Maryland Health Workforce Study Phase Two Report: Assessment of Health Workforce Distribution and Adequacy of Supply

Prepared for:

CENTER FOR ANALYSIS AND INFORMATION SYSTEMS

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Executive Summary

Maryland is striving to advance the triple aim of ensuring access to high quality care, achieving superior outcomes and providing cost efficient care. It is doing so in a rapidly evolving environment being transformed by the needs of a growing and aging population, evolving care delivery models, emerging technologies and the requirements of the federal Affordable Care Act (ACA). Together, these developments are likely to have significant effects on demand for and supply of health professionals at both state and local levels.

Maryland seeks to ensure the production of a healthcare workforce that is sufficient in size and skill to meet both statewide and local health care needs. This requires robust data on the current health workforce to develop an accurate picture of the characteristics and distribution of the health workforce at the State and sub-State levels.

With funding support from the Robert Wood Johnson Foundation, IHS Global Inc. (IHS) was engaged to study the Maryland healthcare workforce at State and sub-State levels. The Maryland Health Care Commission (MHCC) served as the project manager in collaboration with the Governor's Office of Health Care Reform and the Governor's Workforce Investment Board. This study is divided into two phases—each with its own report. The Phase I report focuses on evaluating the quality and utility of Maryland's health workforce data available to inform measuring the adequacy of Maryland's current and future health workforce supply.

This Phase II study presents estimates of current supply and demand for health professions designated by the MHCC as high priority in supporting Maryland's transition to health reform, and for which data were readily available for estimating supply and demand. These professions include primary care specialties (general and family practice, general internal medicine, geriatrics, and general pediatrics), and psychiatrists.

Estimates of current supply are also presented for psychologists, social workers, counselors, physician assistants, pharmacists, registered nurses and dentists. Current estimates of demand are unavailable at this time for these and other professions. We also discuss the potential implications of study findings for key Maryland stakeholders as they pertain to future market trends.

Phase II study guiding research questions include:

- In Maryland, are there specialties where supply and demand currently are not in balance? If so, which specialties, and what is the estimated gap between supply and demand?
- Are there areas within the State where supply is inadequate to meet the estimated demand for services? If so, which professions, which locations in the State, and what is the estimated gap between supply and demand?
- What are the potential implications of health care reform initiatives, emerging care delivery models and other market factors and trends on Maryland's health workforce supply and demand?

Study methods employed to inform these research questions include:

- **Creating and assessing Maryland provider supply datasets**. Maryland's health professions licensure boards served as primary data sources for estimating full time equivalent (FTE) supply for the healthcare professions. Licensure data was obtained in collaboration with the MHCC.
- **Demand modeling**. Estimates of the current demand for healthcare providers were developed using the IHS Healthcare Demand Microsimulation Model. The major components of this model include: 1) A population database that contains characteristics and health risk factors for a representative sample of the population in each Maryland county; 2) Equations that relate a person's characteristics to his or her demand for healthcare services by care delivery setting (e.g., office, outpatient, emergency, and inpatient); and 3) Staffing patterns that convert demand for healthcare services to demand for FTE providers.

Three key findings related to the Phase II research questions are summarized below:

1. **At the State level, the supply of primary care physicians and psychiatrists appears adequate to provide a level of care that meets or exceeds the national average level of care—taking into considering the demographic, socioeconomic, and health risk characteristics of Maryland's population.**

Compared to the national average, the supply of primary care physicians and psychiatrists in Maryland appears adequate to provide a national average level of care. Study findings suggest that Maryland has 4,565 FTE primary care physicians, and based on the characteristics of the State's population would require 4,357 FTEs to provide a level of primary care services equivalent to the national average (Exhibit ES). The 5 percentage point difference between supply and demand (or 208 FTEs) is within the margin of error for modeling and suggests that at the State level supply and demand are roughly in balance.

Based upon available data, Maryland appears to use fewer general and family practitioners and more general internists relative to national care delivery patterns. The supply of general pediatricians also appears adequate at the State level.

Maryland's supply of practicing psychiatrists (985 FTEs) is approximately 164 more than is required to provide a national average level of care (821 FTEs). However, the national average level of care for mental health services might be inadequate and should not be equated to clinical guidelines or best practices. In addition, the effective supply of psychiatrists in Maryland is likely lower than this analysis suggests because many psychiatrists do not currently participate with private and public health insurance plans.

Exhibit ES: Estimated 2012 Maryland Statewide Adequacy of Supply by Health Profession

Profession	FTE Supply	FTE Demand	Supply - Demand	% Difference	FTE Supply Per 10,000 Pop.	FTE Demand Per 10,000 Pop.
Total Primary Care	4,565	4,357	208	5%	7.8	7.4
General & Family Practice	1,167	1,623	-456	-28%	2.0	2.8
General Internal Medicine	2,252	1,733	519	30%	3.8	3.0
Geriatrics	85	58	27	47%	0.1	0.1
Pediatrics	1,061	943	118	13%	1.8	1.6
Psychiatry	985	821	164	20%	1.7	1.4
Other Health Professions						
Psychology	2,278	N/A	N/A	N/A	3.9	N/A
Professional Counselors	9,131	N/A	N/A	N/A	4.0	N/A
Social Workers	14,982	N/A	N/A	N/A	6.0	N/A
Physician Assistants	2,045	N/A	N/A	N/A	3.7	N/A
Pharmacists	9,704	N/A	N/A	N/A	13.5	N/A
Nurses	61,348	N/A	N/A	N/A	85.1	N/A
Dentists	21,608	N/A	N/A	N/A	30.0	N/A

2. Across the state there is substantial geographic variation in adequacy of supply exist for some health professions

Geographic variations consists primarily of large metropolitan areas having more than adequate supply to provide a national average level of care to the population in their county, with non-metropolitan areas having insufficient supply to provide a national average level of care. Identifying and analyzing local geographic variations is complicated by factors that influence patient care seeking behavior. Commuting patterns, insurance coverage and presence of large provider networks may cause residents in one Maryland County to seek care from physicians or other providers located in another county, the District of Columbia or elsewhere.

Primary Care Specialties

The supply of primary care physicians in 11 of Maryland's 24 counties is sufficient to meet at least 90% of the demand for services. Estimates of FTE primary care physician supply range from a high of 13.1/10,000 population in Baltimore City to a low of 2.9/10,000 population in Somerset County, the southernmost county on Maryland's Eastern Shore. Counties with the largest shortfalls in percentage terms include Somerset (58% shortfall), Caroline (44% shortfall) and Dorchester (44% shortfall).

Mental Health Specialties

This study focused on psychiatrist supply—as supply and/or demand data on other mental health providers was not readily available. Substantial geographic variation in adequacy of psychiatrist supply exists. The estimated 2012 demand for FTE psychiatrists in Maryland of 1.4/10,000 population is slightly lower than the estimated supply of 1.7/10,000 population. Demand estimates for individual counties are relatively stable (ranging from 1.3 to 1.5 per 10,000 population), with slight variations taking into account population characteristics. Supply estimates per 10,000 population range from a high of 3.7 in Baltimore City to two counties (Caroline and Kent) with no psychiatrists. The supply of psychiatrists is heavily concentrated in Baltimore County (25% of State's supply, but 14% of State's demand), Baltimore City (24% of State's supply, but 11% of State's demand), and Montgomery County (22% of State's supply, but 16% of State's demand). In 8 counties supply is sufficient to provide at least 90% of the estimated demand for services, while in 16 counties supply is insufficient to provide this level of care.

3. Implications of evolving market factors on the health workforce are currently unclear

Many features of the current healthcare system are undergoing change with implications for the Maryland health workforce. Between 2014 and 2016, we estimate that the medical insurance coverage provisions of the ACA will create a one-time approximately 1.9% increase in demand for adult primary care physicians in Maryland (equivalent to approximately 83 FTE physicians). Maryland has sufficient supply at the State level to absorb this 83 FTE increase and still be able to provide a level of care equal to or greater than the current national average.

Although the projected demand implications of expanded coverage under the ACA have been modeled, insufficient data is available at this time to assess the health workforce supply and demand implications of other ACA provisions that support development of new care delivery models (e.g., accountable care organizations and patient centered medical homes) that might require even greater numbers of primary care providers. Likewise, this phase of the study did not include nurse practitioners and physician assistants in primary care—two professions that are growing in importance in the provision of primary care services.

The speed of adoption and growth among these and other emerging care delivery models also will be an important factor in assessing implications for future health profession supply and demand. These factors may also vary depending on the characteristics of Maryland's local healthcare markets. However, although many implications of evolving market factors are unknown, it is clear that the ACA's focus on seeking value in care delivery will direct renewed attention and resources to support continued growth of some health professions while reducing demand for other professions (e.g., specialists and providers that work primarily in expensive inpatient and emergency care setting).

Conclusion

This study combined data from multiple sources to estimate the current adequacy of supply for primary care and psychiatry specialties in Maryland. These findings suggest that Maryland's

supply of primary care physicians and psychiatrists is adequate to provide a national average level of care. Substantial geographic variation in adequacy of supply exists at the county level, largely involving differences between metropolitan and non-metropolitan areas.

Additional research is needed to better understand if variation in access to primary care physicians is partially offset by greater use of specialist physicians and/or use of nurse practitioners and physician assistants. At the national level, the rate of growth in demand for primary care services is projected to exceed the rate of growth of physician supply. Therefore, Maryland may face increasing competition in the future with other States for primary care physicians and may rely on greater use of nurse practitioners and physician assistants to provide primary care services.

Introduction

Maryland's health sector operates in an environment with economic and regulatory pressures to improve access to quality care while containing medical costs. In this system, the use of health care services, the available supply of services, and how care is delivered is determined by the choices made by nearly 5.9 million people in the State, the thousands of health professionals practicing in the State, numerous health care facilities and payers, and federal and State policies. Furthermore, the environment is being transformed by a growing and aging population, evolving care delivery models, emerging technologies and the requirements of the federal Affordable Care Act (ACA).

These developments may have a dramatic impact on demand for and supply of health professionals at State and local level over time. An accurate picture of the current characteristics and distribution of the health workforce at the State and at the sub-State level is essential to identifying possible disparities in access to care, to informing health care policy making and the workforce transition to health reform initiatives, and to evaluating whether policies designed to improve access to care are working.

As the State's population grows and ages, the demand for medical services is expected to rise. Between 2000 and 2010, Maryland's population gained 477,066 people, an increase of 9%. [1] The United States Census Bureau's census projections suggest that the population in Maryland will likely reach close to 6.3 million by 2020 and 6.7 million by 2030.[2]

The Urban Institute estimated that approximately 300,000 people in Maryland will gain medical coverage because of the ACA (with the expansion expected between 2014 and 2016).[3] Expanded health insurance coverage under the ACA is projected to increase demand for a wide range of medical services. For example, Hofer et al (2011) project that demand for primary care physicians in the U.S. will rise by 4,307 to 6,940 as a result of the ACA.[4] Petterson et al (2013) estimate a national increase of 3% (about 8,000 additional primary care physicians) will be needed to accommodate insurance expansion under the ACA.[5]

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[1] http://www.census.gov/prod/2002pubs/c2kprof00-ar.pdf
http://quickfacts.census.gov/qfd/States/05000.html

[2] U.S. Census Bureau. *Interim State Population Projections 2000-2030 based on Census 2000*. 2005; http://www.census.gov/population/www/projections/projectionsagesex.html

[3] http://www.urban.org/uploadedpdf/1001520-Uninsured-After-Health-Insurance-Reform.pdf

[4] Hofer AN, Abraham JM. and Moscovice I. Expansion of Coverage under the Patient Protection and Affordable Care Act and Primary Care Utilization. *Milbank Quarterly*, 2011; 89: 69–89.

[5] Petterson SM, Liaw WR, Phillips RL, Rabin DL, Meyers DS, and Bazemore AW. Projecting US Primary Care Physician Workforce Needs: 2010-2025. *Annals of Family Medicine*, 2013; 10(6):503-509. http://www.annfammed.org/content/10/6/503.full.pdf+html

Estimates of the ACA impact by Dall et al. (2011) suggest the nation will experience approximately a 2.7% increase in demand for primary care services—equivalent to 5,600 physicians—and that the impact for Maryland will be approximately a 1.9% increase in demand for adult primary care physicians (equivalent to the work of approximately 83 full time equivalent [FTE] physicians).[6] Impacts of health reform initiatives and other emerging trends will vary by county based on their respective population size, demographics, socioeconomic characteristics, disease prevalence and health risk factors.

In consideration of these trends and their possible implications, with funding support from the Robert Wood Johnson Foundation, IHS Global Inc. (IHS) was engaged to study Maryland's healthcare workforce and health workforce data collection system. This study is divided into two Phases—each with its own report.

The Phase I report focuses on addressing three health workforce data related research questions intended to inform measuring the adequacy of Maryland's current health workforce supply: (1) what types of data are needed to monitor and assess the current and future adequacy of health workforce supply in Maryland? (2) What data are currently available in Maryland and elsewhere (e.g., federal, State and other sources) and what are their respective strengths and limitations in terms of quality and utility? (3) How might any current gaps between data requirements and availability be closed or narrowed?

This Phase II report presents State and county level estimates of current supply and demand for health professions designated by the MHCC as high priority in supporting Maryland's transition to health reform, and professions for which supply and demand data were readily available. These professions include primary care specialties (general and family practice, general internal medicine, geriatrics, and general pediatrics) and psychiatrists. Workforce estimates are provided for select other specialties for which supply or demand data were readily available. This report presents findings and discusses the potential implications of study findings for Maryland stakeholders.

Phase II report research questions addressed by this study include:

- In Maryland, are there specialties where supply and demand currently are not in balance? If so, which specialties, and what is the estimated gap between supply and demand?
- Are there areas within the State where supply is inadequate to meet the estimated demand for services? If so, which professions, which locations in the State, and what is the estimated gap between supply and demand?

[6] 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

- What are the potential implications of health care reform initiatives, emerging care delivery models and other market factors and trends on Maryland's health workforce supply and demand?

The overarching goal of Phases I and II is to conceptualize a data collection and forecasting system designed to provide an updated picture of the current and projected future adequacy of the State-wide and sub-state supply of health professionals in Maryland. The remainder of this report summarizes Phase II study methods and limitations, addresses each of the primary research questions and provides a summative conclusion.

Phase II Study Data and Methods

This section describes the data and methods used to develop county level estimates of full time equivalent supply and demand for various health occupations and medical specialties, which are then summed to produce State totals. The decision to estimate supply and demand at the county level reflects, in large part, that key determinants of demand such as population characteristics that are available at the county level are not readily available for smaller sub-State geographic areas. Below we describe our study methods and data sources in greater detail.

Creation and Assessment of Maryland Provider Supply Datasets

Maryland's health professions licensure boards served as primary data sources for estimating FTE supply for the healthcare professions. Data for assessing the adequacy of health workforce supply was obtained in collaboration with the MHCC. Following guidelines and stipulations set out in the data use agreement and data management plan, IHS conducted the following internal data compilation and analysis activities.

The initial Maryland physician population data was obtained from a file prepared by MHCC based on data collected by the Maryland Board of Physicians as part of the biannual physician renewal application. The file developed by MHCC contains information on all physicians licensed and active in providing patient care in Maryland. Information on this list (including self-reported medical specialty) was compared to the American Medical Association's specialty codes to help group physicians by specialty category.

For analysis purposes, the list of physicians was limited to those currently practicing in Maryland. This dataset yielded a total of 14,854 active practicing physicians. To calculate the number of FTE physicians working in Maryland, we used the self-reported hours worked recorded in the population file as follows:

First, we calculated the average number of hours worked per week for full-time physicians by specialty (where full time was defined as working 30 or more hours per week). For physicians who reported working more than 100 hours per week, hours were capped at 100. Next, the total

hours for all physicians, both full-time and part-time, were calculated for each specialty. The sum of the total hours worked was then divided by the average hours worked among full time physicians to create the total number of FTE physicians working for each specialty.

The calculated FTE average hours per week worked by physician specialty included: General and Family Practice (47.8), General Internal Medicine (51.0), Geriatrics (49.2), Pediatrics (45.8), and Psychiatry (46.5).

The licensure data does not include hours worked for other professions analyzed (e.g., psychologists, professional counselors, social workers, physician assistants). For these professions we calculated FTEs based on employment status. Using the self-reported employment status, we counted a full-time worker as 1.0 FTE and a part-time worker as 0.5 FTE.

Demand Modeling and the Creation of County Population Files

Demand Model Overview

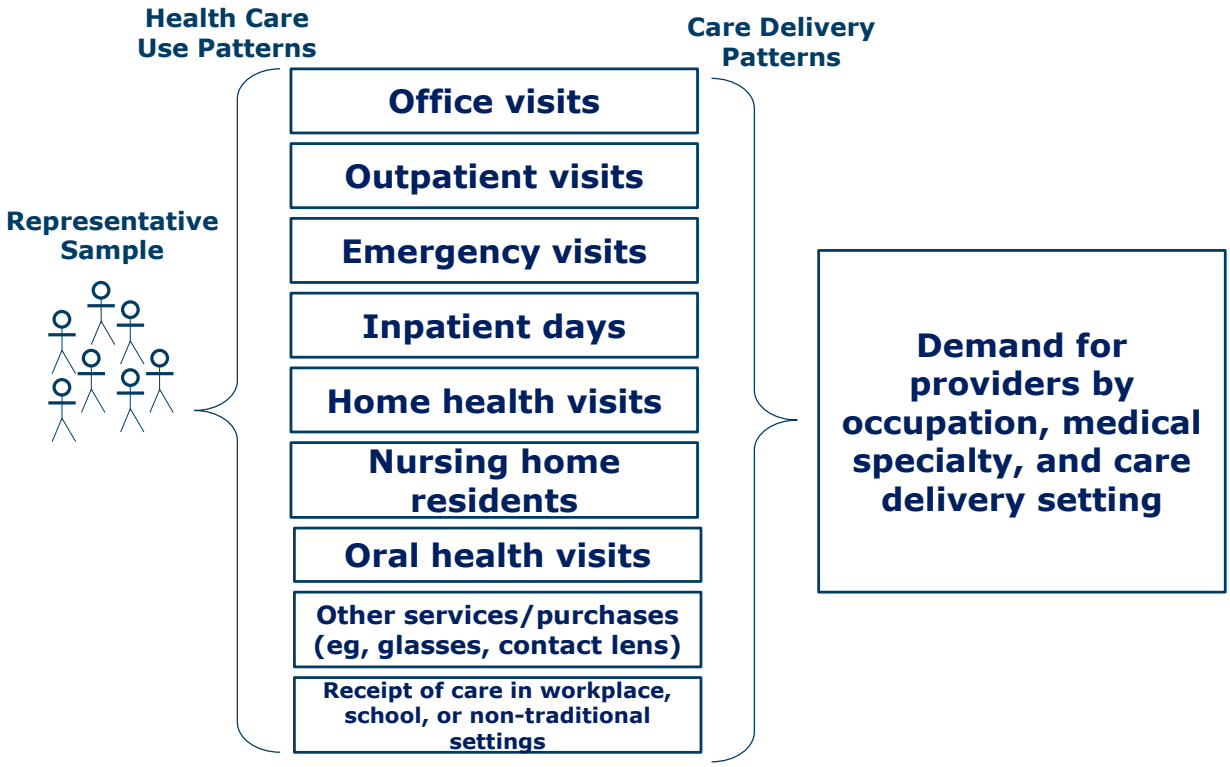
Estimates of the current demand for healthcare providers were projected using the IHS Health Care Demand Microsimulation Model. This model is described in the published literature, with an overview of the model provided in Exhibit 1.[7] The major components of the demand model include: 1) a population database that contains characteristics and health risk factors for a representative sample of the population in each Maryland county, 2) equations based on national data that relate a person's characteristics to his or her demand for healthcare services by care delivery setting (office, outpatient, emergency, inpatient, nursing facility, and home health), and 3) national care delivery patterns that convert demand for healthcare services to demand for FTE providers.

[7] 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.

Dall TM, Chakrabarti R, Storm MV, Elwell EC, and Rayburn WF. Estimated Demand for Women's Health Services by 2020. *Journal of Women's Health*, 2013; 22(7): 643-8.

Dall TM, Storm MV, and Chakrabarti R. Supply and demand analysis of the current and future US neurology workforce. *Neurology*, 2013; 81(5): 470-478.

Exhibit 1: Health Care Demand Microsimulation Model Overview



The forecasting equations and staffing patterns are based on national data, while the population database was constructed to be representative of the population in each of Maryland's counties. Applying the model to Maryland, therefore, produces estimates of demand for FTE providers if people in Maryland received a level of care consistent with the national average—but adjusting for differences between Maryland counties and the nation in health and economic factors that affect demand for health care services.

Creating the Maryland Population Database

The demand model contains health, demographic, and socioeconomic characteristics for each person in a stratified random sample of the population in each county. The database was populated with information for Maryland gathered from the United States Census Bureau's 2011 American Community Survey (ACS), and the 2010 and 2011 Centers for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS) files. Information from the 2004 National Nursing Home Survey (NNHS) is used in the model, as well as the United States Census Bureau's 2012 Annual County Estimates Population file.

Information for each individual in this population database used to model demand for health care services (via regression analysis summarized later) includes:

- Demographics
  - Age group (0-2, 3-5, 6-13, 14-17 years for children; 18-34, 35-44, 45-64, 65-74, 75+ years for adults)
  - Sex
  - Race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic other, Hispanic)
- Health-related lifestyle indicators
  - Body weight status (unknown, normal, overweight, obese)
  - Current smoker status
- Socioeconomic conditions
  - Household annual income (<$10,000, $10,000 to <$15,000, $15,000 to < $20,000, $20,000 to < $25,000, $25,000 to < $35,000, $35,000 to < $50, 000, $50,000 to < $75,000, $75,000+)
  - Medical insurance type (private, public, self-pay)
- Chronic conditions
  - Diagnosed with arthritis, asthma, cardiovascular disease, diabetes, or hypertension
  - History of heart attack, or history of stroke
- Geographic location
  - Living in a metropolitan area

Creating a representative population sample for each Maryland County in 2012 involved the following steps:

1. We first employed a statistical matching process that combined (1) socioeconomic data from approximately 3 million individuals in the 2011 ACS, (2) health risk factors and chronic conditions from the approximately 1,029,063 people in the combined 2010 and 2011 files of the BRFSS which covers the non-institutionalized population, and (3) health data from 15,948 nursing home residents in the 2004 NNHS.[8] Use of data on nursing home residents is important because this institutionalized population has poorer health and different health care use patterns compared to their peers living in the community.

   Using information on residence type, we divided the ACS population into those in nursing facilities to be matched to people in the NNHS, and those not in nursing facilities to be matched to people in the BRFSS. For the non-institutionalized population, each ACS individual in Maryland was randomly matched with someone in the BRFSS from Maryland with the same sex, age (15 groups), race/ethnicity, insured/uninsured status, and household income level (8 levels). Individuals categorized as residing in a nursing home were randomly

[8] An updated NNHS with 2012 data is scheduled for release in late 2013.

matched to a person in the NNHS in the same age group, sex and race-ethnicity strata. The final matched ACS-BRFSS-NNHS database includes a sample weight for each person. This weight reflects the number of people he or she represents among the general population. Applying the sample weights to this population can produce estimates for the population in Maryland in 2011.

Using Census Bureau 2012 data, we identified the current size of the population in each county by age, sex, and race/ethnicity. The county population database based on Census Bureau information was merged with the ACS-BRFSS-NNHS matched population file for Maryland, creating a health and socioeconomic profile for each individual at the county level. Finally, for each metropolitan/non-metropolitan county the sample weights for the individuals in the merged file were re-weighted so that the weighted statistics matched the county's demographic composition.

2. We then calibrated the population file so that county estimates of health risk factors replicated published aggregate statistics. We did this by using State-level forecasting equations of the probability that a person has a particular characteristic (e.g., diagnosed with diabetes) as a function of their other characteristics (e.g., age, race/ethnicity, body weight status, smoker). We adjusted the number of people with a characteristic based on their survey response and the predicted probability distribution.

Developing Health Care Use Forecasting Equations

National patterns of health seeking behavior were generated by regression analysis using data from approximately 169,000 participants in the pooled 2007-2011 files of the Medical Expenditure Panel Survey (MEPS). There are several hundred prediction equations in the simulation model. We estimated each equation using either Poisson regression (to model annual number of office, outpatient, or home health visits with a particular provider type); or using logistic regression (to model annual probability of hospitalization or emergency visit for one of approximately 30 diagnosis categories, e.g., hospitalization for a cardiovascular condition). The dependent variable reflected annual use of health care services, while the explanatory variables consisted of the demographic characteristics, health risk factors, medical conditions, and socioeconomic factors described previously.

We pooled multiple years of data to provide a sufficient sample size for regression analysis. Applying the health forecasting equations estimated through regression analysis to the population data described above provided projections of health care use by care delivery setting and type of care provided.

Staffing to Meet Demand for Health Care Services

The number and mix of health professionals required to provide the level of health care services demanded is influenced by how the care system is organized and care is reimbursed, provider

scope of practice requirements, economic constraints, technology, and other factors. To convert projected demand for services into demand for providers we determined how each unit of service demanded (e.g., psychiatrist office visits, hospital inpatient days, pharmacist prescriptions) translates into demand for a partial FTE provider (i.e., the fraction of an FTE provider's time to provide care during that one patient encounter).

Demand for psychiatrists, for example, was linked to projected number of office and outpatient visits to a psychiatrist, and emergency department visits and hospitalizations requiring psychiatry related services and procedures (e.g., ICD-9 CM codes 290-319). The demand estimates provided in this report are based on the current care delivery model and do not reflect emerging care delivery models.

Strengths and Limitations of Microsimulation Modeling

Strengths of Microsimulation Modeling

This Healthcare Demand Microsimulation Model reflects state-of-the-art methods for health workforce modeling and the latest available data on patterns of health care use and health care delivery. The microsimulation approach has several advantages over traditional population-based models:

- The microsimulation approach takes into consideration more information about the population in each State and county. For example, rates of disease prevalence, health related risk factors and household income can vary significantly by geographic area even after controlling for demographics. This additional population data can provide more precise estimates of service demand at State and county levels compared to models that assume all people within a demographic group use the same level of services.
- The microsimulation model simulates care use patterns by delivery setting. Model findings highlight, for example, that certain populations have disproportionately high use of certain care delivery settings (e.g., emergency care) and lower use of other settings (e.g., physician office-based care). Such information provides insights for changing the way that care is delivered and potential implications in the health care system.
- The microsimulation model uses individuals as the unit of analysis. For example, the model can simulate demand for health care services and providers to care for populations in low income categories, populations in select underserved areas, or populations with certain chronic conditions. Using individuals as the unit of analysis creates flexibility for incorporating evidence-based research on the implications of changes in technology and care delivery models that disproportionately affect subsets of the population with certain chronic conditions or health-related behaviors and risk factors.

Current Limitations of Microsimulation Modeling

Similar to health workforce models developed by government, non-profit, and private organizations, microsimulation models may share potential limitations.

- These models are complex and reflect substantial efforts to build and maintain.
- Data for microsimulation models is often culled from a variety of sources, and sophisticated statistical techniques are often required to standardize the data or to predict behavioral responses.
- In some cases, research literature or data to estimate model parameters may be insufficient, nonexistent, unreliable or invalid for modeling purposes. For example, there is a paucity of published literature on the potential workforce supply and demand implications of emerging care models, with the evaluation results of large demonstrations of new care delivery models just starting to emerge in the literature.
- Current data sources provide challenges in accounting for patient and provider geographic migration patterns.

Study Findings

Statewide supply of primary care physicians and psychiatrists appears adequate to meet demand for services

An accurate picture of the current size and distribution of Maryland's health workforce at the State and sub-State levels is essential to identify possible disparities in access to care and to inform workforce transition to health reform initiatives and other emerging developments. In this section we summarize State level estimates of health workforce supply and demand for select professions for which supply and demand data could be collected, as well as high priority professions for ACA implementation:

- Primary care specialties (general and family practice, general internal medicine, geriatrics, and general pediatrics).
- Mental health specialties (psychiatrists).

We also report current State-wide FTE supply estimates for a number of non-physician health professions of interest due to their growing importance in supporting State health care reform policy initiatives, such as development of medical homes and other emerging care models. These include psychologists, physician assistants, social workers, professional counselors, pharmacists, dentists and registered nurses (RNs). Key determinants needed to estimate FTE demand for these professions were not readily available to support current modeling efforts, so only supply estimates are reported at this time.

The supply of primary care physicians and psychiatrists in Maryland appears adequate to provide a national average level of care. Study findings suggest that Maryland has 4,565 FTE primary care physicians, and based on the characteristics of the State's population would require 4,357 FTEs to provide a level of primary care services equivalent to the national average (Exhibit 2). The 208 FTE (5%) difference between supply and demand is within thresholds for modeling and suggest that supply and demand for primary care physicians in Maryland are roughly in balance. Lower than average use of general & family practice physicians (-28%) was offset by greater than average use of general internal medicine practitioners (+30%). The supply of general pediatricians also appears adequate at the State level.

The national demand for primary care physicians in 2012 was about 222,600 (which takes into consideration that approximately 7,500 FTE primary care providers would be needed in federally designated Health Professional Shortage Areas to eliminate the shortage designations).[9] That is, the national demand is based on current supply plus the number of physicians needed to de-designate federal shortage area designations. Dividing this national demand number by the U.S. population translates to a national demand estimate of 7.1 primary care physicians per 10,000 population.[10]

Maryland primary care demand estimates are influenced not only by population size, but the demographic makeup of the population, the prevalence of risk factors such as obesity and smoking, the prevalence of chronic diseases such as diabetes and cardiovascular disease, household income levels, and the levels of health care insurance coverage. Taking these factors into consideration, we estimate that demand for primary care physicians in Maryland is about 7.4 FTEs per 10,000 population (with slight variation across counties due to the variation in population characteristics and risk factors). The higher than national average demand ratio for Maryland reflects, in large part, that Maryland has slightly higher rates of health insurance coverage and higher household income levels relative to the national average. The age distribution and disease prevalence rates in Maryland are similar to national statistics, although Maryland has slightly higher prevalence of obesity and smoking. FTE supply is estimated at 7.8 per 10,000 population in Maryland.

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[9] Petterson SM, Liaw WR, Phillips RL, Rabin DL, Meyers DS, and Bazemore AW. Projecting US Primary Care Physician Workforce Needs: 2010-2025. Annals of Family Medicine, 2013; 10(6):503-509. http://www.annfammed.org/content/10/6/503.full.pdf+html.

Health Resources and Services Administration. Projecting the Supply and Demand for Primary Care Practitioners Through 2020. November 2013. http://bhpr.hrsa.gov/healthworkforce/supplydemand/usworkforce/primarycare/index.html.

[10] This estimate is substantially lower than estimates based off of the American Medical Association's Physician Masterfile, but reflects analyses that suggest the number of active, primary care physicians is overstated in the AMA Masterfile. Analyses of the AMA Masterfile suggest that a substantial number of older physicians listed in the AMA Masterfile are retired, and work by the federal government to prepare the National Ambulatory Medical Care Survey (NAMCS) finds that a substantial number of physicians listed as primary care physicians in the AMA Masterfile turn out to be specialists when contacted to participate in the NAMCS. The estimate of demand reflects the number of primary care physicians required to de-designate federal Primary Care Health Professional Shortage Areas.

Maryland's estimated State-wide adequacy of psychiatrists suggests about 164 FTEs (20%) above the number required to provide the national average level of services to the population in Maryland (Exhibit 2). While Maryland appears to have more psychiatrists than is required to provide a national average level of care, the national average level of care for mental health services might be inadequate and should not be equated to clinical guidelines or best practices. The effective supply of psychiatrists in Maryland may also be lower than suggested by this because many may not currently participate with private and public health insurance plans.

Exhibit 2: Estimated 2012 Maryland State-wide Adequacy of Supply by Health Profession

Profession	FTE Supply	FTE Demand	Supply - Demand	% Difference	FTE Supply Per 10,000 Pop.	FTE Demand Per 10,000 Pop.
Total Primary Care	4,565	4,357	208	5%	7.8	7.4
General & Family Practice	1,167	1,623	-456	-28%	2.0	2.8
General Internal Medicine	2,252	1,733	519	30%	3.8	3.0
Geriatrics	85	58	27	47%	0.1	0.1
Pediatrics	1,061	943	118	13%	1.8	1.6
Psychiatry	985	821	164	20%	1.7	1.4
Other Health Professions						
Psychology	2,278	N/A	N/A	N/A	3.9	N/A
Professional Counselors	9,131	N/A	N/A	N/A	4.0	N/A
Social Workers	14,982	N/A	N/A	N/A	6.0	N/A
Physician Assistants	2,045	N/A	N/A	N/A	3.7	N/A
Pharmacists	9,704	N/A	N/A	N/A	13.5	N/A
Nurses	61,348	N/A	N/A	N/A	85.1	N/A
Dentists	21,608	N/A	N/A	N/A	30.0	N/A

Widespread county level variation in adequacy of supply appears to exist for the professions analyzed

Patients' health care seeking patterns complicate identifying and analyzing local geographic imbalances between supply and demand. Commuting patterns, insurance coverage and presence of provider networks may cause residents in one county to seek care from physicians or other providers located in another county, the District of Columbia or elsewhere. Care seeking behavior and migration patterns also are influenced by a concentration of physicians in several large counties (e.g.; Baltimore City and County, Montgomery County) due to the presence of

large provider networks such as Johns Hopkins, University of Maryland and MedStar. Future work to assess trends in patient migration patterns, appointment wait times for emergent/urgent and routine care, and other access indicators such as provider willingness to accept new Medicaid patients will help inform the issue of local adequacy of supply.

Primary Care Physicians

Studies suggest that the supply of primary care physicians is positively associated with population health.[11] While an analysis of population health metrics was outside the scope of this study, across Maryland there is variation in physician supply. Supply for FTE primary care physicians range from a high of 13.1/10,000 population in Baltimore City to a low of 2.9/10,000 population in Somerset County. Somerset County is the southernmost county on Maryland's Eastern Shore. With a population of only about 26,000, like many other small rural counties throughout the U.S., Somerset likely faces challenges recruiting and retaining physicians.

At the county level, estimates of demand for FTE primary care physicians range from a high of 8.1/10,000 population in Talbot County to a low of 7.2/10,000 population in Montgomery County. Factors contributing to differences in estimated county-level demand include differences between counties in population demographics, socio-economic factors, and health status and health care utilization patterns.

Exhibit 3 and Map 1 (see appendix) show that total FTE primary care physician supply in 13 of Maryland's 24 counties appears inadequate to meet service demand by county residents (where inadequate for purposes of this report is defined as supply meeting less than 90% of projected demand). Counties with the largest shortfalls in percentage terms include Somerset (58% shortfall), Caroline (44% shortfall) and Dorchester (44% shortfall).

In 11 counties the supply of primary care physicians appears to be adequate to meet the demand for services by that county's residents—although these physicians might be providing some level of services to residents of surrounding counties. It is unclear to what extent populations in counties with estimated primary care provider shortfalls migrate for care to neighboring counties or are forced to travel longer distances—which creates access barriers to care (especially for vulnerable populations such as the poor, elderly, and patients with chronic conditions).

Psychiatrists

The estimated 2012 State-wide demand for FTE psychiatrists in Maryland is 1.4/10,000 population compared to an estimated supply of 1.7/10,000 population. As noted above, although there appears to be sufficient supply of psychiatrists to provide a level of care equivalent to that

[11] See, for example: Starfield B, Shi L, and Macinko, J. Contribution of Primary Care to Health Systems and Health. *Milbank Quarterly*, 2005; 83(3):457-502. Barbara Starfield, Primary care: an increasingly important contributor to effectiveness, equity, and efficiency of health services. SESPAS report 2012, Gaceta Sanitaria, Volume 26, Supplement 1, March 2012, Pages 20-26.

provided at the national level, a national level of care might be considered substandard. In addition, the effective supply of psychiatrists may also be lower than the total supply reported because many may elect not to currently participate with private and public health insurance plans.

Substantial geographic variation in adequacy of supply is present at the county level, as depicted in Exhibit 5 and Map 2, with provider supply capable of meeting at least 90% of estimated demand in only 8 of Maryland's 24 counties.

Counties with large populations and provider networks appear to have sufficient supply relative to demand for their resident populations and also appear to have sufficient capacity to provide access to psychiatrist care for many residents of neighboring counties. These include Baltimore County, Baltimore City and Montgomery County. These findings suggest that to some extent larger Maryland counties with an abundance of psychiatrists have the capacity to provide access to care for residents of neighboring counties and elsewhere that may lack adequate supply.

Potential implications of market factors on Maryland health workforce supply and demand are unclear

Many features of the current healthcare system are undergoing change with implications for the Maryland health workforce. Using the demand simulation model and as published in a recent Health Affairs article, we calculated that the increased insurance coverage under ACA will contribute to slight increases in demand for certain types of health care services in Maryland. [12] For adult primary care services we estimated a 1.9% increase in services, compared to a 3.5% increase in services at the national level (Exhibit 7). Other physician specialties projected to see a substantial increase in services in Maryland include radiology (2.6%), dermatology (2.5%), neurology (1.9%), and urology (1.8%).

Although the projected demand implications of expanded coverage under ACA have been modeled, insufficient data is currently available to assess the health workforce supply and demand implications of other ACA provisions that support development of new care delivery models (e.g., accountable care organizations [ACOs] and patient centered medical homes) and expand primary care capacity (e.g., federally qualified health centers).

Despite these issues it is clear that the ACA's focus on seeking value in care delivery will direct renewed attention and resources to support continued growth of some health professions. For example, the patient centered medical home model created under the ACA is a primary care practice that coordinates care across settings and providers. Under this model ACA authorizes the Department of Health and Human Services to provide grants to, or contract directly with,

[12] 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.

states or state-designated entities to establish community-based interdisciplinary, inter-professional teams ("health teams") to support primary care practices.

In addition to physicians these health teams may include other health professions—such as nurse practitioners, physician assistants, pharmacists, nutritionists and dieticians, social workers, behavioral and mental health providers and chiropractors.[13] The speed of adoption and growth in market share among this and other emerging care delivery models will be an important factor in assessing implications for future health profession supply and demand. These factors may also vary depending on the characteristics of Maryland's local healthcare markets. New models of care delivery that rely on greater use of non-physicians may require changes to provider scope of practice and reimbursement policies.

Other examples of evolving care delivery patterns likely to influence future supply and demand for Maryland health professions include:

- **Continued care migration from inpatient and ED to community settings:** Shifts in care settings and modalities spurred by development and expansion of ACOs, the patient-centered medical home, free-standing federally qualified health centers and other non-acute care settings will likely continue to shift demand for services and health professions from hospitals and emergency departments to more appropriate community-based care settings.
- **More effective management of chronic disease**: Chronic disease management is transitioning to a model that emphasizes team-based care management and patient education conducted in community and home settings. Screening for early diagnosis, medication management, and teaching self-management of daily activities are examples of chronic disease management activities likely to increase future health workforce demand for case managers, social workers and other health professions trained in carrying out these activities. An emphasis on team based care will also support expanding the scope of practice for selected health professions such as nurse practitioners and physician assistants.

Unanticipated shocks to the healthcare system may also have significant implications for future adequacy of Maryland's health workforce supply and workforce projections. Examples include national and State economic developments and changing public and private health care payment and coverage policies.

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[13] Altschuler J, Margolius D, Bodenheimer T, and Grumbach K. Estimating a Reasonable Patient Panel Size for Primary Care Physicians With Team-Based Task Delegation. Annals of Family Medicine, 2012; 10(5):396-400.

Kellermann AL, Saultz JW, Mehrotra A, Jones SS, and Dalal S. Primary Care Technicians: A Solution To The Primary Care Workforce Gap. *Health Affairs*, 2013; 32(11): 1893-1898.

Auerbach DI, Chen PG, Friedberg MW, Reid R, Lau C, Buerhaus PI, and Mehrotra A. Nurse-Managed Health Centers And Patient-Centered Medical Homes Could Mitigate Expected Primary Care Physician Shortage. *Health Affairs*, 2013; 32(11): 1933-1941.

- **Economic developments**: National and State unemployment may influence the health professions and trigger the need to update both supply and demand projections. The recent economic downturn appears to have influenced supply and demand by slowing retirements as well as consumer demand for many services. Recent research also identified that health spending strongly responds to changes in the economy and that the recession of 2007-2009 was the main factor causing a 50% slowdown in the growth rate of healthcare spending between 2008 and 2012 (compared to 2001 and 2003).[14] Periods of economic growth may increase service demand and employment as consumers have greater disposable income.
- **Changing healthcare coverage and payment policies**: National patterns of home health service use (and the workforce that provides home health services) have varied substantially over the years in response to changes in Medicare coverage and payment policies. Under the ACA some preventive services are to be provided at no cost (or at low cost) to patients. Changes in the types of services covered, out-of-pocket costs, and provider reimbursement rates can influence the quantity of certain health services that are used.

Conclusion

This study combined data from multiple sources to estimate the current adequacy of supply for primary care physicians and psychiatrists. It also presented estimates of current supply for other non-physician professions in Maryland important to facilitating health sector transition to health reform. The study used a microsimulation model to estimate demand for select medical specialties in Maryland, taking into account the health risk factors and other characteristics of the population in each county.

Study findings suggest that Maryland has a sufficient supply of primary care physicians and psychiatrists to provide a level of care that slightly exceeds the national average. However, substantial geographic variation in adequacy of provider supply exists throughout the State. A substantial number of non-metropolitan counties currently lack the primary care and psychiatrist provider capacity to meet estimated population service demand. More populated counties (e.g., Baltimore City and County) are likely providing a substantial amount of care to residents in neighboring counties and elsewhere where estimated provider supply is inadequate to meet demand. This is especially true when large provider networks serve a population beyond their immediate county borders.

Between 2014 and 2016, the medical insurance coverage provisions of the ACA are projected to create a one-time approximately 1.9% increase in demand for adult primary care physicians in Maryland. This increased demand will be additive to current primary care capacity and points to

[14] Healthcare News. Recession Slowed Down Healthcare Spending Significantly (Accessed 8/19/2013) http://www.medicalnewstoday.com/articles/259602.php.

the need for innovative approaches and models to delivery care. Maryland's new Community-Integrated Medical Home initiative and its focus on team-based care coordination is an example of a new delivery model with the potential to offset some of the projected increases in FTE primary care physician demand.

Projected future adequacy of primary care provider supply in Maryland needs to be understood in the context of national trends. At the national level, the rate of growth in demand for primary care services is projected to exceed the rate of growth of physician supply.[15] Therefore, Maryland may find increasing competition with other states to attract and retain primary care providers.

Maryland currently has the data infrastructure to allow the MHCC and other stakeholders to identify differences between supply and demand for primary care and mental health medical specialties at State and county levels. This ability is essential for future targeting of resources to help address disparities in adequacy of supply.

Supply, demand, and gaps in adequacy of supply will continue to evolve over time at both the State and county levels. Changing demographics and disease burden, changing economic circumstances, and emerging care delivery models will influence supply and demand. These trends highlight the importance of developing a health workforce monitoring system within Maryland to identify and track health workforce trends that can affect access, quality, and cost of medical care.

Limitations of this study include the following:

- Data is needed to better understand geographic migration patterns of physician practice and patient care seeking behavior—both within Maryland and across states and the District of Columbia.
- Data is not readily available to estimate demand and adequacy of supply at the State, county and sub-county levels for many health professions.
- On the demand side, there is a current paucity of information on how care delivery patterns might change over time in response to ACA and other market factors.
- There is also little available information on the influence of provider and payer networks on demand and consumer care migration patterns.
- Understanding the adequacy of primary care physicians should be done within the context of adequacy of supply of nurse practitioners and physician assistants also providing primary care services. Likewise, understanding the adequacy of supply of psychiatrists should be done within the context of supply adequacy for other mental health providers.

[15] Health Resources and Services Administration. Projecting the Supply and Demand for Primary Care Practitioners Through 2020. November 2013. http://bhpr.hrsa.gov/healthworkforce/supplydemand/usworkforce/primarycare/index.html.

Still, these findings suggest that for many health professions Maryland has an adequate supply to meet or exceed the national average level of care. There remains, though, substantial geographic variation in supply that could limit access to care.

Appendix

County Level Tables of Current Maryland FTE Adequacy of Supply for Selected Health Professions

Exhibit 3: Adequacy of Supply for Primary Care Physicians by County, 2012

County	Total FTEs			FTEs/10,000 Population	
	FTE Demand	FTE Supply	Supply - Demand	FTE Demand	FTE Supply
Allegany	57	63	6	7.6	8.5
Anne Arundel	407	379	(28)	7.4	6.9
Baltimore City	464	817	353	7.5	13.1
Baltimore County	621	788	167	7.6	9.6
Calvert	66	56	(10)	7.5	6.2
Caroline	25	14	(11)	7.5	4.2
Carroll	125	103	(22)	7.5	6.2
Cecil	75	60	(15)	7.5	5.9
Charles	111	91	(20)	7.4	6.1
Dorchester	25	14	(11)	7.9	4.1
Frederick	176	140	(36)	7.4	5.8
Garrett	23	20	(3)	7.7	6.6
Harford	186	142	(44)	7.5	5.7
Howard	218	197	(21)	7.3	6.6
Kent	16	16	0	8.0	7.9
Montgomery	729	833	104	7.2	8.3
Prince George's	637	471	(166)	7.2	5.3
Queen Anne's	37	25	(12)	7.6	5.1
St. Mary's	80	53	(27)	7.3	4.9
Somerset	19	8	(11)	7.3	2.9
Talbot	31	42	11	8.1	11.0
Washington	112	111	(1)	7.5	7.4
Wicomico	75	81	6	7.5	8.0
Worcester	42	41	(1)	8.0	7.9
Total	**4,357**	**4,565**	**208**	**7.4**	**7.8**

Note: Primary care specialties include general and family practice, general internal medicine, geriatrics, and general pediatrics.

Exhibit 4: Adequacy of Supply for Pediatricians by County, 2012

County	Total FTEs			FTEs/10,000 Children	
	FTE Demand	FTE Supply	Supply - Demand	FTE Demand	FTE Supply
Allegany	10	11	1	7.0	7.9
Anne Arundel	87	85	(2)	7.1	6.9
Baltimore County	125	185	60	7.1	10.4
Baltimore City	99	168	69	7.3	12.3
Calvert	15	13	(2)	7.0	6.1
Caroline	6	1	(5)	7.0	0.9
Carroll	26	21	(5)	6.9	5.4
Cecil	16	9	(7)	7.0	3.9
Charles	26	26	0	7.1	7.0
Dorchester	5	1	(4)	7.1	1.9
Frederick	40	34	(6)	7.0	5.9
Garrett	4	-	(4)	6.9	-
Harford	40	40	0	7.0	7.0
Howard	51	52	1	7.1	7.2
Kent	2	1	(1)	7.0	2.6
Montgomery	163	234	71	7.1	10.1
Prince George's	148	104	(44)	7.2	5.1
Queen Anne's	7	6	(1)	6.9	5.7
St. Mary's	19	12	(7)	7.0	4.3
Somerset	3	2	(1)	7.1	3.6
Talbot	5	9	4	7.0	13.4
Washington	23	21	(2)	7.0	6.5
Wicomico	16	26	10	7.1	11.1
Worcester	7	-	(7)	7.0	-
Total	**943**	**1,061**	**118**	**7.1**	**8.0**

Exhibit 5: Adequacy of Supply for Psychiatrists by County, 2012

County	Total FTEs			FTEs/10,000 Population	
	FTE Demand	FTE Supply	Supply - Demand	FTE Demand	FTE Supply
Allegany	10	10	0	1.3	1.4
Anne Arundel	74	41	(33)	1.3	0.7
Baltimore City	94	233	139	1.5	3.7
Baltimore County	113	242	129	1.4	3.0
Calvert	12	6	(6)	1.3	0.7
Caroline	4	-	(4)	1.3	-
Carroll	22	26	4	1.3	1.6
Cecil	13	6	(7)	1.3	0.6
Charles	22	6	(16)	1.5	0.4
Dorchester	5	8	3	1.4	2.5
Frederick	32	18	(14)	1.3	0.8
Garrett	4	2	(2)	1.3	0.5
Harford	33	15	(18)	1.3	0.6
Howard	40	64	24	1.3	2.1
Kent	3	-	(3)	1.4	-
Montgomery	134	214	80	1.3	2.1
Prince George's	135	47	(88)	1.5	0.5
Queen Anne's	6	3	(3)	1.3	0.6
St. Mary's	14	5	(9)	1.3	0.4
Somerset	4	1	(3)	1.5	0.3
Talbot	5	8	3	1.3	2.2
Washington	20	18	(2)	1.3	1.2
Wicomico	14	8	(6)	1.4	0.8
Worcester	7	2	(5)	1.3	0.5
Total	**820**	**983**	**163**	**1.4**	**1.7**

Exhibit 6: Supply of Selected Health Professions by County, 2012

County	Professional Counselors		Social Workers		Psychologists		Physician Assistants	
	FTEs	FTE/ 10,000	FTEs	FTE/ 10,000	FTEs	FTE/ 10,000	FTEs	FTE/ 10,000
Allegany	267	36.1	222	29.9	27	3.6	27	3.6
Anne Arundel	684	12.4	833	15.1	144	2.6	162	2.9
Baltimore City	2,132	34.3	4,030	64.9	405	6.5	570	9.2
Baltimore County	1,294	15.8	2,124	26.0	357	4.4	330	4.0
Calvert	118	13.2	128	14.2	8	0.8	20	2.2
Caroline	17	5.2	61	18.6	-	-	1	0.3
Carroll	277	16.5	315	18.8	48	2.9	52	3.1
Cecil	97	9.5	175	17.2	25	2.4	23	2.3
Charles	193	12.8	126	8.4	14	0.9	49	3.2
Dorchester	79	24.3	150	45.9	5	1.4	3	0.8
Frederick	320	13.3	530	22.1	56	2.3	62	2.6
Garrett	53	17.6	73	24.3	1	0.2	5	1.5
Harford	351	14.1	355	14.3	46	1.9	63	2.5
Howard	407	13.6	667	22.3	181	6.0	40	1.3
Kent	41	20.1	52	25.5	8	3.7	3	1.5
Montgomery	1,200	11.9	2,927	29.1	754	7.5	300	3.0
Prince George's	833	9.4	913	10.4	129	1.5	154	1.7
Queen Anne's	29	5.9	70	14.4	9	1.7	3	0.5
St. Mary's	105	40.0	115	43.8	18	1.6	22	8.4
Somerset	45	4.1	79	7.2	-	-	4	0.3
Talbot	62	16.3	167	43.8	7	1.8	11	2.8
Washington	273	18.3	435	29.1	18	1.2	65	4.4
Wicomico	193	19.1	334	33.2	20	1.9	72	7.1
Worcester	67	12.9	106	20.6	5	0.9	11	2.1
Total	**9,131**	**15.5**	**14,982**	**25.5**	**2,278**	**3.9**	**2,045**	**3.5**

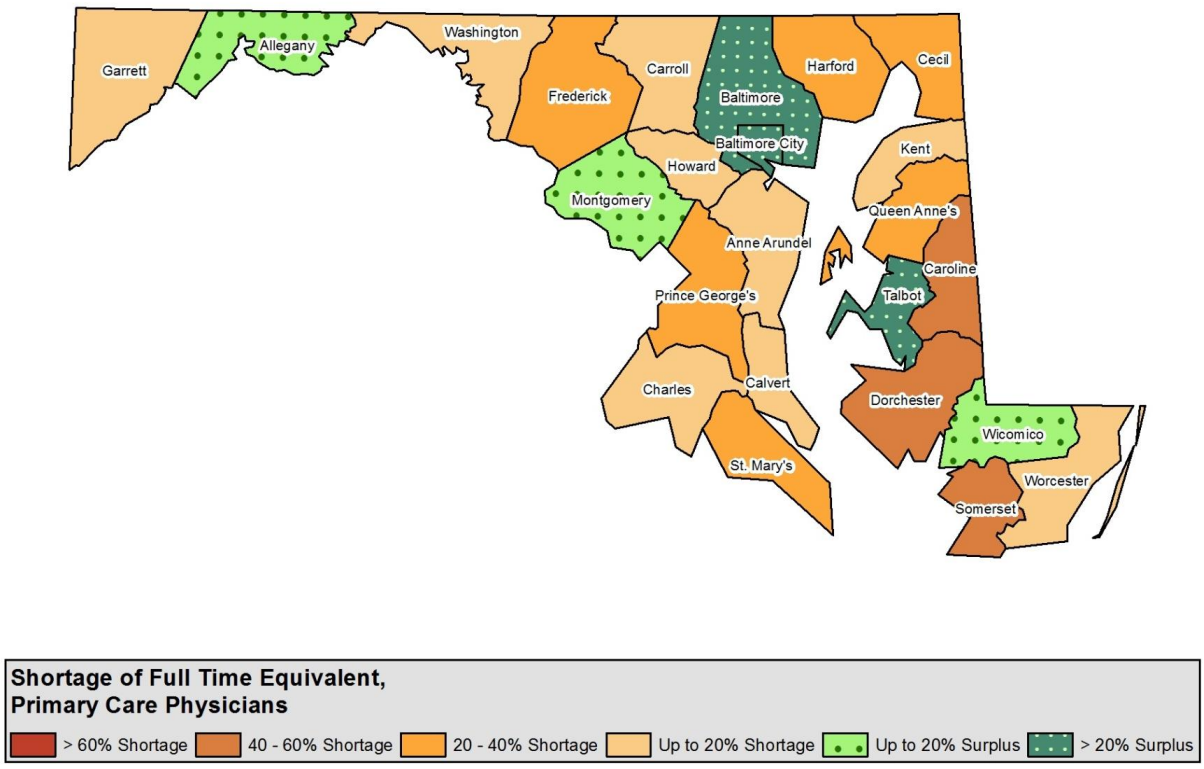
Note: These are professions for which only FTE supply analysis was possible at this time.

Exhibit 7: Estimated Percent Increase in Demand for Physician Services from Expanded Insurance Coverage under the Affordable Care Act

State	Maryland	U.S.
Adult Primary Care	1.9	3.5
Allergy & Infectious Diseases	0.6	1.2
Cardiology	1.4	2.3
Dermatology	2.5	4.7
Endocrinology	0.2	0.3
General Surgery	1.3	2.3
Nephrology	0.3	0.5
Neurological Surgery	1.7	3.0
Neurology	1.9	3.3
Pulmonology	0.5	0.9
Radiology	2.6	4.6
Urology	1.8	3.3
Vascular Surgery	0.7	1.1

Maps

Map 1: Maryland County-Level Adequacy of FTE Primary Care Physician Supply



Map 2: Maryland county-Level Adequacy of FTE Psychiatrist Supply