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2019 UPDATE

The Complexities of Physician Supply and Demand: Projections from 2017 to 2032

April 2019

Prepared for: Association of American Medical Colleges
Submitted by: IHS Markit Ltd

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The Complexities of Physician Supply and Demand:

Projections from 2017 to 2032

April 2019

Association of American Medical Colleges
Washington, D.C.

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EXECUTIVE SUMMARY

Assessing the capacity of the nation's future physician workforce is important to give both the public and private sectors the information they need to make investments in optimizing the physician workforce for delivering high-quality health care to the U.S. population. The pace of change in health care necessitates continuously updating and improving workforce projections. Furthermore, shifts in health policy at the national and state levels create uncertainty in plotting a successful course toward achieving major goals. For these reasons, in 2015 the Association of American Medical Colleges (AAMC) made a commitment to commission annual updates of national physician workforce projections prepared by independent experts. The purpose of these updates is threefold:

- **Update and improve workforce projections**: The AAMC is committed to supporting ongoing efforts to use the most recent and best-quality data to update projections and to respond to constructive feedback about previous projections.
- **Present new analyses**: The reports present new research on the physician workforce implications of important issues such as an evolving health care system and health care utilization inequities.
- **Identify future directions for research**: The process of modeling future supply and demand for physicians helps identify areas for future research, data collection, and analysis that will strengthen future projections and support decision-making to help align the nation's physician workforce with its health needs.

This 2019 update, prepared by independent consultants, uses a modeling approach and data sources similar to those used in previous reports and also used by the federal government (which contracts with the same independent consultants). As in the past, this update projects the future supply of physicians by considering trends in key physician supply determinants and the sensitivity of supply projections to changes in these determinants. The demand projections reflect changing demographics as the population grows and ages, changes in health insurance coverage, the expanding role of advanced practice registered nurses (APRNs) and physician assistants (PAs) in care delivery, and other important trends in health care, such as a growing emphasis on achieving population health goals and improving care access and delivery. Projections of each supply scenario modeled are compared with projections from each demand scenario. Because it is impossible to predict with certainty the degree to which each scenario will transpire, the projected shortfalls are presented as a range (the 25th to 75th percentile) of the possible outcomes of the scenario pairs, rather than as a single projection.

Updated estimates are also presented for the physician demand implications of populations facing higher barriers to accessing care — racial/ethnic minorities, uninsured people, and those living outside metropolitan areas — having health care use patterns like populations facing fewer access barriers. These estimates were not included in developing the shortfall ranges.

This report presents new research on the potential physician demand implications of the evolving care delivery system. This analysis combines some of the scenarios used to develop the projected shortfall ranges, as well as additional trends in care delivery, but because this work is exploratory, it is not included in developing the shortfall ranges.

Study findings offer stakeholders insights into directional changes expected in the physician workforce by 2032. All supply and demand projections are reported as full-time-equivalent (FTE) physicians, where an FTE is defined for each specialty as the average weekly patient care hours for that specialty. For example, if the average of patient care hours per week in a specialty was 40 hours but an individual physician in that specialty with a given age and sex was projected to work 35 hours, then that physician would be counted as 0.875 FTEs (35/40 hours). Average patient care hours worked per week ranged from a low of 35.2 hours for allergy and immunology to a high of 51.5 hours for neonatology. The projections include all active physicians who have completed their graduate medical education.

Key Findings

- **We continue to project that physician demand will grow faster than supply, leading to a projected total physician shortfall of between 46,900 and 121,900 physicians by 2032** (Exhibit ES-1). This projected shortfall range reflects updates to model inputs including updated population projections, revised starting demand and supply projections, updated estimates of physician specialty choice, larger starting-year shortfall estimates based on recently revised federal health professional shortage area (HPSA) designations for primary care and mental health, and lower projections of future insurance coverage expansion. The projected range is similar to the previous (2018) study's projected shortfall range for 2030 of between 42,600 and 121,300 physicians**.**

  By 2032, we project:

  - ✓ ***A primary care physician shortage of 21,100 to 55,200 physicians.***
  - ✓ ***A shortfall across the non-primary care specialties of 24,800 to 65,800 physicians.***
  - ✓ ***A shortage of physicians in surgical specialties of 14,300 to 23,400.***

  - **A primary care physician shortage of 21,100 to 55,200 physicians is projected by 2032**. The shortfall range reflects the projected rapid growth in the supply of APRNs and PAs and their role in care delivery, trends that might strengthen the nation's primary care foundation and improve access to preventive care, and an estimate by the Health Resources and Services Administration that nearly 14,472 primary care physicians are needed to remove the primary care shortage designation from all currently designated shortage areas.
  - **Projected shortfalls in non-primary care specialty categories of 24,800 to 65,800 physicians**, including a 14,300 to 23,400 shortfall in 2032 for surgical specialties. The range reflects different assumptions about shifting workforce patterns for physicians and other professionals. In the surgical specialties, a largely stagnant projected supply also contributes to projected shortages.

Exhibit ES-1: Total Projected Physician Shortfall Range, 2017-2032

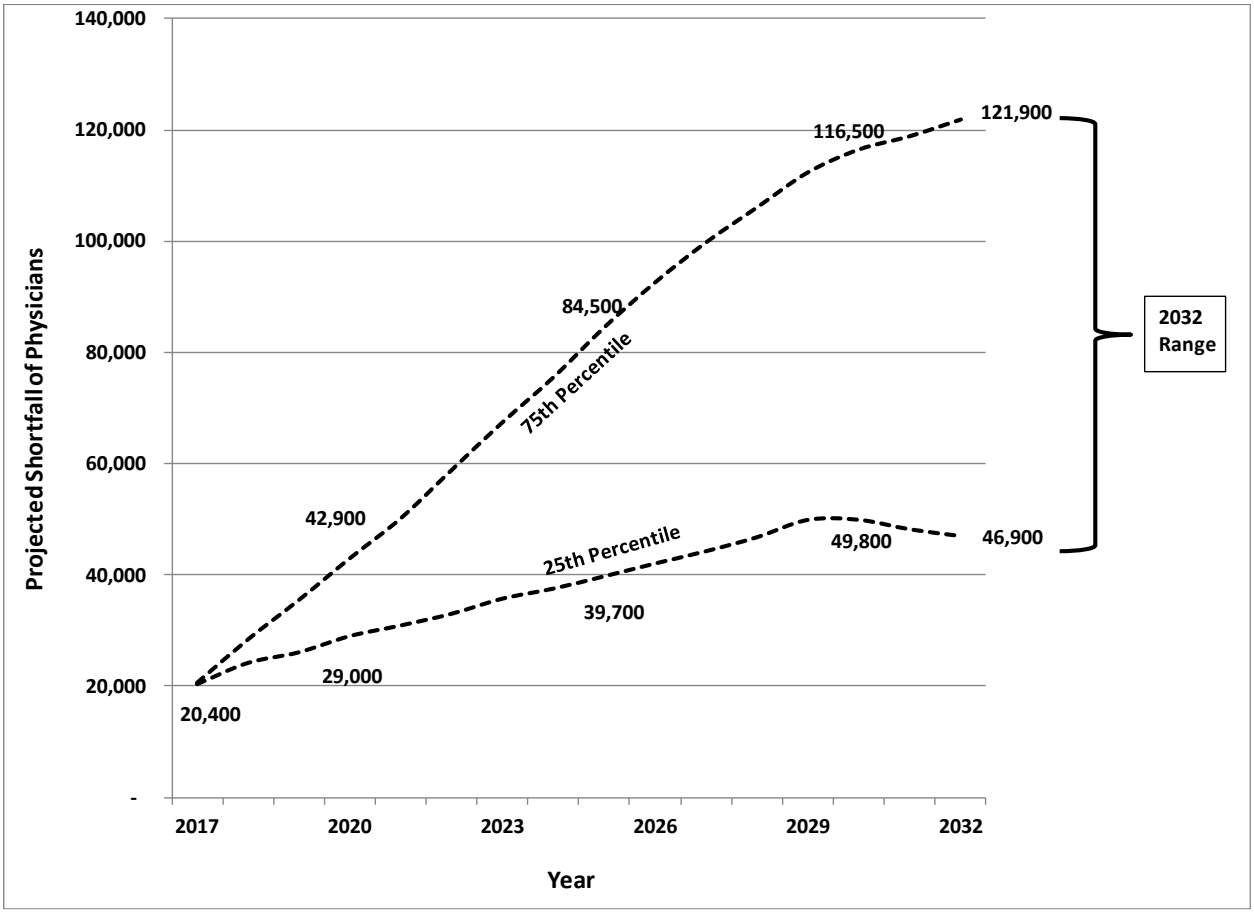


Exhibit ES-1: As complex systems have internal "checks and balances" to avoid extremes, the 25th to 75th percentile of the shortage projections reflects the most likely outcomes. This range grows over time, reflecting growing uncertainty in key supply and demand trends. The projected shortfall of total physicians in 2032 is between 46,900 and 121,900.

- **Demographics — specifically, population growth and aging — continue to be the primary driver of increasing demand from 2017 to 2032.** During this period, the U.S. population is projected to grow by 10.3%, from about 326 million to 359 million. The population under age 18 is projected to grow by only 3.5%, while the population aged 65 and over is projected to grow by 48.0%. Because seniors have much higher per capita consumption of health care than younger populations, the percentage growth in demand for services used by seniors is projected to be much higher than the percentage growth in demand for pediatric services.
- **Achieving population health goals will raise demand for physicians in the long term.** This scenario models the implications for physician demand associated with achieving select population health goals like reducing excess body weight; improving control of blood pressure, cholesterol, and blood glucose levels; and reducing smoking prevalence. Under this scenario, the longevity associated with improved population health would result in greater demand for services by 2032. The demand for physicians would thus be 33,900 FTEs higher in 2032 relative

to demand levels in the absence of achieving these goals. Although prevention efforts likely will reduce demand for some specialties, like endocrinology, demand for other specialties, like geriatric medicine, will increase.

- **If underserved populations had care utilization patterns like those of populations with fewer access barriers, demand for physicians could rise substantially.** Improved access to care is a national goal. We updated two hypothetical scenarios around the effects of removing access barriers. The health care utilization equity scenario models the implications for physician demand if currently underserved populations utilized health care at similar rates to populations facing fewer barriers to care. These estimates, which are excluded from the shortfall projection ranges, help illuminate the magnitude of current barriers to care and provide an additional reference point when gauging workforce adequacy.
- **More than two out of five currently active physicians will be 65 or older within the next decade, and changes in physician retirement decisions could have the greatest impact on supply** (Exhibit ES-2)**.** Analysis of the American Medical Association (AMA) Masterfile to develop the starting supply finds that physicians over age 65 account for 15% of the active workforce, and those between ages 55 and 64 make up 27% of the active workforce. Thus, over 40% of the physician workforce is at risk for retiring over the next decade.
- **The trend toward fewer weekly hours worked is reducing FTE-physician supply.** Over the past decade, there has been a trend toward physicians of all ages working fewer hours, with the decline in hours worked particularly large when comparing recent hours-worked patterns of younger physicians relative to physicians of a similar age a decade ago. If this trend continues and hours worked decline even further, then by 2032 the national supply will be 20,900 FTE physicians lower than if physician hours-worked patterns remained unchanged.

Exhibit ES-2: Projected Change in Physician Supply by Specialty Category, 2017-2032

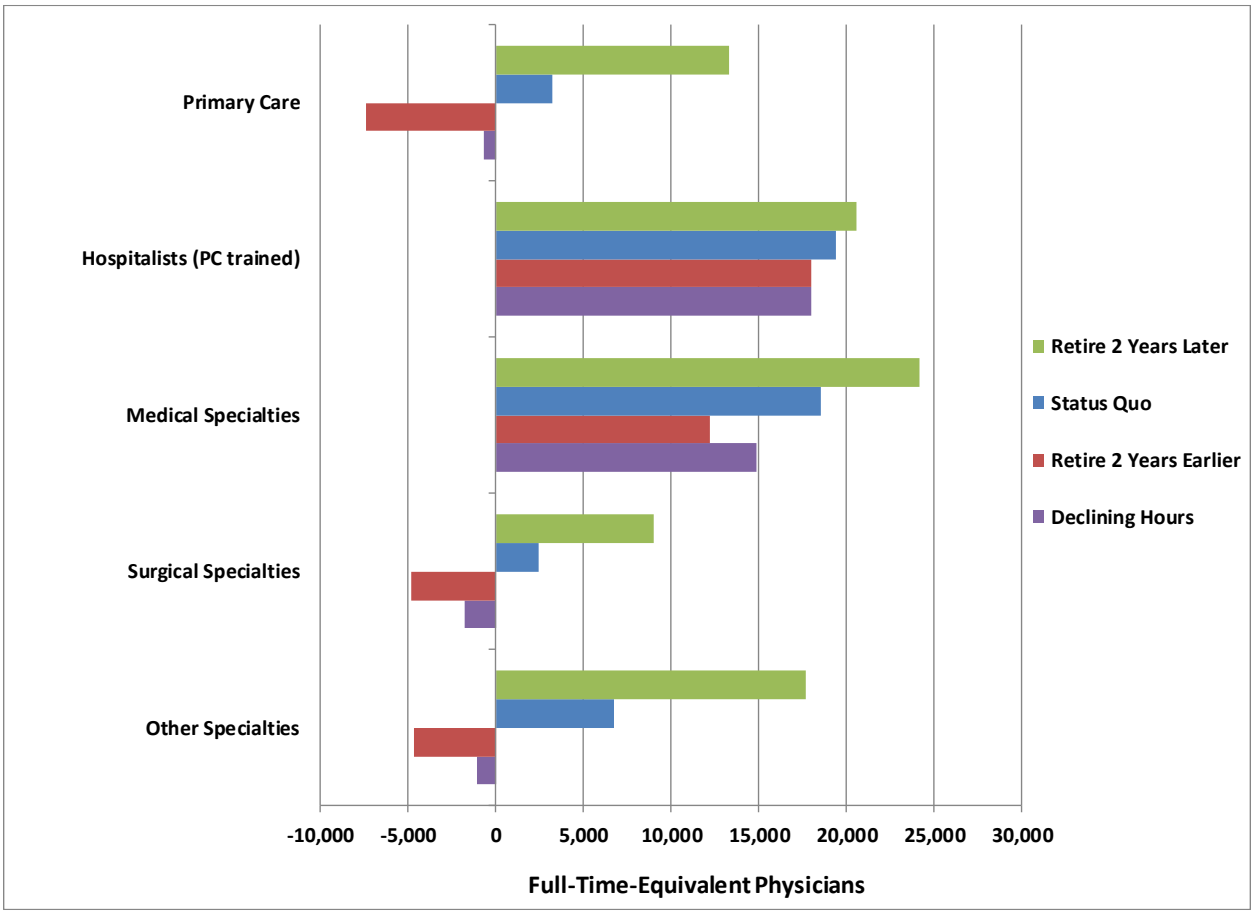


Exhibit ES-2: The projected change in physician supply (by specialty category) is presented for four different scenarios. The status quo supply scenario assumes a continuation of current hours worked and retirement patterns as well as the current number and specialty distribution of physicians completing their graduate medical education. Two supply scenarios modeled the workforce implications if retirement patterns were to change: one scenario models a shift to retiring earlier by an average of two years and a second scenario models an average delay in retirement of two years. The declining hours scenario reflects physician supply if the average annual decline in hours worked (by age and gender cohort) during the past decade continues.

New Research and Analyses

Differences between these updated 2019 projections and projections in previous years' reports reflect updates and refinements to supply and demand data inputs and methods. The 2019 projections:

- Use the same microsimulation model and similar supply and demand scenarios used to develop last year's projections but incorporate the most recent updates to supply and demand data.

- Extrapolate a 2017 level of care delivery to 2032 to project future demand under the status quo scenario, whereas the previous report extrapolated a 2016 level of care delivery to 2030 (this represents a shift to producing projections that consistently cover a 15-year period).
- Represent refinements to how specialty is assigned based on AMA Masterfile data.
- Reflect the federal Health Resources and Services Administration's upward revision of HPSA designations for primary care and mental health specialties.

The net effect of these refinements and updates to the model's inputs was to project a lower rate of growth in physician supply and a lower rate of growth in physician demand, with the overall shortfall range of total physician shortage comparable to last year's report. Compared with last year's report, the shortfall range has shifted higher for primary care. This reflects lower estimates of physicians entering primary care practice based on refinements to our modeling approach, which reclassified some physicians previously included in primary care, and an expectation that the number of primary care-trained hospitalists will continue to increase. Shortfall estimates have shifted lower for surgery, reflecting slightly higher numbers of physicians entering surgery, with most of this shift due to model and data refinements about physician hours-worked patterns and characteristics of the current surgeon workforce.

This report includes new exploratory work analyzing how the health care delivery system is evolving and the potential implications for physicians. While this new work was not used to construct the projected shortfall ranges, it incorporated several of the demand scenarios used to construct the shortfall ranges: (1) greater use of managed care principles, which shifts a portion of care from specialist physicians to primary care physicians and increases the overall demand for primary care services, (2) achieving select population health goals, and (3) reduced demand for physician services as the rapid growth in advanced practice provider (APP) supply shifts some care from physicians to APPs. We also modeled potential physician workforce implications of addressing unmet behavioral health needs and reducing demand for hospital-based care through a combination of prevention and diversion to appropriate community-based settings.

Some factors analyzed in the new evolving health care system scenario will increase demand for physicians, especially for primary care services, to provide increased access and more comprehensive care, such as (1) increased use of managed care, (2) efforts to achieve population health goals and the potential to reduce patient mortality, and (3) efforts to address unmet behavioral health needs. Other trends will decrease demand for physicians, such as increased use of APPs. Still other trends will redirect care to another physician specialty or care delivery setting — such as increasing efforts to redirect care away from hospitals to community-based settings. The net effect is a less-than-1% rise in demand for physicians in 2032 relative to the status quo scenario, which extrapolates future demand based on current care delivery patterns accounting for changing demographics. Additional research is needed to refine this work, but early findings suggest that the evolving care delivery system will not substantially change the total number of physicians required but will shift care across care delivery settings and physician specialties.

Future Directions in Physician Workforce Research

An ever-present challenge in making these workforce projections is the rapid pace of change in the health care system, often in unpredictable ways, while much of the information required for the models

is available only for the current health care system. Uncertainties continue to abound about whether, how, and how fast emerging payment and care delivery models might affect physician supply and demand. Still, evidence to date has not demonstrated that changes in payment or care delivery models substantially change physician workforce supply or demand, though they could.

Improving the accuracy of workforce projections requires using recent data and research to inform modeling assumptions. The AAMC is fielding a physician survey in 2019 that will collect data to update estimates of physician retirement patterns and physician work patterns. These data will help address supply-related questions of whether high levels of physician burnout are anticipated to accelerate physicians' plans to retire, to reduce hours worked, or both. Examples of directions for future research to improve analytic capabilities and advance the field of health workforce modeling include:

- **Changing physician work patterns:** The strongest drivers of projected physician supply are work hours and retirement patterns. Driven by multiple factors, including changing economic pressures, shifts in the structure of health care delivery, increasing burnout, and changing demographics, these patterns need to be understood in greater detail. More detailed, targeted, up-to-date, and ongoing data collection is necessary.
- **Market saturation and displacement of occupations and select specialties**: To what extent can the health care system continue to absorb the rapidly growing supply of APPs and hospitalists? Has a saturation point been reached, at least in some specialties and settings? What are the implications on demand for physicians? To what extent have APPs reduced demand for physicians in some specialties, and to what extent are they providing previously unfilled services and expanding access to care?
- **Current shortages and inefficiencies**: The demand projections start with the assumption that physician supply and demand were in equilibrium in 2017 — except for primary care and psychiatry, where federal government estimates for HPSAs are used as a proxy for the current shortfall. How might we better measure current shortages in other specialties?
- **New care delivery and financing models**: As health systems implement new care delivery models to reflect changes in health care financing and efforts to improve the quality and value of care delivered, information is needed on how these changes affect health care utilization and health workforce staffing. How will emerging technologies and payment reform that better enable telemedicine and new digital technologies affect demand for physician services, physician productivity, physician career satisfaction, patient access to care, patient care utilization, and outcomes?

These knowledge deficits present opportunities for ongoing research on the workforce implications of the evolving health care system and underscore the need for timely updates to projections.

I. INTRODUCTION

The AAMC has engaged IHS Markit Ltd. to carry out these studies, with each year's update building on earlier work published by the AAMC, dating back to 2008.[1] The primary purpose of these studies is to inform policies and strategies that help ensure the U.S. trains a sufficient number and specialty mix of physicians to further national goals of increased access to high-quality and affordable care. Other goals of these studies are to further discussion of unequal access to health care services and to advance the field of health workforce research.

The updated projections indicated a shortfall range of 46,900 to 121,900 physicians by 2032 — similar to the previous (2018) study's projected shortfall range for 2030 of between 42,600 and 121,300 physicians.[2] Projections of future supply adequacy are presented as a range to reflect uncertainties in key trends affecting physician supply and demand. Study findings support efforts to continue expanding the physician workforce.

The title of this report, *Complexities of Physician Supply and Demand Modeling*, reflects the data challenges and uncertainties encountered when projecting future workforce supply and demand.[3,4] In recent years and continuing into the future, we see (1) continued rapid growth in the supply of advanced practice registered nurses (APRNs) and physician assistants (PAs) and their contributions to care delivery; (2) ongoing health care reform efforts at the national and state levels; (3) efforts to improve care delivery through new payment models such as accountable care organizations (ACOs) and value-based reimbursement, team-based and integrated care, telemedicine, and patient-centered care; (4) advances in medicine, medical equipment, and information technology; and (5) more physicians employed by hospitals.[5-8] Uncertainties about future economic conditions have implications for physician supply and demand.[9,10] Against this backdrop is a U.S. population that is growing and aging. Mindful of the magnitude and speed of these changes, the AAMC contracted with IHS Markit to update physician workforce projections incorporating the latest available data on trends and factors affecting physician supply and demand.

The lead time required to adjust the nation's training capacity and train new physicians underscores the importance of projecting future adequacy of physician supply. Past studies typically have looked 10 to 15 years into the future. The AAMC's 2008, 2010, and 2015 studies projected through 2025; the 2016-2018 studies projected through 2030. This study models a 15-year time horizon — 2017 through 2032 — with the goal for study updates to maintain a 15-year projection.

2019 Report

This 2019 update continues to reflect the AAMC's commitment to regularly update projections and to refine scenarios that reflect the best available evidence on trends in health care delivery and the physician workforce. Key trends likely to affect the supply and demand for health care services were identified and modeled under multiple supply and demand scenarios. Projections for individual specialties were aggregated into five broad categories for reporting, consistent with specialty groupings designated by the American Medical Association. These include primary care, medical specialties, surgical specialties, and "other" specialties — with primary care-trained hospitalists reported as a fifth category starting with the 2017 report.[i]

Each year the updated demand projections also shift to reflect new levels of care use. For example, data inputs and demand projections in the 2018 report extrapolated a "2016 national average" level of care, while this 2019 report extrapolates a "2017 national average" level of care. The 2017 data were used because they were the most recent available at the time this study was conducted. A status quo demand scenario extrapolates current care use and delivery patterns to future populations, while alternative scenarios model different assumptions about ongoing and future trends in care delivery. The alternative supply and demand scenarios form the basis for the projection ranges comparing supply and demand.

This report delves more deeply than previous reports into emerging care delivery trends and the implications for physician demand. The emerging care delivery scenario modeled is in part an amalgamation of alternative scenarios used to calculate future ranges of supply and demand imbalances. Consequently, this new scenario modeled is not used to calculate future shortfall ranges.

The remainder of this update is organized along the lines of past reports and presents the comparison of updated physician supply and demand projections (Section II), describes the supply scenarios and results (Section III), and describes the demand scenarios and results (Section IV). Section V describes the new evolving care delivery scenario modeled and the implications for physician demand. Section VI updates the health care utilization equity scenarios. Key findings and conclusions are summarized in Section VII, and Section VIII discusses possible future directions in the field of health workforce research. Appendix 1 provides additional detail on modeling data and methods, and Appendix 2 contains additional tables and charts.

II. UPDATED PROJECTIONS

Projected growth in physician supply and growth in physician demand both are slightly lower than projections from our 2018 report, and growth in demand continues to exceed supply growth, leading to a projected shortfall of between 46,900 and 121,900 physicians by 2032. This projected shortfall for 2032 is of similar magnitude to the projected 2030 shortfall (44,900 to 121,300) in last year's report. The update reflects the following:

(1) The demand projections have been recalibrated to reflect a 2017 level of care (rather than a 2016 level of care) using updated data on population demographics, disease prevalence, and health risk factors; and newer data on health care use and delivery patterns.

(2) The federal government raised its estimates of the number of additional physicians required to provide a level of care that will remove the HPSA designations for areas with primary care and mental health shortages. These estimates are used as a proxy for the current national shortfall of physicians.[11] At the end of 2017, an estimated 14,472 primary care physicians and 5,906 psychiatrists were needed to provide a minimum level of care that would remove the HPSA designations.[ii]

(3) Projections of future insurance coverage are lower: expansion of insurance coverage as envisioned under the Affordable Care Act (ACA) was less than expected, while some state efforts to expand coverage continue to advance.[12,13]

(4) Supply projections for physicians, APRNs, and PAs have been updated using more recent data on the demographics and specialty mix of current supply, hours-worked patterns, and the characteristics and specialty mix of new graduates.

The modeled scenarios used to calculate the shortfall range remain the same as last year's report.

The updated primary care physician shortfall range for 2032 is 21,100 to 55,200 physicians, which is higher than in last year's report. The higher shortfall estimate reflects, in part, a downward revision in estimates of the number of new physicians entering primary care. Our revised estimate of the number of primary care-trained physicians becoming hospitalists is higher, and our estimate of the number of primary care physicians who later specialize in non-primary care specialties is higher. The projected 2032 shortfall ranges for non-primary care physicians are 14,300 to 23,400 for surgical specialties; 20,600 to 39,100 for the "other" physician specialties category; and 1,900 to 12,100 for medical specialties.

If the annual number of primary care-trained physicians becoming hospitalists remained similar over time, then by 2032, the general hospitalist supply would be about 10,900 to 12,700 higher than demand. Hospitals will not employ more hospitalists than are needed, so the rapid increase in hospitalist employment over the past decade cannot be explained by increases in hospital utilization. If the nation reaches saturation in the supply of hospitalists, physicians who might otherwise choose to become hospitalists might choose other specialties. Hospitalists are discussed in more detail later.

Projected shortfalls continue to be especially acute in select surgical specialties and other specialties such as psychiatry.

The supply and demand scenarios used to calculate the shortfall ranges reflect the uncertainty, complexity, and evolving nature of the environment within which physicians practice. One scenario alone is inadequate to convey the associated uncertainty. We examined five scenarios reflecting different assumptions in key supply determinants and six scenarios reflecting changes in key determinants of demand for physician services. We compared each supply scenario with each demand scenario to estimate the likely range of paired supply and demand projections. The supply and demand scenarios modeled are described in detail in Sections III and IV, respectively.

The extreme high and low scenarios are least likely to occur because multiple factors tend to mitigate highs and lows. For example, if physicians were to begin retiring earlier, the growing systemic stresses this could cause due to the growing shortfall of physicians might eventually lead some physicians to delay retirement. Given the propensity of such systems-level "checks and balances" to avoid extremes, we believe that the 25th to 75th percentile of the paired projections continues to reflect a likely range.

The updated projections reflect a similar estimate of the number of new physicians entering the workforce each year (28,854 versus the estimate of 28,836 used in the 2018 report) as well as continued growth in the number of APRNs and PAs entering the workforce. The starting supply

of physicians comes from analysis of the 2017 American Medical Association Masterfile. The updated demand projections reflect new data from the 2016 Medical Expenditure Panel Survey on health care use patterns (2012-2016 data were used), and updated data on population characteristics and prevalence of health risk factors as reflected by the 2017 American Community Survey and the 2017 Behavioral Risk Factor Surveillance System. In 2018, the U.S. Census Bureau lowered its population projections. Previous projections for 2030 were 359.4 million, but now the 2030 projection is 355.1 million, with population projected to reach 359.1 million by 2032.[14]

Total Physician Supply and Demand

Under most of the scenarios projected, the total projected demand for physicians exceeds total projected supply (Exhibit 1). Looking at the 25th to 75th percentile projections for total physicians, demand will continue to grow faster than supply, leading to a projected shortfall of between 46,900 and 121,900 physicians by 2032 (Exhibit 2).

Exhibit 1: Projected Physician Supply and Demand by Scenario, 2017-2032

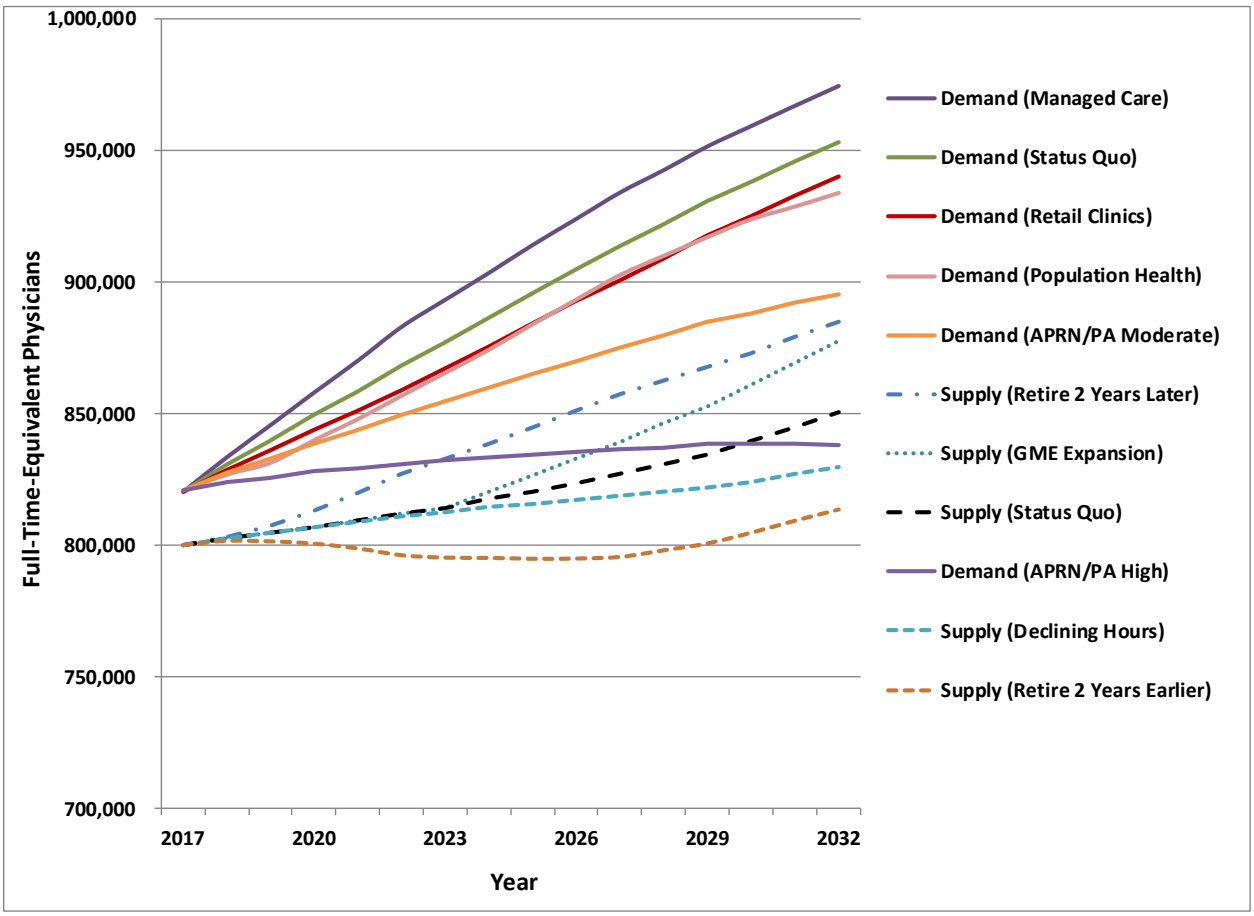
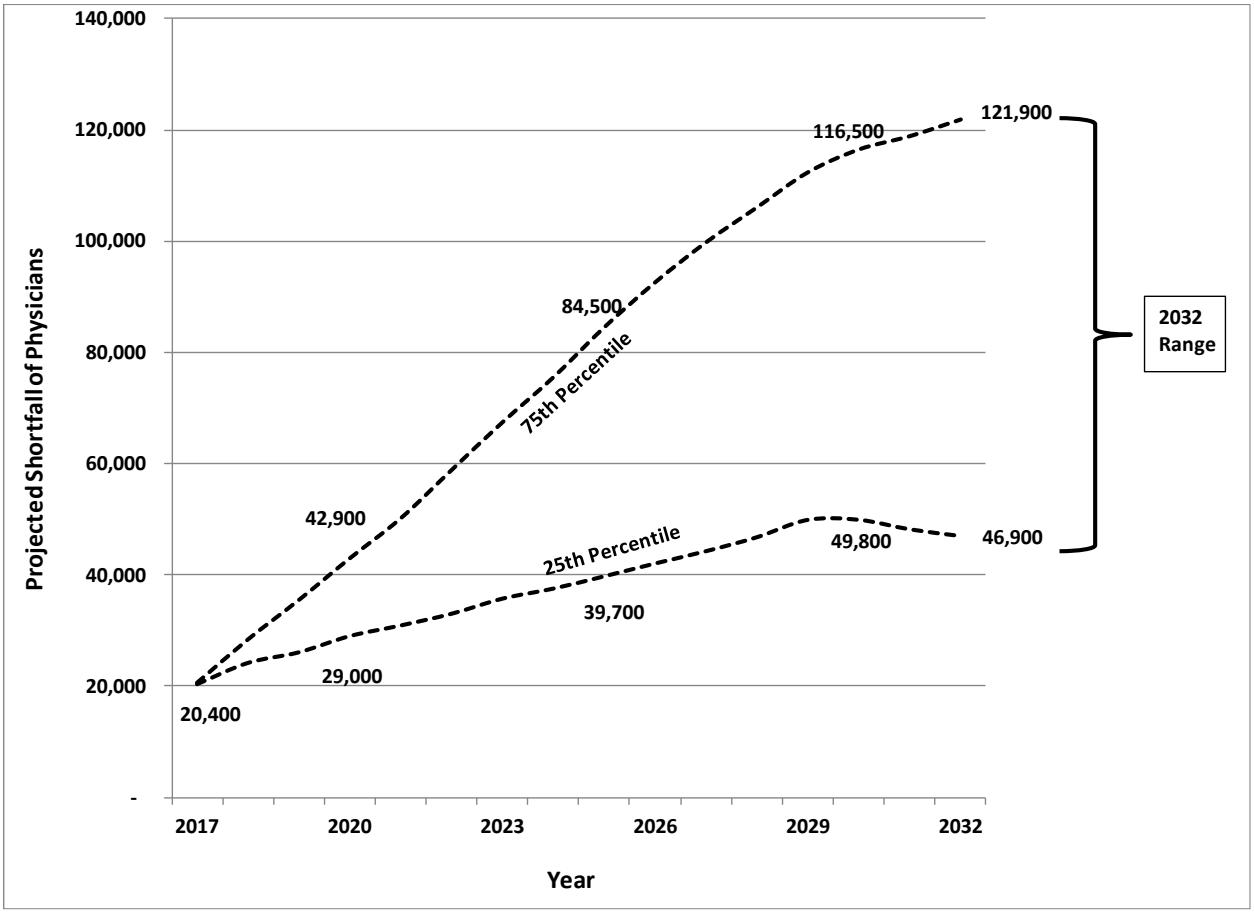


Exhibit 2: Total Projected Physician Shortfall Range, 2017-2032



Note: Reported projections are for 2017, 2020, 2025, 2030, and 2032.

Primary Care Supply and Demand

Comparison of projected supply and demand for primary care physicians (Exhibit 3) predicts a shortfall by 2032 of between 21,100 and 55,200 physicians (Exhibit 4). This shortfall range for 2032 is higher than the previous (2018 study) shortfall projection of 14,800 to 49,300 primary care physicians. The higher shortfall projection reflects our recalculations of the number of generalists who remain in primary care versus becoming a hospitalist or later specializing in non-primary care. As discussed later, our estimate of primary care-trained physicians becoming hospitalists each year increased from 1,572 in our 2018 report to 1,831 in this year's analysis. We also increased our estimate of the number of primary care physicians who later subspecialize in non-primary care specialties by 481. Although the number of physicians completing a primary care residency increased during the past year, after the adjustments for more physicians becoming hospitalists and refinement of the number specializing, our estimate is that 7,420 new primary care physicians enter the workforce each year (down from the 7,705 estimate in the 2018 report). The estimated shortfall of approximately 14,500 primary care physicians in 2017 is based on the Health Resources and Services Administration (HRSA) calculation that approximately this number of primary care providers is needed to remove the primary care shortage designation in currently designated shortage areas.

Each modeled supply and demand scenario is based on assumptions about the continuation of current trends or changes in care delivery that might happen at a future date. Thus, each scenario has a degree of uncertainty. The projected shortfall range widens over time, reflecting that (1) some trends have a compounding effect (such as annually training more nurse practitioners [NPs] and PAs), and (2) greater uncertainty exists in supply and demand determinants as we move further into the future. As illustrated in Exhibit 3, projected demand exceeds supply under all scenarios modeled except the scenario that reflects the largest assumptions for the degree to which increased supply of NPs and PAs in primary care will offset demand for physicians. This "APRN/PA High" demand scenario assumes (1) that the number of new NPs and PAs trained each year will continue growing at high rates, and the proportion of new entrants choosing primary care will remain at recent levels; and (2) that NPs and PAs will offset demand for physicians at the rates modeled. The supply of PAs and APRNs is growing at about six times the rate of growth of demand for health care services, raising the question of how many PAs and APRNs the health care system needs. Employment remains strong for both new and experienced NPs and PAs, and there appears to be room for continued growth in supply, but the rate of growth cannot be sustained indefinitely, and at what level the nation will reach market saturation is unknown.[15-18] Another factor that might limit supply growth is the shortage of clinical training sites.[19] Economic factors appear to be contributing to PAs and NPs choosing to specialize rather than enter primary care.[20]

Exhibit 3: Projected Supply and Demand for Primary Care Physicians, 2017-2032

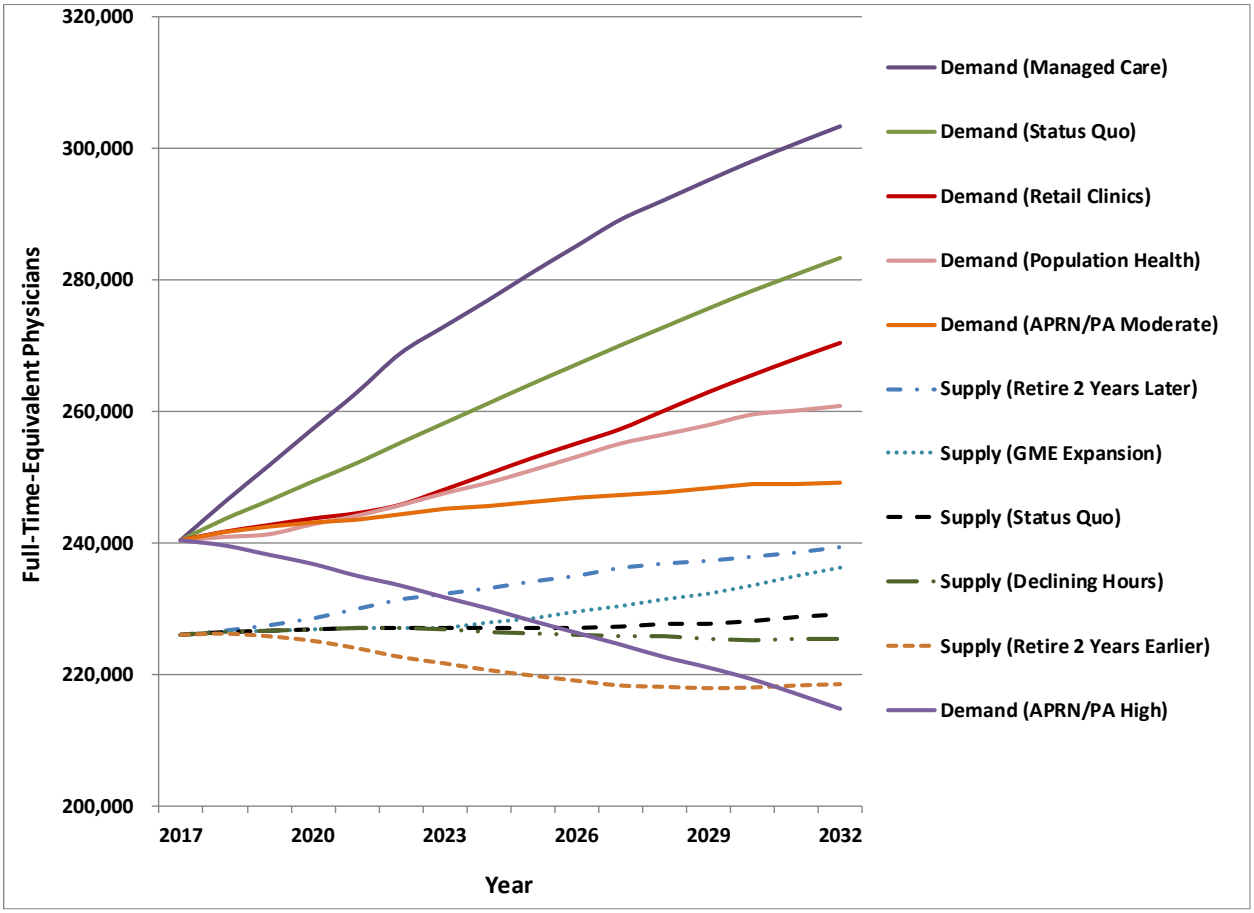
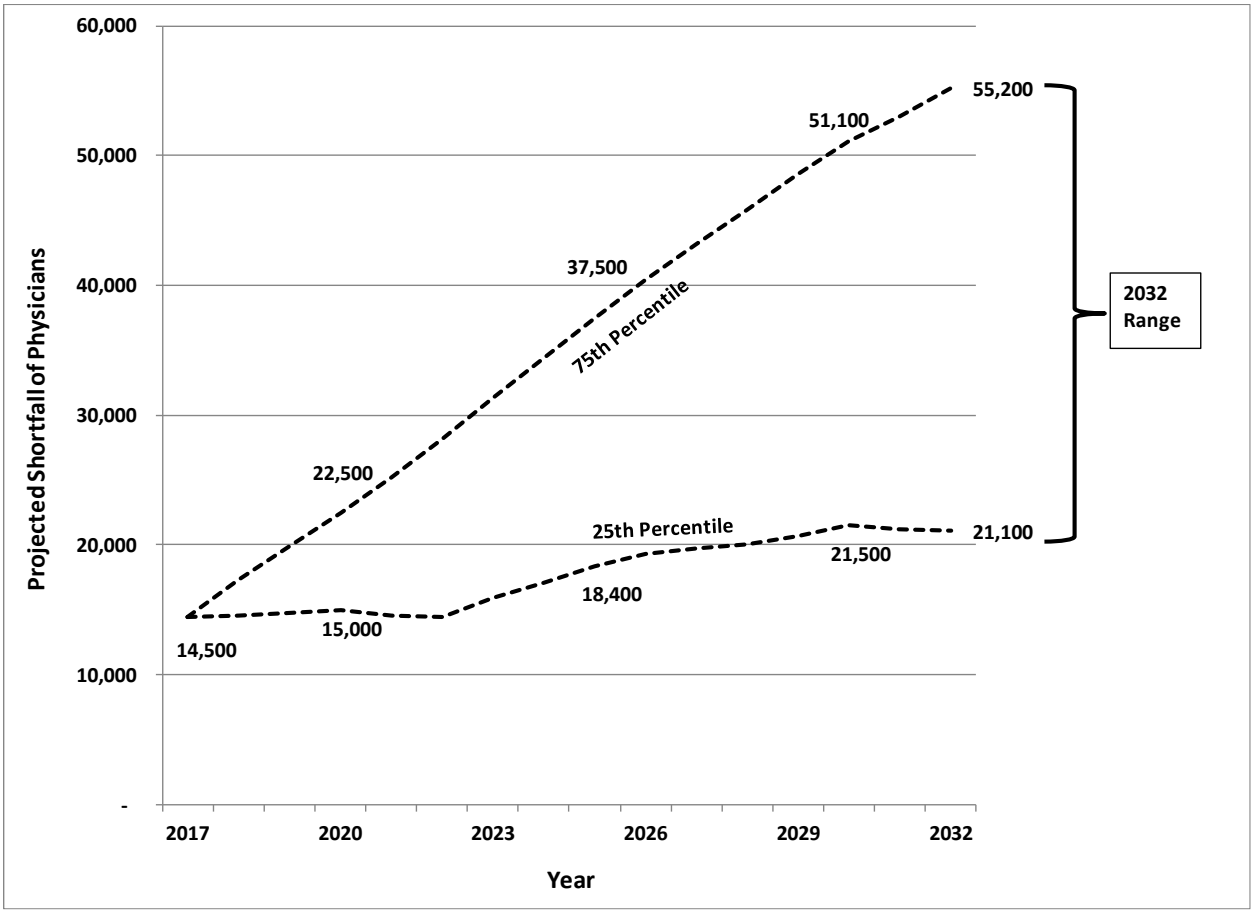


Exhibit 4: Projected Primary Care Physician Shortfall Range, 2017-2032



Note: Reported projections are for 2017, 2020, 2025, 2030, and 2032.

Non-primary Care Supply and Demand

Exhibits 5 through 10 depict the overall range of supply and demand growth and projected shortfall ranges for non-primary specialty category. Under the scenarios modeled, we project a shortfall of care physicians by between 24,800 and 65,800 non-primary care physicians by 2032. Non-primary care specialties are grouped into four categories: medical specialties, surgical specialties, other specialties, and primary care-trained hospitalists.

Medical Specialties

The demand for physicians in medical specialties is growing rapidly, but since many physicians are choosing internal medicine and pediatric subspecialties, supply is also growing in these specialties (Exhibit 5). Under the scenarios modeled, this update projects a shortfall range of 1,900 to 12,100 FTEs by 2032 (Exhibit 6), a slightly higher shortfall from the previous year's projected range for 2030
of a 700 surplus to a 9,600 shortfall. These projections are aggregated across all medical specialties, and projections of the future adequacy of supply vary by individual subspecialty.

Exhibit 5: Projected Supply and Demand for Medical Specialist Physicians, 2017-2032

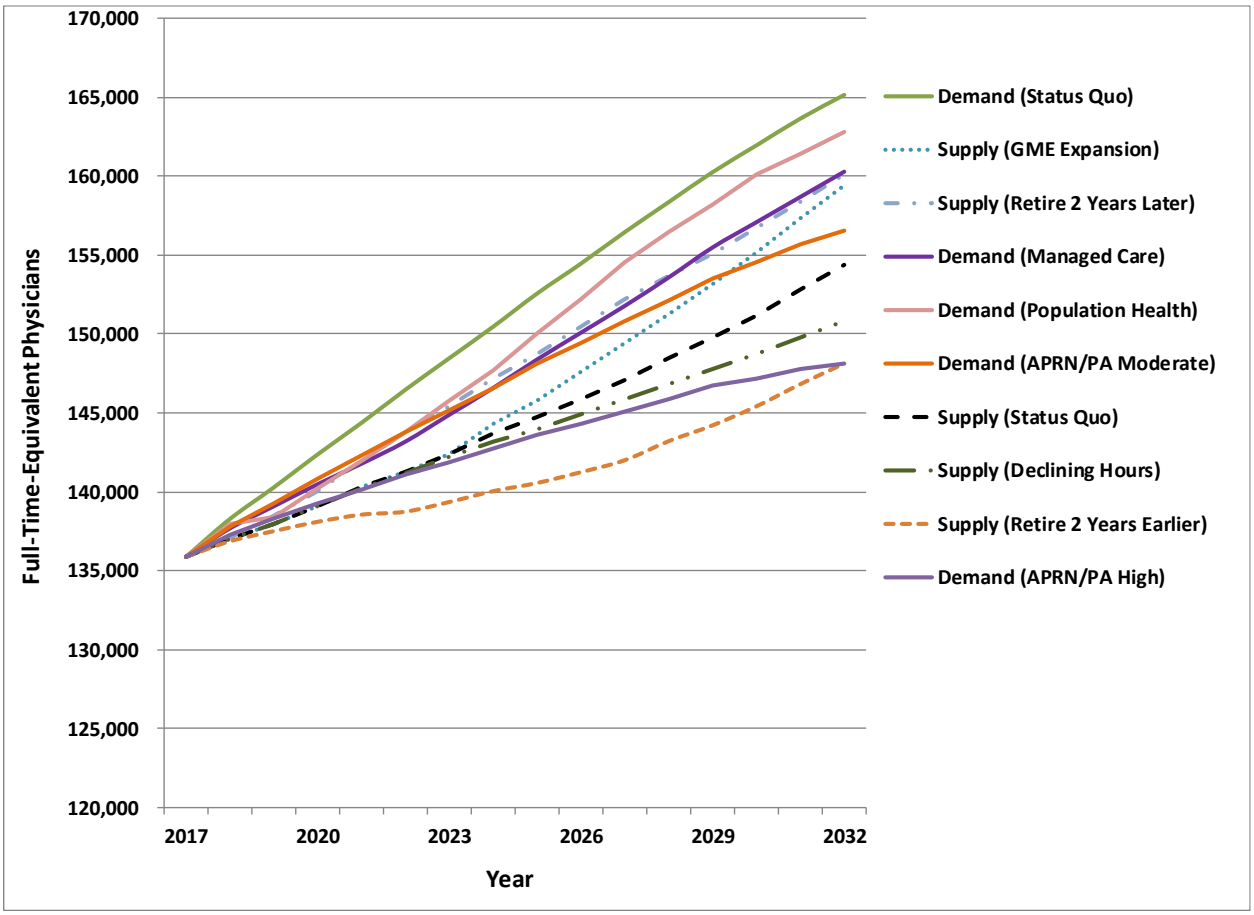
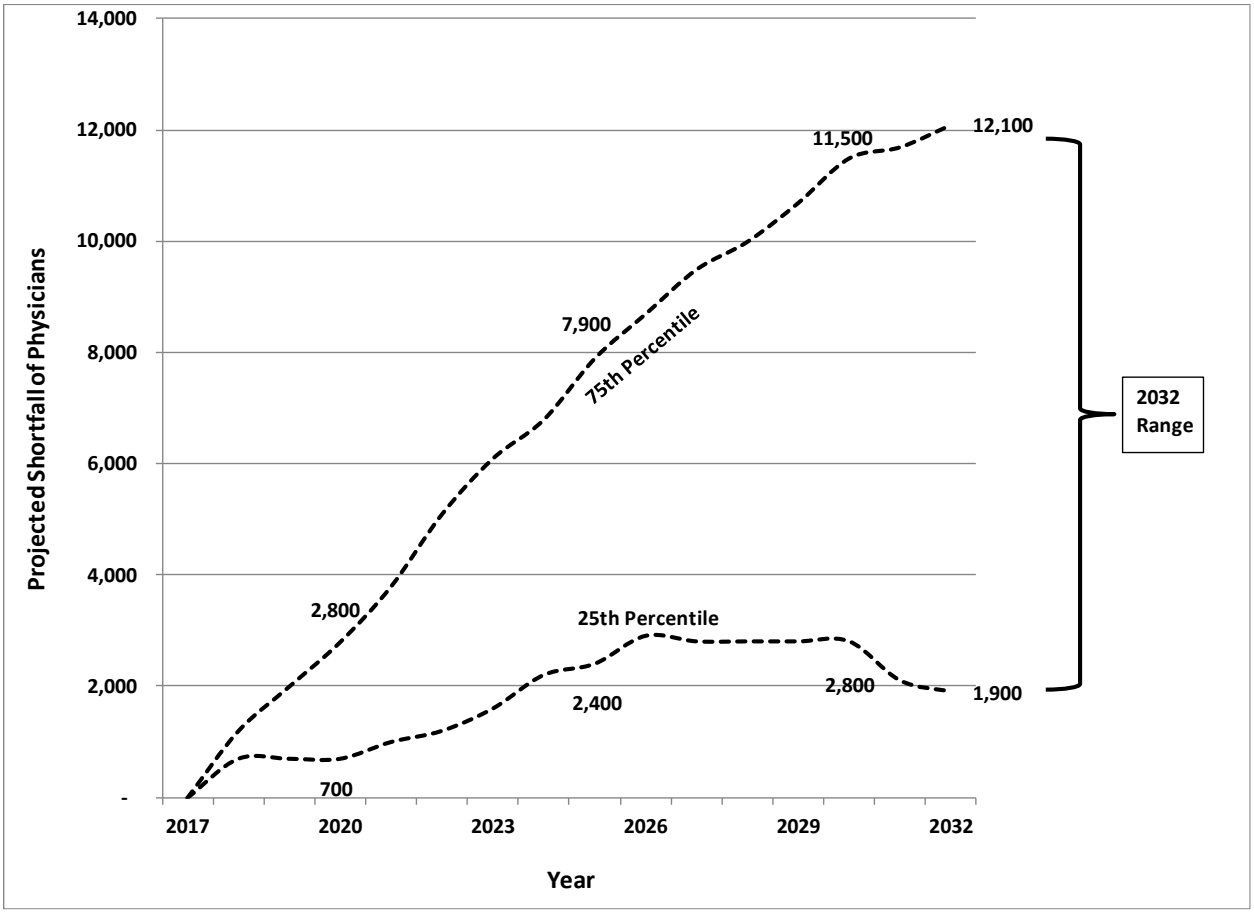


Exhibit 6: Projected Medical Specialist Physician Shortfall Range, 2017-2032



Note: Reported projections are for 2020, 2025, 2030, and 2032.

Surgical Specialties

Based on current trends, the supply of surgeons is not projected to change substantially over the next 10-15 years, as future attrition offsets the number of newly trained surgeons. Demand continues to grow, with projected demand exceeding projected supply under all scenarios modeled (Exhibit 7). The projected shortfall for 2032 is between 14,300 and 23,400 surgeons by 2032 (Exhibit 8), compared with last year's projected shortfall range of between 20,700 and 30,500 in 2030. This report's lower shortfall estimates reflect slightly higher estimates of the annual number of new surgeons completing training, but most of the lower shortfall estimate is associated with additional cleaning of the AMA Masterfile data to estimate starting supply, which shifted the age distribution of surgeons slightly lower than previously estimated.[iii] These projections represent an aggregation, and substantial variations in shortfall projections for individual surgical specialties would be expected.

Exhibit 7: Projected Supply and Demand for Surgeons, 2017-2032

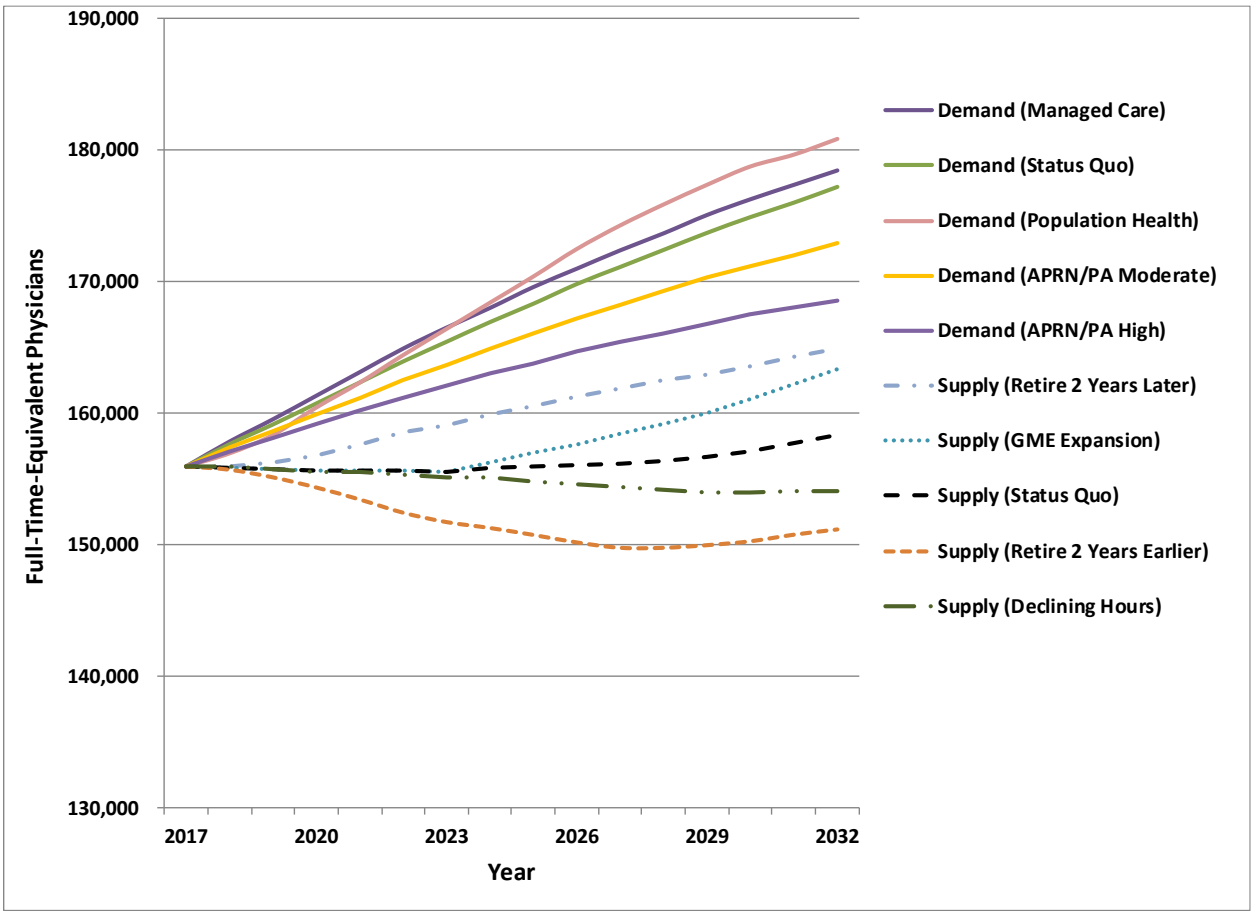
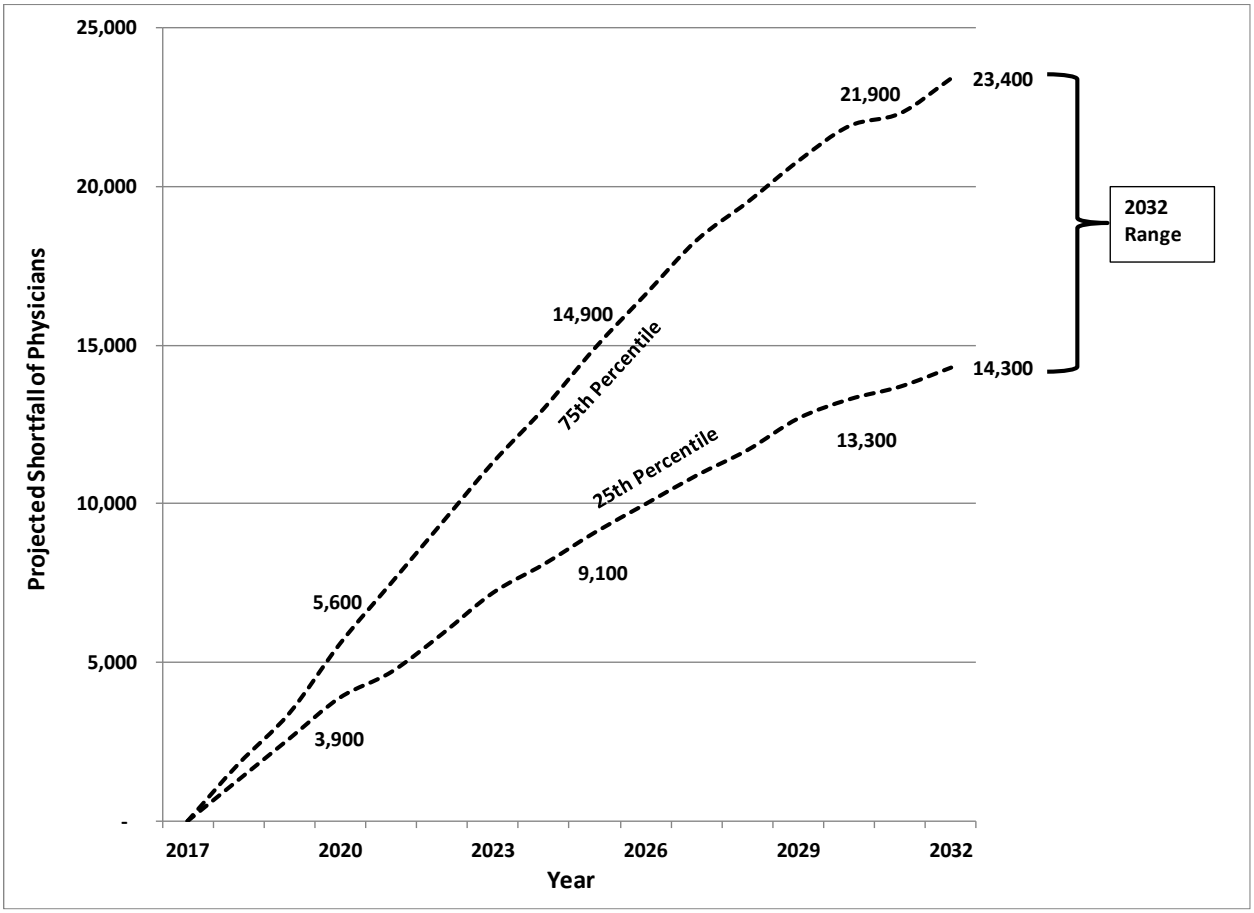


Exhibit 8: Projected Surgeon Shortfall Range, 2017-2032



Note: Reported projections are for 2020, 2025, 2030, and 2032.

Primary Care-Trained Hospitalists

Starting with the 2017 report, primary care-trained hospitalists are analyzed separately from the primary care category. The number of physicians working as hospitalists over the past decade has grown rapidly[21] — reflecting a shift in how care is provided rather than a growing demand for hospital inpatient services (which has declined over this same period[22]). Analysis of billing records by the AAMC identified physicians with at least 90% of revenue billed through hospitals as physicians likely practicing as hospitalists. Analysis of billing records over multiple years suggests that the number of physicians becoming hospitalists for the first time increased from 1,527 in our 2018 report to 1,831 for this year's analysis. We estimate that approximately 508 hospitalists retire each year of the simulation, on average, so the total number of hospitalists increases by approximately 1,323 annually. If this trend were to continue, then by 2032 the nation will produce 10,900 to 12,700 more hospitalists than would be required to meet the growing demands of an aging population. Having more hospitalists reduces the amount of primary care physician time required for hospital rounds, freeing up time to see more patients in ambulatory settings; the increase in primary care productivity might not offset the loss of primary care providers to the hospitalist workforce, however.[23,24] Hospitals will not hire more hospitalists than are needed. Hence, as with many relatively young

professions, a shift has been taking place that is not being captured by the workforce simulation model. The rapid growth in hospitalist supply over the past two decades has been facilitated by financial considerations that increased primary care physician willingness to turn inpatient care over to hospitalists; new duty-hour limits for residents, which reduced their availability to oversee patients in hospitals; the widespread implementation of electronic health records and hospital focus on quality and patient safety; and the availability of newly trained generalists trained in hospital settings.[21] It is unclear whether this growth surge in hospitalist employment will continue or the nation will reach a saturation point at which hospitalist demand will grow at roughly the same rate as demand for inpatient services. Likewise, if saturation is reached, it is unclear whether physicians who might otherwise choose to become hospitalists would choose other specialties.

Other Specialties

For the Other Specialties category, projected demand exceeds supply for all scenarios except the scenario with the lowest demand projection paired with the highest supply scenario (Exhibit 9). The projected shortfall range for 2032 is 20,600 to 39,100 physicians (Exhibit 10), similar to last year's shortfall range of 20,300 to 36,800 physicians in 2030.

Exhibit 9: Projected Supply and Demand for Other Specialties, 2017-2032

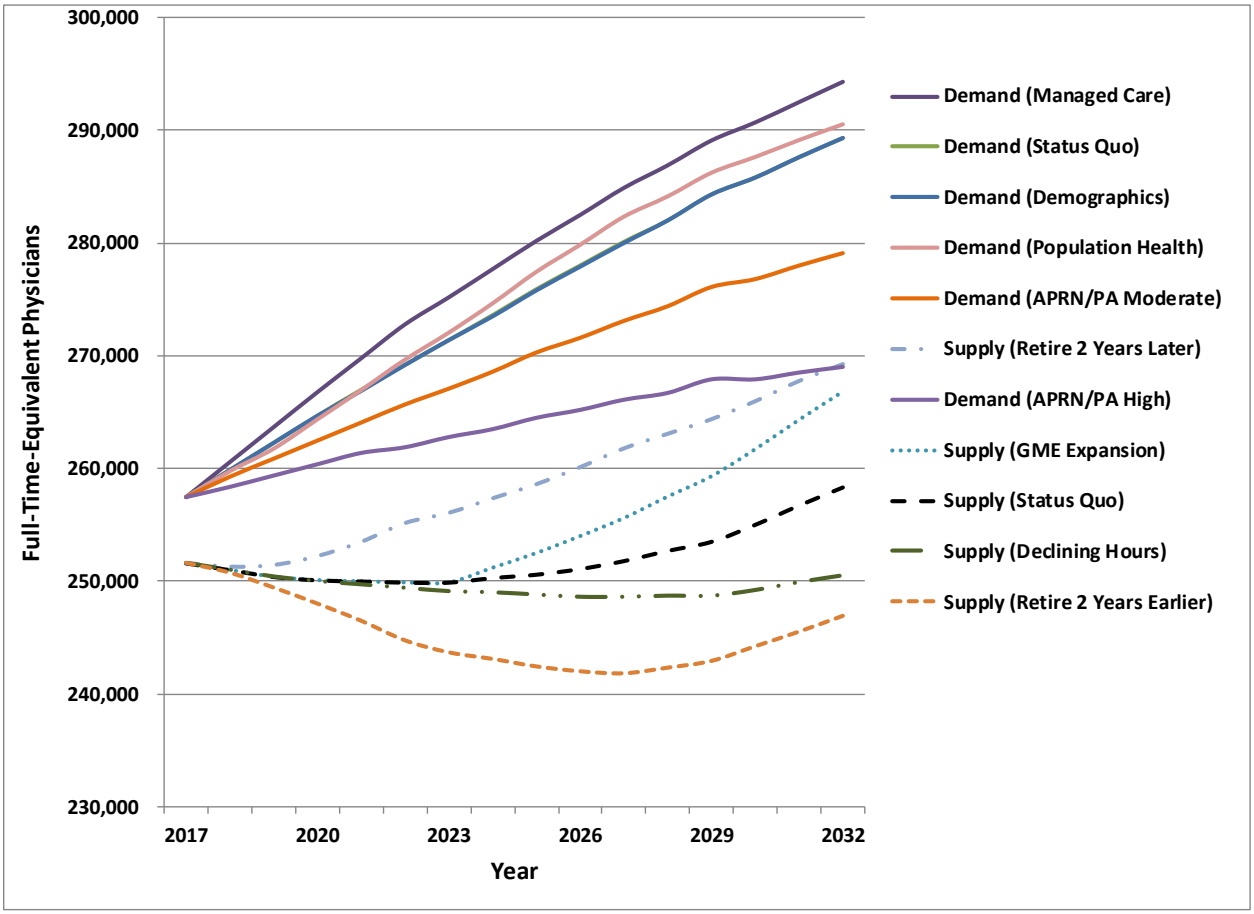
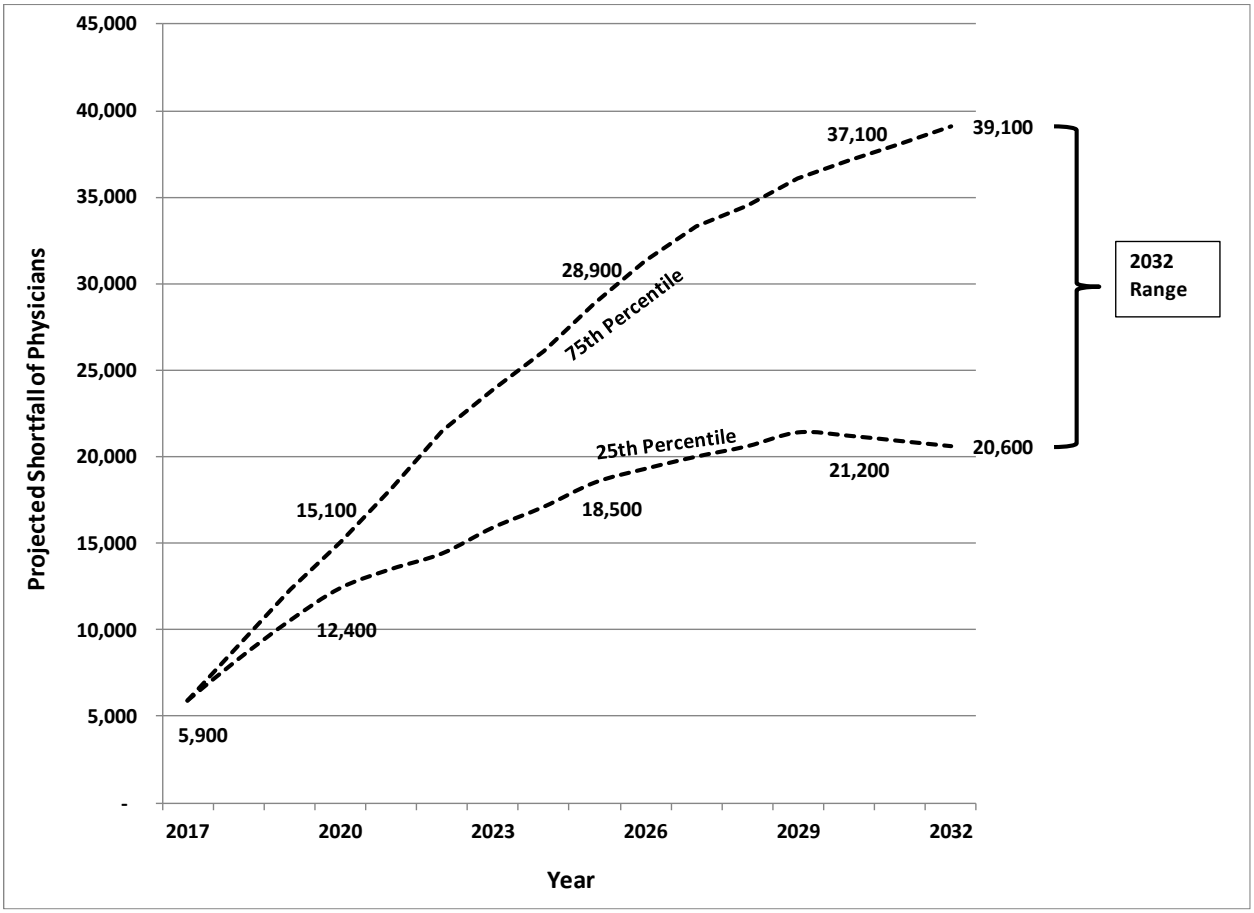


Exhibit 10: Projected Other Specialist Physician Shortfall Range, 2017-2032



III. SUPPLY MODELING

The microsimulation supply model projects future physician supply based on the number and characteristics of the current supply, the number and characteristics of new entrants to the physician workforce, hours-worked patterns, and retirement patterns. The projections include all active physicians who have completed their graduate medical education. The model has been documented elsewhere, and a brief description of modeling methods is in Appendix 1.[25,26] Below we summarize modeling assumptions and results for supply scenarios modeled in this 2019 update.

Supply Modeling Assumptions and Scenarios

Consistent with the organization of the previous 2015-2018 reports, this year the status quo, retirement, and hours-worked scenarios described below were included in the analysis comparing physician supply and demand to project a range for future adequacy of physician supply. As in past years, modest graduate medical education (GME) expansion was modeled separately as a policy-oriented scenario but was not included in the shortage projections.

- **Status quo**: This scenario assumes continuation of the status quo in terms of number and characteristics of physicians newly entering the workforce, hours worked, and retirement patterns. While the number of new physicians entering the workforce has increased in past years by about 1% annually, this trend is tempered by tightening budgets for GME. Our estimate of annual new physicians entering the workforce (28,854) is similar to last year's estimate (28,836).
- **Early and delayed retirement:** Reflecting uncertainty about future physician retirement patterns, the modeled scenarios assume physicians retire two years earlier or two years later, on average, relative to current patterns. Scenario assumptions reflect that physicians might delay or speed retirement for financial, health, and other reasons. The 2018 Medscape National Physician Burnout and Depression Report indicates that 42% of physician respondents reported burnout, with long work hours and excess bureaucratic tasks leading contributors to burn out.[iv,27] Burnout could contribute to physicians accelerating retirement.[28-32]
- **Declining average hours worked**: Our previous report estimated the decline in average weekly hours worked by physicians between 2000 and 2016 using the American Community Survey (ACS) and modeled the implications on future supply if this trend continued. Published work attributes part of this decline in work hours to high rates of physician burnout and a growing proportion of physicians who are employed rather than self-employed.[28-30,33] Further analysis of the ACS suggests the decline in average weekly hours worked has been slowing down.[v] Declines in average hours worked were greatest for younger, male physicians, with some age-gender combinations experiencing an increase in average hours worked. For this model we simulate the effects if the average annual change in hours worked during the past decade (2005-2007 to 2015-2017)continue. We modeled the decline in hours worked by age and gender as a cohort effect.
- **GME expansion**: This scenario assumes an increase in federally funded GME support to train an additional 15,000 physicians per year, with 3,000 new residency slots added per year over a five-year period. Given an average residency length of four years, this increase is modeled as an additional 3,750 new physicians starting to enter the workforce each year, beginning in 2024. This scenario is based on the proposed Resident Physician Shortage Reduction Act of

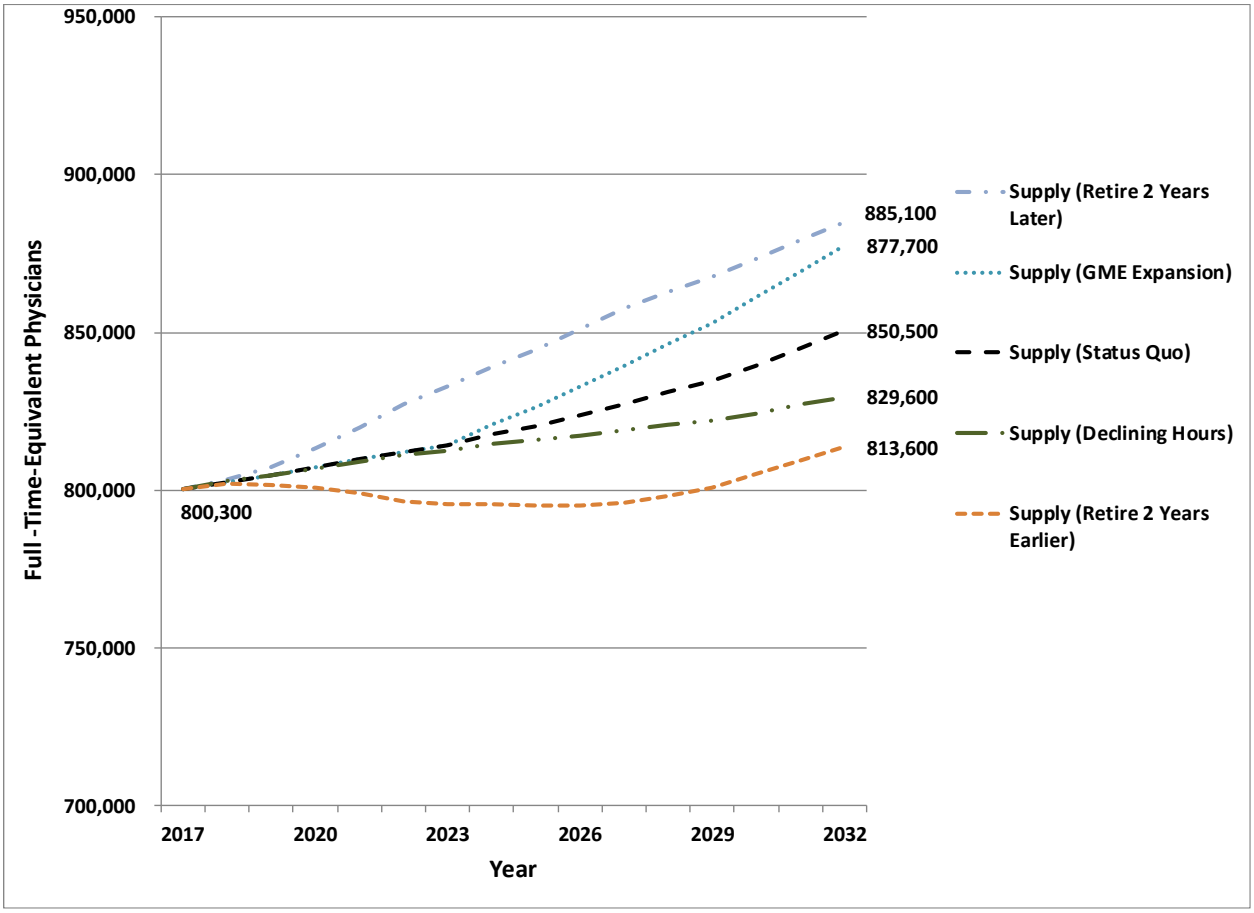
2019. The distribution of new residency slots across specialties is currently unknown, so for modeling purposes we assume that all specialties will gain the same proportion of residency slots. This policy-related scenario was not included when calculating the shortage ranges.

- **Hospitalist projections**: Consistent with previous reports, we modeled primary care-trained hospitalists separately from primary care physicians.[vi] The hospitalist projections build on work by the AAMC to identify hospitalists using Medicare fee-for-service billing records linked to the AMA Masterfile. We defined hospitalists as physicians who generate 90% or more of their billing for hospital-based services. We used reported practice location from the AMA Masterfile to reflect that a small number of pediatricians are hospitalists. The analysis estimates approximately 30,900 physicians were primary care-trained hospitalists in 2017. We estimate 1,831 new primary care-trained hospitalists per year (higher than estimates of 1,572 and 1,647 in the 2018 and 2017 reports, respectively). Hospitalists trained in non-primary care specialties are modeled with projections for their individual specialty.

Supply Projections

Updated annual projections for physician supply across all scenarios modeled are summarized in Exhibit 11. Under the status quo scenario, total physician supply increases from 800,300 in 2017 to 850,500 in 2032 — a 6% increase. This is below the approximately 10.3% projected growth in the U.S. population over this period, contributing to a 4% decline in the physician-to-population ratio (declining from 246 to 237 per 100,000 population).

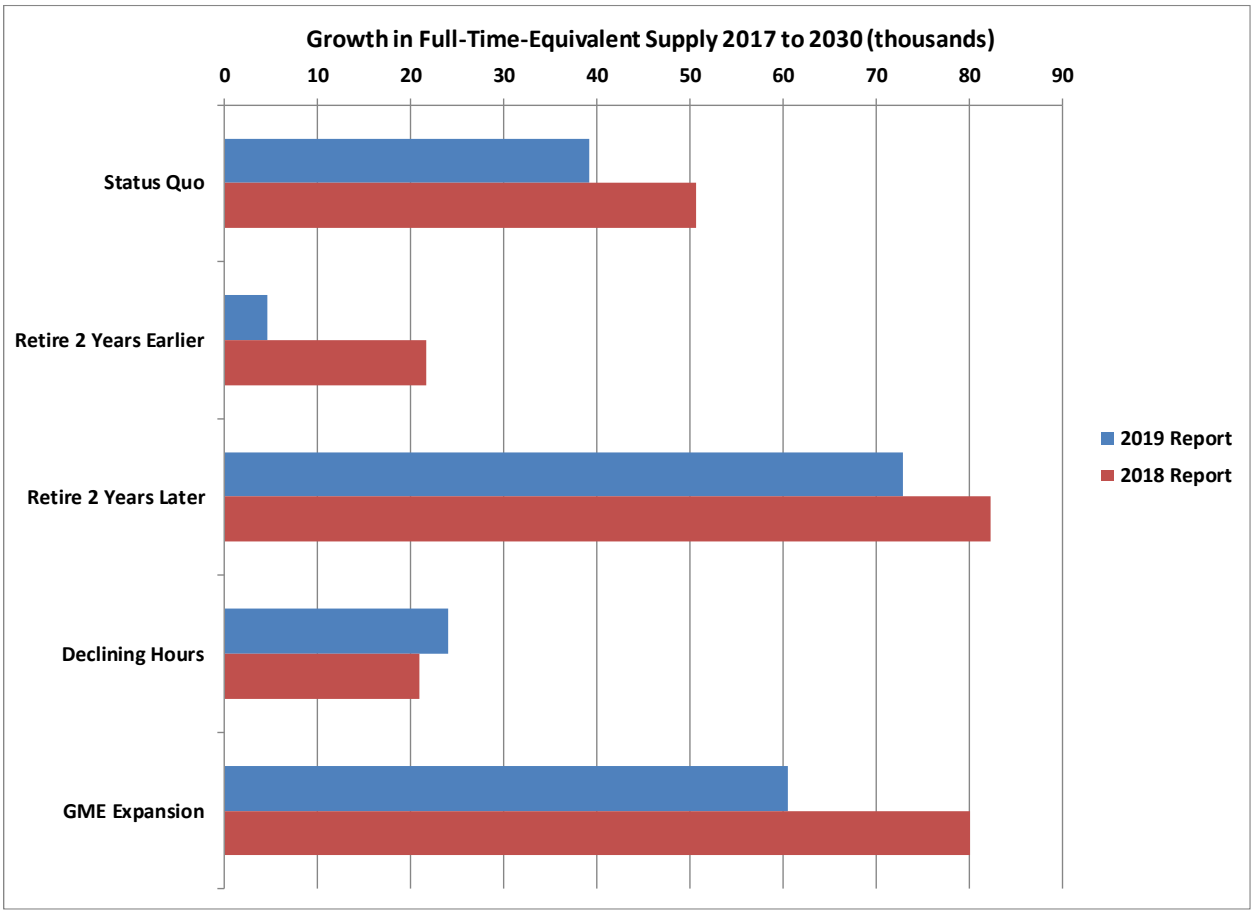
Exhibit 11: Projected Supply of Physicians, 2017-2032



As illustrated in Exhibit 12, this year's updated supply projections covering the period 2017 to 2030 (the years that overlap this report and last year's report) show slower growth in supply compared with last year's report. The exception is higher supply growth for the declining hours scenario, which is based on ACS data showing that the rate of the decrease in average weekly hours worked by physicians from year to year tends to be slowing. The lowered supply projections are the results of refinements to the projection model and data inputs — including lower estimates of hours worked among older physicians.[vii]

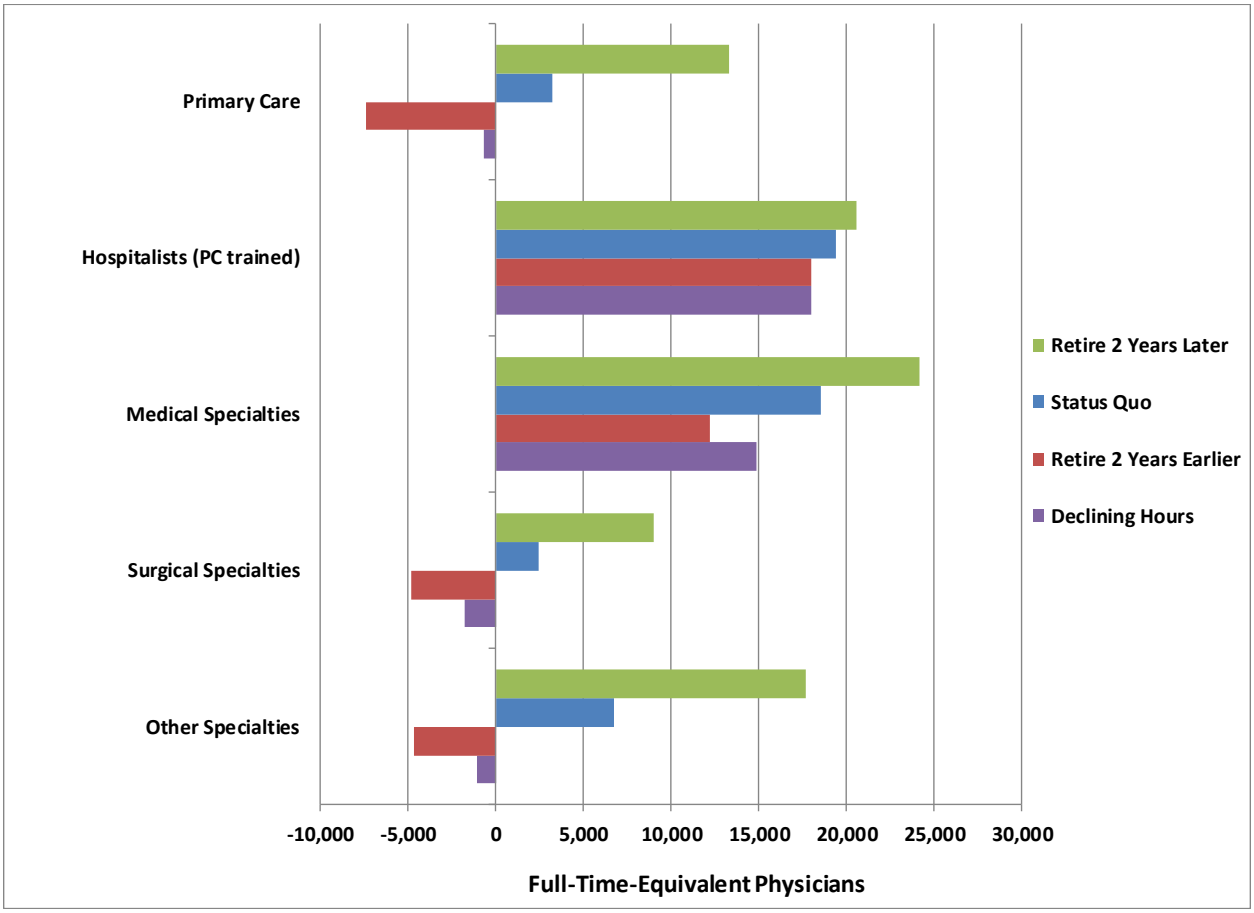
The GME expansion scenario is designed to approximate proposed legislation that would increase the number of physician residency slots. Because the legislation has yet to be passed, for this report we modeled a delayed effect of the proposed legislation by one year in this study compared with last year's study, which means that the scenario has lower supply growth in 2030 than before.

Exhibit 12: Projected Change in Physician Supply: 2019 vs. 2018 Scenario Projections



Projected growth in physician supply by specialty category between 2017 and 2032 ranges from a high of about 24,200 additional FTEs among medical specialties under a delayed retirement scenario to a projected 7,400-FTE decrease in primary care physicians under a declining hours scenario (Exhibit 13). Under the modeled scenarios, the medical specialties and primary care-trained hospitalist categories experience the largest growth, while for primary care, surgical specialists, and the Other Specialties categories, supply growth is much smaller and, under some scenarios, projected to decline.

Exhibit 13: Projected Change in Physician Supply by Specialty Category, 2017-2032



IV. DEMAND MODELING

This section presents an overview of the demand scenarios modeled and updated demand projections. A summary of demand modeling methods and data is provided in Appendix 1. Detailed information about the microsimulation modeling approach was published elsewhere.[25,26]

Demand Modeling Assumptions and Scenarios

We projected physician demand under scenarios that reflect varying assumptions about the use of health care services and care delivery. All scenarios modeled reflect changing demographics from 2017 to 2032. The scenarios also include a small increase in medical insurance coverage, reflecting ongoing efforts to expand coverage in five states (Idaho, Maine, Nebraska, Utah, and Virginia), though at the national level the projected expansion is smaller than modeled in previous reports that assumed continuing expansion under ACA. Expanded insurance coverage under ACA has largely already occurred, with 13 states not expanding Medicaid programs and with no current plans to do so. Uncertainty about the future of ACA and the demand implications are discussed below.

As in previous reports, we modeled the implications of greater use of managed care, retail clinics staffed primarily by advanced practice providers (APPs), the contributions of PAs and APRNs, and the implications of achieving certain population health goals to illustrate the potential impact of improved preventive care. In Section V we present a scenario modeling evolving care delivery, which is a combination of multiple demand scenarios presented below, as well as other possible trends with potential implications for physician demand but for which there is limited information in the literature to define parameters for the scenario. Modeled scenarios used to estimate future shortfall ranges are described below in more detail.

- **Changing demographics and continuation of ACA (status quo)**: This scenario extrapolates current health care use and delivery patterns to future populations using projected demographic shifts (e.g., age, gender, and race/ethnicity) from 2017 to 2032 and anticipated change in health care use associated with increased coverage, reflecting ongoing efforts in five states to expand insurance coverage. By 2017, many of the expanded-coverage provisions of ACA had been implemented, and this is reflected in the starting-year demand estimates. The remaining demand scenarios summarized below all build on this scenario and reflect both changing demographics and continuation of ACA, but with only small increases in insurance expansion, reflecting efforts by five states to expand coverage.

  Between 2017 and 2032, the U.S. population is projected to grow about 10.3%, from about 326 million to 359 million. The population under age 18 is projected to grow by 3.5%; the population aged 65 and older is projected to grow by 48.0%; and the population age 75 and older is projected to grow by 75.3%.[14] The status quo scenario reflects differences in annual use of health care services by race and ethnicity even after controlling for age, socioeconomic factors including having medical insurance, and presence of select chronic conditions.

  The total U.S. population that is non-Hispanic white is projected to remain constant at about 197.3 million between 2017 and 2032, while the population that is non-Hispanic black is projected to grow by 14.6% (from 40.1 to 46.0 million). The non-Hispanic, all-other-races category is projected to grow 30.4% (from 29.5 to 38.4 million), while the Hispanic population

is projected to grow by 31.5% (from 58.8 to 77.4 million). Based on demographics alone, the percentage growth in demand for health care services used by seniors is projected to be much higher than the percentage growth in demand for pediatric services, and a growing proportion of demand will be for racial minority and Hispanic patients.

- **Managed care as a proxy for ACOs and value-based payment models**: Over the past several decades, the U.S. health care system has explored a variety of value- and outcome-based payment and of integrated care delivery models for both publicly and privately insured populations. Delivery models have differed in terms of who bears the risks when patients' health care use exceeds expected levels and when patients access out-of-network care. Still, the goals of these delivery systems are similar, including improved care coordination and quality, improved efficiency by eliminating unnecessary care and shifting care to appropriate lower-cost settings and providers, improved preventive care efforts, and improved control of cost growth.

  In early 2018, there were over 1,000 ACOs across the United States, covering an estimated 32.7 million lives, or 10% of the population.[34] A growing body of literature has been published on the impact of ACOs on care utilization and quality, and the results have been mixed.[35-39] A systematic review found that among published ACO outcomes, there is evidence that Medicare ACO implementation is associated with reduced hospital inpatient use and emergency department visits and improvements in some measures of preventive care and disease management.[35]

  The goals of ACOs are consistent with goals of other risk-bearing organizations, such as managed care organizations, for which historical data for quantifying differences in patient care utilization patterns are more readily available in databases like the Medical Expenditure Panel Survey (MEPS). Looking historically at the effect of managed care on the use of services can thus provide insights into what might happen if ACOs and other integrated care models gain greater prominence. Using MEPS data, we analyzed systematic differences in use of health care services for patients in a managed care plan versus patients not in managed care, controlling for demographics, health risk factors, and disease presence. Consistent with assumptions guiding the projections in previous reports, this scenario models physician demand implications if 100% of the population is enrolled in risk-based entities. The key modeled impacts are a 7.1% overall increase in demand for primary care physicians, a 3% decrease in total demand for medical specialty physicians, and mixed impact on demand for surgeons and other physician specialties.

- **Expanded use of retail clinics**: Retail clinics provide a convenient, cost-effective option for patients with minor acute conditions with widespread coverage by many insurance plans.[40] The number of retail health clinics in the U.S. was projected to exceed 2,800 by 2018, double the 1,400 estimate for 2012.[41] Analysis of Aetna health claims data for approximately 20 million patients per year looked at trends in acute-care visits for treatment of low-acuity conditions from 2008 to 2015.[42] The annual number of visits to retail clinics grew from 7 per 1,000 patients to 22 per 1,000 patients over that period.

  Retail clinics may be an alternative to traditional primary care providers for some services, and there is some evidence that they appear to be serving a population underserved by primary care providers.[43] Ashwood et al. estimate that about 39% of clinic visits replace physician visits, 3% replace emergency department visits, and 58% are new visits that would not otherwise have

occurred.[44] (Retail clinics, typically staffed by NPs, appear to increase the total amount of health care services delivered rather than simply substitute for primary care providers, which supports our use of a range of ratios for the rate at which APPs offset demand for physicians in the APRN/PA moderate- and high-demand scenarios.) What remains to be seen is how a large increase in retail clinics might be staffed and whether the scope of services provided in such locations might broaden beyond addressing relatively noncomplex, acute-care issues. This scenario that models the expanded use of retail clinics explores the demand implications of shifting care from primary care physician offices to retail clinics for 10 conditions typically treated at retail clinics.[43] This scenario assumes the following:

- Patients with chronic conditions will be seen by their regular primary care provider.
- Care in retail clinics will primarily be provided by NPs (only an estimated 122 PAs were practicing in retail clinics at the end of 2017).[45]
- For care provided in primary care physician offices, 77% of visits to a pediatrician's office are handled primarily by a physician (reflecting that, in comparing NPs and physicians, 77% of the pediatric workforce are physicians) and 70% of adult primary care office visits are handled primarily by a physician.
- Because the categories of visits modeled tend to be less complex than the average office visit, we used the Management Group Medical Association's 2015 estimates for the 75th percentile of annual ambulatory patient encounters for general pediatricians and family physicians to translate the reduction in office visits to reduced demand for physicians.

These assumptions suggest that 6,541 visits by children to a retail clinic rather than a pediatrician's office reduce demand for pediatricians by one physician, and 7,266 retail clinic visits by an adult reduce demand for an adult primary care physician by one physician. Given the findings from Ashwood et al., these estimates might overstate the degree to which retail clinics reduce demand for primary care physicians.

- **Increased use of APRNs and PAs under "moderate-use" and "high-use" assumptions:** These scenarios reflect the rapid growth in supply of PAs, certified registered nurse anesthetists (CRNAs), certified nurse midwives (CNMs), and NPs and build on analyses from previous AAMC reports and projections developed for HRSA.[viii,46] At the end of 2017, there were an estimated 123,100 certified PAs, with approximately 95% (118,000) of these PAs practicing clinically.[45] Approximately 46% of PAs in clinical practice worked in a hospital or federal government facility, 41% worked in an office-based private practice, and the remaining 13% worked in a variety of outpatient centers and clinics. Approximately 21.9% of PAs in clinical practice provided primary care services, 21.4% worked in surgical specialties, 13.1% worked in emergency medicine, 9.4% worked in internal medicine subspecialties, and smaller numbers worked in various other practice areas.

  The supply of PAs is projected to more than double by 2032 if current growth patterns in number of graduates continue. In 2018, an estimated 248,000 NPs were licensed in the U.S., with approximately 77.8% of NPs involved in delivery of primary care.[47] As with PAs, if current trends continue, the NP workforce is projected to nearly double by 2032. In 2017, there were 11,826 CNMs and 101 certified midwives, and in 2018, there were approximately 58,000 CRNAs.[48,49]

Overall demand for health care services is projected to grow by about 16% between 2017 and 2032, so the supply of PAs and APRNs is growing at about six times the rate of growth of demand for health care services. This leads to questions of possible oversaturation in future years, though job growth remains strong in the short term.[15,16] An unknown portion of supply growth will be used to enhance the provision of health care services and provide services that are not currently offered — for example, NPs working in retail clinics help provide services to people who otherwise might not receive services.[44] A portion of supply growth will also help offset the projected growing shortfall of physicians.

Among the unknowns are whether there is a market saturation point at which APRNs and PAs might have difficulty finding employment; to what extent these additional clinicians provide services that currently are not provided by physicians, such as taking on new roles or addressing currently unmet needs; and by how much these additional clinicians will reduce demand for physicians. While there is a growing body of literature both in the U.S. and internationally that indicates APRNs and PAs can provide high-quality care, increase physician productivity, and, in some specialties, perform many of the same functions as physicians, there is little information to indicate the extent to which APRNs and PAs might displace demand for physicians.[50-53]

For modeling purposes, the "high-use" scenario assumes that each additional APRN or PA beyond the supply needed to maintain current staffing patterns will ease demand for physicians in their specialty as follows: anesthesiology (60%), women's health (40%), primary care (50%), medical specialties (30%), surgery (20%), and other medical specialties (30%). The "moderate-use" scenario assumes the adjustment in physician demand is half the above amounts. These percentages imply nothing about the value of services provided by APRNs and PAs relative to physicians, but rather about the role these providers will play in the future health care system and whether the role fills a currently unmet need (see Section VI) versus reducing demand for physicians.

- **Achieving select population health goals**: This scenario modeled the effects of achieving the goals of reducing excess body weight, smoking cessation, and improved control of hypertension, hypercholesterolemia, and high blood glucose levels. The mechanisms by which this hypothetical scenario could be achieved include increased use of medical homes, value-based insurance design, and increased emphasis on preventive care to provide patients with testing and counseling and to improve patient adherence to treatment regimens.[54-60]

  The modeling assumption is optimal use of APRNs, PAs, and other health professionals to provide the additional counseling and monitoring required to achieve these goals. This scenario illustrated the potential impact on demand for physicians associated with improved population health and reduced disease prevalence and mortality. Modeling assumptions and the source of key parameters are described in the 2017 report. This population health scenario is a major component within the new evolving care delivery scenario described in Section V, which explores the physician demand implications of multiple changes in care delivery as the nation strives to improve access to high-quality, cost-effective care.

Summary Demand Projections

Population growth and aging are the largest contributors to changing demand for physician services. Between 2017 and 2032, changing demographics alone are projected to increase national demand for physicians by about 132,200 FTEs (16%), with demand for primary care physicians projected to grow by 42,800 FTEs (18%). Faster growth rates are expected among hospitalists (23%; 7,100 FTEs) and medical specialists (22%; 29,300 FTEs), and lower growth rates are expected among surgical specialties (14%; 21,200) and the other specialties (12%; 31,800 FTEs) (Exhibit 14).

Expanded medical insurance coverage under ACA had largely occurred by 2017. Five states (Idaho, Maine, Nebraska, Utah, and Virginia) currently are pursuing or have recently implemented plans to expand coverage, while 13 states that have not expanded Medicaid programs have no current plans to do so. Model results suggest that the increased coverage in these five states will increase physician demand by approximately 200 FTEs, with half the increase in primary care and half in non-primary care specialties. The projected increase in demand for physicians from expanded insurance coverage is substantially lower than modeled in previous years' reports (an approximately 4,800-FTE increase), reflecting that at the national and state levels, momentum for insurance expansion has slowed. Changing demographics plus the small increase in demand from continued medical insurance expansion constitute the status quo scenario.

Analysis of MEPS data finds that, controlling for demographics and health risk factors, patients who report being in a managed care plan have more touch points with the health care system than patients not in a managed care plan. The modeled managed care scenario indicates that if patients not in managed care were moved into managed care, there would be a net increase in physician demand, with the increase coming largely from higher demand for primary care providers. By 2032, national demand would be approximately 21,600 physicians higher than the status quo scenario, with additional demand for 20,000 primary care physicians partially offset by reduced demand for 4,900 physicians in internal medicine and pediatric subspecialties. Demand for surgeons is 1,300 higher than the status quo scenario — mostly due to increased demand for general surgeons and ophthalmologists, some of which is offset by decreases in other specialties like orthopedic surgery and vascular surgery. Demand for physicians in the "other" category is 5,000 higher due primarily to higher demand for psychiatrists, neurologists, and emergency physicians. Demand for primary care-trained hospitalists is largely unchanged (200 FTE increase).

The simulated increase in the use of retail clinics modeled only demand for primary care, and it showed demand for primary care physicians declining by 12,900 physicians in 2032 relative to the status quo scenario. This scenario used conservative assumptions about which primary care visits would be provided in a retail clinic, so the impact could be larger than reported here. This scenario assumes that people with severe chronic disease continue to receive care from their normal primary care provider even for services that are often provided in retail clinics. Although this scenario only modeled demand historically provided in primary care offices that might shift to retail clinics, the growth in retail clinics could reduce the number of avoidable emergency visits: Ashwood et al. estimate that about 3% of clinic visits replace emergency department visits.[44]

The impacts of increased use of APRNs and PAs are substantial and will vary by physician specialty and assumptions about the future level and scope of care delivery provided by these professions. Relative to the status quo scenario projections for 2032, projected physician demand declines by

57,600 physicians in 2032, with increased use of APRNs and PAs under the "moderate-use" scenario, and by 115,000 physicians under the "high-use" scenario. This scenario reflects an approximate doubling of the APRN and PA workforce between 2017 and 2032.

Under the population health achievement scenario, approximately 18 million more people would be alive in 2032 compared with the status quo scenario, and the care required by this still-living population more than offsets the reduction in care from people being healthier, on average. The net effect is an increase in demand for health care services relative to the status quo scenario. This scenario is combined with the "moderate-use" APRN/PA scenario, under the assumption that achieving the modeled population health goals would happen through greater use of APRNs and PAs for counseling and follow-up care, beyond levels currently provided, to help patients achieve desired health outcomes. Furthermore, the additional 18 million people alive in 2032 under this scenario would require more APRN and PA services, so there would be fewer available APRNs and PAs to offset projected physician shortfalls. Physician demand under this scenario is 21,200 FTEs fewer than the status quo projections for 2032.

Exhibit 15 compares projected growth in physician demand from the updated projections with last year's report. The comparison covers the years 2017 to 2030 because this range overlaps the previous projections (2016 to 2030) and the updated projections (2017 to 2032). Under most scenarios, the updated demand projections show slower growth than last year's report did. The 2018 report used Census Bureau population projections suggesting the U.S. population would grow by 32.8 million between 2017 and 2030, whereas the updated population projections suggest growth of 29.6 million during this period. The managed care scenario shows approximately the same growth as the previous projections.

The population health scenario shows higher demand growth than the previous projections. The additional growth reflects updates to the Disease Prevention Microsimulation Model (DPMM) used to model changes in disease states and mortality caused by achieving the model population health goals.[61-63] Updates to the DPMM include using newer data from the National Health and Nutrition Examination Survey, using updated health-transition equations derived from published clinical trials and observational studies, and adding new components to the DPMM around behavioral health and modeling additional disease states. Updated modeling with the DPMM suggests the modeled population health goals would lead to a larger reduction in mortality than previously modeled, so more people would still be living in future years in this scenario.

Exhibit 14: Projected Demand for Physicians, 2017-2032

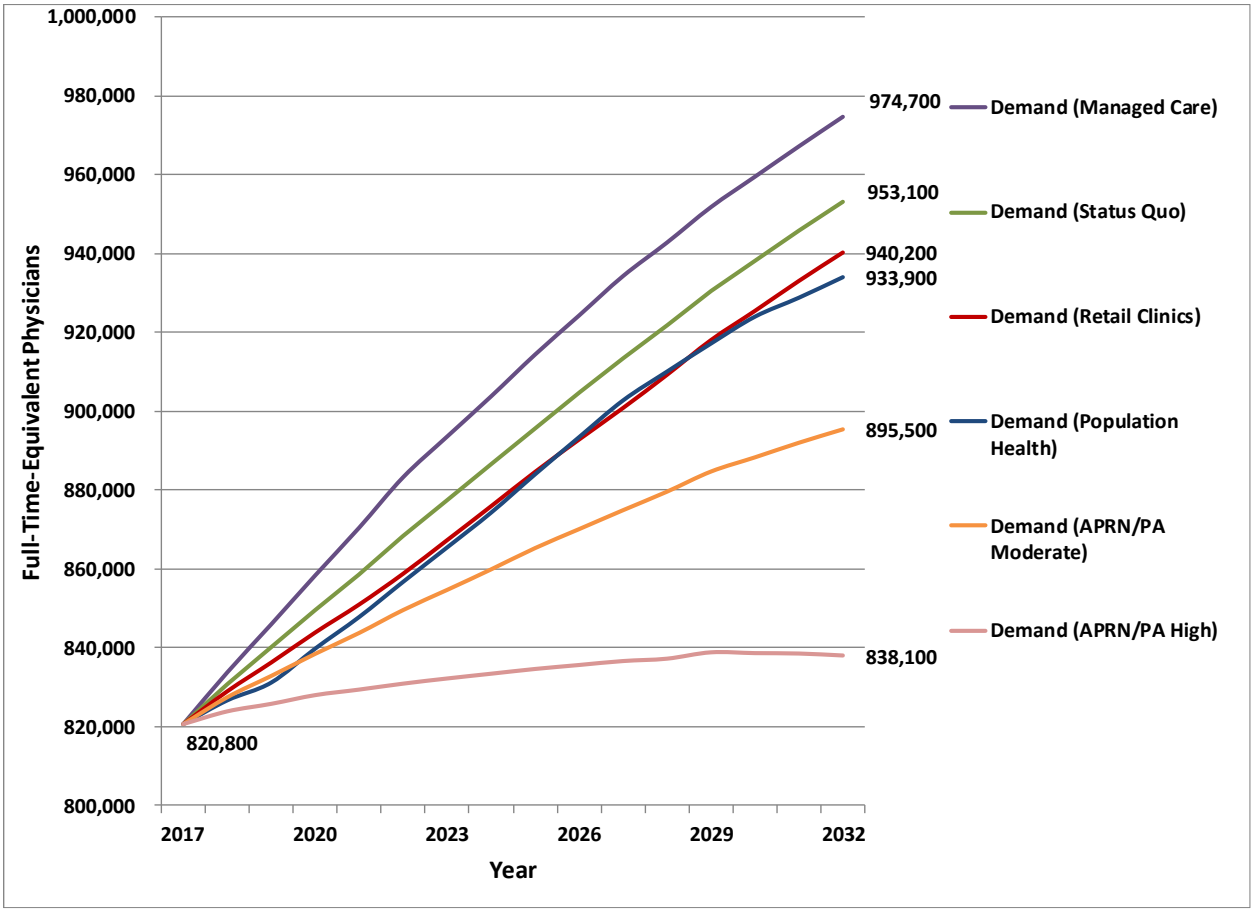
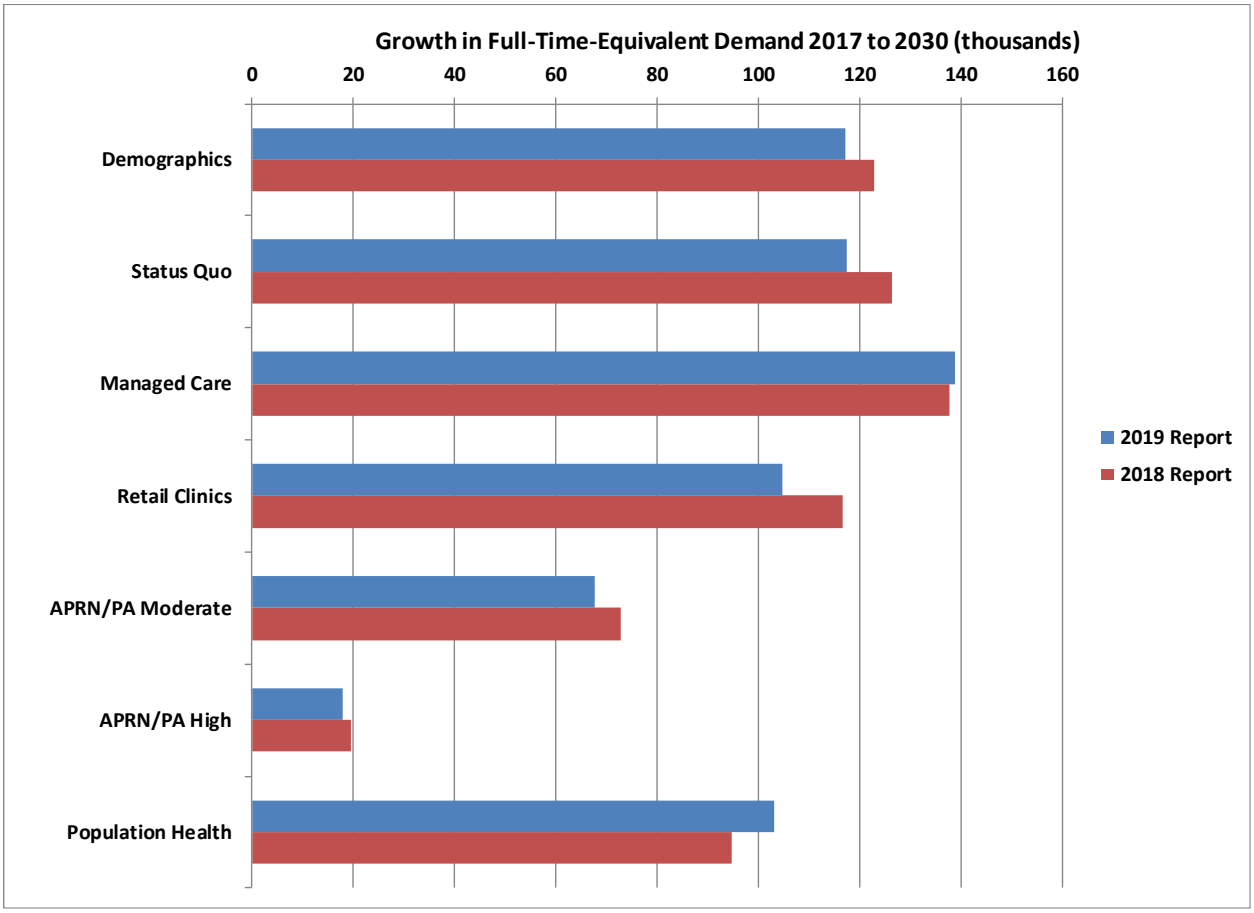


Exhibit 15: Projected Change in Physician Demand: 2019 vs. 2018 Scenario Projections



Updated physician demand projections by patient race and ethnicity,[ix] census region, and metropolitan-non-metropolitan areas are provided in Appendix 2 (Exhibit 23 through Exhibit 27). Study findings are summarized below.

Physician demand by patient race and ethnicity (Exhibit 23 and Exhibit 24): Patterns of health care use and delivery differ systematically by patient race and ethnicity, reflecting underlying differences in age distribution, disease prevalence, health-related behavior such as obesity and smoking, economic factors including medical insurance coverage and household income, possibly cultural differences in care utilization, and other access barriers. For modeling purposes, we categorize patients in one of four mutually exclusive categories: non-Hispanic white, non-Hispanic black, non-Hispanic other, and Hispanic.[x] In 2017, an estimated 61% of the population was non-Hispanic white, but this population accounted for approximately 69% (567,500 FTEs) of total physician demand.

The Hispanic population, however, represented 18% of the U.S. population but accounted for only about 12% (102,000 FTEs) of physician demand (Exhibit 23). Between 2017 and 2032, the Hispanic population is projected to grow the most rapidly in percentage terms (32%), followed by the non-Hispanic other (30%), black (15%), and white (<1%) populations. Based on changing demographics

with a slight impact from state-level initiatives that continue expanding access to medical care, demand for physician services is projected to grow by 132,400 FTEs from 2017 to 2032 (Exhibit 24). This growth includes an additional 46,300 FTEs (8% growth) associated with an aging non-Hispanic white population, 41,500 FTEs (41% growth) associated with growth and aging of the Hispanic population, 23,400 FTEs (39% growth) associated with growth and aging of the non-Hispanic other population, and 21,200 FTEs (23% growth) associated with growth and aging of the non-Hispanic black population.

In 2016, an estimated 68.2% of physicians were white (including Hispanic, white), 22.6% were Asian, 5.7% were black, and the remaining 3.5% were other races or reported two or more races.[64] During the 2018-2019 academic year, the demographics of medical school enrollment consisted of 51% non-Hispanic white, 21.9% Asian, 7.1% black, 6.4% Hispanic, and a remaining 13.5% made up of multiple race/ethnicity (8.6%), unknown race/ethnicity (1%), or other race/ethnicity (3.9%).[65] These findings highlight that some minorities (specifically black and African-American, Hispanic/Latino, Native American and American Indian, and Native Hawaiian and Pacific Islander) are underrepresented among physicians relative to both U.S. demographics and the demographic mix of patients. Furthermore, demand for physician services is projected to grow proportionately faster for minority populations based on national demographic trends.

Physician demand by census region (Exhibit 25 and Exhibit 26): Utilization of physician services and projected growth in demand vary by census region due to differences in demographics and projected population growth, insurance coverage, health risk factors (obesity and smoking prevalence), disease prevalence, practice patterns, and care access barriers. If care were evenly distributed across the U.S. after adjusting for demographics, socioeconomic factors, and prevalence of disease and health risk factors, physician demand in 2017 would be distributed as follows across census regions: 310,200 FTEs (37.8%) in the South, 185,900 FTEs (22.6%) in the West, 177,200 FTEs (21.7%) in the Midwest, and 146,900 FTEs (17.9%) in the Northeast (Exhibit 25 and Exhibit 26). Demand growth from 2017 to 2032 is projected to be largest in the South (65,300 FTEs) and lowest in the Northeast (11,000 FTEs).

For comparison, in 2017, there were 278,800 FTEs (34.8%) in the South, 186,000 FTEs (23.2%) in the West, 170,800 (21.3%) in the Northeast, and 164,800 FTEs (20.6%) in the Midwest. Physician supply in the Northeast was higher than required to provide the national average level of care, though that region has more training institutions. Supply in the Midwest and South was below that required to provide the national average level of care, and supply in the West was on par with requirements to provide the national average level of care.

Physician demand by metropolitan-non-metropolitan area (Exhibit 27): Comparing projected physician demand in metropolitan areas with non-metropolitan areas indicates that utilization of physician services is slightly higher in metropolitan areas than non-metropolitan areas after controlling for demographics, disease prevalence, medical insurance coverage, and other patient factors. Approximately 90% of total FTE-physician demand comes from populations residing in metropolitan areas, and about 86% of the U.S. population resides in metropolitan counties. These findings suggest that after controlling for demographics, disease prevalence, medical insurance coverage, and other patient factors, per capita utilization of physician services is slightly lower in non-metropolitan areas than metropolitan areas (possibly reflecting access barriers and different use patterns in non-metropolitan areas).

V. EVOLVING CARE DELIVERY SYSTEM DEMAND IMPLICATIONS

The U.S. health care system continually evolves to reflect changes in the nation's goals and priorities, changes in medicine and technology, changes in patient expectations, and the economic realities of care delivery. National priorities and legislation over the past decade — such as the Affordable Care Act of 2010, the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA), and the 21st Century Cures Act — generally aim to improve access to high-quality and affordable care and improve patient satisfaction.[66-68]

Utilization-based health workforce demand projections have been criticized for assuming a perpetuation of the current health care system, which is represented by the status quo demand scenario, rather than modeling the workforce needed for a future system. While recognizing that the contemporary health care system is based on current health policy, infrastructure, and technology that will not transform overnight, the research presented in this section of the report explores trends in system transformation and their potential implications for the physician workforce. The projections presented combine elements of modeling scenarios described previously in this report, along with information from the literature on other emerging trends. ***Because this work is exploratory and is an amalgamation of demand scenarios included in the shortfall projections, this scenario is not included in calculating the shortfall projections***.

The goal of some recent health care legislation has been to move the health care system away from a fee-for-service model that rewards quantity of services delivered to a system that promotes quality and value.[69] Desired changes encouraged by legislation and payment reform include strengthening the nation's primary care foundation,[70] promoting and achieving population health goals to improve disease prevention,[71-74] better coordinating care to manage high-risk patients across the care continuum,[75,76] and making care more affordable by eliminating unnecessary spending and discouraging low-value care.[77] Only a few early ACA policies specifically targeted physician supply — with modest changes to GME funding and increased funding for health centers and the National Health Service Corps. Most recent changes in legislation and business practices primarily affect physician demand indirectly through changes in care usage and delivery patterns.

Responses to changing financial incentives have led to changes in the organization of the health care industry. Payers and providers are consolidating horizontally and vertically and restructuring internal operations to increase efficiency.[78] A growing proportion of physicians are employees rather than practice owners, with 2016 marking the first year that more than half (52.9%) of practicing physicians were employees.[79] There is some evidence that employee physicians work fewer hours per week in direct patient care compared with self-employed physicians due to more time spent in administrative and indirect patient care activities and to reduced financial incentive to extend already long hours worked per week.[80-82]

Key mechanisms for enhancing value that are specifically promoted by the ACA or incentivized through payment reform include patient-centered care, team-based care, value-based insurance design (VBID), risk sharing, disease management, rewarding quality, and greater use of technology such as electronic medical records and telemedicine. These mechanisms are not mutually exclusive, and multiple mechanisms often contribute to the same goals. For example, improved medication adherence to control hypertension, hyperlipidemia, and hyperglycemia helps reduce risk for cardiovascular disease, stroke and diabetes and sequelae.[83,84] There is strong evidence that

medication adherence is improved through VBID,[58,59] patient-centered medical homes (PCMHs),[55,57] disease-management programs and counseling,[85,86] team-based care,[60,87,88] and increased use of technology.[89,90]

The challenges with modeling the implications of evolving care delivery for future demand for physicians include (1) little evidence has been generated, and what has been generated focuses on the earliest and most successful trials of the innovation, (2) much of the published literature evaluating interventions to change patient health and utilization outcomes pertains to a specific population or disease and thus cannot be generalized to the U.S. population, (3) multiple factors often influence patient outcomes, so the impact of specific interventions or trends cannot be isolated (e.g., using technology in conjunction with a PCMH), and (4) the mechanisms to achieve health system goals (e.g., technology) continue to evolve over time. Because of these data limitations, rather than model a set of interventions like VBID, PCMH, and the other mechanisms discussed above, we modeled five major components of what the system is striving to achieve:

1. **Improving population health**: Key risk factors and lifestyle behaviors that policies and programs target for disease prevention are obesity, hypertension, dyslipidemia, hyperglycemia, and smoking.[91-93] To assess the physician shortfall under a population health scenario, we used the DPMM[61-63,94] to simulate the health care demand implications of (a) a modest 5% sustained reduction in excess body weight among adults who are overweight or obese; (b) reductions in blood pressure, cholesterol, and blood glucose levels among adults with elevated levels, with the magnitude of reductions reflecting what can be achieved through appropriate medication and counseling as reported in published clinical trials[95-97]; and (c) 25% of smokers quit smoking — though with high recidivism.

   Clinical trials indicate that patients with hypercholesterolemia can reduce total blood cholesterol by 34.42 mg/dL (CI, 22.04-46.40) by using statins[95]; patients with uncontrolled hypertension can reduce systolic blood pressure by 14.5 mm Hg (CI, 14.2-14.8) and diastolic blood pressure by 10.7 mm Hg (CI, 10.5-10.8) by using anti-hypertensives[96]; and patients with elevated hemoglobin A1c levels can reduce A1c by one percentage point (CI, 0.5-1.25) annually — with improvements occurring gradually until diabetes control is reached at A1c of 7.5%.[97] Patients who stop smoking can lower their risk for various cancers, diabetes, cardiovascular disease, and other diseases and can reduce mortality.[98] Researchers report that compared with a similar population that continues to smoke, cessation at age 25 to 34 years extends life by about 10 years, on average.[99] Cessation at ages 35 to 44 extends life by nine years, and cessation at age 45 to 54 extends life by six years, on average.

   These modeled outcomes are only a subset of targeted patient health outcomes, but achieving these outcomes would (a) prevent or delay disease onset and disease severity leading to lower demand for physician services and (b) reduce mortality, with more people living longer, leading to increased demand for physician services. Model outcomes suggest a net increase in physician demand of 33,800 FTEs. The population health scenario combined the net effect of achieving modeled health outcomes with the moderate-APRN/PA demand scenario (discussed in Section IV) under the assumption that achieving the modeled outcomes would require more counseling and treatment than currently is being provided.

NPs and PAs would be a key workforce component to provide the additional counseling and follow-up required.

2. **Managing care and risk-bearing organizations**: As discussed in Section IV, one of the demand scenarios modeled differences in health care use patterns of patients in a managed care plan compared with patients not in a managed care plan, as a proxy for differences in care use and delivery patterns associated with applying managed care principles. While ACOs differ in many ways from traditional managed care plans, they share many of the same goals around disease prevention, shifting care to appropriate lower-cost settings and providers, care coordination, and improving care quality and efficiency. This component of the evolving care delivery scenario incorporates the managed care scenario modeled to forecast the range of future physician shortfalls. The main outcome of this scenario is a net 21,500-FTE increase in physician demand due almost entirely to greater demand for primary care physicians — with a decrease in demand for physicians in many non-primary care specialties.
3. **Addressing unmet behavioral health needs**: The shortage of behavioral health providers and unmet behavioral health needs in the U.S. has been well documented. In 2017, approximately 13.55 million adults reported a perceived unmet need for mental health services, with one in five (20.1%) adults with mental illness reporting that they were unable to obtain treatment because of barriers to getting help they need.[100,101] Approaches to addressing unmet behavioral health needs include improving access to behavioral health services and training primary care providers and others to screen patients for behavioral health needs. While psychiatrists are the only physician specialty focused on addressing patient mental health needs, primary care providers are essential for addressing and screening for patient behavioral health needs because primary care is the main point of entry into the health care system.[102] This is especially true in rural areas and underserved communities.[103] Currently, there is insufficient information to quantify how addressing unmet behavioral health needs will affect demand for primary care physicians, so for this scenario we model only the potential impact on demand for psychiatrists. Better understanding the role of primary care physicians in addressing behavioral health needs and the implications for physician demand is a goal for future research.

   To assess psychiatrist demand for this scenario, we assumed that the national shortfall was 5,906 psychiatrists in 2017 — that is, the number of providers required to provide the minimum level of care that would de-designate the federally designated mental health professional shortage areas.[xi] The 5,906 gap in 2017 equates to demand being 13.5% higher than supply. Consistent with a recent government workforce study, we model the workforce implications of addressing a 20% shortfall of mental health providers (including general and child and adolescent psychiatrists, and approximately 1,617 physicians in addiction psychiatry).[104] By 2032, this equates to a shortage of 3,400 psychiatrists beyond the growth in demand already modeled under the status quo scenario. The increase in total demand to address unmet behavioral health needs could be substantially higher because this estimate excludes the role of other specialties in addressing patient behavioral health needs.

   Analysis of the AMA Masterfile suggests that in 2017 an estimated 823 physicians in addiction medicine were active in the workforce (in addition to the 1,617 in addiction

psychiatry). We found no published estimates of unmet need for substance abuse treatment providers. However, consistent with a recent government study that modeled unmet need for addiction counselors, we assume a 20% unmet need — an estimate that is likely conservative.[104] In this scenario, by 2032, demand for physicians in addiction medicine would be 200 FTEs higher than modeled under the status quo scenario.

4. **Organizing care across care delivery settings and coordinating multidisciplinary care**: Efforts to improve quality of care and better coordinate multidisciplinary care across delivery settings, as well as incentives through the Hospital Readmissions Reduction Program, have contributed to declines in the proportion of patients readmitted to the hospital following discharge.[38,105-107] Efforts continue to prevent avoidable hospitalizations and emergency visits through increased access to primary care and preventive services and through diverting emergency visits to appropriate lower-cost settings such as physician offices, retail clinics, urgent care centers, and crisis centers for behavioral health conditions.[108-111] A study of 98,000 patients found that PCMH implementation reduced annual emergency visits by 9.3%.[112] This 9.3% reduction is only a portion of what the health care system is striving to achieve. In some instances, efforts to reduce demand for hospital services will reduce overall demand for physicians. In other instances, these efforts will shift demand from hospital-based physicians to physicians practicing in ambulatory settings. For this analysis we modeled the following assumptions:

    a. Consistent with recent health workforce modeling for HRSA, we modeled a gradual 5% reduction in hospital inpatient utilization relative to the status quo demand projections, with a corresponding reduction in demand for hospitalists. We assumed that reduced hospital demand for other physicians (e.g., medical specialists and surgeons) would be offset by increased demand for these physician services in ambulatory or outpatient settings. This 5%-decline assumption likely is conservative, and the potential impact is larger. Studies report that participation in a PCMH team-based intervention reduced hospitalizations for PCMH-targeted conditions by 13.9% and for all other conditions by 3.8%,[113] and reduced rehospitalization rates from 18.8% to 7.7%.[114]

    b. We modeled an 18% decline in emergency visits, relative to the status quo demand projections, with a corresponding decrease in demand for emergency physicians. We assumed that each averted emergency visit would be replaced by a visit to a physician office or outpatient/clinic visit, with two-thirds of redirected visits seen by a primary care provider and one-third seen by a medical specialist. The modeled 18% decline starts with estimates by Truven Analytics that 71% of emergency visits by people with employer-sponsored health insurance are potentially avoidable (either by diverting the visit to an appropriate ambulatory setting or by having treated the medical condition that precipitated the visit).[115] We assume that this 71% estimate approximates potentially avoidable emergency visits for the Medicaid, Medicare, and uninsured populations. Not all potentially avoidable emergency visits can be prevented or diverted, and we model a 25% reduction in these visits. Thus, the 18%-decline assumption reflects a 25% reduction of the 71% of emergency visits that are potentially avoidable.

The impact in 2032 of this scenario component is a 9,400-FTE decrease in demand for emergency physicians and a 2,000-FTE decrease in demand for hospitalists, offset by an increase in demand for 5,900 FTE primary care physicians and 3,500 FTE specialists.

5. **Increased supply and expanding role of advanced practice providers (APPs)**: The physician demand projections used to create the shortage range projections included two scenarios modeling rapid growth in the supply of APRNs and PAs, with the scenarios making different assumptions about the degree to which the rapid growth in APP supply would reduce demand for physicians. We noted previously that APRN and PA supply is projected to approximately double in size by 2032. With supply growing more rapidly than demand, two outcomes are assumed: (1) Some care that historically has been provided by physicians will instead be provided by APPs, which slows the growth in demand for physician services. An example is an APP managing a patient panel in a primary care practice. (2) Total care provided to patients expands, with APPs addressing currently unmet needs or providing other care that currently is not being provided. An example is NPs working in a retail clinic; one study estimates that 58% of retail clinic visits are new visits that would not have occurred in the absence of retail clinics.[44] Another example is NP-led interventions to reduce hospital readmissions by conducting post-discharge follow-up care.[116] The modeled evolving care delivery system scenario used the moderate-APRN/PA assumptions described in Section IV. We used the lower estimates of the degree to which APPs would reduce demand for physicians under the assumption that to achieve the other modeled outcomes (e.g., achieving population health outcomes), there would be a net increase in provision of health care services and APPs would be major contributors to addressing this increase in services.

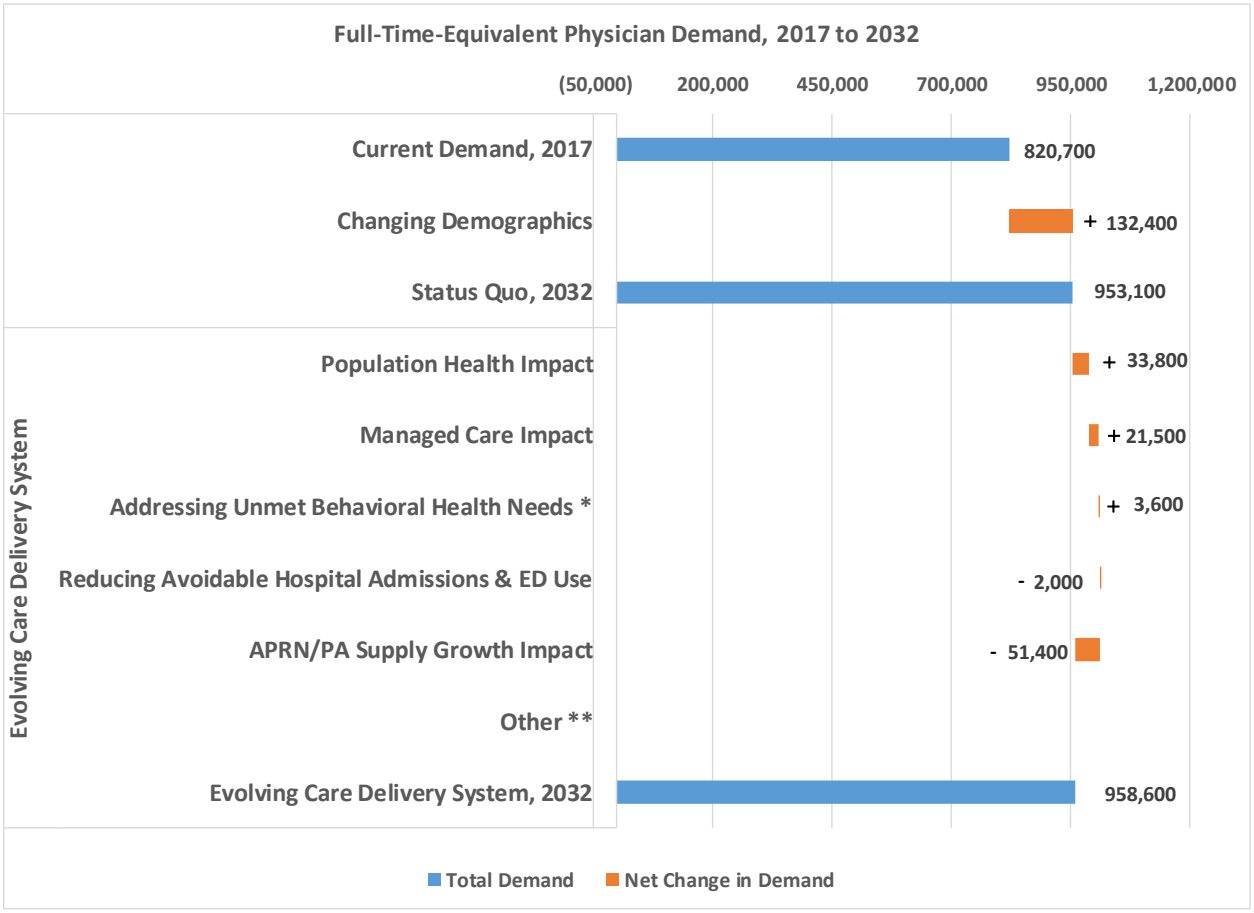
Beyond the five modeled components of this evolving care delivery system scenario, other trends could change future demand for physician services — though currently there is insufficient information to quantify the magnitude of increases or decreases in demand and which specialties each trend might apply to. Trends not modeled include potential advances in medicine and technology and increased use of existing technologies. For example, a growing body of research documents the potential for telemedicine and e-health to transform how some patients receive care. Virtual care delivery, as a replacement for face-to-face visits, in some circumstances can be as effective as in-person visits, more convenient for patients, and more convenient for physicians. What is less certain is the implications for physician demand. A recent study of an ACO-based medical practice found that virtual visits reduced in-person visits by 33% but increased total visits by 80% over 1.5 years.[117] This finding suggests that telemedicine and virtual care (videoconferencing with physicians) might not reduce demand for physicians and could possibly increase demand.

The status quo demand scenario modeled that between 2017 and 2032, total demand for physicians would increase by 132,400 FTEs if care delivery were relatively unchanged, with this increase coming almost entirely from a growing and aging population and a slight increase from continued expansion of insurance coverage in five states with plans for expansion (Exhibit 16). If the nation achieved the modeled population health goals around modest reductions in excess body weight, smoking cessation, and better control of hypertension, hypercholesterolemia, and hyperglycemia, then population health would improve, and mortality rates would decline. The modeling suggests a net increase of 33,800 FTE physicians required, with the increase in health services demand from a still-living population exceeding the decrease in health services demand because each person

is healthier, on average. If 100% of the insured population were in a managed care plan, then total physician demand would increase by 21,500 FTEs, with the increase mostly for additional primary care physicians.

Addressing unmet behavioral health needs would increase demand for psychiatrists and addiction medicine by 3,600 beyond the levels already modeled — which includes the estimated 5,900 additional psychiatrists to provide a minimum level of care required to remove the federal mental health shortage designations in underserved communities and facilities. This estimate of additional physicians required to address unmet behavioral health needs is likely conservative because it omits the potential impact on primary care physicians who currently provide a substantial portion of behavioral health care to patients. Efforts to reduce hospitalizations and emergency visits are modeled as having a small impact on overall physician demand because most avoided hospital care would likely be redirected to appropriate ambulatory settings or avoided by increasing the level of preventive care. The largest modeled impact on physician demand is the 51,400-FTE decrease in demand associated with rapid growth in APRN and PA supply and a growing portion of care provided by APPs. Modeling results suggest that trends decreasing demand for physicians are almost exactly offset by trends increasing demand for physicians, such that physician demand in 2032 would be approximately 958,600 FTEs — virtually the same as the 953,100-FTE estimate from the status quo scenario.

Exhibit 16: Physician Demand Implications of Evolving Care Delivery System Components



*This estimate likely understates the total impact on physician demand because it reflects only the impact on demand for psychiatrists. The impact on demand for primary care physicians and specialist physicians is unknown.

**Other potential impacts not modeled due to data limitations include advances in medicine and technology and increased use of existing technologies, such as telemedicine and decision support systems. The demand implications of these other factors likely will contribute to both increases and decreases in demand for physicians. For example, some medical advances might cure existing diseases, thus reducing demand for physicians, while other medical advances might increase longevity and allow physicians to treat conditions that today are largely untreatable, thus increasing demand for physicians.

Modeling results suggest that demand for primary care physicians would increase by 4,600 FTEs, with a matching decline of 4,500 FTEs in the medical specialties category (Exhibit 17). Demand for surgeons would increase slightly — with this increase due primarily to greater demand for surgery associated with the larger and older population resulting from the modeled population health goals' reduced mortality rates. These net changes in FTE demand are small relative to total demand for physicians (Exhibit 18). The estimated 5,500-FTE increase in demand for physicians is less than a 1% difference from the 953,100-FTE demand in 2032 that would occur if current care delivery patterns were extrapolated to the projected future population. Compared with FTE demand in 2032 under the status quo scenario, demand for primary care physicians, surgeons, and physicians in the "other" category would be higher by 1.6%, 2.4%, and 0.8%, respectively. Demand for physicians in the medical specialties and primary care-trained hospitalist categories would be lower by 2.7% and

2.6%, respectively. Although the evolving care delivery scenario is not used to compute physician shortfall ranges, demand projections from this scenario fall within the range of demand scenarios modeled (Exhibit 19).

Exhibit 17: Evolving Care Delivery System Implications by Specialty Category

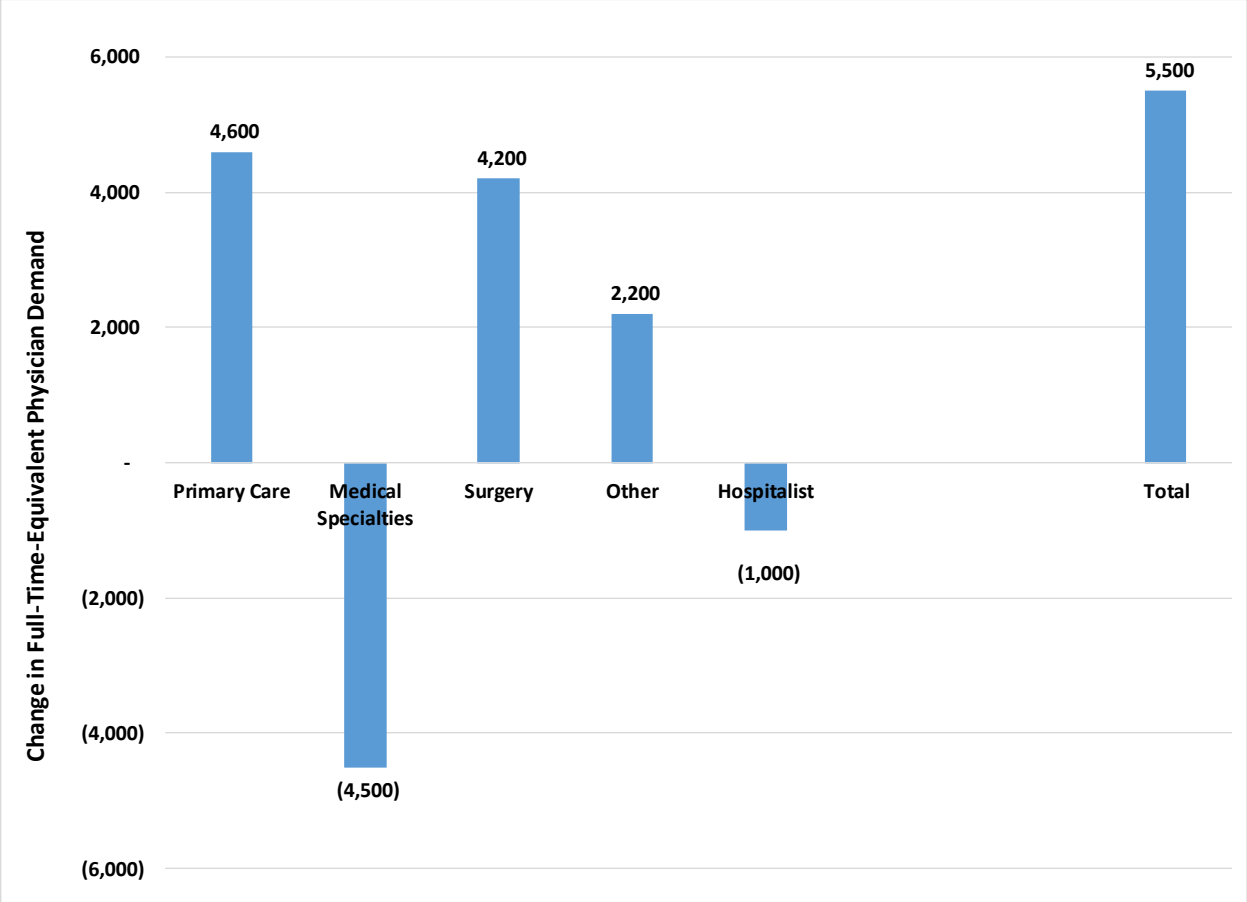


Exhibit 18: Physician Specialty Implications of Evolving Care Delivery System

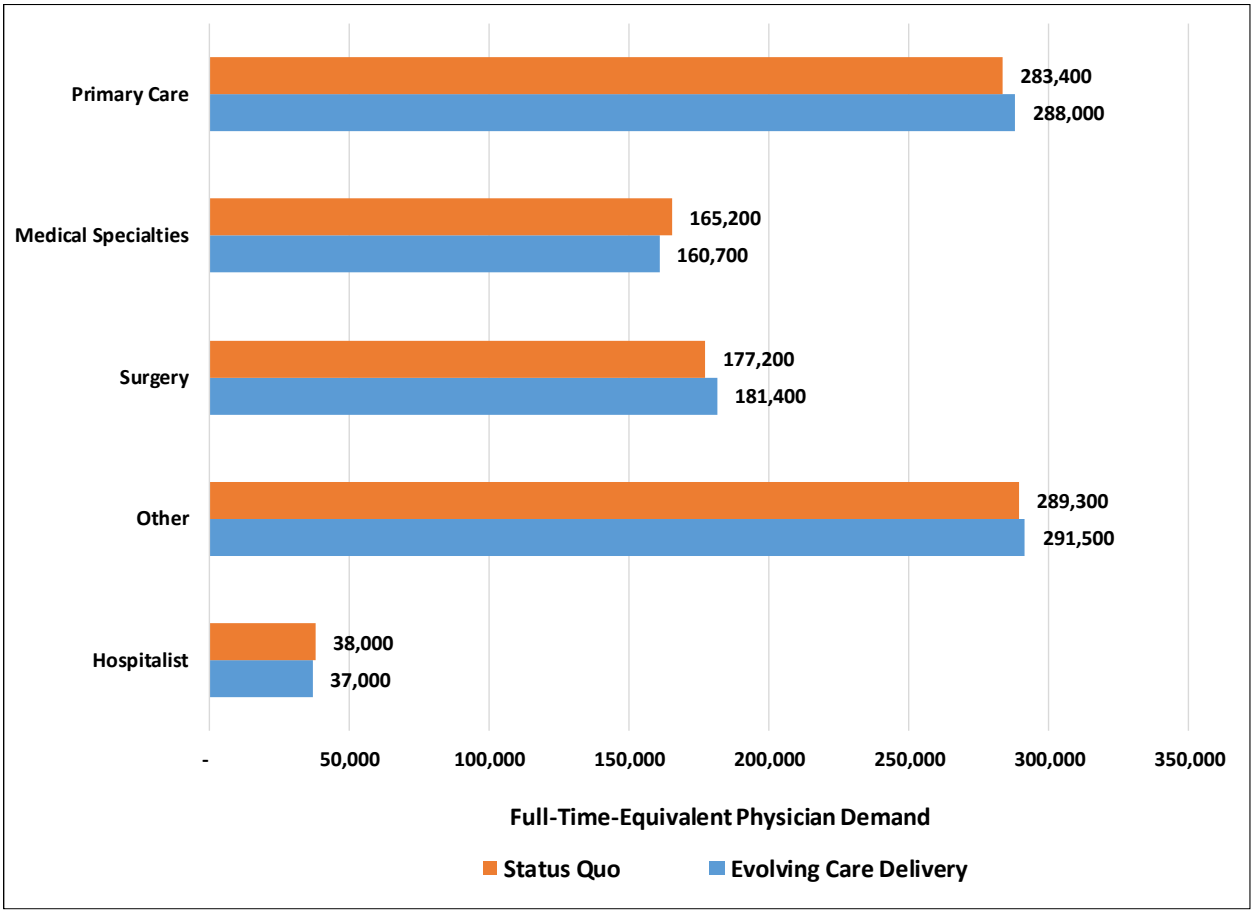
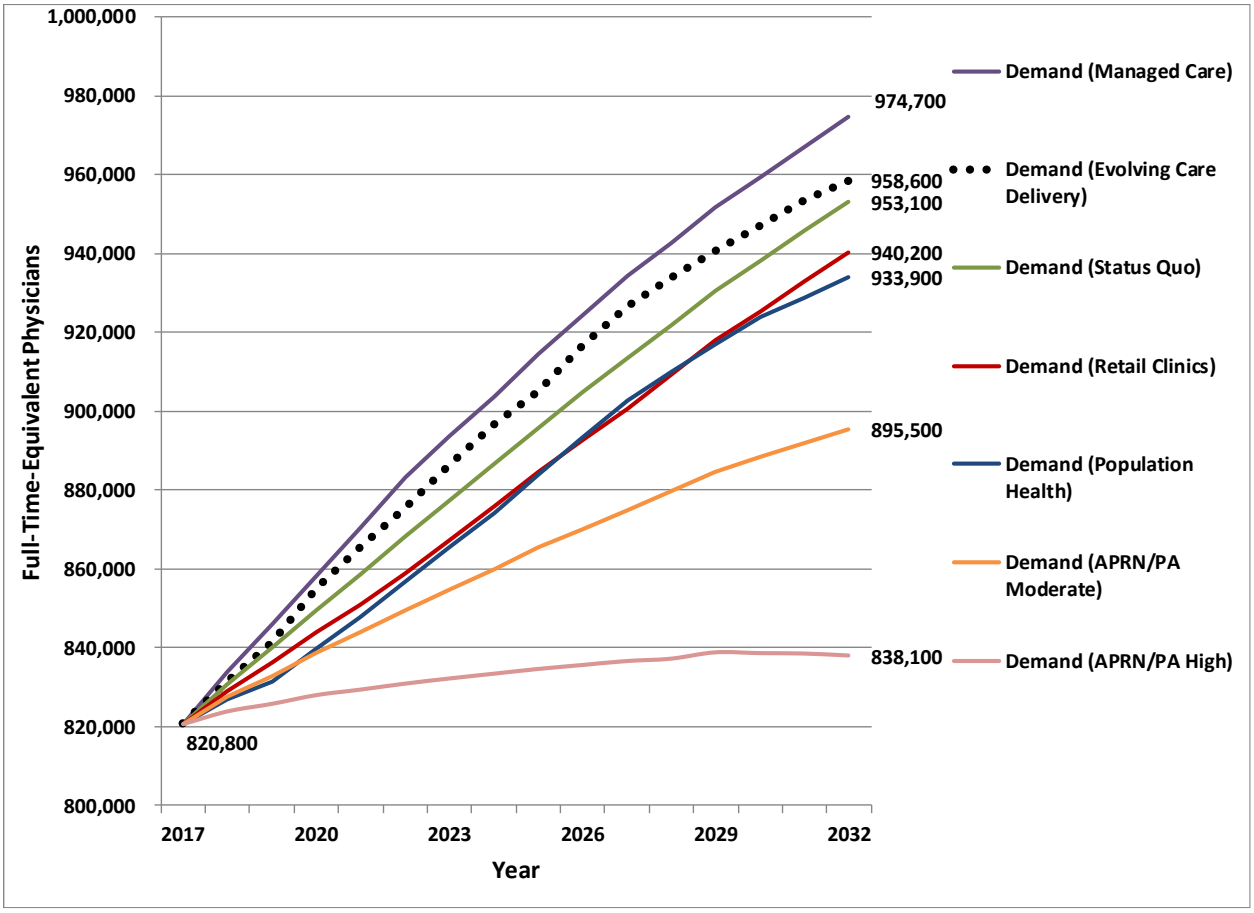


Exhibit 19: Evolving Care Delivery Scenario and Other Demand Scenario Comparison



While substantial work is needed to better understand how care delivery will evolve over time and the workforce implications of that evolution, the early findings presented here suggest that changes in care delivery that decrease demand for physicians will be offset by changes in care delivery that increase demand for services. This result is not surprising because national priorities to expand access to care and provide more comprehensive care, as well as priorities to reduce mortality, will all increase demand for health care services and providers. System changes to reduce the growth of health care expenditures will decrease physician demand in some specialties and care delivery settings by shifting care from specialists to generalists, from physicians to nonphysicians, and from hospital-based physicians to community-based physicians.

VI. PROVIDERS REQUIRED IF U.S. ACHIEVED EQUITY IN HEALTH CARE UTILIZATION

The health care utilization equity (HCUE) analysis models the implications for physician demand if currently underserved populations had similar care use patterns to populations facing fewer barriers to care. ***This analysis is not included in the ranges of scenarios that summarize projected gaps between supply and demand across physician specialty categories at the 25th and 75th percentile of projected shortages***. Rather, it is intended as an additional point of consideration when gauging workforce adequacy and to stimulate discussion of how best to address health care utilization inequity. This analysis illustrates that sociodemographic differences result in lower levels of care received by historically underserved populations — beyond utilization differences that can be explained by differences in age distribution, disease prevalence, and other health risk factors. We modeled two hypothetical scenarios to estimate the anticipated increase in the use of health care services if use patterns of underserved populations and a population not perceived as underserved were similar (see Exhibit 20 and Exhibit 21, and Appendix 2: Exhibit 32 through Exhibit 37).

The first scenario (HCUE Scenario 1) models people without medical insurance and people living in non-metropolitan areas having equivalent care use patterns as their insured peers living in metropolitan areas with similar demographics and health risk factors. For example, an uninsured person with heart disease living in a non-metropolitan area was modeled as having the utilization patterns of an insured person with heart disease and the same demographics living in a metropolitan area. Under these assumptions, an additional 30,800 FTE physicians (4% increase) would be required to meet additional demand for services (Exhibit 20). More APRNs and PAs would also be required to meet the additional demand for services.

The second health care utilization equity scenario (HCUE Scenario 2) models the additional physicians required under a hypothetical scenario where everyone utilizing care had equivalent utilization patterns to non-Hispanic white, insured populations residing in metropolitan areas. For example, an uninsured black person with heart disease living in a rural area was modeled as having the utilization rate of an insured white person with heart disease living in a metropolitan area. Under these assumptions, we estimate a 12% increase in physician demand — or approximately 95,900 FTE physicians (Exhibit 21).

Exhibit 20: Health Care Utilization Equity Scenario 1, 2017

	Physicians				Additional Providers Required	
	Current Supply	Requirements Under Equity Scenario	Current Gap		Advanced Practice Nurses	Physician Assistants
			Number	%		
Total	800,300	831,100	30,800	4%	10,000	3,800
Primary Care	226,000	235,500	9,500	4%	8,100	800
Non-primary Care	574,300	595,600	21,300	4%	1,900	3,000
Medical Specialties	135,900	140,600	4,700	3%	800	600
Surgery	155,900	162,300	6,400	4%	500	1,600
Other Specialties	251,600	261,300	9,700	4%	400	700
Hospitalists*	30,900	31,400	500	2%	200	100

*Includes only hospitalists trained in primary care. Hospitalists in non-primary care specialties are included with their individual specialty. Category totals might not sum to totals because of rounding.

Exhibit 21: Health Care Utilization Equity Scenario 2, 2017

	Physicians				Additional Providers Required	
	Current Supply	Requirements Under Equity Scenario	Current Gap		Advanced Practice Nurses	Physician Assistants
			Number	%		
Total	800,300	896,200	95,900	12%	22,700	12,800
Primary Care	226,000	245,600	19,600	9%	16,700	2,200
Non-primary Care	574,300	650,600	76,300	13%	6,000	10,600
Medical Specialties	135,900	144,800	8,900	7%	1,600	1,100
Surgery	155,900	180,900	25,000	16%	1,900	5,500
Other Specialties	251,600	291,100	39,500	16%	1,500	3,600
Hospitalists*	30,900	33,800	2,900	9%	1,000	400

*Includes only hospitalists trained in primary care. Hospitalists in non-primary care specialties are included with their individual specialty. Category totals might not sum to totals because of rounding.

The implications of these hypothetical scenarios vary substantially by patient race and ethnicity (Exhibit 33), census region (Exhibit 34 and Exhibit 35), and whether the patient resides in a metropolitan area (Exhibit 36 and Exhibit 37). For most specialties, demand for physician services by underserved populations would rise under the HCUE1 and HCUE2 scenarios. However, for some underserved populations, demand would fall — reflecting higher prevalence of select chronic conditions among these underserved populations and potential declines in demand for chronic disease services if these patients had improved access to preventive care. Examples under the HCUE2 scenario include declines among minority populations in physician demand for

hematology and oncology, nephrology, rheumatology, colorectal surgery, and radiation oncology. Possible declines in demand for these specialties reflect that access to preventive care might diminish higher prevalence rates among minority populations for obesity, hypertension, diabetes, nonalcoholic fatty liver disease, colon and other types of cancer, and other chronic diseases.[118-123]

VII. KEY FINDINGS AND CONCLUSIONS

As rapidly changing business practices and conditions, as well as public policies, continue to reshape the U.S. health care system, both public and private stakeholders need reliable information about the capacity of the nation's future health care workforce in general — and the physician workforce in particular — to make well-informed investments in supplying the U.S. population with the health care it needs. The pace of change in the health care system necessitates frequent updating of health care workforce models and their resulting projections. Therefore, the AAMC has made a commitment to commission an annual update of national physician workforce projections with a threefold aim: (1) updating and improving workforce projections, (2) presenting new analyses of the workforce needed for a growing and aging population and an evolving health care system, and (3) identifying future directions for research to inform and improve these projections. A physician survey being fielded by the AAMC in 2019 is collecting valuable information to strengthen future physician workforce modeling efforts and support additional research.

Key findings from this year's report are:

1. While the political, economic, and technological context in which health care takes place is constantly transforming, the essential nature of doctors treating patients does not change. Thus, despite the dizzying pace of reformation in organization, regulation, finance, and technology within the health care market currently, the supply and demand projections for physicians are changing much less dramatically. We continue to project that physician demand will grow faster than supply, leading to a projected total physician shortfall of between 46,900 and 121,900 physicians by 2032, including a primary care physician shortage of 21,000 to 55,200 physicians and a non-primary care specialty shortage of 24,800 to 65,800 physicians (which includes a 14,300 to 23,400 shortfall of surgical specialties in 2032).
2. If the population health goals of a modest reduction in excess body weight; improved control of blood pressure, cholesterol, and blood glucose levels; and reduced smoking prevalence were to be achieved, the demand for physicians would be 33,900 FTEs higher in 2032 than it would be if the goals were not met. This appears to be somewhat of a paradox — improving population health leads to greater demand for physicians. Our modeling efforts suggest that improved health will reduce mortality, and the resulting larger and older population will increase demand for physicians.
3. To bring rates of care for currently underserved populations up to rates of care for populations facing fewer sociodemographic, economic, and geographic barriers to care, 30,800 to 95,900 more physicians would be needed. These challenges are made all the more daunting by the realities that approximately 40% of the physician workforce is set to retire in the next decade, and physicians' weekly work hours are trending down.

This report also includes new exploratory work analyzing how the health care delivery system is evolving and the potential implications for physicians. While this new work was not used to construct the projected shortfall ranges, it incorporated several of the demand scenarios used to construct the shortfall ranges: (1) greater use of managed care principles, which shift a portion of care from specialist physicians to primary care physicians and increase the overall demand for primary care services; (2) achieving select population health goals; and (3) reduced demand for physician services as the rapid growth in APP supply shifts some care from physicians to APPs. We also modeled the potential physician workforce implications of addressing unmet behavioral health needs and reducing demand for hospital-based care through a combination of prevention and diversion to appropriate community-based settings. We found that some trends will increase demand for physicians to provide increased access and more comprehensive care, while other trends will decrease demand. The net effect is a small rise (less than 1%) in demand for physicians in 2032 relative to the status quo scenario that extrapolates future demand based on current care delivery patterns, accounting for changing demographics. Additional research is needed to refine this work, but early findings suggest that the evolving care delivery system will not substantially change the total number of physicians required but will shift care across care delivery settings and physician specialties. For each of the past five annual reports, the study has used the most recent data available to the modeling team and has continued to refine model inputs, assumptions, and the scenarios.

Key findings from reports over the past five years are:

1. For modeling demand, population growth and aging continue to have the greatest impact on demand growth. While the U.S. Census Bureau periodically updates population projections, this source of demand growth is relatively stable and can be projected with a high level of confidence, barring unforeseen catastrophic events.
2. Efforts to improve population health might cause small short-term reductions in demand for health services, but in the long run could increase demand for physicians as people live longer.
3. Expanded insurance coverage under ACA appears to have increased demand for physicians by only a few percentage points — in large part because patients with the greatest medical needs typically already have insurance or gain insurance (e.g., through Medicaid) due to high need.
4. There are substantial inequities in access to care beyond what can be explained by lack of medical insurance and residing in non-metropolitan areas. Improving access to care for racial and ethnic minority populations will require a large increase in physician supply in addition to the policy changes and economic considerations needed to improve equity.
5. The rapid growth in supply of advanced practice providers will partially offset the projected growing shortfall of physicians, but much additional research is needed on this topic, as discussed in the next section.
6. Retirement patterns appear to have the largest potential short-term impact on physician supply, though the number of physicians trained each year has the largest long-term impact on supply.

VIII. FUTURE DIRECTIONS IN HEALTH WORKFORCE RESEARCH

Ever-present challenges in developing these workforce projections are the rapid pace of change in the health care system, often unpredictable, and that much of the information required for the models is available only for the current health care system.[124] While some factors affecting future supply and demand for physicians, such as changing demographics of the U.S. population and physician supply, can be modeled with reasonable accuracy, the workforce implications of advances in medicine and technology are more challenging to quantify because of the many unknowns and data limitations. Similarly, changes in federal legislation have the potential to transform the health care system, but such legislation often involves competing interests and fiscal considerations, which make legislative outcomes less certain. The future of some aspects of the ACA remain uncertain, and a small number of states have ongoing efforts to expand Medicaid coverage. Overall, though, passage of new major legislation that fundamentally changes the health care system remains unlikely.

The projected shortfall ranges reflect uncertainties about how emerging care delivery and financing models might change health care use and delivery patterns, as well as uncertainties about physician labor force participation patterns. Still, even sophisticated computer models are challenged to quantify the future impact of fundamental changes that have not yet happened or been anticipated. This high level of uncertainty, combined with the need to incorporate new research and updated data on physician supply and demand, underscores the importance of continually monitoring the projected future adequacy of supply. Uncertainties continue to abound about whether, how, and how quickly emerging payment and care delivery models might affect physician supply and demand. Evidence to date has not demonstrated that changes in payment or care delivery models substantially change physician workforce supply or demand. The exploratory work presented in Section V suggests that care delivery trends that increase demand for physicians are largely offset by trends that decrease demand for physicians, such that the number and specialty mix of the future physician workforce might not look substantially different from those projected by extrapolating current care delivery patterns to future populations — though the way that care will be delivered in the future is projected to change.

Uncertainties continue to abound about whether, how, and how quickly emerging payment and care delivery models might affect physician supply and demand. Evidence to date has not demonstrated that changes in payment or care delivery models have substantially changed physician workforce supply or demand.

Improving the accuracy of workforce projections requires recent data and research to inform modeling assumptions. The AAMC is fielding a physician survey in 2019 that is collecting data to update estimates of physician retirement and work patterns. These data will help address supply-related questions of whether high levels of physician burnout are expected to accelerate physicians' plans to retire, to reduce hours worked, or both.[28-32] Survey data will provide information on physicians' use of electronic communications technology to provide patient care and their openness to shifting more care to telehealth. This could inform demand scenarios around broader patient access to care and physician productivity when combined with research on the potential role of telehealth in transforming care delivery.

Examples of directions for future research to improve analytic capabilities and advance the field of health workforce modeling include:

- **Changing physician work patterns:** The strongest drivers of projected physician supply are work hours and retirement patterns. Driven by multiple factors, including changing economic pressures, shifts in the structure of health care delivery, increasing burnout, and demographics, these patterns need to be understood in greater detail. More detailed, targeted, up-to-date, and ongoing data collection is necessary. The AAMC is fielding a new national sample survey of physicians to meet this pressing data need.
- **Market saturation and displacement of occupations and select specialties**: This report explores the potential implications of continued rapid growth in APRN and PA supply, but more information is needed. To what extent can the health care system continue to absorb this new supply? Has a saturation point been reached, at least in some specialties, settings, and geographic areas? What are the implications for demand for physicians? To what extent have APRNs and PAs reduced demand for physicians in some specialties, and to what extent are APRNs and PAs providing previously unfilled services and expanding access to care? More up-to-date and complete estimates of these effects are needed. Similarly, the hospitalist supply continues to grow rapidly. Might market saturation be reached for hospitalists, and if so, at what point will employment growth slow to a level to keep pace with growth trends in hospital inpatient care?
- **Current shortages and inefficiencies**: The demand projections start with the assumption that physician supply and demand were in equilibrium in 2017 — except for primary care and psychiatry, where federal government estimates for health professional shortage areas are used as a proxy for the current shortfall of physicians. This modeling assumption applies a 2017 level of care to future years based on current care use and delivery patterns. How might we better measure current shortages in other specialties? To the extent that current national shortages exist for other specialties, the projections underestimated demand from 2017 through 2032 by roughly the size of the current national shortage.
- **New care delivery and financing models**: As health systems implement new care delivery models to reflect changes in health care financing and to improve the quality and value of care delivered, information is needed on how these changes affect patient care use and health workforce staffing. How will the emerging technologies and payment reform that better enable telemedicine and other technology affect demand for physician services, physician productivity, physician career satisfaction, patient access to care, patient care utilization, and outcomes? Because health systems consider such information proprietary, relatively little information makes its way into the public domain in the form of peer-reviewed, published research. Published evaluations of new care delivery models often lack key information for workforce modeling — such as how an intervention affected physician productivity or staffing. Case studies of best practices in care delivery could provide information to use in quantifying the implications for the health workforce of generalizing those best practices to a broader population, and they could lead to a better understanding of the role of primary care physicians in addressing behavioral health needs and the implications for physician demand.

These knowledge deficits present opportunities for ongoing research on the workforce implications of the evolving health care system and underscore the need for timely updates to projections.

APPENDIX 1: DATA AND METHODS

This appendix provides a brief overview of the workforce microsimulation models used, the data and assumptions, and information about select model inputs. Detailed technical documentation of the supply and demand models is available elsewhere.[25,26]

Synopsis of Study Methods

Consistent with the previous physician workforce reports, this 2019 update used a microsimulation approach to project the supply of and demand for health care services and physicians. These supply and demand projection models have been used for health workforce modeling for federal and state governments, trade and professional associations, and health systems to model supply and demand for physicians and other health occupations.

The supply model, under a status quo scenario, simulates the likely career decisions of physicians, given the current numbers, specialty mix and demographics of new entrants to the physician workforce, retirement and mortality patterns, and patterns of patient care hours worked. The supply model begins with the 2017 American Medical Association (AMA) Physician Masterfile, adds new physicians based on reported numbers of physicians completing their graduate medical education, subtracts estimates of physicians retiring, and accounts for projected differences in average patient care hours worked as the demographics of the physician workforce change. Additional supply scenarios modeled the implications of (1) changing physician retirement patterns — including delaying retirement or retiring earlier by two years, on average; (2) a "declining hours" scenario under which the downward trend in hours worked observed between 2005-2007 and 2015-2017 continues over time, where today's physicians work slightly fewer hours per week than older cohorts; and (3) a modest expansion of graduate medical education programs.

The demand projections start by extrapolating current levels of care into the future as the population grows and ages, taking into consideration projected changes in disease prevalence and other health risk factors among the population if health care use and delivery patterns remained unchanged. The implications of continued expansion of medical insurance coverage was modeled based on initiatives being pursued by five states, though the modeled expansion is substantially less than what was modeled in previous years when the Affordable Care Act (ACA) more strongly encouraged insurance coverage. We updated scenarios reflecting possibly greater reliance on managed care and retail clinics, rapid growth in supply of APRNs and PAs, and the implications of achieving certain population health goals: improved body weight, smoking cessation, and improved control of blood pressure, cholesterol, and blood glucose levels.

Supply Model Overview and Updates

Current physician workforce: Supply modeling starts with the 2017 AMA Physician Masterfile to identify the size and characteristics of the current workforce. In 2017, there were approximately 800,300 physicians under age 75 in active practice who had completed their graduate medical education (compared with about 791,400 in 2016).[xii] The approximately 226,000 active primary care physicians were 28% of the workforce, with another 135,900 (17%) in medical specialties, 155,900 (19%) in surgical specialties, 30,900 (4%) primary care-trained hospitalists, and 251,600 (31%) in the remaining specialties. Women constituted about a third of the workforce. Physicians within the

traditional retirement age between 65 and 75 were 15% of the active workforce, and those between age 55 and 64 made up 27% of the active workforce. Therefore, it is possible that more than a third of currently active physicians might retire within the next decade.

New entrants: Under the status quo supply scenario, estimates of the number of physicians completing their GME in individual specialties came from published information about programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) and the American Osteopathic Association (AOA), considering that some programs are dually accredited.[125,126] The age and sex distribution of new physicians was derived from analysis of the 2017 AMA Physician Masterfile. We estimate approximately 28,854 physicians completed GME between 2017 and 2018 (similar to the 28,836 estimate in last year's report). In total, approximately 7,420 physicians (26% of new graduates) entered the workforce as primary care providers; 1,831 (6%) entered as primary care-trained new hospitalists; 5,450 (19%) entered in internal medicine and pediatric subspecialties; 5,189 (18%) entered in surgical specialties; and 8,964 (31%) entered in other specialties. Compared with the 2018 report, our estimates of annual new entrants to the workforce are lower for primary care by 285 physicians, lower for medical specialties by 68 physicians, higher for surgery by 51 physicians, higher for the "all other" category by 61 physicians, and higher for primary care-trained hospitalists by 259 physicians. Changes from last year reflect, in part, additional analysis of first and second specialty for physicians in the AMA Masterfile reflecting changes in physician specialization after completing initial residency (e.g., small numbers of primary care physicians moving into the field of sleep medicine or another specialty outside their initial training).

Hours-worked patterns: Supply projections take into consideration differences in average hours per week spent in patient care by physician age, sex, and specialty. This component of the model is based on regression analysis of combined data from four states: (1) biannual 2012-2013 survey data (n = 17,782) of physicians in Florida who renewed their license and who work at least eight hours per week in professional activities; (2) 2013 survey data from physicians in South Carolina (n = 9,252); (3) 2013 survey data from physicians in New York (n = 24,668); and (4) 2018 licensing data from physicians in Maryland. The analysis found that, controlling for specialty, hours worked per week were relatively constant through age 59 for men but decreased beyond age 60. Female physicians worked about four to five fewer hours per week than their male counterparts through age 54, but among those age 55 and older, worked only about one to three fewer hours per week than males of similar age and specialty.

Retirement patterns: For the previous reports and this update, the supply model used age-sex-specialty-dependent annual attrition probabilities to simulate providers leaving the workforce. Publicly available sources of data for modeling specialty-specific retirement patterns are unavailable. These supply projections use retirement patterns estimated from data collected through Florida's mandated biannual physician licensure survey (2012-2013 data), which asks about intention to retire in the upcoming five years. The Florida physician survey is currently among the timeliest sources of information available regarding physician retirement patterns.

Calculated retirement rates from the Florida survey are generally consistent with estimates derived from analysis of the AAMC's 2006 Survey of Physicians Over Age 50 (which collected information on age at retirement or age expecting to retire). The 2006 AAMC survey data were collected before the economic downturn (which occurred from approximately 2008 to 2010), while the Florida survey data were collected during a period of economic recovery. Mortality rates from the Centers for Disease

Control and Prevention (CDC), which are specific to each age-sex combination, were combined with rates of intention to retire to calculate overall attrition rates.[xiii] Johnson et al. found that age-adjusted mortality rates for occupational and technical specialties are approximately 25% lower than national rates for men and 15% lower for women through age 65. As a result, mortality rates for physicians under age 65 were adjusted downward.[xiv]

Demand Model Overview and Updates

Demand for physicians is calculated based on projected demand for health care services and staffing patterns for care delivery. Demand for health care services is defined as the level of care likely to be sought by consumers given their needs, care use patterns, and economic considerations like level of health insurance coverage and cost of care. "Demand" differs from "need," which is based on clinical and epidemiological considerations.

For modeling purposes, at the national level we quantify current demand for health care services (and physicians) as equivalent to the level of health care services utilized (and current physician supply). Demand projections are thus extrapolating a 2017 level of care, with any imbalances between supply and demand (whether shortfalls or excesses) extrapolated into the future. An exception pertains to federal government estimates that the nation requires approximately 14,472 primary care physicians and 5,906 psychiatrists to de-designate the federally designated primary care and mental health professional shortage areas (HPSAs). For modeling purposes, we assume these 20,378 physicians reflect national shortfalls.[xv] To the extent that other shortages already exist in specialties other than primary care and psychiatry, our starting point assumption may be a moderate one.

The microsimulation approach simulates demand for health care services for a nationally representative sample of the current U.S. population projected to 2032. Then, demand for physicians, APRNs, and PAs are modeled to meet the projected demand for services. Exhibit 22 summarizes, by demand model component, the data sources incorporated into the 2018 and this 2019 workforce projections update.

Exhibit 22: Summary of 2018 and 2019 Report Demand Modeling Data Sources

Model Component	2018 Report Projections	2019 Report Projections
National/state population files	2016 ACS 2015 & 2016 BRFSS 2015 CMS Minimum Dataset for Nursing Home Residents 2013 MCBS Dataset for Residential Care Residents	2017 ACS 2015 & 2017 BRFSS 2015 CMS Minimum Dataset for Nursing Home Residents 2015 MCBS Dataset for Residential Care Residents
Weights for population projections	2017 U.S. Census Bureau national population projections; State population projections to estimate demand by region and metro/non-metropolitan area	2017 U.S. Census Bureau national population projections; State population projections to estimate demand by region and metro/non-metropolitan area
Health care use equations	2011-2015 Pooled MEPS	2012-2016 Pooled MEPS
Hospital inpatient day equations	2014 NIS	2014 NIS
Health care use calibration/validation	2014 NIS 2015 NAMCS	2014 NIS 2015 NAMCS

	2013 & 2014 NHAMCS	2014 & 2015 NHAMCS
Physician staffing ratios	2016 AMA Masterfile	2017 AMA Masterfile

Notes: ACS = American Community Survey; BRFSS = Behavioral Risk Factor Surveillance System; CMS = Centers for Medicare and Medicaid Services; NNHS = National Nursing Home Survey; MCBS=Medicare Beneficiary Survey; MEPS = Medical Expenditure Panel Survey; NIS = Nationwide Inpatient Sample; NHANCS = National Hospital Ambulatory Medical Care Survey; AMA = American Medical Association.

APPENDIX 2: PHYSICIAN DEMAND BY PATIENT RACE AND ETHNICITY, REGION, AND METROPOLITAN STATUS

Below we provide detailed updated demand projections for physicians by patient race and ethnicity, region of the country, and metropolitan/non-metropolitan areas.

Exhibit 23: Projected Physician Demand by Patient Race and Ethnicity, 2017-2032

	Non-Hispanic				
	White	**Black**	**Other**	**Hispanic**	**Total**
2017					
Total	**567,500**	**91,300**	**59,900**	**102,000**	**820,700**
Primary Care	158,500	25,300	21,500	35,200	240,500
Non-primary Care	409,000	66,000	38,400	66,800	580,200
Medical Specialties	92,600	18,100	9,100	16,100	135,900
Surgery	110,000	16,400	10,700	18,800	155,900
Other	185,100	27,200	16,600	28,600	257,500
Hospitalist	21,300	4,300	2,000	3,300	30,900
2032					
Total	**613,800**	**112,500**	**83,300**	**143,500**	**953,100**
Primary Care	173,400	31,800	30,000	48,200	283,400
Non-primary Care	440,400	80,700	53,300	95,300	669,700
Medical Specialties	104,800	23,100	13,100	24,200	165,200
Surgery	116,900	19,400	14,400	26,500	177,200
Other	194,300	32,600	22,800	39,600	289,300
Hospitalist	24,400	5,600	3,000	5,000	38,000
Growth 2017 to 2032					
Total	**46,300**	**21,200**	**23,400**	**41,500**	**132,400**
Primary Care	14,900	6,500	8,500	13,000	42,900
Non-primary Care	31,400	14,700	14,900	28,500	89,500
Medical Specialties	12,200	5,000	4,000	8,100	29,300
Surgery	6,900	3,000	3,700	7,700	21,300
Other	9,200	5,400	6,200	11,000	31,800
Hospitalist	3,100	1,300	1,000	1,700	7,100

Exhibit 24: Projected Physician Demand Growth by Patient Race and Ethnicity, 2017-2032

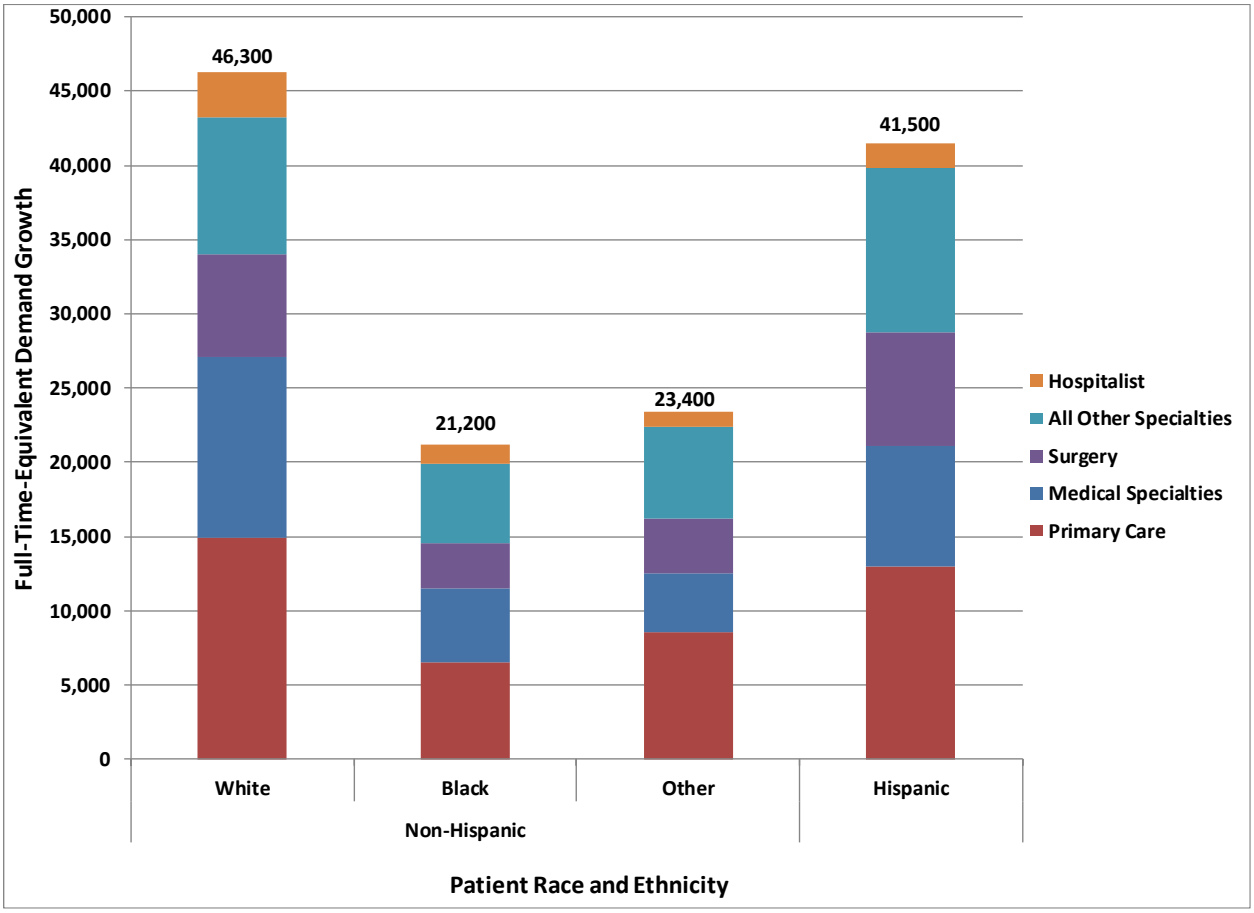


Exhibit 25: Physician Supply and Demand by Census Region, 2017

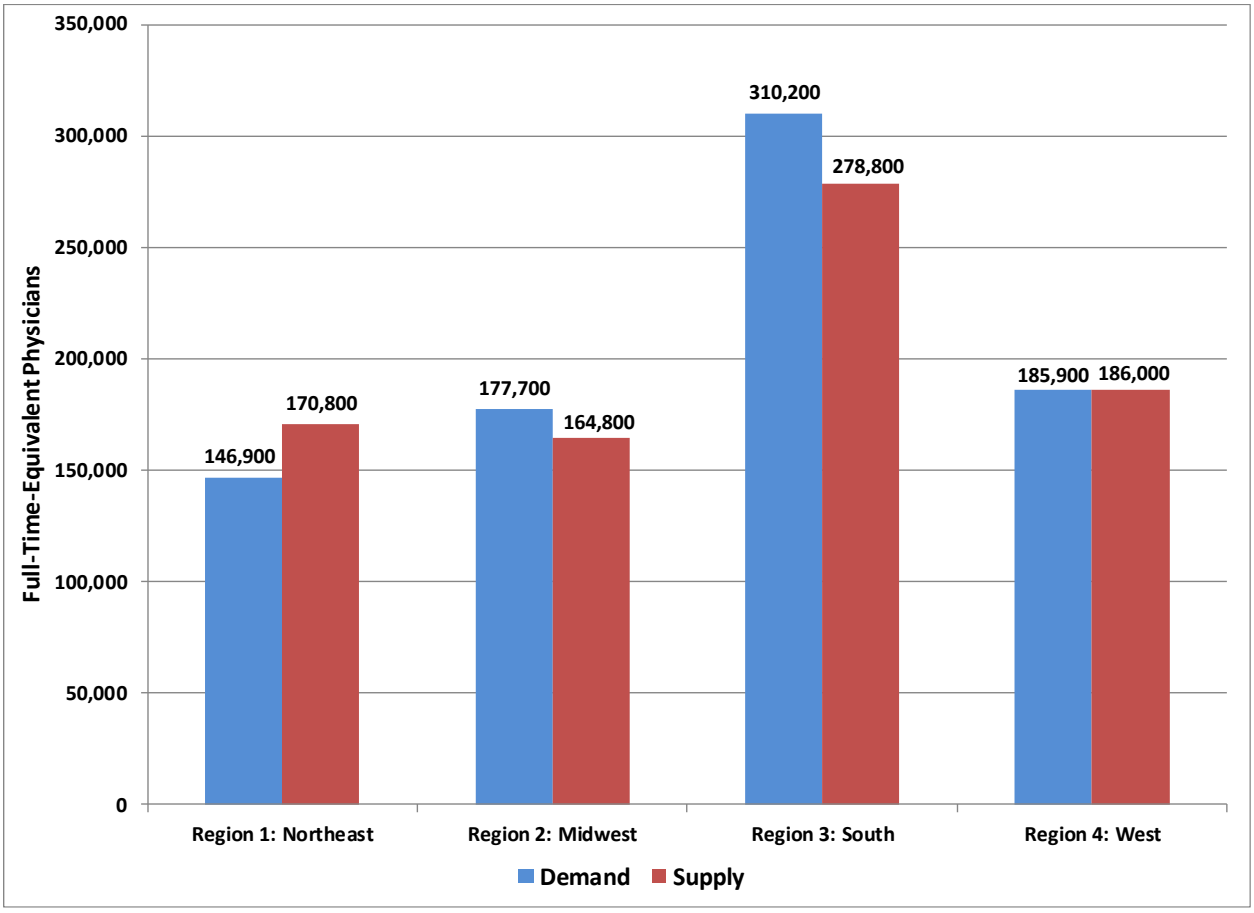


Exhibit 26: Projected Physician Demand by Census Region, 2017-2032

	Region 1: Northeast	Region 2: Midwest	Region 3: South	Region 4: West	Total
2017					
Total	**146,900**	**177,700**	**310,200**	**185,900**	**820,700**
Primary Care	42,500	51,500	90,400	56,100	240,500
Non-primary Care	104,400	126,200	219,800	129,800	580,200
Medical Specialties	24,100	28,900	52,700	30,200	135,900
Surgery	28,200	34,100	58,300	35,300	155,900
Other	46,600	56,400	96,800	57,700	257,500
Hospitalist	5,500	6,800	12,000	6,600	30,900
2032					
Total	**157,900**	**186,600**	**375,500**	**233,100**	**953,100**
Primary Care	46,400	54,800	111,500	70,700	283,400
Non-primary Care	111,500	131,800	264,000	162,400	669,700
Medical Specialties	26,900	31,600	66,800	39,900	165,200
Surgery	29,700	35,100	68,900	43,500	177,200
Other	48,700	57,500	112,900	70,200	289,300
Hospitalist	6,200	7,600	15,400	8,800	38,000
Growth 2017 to 2032					
Total	**11,000**	**8,900**	**65,300**	**47,200**	**132,400**
Primary Care	3,900	3,300	21,100	14,600	42,900
Non-primary Care	7,100	5,600	44,200	32,600	89,500
Medical Specialties	2,800	2,700	14,100	9,700	29,300
Surgery	1,500	1,000	10,600	8,200	21,300
Other	2,100	1,100	16,100	12,500	31,800
Hospitalist	700	800	3,400	2,200	7,100

Exhibit 27: Projected Physician Demand by Metropolitan/Non-metropolitan Location, 2017

	Metropolitan	Non-metropolitan
Total	**741,600**	**79,100**
Primary Care	216,600	23,900
Non-primary Care	525,000	55,200
Medical Specialties	121,200	14,700
Surgery	141,600	14,300
Other	235,100	22,400
Hospitalist	27,100	3,800

Exhibit 28: Summary of Projected Gap Between Physician Supply and Demand

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Total Physicians																
	20,40	28,30	35,40	42,90	50,10	58,80	67,40	75,50	84,50	92,60	99,80	106,10	112,40	116,50	118,90	121,90
75th Percentile	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	20,40	24,20	26,10	29,00	30,90	33,00	35,70	37,50	39,70	42,00	44,20					
25th Percentile	0	0	0	0	0	0	0	0	0	0	0	46,700	49,800	49,800	48,100	46,900
Primary Care																
	14,50	17,30	19,90	22,50	25,20	28,20	31,40	34,40	37,50	40,40	43,20					
75th Percentile	0	0	0	0	0	0	0	0	0	0	0	45,800	48,600	51,100	53,000	55,200
	14,50	14,60	14,80	15,00	14,60	14,50	15,90	17,10	18,40	19,30	19,70					
25th Percentile	0	0	0	0	0	0	0	0	0	0	0	20,100	20,700	21,500	21,200	21,100
Non-primary Care																
		11,00	15,50	20,40	25,00	29,70	33,70	37,70	43,50	47,50	50,70					
75th Percentile	5,900	0	0	0	0	0	0	0	0	0	0	54,500	58,700	61,100	63,400	65,800
			11,90	15,50	16,40	17,00	18,60	19,50	21,90	22,80	23,30					
25th Percentile	5,900	9,400	0	0	0	0	0	0	0	0	0	24,100	25,800	25,600	25,100	24,800
Medical Specialties																
75th Percentile	-	1,200	2,000	2,800	3,800	5,100	6,100	6,800	7,900	8,700	9,500	10,000	10,700	11,500	11,700	12,100
25th Percentile	-	700	700	700	1,000	1,200	1,600	2,200	2,400	2,900	2,800	2,800	2,800	2,800	2,100	1,900
Surgical Specialties		1,200	2,000	2,800	3,800	5,100	6,100	6,800	7,900	8,700						
							11,30	13,00	14,90	16,60	18,30					
75th Percentile	-	1,800	3,400	5,600	7,500	9,400	0	0	0	0	0	19,500	20,800	21,900	22,300	23,400
										10,00	10,90					
25th Percentile	-	1,300	2,600	3,900	4,700	5,900	7,200	8,100	9,100	0	0	11,700	12,700	13,300	13,700	14,300
Other Specialties																
			12,30	15,10	18,20	21,50	23,90	26,10	28,90	31,30	33,30					
75th Percentile	5,900	9,100	0	0	0	0	0	0	0	0	0	34,500	36,100	37,100	38,100	39,100
			10,50	12,40	13,50	14,40	15,90	17,10	18,50	19,30	20,00					
25th Percentile	5,900	8,300	0	0	0	0	0	0	0	0	0	20,600	21,400	21,200	20,900	20,600
Hospitalists (primary care-trained)																
75th Percentile	-	-1,000	-2,000	-3,000	-3,900	-4,700	-5,500	-6,200	-7,000	-7,600	-8,400	-9,000	-9,500	-10,100	-10,500	-10,900
25th Percentile	-	-1,000	-2,100	-3,200	-4,200	-5,000	-5,900	-6,800	-7,700	-8,400	-9,200	-9,900	-10,600	-11,400	-12,100	-12,700

Note: The shortage range for total physicians can differ from the sum of the ranges for the specialty categories. The demand scenarios modeled project future demand for physician services, but scenarios can differ in terms of whether future demand will be provided by primary care or non-primary care physicians. Likewise, the range for total non-primary care can differ from the sum of the ranges for the specialty categories. Negative numbers reflect projected excess supply, and positive numbers reflect projected shortfalls.

Exhibit 29: Projected Physician Supply, 2017-2032

Year	Workforce Participation Scenarios				Policy Scenario
	Status Quo	Retire 2 Years Earlier	Retire 2 Years Later	Declining Hours	GME Expansion
2017	800,300	800,300	800,300	800,300	800,300
2018	802,600	801,820	803,365	802,700	802,600
2019	804,600	801,630	807,450	804,600	804,600
2020	807,100	800,755	813,175	806,800	807,100
2021	809,700	798,960	819,840	809,100	809,700
2022	812,100	796,425	827,325	811,000	812,100
2023	814,400	795,520	832,720	812,600	814,400
2024	817,700	795,430	838,950	814,500	820,700
2025	820,400	795,110	844,790	815,800	826,500
2026	823,600	795,195	851,055	817,300	832,800
2027	827,100	795,800	857,600	819,000	839,300
2028	831,100	798,300	862,900	820,700	846,400
2029	834,700	800,900	867,700	822,100	853,000
2030	839,500	804,900	873,200	824,300	860,900
2031	845,200	809,400	879,500	827,300	869,500
2032	850,500	813,600	885,100	829,600	877,700
% Growth 2017-2032	6%	2%	11%	4%	10%

Exhibit 30: Physician Supply Projection Summary by Specialty Category, 2017-2032

Year	Workforce Participation Scenarios				Policy Scenario
	Status Quo	Retire 2 Years Earlier	Retire 2 Years Later	Declining Hours	GME Expansion
2017					
Total	800,300				
Primary Care	226,000				
Non-primary Care	574,300				
Medical Specialties	135,900				
Surgical Specialties	155,900				
Other Specialties	251,600				
Hospitalists *	30,900				
2032					
Total	850,500	813,600	885,100	829,600	877,700
Primary Care	229,200	218,600	239,300	225,300	236,200
Non-primary Care	621,300	595,000	645,800	604,300	641,500
Medical Specialties	154,400	148,100	160,100	150,800	159,400
Surgical Specialties	158,300	151,100	164,900	154,100	163,300
Other Specialties	258,300	246,900	269,300	250,500	266,800
Hospitalists *	50,300	48,900	51,500	48,900	52,000
Growth 2017 to 2032					
Total	50,200	13,300	84,800	29,300	77,400
Primary Care	3,200	-7,400	13,300	-700	10,200
Non-primary Care	47,000	20,700	71,500	30,000	67,200
Medical Specialties	18,500	12,200	24,200	14,900	23,500
Surgical Specialties	2,400	-4,800	9,000	-1,800	7,400
Other Specialties	6,700	-4,700	17,700	-1,100	15,200
Hospitalists *	19,400	18,000	20,600	18,000	21,100

*Includes only hospitalists trained in primary care. Hospitalists in non-primary care specialties are included with their individual specialty. Category totals might not sum to totals because of rounding.

Exhibit 31: Projected Physician Demand Summary by Scenarios Modeled, 2017-2032

Scenario	2017	2032	Growth 2017 to 2032	% Growth 2017 to 2032
Scenario 1: Changing Demographics				
Total	**820,700**	**952,900**	**132,200**	**16%**
Primary Care	240,500	283,300	42,800	18%
Non-primary Care	580,200	669,600	89,400	15%
Medical Specialties	135,900	165,200	29,300	22%
Surgery	155,900	177,100	21,200	14%
Other Specialties	257,500	289,300	31,800	12%
Hospitalists*	30,900	38,000	7,100	23%
Scenario 2: Changing Demographics + ACA Medical Insurance Expansion				
Total		**953,100**	**132,400**	**16%**
Primary Care		283,400	42,900	18%
Non-primary Care		669,700	89,500	15%
Medical Specialties		165,200	29,300	22%
Surgery		177,200	21,300	14%
Other Specialties		289,300	31,800	12%
Hospitalists*		38,000	7,100	23%
Scenario 3: Changing Demographics + ACA + Managed Care				
Total		**974,700**	**154,000**	**19%**
Primary Care		303,400	62,900	26%
Non-primary Care		671,300	91,100	16%
Medical Specialties		160,300	24,400	18%
Surgery		178,500	22,600	14%
Other Specialties		294,300	36,800	14%
Hospitalists*		38,200	7,300	24%
Scenario 4: Changing Demographics + ACA + Increased Use of Retail Clinics				
Total		**940,200**	**119,500**	**15%**
Primary Care		270,500	30,000	12%
Non-primary Care		669,700	89,500	15%
Medical Specialties		165,200	29,300	22%
Surgery		177,200	21,300	14%
Other Specialties		289,300	31,800	12%
Hospitalists*		38,000	7,100	23%
Scenario 5: Changing Demographics + ACA + Increased Use of Advanced Practice Nurses and PAs ("moderate-use" level)				
Total		**895,500**	**74,800**	**9%**
Primary Care		249,100	8,600	4%
Non-primary Care		646,400	66,200	11%
Medical Specialties		156,600	20,700	15%
Surgery		172,900	17,000	11%
Other Specialties		279,100	21,600	8%
Hospitalists*		37,800	6,900	22%
Scenario 6: Changing Demographics + ACA + Increased Use of Advanced Practice Nurses and PAs ("high-use" level)				
Total		**838,100**	**17,400**	**2%**
Primary Care		214,800	-25,700	-11%
Non-primary Care		623,300	43,100	7%
Medical Specialties		148,100	12,200	9%
Surgery		168,600	12,700	8%
Other Specialties		269,000	11,500	4%
Hospitalists*		37,600	6,700	22%
Scenario 7: Changing Demographics + ACA + Increased Use of Advanced Practice Nurses (moderate practice level) + Population Health Goals Achieved				
Total		**933,900**	**113,200**	**14%**
Primary Care		260,800	20,300	8%
Non-primary Care		673,100	92,900	16%
Medical Specialties		162,800	26,900	20%
Surgery		180,900	25,000	16%
Other Specialties		290,600	33,100	13%
Hospitalists*		38,800	7,900	26%

*Includes only hospitalists trained in primary care. Hospitalists in non-primary care specialties are included with their individual specialty. Category totals might not sum to totals because of rounding.

Exhibit 32: Additional Physicians Required to Achieve Health Care Utilization Equity, 2017

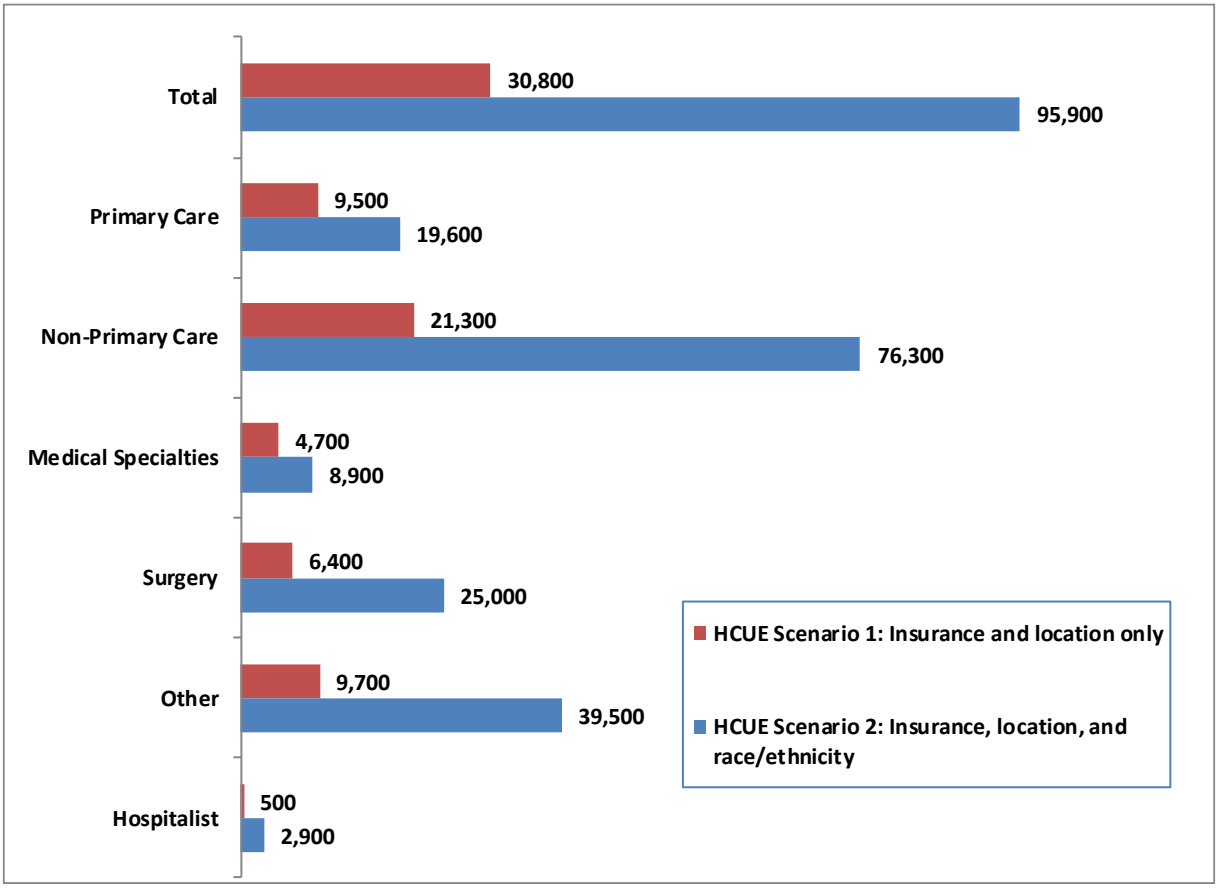


Exhibit 33: Additional Physicians Required to Achieve Health Care Utilization Equity in 2017, by Patient Race/Ethnicity

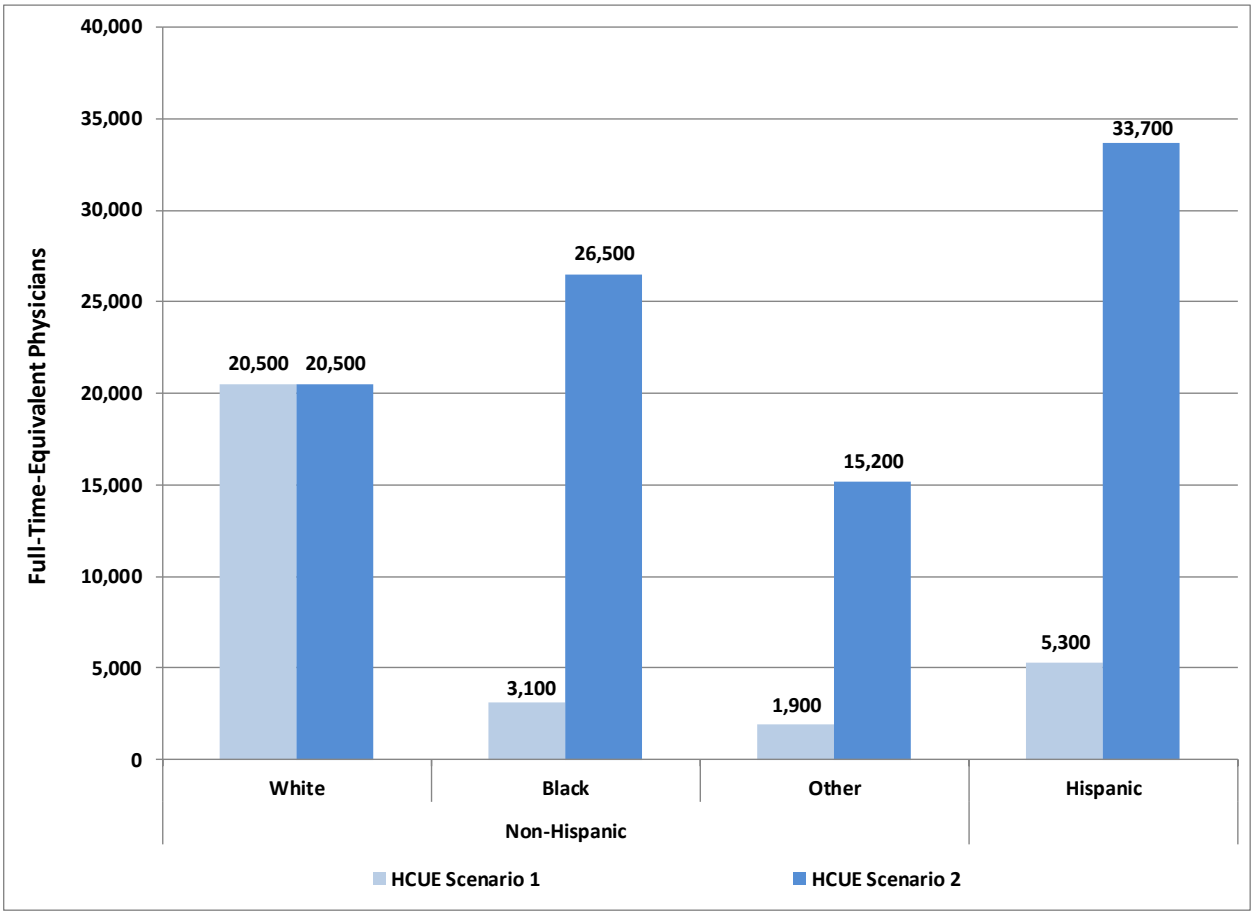


Exhibit 34: Additional Physicians Required to Achieve Health Care Utilization Equity in 2017, by Region

Scenario	Region I: Northeast	Region 2: Midwest	Region 3: South	Region 4: West	Total
HCUE Scenario 1: Total	**3,600**	**6,700**	**15,100**	**5,400**	**30,800**
Primary Care	1,100	2,000	4,700	1,700	9,500
Non-primary Care	2,500	4,700	10,400	3,700	21,300
Medical Specialties	600	1,100	2,200	800	4,700
Surgery	700	1,200	3,300	1,200	6,400
Other	1,100	2,300	4,700	1,600	9,700
Hospitalist	100	100	200	100	500
HCUE Scenario 2: Total	**13,900**	**15,400**	**42,400**	**24,200**	**95,900**
Primary Care	2,600	3,500	9,800	3,700	19,600
Non-primary Care	11,300	11,900	32,600	20,500	76,300
Medical Specialties	1,200	1,500	3,600	2,600	8,900
Surgery	3,700	3,700	11,100	6,500	25,000
Other	5,900	6,300	16,700	10,600	39,500
Hospitalist	500	400	1,200	800	2,900

Exhibit 35: Additional Physicians Required to Achieve Health Care Utilization Equity in 2017, by Region

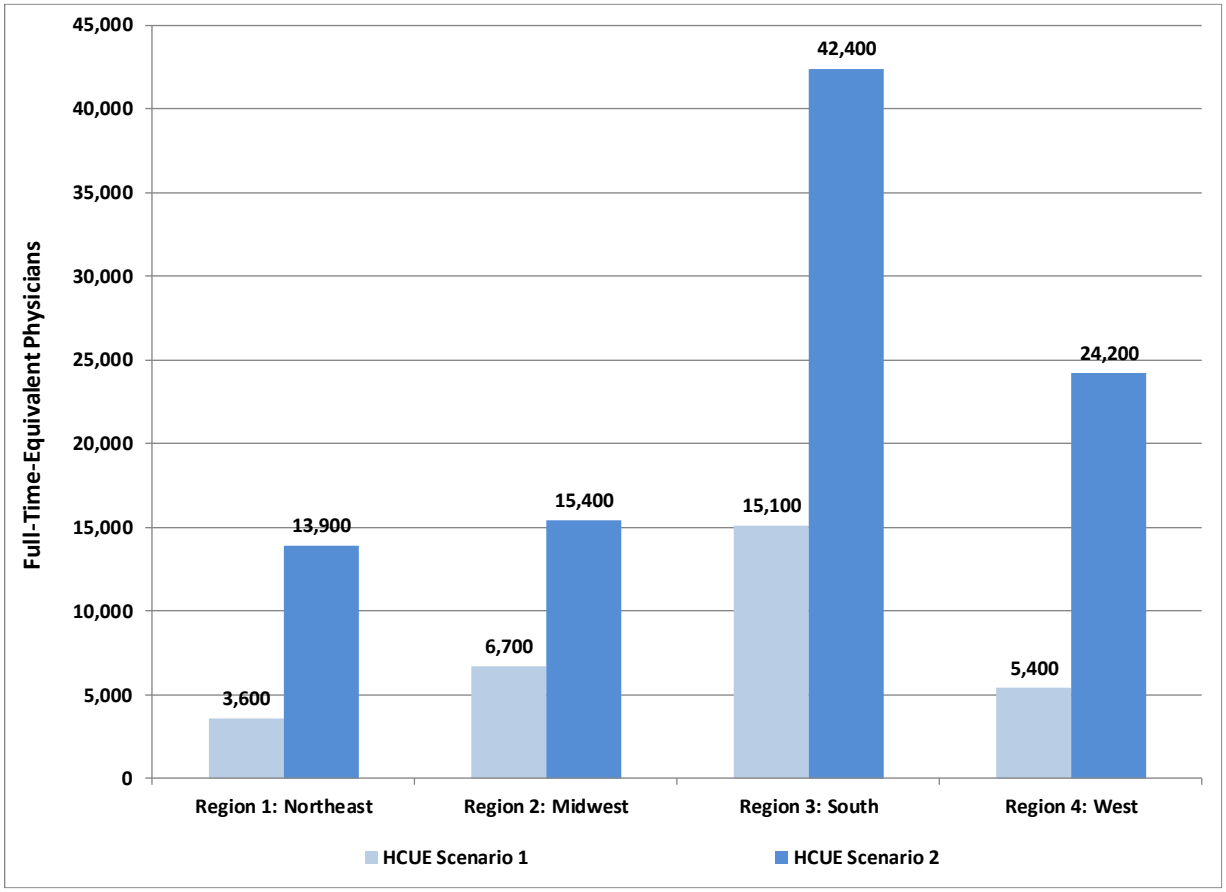
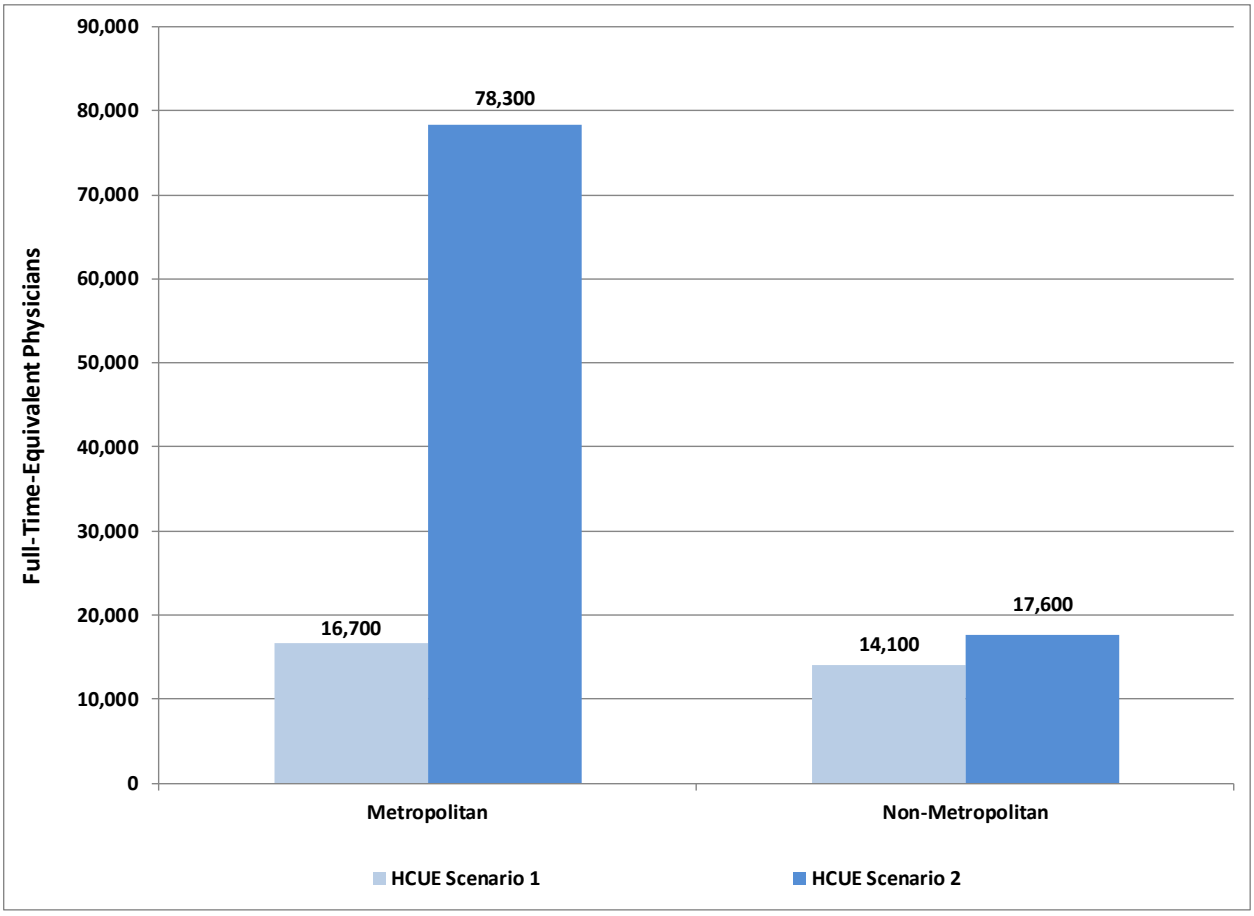


Exhibit 36: Additional Physicians Required to Achieve Health Care Utilization Equity in 2017, by Metropolitan/Non-metropolitan Area

Scenario	Metropolitan	Non-metropolitan	Total
HCUE Scenario 1: **Total**	**16,700**	**14,100**	**30,800**
Primary Care	5,500	4,000	9,500
Non-primary Care	11,200	10,100	21,300
Medical Specialties	2,400	2,300	4,700
Surgery	4,300	2,100	6,400
Other	4,100	5,600	9,700
Hospitalist	400	100	500
HCUE Scenario 2: ***Total***	**78,300**	**17,600**	**95,900**
Primary Care	15,000	4,600	19,600
Non-primary Care	63,300	13,000	76,300
Medical Specialties	6,400	2,500	8,900
Surgery	21,900	3,100	25,000
Other	32,300	7,200	39,500
Hospitalist	2,700	200	2,900

Exhibit 37: Additional Physicians Required to Achieve Health Care Utilization Equity in 2017, by Metropolitan/Non-metropolitan Area



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ENDNOTES

i. Primary care consists of family medicine, general internal medicine, general pediatrics, and geriatric medicine. Medical specialties consist of allergy and immunology, cardiology, critical care, dermatology, endocrinology, gastroenterology, hematology and oncology, infectious diseases, neonatal and perinatal medicine, nephrology, pulmonology, and rheumatology. Surgical specialties consist of general surgery, colorectal surgery, neurological surgery, obstetrics and gynecology, ophthalmology, orthopedic surgery, otolaryngology, plastic surgery, thoracic surgery, urology, vascular surgery, and other surgical specialties. The Other Specialties category consists of anesthesiology, emergency medicine, neurology, pathology, physical medicine and rehabilitation, psychiatry, radiology, and all other specialties. Hospitalists trained in adult primary care are modeled as their own category and have been moved out of the primary care category. Hospitalists trained in non-primary care specialties are modeled within their trained specialty.

ii. By Dec. 31, 2018, the estimate of practitioners necessary to remove shortage designations had risen to 14,900 for primary care and 6,894 for mental health.

iii. The AMA Masterfile contains a first and second reported specialty. Previously we identified surgeons and their specialty based on first reported specialty. For this report we considered both the first and second reported specialty, and categorized surgeon specialty based on the surgical specialty that required the most extensive training. In addition, some physicians have a non-surgical specialty as their first specialty and a surgical specialty as their second specialty. These physicians were modeled as surgeons in this study. This includes some dermatologists who were reclassified under plastic surgery based on secondary specialty code, some family physicians also providing obstetrics and gynecology services, some anesthesiologists recategorized into general surgery based on second reported specialty, and physicians across a variety of other specialties such as emergency medicine and critical care that were reclassified into surgery based on second reported specialty. Physicians reclassified as surgeons tended to be younger, resulting in lower rates of annual retirements.

iv. The rate of burnout varies by specialty; is higher for female physicians (48%) compared with male physicians (38%), partly reflecting different specialty mix among female and male physicians; and rates vary by physician age, with half of physicians ages 45-54 reporting burnout. Top contributors to physician burnout are “too many bureaucratic tasks” and “spending too many hours at work.”

v. For example, comparing average hours worked for physicians age 35-39 indicates an 8.9% decline for men and 13.3% decline for women when comparing hours worked in 2000-2002 with 2005-2007. Comparing 2005-2007 hours versus 2010-2012 hours indicates a 1.6% decline for men and 1.8% decline for women. Comparing 2010-2012 hours versus 2015-2017 hours indicates a 1.1% decline for men and 4.2% increase for women.

vi. Hospitalists trained in pediatrics cannot easily be identified using Medicare billing records. Therefore, for hospitalists with pediatric training we use estimates from the AMA Masterfile of pediatricians who report their work location as a hospital. Hospitalists with specialized training in an internal medicine subspecialty or other specialty were categorized under their specialty rather than as a hospitalist for purposes of our modeling (e.g., a neurologist practicing as a

hospitalist was categorized as a neurologist). In the remainder of this section, references to hospitalists focus on those whose final GME training was in general internal medicine, family medicine, geriatric medicine, or pediatric medicine.

vii. By adding data from an additional state (Maryland) to states for which we already had physician hours-worked data (Florida, New York, and South Carolina), the sample size was sufficient to model separate hours-worked prediction equations by medical specialty and capture age effects on hours worked by specialty.

viii. Clinical nurse specialists (CNSs) are not included in the workforce projections due to lack of data for modeling CNS supply and demand. Whereas NPs concentrate on direct patient care, CNSs often work in health care administration and are less likely to displace demand for physicians or directly affect physician productivity compared to NPs and PAs.

ix. For race and ethnicity, we divided the population into four mutually exclusive categories: non-Hispanic white, non-Hispanic black, non-Hispanic other, and Hispanic. People of Hispanic ethnicity are in the Hispanic category. For non-Hispanic populations, white only and black only are included in their respective categories. Non-Hispanic individuals listing any other race or combination of races are included in the “other” category. Race is self-reported, but the “other” category includes Asian, Native Hawaiian or Other Pacific Islander, and American Indian or Alaska Native. Many of racial groups in the “other” category have a very small sample size in the databases analyzed for modeling. These race/ethnicity categories are consistent with those used by the Health Resources and Services Administration for workforce modeling.

x. In many of the databases analyzed, such as the Medical Expenditure Panel Size and the Behavioral Risk Factor Surveillance System, the sample sizes are too small to model other ethnicities of interest (e.g., Native Americans, Pacific Islanders, Alaskan Natives) — especially when sub-setting by state, age group, and gender.

xi. By Dec. 31, 2018, the estimate of practitioners required to remove mental health shortage designations had risen to 6,894.

xii. Both the supply and demand models measure full-time equivalents based on number of physicians who have completed their graduate medical education. To the extent that some physicians-in-training also provide direct patient care, both demand and supply would be adjusted upward by the same amount so any gap between supply and demand would be unchanged.

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xv. For information on HPSA designation, see https://data.hrsa.gov/topics/health-workforce/shortage-areas.

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