychiatrists used 2017 as the baseline year. Future projections, by a subnational geographic level, were not made for psychiatrists due to the small numbers of psychiatrists practicing in rural areas.

[26] Health Resources and Services Administration, National Center for Health Workforce. Behavioral Health Workforce Projections, 2017-2030: Accessed June 2, 2020. Available from: HRSA: Behavioral Health Workforce Projections, 2017-2030

Also like general surgeons, baseline psychiatrist supply was modeled by rurality level using data from the American Medical Association Masterfile, and new psychiatrists were assigned to a rurality category based on the rurality distribution of psychiatrists who recently completed training. Demand was estimated using geographic indicators available from MEPS, and included a baseline total shortfall of 5,910 psychiatrists, reflecting estimates of psychiatrist shortages associated with HRSA's mental health professional shortage areas.[27]

As shown in Exhibit 6, Exhibit 7, and Exhibit 8, Large Central Metro counties have, on average, sufficient numbers of total psychiatrists, adult psychiatrists, and child/adolescent psychiatrists to meet the estimated demands by populations residing in those areas. In contrast, Noncore counties have only 22-23 percent adequacy for all three provider groups. Similar to surgeons, the remaining four rural/urban classifications (i.e., Micropolitan, Small Metro, Medium Metro, and Large Fringe Metro counties) have greater adequacy at baseline than Noncore counties, but all of these categories are predicted to have some degree of psychiatrist shortage relative to national average levels. Similar to general surgeons, these adequacy estimates likely obscure greater levels of maldistribution in some areas.

Exhibit 6: U.S. Supply and Demand for Total Psychiatrists by Rurality (6 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Noncore (Rural)	470	2,150	-1,690	22 %
Micropolitan (Rural)	1,670	3,590	-1,930	47 %
Small Metro (Urban)	3,100	3,870	-770	80 %
Medium Metro (Urban)	8,260	10,550	-2,280	78 %
Large Fringe Metro (Suburban)	9,470	12,250	-2,780	77 %
Large Central Metro (Urban)	18,770	15,230	3,540	123 %
Total	**41,740**	**47,650**	**-5,910**	**88 %**

Note: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] Demand for total psychiatrists at baseline (2017) includes a shortage of 5,910 psychiatrists, based on the number of providers needed to de-designate HRSA's mental health professional shortage areas.

[27] Health Resources and Services Administration, Bureau of Health Workforce. Health Professional Shortage Areas. Accessed December 27, 2019. Available from: HRSA: Health Professional Shortage Areas (HPSAs).

Exhibit 7: U.S. Supply and Demand for Adult Psychiatrists by Rurality (6 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Noncore (Rural)	410	1,890	-1,480	22 %
Micropolitan (Urban)	1,390	2,730	-1,340	51 %
Small Metro (Urban)	2,530	3,070	-550	82 %
Medium Metro (Urban)	6,640	8,300	-1,650	80 %
Large Fringe Metro (Suburban)	7,500	9,870	-2,370	76 %
Large Central Metro (Urban)	15,180	12,550	2,630	121 %
Total	**33,650**	**38,410**	**-4,760**	88 %

Note: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] Demand for total psychiatrists at baseline (2017) includes a shortage of 5,910 psychiatrists, based on the number of providers needed to de-designate HRSA's mental health professional shortage areas.

Exhibit 8: U.S. Supply and Demand for Child and Adolescent Psychiatrists by Rurality (6 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Noncore (Rural)	60	260	-200	23 %
Micropolitan (Rural)	280	860	-590	33 %
Small Metro (Urban)	570	800	-230	71 %
Medium Metro (Urban)	1,620	2,250	-630	72 %
Large Fringe Metro (Suburban)	1,970	2,370	-400	83 %
Large Central Metro (Urban)	3,590	2,690	910	133 %
Total	**8,090**	**9,240**	**-1,150**	88 %

Note: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] Demand for total psychiatrists at baseline (2017) includes a shortage of 5,910 psychiatrists, based on the number of providers needed to de-designate HRSA's mental health professional shortage areas.

Using the three-category rural/suburban/urban classification framework, this same trend persists (Exhibit 9, Exhibit 10, Exhibit 11). These findings suggest that widespread shortages of

psychiatrists may exist across the U.S. outside of urban areas, and they are consistent with other recent analyses of the psychiatric workforce.[28,29]

[28] Beck AJ, Page C, Buche J., Rittman D, Gaiser M. 2018. Mapping the Supply of the U.S. Psychiatric Workforce. Ann Arbor, MI: U Michigan Behavioral Health Workforce Research Center. Available from: Mapping Supply of the U.S. Psychiatric. Accessed 2/24/2020.

[29] Beck AJ, Page C, Buche J., Rittman D, Gaiser M. 2018. Estimating the Distribution of U.S. Psychiatric Subspecialist Workforce. Ann Arbor, MI: U Michigan Behavioral Health Workforce Research Center. Available from: Estimating the Distribution of the U.S. Psychiatric. Accessed 2/24/2020.

Exhibit 9: U.S. Supply and Demand for Total Psychiatrists by Rurality (3 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Rural	2,140	5,740	-3,620	37 %
Suburban	9,470	12,250	-2,780	77 %
Urban	30,130	29,650	490	102 %
Total	**41,740**	**47,650**	**-5,910**	**88 %**

Note: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] Demand for total psychiatrists at baseline (2017) includes the number of providers needed to de-designate HRSA's mental health professional shortage areas.

Exhibit 10: U.S. Supply and Demand for Adult Psychiatrists by Rurality (3 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Rural	1,800	4,620	-2,820	39 %
Suburban	7,500	9,870	-2,370	76 %
Urban	24,350	23,920	430	102 %
Total	**33,650**	**38,410**	**-4,760**	88 %

Note: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] Demand for adult psychiatrists at baseline (2017) includes the number of providers needed to de-designate HRSA's mental health professional shortage areas.

Exhibit 11: U.S. Supply and Demand for Child and Adolescent Psychiatrists by Rurality (3 Levels), 2017

Rural-Urban Classification	Supply	Demand[a]	Supply - Demand	Percent Adequacy (100 * Supply ÷ Demand)
Rural	340	1,120	-790	30 %
Suburban	1,970	2,370	-400	83 %
Urban	5,780	5,740	50	101 %
Total	**8,090**	**9,240**	**-1,150**	88 %

Note: Numbers may not sum to totals due to rounding. All numbers are in Full-Time Equivalents (FTEs).
[a] Demand for child and adolescent psychiatrists at baseline (2017) includes the number of providers needed to de-designate HRSA's mental health professional shortage areas.

Assumptions and Limitations

As with all models, HRSA's HWSM relies on a number of assumptions and reflects limitations and uncertainties pertaining to data inputs and structural unknowns. Chief among these is that the HWSM assumes current national supply and demand are roughly in equilibrium in the base year, and extrapolates current patterns of healthcare delivery and utilization into the future. This assumption is consistent with prevailing practices in the health workforce analysis field.[30] Thus, the HWSM reflects the following specific assumptions and limitations:

- Present age and sex distributions of new entrants to the workforce are assumed to remain constant in future years.
- Recent patterns of retirement and hours worked are assumed to remain unchanged within each age and sex group in future years.
- The prevalence of health behaviors and health conditions within each demographic group is assumed to be constant, at base year levels, across the projection period.
- Current patterns of healthcare use by demographic group and health risk status are assumed to be constant at base year levels across the projection period.
- The HWSM does not consider the impact of potential policy changes or technological innovations that might affect how healthcare is delivered and utilized in the future.

In addition to the limitations resulting from the HWSM's use of status quo assumptions to forecast supply and demand, there are specific limitations associated with the rural-urban analyses presented here. First is the definitional constraint. Given the lack of consensus on which geographic areas may be classified as rural,[31] imposing a particular rural-urban categorization inherently makes the many research studies and policy applications that use varying definitions of rurality difficult to directly compare to each other, as well as creates

[30] Ono, T., Lafortune, G., Schoenstein, M. 2013. "Health workforce planning in OECD countries: a review of 26 projection models from 18 countries". OECD Health Working Papers, No. 62. France: OECD Publishing 2013:8-11.
[31] Snyder JE, Jensen M, Nguyen NX, Filice CE, Joynt KE. 2017. Defining Rurality in Medicare Administrative Data. *Medical Care*, 55(12):e164:e169.

limitations for the resulting supply/demand estimates described here. For example, while the six-category NCHS framework affords greater precision as well as consistency with other health analyses,[32,33] this approach does not fully capture the variability within individual categories. In particular, our implementation of the six-category framework (which equates Large Fringe Areas with suburban areas) likely does not describe supply and demand in all suburban areas, especially in less populous suburban areas associated with some Medium and Small Metro counties. Indeed, recent research has found that medical infrastructure in suburban areas can vary widely,[34] and this variability is not reflected in the HWSM results presented here.

A related limitation is that the results described here do not take into account variations in healthcare practice across rural, suburban, and urban areas. Rural health providers may, in general, offer a wider variety of services than urban counterparts as there are limited other options available for rural residents to otherwise receive these services. For example, rural family medicine physicians may deliver babies and offer house calls more often than their urban peers.[35] Similarly, rural general surgeons may more often provide emergency and critical care services, as well as perform necessary endoscopies, obstetrics-gynecology care, and orthopedic procedures.[36] As a result, comparisons of general surgeons and psychiatrists across the six rural-urban categories may not fully capture differences related to professional characteristics, practice scopes, and other factors that influence access to care – which is ultimately what workforce analysis aims to describe. When the number of rural-urban categories is reduced from six to only three, local variations and potential imbalances between supply and demand are likely further obscured. Thus, the simple "snapshots" afforded by the

[32] Ibid.
[33] NCHS Urban-Rural Classification Scheme for Counties. Available from: NCHS Urban-Rural Classification Scheme for Counties. Accessed November 7, 2019.
[34] Schnake-Mahl AS, Sommers BD. Health Care in the Suburbs: An Analysis of Suburban Poverty and Health Care Access. *Health Aff (Millwood)*. 2017;36(10):1777–1785. doi:10.1377/hlthaff.2017.0545. Available from: Health Care In The Suburbs: An Analysis Of Suburban Poverty And Health Care Access. Accessed 2/24/2020.
[35] Rabinowitz HK, Paynter NP. The Rural vs Urban Practice Decision. JAMA. 2002;287(1):113. doi:10.1001/jama.287.1.113-JMS0102-7-1
[36] Thompson MJ, Lynge DC, Larson EH, Tachawachira P, Hart LG. Characterizing the General Surgery Workforce in Rural America. Arch Surg. 2005;140(1):74–79. doi:10.1001/archsurg.140.1.74

three-category aggregation may mask distributional imbalances to an even greater extent than under the six-category classification.

Finally, while travel times to obtain healthcare remain high,[37] it must be remembered that demand in certain geographic areas may not always equate to demand for services in an identical type of area, and thus, achieving balance between supply and demand may not always require that provider supplies be precisely co-located. For example, in some suburban areas, patients may be able to obtain care in an adjacent urban area with relative ease, due to the presence of a nearby and accessible academic referral center. In such situations, the absence of a co-located provider supply in the same geography category (e.g., suburban) is not necessarily as indicative of a shortage as it is for an area without a similar nearby resource.

Additional limitations associated with HWSM inputs and modeling assumptions are discussed in greater detail in the technical documentation.[38]

Conclusion

This report describes the application of NCHS' classification to estimate health workforce supply and demand in rural, suburban, and urban areas. Using this approach, supply and demand for general surgeons in 2017 and 2030 were estimated, along with psychiatrists in 2017. For general surgeons in 2017, the supply is estimated to provide about 69 percent of the national average level of demand for general surgeons in rural areas, and 75 percent of demand for general surgeons in suburban areas. In contrast, the supply of general surgeons is estimated to be adequate to supply 119 percent of the national average level of demand in urban areas in 2017. These same geographic imbalances are seen in projections of supply and demand for general surgeons in 2030 and in estimates of supply and demand for psychiatrists in 2017.

[37] Rhyan, CN. 2019. Travel and Wait Times are Longest for Longest for Health Care Services, and Result in an Annual Opportunity Cost of $89 Billion. Research brief, February 22, 2019. Altarum.org (Altarum Center for Value in Health Care). Available from: Altarum Travel and Wait . Accessed 2/24/2020.

[38] Health Resources and Services Administration (HRSA). 2018. Technical Documentation for the Health Resources and Services Administration's Health Workforce Simulation Model. Available from: Technical Documentation for Health Resources

Collectively, these analyses underscore a persistent and continuing maldistribution of physicians across the rural-urban continuum. Indeed, research suggests a growing shortfall of both primary care and specialty physicians (such as general surgeons and psychiatrists), [39] and such shortfalls could exacerbate shortages in rural areas beyond the levels projected by HRSA's HWSM under the status quo scenario.

HRSA continues to develop and refine potential modeling scenarios that may better inform health workforce and health services planning and policy making. To this end, NCHWA will strive to continue to refine its reporting of health workforce projections in a manner and at geographical levels that are optimally informative for policymakers aiming to strengthen access to healthcare in the United States. However, quantifying changes in healthcare demand resulting from innovations in healthcare delivery models, team-based care, health-seeking behaviors, and other health system-level factors presents many challenges and requires detailed, national level data that is not always available for analysis. HRSA will incorporate such factors into its future workforce projections to the extent feasible, as the evidence-base evolves and as reliable data sources become available for analysis. Further, when evidence becomes available, HRSA will also continue exploring the development of alternative models to the "status quo" scenario, in order to better inform health workforce-related planning and policy making as the U.S. health system evolves.

[39] Dall TM, Reynolds R, Jones K, Chakrabarti R, Iacobucci W. 2019 Update, The Complexities of Physician Supply and Demand: Projections from 2017 to 2032. Washington, D.C.: IHS Markit report prepared for the Association of American Medical Colleges; 2019. The Complexities of Physician Supply and Demand: Projections from 2017-2032.

Acronym List

ACS	American Community Survey
AHRQ	Agency for Healthcare Research and Quality
BHW	HRSA's Bureau of Health Workforce
CDC	Centers for Disease Control and Prevention
FORHP	Federal Office of Rural Health Policy
FTE	Full-Time Equivalent
HHS	US Department of Health and Human Services
HWRC	Health Workforce Research Center
HRSA	Health Resources and Services Administration
HWSM	Health Workforce Simulation Model
MEPS	Medical Expenditure Panel Survey
MSA	Metropolitan Statistical Area
NCHS	National Center for Health Statistics
NCHWA	National Center for Health Workforce Analysis
OMB	Office of Management and Budget