2017 Update

The Complexities of Physician Supply and Demand: Projections from 2015 to 2030

Final Report

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EXECUTIVE SUMMARY

The need to assess the capacity of the nation's future health care workforce in general—and physician workforce in particular—is important for both public and private sectors. They both need up-to-date information to make needed investments in a health care system that provides high-quality, cost-efficient health care while also developing the physicians needed to transform the current system and to maximize population health. The pace of change in the world of health care delivery and finance necessitates that workforce projections and the models they are based on are updated and improved almost constantly. Furthermore, any shift in the likely fortunes of health care reform creates uncertainty about how to plot a successful course toward achieving national goals of improved access to high-quality, affordable care. That is why in 2015, the Association of American Medical Colleges (AAMC) made a commitment to publish annual updates of national physician workforce projections. Their purpose is threefold:

- **Update projections:** Support the ongoing development of up-to-date projections of the physician workforce based on the most recent and best-quality data and respond to questions raised by previous reports.
- **Present new analyses:** Produce research and data on specific topics to further develop the physician workforce projections.
- **Identify future directions for research:** Identify specific areas for future research, data collection, and analysis that will also strengthen future projections work and support the decision making to help align the nation's health needs with its health workforce.

Through these efforts, the AAMC intends to invite discussion that will continue to advance our collective capacity for developing improved health workforce projections with data-driven analysis. Though the microsimulation model and most of the supply and demand scenarios are identical to those in the 2016 report, the inputs to them have been updated with the latest data and with improvements suggested by commentators responding to the projections in the 2015 and 2016 reports.

This 2017 update to the previous (2016 and 2015) reports reflects the AAMC's commitment to produce annual, refined physician workforce projections that incorporate the most current and best available evidence about health care delivery. As in the 2016 report, this update examines five scenarios that might affect key physician supply determinants (e.g., early or delayed retirement of physicians). In addition to the six scenarios around trends expected to affect the demand for physician services over the next decade (e.g., changing demographics, greater adoption of managed-care models, and greater integration of advanced practice registered nurses [APRNs] and physician assistants [PAs]), we include a seventh scenario in all the projection ranges. This newly added scenario models the potential workforce implications of achieving certain population health goals: reducing excess body weight; controlling blood pressure, cholesterol, and blood glucose levels better; and stopping smoking.

This report compares each supply scenario with each demand scenario to estimate the likely magnitude of the physician shortfall when looking at each combination in isolation. Because it is impossible to predict with certainty the degree to which each scenario will manifest, this analysis reports the

projected shortfalls as a range of the projected scenario pairs (based on the 25th to 75th percentile of the projections) rather than a single projection. The resulting findings thus offer stakeholders insights into the directional changes expected in the physician workforce by 2030. 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.[1]

We have also expanded the section on the implications of potentially unmet need and care use patterns by patient race and ethnicity, region of the United States, and whether patients reside in a metropolitan area. Furthermore, because it takes at least seven years to train a doctor, the projections now extend to 2030 rather than to 2025 to reflect the need for a sufficiently long planning horizon for the nation's physician workforce pipeline.

Key Findings

- **For the third year in a row, we project physician demand will continue to grow faster than supply, leading to a projected total physician shortfall of between 40,800 and 104,900 physicians by 2030 (Exhibits ES-1 and ES-2)**. The shortfall ranges from 34,600 to 88,000 physicians in 2025, and it is projected to increase significantly by 2030. These estimates reflect updates to demand inputs and updates to projected PA and APRN supply through 2030. There is only one scenario where the projected demand for physicians is lower than any of the projected supply estimates.
  - **Projected shortfalls in primary care range between 7,300 and 43,100 physicians by 2030**. These updated projections reflect a projected faster growth in the supply of nurse practitioners (NPs) in primary care and the updated starting point of 2015.
  - **Projected shortfalls in non-primary care specialties range between 33,500 and 61,800 by 2030.** This shortfall is primarily in surgery and selected other specialties (e.g., psychiatry and pathology).
  - **Although projections for individual surgical specialties vary, the projected shortfall in surgical specialties is between 19,800 and 29,000 surgeons by 2030.** This shortfall is driven by projected stagnant supply levels for surgical specialists. On the basis of current trends, the number of newly trained surgeons is almost equal to projected future attrition, so there is little (if any) projected growth in supply. However, there continues to be strong projected growth in demand.
- **Demographics—specifically, population growth and aging—continue to be the primary driver of increasing demand from 2015 to 2030.** During this period, the U.S. population is projected to grow by close to 12%, from about 321 million to 359 million. The population under age 18 is projected to grow by only 5%, while the population aged 65 and over is projected to grow by 55%. Because seniors have much higher per capita consumption of health care than younger populations, the percentage

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[1] For example, if average patient-care hours per week in a particular specialty were 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 35.3 hours for preventive medicine to a high of 54.3 hours for neonatal and perinatal medicine.

growth in demand for services used by seniors is projected to be much higher than the percentage growth in demand for pediatric services.

- **For all specialty categories, physician-retirement decisions are projected to have the greatest impact on supply, and more than one-third of all currently active physicians will be 65 or older within the next decade.** Physicians between ages 65 and 75 account for 10% of the active workforce, and those between ages 55 and 64 make up nearly 26% of the active workforce.

- **The ratio of physicians to APRNs and PAs is projected to fall over time as the APRN and PA supplies grow at faster rates than physician supply.** These projections suggest that the physician-to-PA ratio will fall from 7.2:1 in 2015 to 3.5:1 in 2030. The physician-to-APRN ratio will fall from 3.6:1 in 2015 to 1.9:1 in 2030. It is unclear whether these decreasing ratios are sustainable as an increased number of APRNs and PAs continue to enter the market or to what extent these shifts will affect the demand for physicians.

- **Achieving population health goals may actually raise demand for physicians in the long term.** In this report we present new research on the implications for physician demand associated with achieving select population health goals (reduce excess body weight by 5%; improve control of blood pressure, cholesterol, and blood glucose levels; and stop smoking). Under this scenario, short-term demand for physicians would decline slightly with improvements in population health. However, by 2030, there would be an additional 6.3 million adults still living. Caring for an additional 6.3 million adults (most of whom are elderly) would result in the demand for an additional 15,500 FTE physicians in the year 2030.

- **If underserved populations had care utilization patterns similar to populations with fewer access barriers, demand for physicians could rise substantially.** Improved access to care is a national goal. As with last year's study, we modeled two hypothetical scenarios around removing access barriers. The findings are similar to those reported last year.
    - Scenario 1: If people without medical insurance and people living in non-metropolitan areas had care utilization patterns equivalent to those of their insured peers living in metropolitan areas with similar demographics and health risk factors, then an additional 34,800 FTE physicians would have been required to meet this increase in demand.
    - Scenario 2: If everyone in the United States had care utilization patterns equivalent to non-Hispanic white, insured populations residing in metropolitan areas, then an additional 96,800 FTE physicians would have been required. Of this total increase, 35,500 (37%) would reflect increased demand among the Hispanic population, 25,000 (26%) would reflect increased demand among the non-Hispanic black population, 12,300 (14%) would reflect increased demand among the non-Hispanic "all other" population, and 23,100 (24%) would reflect increased demand among the non-Hispanic white population. While many other factors would need to be addressed to achieve health care–utilization equity—such as minimizing barriers related to insurance coverage, access, trust—these figures highlight the potential scale of currently unmet need.

Exhibit ES-1: Projected Total Physician Shortfall Range, 2015–2030
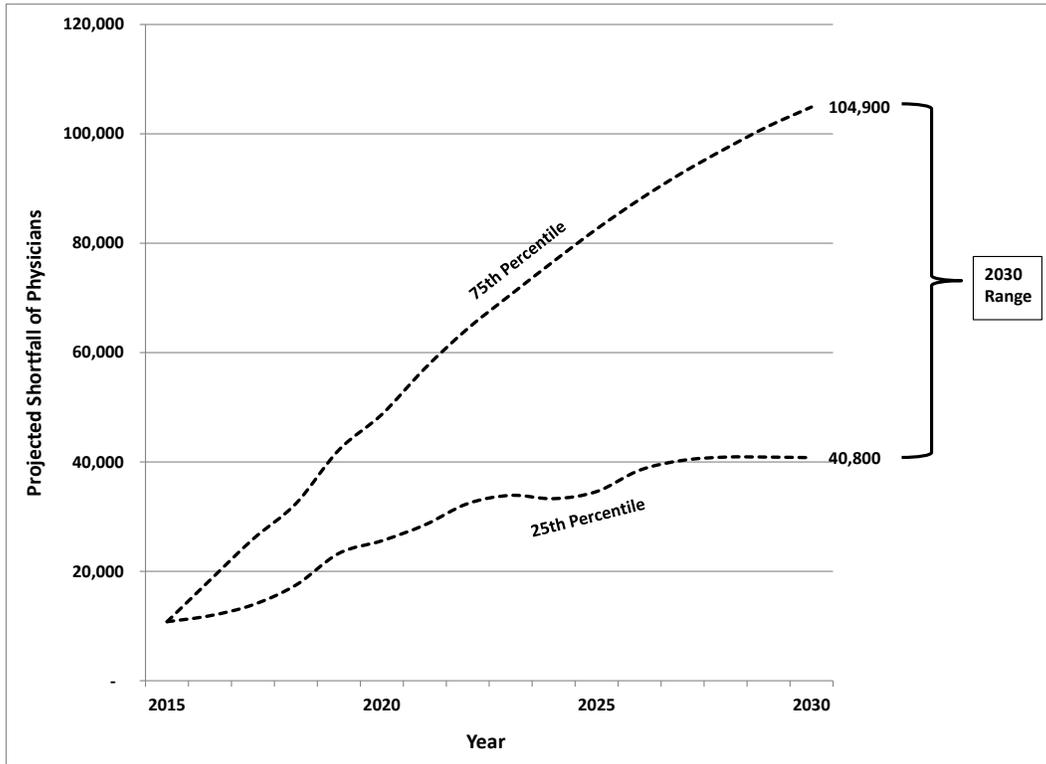
Exhibit ES-1: As complex systems have internal "checks and balances" to avoid extremes, we believe that the 25th to 75th percentile of the shortage projections continues to reflect a likely range for the projected adequacy of physician supply. The projected shortfall of total physicians in 2030 is 40,800–104,700, with the range growing over time to reflect growing uncertainty in key supply and demand trends.

Exhibit ES-2: Projected Total Supply and Demand for Physicians, 2015–2030
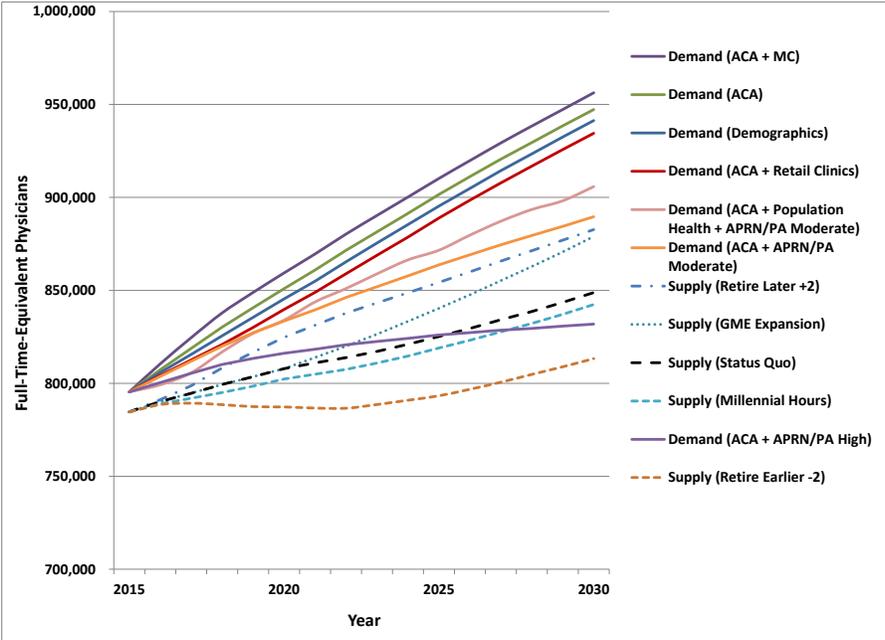
Exhibit ES-2: Only one demand scenario dips below the supply projections.

Exhibit ES-3: Projected Change in Physician Supply by Specialty Category, 2015–2030
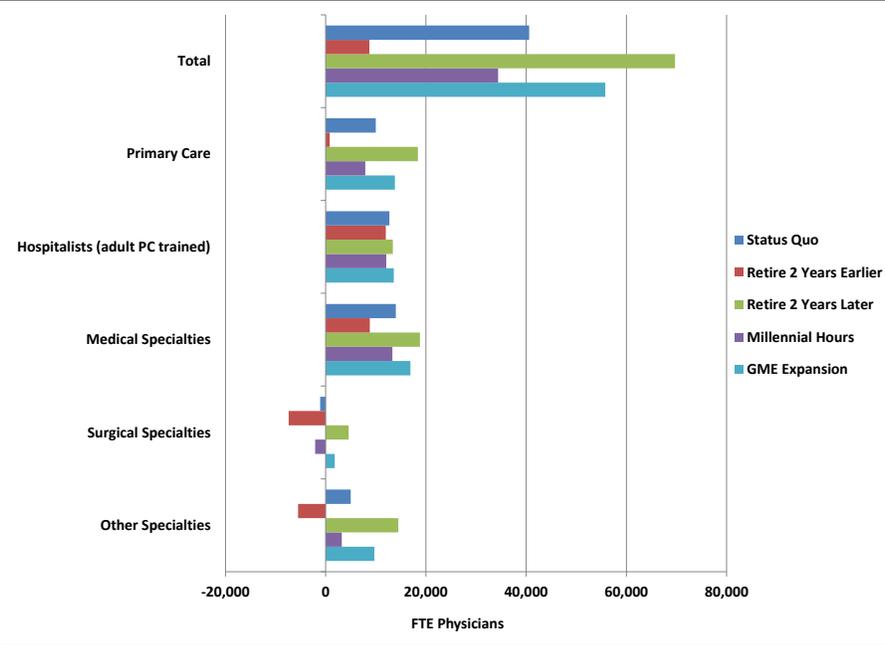
Exhibit ES-3: Under virtually all scenarios, the supply of surgical specialists is projected to either grow slowly or decline by 2030.

New Research and Analyses

Differences between these updated projections and projections in previous years' reports reflect updates and improvements to supply and demand data and trends. The 2017 updated projections:

- Use the same microsimulation model and same multiple scenarios that we used to develop last year's projections, with the exception of one additional demand scenario that models the potential workforce implications of achieving certain population health goals.
- Incorporate updates to supply and demand data and trends.
- Reflect higher projections for the growth in supply of advanced practice registered nurses (APRNs), whereas the physician assistant (PA) supply projections are similar to those from last year's analysis.
- Extrapolate a "2015" level-of-care delivery compared with the 2016 report's "2014" level-of-care delivery.
- Provide additional detail on the growth in demand and the workforce implications of greater equity in health care utilization by patient race and ethnicity, by region of the country, and by whether patients reside in a metropolitan area or not.

The net effect of these refinements and updates to the model's inputs was to project a smaller, but still substantial, total physician shortage than last year's analysis, driven primarily by projections of more rapid growth in the supply of APRNs and the continued large growth in PA supply between 2025 and 2030.

Health Care Utilization Equity Estimates

This year's report expands the section on health care utilization equity to provide additional information on the implications of patient race and ethnicity, region of the country, and whether residing in a metropolitan area. Current projection methods only partially account for possible underutilization by those with inadequate access. To further explore this limitation in current methodologies, the scenarios for health care utilization equity model the implications for physician demand if currently underserved populations utilized care at a rate similar to that for

If currently underserved populations utilized health care at the same rate as the rest of the population, an additional 34,800–96,800 physicians (4–12%) would have been needed in 2015.

While many other factors would need to be addressed to achieve health care utilization equity—such as minimizing barriers related to insurance coverage, access, trust—these figures highlight the potential scale of the currently unmet need.

populations facing fewer sociodemographic, economic, and geographic barriers to care. Therefore, to better gauge the degree of currently unmet need, this section includes estimates of the additional workforce needed if currently underserved populations utilized health care at the same rate as the rest of the population under two different scenarios. These estimates are **not included** in the ranges of

projections. Moreover, the estimates we put forth are by no means deemed definitive; instead, they are intended to stimulate much-needed discussion and analysis about how best to address health care utilization inequity in future projections.

Population Health

New research (added as a seventh scenario for demand modeling) reflects that many care-delivery and reimbursement practices and government policies support the provision of timely and appropriate preventive care and population health initiatives. Among the nation's Healthy People 2020 goals are (1) improving the percentage of adults with hypertension whose blood pressure is under control, (2) improving blood glucose control of people with diabetes, (3) improving cholesterol levels for adults with hypercholesterolemia, (4) reducing prevalence of obesity by encouraging improved nutritional intake and increased physical activity, (5) reducing

If the nation achieved population health goals around weight loss, improved control of clinical measures (blood pressure, cholesterol, and blood glucose levels), and smoking cessation, then demand for physicians would rise by an additional 15,500 FTEs in the year 2030 because the physicians needed to support an additional 6.3 million adults still living more than offset the reduced demand associated with a healthier population.

While laudable pursuits, preventive care and achievement of certain population health goals could actually increase demand for physicians in the long term.

prevalence of smoking, and (6) many other goals related to receiving preventive care and improving health-related behavior.[2]

Progress toward achieving many of these goals has been strengthened by changes in policy or treatment guidelines. Examples include new U.S. Preventive Services Task Force (USPSTF) recommendations for intensive behavioral counseling to promote a healthful diet and physical activity for individuals who are obese or who are at high risk for developing cardiovascular disease or diabetes[3]; Medicare reimbursement for intensive behavioral counseling to reduce diabetes and cardiovascular disease

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[2] Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services. Healthy People 2020. https://www.healthypeople.gov/2020/topics-objectives.

[3] U.S. Preventive Services Task Force (USSTF). Final Recommendation Statement—Obesity in Adults: Screening and Management. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/obesity-in-adults-screening-and-management. USPSTF Final Recommendation Statement—Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors: Behavioral Counseling. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/healthy-diet-and-physical-activity-counseling-adults-with-high-risk-of-cvd. USPSTF Final Recommendation Statement—Abnormal Blood Glucose and Type 2 Diabetes Mellitus: Screening. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/screening-for-abnormal-blood-glucose-and-type-2-diabetes.

prevalence[4]; and provisions in the Affordable Care Act (ACA) to cover counseling and treatment related Ito smoking cessation and improving clinical metrics such as blood pressure, cholesterol levels, hemoglobin A1c levels.[5]

The main finding of this new research is that if the nation were to achieve the population health goals modeled (reduce excess body weight by 5%; improve control of blood pressure, cholesterol, and blood glucose levels; and stop smoking), then initially, total demand for physicians might decline due to slight improvements in average levels of health. However, over time, more people would live longer, and by 2030, the demand for physicians would actually be higher than in the projections that did not model population health achievements. This scenario addresses the critique of workforce projections that such projections might overstate future demand because evolving care-delivery models are designed to keep people healthier. Our findings suggest the potential for the opposite effect. Healthier people live longer, and the increase in physician demand associated with living longer more than offsets the decrease in demand associated with improved average health.

Future Directions in Research

Uncertainties continue to abound about whether, how, and how quickly emerging payment and care-delivery models might affect physician supply and demand. This uncertainty has increased with the new administration's goal to replace portions of the ACA. Still, evidence to date has not shown a substantial effect of changes in payment or care-delivery models on physician workforce needs.

Having a better understanding of how clinicians and care settings will respond to economic and other trends, through retirement and other decisions, will better inform future projections. Likewise, whether the continued rapid growth in the supply of hospitalists, PAs, and APRNs can be sustained or will reach a saturation point is unclear. A better understanding of how the increased supplies of PAs and APRNs affect demand for physicians can improve workforce projections.

Growth in demand for health care services is projected to exceed the growth of physician supply. How a growing shortfall at the national level may exacerbate geographic imbalances in supply, thus aggravating extant disparities in geographic distribution, needs to be better understood.

The demand projections start with the assumption that physician supply and demand were in equilibrium in 2015—with the exception of 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 extrapolates a "2015 level of care" to future years based on

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[4] Center for Medicare and Medicaid Services (CMS). Medicare Preventive Services, 2016.
https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/Downloads/MPS-QuickReferenceChart-1TextOnly.pdf
[5] U.S. Department of Health and Human Services. Preventive Services Covered Under the Affordable Care Act.
https://www.hhs.gov/healthcare/facts-and-features/fact-sheets/preventive-services-covered-under-aca/

current care use and delivery patterns. Better measures of current shortages could help inform this starting-point assumption.

This study focuses on the total physician workforce and broad specialty categories. There continues to be a need to look more closely at individual specialties and conditions that may experience or portend future shortages.

These deficits in the knowledge base 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

Over the past few decades, the AAMC has published multiple workforce studies that projected future physician supply and demand and summarized the implications of selected trends and policies likely to affect physician supply and demand. The AAMC continues to update the workforce projections to reflect that over time:

- The number and mix of physicians trained annually has changed;
- The supply of advanced practice registered nurses (APRNs) and supply of physician assistants (PAs) have greatly increased;
- The Affordable Care Act (ACA) was enacted and expanded medical insurance coverage, encouraged more preventive care, and established new payment models—and will continue to be updated to reflect the new administration's intent to make major changes to the ACA;
- Care-reimbursement and -delivery models continue to evolve; and
- New data have become available on the characteristics and projected changing demographics of the U.S. population and the health workforce.

Mindful of these changes, in 2015, the AAMC contracted with IHS Markit Inc. to publish an update to its previous reports (2010 and 2008) and has since published annual updates (2015, 2016, and 2017). The current series of reports uses a microsimulation modeling approach and the most recent available data on trends and factors affecting the physician workforce. Key trends likely to affect the supply and demand for health care services were identified under multiple supply and demand scenarios. Projections for individual specialties were aggregated into 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.[6] Reflecting new research, starting in 2016, a fifth category was added when adult primary care–trained hospitalists were moved out of primary care and into their own category.

Previous reports all suggested a growing shortfall of physicians over time as demand for health care services—driven by a growing and aging population with accompanying growing prevalence of chronic disease and expanded insurance coverage under ACA and a recovering economy—was projected to grow faster than physician supply. The 2016 study projected a shortfall of 61,700–94,700 physicians by 2025 (a narrower range than the projected shortfall of 46,100–90,400 physicians reported in the 2015 report). The 2016 projections reflected refinements to the number of new physician graduates (smaller

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[6] **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. For the 2016 report, **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.

estimates than modeled from the 2015 report) and larger estimates of the growth in the annual number of physician assistants trained. Also, each year, the demand projections shift to reflect new standards of care. For example, demand projections in the 2015 report extrapolated a "2013 national average" level of care while this 2017 report extrapolates a "2015 national average" level of care. This resetting of the level of care modeled pushes back the projected growing shortfall of physicians.

Study findings across the various reports highlighted how the pace of change in health care delivery is too rapid for projections to be produced infrequently. Accordingly, this 2017 update report reflects the AAMC's commitment to produce regularly updated projections focusing on developing and refining scenarios that reflect the best available evidence on trends in health care delivery. In addition to updating data inputs and trends, several key changes were made to this 2017 report compared with previous reports:

- The projections are now reported to 2030 rather than 2025 to reflect the long planning horizon required for health-workforce-pipeline planning.
- While the PA-supply growth projections are similar to those in last year's report, the APRN-supply growth projections are higher to reflect higher estimates of the number of APRNs trained annually and updated assumptions about the annual growth in the number of APRNs trained.
- A new demand scenario was added to the analysis to reflect the potential implications of improving population health—which is an area of focus in new care-delivery models.
- Reflecting the consensus that geographic imbalances in health workforce supply and access barriers are particularly troublesome, in this updated report, we provide additional data on physician demand and on the implications of health care–utilization equity by geographic area and patient race and ethnicity.

The remainder of this update is organized like past reports and presents the updated projections (Section II), supply modeling (Section III), and demand modeling (Section IV). Section V updates the content on health care–utilization equity. New research around modeling population health goals is presented in Section VI. Key findings and conclusions are summarized in Section VII, and Section VIII discusses possible future directions in the field of health workforce research. A technical appendix in Section IX provides additional detail on modeling data and methods, and detailed tables are presented in Section X.

II.   UPDATED PROJECTIONS

Physician demand continues to grow faster than supply, leading to a projected shortfall of between 40,800 and 104,900 physicians by 2030. The projected shortfall range for 2025 (34,600–82,600) is smaller than the projected shortfall reported in the 2016 report for 2025 (61,700–94,700), reflecting assumptions about faster growth in APRN supply and the recalibration of the model to a 2015 level of care for the starting point of modeling future demand. Projected shortfalls in non-primary care specialties range between 33,500 and 61,800 by 2030, with the shortfalls especially acute in select surgical and other specialties. The broader range for the shortfall projections reflects greater uncertainty about trends continuing through 2030 vs 2025.

The ranges of supply and demand scenarios presented reflect the complexity and evolving nature of the environment within which physicians practice. One scenario alone is inadequate to convey the associated uncertainty. Therefore, this 2017 report examines five scenarios commonly expected to affect physician supply and seven scenarios expected to affect the demand for physician services over the next decade. We compared each supply scenario with each demand scenario to estimate the likely range of paired supply and demand projections. The specific supply and demand scenarios modeled are described in detail in Sections III and IV.

The extreme high and low scenarios are least likely to occur—as multiple factors tend to mitigate highs and lows. For example, if physicians were to begin retiring earlier, the growing systemic stresses this could cause as a result of the growing shortfall of physicians would 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 percentiles 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 (28,698 vs the estimate of 28,233 used in the 2016 report). Other changes include demand projections that extrapolate a "2015" level-of-care delivery compared with a "2014" level-of-care delivery extrapolated for the 2016 report, additional modeling of the growth in PA supply, and other updates to the supply and demand models and data inputs (e.g., AMA Masterfile, American Community Survey, Medical Expenditure Panel Survey, and Behavioral Risk Factor Surveillance System).

Lastly, the model in this 2017 report assumes that current physician supply and demand are roughly in equilibrium at the national level (i.e., that supply and demand are about equal), with the exception of primary care (8,400 physician shortfall) and psychiatry (2,400 shortfall), based on federally designated Health Professional Shortage Areas.[7] However, this assumption may be conservative because the adequacy of other specialties' supply is not measured by any federal agencies. To the extent that current national shortages exist for other specialties, such as the surgical specialties, the demand projections are underestimated from 2015 through 2030 by roughly the size of the current national shortage.

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[7] For information on Health Professional Shortage Area designation, see www.hrsa.gov/shortage.

Total Physicians

Under all but one of the demand 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 40,800 and 104,900 physicians by 2030 (Exhibit 2). The updated shortfall for 2025 of 34,600–82,600 is lower than the previously projected 2025 shortfalls (the 61,700–94,700 shortfall estimated in the 2016 report and the 46,100–90,400 shortfall estimated in the 2015 report). Again, the new shortfall projections reflect both updates to supply and demand inputs and trends and "resetting" the assumption of market equilibrium in the initial year.

Exhibit 1: Projected Total Supply and Demand for Physicians, 2015–2030
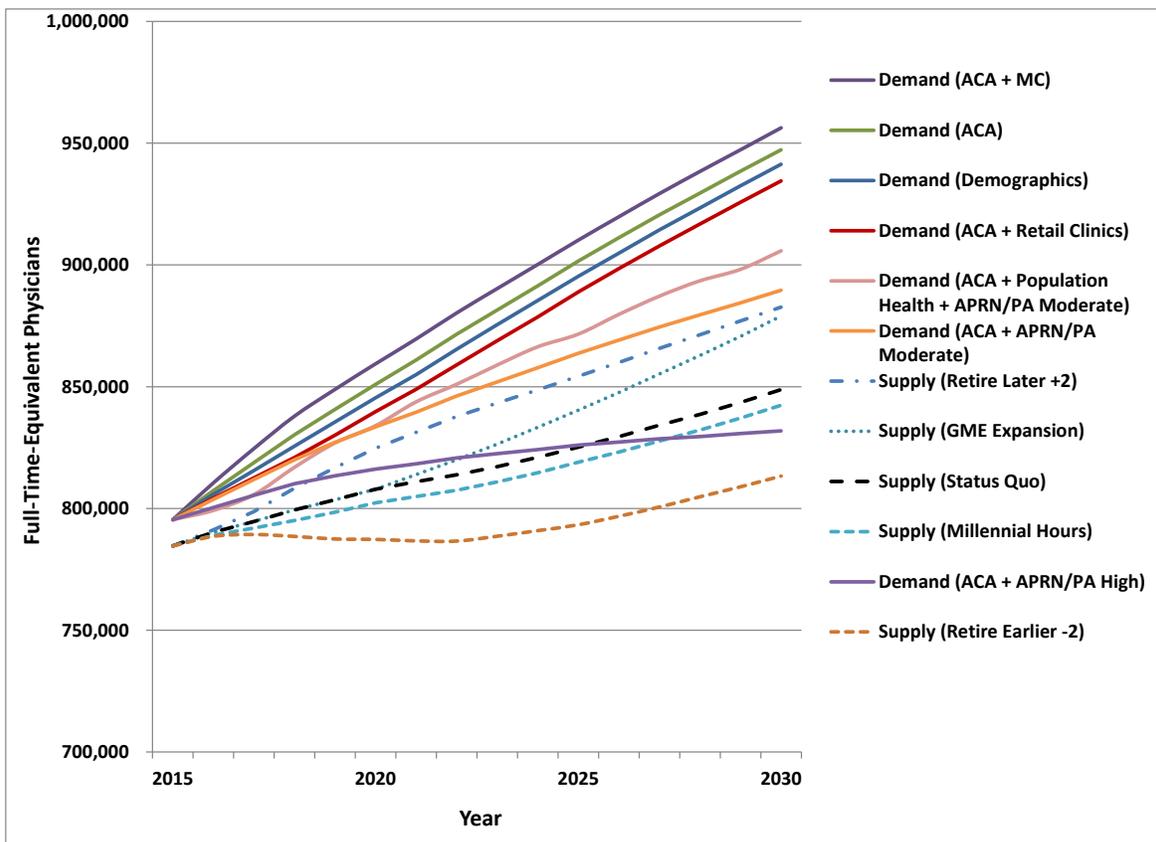
Exhibit 2: Projected Total Physician Shortfall Range, 2015–2030
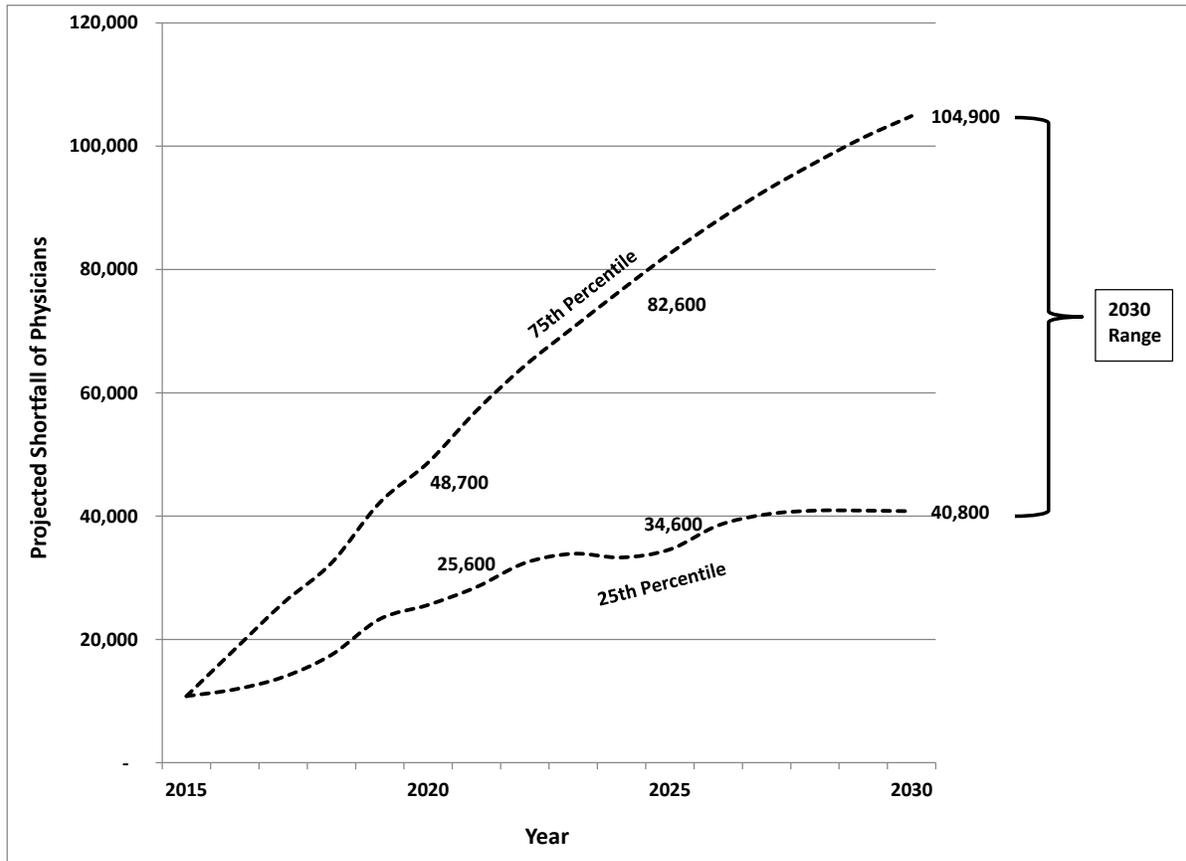
Primary Care

Projected shortfalls in primary care range between 7,300 and 43,100 physicians by 2030. Exhibit 3 (projected supply and demand for primary care physicians by scenario) and Exhibit 4 (primary care scenario shortfall range) summarize the projected supply, demand, and shortfall range for primary care physicians. The demand scenarios modeled project future demand for physicians, but scenarios can differ to the extent that future demand may be met by primary care or non-primary care physicians or other clinicians.

The updated primary care shortfall projections for 2025 (7,800–32,000) are lower than the 2025 shortfall projections from the 2016 report (14,900–35,600). The lower shortfall estimates primarily reflect higher projected supply of nurse practitioners (NPs) in primary care and resetting the demand projections to reflect the assumption of equilibrium between national supply and demand in 2015 with the exception of an estimated 8,400 primary care providers required to de-designate the federal government's primary care Health Professional Shortage Areas.

Exhibit 3: Projected Supply and Demand for Primary Care Physicians by Scenario, 2015–2030
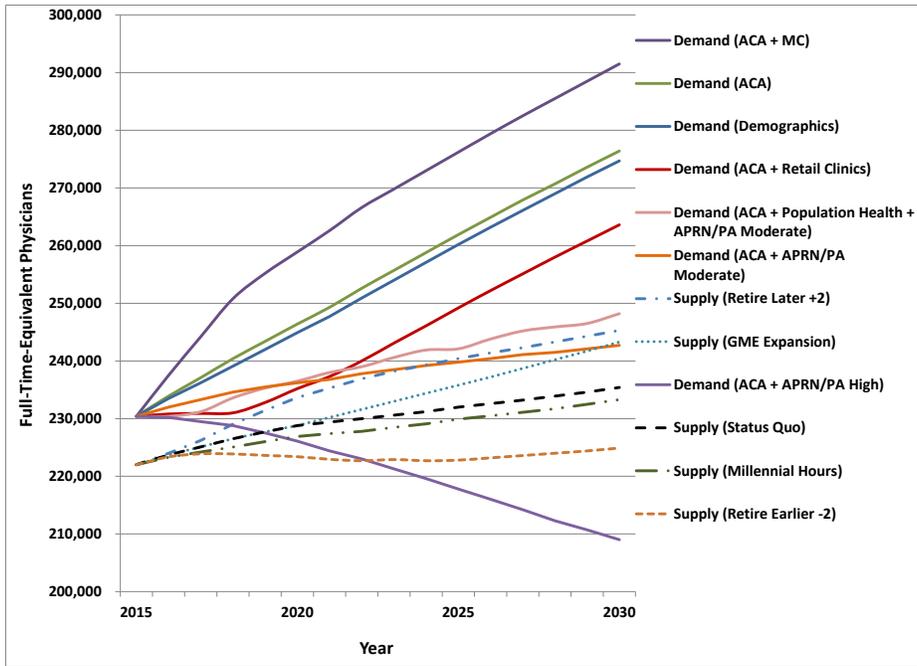
Exhibit 4: Projected Primary Care Physician Shortfall Range, 2015–2030
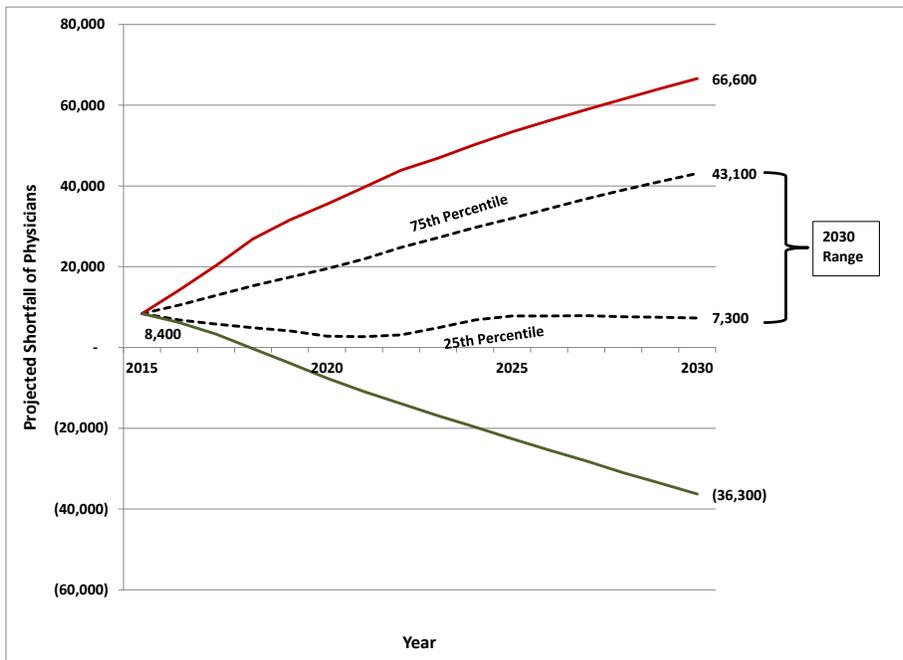
Non-Primary Care

Exhibits 6 through 11 depict the overall range of supply and demand growth and projected shortfall ranges for non-primary care physicians by specialty category. Under the scenarios modeled, we project a shortfall of between 33,500 and 61,800 non-primary care physicians by 2030. Consistent with previous reports, non-primary care specialties are grouped into three categories: medical specialties, surgical specialties, and other specialties (with primary care–trained hospitalist addressed separately).

Medical Specialties

The demand for physicians in medical specialties is growing rapidly, but many physicians are choosing internal medicine subspecialties and pediatric subspecialties, so physician supply is also growing in the medical specialties (Exhibit 6). Under the scenarios modeled, this update projects a shortfall range of about 1,300–12,000 by 2030 (Exhibit 6).

Exhibit 5: Projected Supply and Demand for Medical Specialist Physicians, 2015–2030
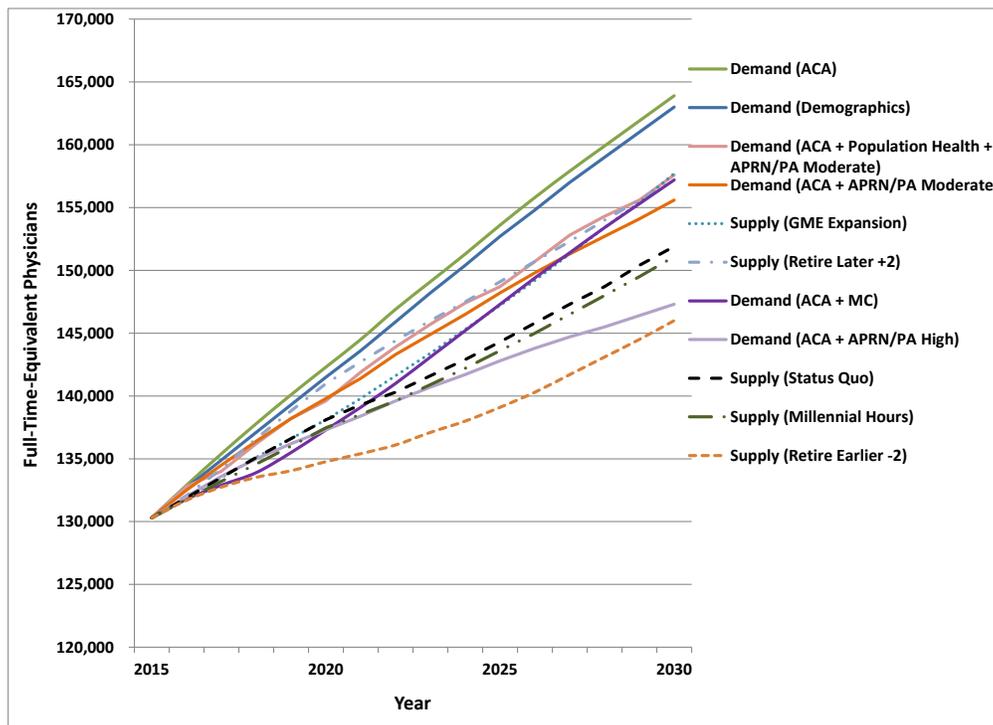
Exhibit 6: Projected Medical Specialist Physician Shortfall Range, 2015–2030
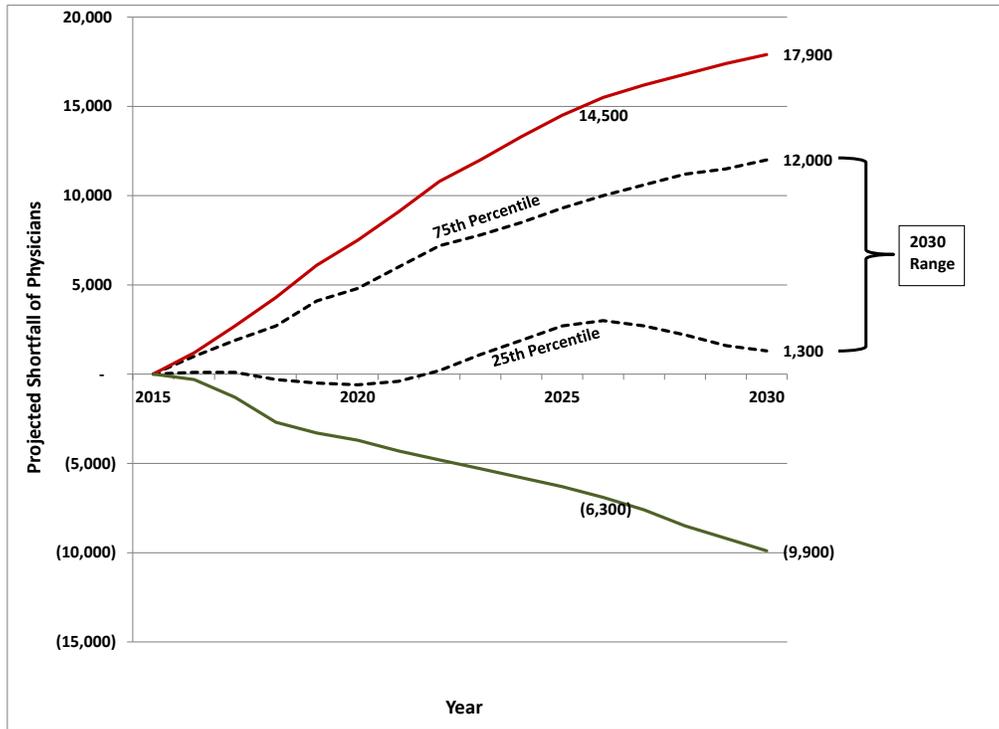
Surgical Specialties

On the basis of current trends, the supply of surgeons is not projected to change substantially over the next 10–15 years because future attrition is likely to meet or exceed the number of newly trained surgeons. In addition, there continues to be strong projected growth in demand (Exhibit 7). Under the scenarios modeled, we project an updated shortfall of between 19,800 and 29,000 surgeons by 2030 (Exhibit 8). These projections represent an aggregation, and projections for individual surgical specialties might vary significantly.

Exhibit 7: Projected Supply and Demand for Surgeons, 2015–2030
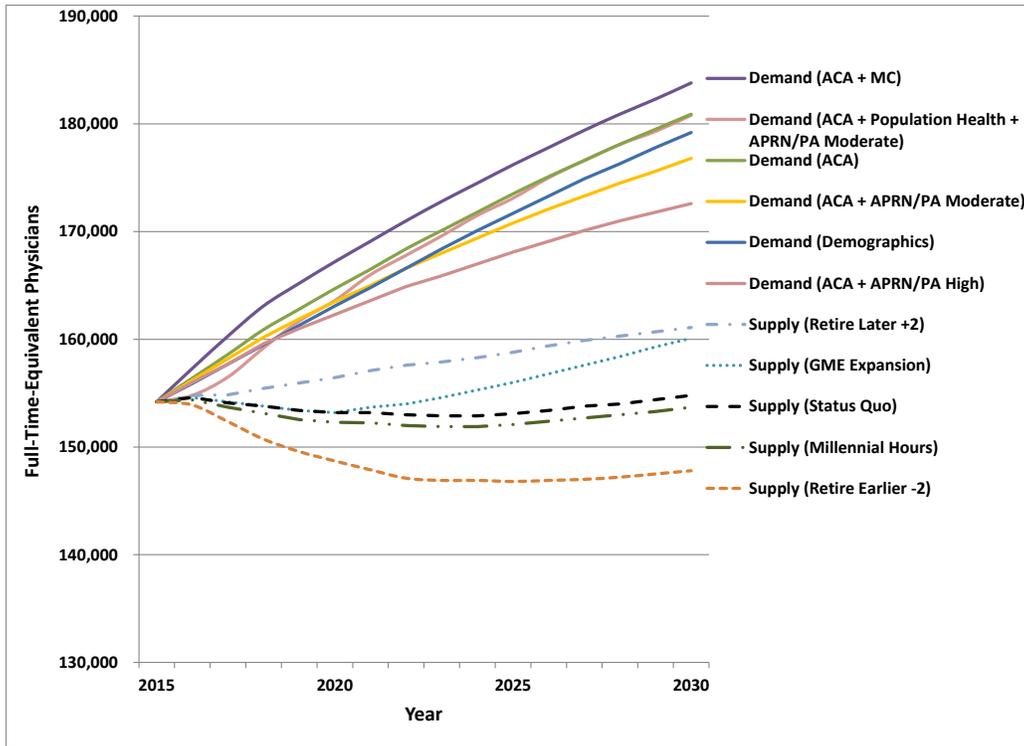
Exhibit 8: Projected Surgical Physician Shortfall Range, 2015–2030
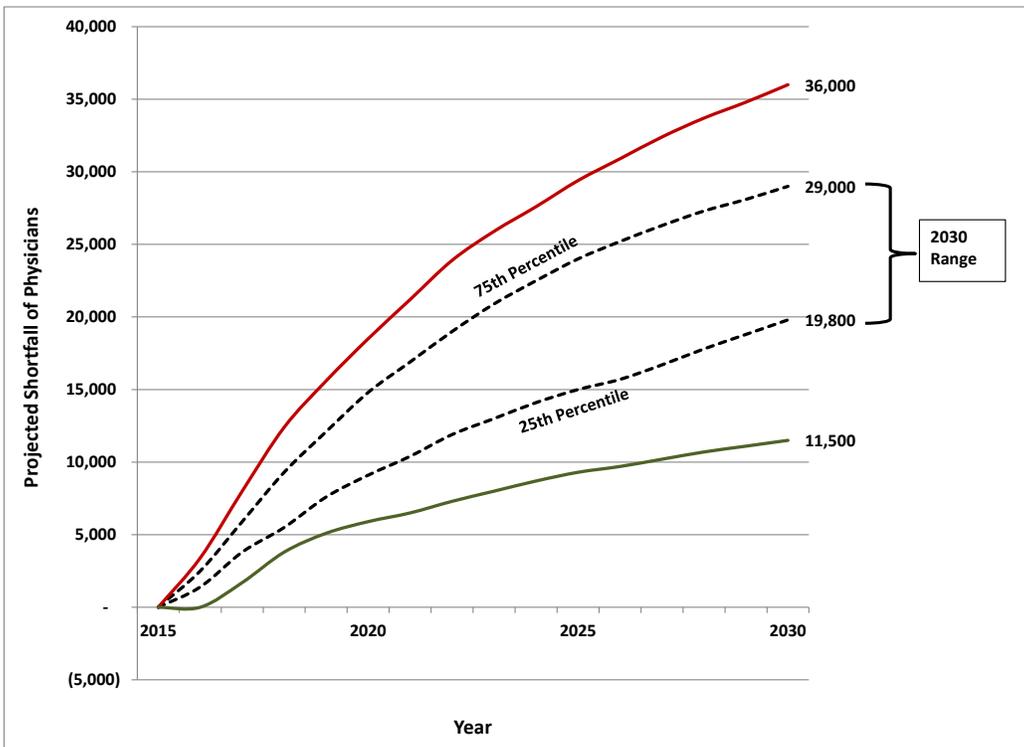
Other Specialties

For the other specialties category, while the demand projections across scenarios modeled are mostly similar, the supply projections vary substantially and are sensitive to retirement assumptions (Exhibit 9). The projected shortfall range for 2030 is between 18,600 and 31,800 physicians (Exhibit 10).

Exhibit 9: Projected Supply and Demand for Other Specialties, 2015–2030
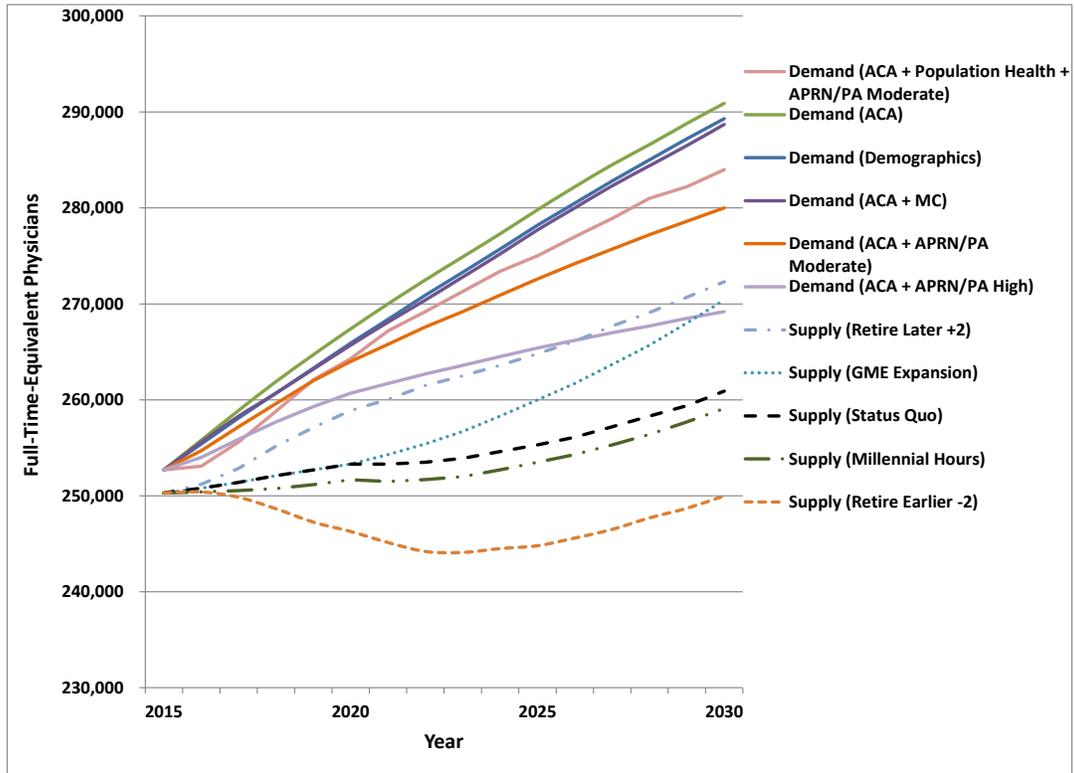
Exhibit 10: Projected Other Specialist Physician Shortfall Range, 2015–2030
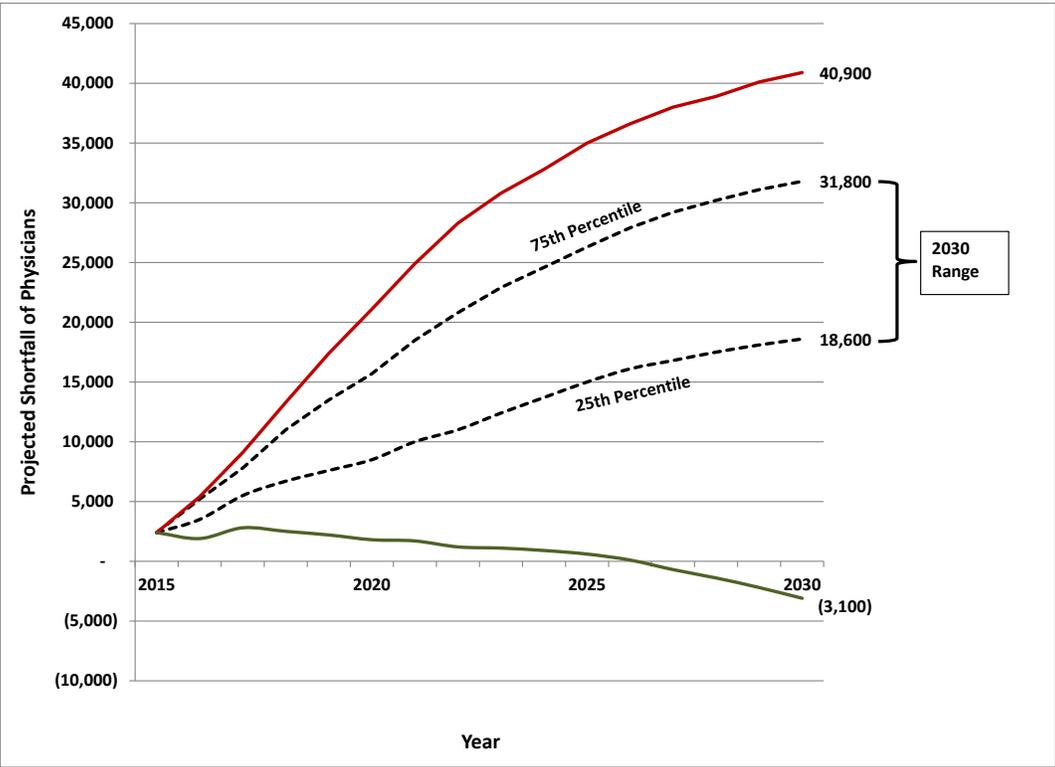
III. SUPPLY MODELING

The supply model used a microsimulation approach to project the future supply of physicians 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 model has been extensively documented elsewhere, and a brief description of modeling methods may be found in the Technical Appendix (Section IX).[8,9] Below, we summarize supply scenarios modeled for this update.

Supply Scenarios Modeled

For consistency with previous reports, the status quo, retirement, and hours-worked scenarios described below were included in the gap analysis comparing physician supply and demand to project a range for future adequacy of physician supply. Graduate medication education (GME) expansion was modeled separately as a policy-oriented scenario but was not included in the final 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.
- **Early Retirement and Delayed Retirement**: Reflecting uncertainty about when physicians might retire in the future, we model scenarios assuming physicians retire two years earlier or two years later, on average, relative to current patterns. Scenario assumptions reflect that physicians might decide to delay or accelerate retirement for financial, health, and other reasons. The Physician Foundation's 2014 survey reports that "39% of physicians indicate they will accelerate their retirement due to changes in the healthcare system, whereas the 2016 report indicates 47% plan to accelerate retirement."[10] However, the U.S. Bureau of Labor Statistics reports that, on average, workers are delaying retirement and this trend is likely to continue.[11,12]
- **Millennial Hours Worked**: This scenario assumes that physicians currently under age 35 will continue to work about 13% fewer hours per week than earlier cohorts. The 13%-reduction assumption is based on an analysis by the AAMC's Center for Workforce Studies comparing self-reported weekly hours worked from the 1980 Census with those reported in the 2012–2014 American Community Survey.

[8] U.S. Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis. Technical Documentation for HRSA's Health Workforce Simulation Model. Rockville, MD: U.S. Department of Health and Human Services, 2015.
https://bhw.hrsa.gov/sites/default/files/bhw/nchwa/projections/simulationmodeldocumentation.pdf.

[9] Dall TM, West T, Chakrabarti R, Iacobucci W, Semilla AP, Hansari A. Health Workforce Model Documentation, 2016. https://cdn.ihs.com/www/pdf/IHS-HDMM-DocumentationApr2016.pdf.

[10] The Physicians Foundation. 2014 and 2016 Survey of American's Physicians.
http://www.physiciansfoundation.org/uploads/default/Biennial_Physician_Survey_2016.pdf.
http://www.physiciansfoundation.org/uploads/default/2014_Physicians_Foundation_Biennial_Physician_Survey_Report.pdf.

[11] *Closing the Deficit: How Much Can Later Retirement Help?* Burtless H and Aaron HJ, eds. Washington, DC: Brookings Institute Press, 2013.

[12] Leonesio MV, Bridges B, Gesumaria R, Del Bene L. The increasing labor force participation of older workers and its effect on the income of the aged. *Social Security Bulletin*. 2012;72(1). https://www.ssa.gov/policy/docs/ssb/v72n1/v72n1p59.html.

- **GME Expansion**: This scenario assumes a possible expansion of federally funded GME slots. The GME-expansion scenario is based on the proposed Resident Physician Shortage Reduction Act of 2015 and assumes an increase in the approved GME slots by 3,000 annually between 2017 and 2021. Since it is unknown which specialties might gain residency slots, for modeling purposes, we assume that all specialties will gain the same proportion of residency slots.

As in the 2016 report, we separated adult primary care–trained hospitalists from primary care physicians.[13] The hospitalist projections build on work by the AAMC Center for Workforce Studies to identify hospitalists using Medicare fee-for-service billing records linked to the American Medical Association (AMA) Masterfile. In the 2016 report, we defined hospitalists as those physicians whose Evaluation and Management billing was 100% hospital based. For this year's report, we defined hospitalists as those physicians whose billing was at least 90% hospital based. Whereas use of the 90% criterion suggests there were about 27,800 adult primary care–trained hospitalists in 2015, the 100% criterion estimated 26,260 hospitalists, and using an 80% criterion estimated 29,010 hospitalists in 2015. Using data from 2011 to 2014 on physicians trained in adult primary care who entered the hospitalist workforce, we estimate 1,647 new hospitalists each year (lower than last year's modeled estimate of 1,927 each year).

Supply Projections

Updated annual projections for total physician supply are summarized in Exhibit 11. Under the status quo scenario, total physician supply increases from 784,600 in 2015 to 825,200 in 2025 to 848,800 in 2030—a 57,800 FTE (8%) increase between 2015 and 2030. This is less than the approximately 12% projected growth in the U.S. population over this period and will contribute to a 3% decline in the physician-to-population ratio despite increasing health care needs associated with an aging population. As illustrated in Exhibit 12, the updated supply projections covering the period 2015 to 2025 are similar to projections reported in the 2016 report.

Growth in total physician supply by specialty category between 2015 and 2030 ranges from a high of 18,800 additional FTEs among medical specialties under a delayed-retirement scenario to projected negative growth among surgical specialties of –7,400 physicians under an early-retirement scenario (Exhibit 13). Under all scenarios, the supply of surgical specialists is projected to grow negligibly or decline. For primary care and medical specialties, supply is projected to grow under all scenarios. The supply of physicians in the other specialties category is projected to grow under most scenarios.

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[13] Hospitalists trained in pediatrics cannot easily be identified using Medicare billing records. 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, or geriatric medicine.

Exhibit 11: Projected Supply of Physicians, 2015–2030
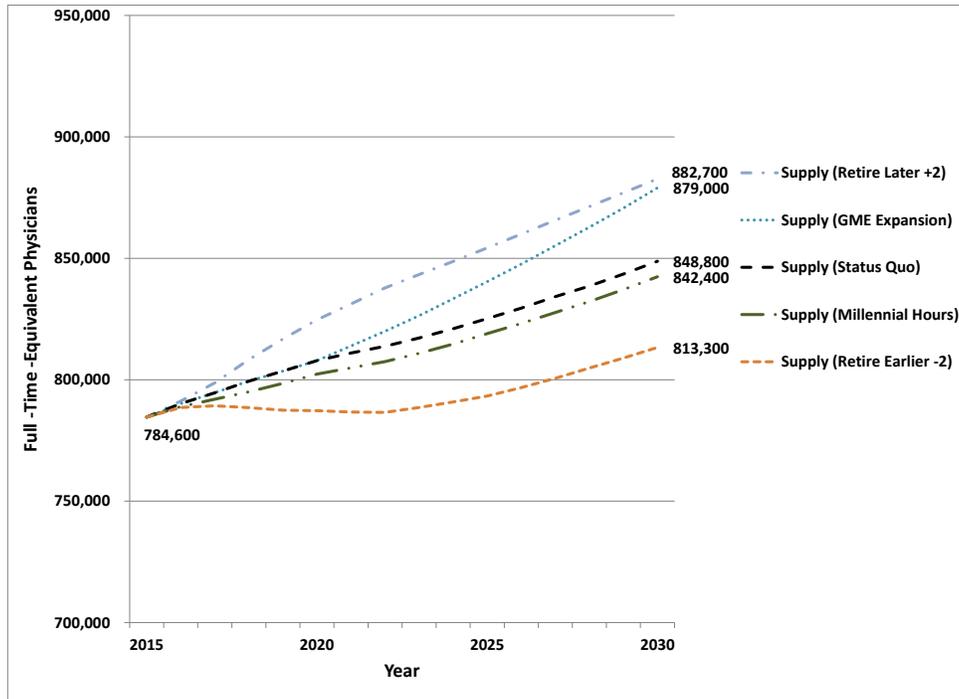
Exhibit 12: Projected Growth in Physician Supply 2015–2025: 2016 Report vs 2017 Report
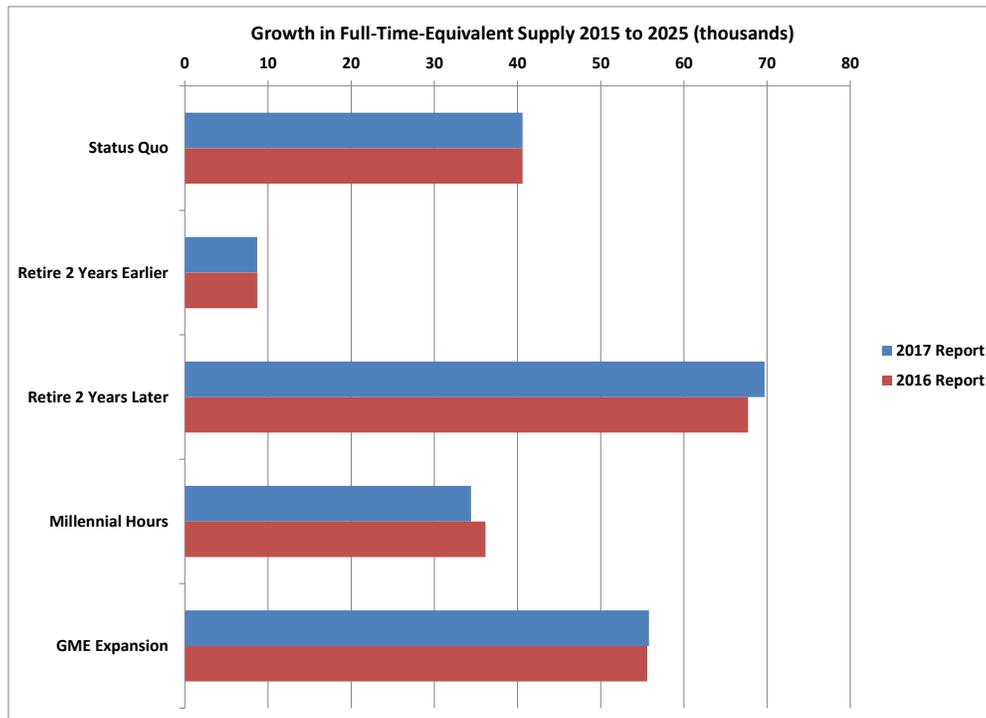
Exhibit 13: Projected Change in Physician Supply by Specialty Category, 2015–2030

Legend:
- Status Quo
- Retire 2 Years Earlier
- Retire 2 Years Later
- Millennial Hours
- GME Expansion

Categories (y-axis): Total, Primary Care, Hospitalists (adult PC trained), Medical Specialties, Surgical Specialties, Other Specialties

X-axis: FTE Physicians (-20,000 to 80,000)
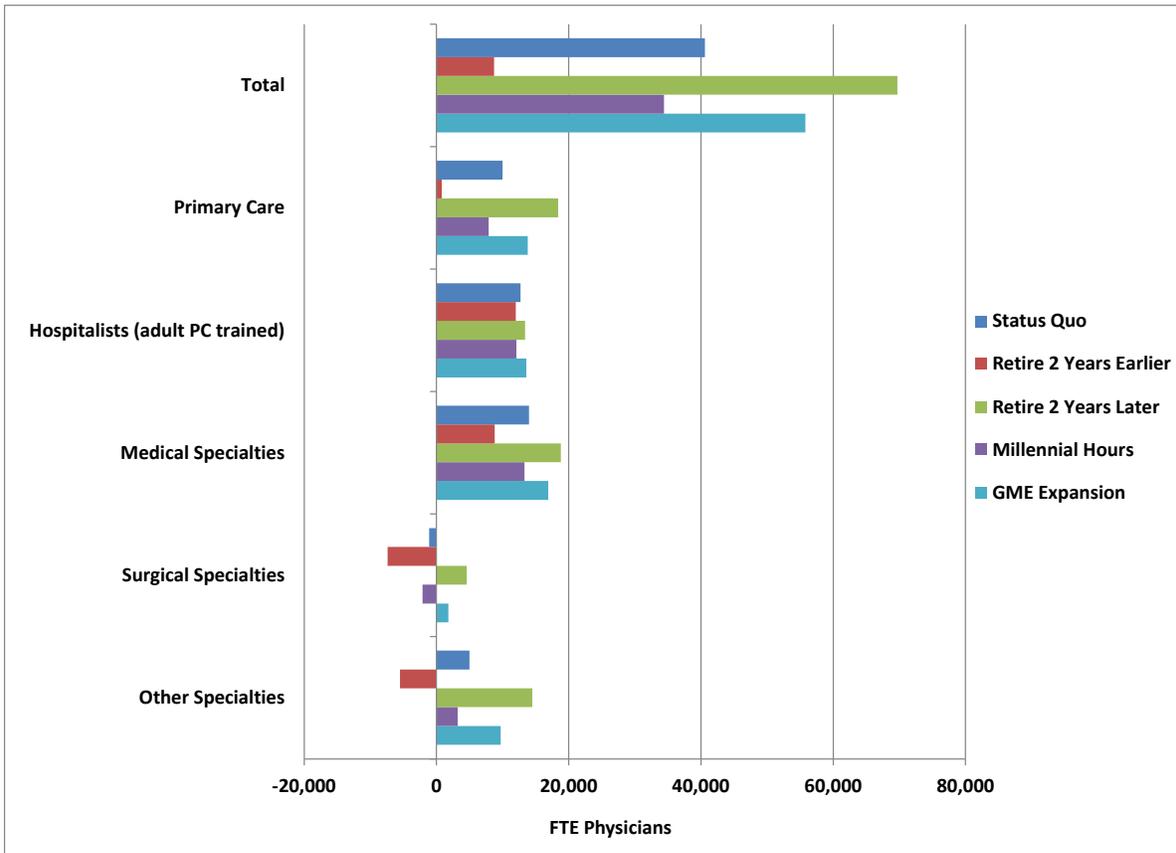
IV. DEMAND MODELING

This section presents an overview of demand scenarios modeled, updated projections, and comparisons with 2016 study findings. Detailed information about the microsimulation modeling approach has been published elsewhere, though a brief summary is provided in the Technical Appendix (Section IX).[14,15,16]

Demand Modeling Assumptions and Scenarios

We projected demand for physicians under scenarios that reflect varying assumptions about the use of health care services and care delivery. All scenarios modeled reflect changing demographics from 2015 to 2030. All scenarios modeled except the one that reflects only changing demographics include the projected impact of continued expansion of medical insurance coverage under ACA. Uncertainty about the future of ACA and the implications on demand for physicians are discussed below. However, the assumption modeled is that any replacement of ACA will have a similar impact on patient access to care. Therefore, coverage of the additional 22 million individuals has been included.

Similar to previous versions of this report, we modeled the implications of greater use of managed care, retail clinics, and the contribution of PAs and APRNs. We added one new scenario that models the implications of achieving certain population health goals to illustrate the potential impact of improved preventive care. Modeled scenarios are described below in more detail, and additional information on methods and outcomes for the population health scenario is provided in Section VI.

- **Changing demographics**: This scenario extrapolates current health care use and delivery patterns to future populations, taking into account projected future demographics (e.g., age, gender, and race and ethnicity) from 2015 to 2030. During this period, the U.S. population is projected to grow 12%, from about 321 million to 359 million. The population under age 18 is projected to grow by less than 4%; the population aged 65 and older is projected to grow by 55%; and the population age 75 and older is projected to grow by 73%. Therefore, 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.

- **Growth in demand due to health care reform**: This scenario models anticipated change in health care use associated with health care reform—which in earlier reports modeled gains in medical insurance under the Affordable Care Act. By 2015, some parts of ACA had already been implemented and hence are reflected in the starting-year demand estimates. The remaining

[14] U.S. Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis. Technical Documentation for HRSA's Health Workforce Simulation Model. Rockville, MD: U.S. Department of Health and Human Services, 2015. https://bhw.hrsa.gov/sites/default/files/bhw/nchwa/projections/simulationmodeldocumentation.pdf.

[15] Dall TM, West T, Chakrabarti R, Iacobucci W, Semilla AP, Hansari A. Health Workforce Model Documentation, 2016. https://cdn.ihs.com/www/pdf/IHS-HDMM-DocumentationApr2016.pdf.

[16] Dall TM, Gallo PD, Chakrabarti R, West T, Semilla AP, Storm MV. An aging population and growing disease burden will require a large and specialized health care workforce by 2025. *Health Affairs*. 2013;32:2013-2020. http://content.healthaffairs.org/content/32/11/2013.abstract.

demand scenarios summarized below all build on this scenario and reflect both changing demographics and expanded medical insurance coverage. While the future of ACA is uncertain, the assumption modeled is that any replacement of ACA will have similar impact on patient access to care. To the extent that ACA is replaced with policies and programs that reduce current coverage (in addition to foregoing increased coverage beyond current levels) back to pre-ACA levels, our projections might overstate future demand by 6,000–10,000 FTE physicians.

- **Managed and integrated care**: A variety of integrated care–delivery models promoted by provisions in ACA are being implemented for use with both publicly and privately insured populations. Goals include improving the coordination and quality of patient care, reducing inefficiencies, shifting care to lower cost settings and providers as appropriate, improving preventive care efforts, and better controlling medical expenditures. An estimated 23.5 million Americans were enrolled in an Accountable Care Organization (ACO) in 2014, and this number is projected to grow to possibly 105 million enrollees by 2020.[17,18] Many of the goals of ACOs are similar to those of other risk-bearing organizations such as Health Maintenance Organizations (HMOs), including incorporating financial incentives for patients and physicians to better manage utilization. Looking historically at the effect of these delivery models on the use of services provides insights into what might happen if ACOs and other integrated-care models gain greater prominence. Consistent with assumptions guiding the projections in previous reports, this scenario models the physician-demand implications if 100% of the population were enrolled in risk-based entities.

- **Expanded use of retail clinics**: Between 2009 and 2015, the number of retail clinics in operation increased from about 1,100 to more than 2,000.[19] One study estimates that by 2012, retail clinics were providing 2% of total primary care services.[20] Chief drivers of retail clinic utilization include convenience, after-hours accessibility, cost-effectiveness, and coverage by insurance plans. As a result, retail clinics may be an alternative to traditional primary care for many consumers. This scenario explores the demand implications of shifting care from primary care physician offices to retail clinics for 10 conditions typically treated at retail clinics.[21] This scenario assumes the following:

  o Patients with chronic conditions will be seen by their regular primary care provider.
  o Care in retail clinics will be provided primarily by NPs and PAs.
  o For care provided in primary care physician offices, 77% of visits to a pediatrician's office are handled primarily by a physician (reflecting that between NPs and physicians, 77% of the

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[17] Tu T, Muhlestein D, Kocot SL, White R. Origins and Future of Accountable Care Organizations, 2015. http://www.brookings.edu/~/media/research/files/papers/2015/05/12-aco-paper/impact-of-accountable-careorigins-052015.pdf.

[18] Muhlestein D, Gardner P, Caughey W, de Lisle K. Projected Growth of Accountable Care Organizations. Report by Leavitt Partners, 2015.

[19] National Conference of State Legislators. Retail Health Clinics: State Legislation and Laws, 2016. http://www.ncsl.org/research/health/retail-health-clinics-state-legislation-and-laws.aspx.

[20] Bachrach D, Frohlich J, Garcimonde A, Nevitt K. The Value Proposition of Retail Clinics, 2015. http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2015/rwjf419415.

[21] Mehrotra A, Wang MC, Lave JR, Adams JL, McGlynn EA. Retail clinics, primary care physicians, and emergency departments: a comparison of patients' visits. *Health Affairs.* 2008;27(5):1272-1282.

pediatric workforce are physicians) and 70% of adult primary care office visits are handled primarily by a physician.

- o To reflect that the categories of visits modeled tend to be less complex than the average office visit, which leads to fewer office visits and, thus, to reduced demand for physicians, 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.

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.

- **Increased use of APRNs and PAs under "moderate use" and "high use" assumptions:** These scenarios use updated supply projections for PAs, certified registered nurse anesthetists (CRNAs), certified nurse midwives (CNMs), and nurse practitioners (NPs) that build on analyses from previous AAMC reports and projections developed for the Health Resources and Services Administration.[22] The projections contain updated estimates of the number of clinicians trained each year and projected growth in the training pipeline. Currently, there are an estimated 174,700 NPs in active practice, 91,800–108,700 PAs, 11,300 CNMs, and 46,900 CRNAs.[23,24,25] Using graduate-pipeline data from multiple sources, we estimated the number of new PAs and APRNs that will enter the workforce each year through 2030. We modeled the following assumptions:

  - o PA graduates will increase from about 7,888 in 2015 to 11,330 by 2020 and remain constant thereafter as the number of PA programs increases from 196 to 273.[26] Our projections suggest that PA supply will more than double between 2015 and 2030 (121% growth).
  - o NP graduates will continue to increase over time, with estimates from the 2012 National Sample Survey of Nurse Practitioners suggesting that about 85% of NPs will practice in clinical NP roles. Using this 85% assumption, we projected the number of new NPs entering the workforce each year to increase from 16,730 in 2015 (85% of 19,581 NP graduates and 101 combined NP and certified nurse specialist graduates) to 21,230 new entrants by 2025 and constant thereafter—which assumes about 10 new NP programs per year. CRNA graduates remain constant at 1,272 per year (down slightly from 1,321 graduates in 2014).

[22] U.S. Department of Health and Human Services. Health Workforce Projections, 2016. https://bhw.hrsa.gov/health-workforce-analysis/research/projections.

[23] Kaiser Family Foundation. State Health Facts, 2016. http://kff.org/state-category/providers-service-use/nurses-and-physician-assistants.

[24] National Commission on Certification of Physician Assistants. 2015 Statistical Profile of Certified Physician Assistants, 2016. https://www.nccpa.net/Uploads/docs/2015StatisticalProfileofCertifiedPhysicianAssistants.pdf.

[25] American College of Nurse-Midwives. Essential Facts about Midwives, 2016. http://www.midwife.org/Essential-Facts-about-Midwives.

[26] Accreditation Review Commission on Education for the Physician Assistant, Inc. Projected Growth in Accredited Programs, 2015. http://www.arc-pa.org/documents/current%20and%20project%20growth%204.17.15.pdf.

CNM graduates remain constant at 483 per year.[27] Our projections suggest that APRN supply will more than double between 2015 and 2030 (109% growth), with this growth mainly coming from increased supply of NPs and little growth in supply of CRNAs and CNMs.

Our analysis compared projections of future APRN and PA supplies with the level of demand that would be required simply to maintain a 2015 level of care (based on current staffing patterns). In percentage terms, APRN and PA supplies are both growing substantially more rapidly than is demand for health care services. By 2030, projected supply of APRNs could exceed the number required to maintain current staffing levels by about 90,100 APRNs; PA supply could exceed the number required to maintain current staffing levels by 111,600 PAs. What is unknown is the extent to which these additional 201,700 APRNs and PAs (beyond what is needed to maintain current patient-to-provider ratios) will affect the demand for physicians. Their effect will likely vary by medical specialty, geographic location, care-delivery setting, population served, services offered, and numerous other factors.

These projections suggest that the physician-to-PA ratio will fall from 7.2:1 in 2015 to 3.5:1 in 2030. The physician-to-APRN ratio will fall from 3.6:1 in 2015 to 1.9:1 in 2030. What is unknown is whether there is a market saturation point at which APRNs and PAs in the future might have difficulty finding employment, whether these additional clinicians will provide services that currently are not provided by physicians (e.g., 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 that indicates that APRNs and PAs can provide high-quality care, can increase physician productivity, and, in some specialties, can 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.

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 that the adjustment in physician demand is half the above amounts. The above percentages imply nothing about the value of services provided by APRNs and PAs relative to physicians. Instead, they allow for the examination of the role these providers will play in the future health care system and whether that role fills a currently unmet need (see Section V) or reduces demand for physicians.

- **Achieving select population health goals**: As described in more detail in Section VI, we modeled achieving the goals of reducing excess body weight; stopping smoking; and improving control of hypertension, hypercholesterolemia, and high blood glucose levels. This scenario illustrates the

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[27] Fang D, Li Y, Arietti R, Trautman DE. 2016. *2015-2016 Enrollment and Graduations in Baccalaureate and Graduate Programs in Nursing*. Washington, DC: American Association of Colleges of Nursing.

potential impact on demand for physicians associated with improved population health and reduced mortality. The mechanism by which this hypothetical scenario could be achieved is increased use of medical homes and increased emphasis on preventive care—with the modeled assumption that an intervention to achieve these goals would primarily come through increased use of NPs, PAs, and other health workers (e.g., nutritionists) to provide intensive behavioral counseling and follow-up care.

Summary Demand Projections

As noted in previous reports, rapidly changing population demographics are the primary factor affecting future growth in demand for services and physicians. High rates of projected population growth, especially among the "Baby Boomer" population, portend rapidly growing demand for health care services, with highest growth expected for those specialties that disproportionately serve seniors. Because these demographic trends are inevitable, they are incorporated into all the demand scenarios. Between 2015 and 2030, changing demographics alone are projected to increase national demand for physicians by about 145,900 FTEs (18%), with demand for primary care physicians projected to grow 44,300 FTEs (19%), faster growth rates expected among hospitalists (26%; 7,300 FTEs) and medical specialists (25%; 32,700 FTEs), and lower growth rates expected among the other specialties (15%; 36,600 FTEs) and surgical specialties (16%; 25,000) (Exhibit 14).

The effect of ACA-related expansion in medical insurance coverage was already underway by 2015, and its future is uncertain with the new administration. However, if ACA or its replacement were to achieve similar insurance expansion coverage, then eventually an estimated 6,000 additional FTE physicians would be required to cover the newly insured (of which approximately 1,700 are for primary care and 4,300 are for non-primary care specialties). The effects of ACA-related medical insurance expansion are incorporated into all but the changing-demographics scenario.

The managed-care scenario continues to have little impact on overall physician demand but does shift the specialty mix. By 2030, national demand would be about 9,000 physicians higher, with additional demand for 15,100 primary care physicians partially offset by reduced demand for 6,100 specialist physicians.

Simulated increased use of retail clinics only affected demand for primary care, with demand for primary care physicians declining by 12,800 physicians in 2030 relative to the scenario with ACA plus changing demographics. This scenario used conservative assumptions about which primary care visits could be provided in a retail clinic, so the impact could be larger than reported here.

The impacts of increased use of APRNs and PAs are substantial and will vary depending on physician specialty and assumptions about the future level and scope of care delivery provided by these professions. Relative to the scenario with ACA plus changing demographics, the projected physician demand declines by 57,700 physicians in 2030 with increased use of APRNs and PAs under the

"moderate use" scenario and 115,400 physicians under the "high use" scenario. These scenarios reflect the more than doubling of the APRN and PA workforce between 2015 and 2030.

Under the population health achievement scenario, increased demand for health care services associated with reduced mortality and the associated 6.3 million population growth more than offsets the decreased demand associated with a healthier population resulting in a net increase in demand for 15,500 physicians. This scenario is combined with the "moderate use" APRN-PA scenario under the assumption that achieving the modeled population health goals would come through greater use of NPs and PAs to provide counseling and follow-up care to help patients achieve the desired health outcomes. Furthermore, the additional 6.3 million people alive in 2030 under this scenario would require more APRN and PA services, so there would be fewer available APRNs and PAs to offset projected physician shortfalls.

Exhibit 15 compares projected physician demand growth by scenario between the 2016 report and this 2017 update. The 2016 update projects slightly higher demand growth between 2014 and 2025 under most scenarios modeled. For the two scenarios modeling possible effects of APRNs and PAs, the demand projections are now lower for 2025, reflecting that projected growth in NP supply is larger than what was modeled in the 2016 report.

Exhibit 14: Projected Demand for Physicians, 2015–2030
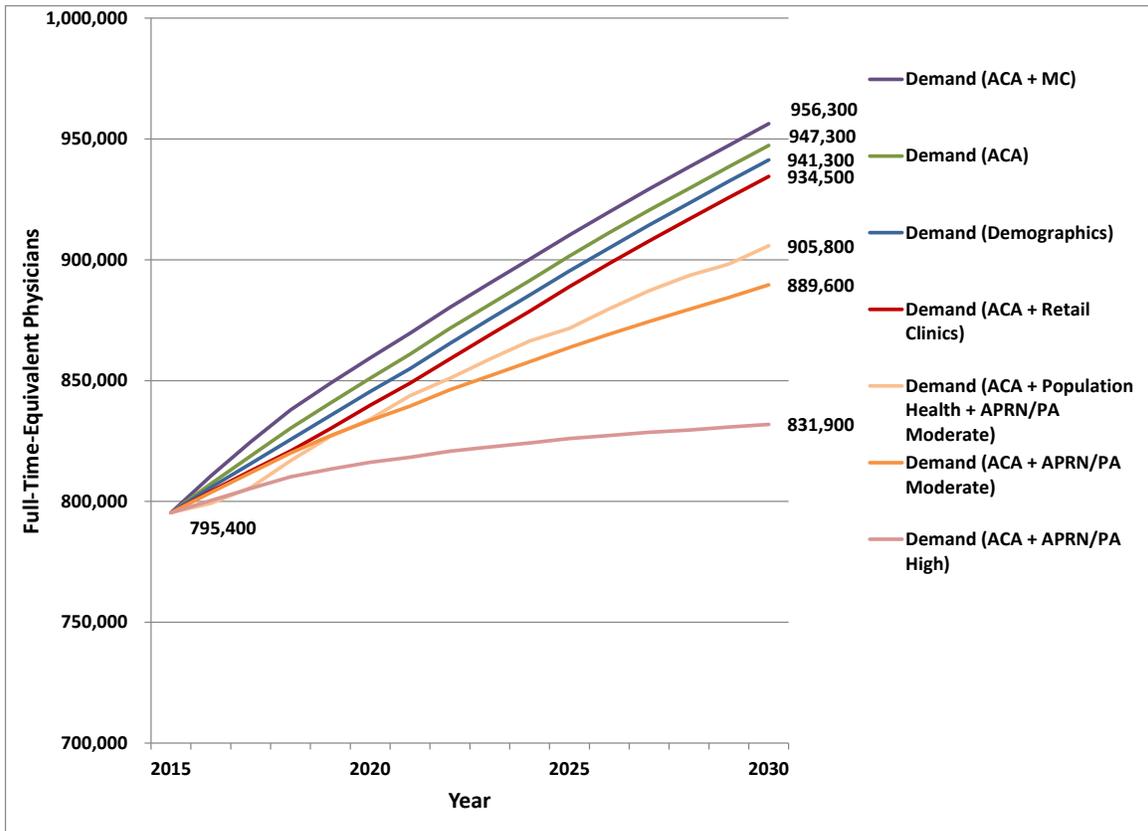
Exhibit 15: Projected Growth in Physician Demand, 2014–2025: 2015 Report vs 2016 Report

Growth in FTE Demand 2015 to 2025 (thousands)

Categories (top to bottom):
- Changing Demographics
- Changing Demographics + ACA Medical Insurance Expansion
- Changing Demographics + ACA + Managed Care
- Changing Demographics + ACA + Increased Use of Retail Clinics
- Changing Demographics + ACA + Increased Use of APNs/PAs (moderate use)
- Changing Demographics + ACA + Increased Use of APNs/PAs (high use)
- Demand (ACA + Population Health + APRN/PA Moderate)

Legend:
- ■ 2017 Report
- ■ 2016 Report

Detailed Demand Projections

In this report we provide additional detail on demand for physicians by patient race and Hispanic ethnicity, region of the country, and metropolitan vs non-metropolitan area.

Physician Demand by Patient Race and Hispanic Ethnicity

Patterns of health care use and delivery differ systematically by patient race and Hispanic 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 supply-related access barriers.

For modeling, we categorize patients in one of four mutually exclusive categories: non-Hispanic white, non-Hispanic black, non-Hispanic all other, and Hispanic.[28] In 2015, an estimated 62% of the population was non-Hispanic white, but this population accounted for about 71% (562,000 FTEs) of total physician demand. The Hispanic population, however, represented 18% of the U.S. population but accounted for about 11% (89,600 FTEs) of physician demand (Exhibit 16).

Between 2015 and 2030, the Hispanic population is projected to grow the most rapidly in percentage terms (26%), followed by the non-Hispanic other (19%), black (11%), and white (9%) populations. On the basis of changing demographics alone (independent of any health care reform initiatives that increase access to care), demand for physician services is projected to grow by 149,000 FTEs from 2015 to 2030 (Exhibit 17). This growth includes an additional 58,400 FTEs associated with growth in the non-Hispanic white population, 43,500 FTEs associated with growth in the Hispanic population, 25,100 FTEs associated with growth in the non-Hispanic other population, and 22,000 FTEs associated with growth in the non-Hispanic black population. Improving medical insurance coverage or removing other barriers to care will likely increase demand for minority populations at a higher rate than demand for non-Hispanic whites.

AAMC reports that in 2013, among physicians whose race or ethnicity was reported, about 6% were non-Hispanic black, 6% were Hispanic, 19% were non-Hispanic other, and 69% were non-Hispanic white.[29] These findings highlight that minority physicians are underrepresented in terms of 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.

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[28] 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 subsetting by state, age group, and gender.

[29] AAMC. Diversity in the Physician Workforce: Facts & Figures 2014. http://aamcdiversityfactsandfigures.org/section-ii-current-status-of-us-physician-workforce/#fig1.

Exhibit 16: Projected Physician Demand by Patient Race and Ethnicity, 2015–2030

Year	Non-Hispanic			Hispanic	Total
	White	**Black**	**Other**	**Hispanic**	**Total**
2015					
Total	**562,000**	**87,800**	**56,100**	**89,600**	**795,500**
Primary Care	154,500	24,700	19,600	31,600	230,400
Non-primary Care	407,500	63,100	36,500	58,000	565,100
Medical Specialties	91,300	17,400	8,000	13,600	130,300
Surgery	110,900	16,200	10,100	17,100	154,300
Other	186,000	25,600	16,500	24,500	252,600
Hospitalist	19,300	3,900	1,900	2,800	27,900
2030					
Total	**620,400**	**109,800**	**81,200**	**133,100**	**944,500**
Primary Care	170,300	30,900	28,300	45,200	274,700
Non-primary Care	450,100	78,900	52,900	87,900	669,800
Medical Specialties	106,300	22,800	12,100	21,800	163,000
Surgery	120,400	19,600	14,200	24,900	179,100
Other	200,700	31,400	23,800	36,800	292,700
Hospitalist	22,700	5,100	2,800	4,400	35,000
Growth 2015 to 2030					
Total	**58,400**	**22,000**	**25,100**	**43,500**	**149,000**
Primary Care	15,800	6,200	8,700	13,600	44,300
Non-primary Care	42,600	15,800	16,400	29,900	104,700
Medical Specialties	15,000	5,400	4,100	8,200	32,700
Surgery	9,500	3,400	4,100	7,800	24,800
Other	14,700	5,800	7,300	12,300	40,100
Hospitalist	3,400	1,200	900	1,600	7,100

Exhibit 17: Projected Physician Demand Growth by Patient Race and Ethnicity, 2015–2030
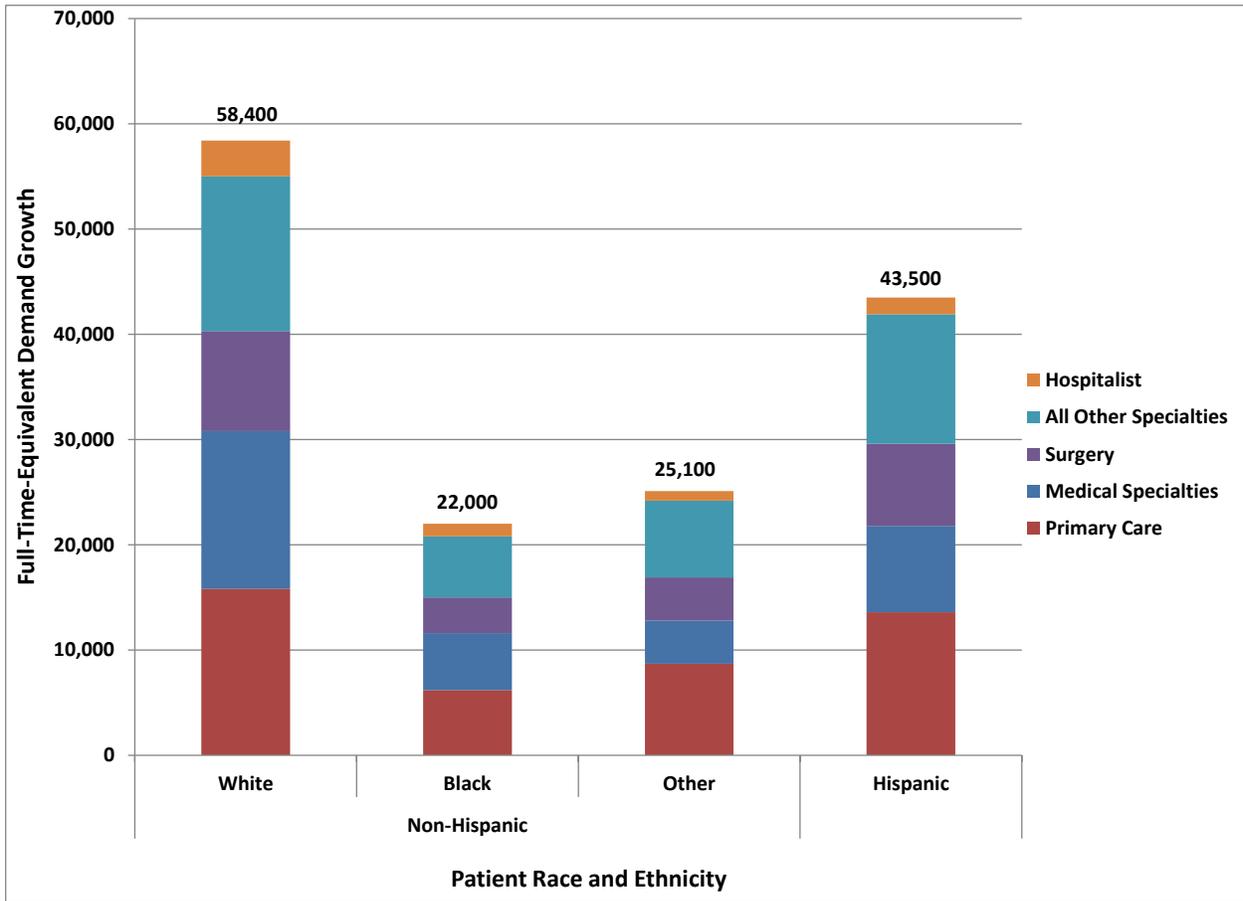
Physician Demand by Region and Metropolitan vs Non-Metropolitan Area

Utilization of physician services and the projected growth in demand vary by geographic region due to differences in demographics and projected population growth, insurance coverage and other financial considerations (e.g., household income), health-related behavior and disease prevalence, and care-access barriers. For this analysis, we projected national demand to the region level accounting for differences in demographics and other variables in the model (disease prevalence, obesity and smoking prevalence, insurance status, etc.). If each person in the United States had a level of care identical to the national average for a similar person (same demographic, insurance status, disease presence, etc.), then in 2015, demand for physicians would be distributed as follows: 295,500 FTEs (37%) in the South Region, 179,000 FTEs (23%) in the West Region, 174,100 FTEs (22%) in the Midwest Region, and 144,600 FTEs (18%) in the Northeast Region (Exhibit 18 and Exhibit 19). Demand growth is projected to be largest in the South Region (69,400 FTEs) and lowest in the Northeast (12,500 FTEs).

Exhibit 18: Physician Demand by Region Based on National Average Utilization Patterns, 2015
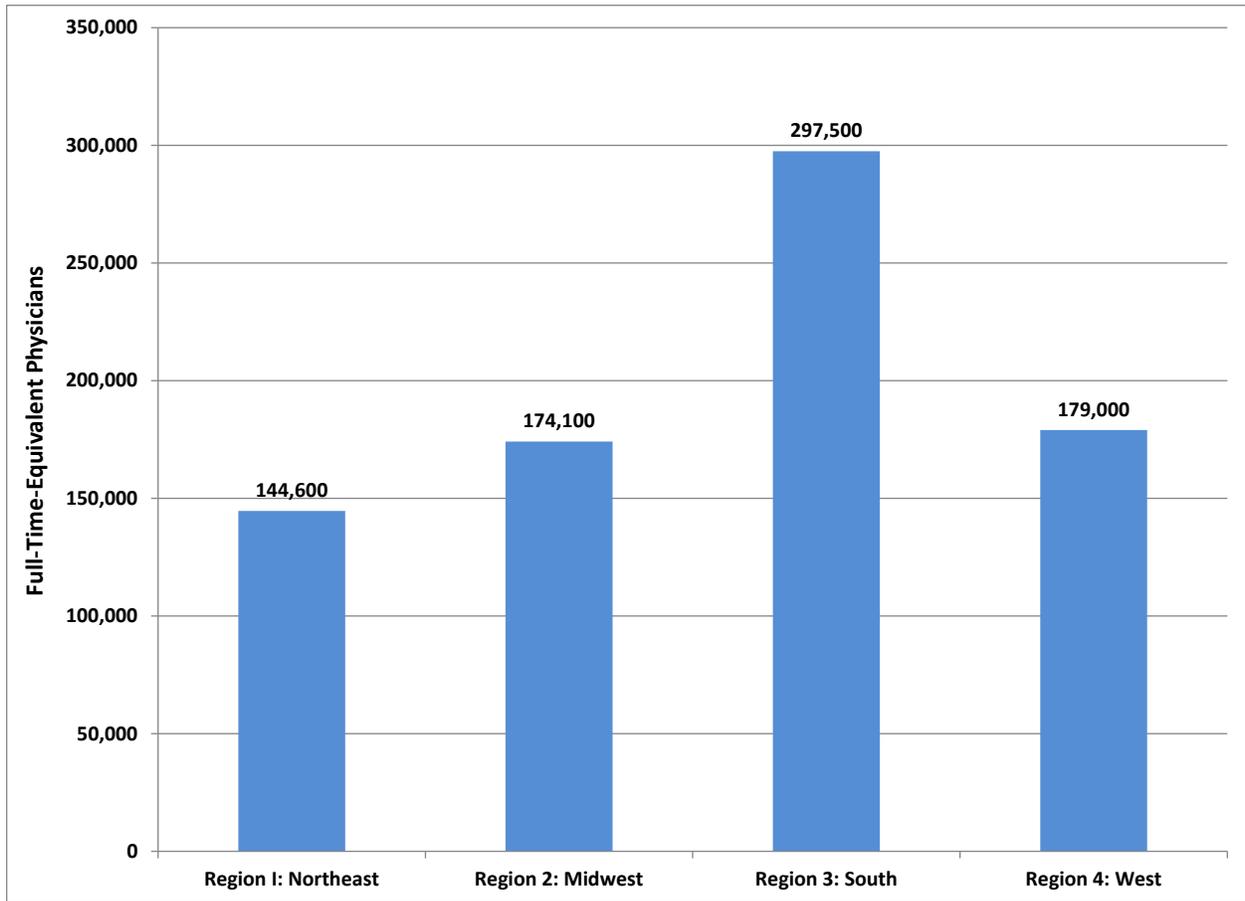
Exhibit 19: Projected Physician Demand by Region, 2015–2030

Year	Region I: Northeast	Region 2: Midwest	Region 3: South	Region 4: West	Total
2015					
Total	**144,600**	**174,100**	**297,500**	**179,000**	**795,200**
Primary Care	41,300	49,900	86,100	53,100	230,400
Non-primary Care	103,300	124,200	211,400	125,900	564,800
Medical Specialties	23,600	28,100	50,000	28,600	130,300
Surgery	28,200	34,100	57,100	34,700	154,100
Other	46,500	55,900	93,600	56,600	252,600
Hospitalist	5,000	6,100	10,700	6,000	27,800
2030					
Total	**157,100**	**187,200**	**366,900**	**228,200**	**939,400**
Primary Care	45,000	53,800	107,200	68,400	274,400
Non-primary Care	112,100	133,400	259,700	159,800	665,000
Medical Specialties	26,900	31,900	65,000	38,800	162,600
Surgery	30,300	36,200	69,200	43,100	178,800
Other	49,100	58,300	111,500	69,700	288,600
Hospitalist	5,800	7,000	14,000	8,200	35,000
Growth 2015 to 2030					
Total	**12,500**	**13,100**	**69,400**	**49,200**	**144,200**
Primary Care	3,700	3,900	21,100	15,300	44,000
Non-primary Care	8,800	9,200	48,300	33,900	100,200
Medical Specialties	3,300	3,800	15,000	10,200	32,300
Surgery	2,100	2,100	12,100	8,400	24,700
Other	2,600	2,400	17,900	13,100	36,000
Hospitalist	800	900	3,300	2,200	7,200

Projected utilization of physician services by metropolitan vs non-metropolitan area suggests that about 89% of total utilization of FTE physicians comes from the population in metropolitan areas. About 86% of the U.S. population resides in metropolitan counties—suggesting that after controlling for demographics, disease prevalence, medical insurance coverage, and other patient factors, per capita utilization of physician services is slightly higher in metropolitan areas than in non-metropolitan areas. This finding possibly reflects access barriers in non-metropolitan areas.

Exhibit 20: Physician Demand by Metropolitan vs Non-metropolitan Location, 2015

Baseline	Metropolitan	Non-metropolitan
Total	**707,200**	**88,200**
Primary Care	204,500	25,900
Non-primary Care	502,700	62,300
Medical Specialties	114,200	16,100
Surgery	136,800	17,400
Other	227,700	25,000
Hospitalist	24,000	3,800

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

The scenario for health care–utilization equity (HCUE) models the implications for physician demand if currently underserved populations utilized care at a rate similar to that for populations facing fewer barriers to care. ***It 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. This stand-alone scenario illustrates that sociodemographic and geographic imbalances in the supply of physicians and other barriers to accessing care result in lower levels of care received by historically underserved populations beyond utilization differences that can be explained by differences in disease prevalence and other health risk factors. The estimates we put forth are by no means deemed definitive; instead, they are intended to stimulate much-needed discussion and analysis about how best to address health care utilization inequity in future projections.

Two scenarios were modeled to estimate the increase in use of health care services anticipated if underserved populations had similar use patterns as the rest of the population (see Exhibit 21 through Exhibit 27, and Exhibit 38 and Exhibit 39). The first scenario (HCUE Scenario 1) modeled a hypothetical scenario if people without medical insurance and people living in non-metropolitan areas had equivalent care utilization 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 rural area was modeled as having the utilization rate of an insured person with heart disease living in a metropolitan area.) Under these assumptions, we estimate a 4% gap in total physician supply in 2015 compared with the number required under this HCUE scenario. Compared with the supply in 2015, an additional 34,800 physicians would have been required to enable uninsured, non-metropolitan patients to utilize care in the same manner as other patients. (This estimate for physicians is in addition to the extra PAs and APRNs that would be needed based on current national delivery patterns.) This estimate is slightly smaller than the 5% gap for 2014 estimated in the previous version of this report, reflecting the gains in insurance coverage from the ACA. The estimated 10,300 gap between primary care physician supply and demand is similar to the estimated gap—8,200 providers—required to de-designate extant primary care Health Professional Shortage Areas (HPSAs).

The second scenario for health care utilization equity (HCUE Scenario 2) estimated the 2015 physician shortfall under a hypothetical scenario wherein we modeled everyone utilizing care as if they 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% gap (or about 96,800 physicians) between the total physician supply in 2015 and the number of physicians required.

Exhibit 21: Additional Physicians Needed if U.S. Had Achieved Health Care Utilization Equity in 2015
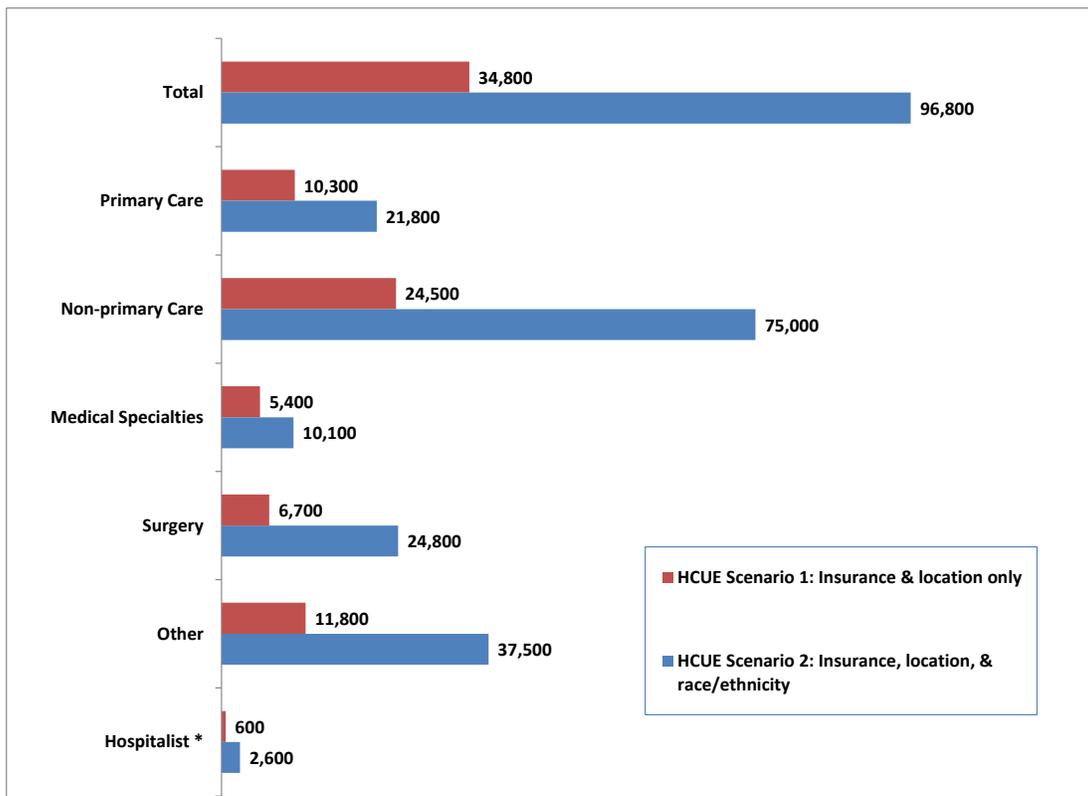
The implications of these hypothetical scenarios vary substantially by race and ethnicity (Exhibit 22 and Exhibit 23), region of the country (Exhibit 24 and

Exhibit 25), and whether residing in a metropolitan area (Exhibit 26 and Exhibit 27). Under HCUE Scenario 1, demand for physicians rises by about 4% for all race and ethnicity categories except Hispanics (which rises by 7% to reflect higher rates of uninsured people in this population). Under HCUE Scenario 2, the Hispanic population would use services requiring an additional 35,500 FTE physicians (a 40% increase from the current level of care used by Hispanics). The black population would use services requiring an additional 25,000 FTE physicians. Demand for services would increase for the black population in all specialty categories with the exception of medical specialties—where demand would fall for the areas where blacks use disproportionately more services than whites (nephrology, hematology/oncology, and endocrinology). With better access to care, demand for these specialties might fall for blacks to the extent that improved preventive care and screening can reduce prevalence of hypertension, diabetes, cancers, and other preventable conditions.

Under these HCUE scenarios, the increase in demand would be greatest in the South Region and lowest in the Northeast Region (Exhibit 24). Under the HCUE Scenario 1, the increase in demand would be split almost evenly between metropolitan and non-metropolitan areas (Exhibit 26). Under the HCUE Scenario 2, the majority of demand growth would be in metropolitan areas.

Exhibit 22: Additional Physicians Needed if U.S. Had Achieved Health Care Utilization Equity in 2015, by Race and Ethnicity

Scenario	Non-Hispanic White	Non-Hispanic Black	Non-Hispanic Other	Hispanic	Total
HCUE Scenario 1					
Total	**23,100**	**3,500**	**2,200**	**6,000**	**34,800**
Primary Care	6,400	1,100	800	2,000	10,300
Non-primary Care	16,700	2,400	1,400	4,000	24,500
Medical Specialties	3,800	500	300	800	5,400
Surgery	4,000	800	400	1,500	6,700
Other	8,500	1,000	700	1,600	11,800
Hospitalist	400	100	0	100	600
HCUE Scenario 2					
Total	**23,100**	**25,000**	**13,200**	**35,500**	**96,800**
Primary Care	6,400	7,100	800	7,500	21,800
Non-primary Care	16,700	17,900	12,400	28,000	75,000
Medical Specialties	3,800	-100	2,300	4,100	10,100
Surgery	4,000	7,300	4,200	9,300	24,800
Other	8,500	10,100	5,400	13,500	37,500
Hospitalist	400	600	500	1,100	2,600

Exhibit 23: Additional Physicians Required by Health Care Utilization Equity Scenario and Race and Ethnicity, 2015
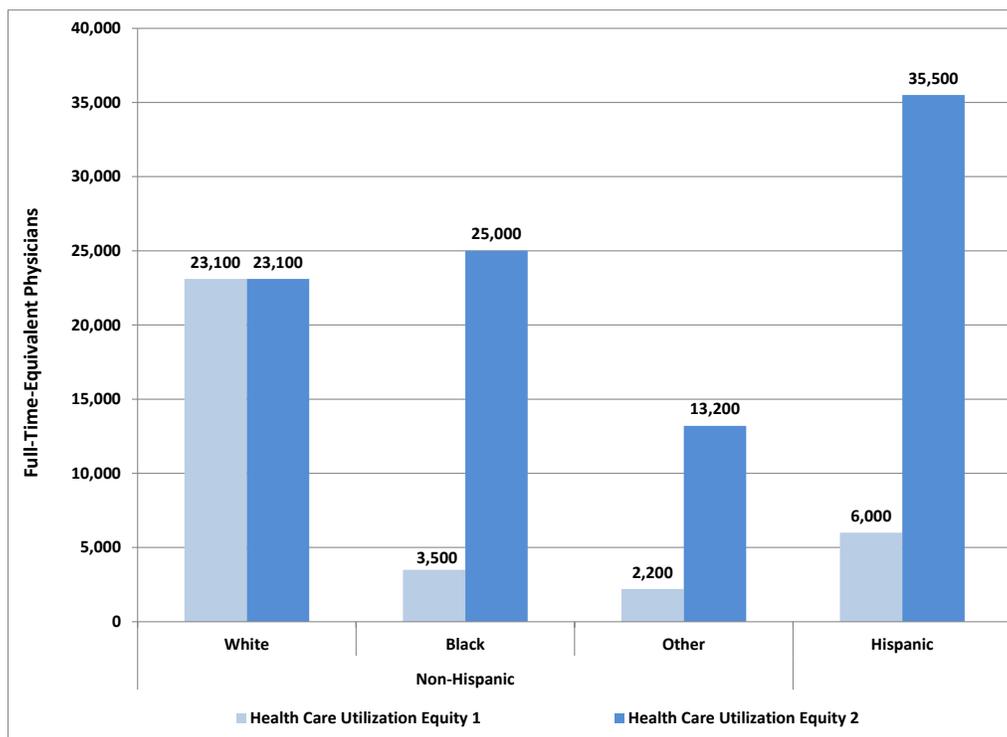
Exhibit 24: Additional Physicians Needed if U.S. Had Achieved Health Care Utilization Equity in 2015, by Region

Scenario	Region I: Northeast	Region 2: Midwest	Region 3: South	Region 4: West	Total
HCUE Scenario 1					
Total	**4,200**	**7,700**	**16,500**	**6,400**	**34,800**
Primary Care	1,200	2,200	5,000	1,900	10,300
Non-primary Care	3,000	5,500	11,600	4,500	24,600
Medical Specialties	700	1,300	2,400	1,000	5,400
Surgery	800	1,300	3,300	1,300	6,700
Other	1,400	2,800	5,500	2,100	11,800
Hospitalist	100	100	300	100	600
HCUE Scenario 2					
Total	**14,100**	**16,000**	**41,900**	**24,800**	**96,800**
Primary Care	3,000	3,900	10,400	4,500	21,800
Non-primary Care	11,100	12,100	31,600	20,300	75,100
Medical Specialties	1,400	1,700	3,900	3,100	10,100
Surgery	3,700	3,700	10,800	6,600	24,800
Other	5,600	6,300	15,800	9,800	37,500
Hospitalist	400	400	1,000	800	2,600

Exhibit 25: Additional Physicians Required by Health Care Utilization Equity Scenario and Region, 2015
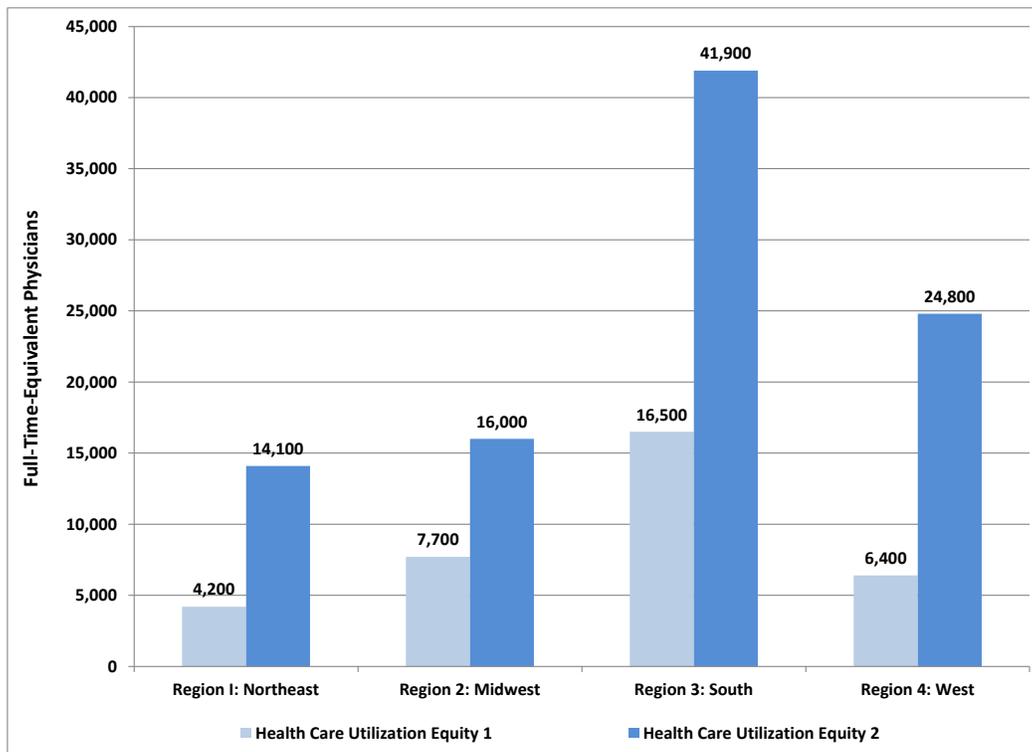
Exhibit 26: Additional Physicians Needed if U.S. Had Achieved Health Care Utilization Equity in 2015, by Metro vs Non-Metro Area

Scenario	Metropolitan	Non-metropolitan	Total
HCUE Scenario 1			
Total	17,900	16,900	34,800
Primary Care	5,600	4,700	10,300
Non-primary Care	12,300	12,200	24,500
Medical Specialties	2,600	2,800	5,400
Surgery	4,600	2,100	6,700
Other	4,800	7,000	11,800
Hospitalist	300	300	600
HCUE Scenario 2			
Total	76,300	20,500	96,800
Primary Care	16,400	5,400	21,800
Non-primary Care	59,900	15,100	75,000
Medical Specialties	7,000	3,100	10,100
Surgery	21,700	3,100	24,800
Other	29,000	8,500	37,500
Hospitalist	2,200	400	2,600

Exhibit 27: Additional Physicians Required by Health Care Utilization Equity Scenario and Metro vs Non-Metro Area, 2015
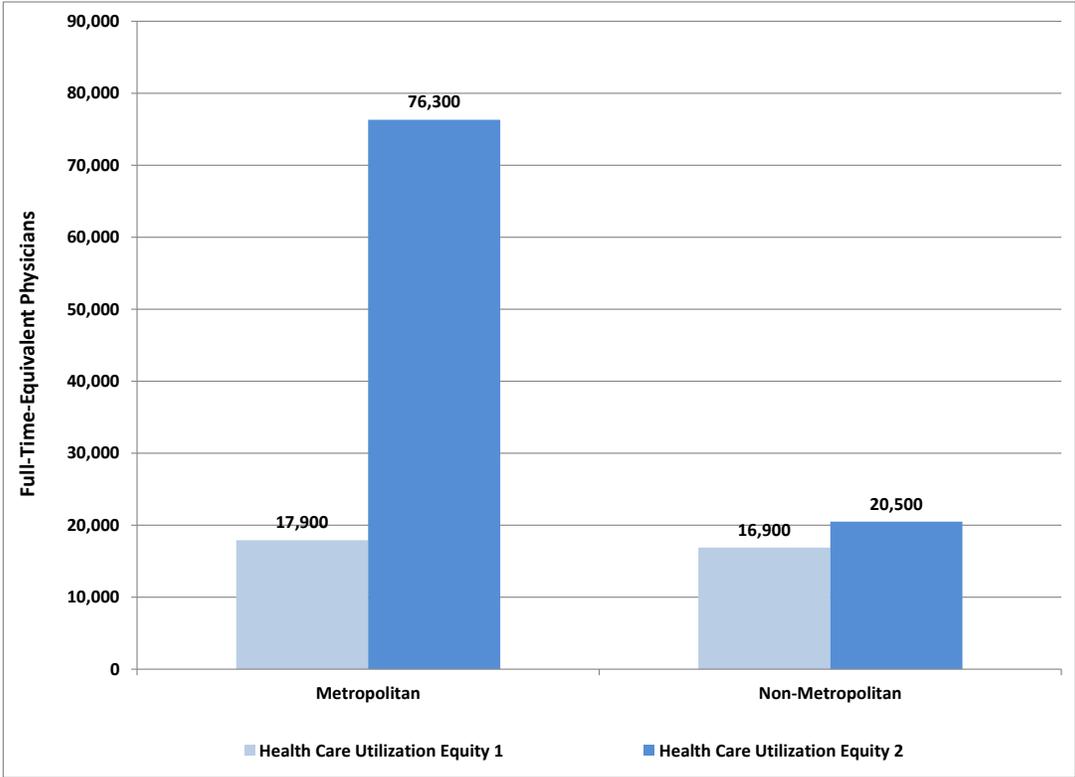
VI.   PHYSICIAN DEMAND IMPLICATIONS OF ACHIEVING SELECT POPULATION HEALTH GOALS

Population health goals and many care-delivery and reimbursement practices support the provision of timely and appropriate preventive care. Among the nation's Healthy People 2020 goals are (1) improving the percentage of adults with hypertension whose blood pressure is under control, (2) improving blood glucose control of people with diabetes, (3) improving cholesterol levels for adults with hypercholesterolemia, (4) reducing prevalence of obesity by encouraging improved nutritional intake and increased physical activity, (5) reducing prevalence of smoking, and (6) many other goals related to receiving preventive care and improving health-related behavior.[30] Progress toward achieving many of these goals has been strengthened by changes in policy or treatment guidelines.

Examples of these policy changes include new U.S. Preventive Services Task Force (USPSTF) recommendations for intensive behavioral counseling for individuals who are obese or who are at high risk for developing cardiovascular disease or diabetes to promote a healthful diet and physical activity[31]; Medicare reimbursement for intensive behavioral counseling to reduce diabetes and cardiovascular disease prevalence[32]; and provisions in ACA to cover counseling and treatment related to smoking cessation and improving clinical metrics such as blood pressure, cholesterol levels, and hemoglobin A1c levels.[33]

This scenario models the potential impact of achieving the following population health improvements on patient health and the resulting demand for health care services and providers:

- **Sustained 5% body weight loss for overweight and obese adults**: Numerous lifestyle interventions have achieved 5% or more body weight loss, on average.[34] Although sustaining weight loss is challenging for many patients, a patient-centered medical home model with long-term counseling

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[30] Office of Disease Prevention and Health Promotion. Healthy People 2020. https://www.healthypeople.gov/2020/topics-objectives

[31] USPSTF Final Recommendation Statement—Obesity in Adults: Screening and Management. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/obesity-in-adults-screening-and-management. USPSTF Final Recommendation Statement—Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults With Cardiovascular Risk Factors: Behavioral Counseling. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/healthy-diet-and-physical-activity-counseling-adults-with-high-risk-of-cvd. USPSTF Final Recommendation Statement—Abnormal Blood Glucose and Type 2 Diabetes Mellitus: Screening. https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/screening-for-abnormal-blood-glucose-and-type-2-diabetes.

[32] CMS. Medicare Preventive Services, 2016. https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/Downloads/MPS-QuickReferenceChart-1TextOnly.pdf.

[33] U.S. Department of Health and Human Services. Preventive Services Covered Under the Affordable Care Act. https://www.hhs.gov/healthcare/facts-and-features/fact-sheets/preventive-services-covered-under-aca/.

[34] Su W, Huang J, Chen F, Iacobucci W, Dall TM, Perreault L. Return on investment for digital behavioral counseling in patients with prediabetes and cardiovascular disease. *Preventing Chronic Disease*. 2016;13;150357. http://www.cdc.gov/pcd/issues/2016/15_0357.htm.

and pharmacotherapy will presumably help patients maintain weight loss. Reducing excess body weight lowers risk for cardiovascular disease, diabetes, various cancers, and other morbidity.

- **Improved blood pressure, cholesterol, and blood glucose levels for adults with elevated levels**: These goals can be achieved by appropriate screening and pharmacotherapy as well as weight loss. For example, 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[35]; 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[36]; and patients with elevated hemoglobin A1c levels can reduce A1c by 1 percentage point (CI, 0.5–1.25) annually, and we assume improvement occurs gradually until diabetes control is reached at A1c of 7.5%.[37]
- **Smoking cessation**: Patients who stop smoking can lower their risk for various cancers, diabetes, cardiovascular disease, and other morbidity.[38]

Using a Markov-based microsimulation approach that has been described in detail elsewhere, we modeled the long-term health impacts of the hypothetical population health scenario described above.[39,40,41] The prediction equations for this Disease Prevention Microsimulation Model came from clinical trials and published studies. The simulation used a nationally representative sample of adults from 2015 to 2030. The population sample was constructed using the 2013–2014 National Health and Nutrition Examination Survey (NHANES) combined with national population projections. The modeled intervention focused on adults who are overweight or obese; have elevated blood pressure, cholesterol, or blood glucose levels; or who smoke. The population was modeled with and without intervention, and model clinical outcomes were then run through the Healthcare Demand Microsimulation Model.

Model outcomes suggest that achieving these lifestyle and clinical goals would, between 2015 and 2030, result in 10.2 million fewer cases of heart disease, 3.2 million fewer strokes, 3 million fewer heart attacks, and reduced incidence of cancer and other diseases. On a per capita basis, national demand for health care services (and physician services) would decline by about 1–2%, with the impact differing by care-delivery setting and by medical specialty.

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[35] Taylor F, Huffman MD, Macedo AF, et al. Statins for the primary prevention of cardiovascular disease. *Cochrane Database Syst Rev.* 2013;1:CD004816. 2010;33(8):1859-1864.

[36] Baguet JP, Legallicier B, Auquier P, Robitail S. Updated meta-analytical approach to the efficacy of antihypertensive drugs in reducing blood pressure. *Clin Drug Investig.* 2007;27(11):735-753.

[37] Sherifali D, Nerenberg K, Pullenayegum E, Cheng JE, Gerstein HC. The effect of oral antidiabetic agents on A1C levels: a systematic review and meta-analysis. *Diabetes Care.* 2010;33(8):1859-1864.

[38] Yang W, Dall TM, Zhang Y, Zhang S, Arday DR, Dorn PW, Jain A. Simulation of Quitting Smoking in the Military Shows Higher Lifetime Medical Spending More Than Offset by Productivity Gains. *Health Affairs.* 2012;31(12):2717-2726. http://content.healthaffairs.org/content/31/12/2717.long.

[39] Dall TM, Storm MV, Semilla AP, Wintfeld N, O'Grady M, Narayan KM. Value of lifestyle intervention to prevent diabetes and sequelae. *Am J Prev Med.* 2015;48:271-280.

[40] Su W, Huang J, Chen F, Iacobucci W, Mocarski M, Dall TM, et al. Modeling the clinical and economic implications of obesity using microsimulation. *J Med Econ.* 2015;18:886-897.

[41] Su W, Chen F, Dall TM, Iacobucci W, Perreault L. Return on investment for digital behavioral counseling in patients with prediabetes and cardiovascular disease. *Prev Chronic Dis.* 2016;13:E13.

However, achieving these population health goals would reduce mortality such that more people would be alive and require physician care. The Census Bureau projects 283 million adults will be alive in 2030, but achieving modeled outcomes could raise the 2030 population by 6.3 million adults—most of whom are elderly. By 2030 national demand for physicians would be about 15,500 FTEs *higher* because the number of physicians needed to support these additional 6.3 million adults more than offsets the reduced demand associated with a healthier population (Exhibit 28). The demand impact varies by physician specialty category (Exhibit 29). The specialty projected to experience the largest percentage increase in demand by 2030 that can be attributed to achieving these population health goals is geriatricians (8% increase in demand associated with more elderly still living), while the specialty projected to experience the largest percentage decrease in demand is endocrinologists (9% decrease associated with fewer patients with diabetes and diabetes-related complications).

Exhibit 28: Projected Adult Population, 2015–2030
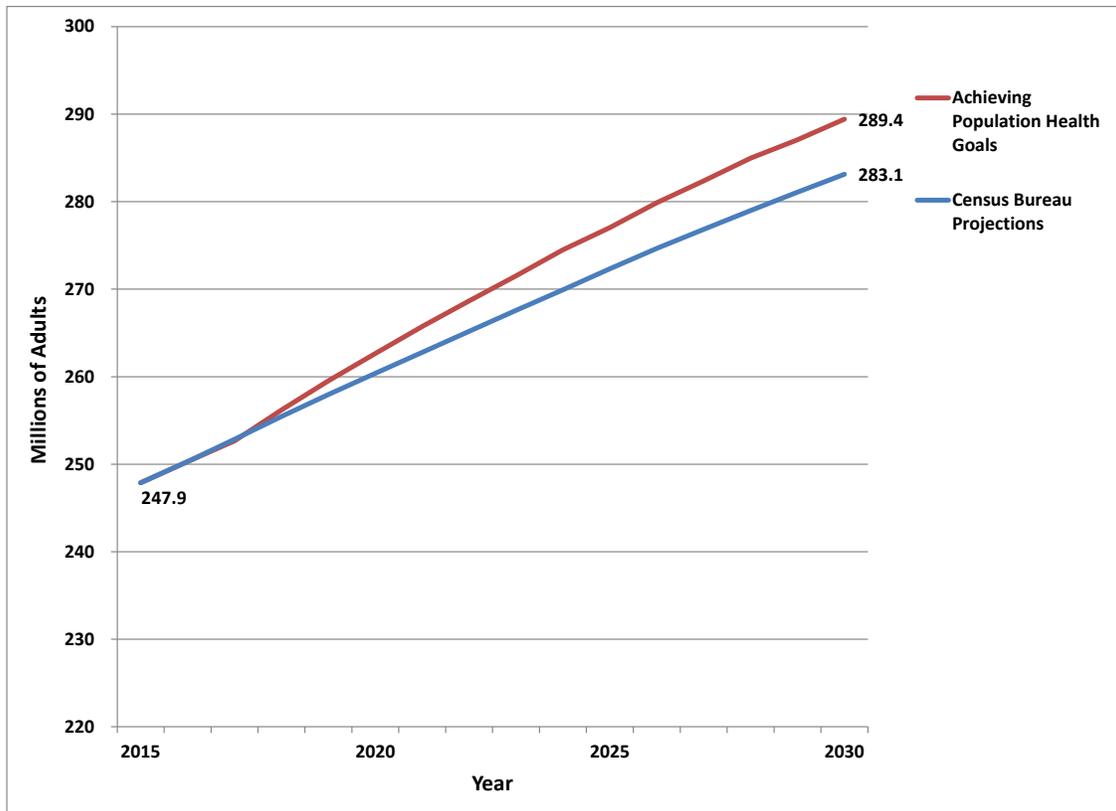
Exhibit 29: Implications of Achieving Modeled Population Health Goals: Net Difference in Physician Demand
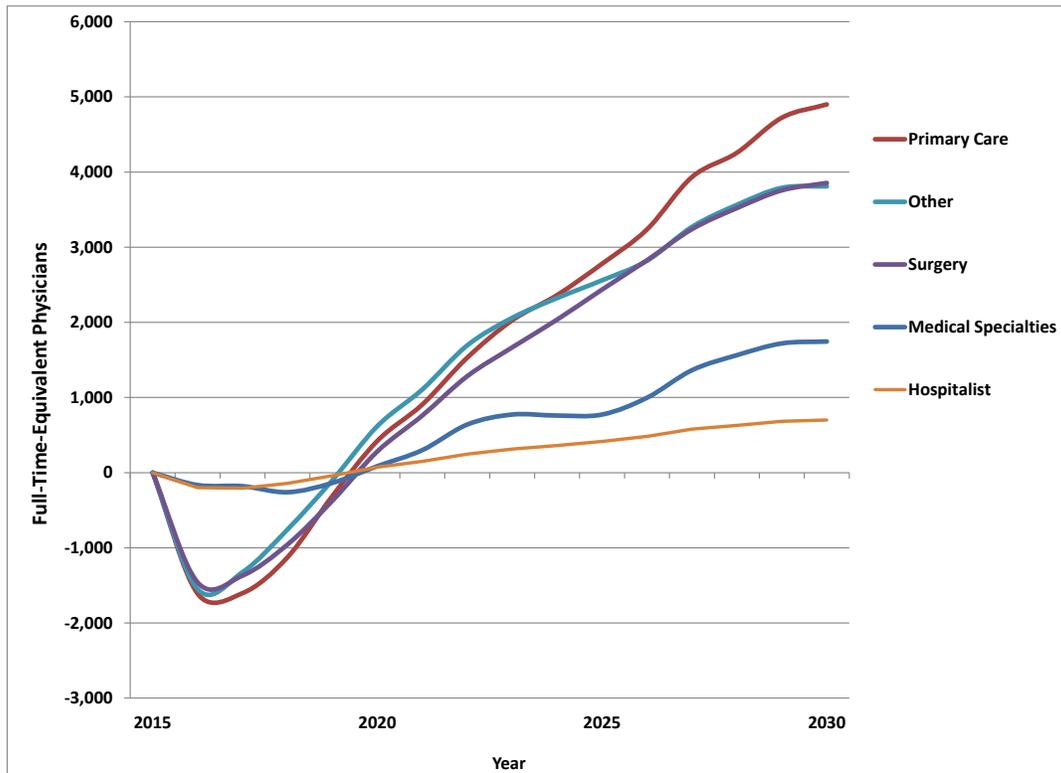
Note: This chart compares national projections of physician demand if the modeled population health goals are achieved vs demand under a continuation of the status quo.

The main conclusion to draw from this scenario is that in the long term, meeting select population health goals will not necessarily decrease demand for physicians—though it might decrease demand for select physician specialties and shift care across delivery settings. Achieving population health goals reduces morbidity and increases longevity and quality of life, but the health-services impact of increased longevity appears to more than offset the declines in service use associated with improved health under the scenario modeled. The net effect is a slight (1%) decline in physician demand in the initial years after achieving these goals and a slight (2%) increase in physician demand by 2030. For modeling purposes, we combined this scenario with the "moderate use" scenario for APRNs and PAs under the assumptions that (1) achieving these population health goals would primarily be achieved through increased provision of preventive care and counseling provided by NPs and PAs and (2) the additional demand for APRNs and PAs required to care for the additional 6.3 million adults who would be alive in 2030 will mean there are fewer "extra" APRNs and PAs to help offset the projected shortfall of physicians. We modeled only a subset of the nation's population health goals, but meeting goals related to improved cancer screening and reduced alcohol abuse and other population health goals would likely lead to similar expectations of an increased demand for physicians to care for a larger population, which would be partially offset by a decreased demand associated with a healthier population.

VII. KEY FINDINGS AND CONCLUSIONS

The need to assess the capacity of the nation's future health care workforce in general—and physician workforce in particular—is more important now than ever so that both public and private sectors can have the necessary information to make the investments needed for a health care system that provides high-quality, cost-efficient health care while also developing the physicians needed to transform the current system and to maximize population health. The pace of change in the world of health care delivery and finance necessitates that workforce projections and projections models are updated and improved almost constantly. That is why the AAMC made a commitment to commission an annual update of national physician workforce projections. The purpose is threefold:

- **Update projections:** Support the ongoing development of up-to-date projections of the physician workforce based on the most recent and best-quality data and respond to questions raised by previous reports. These updated projections now model supply and demand through 2030 (rather than through 2025), use updated data sources and incorporate updated trend data, and include higher projected supply growth estimates for APRNs.
- **Present new analyses:** Produce research and data on specific topics to further develop the physician workforce projections. In this 2017 report, we present new analysis around the physician-demand implications of achieving select goals to improve population health, and we provide additional detail on physician demand and the implications of achieving greater health care–utilization equity (HCUE) by geographic area and by patient race and ethnicity.
- **Identify future directions for research:** Identify specific areas for future research, data collection, and analysis that will also strengthen future projections work and support the decision making that helps align the nation's health needs with its health workforce.

Through these efforts, the AAMC intends to invite discussion to advance our collective capacity for developing continually improved health workforce projections with data-based analysis. This annual (2017) workforce projections update combined data on the national physician workforce; data on the demographics, socioeconomics, and health risk factors of the population; data from national sources on patient-care use and delivery patterns; and health workforce microsimulation supply and demand models to estimate the current and future supply and demand of physicians through 2030. The projections in this analysis are based on available data to date. Further, recognizing the uncertainty inherent to modeling the future workforce, this study presents projections across a variety of scenarios, resulting in a projected range.

Key study findings and conclusions include:

- **For the third year in a row, we project that physician demand will continue to grow faster than supply, leading to a projected total physician shortfall of between 40,800 and 104,900 physicians by 2030 (Exhibits ES-1 and ES-2)**. While the shortfall ranges from 34,600 to 88,000 physicians in 2025, it is projected to increase considerably by 2030. These estimates reflect updates to demand inputs and updates to projected PA and APRN supply through 2030. There is only one scenario where the projected demand for physicians is lower than any of the projected supply estimates.

- o **Projected shortfalls in primary care range between 7,300 and 43,100 physicians by 2030**. These updated primary care shortfall projections reflect projected faster growth in the supply of nurse practitioners (NPs) in primary care and the updating of the starting point to 2015.
  - o **Projected shortfalls in non-primary care specialties range between 33,500 and 61,800 by 2030.** These shortfalls are primarily of surgeons and selected other specialties (e.g., psychiatry and pathology).
  - o **Although projections for individual surgical specialties vary, the projected shortfall in surgical specialties is between 19,800 and 29,000 surgeons by 2030.** This shortfall is driven by projected stagnant supply levels for surgical specialists. On the basis of current trends, the number of newly trained surgeons is almost equal to projected future attrition, so there is little (if any) projected growth in supply. However, there continues to be strong projected growth in demand.
- **Demographics—specifically, population growth and aging—continue to be the primary driver of increasing demand from 2015 to 2030.** During this period the U.S. population is projected to grow by close to 12%, from about 321 million to 359 million. The population under age 18 is projected to grow by only 5%, while the population aged 65 and over is projected to grow by 55%. 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.
- **For all specialty categories, physician-retirement decisions are projected to have the greatest impact on supply, and over one-third of all currently active physicians will be 65 or older within the next decade.** Physicians between ages 65 and 75 account for 10% of the active workforce, and those between ages 55 and 64 make up nearly 26% of the active workforce.
- **The ratio of physicians to APRNs and PAs is projected to fall over time as APRN and PA supplies grow at faster rates than physician supply.** These projections suggest that the physician-to-PA ratio will fall from 7.2:1 in 2015 to 3.5:1 in 2030. The physician-to-APRN ratio will fall from 3.6:1 in 2015 to 1.9:1 in 2030. It is unclear whether these decreasing ratios are sustainable as an increased number of APRNs and PAs continue to enter the market, or to what extent these shifts will affect the demand for physicians.
- **Achieving population health goals may actually raise demand for physicians in the long term.** In this report, we present new research on the implications for physician demand associated with achieving select population health goals (reduce excess body weight by 5%; improve control of blood pressure, cholesterol, and blood glucose levels; and stop smoking). Under the scenario where select goals are achieved, short-term demand for physicians would decline slightly with improvements in population health. However, by 2030, there would be an additional 6.3 million adults still living. Caring for an additional 6.3 million adults (most of whom are elderly) would result in the demand for an additional 15,500 FTE physicians in the year 2030.
- **If underserved populations had care utilization patterns similar to populations with fewer access barriers, demand for physicians could rise substantially.** Improved access to care is a national goal.

As with last year's study, we modeled two hypothetical scenarios around removing access barriers. The findings are similar to those reported last year.

- o Scenario 1: If people without medical insurance and people living in non-metropolitan areas had care utilization patterns equivalent to those of their insured peers living in metropolitan areas with similar demographics and health risk factors, an additional 34,800 FTE physicians would have been required to meet this increase in demand.
- o Scenario 2: If everyone in the United States had care utilization patterns equivalent to non-Hispanic white, insured populations residing in metropolitan areas, an additional 96,800 FTE physicians would be required. Of this total increase, 35,500 (37%) would reflect increased demand among the Hispanic population, 25,000 (26%) would reflect increased demand among the non-Hispanic black population, 12,300 (14%) would reflect increased demand among the non-Hispanic "all other" population, and 23,100 (24%) would reflect increased demand among the non-Hispanic white population. While many other factors would need to be addressed to achieve health care–utilization equity—minimizing barriers related to insurance coverage, access, trust, etc.—these figures highlight the potential scale of currently unmet need.

This year's report expanded the special section on health care–utilization equity to provide additional information by patient race and ethnicity, region of the country, and whether patients reside in a metropolitan area. Current projection methods only partially account for possible underutilization by people with inadequate access. Therefore, to better gauge the degree of currently unmet need, the HCUE-scenario models the implications for physician demand if currently underserved populations utilized health care at a rate similar to that of populations facing fewer sociodemographic, economic, and geographic barriers to care. These estimates are **not included** in the ranges of projections. Moreover, the estimates we put forth are by no means deemed definitive; instead, they are intended to stimulate much-needed discussion and analysis about how best to address health care utilization inequity in future projections.

Finally, projections are constantly challenged by the reality that health care is changing at a tremendous pace and often in unpredictable ways. The projected ranges reflect uncertainties about how emerging care-delivery and financing models might change health care use and delivery patterns, as well as uncertainties about participation patterns in the physician labor force (i.e., retirement and work-life balance decisions) and employment vs independent practice decisions. 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 the AAMC's decision to produce, on an annual basis, ever more sophisticated projections of the nation's physician workforce, address issues that need to be examined further, and identify areas of analysis and research that still need to be explored.

VIII.   FUTURE DIRECTIONS IN HEALTH WORKFORCE RESEARCH

Given the ongoing changes in how health care services are offered and financed, the nation may never arrive at a definitively appropriate mix of providers.[42] Uncertainties continue to abound about whether, how, and how quickly emerging payment and care-delivery models might affect physician supply and demand. This uncertainty has increased with the new administration's goal of replacing portions of ACA—though both political parties have signaled an intention to maintain or increase the proportion of the population with medical insurance coverage. Still, evidence to date has not shown that changes in payment or care-delivery models have a substantial effect on physician workforce needs.

Examples of directions for future research to improve analytic capabilities and advance the field of health workforce modeling, as better data become available, include:

- **Current shortages and inefficiencies**: The demand projections start with the assumption that physician supply and demand are in equilibrium in 2015—with the exception of 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 extrapolates a "2015 level of care" to future years based on current care use and delivery patterns. How might we better measure current shortages? Likewise, can we better quantify inefficiencies in care delivery—as the modeling extrapolates such inefficacies into the future?
- **New care-delivery and financing models**: Care-delivery models continue to evolve in response to new financing models, policies, better understanding of best practices, new technologies, and other (e.g., economic) factors. How will the evolution in care delivery affect demand for health care services and staffing patterns? An aging population will put increasing financial pressure on government programs such as Medicare, Medicaid, and Social Security. What are the implications for reimbursement of health care services and the physician workforce?
- **Physician workforce participation and productivity**: The above trends in the health care system—as well as economic, cultural, and other (e.g., policy) forces—have implications for inputs related to physician supply, such as retirement, hours worked, and productivity. What are the drivers of, and shifts in, physician well-being and their implications for the future physician workforce? Similarly, how will clinicians and care settings respond to economic and other trends, through retirement and other decisions?
- **Telemedicine and digital technology**: How will the emerging technologies and payment reform that better enable telemedicine and new digital technologies affect (1) demand for physician services, (2) physician productivity, (3) physician career satisfaction (e.g., by reducing the burden associated with being on-call), (4) patient access to care, and (5) patient-care utilization and outcomes (e.g., hospital use)?

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[42] Daschle T. Creating a Workforce for the New Health Care World. Health Affairs Blog, March 7, 2013. Available online at http://healthaffairs.org/blog/2013/03/07/creating-a-workforce-for-the-new-health-care-world/.

- **Health care–utilization equity**: This study modeled scenarios around health care–utilization equity. How might care delivery be changed to remove barriers to receiving care? And what might be the implications for physician workforce needs and career satisfaction?
- **Population health initiatives**: This study modeled a hypothetical scenario associated with reducing excess body weight; improving control of blood pressure, cholesterol, and blood glucose levels; and stopping smoking. Many population health initiatives and policies are designed to help accomplish these outcomes through improvements in nutritional intake, increased physical activity levels, and greater use of patient-centered medical care for counseling and improving treatment adherence. Other population health initiatives include improving screening (e.g., cancer screening) for early detection, reducing substance abuse, improving access to prenatal care, increasing immunization rates, and improving access to adolescent health and family planning. Many of these objectives are highlighted as part of the nation's Healthy People 2020 goals.[43] Which of these population health initiatives are likely to be accomplished? How might the health workforce be mobilized to better achieve these goals? How might goal achievement affect patient access, morbidity and mortality, and provider demand and care-delivery patterns?
- **Geographic imbalances in provider supply**: The growth in demand for health care services is projected to exceed the growth of physician supply. How might a growing shortfall at the national level exacerbate geographic imbalances in supply, thus aggravating extant disparities in geographic distribution?
- **Market saturation and displacement of occupations and select specialties**: Although this report explores the implications of continued rapid growth in APRN and PA supply, more information is needed. To what extent can the health care system continue to absorb this new supply? Will a saturation point be reached and if so, when? What implications does demand have for physicians? Moreover, APRN and PA supplies have grown rapidly over the past decade, and these clinicians fill important roles in care delivery. To what extent have APRNs and PAs displaced physicians in some specialties, and to what extent are APRNs and PAs providing previously unfilled services and expanding access to care? Similarly, growth in hospitalist supply has been particularly strong over the past decade. Might market saturation be reached for hospitalists? If so, at what point will employment growth slow to a level to keep pace with growth trends in hospital inpatient care?

This report focuses on broad categories of physician specialties. It is important to look more closely at specific specialties that may experience or portend future shortages (and often signal current, crises)—behavioral and mental health, addiction medicine, and related disciplines; disciplines focused in areas in which the illness burden is increasing, such as oncology, cardiology, and endocrinology; obstetrics and gynecology; and the surgical specialties—to better plan for meeting those more specific physician-supply needs. Finally, given the enormity of research and analysis, we need to understand the role that local studies and qualitative analysis can play in helping analysts develop more sophisticated assumptions on which to build projections.

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[43] https://www.healthypeople.gov/.

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

IX. TECHNICAL APPENDIX

This appendix provides a brief overview of the workforce microsimulation models used, the data and assumptions, and information on select model inputs. Extensive technical documentation of the supply and demand models is available elsewhere.[44,45]

Synopsis of Study Methods

Consistent with the previous two physician workforce reports, this 2017 update used a microsimulation approach to project the supply of and demand for health care services and physicians. The supply and demand projection models have been used for health workforce modeling for federal and state governments and for trade and professional associations for physicians and other health occupations.

The supply model, under a status quo scenario, simulated 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 2015 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 were the implications of change in physician-retirement patterns (including delaying retirement by two years or retiring two years earlier); younger physicians (those currently aged less than 35 and new graduates) working fewer patient-care hours compared with older cohorts; and a modest expansion of graduate medical education (GME) 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 in the population if health care use and delivery patterns remained unchanged. The implications of continued expansion of medical insurance coverage associated with the Affordable Care Act (ACA) were modeled—although there is uncertainty about what might replace ACA under the new administration. As discussed later, to the extent that ACA is replaced with policies and programs that revert to pre-ACA rates of insurance coverage, the projections in this report might overstate future demand by 6,000–10,000 FTE physicians. As in previous reports, we updated scenarios reflecting possibly greater reliance on managed care and retail clinics and rapid growth in supply of advanced practice registered nurses (APRNs) and physician assistants (PAs). A new demand scenario modeled the implications of achieving certain population

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[44] U.S. Department of Health and Human Services, Health Resources and Services Administration, National Center for Health Workforce Analysis. Technical Documentation for HRSA's Health Workforce Simulation Model. Rockville, MD: U.S. Department of Health and Human Services, 2015.
https://bhw.hrsa.gov/sites/default/files/bhw/nchwa/projections/simulationmodeldocumentation.pdf.

[45] Dall TM, West T, Chakrabarti R, Iacobucci W, Semilla AP, Hansari A. Health Workforce Model Documentation. 2016.
https://cdn.ihs.com/www/pdf/IHS-HDMM-DocumentationApr2016.pdf.

health goals around improved body weight, smoking cessation, and improved control of blood pressure, cholesterol, and blood glucose levels. This new scenario is described in more detail in Section VI.

Supply Model Overview and Updates

Current Physician Workforce: Supply modeling starts with the 2015 AMA Physician Masterfile to identify the size and characteristics of the current workforce. In 2015, there were about 784,600 physicians under age 75 in active practice who had completed their graduate medical education (compared with about 782,200 in 2015).[46] Women constituted a third (33%) of the workforce. Physicians within the traditional retirement age between 65 and 75 were 10% of the active workforce, and those between age 55 and 64 made up nearly 26% of the active workforce (Exhibit 30). Therefore, it is possible that a third of all currently active physicians could retire within the next decade.

Exhibit 30: Age Distribution of Active Physicians, 2015
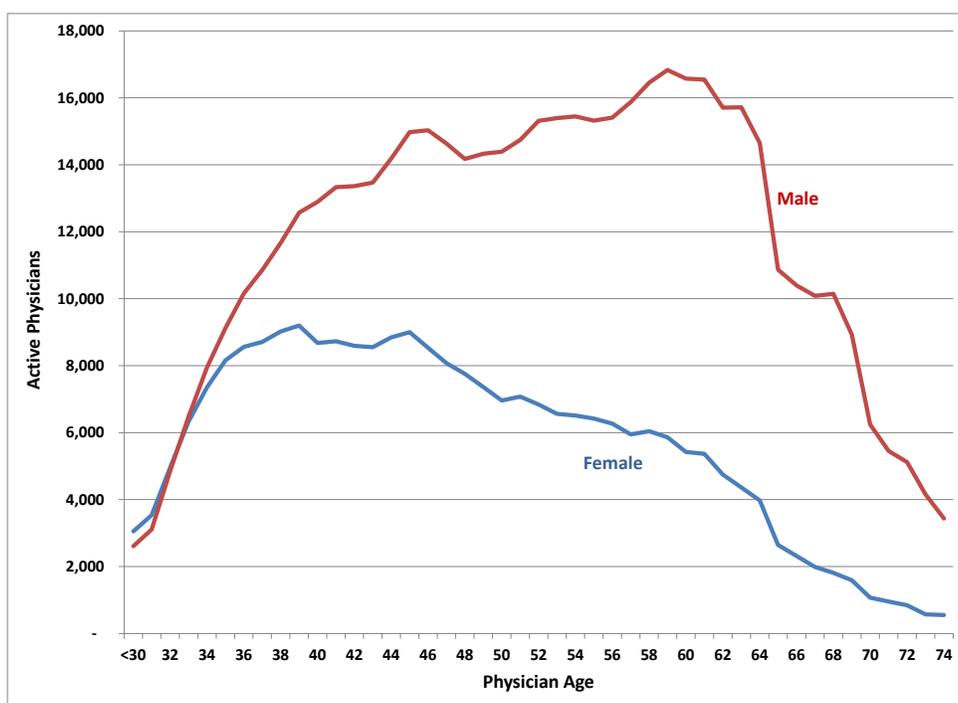
The approximately 222,000 active primary care physicians were 28% of the workforce, with another 130,300 (17%) in medical specialties, 154,200 (20%) in surgical specialties, 27,800 (4%) adult primary care–trained hospitalists, and 250,300 (32%) in the remaining specialties.

New Entrants: Under the status quo supply scenario, estimates of the number of physicians completing their GME in individual specialties came from published information on programs accredited by the

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[46] Both the supply and demand models measure full-time equivalents based on number of physicians who have completed GME. 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.

Accreditation Council for Graduate Medical Education (ACGME) and the American Osteopathic Association (AOA), taking into account that some programs are accredited by both organizations.[47] The age and sex distribution of new physicians was derived from analysis of the 2015 AMA Physician Masterfile. We estimated that 28,698 physicians completed GME between 2015 and 2016 (similar to the 28,233 estimate used in last year's report). This estimate includes 27,081 physicians completing GME from ACGME-accredited programs; 2,099 physicians from AOA-accredited programs; and subtracting out 482 physicians who completed GME in dually accredited programs. In total, 7,675 physicians (27% of new graduates) entered the workforce as primary care providers; 1,647 (6%) entered as adult primary care–trained new hospitalists; 5,476 (19%) entered in internal medicine and pediatric subspecialties; 5,051 (18%) entered in surgical specialties; and 8,849 (31%) entered in other specialties. Compared with the 2016 report, our estimates of annual new entrants to the workforce are higher for primary care (+413), medical specialties (+54), surgery (+164), and the "all other" category (+114) and lower for primary care–trained hospitalists (−280).

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 has been updated and is based on regression analysis of combined data from three states: (1) biannual 2012–2013 survey data (n = 17,782) of physicians in Florida who renewed their license and who work at least 8 hours per week in professional activities; (2) 2013 survey data from physicians in South Carolina (n = 9,252); and (3) 2013 survey data from physicians in New York (n = 44,181). 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 females age 55 and older worked only about one to three fewer hours per week than males of similar age and specialty.

Analysis by the AAMC's Center for Workforce Studies comparing self-reported hours worked per week from the 1980 U.S. Census to hours reported in the 2012–2014 files of the American Community Survey suggested that male physicians age 26 to 35 worked 5.8 fewer hours per week in 2013 relative to 1980. A decline of 3.9 hours worked per week was observed among women physicians age 26 to 35 during that same time. The supply scenarios modeled all use current patterns of hours worked to model the implications of changing demographics among the physician workforce, with the exception of the millennial-hours scenario described previously.

Retirement Patterns: For the previous reports and this update, the supply model used annual attrition probabilities for each combination of age, sex, and specialty 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

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[47] Estimates for graduates from ACGME-accredited programs came from an article in *JAMA*: Brotherton SE, Etzel SI. Graduate Medical Education, 2015-2016. *JAMA*. 2016;316(21):2291-2310. http://jamanetwork.com/journals/jama/fullarticle/2589326.
Estimates for graduates from AOA-accredited programs were unavailable, so information on new entrants to these programs was used. https://natmatch.com/aoairp/stats/2015prgstats.html.

mandated biannual physician licensure survey (2012–2013 data), which asks about intention to retire in the upcoming five years.

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 about 2008 to 2010), and 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-gender combination, were combined with rates of intention to retire to calculate overall attrition rates.[48] Johnson et al. found that age-adjusted mortality rates for occupational and technical specialties are about 25% lower than national rates for men and 15% lower for women through age 65, so mortality rates for physicians under age 65 were adjusted downward accordingly.[49]

Attrition rates are similar for male and female physicians, but they differ by specialty. For example, attrition patterns for male physicians suggest that by age 65, about 65% of allergists and immunologists are still active, while only 50% of emergency physicians are still active (Exhibit 19).

From these patterns we estimate that the median age of retirement is about 67 years old (i.e., about half retire before that age, and half retire after). This estimate of median retirement age is similar to the estimates of the mean age of retiring physicians over age 50 calculated by the AAMC's Center for Workforce Studies using data from the American Community Survey (Exhibit 32). Because of uncertainty, for modeling purposes, we simulate future physician supply under scenarios where physicians retire two years earlier or two years later than they currently do, on average.

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[48] Arias E. United States Life Tables, 2008. *National Vital Statistics Reports*. 2012;61(3).

[49] Johnson NJ, Sorlie PD, Backlund E. The impact of specific occupation on mortality in the US National Longitudinal Mortality Study. *Demography*. 1999;36:355-367.

Exhibit 31: Probability That Male Physician Is Still Active by Specialty and Age
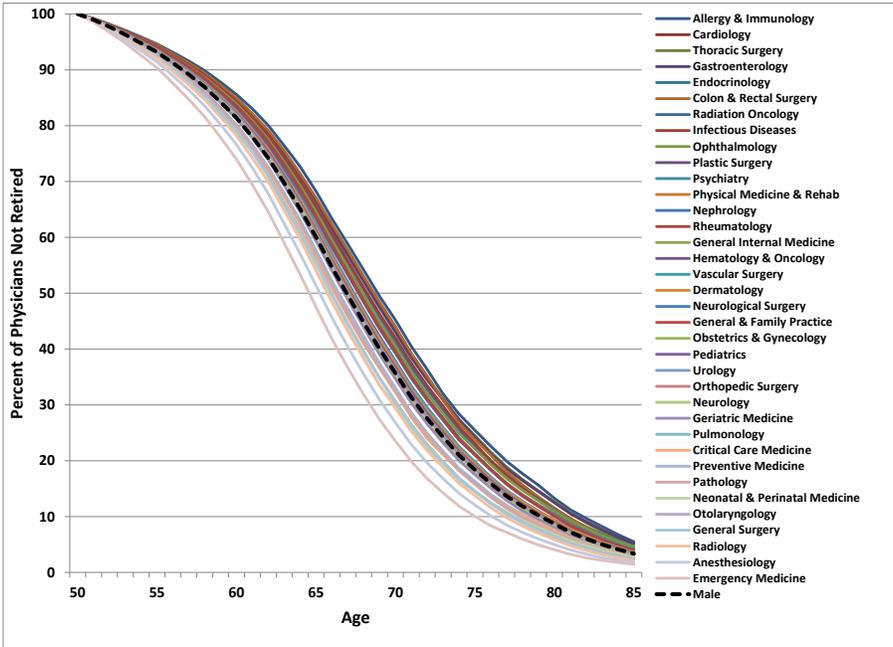
Exhibit 32: Mean Age of Retiring Physicians 2005– 2014 (Age 50+)
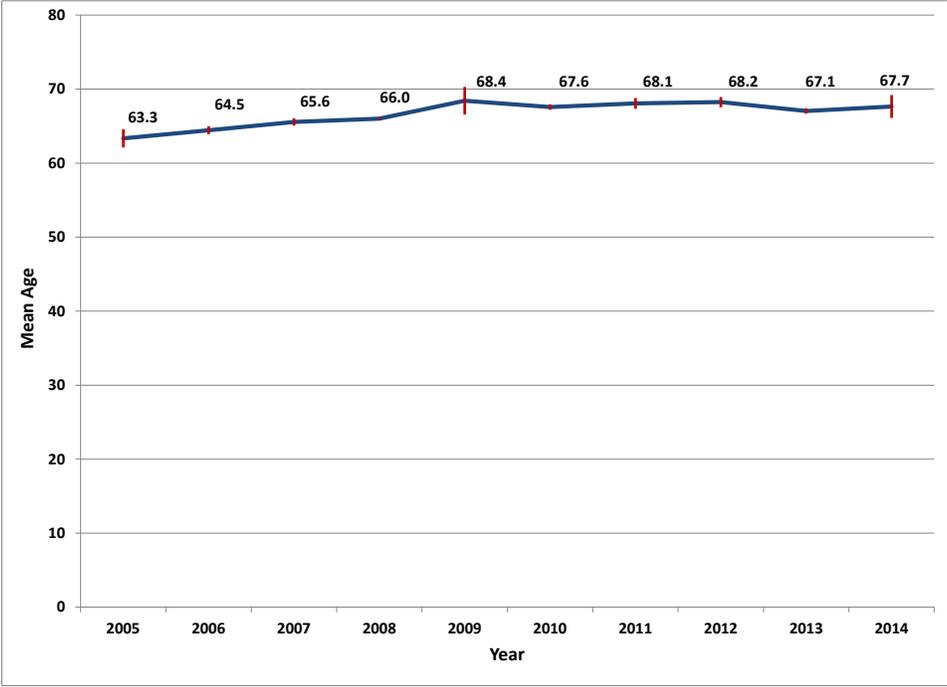
Note: vertical bars reflect the standard errors for the estimated means.

Source: AAMC Analysis of the American Community Survey (2005–2014 data).

Demand Model Overview and Updates

Demand for physicians is calculated based on the 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 patients given patient needs, care use patterns, and economic considerations such as insurance 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 actually utilized. Demand projections are thus extrapolating a "2015 level of care," with any imbalances between supply and demand (whether shortfalls or excesses) extrapolated into the future. An exception pertains to the federal government's estimates of how many more primary care physicians and psychiatrists the nation needs to eliminate federally designated primary care and mental Health Professional Shortage Areas (HPSAs): about 8,400 additional primary care physicians and 2,400 more psychiatrists. For modeling purposes, we assume that these 10,800 physicians reflect national shortfalls.[50] 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 2030. Then, demand for physicians, APRNs, and PAs is modeled to meet the projected demand for services. Exhibit 33 summarizes, by demand model component, the data sources incorporated into the 2016 and this 2017 workforce projections update.

Exhibit 33: Summary of 2015 and 2016 Demand Modeling Data Sources

Model Component	2017 Projections	2016 Projections
National and state population files	2015 ACS 2014 and 2015 BRFSS 2004 NNHS (reweighted to CMS 2014 estimates by demographic) 2013 MCBS	2014 ACS 2013 and 2014 BRFSS 2004 NNHS
Weights for population projections	2014 U.S. Census Bureau population projections; State population projections to estimate demand by region and metro/non-metropolitan area	2014 U.S. Census Bureau population projections
Health care use equations	2010-2014 Pooled MEPS	2009–2013 Pooled MEPS
Hospital inpatient-day equations	2014 NIS	2013 NIS
Health care use calibration and validation	2014 NIS 2013 NAMCS 2012 NHAMCS	2013 NIS 2012 NAMCS 2011 NHAMCS
Physician staffing ratios	2015 AMA Masterfile	2014 AMA Masterfile

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

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[50] For information on HPSA designation, see www.hrsa.gov/shortage.

X.   DETAILED TABLES

The following tables provide more detailed projections of supply, demand, and imbalances between supply and demand across years, scenarios, and specialty categories.

Exhibit 34: Summary of Projected Gap between Physician Supply and Demand

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Physicians																
75th Percentile	10,800	18,400	25,900	32,400	42,200	48,700	57,100	64,400	70,600	76,700	82,600	88,000	92,900	97,300	101,400	104,900
25th Percentile	10,800	11,900	13,900	17,500	23,300	25,600	28,500	32,400	33,900	33,300	34,600	38,500	40,300	40,900	40,900	40,800
Primary Care																
75th Percentile	8,400	10,500	12,900	15,300	17,400	19,500	21,900	24,800	27,200	29,700	32,000	34,400	36,800	39,000	41,100	43,100
25th Percentile	8,400	6,800	5,800	4,900	4,100	2,800	2,700	3,100	4,900	6,800	7,800	7,800	7,900	7,600	7,500	7,300
Non-Primary Care																
75th Percentile	2,400	7,400	13,200	19,900	24,800	29,200	34,200	39,300	43,400	47,000	50,600	53,600	56,100	58,300	60,300	61,800
25th Percentile	2,400	4,400	7,900	10,400	12,000	13,500	15,800	18,100	20,700	23,200	25,800	27,700	29,300	30,800	32,200	33,500
Medical Specialties																
75th Percentile	—	1,000	1,900	2,700	4,100	4,800	6,000	7,200	7,800	8,500	9,300	10,000	10,600	11,200	11,500	12,000
25th Percentile	—	100	100	(300)	(500)	(600)	(400)	200	1,100	1,900	2,700	3,000	2,700	2,200	1,600	1,300
Surgical Specialties																
75th Percentile	—	2,500	5,900	9,300	12,100	14,800	16,900	19,000	20,900	22,500	24,000	25,200	26,300	27,300	28,100	29,000
25th Percentile	—	1,400	3,800	5,500	7,600	9,100	10,400	11,900	13,000	14,100	15,000	15,700	16,700	17,800	18,800	19,800
Other Specialties																
75th Percentile	2,400	5,200	7,800	11,000	13,500	15,700	18,500	20,800	22,900	24,600	26,300	27,900	29,200	30,200	31,100	31,800
25th Percentile	2,400	3,500	5,500	6,700	7,600	8,500	10,000	11,000	12,400	13,700	15,000	16,100	16,800	17,500	18,100	18,600
Hospitalists (adult, primary care–trained)																
75th Percentile	—	(900)	(1,700)	(2,500)	(3,200)	(3,900)	(4,600)	(5,300)	(5,900)	(6,600)	(7,100)	(7,800)	(8,400)	(8,900)	(9,400)	(10,000)
25th Percentile	—	(1,000)	(1,800)	(2,800)	(3,800)	(4,600)	(5,400)	(6,200)	(7,000)	(7,800)	(8,400)	(9,200)	(9,800)	(10,400)	(11,000)	(11,600)

Note: The shortage range for total physicians is smaller than 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 is smaller than the sum of the ranges for the specialty categories. Numbers in parentheses reflect projected excess supply, and numbers not in parentheses reflect projected shortfalls.

Exhibit 35: Total Projected Physician Supply, 2015–2030

Year		Workforce Participation Scenarios			Policy Scenario: GME Expansion
	Status Quo	Retire 2 Years Earlier	Retire 2 Years Later	Millennial Hours	
2015	784,600	784,600	784,600	780,100	784,600
2016	790,200	783,600	794,500	785,200	790,200
2017	794,600	783,900	802,800	789,300	794,600
2018	799,400	784,900	811,300	793,600	799,400
2019	803,600	784,700	819,100	797,500	803,600
2020	807,900	785,100	826,600	801,700	807,900
2021	810,900	785,500	832,300	804,600	814,000
2022	813,800	786,600	837,800	807,600	819,900
2023	817,200	788,600	843,200	810,900	826,400
2024	821,000	790,900	848,700	814,700	833,400
2025	825,300	793,300	854,400	819,000	840,600
2026	829,500	796,800	860,000	823,200	847,700
2027	834,100	800,600	865,800	827,800	855,200
2028	838,600	804,800	871,200	832,300	862,900
2029	843,500	809,000	876,900	837,200	870,700
2030	848,700	813,300	882,800	842,500	878,900
Growth from 2015 to2030 (%)	8%	4%	13%	8%	12%

Exhibit 36: Physician Supply Projection Summary by Specialty Category, 2015–2030

Year	Workforce Participation Scenarios				Policy Scenario: GME Expansion
	Status Quo	Retire 2 Years Earlier	Retire 2 Years Later	Millennial Hours	
2015					
Total	784,600				
Primary Care	222,000				
Non-primary Care	562,600				
Medical Specialties	130,300				
Surgical Specialties	154,200				
Other Specialties	250,300				
Hospitalists*	27,800				
2030					
Total	**848,800**	**813,300**	**882,700**	**842,400**	**879,000**
Primary Care	235,400	224,900	245,300	233,300	243,300
Non-primary Care	613,400	588,400	637,400	609,100	635,700
Medical Specialties	151,900	146,000	157,200	151,100	157,700
Surgical Specialties	154,800	147,800	161,100	153,700	160,100
Other Specialties	260,900	250,000	272,300	259,100	270,400
Hospitalists*	45,800	44,600	46,800	45,200	47,500
Growth 2015 to 2030					
Total	**64,200**	**28,700**	**98,100**	**57,800**	**94,400**
Primary Care	13,400	2,900	23,300	11,300	21,300
Non-primary Care	50,800	25,800	74,800	46,500	73,100
Medical Specialties	21,600	15,700	26,900	20,800	27,400
Surgical Specialties	600	−6,400	6900	-500	5,900
Other Specialties	10,600	−300	22,000	8,800	20,100
Hospitalists*	18,000	16,800	19,000	17,400	19,700

*Adult primary care–trained hospitalists identified through analysis of Medicare billing records.

Exhibit 37: Projected Physician Demand Summary by Scenarios Modeled, 2015–2030

Scenario	2015	2030	Growth 2015 to 2030	% Growth 2015 to 2030
Scenario 1: Changing Demographics				
Total	**795,400**	**941,300**	**145,900**	**18%**
Primary Care	230,400	274,700	44,300	19%
Non-primary Care	565,000	666,600	101,600	18%
Medical Specialties	130,300	163,000	32,700	25%
Surgery	154,200	179,200	25,000	16%
Other Specialties	252,700	289,300	36,600	14%
Hospitalists*	27,800	35,100	7,300	26%
Scenario 2: Changing Demographics + ACA Medical Insurance Expansion				
Total	**795,400**	**947,300**	**151,900**	**19%**
Primary Care	230,400	276,400	46,000	20%
Non-primary Care	565,000	670,900	105,900	19%
Medical Specialties	130,300	163,900	33,600	26%
Surgery	154,200	180,900	26,700	17%
Other Specialties	252,700	290,900	38,200	15%
Hospitalists*	27,800	35,200	7,400	27%

Scenario	2015	2030	Growth 2015 to 2030	% Growth 2015 to 2030
Scenario 3: Changing Demographics + ACA + Managed Care				
Total	**795,400**	**956,300**	**160,900**	**20%**
Primary Care	230,400	291,500	61,100	27%
Non-primary Care	565,000	664,800	99,800	18%
Medical Specialties	130,300	157,200	26,900	21%
Surgery	154,200	183,800	29,600	19%
Other Specialties	252,700	288,700	36,000	14%
Hospitalists*	27,800	35,100	7,300	26%
Scenario 4: Changing Demographics + ACA + Increased Use of Retail Clinics				
Total	**795,400**	**934,500**	**139,100**	**17%**
Primary Care	230,400	263,600	33,200	14%
Non-primary Care	565,000	670,900	105,900	19%
Medical Specialties	130,300	163,900	33,600	26%
Surgery	154,200	180,900	26,700	17%
Other Specialties	252,700	290,900	38,200	15%
Hospitalists*	27,800	35,200	7,400	27%
Scenario 5: Changing Demographics + ACA + Increased Use of Advanced Practice Nurses and PAs ("moderate use" level)				
Total	**795,400**	**889,600**	**94,200**	**12%**
Primary Care	230,400	242,700	12,300	5%
Non-primary Care	565,000	646,900	81,900	14%
Medical Specialties	130,300	155,600	25,300	19%
Surgery	154,200	176,800	22,600	15%
Other Specialties	252,700	280,000	27,300	11%
Hospitalists*	27,800	34,500	6,700	24%
Scenario 6: Changing Demographics + ACA + Increased Use of Advanced Practice Nurses and PAs ("high use" level)				
Total	**795,400**	**831,900**	**36,500**	**5%**
Primary Care	230,400	209,000	-21,400	-9%
Non-primary Care	565,000	622,900	57,900	10%
Medical Specialties	130,300	147,300	17,000	13%
Surgery	154,200	172,600	18,400	12%
Other Specialties	252,700	269,200	16,500	7%
Hospitalists*	27,800	33,800	6,000	22%
Scenario 7: Changing Demographics + ACA + Increased Use of Advanced Practice Nurses (moderate practice level) + population health goals achieved				
Total	**795,400**	**905,800**	**110,400**	**14%**
Primary Care	230,400	248,200	17,800	8%
Non-primary Care	130,300	157,600	27,300	21%
Medical Specialties	154,200	180,800	26,600	17%
Surgery	252,700	284,000	31,300	12%
Other Specialties	27,800	35,200	7,400	27%
Hospitalists*	565,000	657,600	92,600	16%

*Includes only hospitalists trained in adult primary care. Hospitalists in non-primary care specialties are included with their individual specialty.
The use of Medicare payment data for identifying hospitalists precludes identifying pediatric hospitalists.

Exhibit 38: Health Care Utilization Equity Scenario 1, 2015

Specialty Category	Physicians				Additional Providers Required	
	Current Supply	Requirements under Equity Scenario	Current Gap	% Gap	Advanced Practice Nurses	Physician Assistants
Total	**784,600**	**819,400**	**34,800**	**4%**	**11,400**	**4,800**
Primary Care	222,000	232,300	10,300	5%	6,400	1,700
Non-primary Care	562,600	587,100	24,500	4%	5,000	3,100
Medical Specialties	130,300	135,700	5,400	4%	1,100	700
Surgery	154,200	160,900	6,700	4%	1,400	1,100
Other Specialties	250,300	262,100	11,800	5%	2,400	1,200
Hospitalists*	27,800	28,400	600	2%	100	100

*Includes only hospitalists trained in adult primary care. Hospitalists in non-primary care specialties are included with their individual specialty. The use of Medicare payments to identify hospitalists precludes identifying pediatric hospitalists.

Exhibit 39: Health Care Utilization Equity Scenario 2, 2015

Specialty Category	Physicians				Additional Providers Required	
	Current Supply	Requirements under Equity Scenario	Current Gap	% Gap	Advanced Practice Nurses	Physician Assistants
Total	**784,600**	**881,400**	**96,800**	**12%**	**31,300**	**13,100**
Primary Care	222,000	243,800	21,800	10%	16,100	3,600
Non-primary Care	562,600	637,600	75,000	13%	15,200	9,500
Medical Specialties	130,300	140,400	10,100	8%	2,100	1,300
Surgery	154,200	179,000	24,800	16%	5,000	4,100
Other Specialties	250,300	287,800	37,500	15%	7,600	3,800
Hospitalists*	27,800	30,400	2,600	9%	500	300

*Includes only hospitalists trained in adult primary care. Hospitalists in non-primary care specialties are included with their individual specialty. The use of Medicare payments to identify hospitalists precludes identifying pediatric hospitalists.