# Maryland Nurse Workforce Projections: 2021-2035

**Prepared by GlobalData for the Maryland Hospital Association**

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# Executive Summary

This report of Maryland's nurse workforce was commissioned by the Maryland Hospital Association to support workforce planning efforts and help ensure an adequate supply of nurses in the future. Recent evidence finds high vacancy rates for nurses across Maryland hospitals and high rates of nurse burnout, casting doubt on the ability of projected nursing supply to meet projected demand for nursing services in the state, currently and in the future.

Both quantitative and qualitative methods were used to assess the state's registered nurse (RN) and licensed practical nurse (LPN) workforces. Projections of nurse supply and demand from 2021 through 2035 were generated by simulation models also used by the federal government and other states, employing Maryland-specific data and assumptions where available. The impact of COVID was taken into account where possible. For example, Maryland population projections were adjusted for COVID-related impacts on mortality and natality through 2021. However, as the pandemic is ongoing, and because definitive data are available only with a lag, not all of its impact can be captured in these projections. Focus groups were conducted with Maryland nurses to better understand *from them* the impact that COVID – as well as other recent developments in healthcare – are having on providers.

Nurse supply and demand are expressed as nationally-standardized full-time equivalents (FTEs), with an FTE defined by the national average weekly hours worked (by nurses working at least 8 hours per week). This equates to 40.9 hours/week for RNs and 37.7 hours/week for LPNs.

Study findings support Maryland Hospital Association's goals of improving recruitment, training, retention, and the efficient use of Maryland nurses. Key findings from the study include:

- A current and growing shortfall of nurses is predicted for Maryland. In 2021 (the beginning of the projection period, representing the date of the most recent reliable data with which to set a baseline), a shortage of approximately 5,000 RN FTEs was estimated. That is, the supply of RNs was sufficient to meet about 91% of demand for RN services at a national average level of care. (Nurse workforce adequacy varies considerably both geographically and by care setting. If more intense nurse staffing is desired than is observed nationally on average, then the shortages projected for Maryland will understate the number of nurses needed to achieve the desired standard of care.) The RN shortage is projected to grow to 13,800 FTEs by 2035, leaving supply sufficient to meet about 80% of demand. A shortage of approximately 4,000 LPNs was estimated in 2021 (meeting only about 69% of demand at the national average level of care), growing to 9,200 FTEs in 2035 and meeting less than half (44%) of projected demand.
- As is observed nationally and within other states, supply adequacy of nurses varies geographically in Maryland. Supply adequacy of RNs across Maryland regions is estimated to have varied from 72% to 109% in 2021. LPN supply adequacy was estimated to be less than 100% in all regions in 2021. In 2035, all regions are projected to have a shortage of RNs and LPNs, although RN supply is projected to be approximately adequate to meet demand in the Central region (which includes Baltimore City and County). These projections are based on data that only imperfectly captures where nurses licensed in Maryland are working, so are not generally expected to be as accurate as projections at the state level.
- Nurse focus groups provided important perspectives on the dynamics of the nurse pipeline and marketplace for hospital-based nursing services. While nurse shortages are not new, the shortages pre-dating COVID were intensified by the pandemic, and are in a negative feedback loop of increasing nurse workload, which nurses report increases their moral injury and accelerates burnout, thus leading to more nurses leaving bedside jobs and worse shortages, which in turn increases nurse workload. Participants in each group perceived that the shortage of experienced

nurses – who orient, train, and mentor new nurses – mean fewer resources to help the new nurses with little to no bedside experience get acclimated, leading to more failed orientations and further shrinking supply. The shortages of other workers whose jobs impact bedside care increasingly are falling to RNs, furthering increasing nurse workload, burnout, and turnover. The predicted increasing shortage of LPNs is expected to place additional demands on RNs. Trends in nursing education are creating a nurse pipeline that is, in some ways, working at cross purposes to improving the supply of bedside nurses.

# Introduction

As the largest healthcare provider occupation, nurses are the backbone of the hospital workforce, acting as the primary interface with patients, heavily impacting patients' experience and outcomes, and playing a critical role in quality assurance and helping achieve health equity.[1,2] Nurses work in nearly all healthcare settings—hospitals, provider offices and other ambulatory settings, nursing homes, residential care facilities, school health clinics, public health departments, and other settings. In March 2022, more than 86,500 registered nurses (RNs)[a] and 11,100 licensed practice nurses (LPNs) had active licenses in Maryland. Many of these licensed nurses appear not to be practicing in a nursing role in Maryland, with the Bureau of Labor Statistics survey of employers reporting approximately 51,550 RN and 8,730 LPN filled jobs in May 2021.[3]

Nurse shortages existed nationwide before the COVID pandemic,[4] and as has been widely reported the pandemic exacerbated the shortage.[5] Data collected by the Maryland Hospital Association (MHA) in February 2022 found vacancy rates for nursing and medical positions in Maryland hospitals increased nearly 34% over the course of 2021. Licensed practical nurses and registered nurses had the highest vacancy rates of all occupational groups at the end of 2021 with rates of 37.7% and 25.4%, respectively. Echoing surveys nationwide, a December 2021 study by Maryland Board of Nursing, found that 62% of licensed Maryland nurses were considering leaving the profession.[6] As anecdotes from around the country and focus groups with Maryland nurses reveal, COVID has increased rates of nurse burnout and retirements and increased incidence of incivility and violence against health care workers. The pandemic has decreased the amount of hands-on training that could be done, and thus the general level of new nurse preparedness, while simultaneously decreasing the amount of time senior staff had to mentor and train new nurses. In short, COVID exacerbated the forces producing the pre-pandemic nursing shortage.

Even if the need for acute and long-term COVID care continues to moderate, the demand for nurses is expected to increase in Maryland as the population grows and ages. Maryland's population is projected to grow by 9% between 2021 and 2035 (the time period covered by this study). The population age 65-74 years and the population age 75 years or older are projected to grow, respectively, by 20% and 69%. Because disease prevalence and use of health care services increases with age, demand for nurses is projected to grow at a faster rate than overall population growth.

To better understand the magnitude of the current nurse shortfall and the trajectory of future supply and demand, MHA commissioned GlobalData to conduct a study of Maryland's nurse workforce. Study results are intended to inform efforts to address the nursing shortage to help ensure Marylanders' access to high quality care. Projections of nurse supply and demand from 2021 through 2035 were generated using the same simulation model framework employed by the federal government and other states to model health workforce supply and demand,[7–11] using Maryland-specific data and assumptions where possible. Because data to model the effects of COVID and other recent developments affecting the nurse workforce are still being generated and data collected through state and national sources provide only a partial picture of key issues affecting the nurse workforce, we convened focus groups with nurses working in hospitals and other parts of the health system. The focus groups supplement insights from data analysis and modeling efforts.

In the next section, we present and discuss estimated and projected adequacy of nurse supply in Maryland from 2021 through 2035. We discuss the modeling approach and findings with respect to nurse demand (Section 0) and supply (Section 0), supply adequacy findings by region and caveats for their

[a] The RN license numbers include advanced practice registered nurses (APRNs) who are excluded from our analysis as their role is different than that of traditional RN roles and is primarily focused on diagnosis and treatment.

interpretation (Section 0), and findings from the focus groups (Section 0). In Section 0 we provide a discussion, including study strengths and limitations. An appendix provides additional tables and maps.

# Projected Adequacy of Maryland Nurse Supply

- **An estimated 5,000 more RNs would have been needed in 2021 to meet demand at national levels of care; this shortage is projected to increase to about 13,800 RNs by 2035.**
- **Likewise, an estimated 4,000 additional LPNs would have been required in 2021 to clear the estimated shortage, with the number rising to 9,200 by 2035.**
- **In percentage terms, in 2021 RN supply was adequate to satisfy 91% of demand, while LPN supply was adequate satisfy only about 69% of demand. By 2035, these values are projected to drop to 80% and 44% for RNs and LPNs, respectively.**

Supply adequacy is forecasted by comparing the estimated and projected full time equivalent (FTE) supply of nurses to demand. Demand is based on applying national patterns of care use and delivery to the resident population of Maryland and adjusting for the flow of hospital-based care across state boundaries as some Marylanders receive care in hospitals outside the state while some hospital-based care within Maryland is provided to non-Marylanders. Supply in excess of demand indicates that supply of nurses is more than adequate to provide a national average level of nursing care, while demand in excess of supply indicates insufficient supply to provide a national average level of care. Supply adequacy, therefore, can be quantified as the amount by which supply is projected to exceed demand in FTE and/or percentage terms.

Supply adequacy of Maryland RNs and LPNs is assessed from a base year of 2021 (the latest year for which reliable data for supply and demand modeling are available) through 2035. As discussed in more detail in Section 0, first, demand for healthcare services is projected by extrapolating national care use and delivery patterns to the Maryland population, based on demographics, prevalence of disease and health risk factors, and insurance coverage rates among the resident population. Demand for nurses then is derived from demand for healthcare services and the nurse staffing patterns that provider organizations employ. As discussed in more detail in Section 0, supply is projected starting with the number of nurses practicing in the base year then adding expected new entrants and subtracting attrition in each subsequent year of the projection period to estimate supply in future years.

All supply and demand projections are reported as FTEs unless otherwise indicated, with an FTE defined as the national average hours worked per week among nurses working at least 8 hours per week. This equates to 40.9 hours/week for RNs and 37.7 hours/week for LPNs. Nurses in Maryland work slightly more hours per week than their national peers (41.9 hours/week for RNs and 38.4 hours/week for LPNs), so the average Maryland nurse by head count is slightly more than one FTE. Working longer hours than their national peers is possibly one indication of a nursing shortfall in the state.

As discussed further in Sections 0 and 0, the core demand and supply projections are for a *Status Quo* scenario. For demand this means that healthcare use and delivery patterns remain constant over the projection period at pre-pandemic levels with trends driven by changing demographics and associated prevalence of disease and health risk factors. For supply modeling, the *Status Quo* scenario models the implications if the number of annual new entrants to the nursing workforce stays constant at baseline levels, and if labor force participation, retirement, and cross-state migration patterns (based on workforce participants' demographics) all stay constant while being applied to the changing workforce demographics expected over the projection period. A comparison of *Status Quo* supply and demand indicates future supply adequacy absent any changes in healthcare delivery or efforts to increase nurse supply.

Undoubtedly, changes from the status quo will occur over the projection period, but when and how cannot be known during modeling. As such, alternative or "what-if" scenarios are also modeled to assess how projections would be affected by certain possible changes to the status quo. For example, an alternate demand scenario models if all people were to access care at the rates of otherwise identical insured, non-Hispanic Whites in metropolitan areas. This *Reduced Barriers* scenario explores how the demand for nurses would change with substantial progress toward national goals for equity in healthcare access. Alternative supply scenarios include: *10% More Graduates*, which increases the annual supply of new entrants by 10%, thus exploring the potential impact of policies designed to enhance the nurse pipeline; *10% Fewer Graduates*, which decreases the annual supply of new entrants by 10%, thus exploring the potential impact of a continued decline in interest in nursing begun during COVID; *Early Retirement*, which changes retirement patterns such that nurses retire 2 years earlier than otherwise, thus exploring reported early retirements from burnout and other impacts of COVID; and *Delayed Retirement*, which changes retirement patterns such that nurses retire 2 years later than otherwise, thus exploring the potential impact of policies designed to increase retention among senior nursing staff.

At baseline (2021), supply of both RNs (Exhibit 1) and LPNs (Exhibit 2) in Maryland are insufficient to satisfy estimated demand based on national patterns of healthcare utilization and provider staffing (see the Appendix for tables of *Status Quo* scenario values by year as well as alternative scenario values at the beginning and end of the projection period). An estimated 5,000[b] more RNs would have been needed in 2021 to meet demand at national levels of care; this shortage is projected to increase to about 13,800 RNs by 2035. Likewise, an estimated 4,000 additional LPNs would have been required in 2021 to clear the estimated shortage, with the number rising to 9,200 by 2035. In percentage terms, in 2021 RN supply was adequate to satisfy 91% of demand, while LPN supply was adequate satisfy only about 69% of demand. By 2035, these values are projected to drop to 80% and 44% for RNs and LPNs, respectively.

A projected shortage exists across all scenarios modeled. Even if the pipeline could be strengthened to produce 10% more annual new entrants (*10% More Graduates* scenario), RN and LPN supply adequacy would still be an estimated 85% and 45%, respectively, in 2035. And if retention efforts postponed retirements by 2 years (*Delayed Retirement* scenario), supply adequacy is expected to be 82% and 45% for RNs and LPNs, respectively, by 2035. These effects are unequal on the RN and LPN workforces in percentage terms because of the relatively smaller pipeline and higher percentage starting shortage of

[b] All projections were estimated to whole numbers, then reported to the nearest 100 to avoid implying more precision than can be claimed.

LPNs. The expected additional RNs needed to avoid a shortage by 2035 under a *Reduced Barriers* scenario is 18,400, with an additional 10,100 LPNs required. Data on the long-term nursing supply implications of COVID may not be available for several years, but based on reports of high burnout among the nursing workforce there is greater downside potential for the supply projections (e.g., nurses retiring earlier) than there is upside potential (e.g., nurses delaying retirement). Hence, projections of shortages could be even larger than presented here absent efforts to attract and retain more nurses.

**Exhibit 1. RN Supply and Demand Projections through 2035**

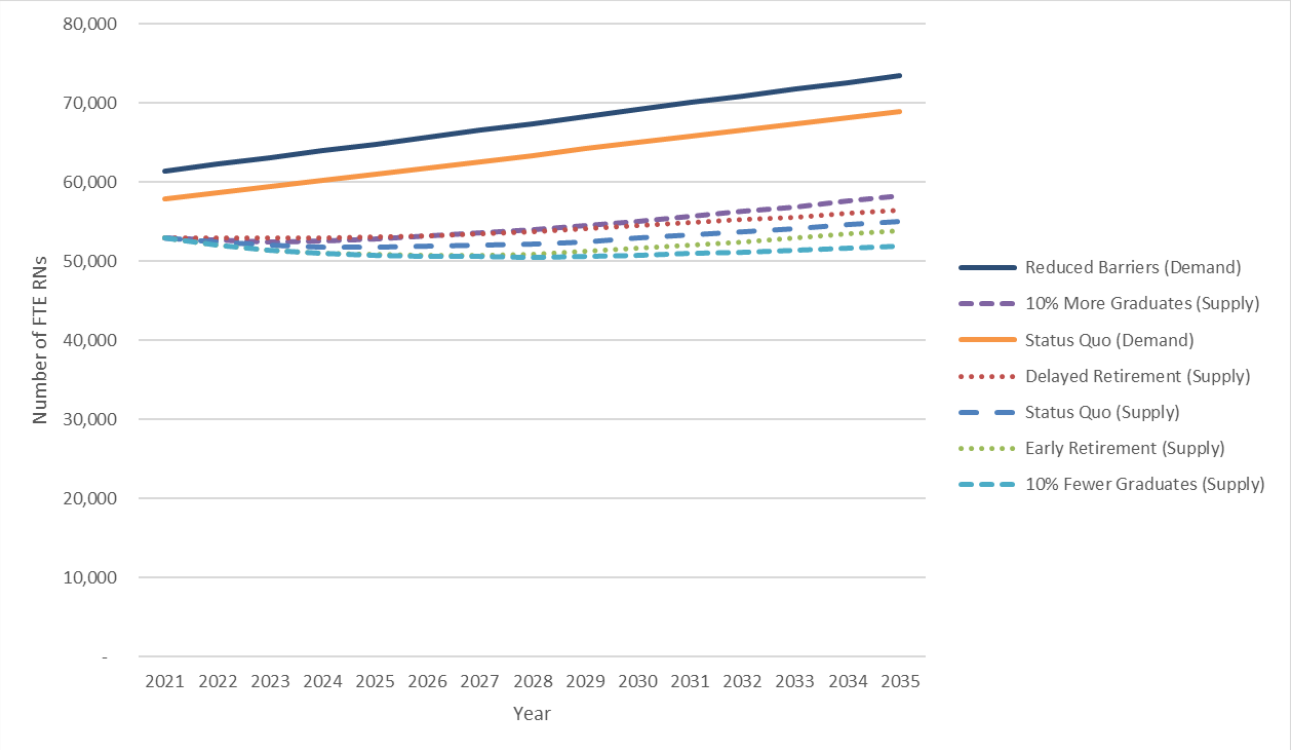
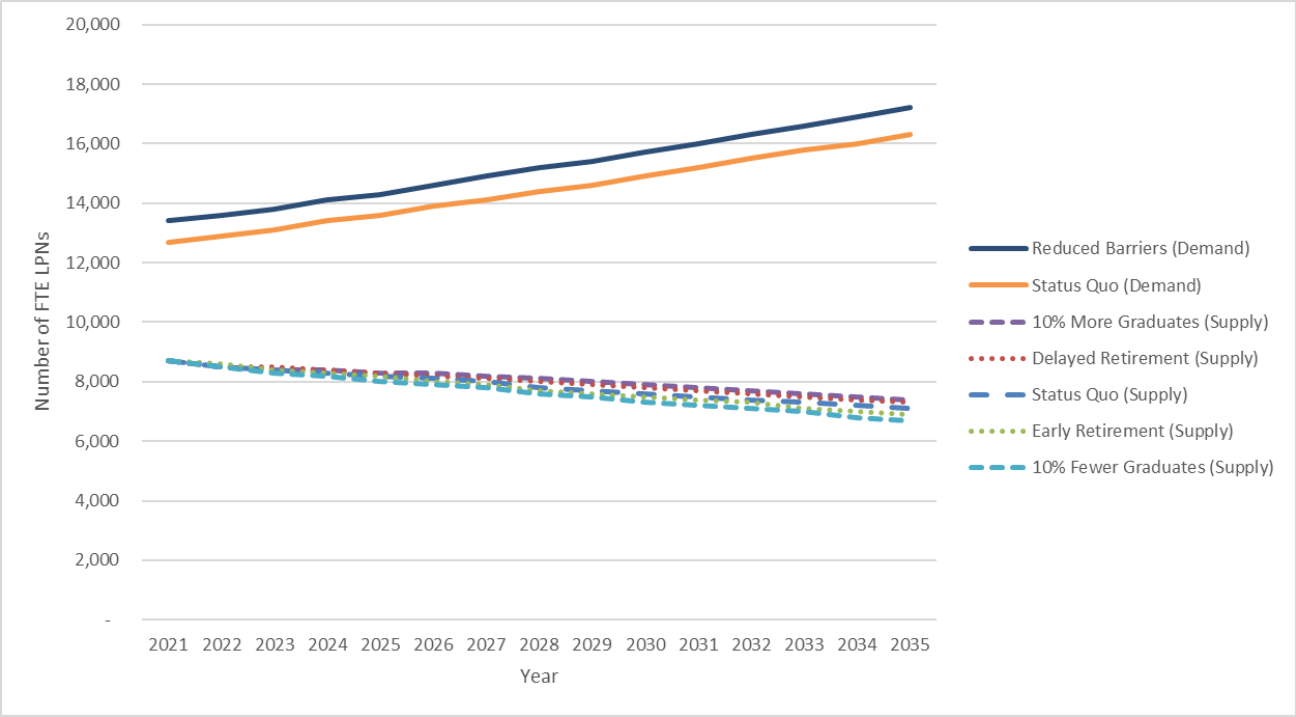


**Exhibit 2. LPN Supply and Demand Projections through 2035**




Several subtleties regarding nurse workforce adequacy are obscured in simple summary numbers and should be considered when interpreting these results.

- **Margin of error.** Given the nature of modeling and forecasting, all projections have some degree of imprecision. As a general rule, if supply is within ±5% of demand then one might conclude that the labor market is essentially in equilibrium. Imprecision arises because generalizations must be made; data regarding healthcare use, health risk factors, healthcare provider hours worked per week, healthcare provider productivity, and other important modeling parameters are not available at local levels and must be estimated with national values.

- **Geographic imbalances in statewide supply and demand.** Nationwide and statewide projections of nurse shortages overshadow the substantial geographic variation in supply adequacy. For this analysis, supply and demand were modeled at the county level, and aggregated to the region and state level. But even county- and region-level projections mask the adequacy experienced within counties/regions as healthcare markets can exist at a sub-county level and/or span (parts of) multiple counties/regions and even cross state lines. Furthermore, demand is assigned to where people reside although they may seek care where they work or in neighboring areas, and limited information regarding where nurses work geographically is available in the licensure data. Thus, supply adequacy projections tend to be more precise the larger the geographic area they cover.

- **Substitution between RNs, LPNs, and other health workers.** In areas facing a shortage of RNs, providers may be able to employ LPNs to help address staffing needs by shifting some duties. When a shortfall of LPNs and other health workers (e.g., phlebotomists) exists, RNs might be tasked with filling additional duties that otherwise would have been provided by these health workers in short supply. While adequacy of RN supply and LPN supply are projected separately, the combined information conveyed in projections for both professions provides a more complete picture of the state's nursing workforce.

- **Productivity differences between newly trained and experienced nurses.** Employing average productivity patterns to all nurses conceals productivity differences between experienced nurses and newer entrants. Thus, overall supply adequacy summaries can mask shortfalls in key areas that require specific experience—such as nursing in intensive care units, or mentoring roles.

- **The level of care for workforce adequacy.** For this study, surpluses are forecast when expected supply exceeds expected demand and shortages are forecast when expected demand exceeds expected supply. In the model, supply and demand are assumed to be in equilibrium nationally at baseline, which establishes a standard for adequacy, with shortages or surpluses determined *relative to the baseline (2021) national level of care*. To the extent that the baseline national average level of care is interpreted as using too few nurses, the magnitude of the projected shortages in Maryland are greater than reported.

# Projected Future Nurse Demand

## 1.1 Modeling Approach

Nurses work in many settings—including hospitals, ambulatory settings, long-term care settings, schools, public health departments, and other patient care settings, as well as non-patient care settings such as within insurance companies and academia. Demand modeling begins with estimating nursing services consumed in each setting at baseline and projects demand forward by accounting for the factors that drive employment growth in each setting over time. Baseline demand within Maryland was estimated by applying national patterns of healthcare use based on demographics, socioeconomics, health characteristics and insurance status to a modeled population representative of these characteristics for each county in Maryland. Adjustments were then made to account for Maryland-specific use of hospital-based services and that some hospital-based care in Maryland is provided to non-Marylanders, and some hospital-based care for Marylanders is provided in hospitals outside the state. Demand projections of healthcare utilization into the future are based on forecasted changes to Maryland's population size and demographics and projected growth in prevalence of chronic disease as the population ages. Demand for nurses is then derived from the expected demand for the services they provide based on national staffing patterns in healthcare delivery (e.g., nurse-to-patient ratios).

Expanding on this overview, the basic elements of the demand modeling are described below and illustrated in Exhibit 3.

1. **Population Database.** The population database contains information about the characteristics of each member of a synthetic population that is representative of the resident population of each Maryland county with regards to demographics (age, sex, race/ethnicity), health conditions and risk factors (arthritis, asthma, cardiovascular disease, diabetes, hypertension, history of heart attack, history of cancer, history of stroke, body weight status, and smoking status), household income, and health insurance status (whether insured, on public insurance, and in a managed care plan). County-level construction of the population file allows projections of demand for healthcare services and healthcare providers to be made at the county-level and aggregated to a region or state level. Key data sources used to construct this file are the Maryland residents' responses to the 2020 American Community Survey, Maryland-county-specific data from 2021 CDC Places (based on 2018-2019 Behavioral Risk Factor Surveillance System data), and 2018 files from the Centers for Medicare and Medicaid Services on residents of nursing homes and residential care facilities in Maryland.

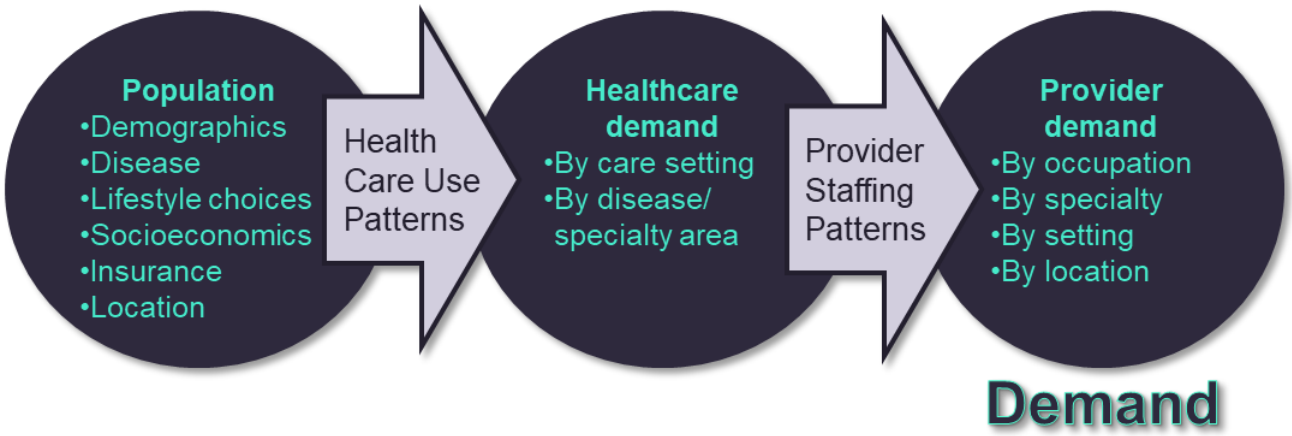
The population database at baseline was created starting with county-level population estimates for 2020 published by the U.S. Census Bureau. Since the Census was taken during 2020, it is assumed to capture some, but not all, of that year's impact of COVID. So, the population baseline was adjusted to reflect the estimated impacts of COVID on mortality and natality. Because of limitations in the Center for Disease Control's data used to adjust for COVID-related excess deaths – namely that the exact values of small numbers of deaths within specific county-by-age-by-sex-by-race/ethnicity categories had to be suppressed – the correction period was expanded to include 2020 and 2021 to capture an adequate amount of unsuppressed data. Thus, the baseline that fully reflects these corrections is 2021.

2. **Healthcare use prediction equations.** These equations are estimated from national data sources and link each individual's characteristics included in the population database to the individual's expected use of healthcare services. Key sources are the combined 2015-2019 files of the Medical Expenditure Panel Survey, and the 2019 National Inpatient Sample. Applying these equations to the constructed population database produces projections of healthcare service demand (e.g., the number of office visits, number of expected hospitalizations and inpatient bed days) for Maryland's resident population, based on national patterns of healthcare use. To aid in calibrating the model to Maryland, national utilization patterns were applied to Maryland's resident population in 2020 and resulting predicted demand for hospital-based services was compared to actual usage reported in the 2019 & 2020 American Hospital Association Annual Survey.[12] The demand for alternately inpatient and emergency department services were overpredicted by 7% and 6%, respectively. The difference between overserved and predicted usage may reflect Maryland's unique hospital funding structure and/or Maryland residents seeking care in other nearby states or the District of Columbia. Demand was adjusted to set estimated and observed use of hospital-based care equal at baseline, with the correction carrying forward through the projection period.

3. **Care delivery patterns.** National average levels of staffing were applied to projections of Marylanders' healthcare use, with staffing quantified in terms of the number of nurses required to provide a set amount of services in a given care delivery setting. For example, demand for RNs in the emergency department is calculated as the number of emergency visits estimated in Maryland divided by the base year national ratio of emergency visits per RN. Staffing ratios are calculated separately for RNs and LPNs and are applied analogously to estimate demand for nurses in the inpatient, outpatient, office, and home health settings. For residential care and nursing home settings, the factors expected to drive demand for nurses are the size of the population living in residential care facilities and nursing homes, respectively, while the age 6-17 population is assumed to drive demand for nurses in schools, and the total Maryland population is assumed to drive demand for nurses in the public health and all other settings. The number of new nurses being trained is the main driver of demand for nurses in teaching/academia. The staffing ratios for these settings are calculated by dividing national estimates of the demand driver by national estimates of FTE nurses working in the setting. Staffing ratios are modeled as remaining constant throughout the modeling period.

4. **Projections of population growth, aging, and demographic shifts**. Population projections accounting for future changes to population size by age, sex, race/ethnicity, and Maryland county were obtained from the Maryland Department of Planning.[13] These projections were corrected for the impact of COVID on mortality and natality and used to project estimated healthcare use by Maryland residents into the future.

**Exhibit 3. Overview of the Demand Modeling Framework**




Additional information about modeling methods is detailed in the model's technical documentation, which is available elsewhere.[14,15]

This study estimates and projects *demand* for healthcare services and nurses, defined, respectively, as the amount and types of healthcare services patients are willing and able to purchase at prevailing prices and the number of nurses employers are willing and able to hire at prevailing salary levels. The concept of *demand* for services differs from *need* for services, which represents the services that patients would use based on clinical or epidemiological considerations combined with an assessment of the level of care that would be considered appropriate.

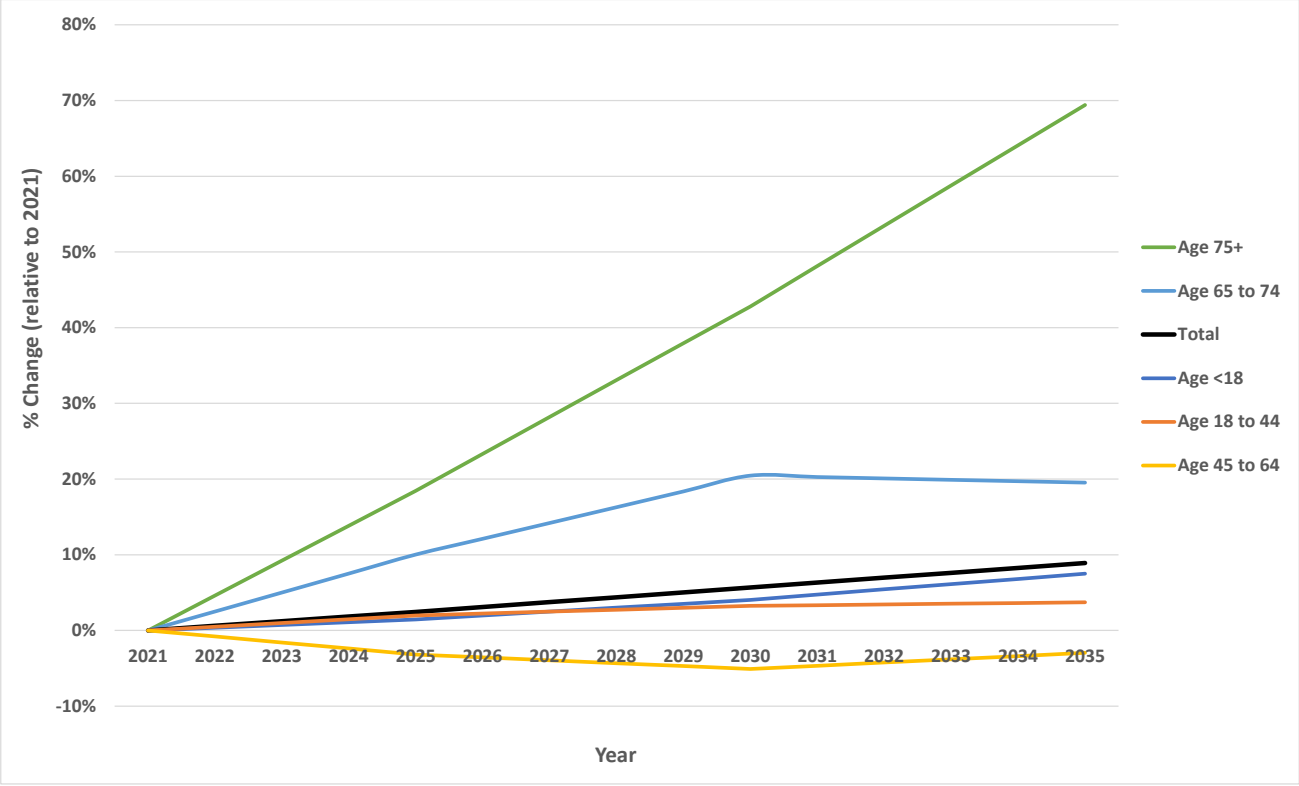
The core demand projections discussed in this report are modeled under a *Status Quo* scenario, which assumes future continuation of base year healthcare use and delivery patterns; thus, projected changes over time reflect projected changes to the size and demographics of Maryland's population. An alternative scenario, the *Reduced Barriers* scenario is intended to reflect the growing emphasis on achieving health equity, a goal that has recently been emphasized further given the disparities associated with COVID outcomes. While efforts to reduce health disparities are complex and require multifaceted solutions, improving access to care is likely one core element that can help address the issue. To explore the potential nurse workforce implications from increasing access to care, the *Reduced Barriers* scenario assumes that historically underserved populations would have healthcare use patterns similar to populations not generally considered underserved, controlling for personal factors like disease prevalence and other personal characteristics. Specifically, all individuals are modeled as having the healthcare use patterns of otherwise identical individuals (in terms of health risks and conditions, income, insurance status and type, and sex) who are 1) insured; 2) living in a metropolitan area; and 3) non-Hispanic White. It should be noted that this scenario is not meant to identify individual members of the population who face significant barriers to obtaining care and/or are underserved; nor is it meant to suggest that healthcare usage of insured, non-Hispanic Whites living in metropolitan areas is appropriate or adequate. Rather this what-if scenario yields general insights regarding the relationship of expected nurse workforce adequacy and reducing barriers of access to care.

## 1.2 Population Growth and Aging and Projected Demand for Healthcare Services

Population growth and changing demographics are the key drivers of changes in expected demand for healthcare services (and therefore nurses) over the projection period. The aging effect in particular will have an outsized impact on future demand for services, as the oldest population cohorts generally use services at a higher rate than those in younger age groups. Both the *Status Quo* and *Reduced Barriers* scenarios employ the same projected population changes over time.

Overall, the population of Maryland is expected to grow 9%, or about 540,000 residents, from 2021 through 2035, with considerable variation in population growth rates by age group. Exhibit 4 shows the expected population growth over the projections period, by age group. At the bottom of the graph, the number of Marylanders aging into the 45–64-year-old range (yellow) is expected to decrease over the period. Only a slight increase (~ 4%) is expected among residents aged 18-44 years (orange), and not much higher growth is forecast for the population age 18 years and younger. In contrast, the population age 65-74 years is projected to increase 20% and the population age 75 years and older is expected to increase a hefty 69% over the projection period. As such, while demand for most healthcare services is likely to grow due to the increasing size of the overall population, growth in care settings that disproportionately serve older patients (e.g., hospital-based care and care in nursing homes and residential care facilities) will be at a higher rate than other settings.

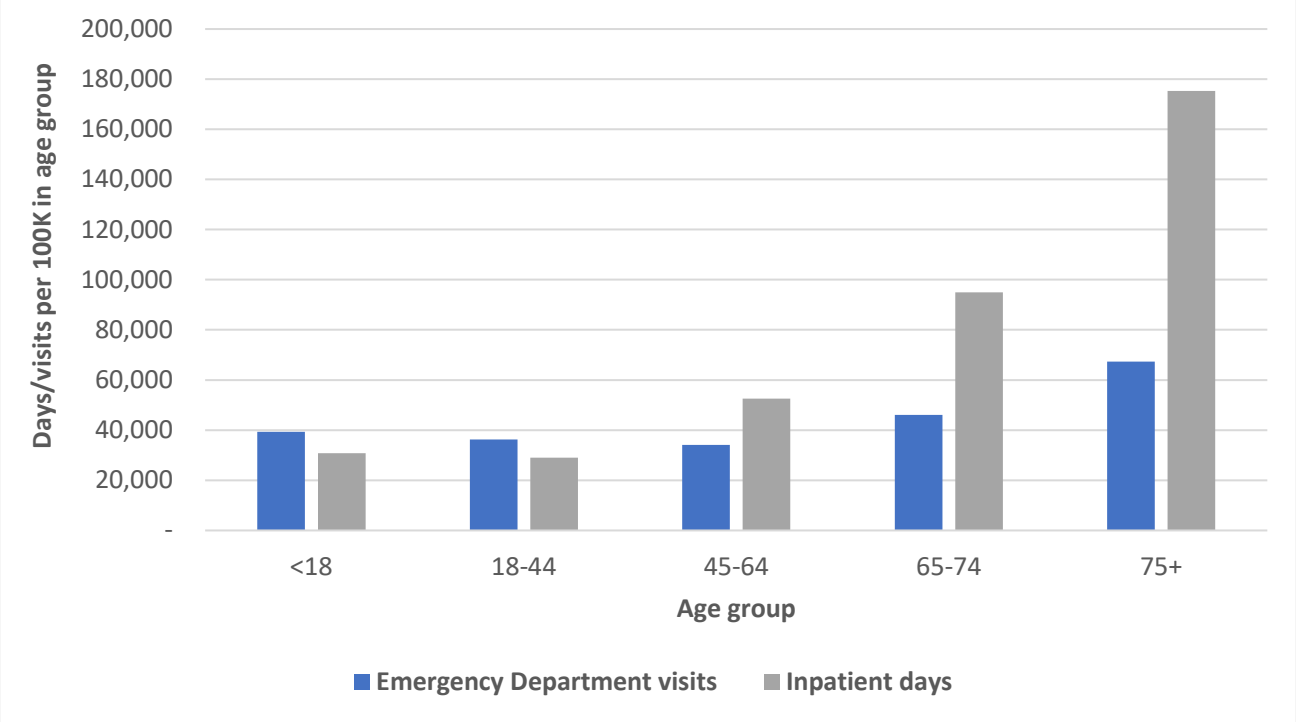
**Exhibit 4. Expected Population Growth in Maryland by Age Group through 2035**




Specifically, Exhibit 5 illustrates the relationship between population age and demand for hospital-based services. Individuals aged 75 and older use both emergency department and inpatient services at rates higher than other age groups. Compared with the Maryland annual average utilization per 100,000

population of approximately 39,000 emergency visits and 52,000 bed days, utilization within the age 65-74 cohort is 17% and 82% higher than the Maryland average emergency department and inpatient utilization, respectively. Utilization within the 75-years-and-older cohort is 71% and 236% higher for the respective settings. Thus, as the Maryland population ages over the projection period, expected demand for healthcare services used disproportionately by older age cohorts (and consequently for nurses in those settings) will increase faster than overall population growth.

**Exhibit 5. Rate of Annual Use of Hospital-based Care by Age Group**




## 1.3 Projected Demand for Nurses

The estimated demand for RNs in Maryland at baseline (2021) was approximately 57,900 FTEs statewide (Exhibit 6). Projected RN demand grows to 68,900 by 2035, which represents a projected growth of 19% over the projection period or approximately double the rate of population growth. The increasing demand for RNs is primarily driven by the projected increase in Maryland's population, particularly the outsized growth of the eldest population age groups, which use a disproportionate amount of healthcare services. Over the projection period, hospitals and other employers of nurses will have incentives to adjust their care models to use their increasingly scarce nurses more efficiently. The *Status Quo* scenario does not account for such adaptations. Thus, to the extent that future innovations in care delivery will allow for more high-quality care with fewer nurses, the *Status Quo* projections will overestimate shortages. Under the *Reduced Barriers* scenario, demand for RNs would be approximately 61,400 FTEs (or 6% higher than under the *Status Quo* scenario) at baseline and 73,500 FTEs (or almost 7% higher than under the *Status Quo* scenario) in 2035.

*Status Quo* demand for LPNs is estimated to be approximately 12,700 FTEs at baseline and is projected to increase to nearly 16,300 by 2035, a 28% increase over the projection period or approximately triple the rate of overall population growth (Exhibit 7). Projected LPN demand growth is higher than projected RN demand growth because LPNs tend to work in care settings disproportionally used by patients in the eldest cohorts, whose membership is projected to grow faster that the overall Maryland population. The

*Reduced Barriers* scenario projects demand for 13,400 LPNs at baseline and 17,200 FTEs in 2035 (both almost 6% higher than under the *Status Quo* scenario).

**Exhibit 6. Maryland Demand for RNs 2021 – 2035**

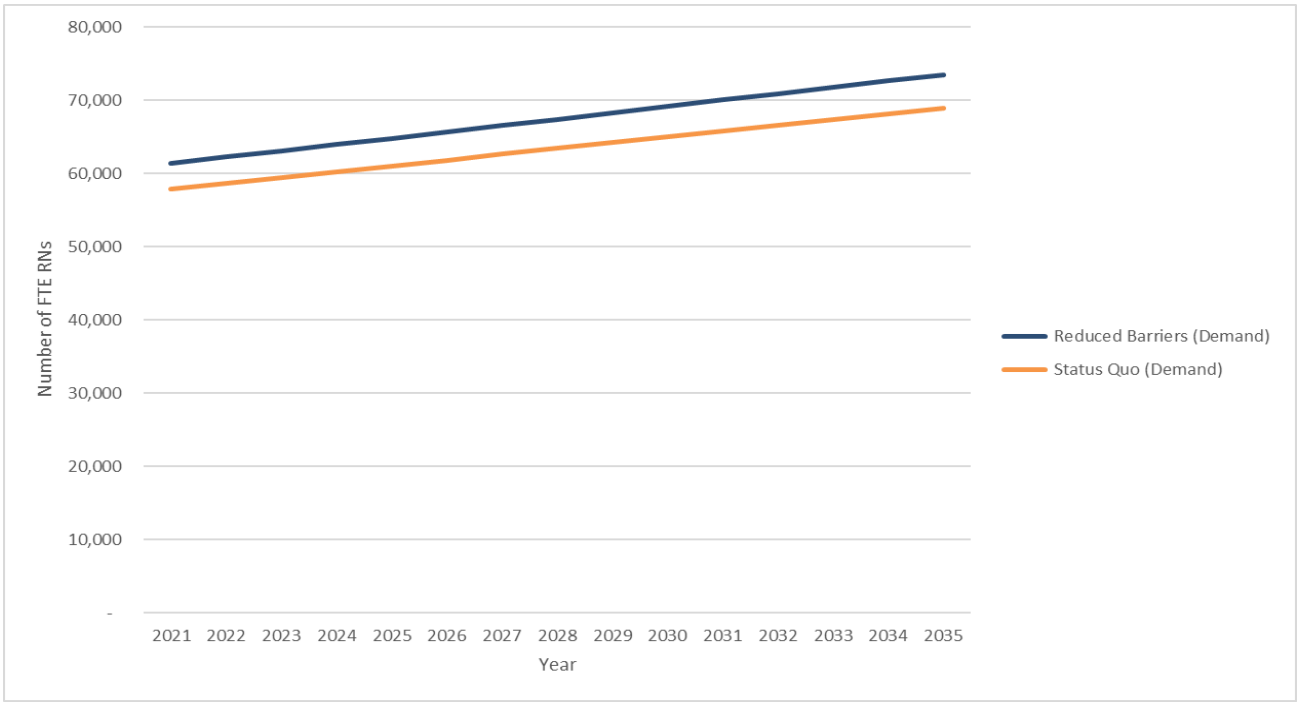
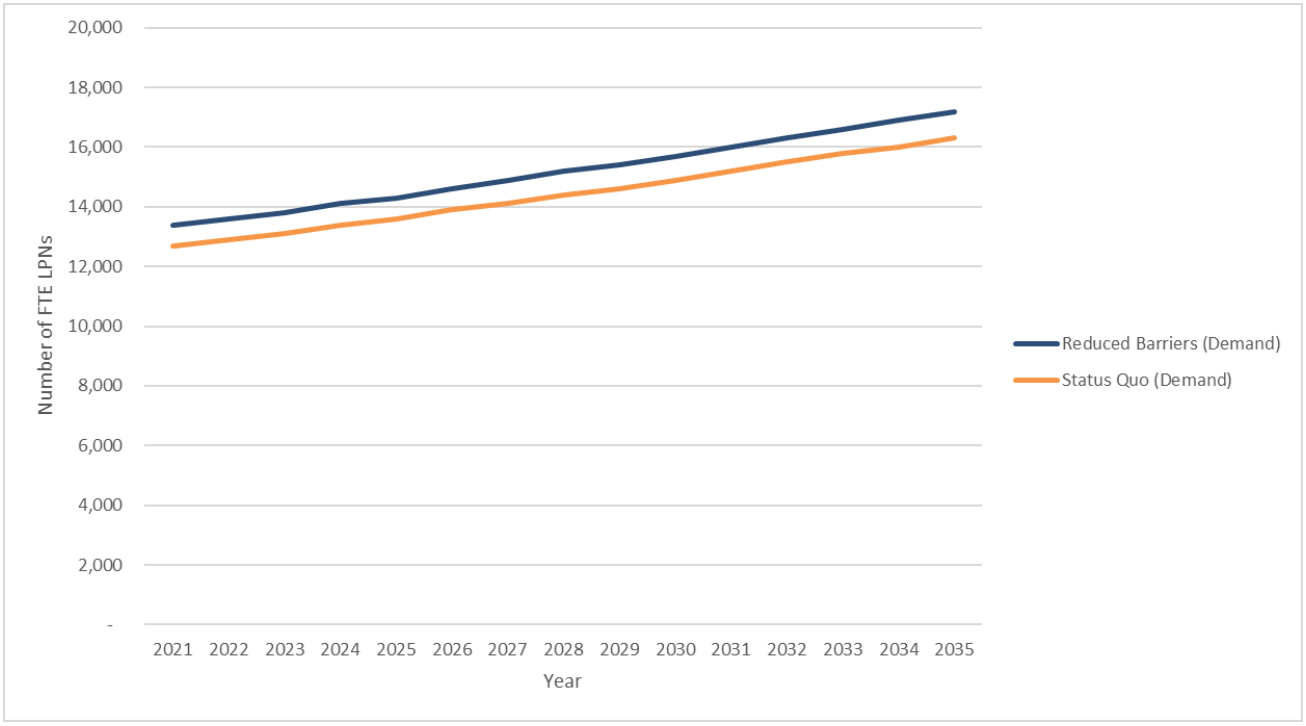



**Exhibit 7. Maryland Demand for LPNs 2021 – 2035**



Demand for nurses was projected by employment setting, and these projections for both RNs and LPNs under the *Status Quo* scenario are summarized in Exhibit 8 and Exhibit 9, respectively. The factors driving demand for both groups (office visits in the office setting, inpatient days in the inpatient setting, the projected size of the population living in nursing homes and residential care facilities for the nursing home and residential care settings, etc.) across all settings are the same, and thus the relative projected nurse growth rate in any setting is the same for both RNs and LPNs[c]. Demand for nurses in academia is projected to remain constant over time, which is consistent with the supply modeling assumption (discussed later in this report) that the number of new nurse graduates will remain constant when projected into the future. If the size of the nurse training pipeline grows, then demand for nurses in academia will grow at the same rate. The 2021-2035 projected nurse FTE growth rates in other settings range from 6% in school settings, due to the slower growth in the school-aged population, to 50% and 57% in the nursing home and residential care settings, respectively, reflecting the high projected population growth in the eldest age groups who use these services at above average rates. Roughly half of the projected growth in demand for RNs is expected to come from the hospital inpatient setting, for which demand is projected to increase by over 5,000 RNs. Nursing homes are the setting with the largest projected FTE growth for LPNs, accounting for 45% (over 1,600 FTEs) of the total LPN demand growth.

**Exhibit 8. Maryland Demand for RNs by Setting (Status Quo Scenario)**

| | 2021 Demand | 2035 Demand | Growth | % Growth |
|---|---|---|---|---|
| **Office** | 3,360 | 3,800 | 440 | 13% |
| **Outpatient** | 8,050 | 8,870 | 820 | 10% |
| **Emergency** | 3,220 | 3,620 | 400 | 12% |
| **Inpatient** | 26,900 | 32,380 | 5,480 | 20% |
| **Home Health** | 3,070 | 4,230 | 1,160 | 38% |
| **Nursing Home** | 1,210 | 1,820 | 610 | 50% |
| **Residential Care** | 2,330 | 3,660 | 1,330 | 57% |
| **School** | 1,760 | 1,870 | 110 | 6% |
| **Public Health** | 2,400 | 2,610 | 210 | 9% |
| **Academia** | 690 | 690 | 0 | 0% |
| **Other** | 4,910 | 5,350 | 440 | 9% |
| **Total** | **57,900** | **68,900** | **11,000** | **19%** |

Note: All values were estimated to whole numbers, then reported to the nearest 10 to avoid implying more precision than can be claimed.

[c] Except the Emergency Department, because insufficient data regarding LPNs working in emergency rooms exists to model this setting.

**Exhibit 9. Maryland Demand for LPNs by Setting (Status Quo Scenario)**

| | 2021 Demand | 2035 Demand | Growth | % Growth |
|---|---|---|---|---|
| **Office** | 1,290 | 1,460 | 170 | 13% |
| **Outpatient** | 1,050 | 1,160 | 110 | 10% |
| **Emergency** | - | - | - | n/a |
| **Inpatient** | 3,170 | 3,800 | 630 | 20% |
| **Home Health** | 1,130 | 1,560 | 430 | 38% |
| **Nursing Home** | 3,280 | 4,910 | 1,630 | 50% |
| **Residential Care** | 810 | 1,270 | 460 | 57% |
| **School** | 140 | 150 | 10 | 6% |
| **Public Health** | 190 | 200 | 10 | 9% |
| **Academia** | 40 | 40 | - | 0% |
| **Other** | 1,600 | 1,750 | 150 | 9% |
| **Total** | **12,700** | **16,300** | **3,600** | **28%** |

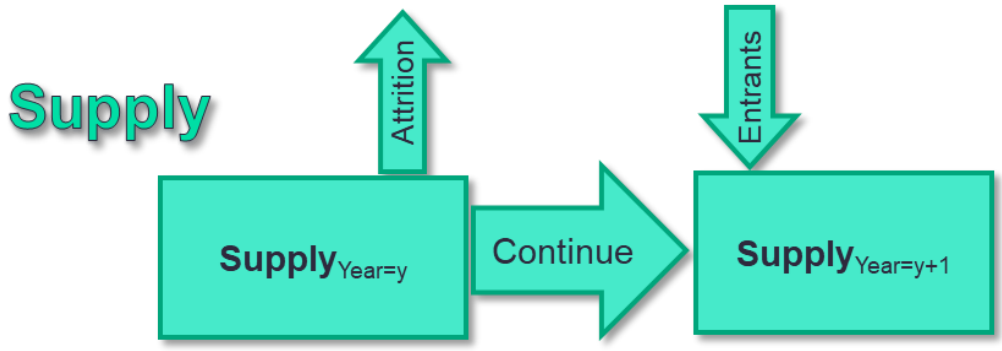
Note: All values were estimated to whole numbers, then reported to the nearest 10 to avoid implying more precision than can be claimed. As a result, the growth rates in school and public health settings for LPNs match the unrounded numbers, but not the rounded numbers in the table.

# Projected Future Nurse Supply

## 1.4 Modeling Approach

Modeling current and future supply of nurses starts with building a representative population of RNs and LPNs licensed and working in Maryland, which constitute the baseline (2021) supply of RN and LPNs. As illustrated in Exhibit 10, using simulation, during each subsequent year of modeling, nurses' ages increase by one year, weekly hours worked and retirement probabilities are calculated for these new ages, new entrants are added to the workforce, and in-state and out-of-state migration of nurses is applied. The data analyzed to inform assumptions regarding nurses' workforce decisions comes from a combination of Maryland-specific and national data sources. Nurse licensure data maintained by the Maryland Board of Nursing (BON) is the basis for both the starting supply of nurses and nurses entering the workforce, while national sources, such as the National Sample Survey of Registered Nurses (NSSRN) and the American Community Survey (ACS), are used to fill in information regarding demographics and workforce participation because Maryland-specific data are not available from the BON.

**Exhibit 10. Overview of the Supply Modeling Framework**




Ideally, nurses identified as having an active license and a work address in Maryland would constitute the starting supply of Maryland nurses. The Maryland nurse licensure data contains, for both RNs and LPNs, information regarding license status (active or not) and address, although whether the address is work or home is not specified. Analysis of the data suggests the information provided is largely home addresses. In March 2022 (the date for which data were provided by BON, likely representing a pool similar to the pool of nurses licensed in Maryland at baseline), approximately 86,500 RNs and 11,100 LPNs held an active license in Maryland. More than 9,500 RNs and more than 800 LPNs had addresses outside of Maryland, so were excluded from Maryland nurse supply. A small number of nurses listed as volunteers were also removed. Nurses with both an active LPN and RN license were counted as RNs. Advanced practice registered nurses (approximately 8,500) were excluded from RN supply, as these nurses perform healthcare delivery tasks substantially different from LPN and RN nursing services.

During COVID, many hospitals had to increase their number of travel nurses, meaning that many of the Maryland licenses could have been for out-of-state travel nurses no longer working in Maryland or Maryland resident nurses who traveled to other states to work. Additionally, because much of Maryland is a commutable distance to other states and the District of Columbia, (as our focus groups confirmed) many Maryland resident nurses work outside of the state and many nurses working in Maryland live outside of the state. Thus, starting supply had to be estimated employing additional information from other sources.

Because this information was unavailable in the BON data, for the microsimulation, remaining members of the licensure data (after making the deletions described above) were assigned age, sex, and race/ethnicity to match these joint distributions among RNs from Maryland in the 2018 NSSRN and 2019 ACS and among LPNs from Maryland in the 2019 ACS. The pools of remaining RNs and LPNs with active licenses in Maryland, were scaled down to match the estimates of nurses working in Maryland in 2021 from the U.S. Bureau of Labor Statistics' Occupational Employment and Wage Statistics.[3] Analyses of the demographics of practicing Maryland RNs in the 2015-2019 ACS and 2018 NSSRN data, and practicing Maryland LPNs in the 2015-2019 ACS data were used to assign probabilities of being in the Maryland workforce to the remaining pool of nurses with active licenses based on their assigned demographics. These steps yielded starting estimates of 52,900 RN FTEs and 8,700 LPN FTEs at baseline.

Survey responses from the 2018 NSSRN and the 2015-2019 ACS for Maryland-based nurses were used to predict RN and LPN weekly hours worked based on nurse age, sex, race/ethnicity, and education level (associate degree or baccalaureate degree for RNs). As discussed in Section 0, an FTE is defined as 40.9 hours/week for RNs and 37.7 hours/week for LPNs reflecting national average hours worked for nurses working at least 8 hours per week.

Using the year a license was issued in the BON licensure data, the number of annual new entrants to the nursing workforce was estimated as the average annual number of new RN and LPN licenses issued from December 2018 through December 2021. This results in 3,053 new RNs and 446 new LPNs added annually to the workforce, with this number assumed to remain constant throughout the period under the *Status Quo* scenario. Ages of new RN and LPN entrants are consistent with the age distribution of newly licensed RNs and LPNs in the 2018 NSSRN and 2015-2019 ACS data, with all other demographics reflective of the distributions of these factors among all Maryland RNs and LPNs in these sources. These demographic distributions remain constant when projecting into the future.

RN and LPN retirement patterns are derived from national survey responses from nurses in the 2018 NSSRN and 2015-2019 ACS, respectively, and probability of retiring is based on the age of the nurse. As the modeling process progresses from year to year, a nurse's probability of retiring will change based on his or her new age, and this probability generally increases with age. Included in this attrition process is the possibility that an LPN becomes an RN, or an RN becomes an APRN. The number of new entrants to the RN workforce each year accounts for LPNs who become RNs.

Nurse migration probabilities are calculated from prediction equations based on age, race/ethnicity, and sex by education level estimated using 2015-2019 ACS data for both RNs and LPNs, and specifically account for the number of nurses leaving Maryland each year. In-migration is also accounted for in the model, but in-migrating nurses are tracked as new entrants to the Maryland nurse workforce.

The supply modeling described above reflect the modeling assumptions for the *Status Quo* scenario. Several alternative scenarios were modeled to account for uncertainties in future nurse workforce patterns. Two scenarios reflecting changing retirement patterns were modeled—the *Early Retirement* scenario, reflecting nurses retiring two years earlier than they do currently, and the *Delayed Retirement* scenario, reflecting nurses retiring two years later than they do currently. The former scenario could reflect the impact of worsening provider burnout during COVID, and the latter could reflect the results of efforts by employers to retain senior staff. Similarly, two scenarios were modeled that assume alternately a 10% increase and a 10% decrease in annual new graduates entering the workforce projected into the future (named the *10% More Graduates* and *10% Fewer Graduates* scenarios, respectively). The former scenario could reflect, for example, the impact of increased efforts within the state to attract and recruit new nurses to the profession, while the latter could reflect the impact of decreased desirability of nursing in the wake of unenviable working conditions during COVID.

## 1.5 Supply Estimates and Projections

Projected RN supply modeling results from the *Status Quo* and alternative scenarios are summarized in Exhibit 11. The number of new RNs entering the Maryland workforce is largely offset by nurses leaving the workforce, with supply projected to increase slightly. Supply dips early in the projection period partially reflecting imminent retirements in a nursing workforce that skews older. Over the projection period, supply is expected to grow only 4% total (or less than 0.3% per year) under the *Status Quo* scenario, with projected growth over the period between -2% (or -1,000 FTE RNs under the *10% Fewer Graduates* scenario) and 10% (or 5,400 FTE RNs under the *10% More Graduates* scenario).

Projected supply of LPNs decreases over the projection period for all scenarios (Exhibit 12), with an 18% decline (or 1,600 LPN FTEs) projected under the *Status Quo* scenario. The generally steady decrease in supply over the projection period reflects that the LPN workforce is disproportionately older (thus, containing many nurses reaching retirement age over the period) with fewer young replacements as new nurses are encouraged to pursue BSNs or other higher certifications. Under alternative scenarios, LPN supply is expected to decline between 1,300 FTEs (or 15% under the *10% More Graduates* scenario) and 2,000 LPN FTEs (or 23% under the *10% Fewer Graduates* scenario). Declines in the supply of LPNs could put further strains on the RN workforce.

**Exhibit 11. Maryland Supply of RNs by Scenario, 2021-2035**

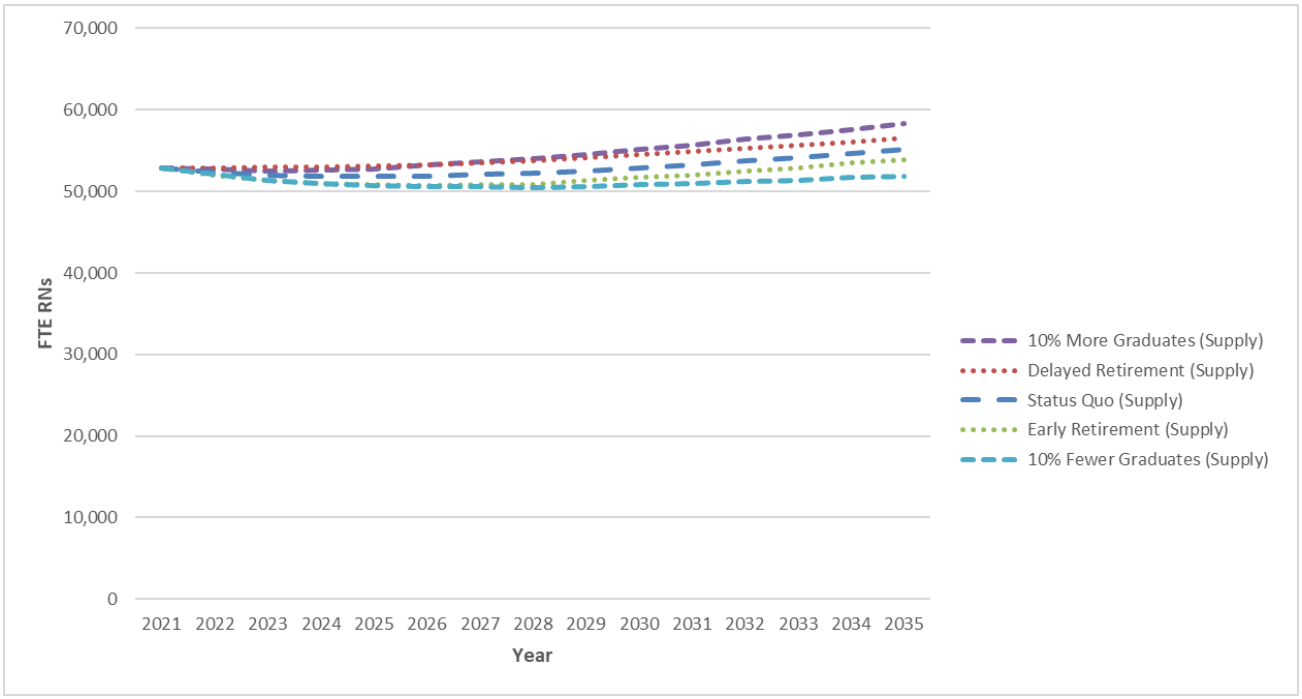
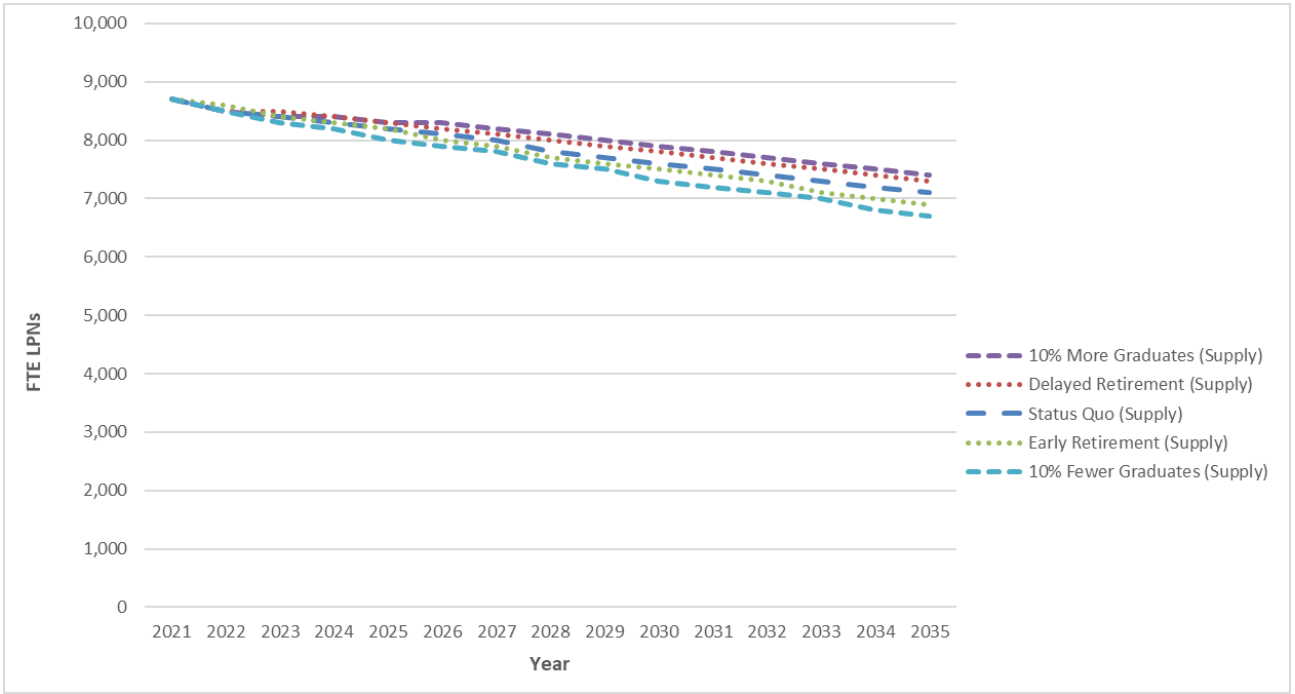



**Exhibit 12. Maryland Supply of LPNs by Scenario, 2021-2035**



# Maryland Nurse Supply and Demand by Region

The workforce projections suggest a current state shortfall projected to grow to approximately 13,800 RNs and 9,200 LPNs by 2035. Both supply and demand are projected to grow differently across Maryland regions as population growth and other factors differ across the state.

Geographic variation in supply and demand for nurses at the county and regional level can reflect a variety of factors, including:

- **Differences in population demographics and characteristics across regions.** Nationwide average ages of city dwellers generally tend to be younger than average ages of those living in rural areas. In Maryland, the counties with the older populations on average are on the Eastern Shore and in Western Maryland. Additionally, socioeconomic status varies across the state, with many of the lower average household income counties on the Eastern Shore and Western Maryland. These sociodemographic characteristics tend to be correlated with population health characteristics like prevalence of chronic disease and health risk behavior, which also tend to be higher in the Eastern Shore and Western Maryland. Of course, the general health of a population in turn influences the population's demand for healthcare services and thus nurses. On the supply side, socioeconomic conditions within local areas can influence decisions to become employed within a particular region.

- **Differences in projected population growth across regions.** As mentioned previously, projections of population growth and demographic shifts by county were used to model healthcare demand. Some counties are projected to grow faster than others. 2021-2035 projected population growth ranged from 19% in St. Mary's County to 3% in Baltimore County and City, with considerable variation around the state average of 9%. The geographic distribution of population characteristics also was projected to shift over time, influencing the population's projected health characteristics (such as prevalence of chronic diseases), and resulting healthcare demand.

- **Geographic variation in supply reflects, in part, where hospitals are located.** While demand for healthcare services and nurses is estimated for where the population resides, geographic variation in demand for nurses is, at least in part, determined by where hospitals and other employers are located. Thus, it is possible that patients are traveling outside of their home county, especially to Baltimore City and Washington, DC to receive treatment and this dynamic is not captured within the model's projected nurse supply adequacy by region.

Both supply and demand were initially estimated at the county level and aggregated to both region-level and state-level projections. Tables of the county-level and region-level projections, as well as county-level heat maps of supply adequacy, for 2021 and 2035 are presented in the Appendix.

**Important caveats should be considered when interpreting county-level findings:**

- **The nurse licensure database only contains the preferred address for the nurse, and there is no indication if this is the nurse's home address or work address. Analysis of the address information suggests that for most nurses this is a home address. Consequently, the county designation for supply is most likely where the nurse lives, with an unknown county for their work address.**
- **Demand is modeled based on the resident population in each county. The analysis does not account for some residents crossing county lines to receive care.**

Because larger areas offer expanded choices, nurses are more likely to work within their regions than within their counties and patients are more likely to seek care within their regions than within their counties. Thus, we aggregate the county-level projections to regions for analysis.

Exhibit 13 contains a scatterplot of estimated 2021 LPN supply adequacy (on the x-axis) and 2021 RN supply adequacy (on the y-axis). Regions are plotted as bubbles on the chart, with each bubble sized according to 2021 region population. The national average adequacy of nurse supply is represented by the intersection of the dark vertical line marking national adequacy of LPNs (or 100% of supply required to meet demand for LPNs at baseline national levels of care) and the dark horizonal line marking national adequacy of RNs (or 100% of supply required to meet demand for RNs at baseline national levels of care). All regions are to the left of the 100% LPN adequacy line, indicating that all regions are estimated to have fewer LPNs than required to provide a national average level of care at baseline. Most regions are below the 100% RN adequacy line, meaning these regions have RN shortages at baseline. However, the Upper Eastern Shore region (represented by the small bubble bisected by the 100% RN adequacy line) is estimated to have 100% RN supply adequacy at the baseline level of care, and the Central region (represented by the larger bubble intersected by the dark horizontal line) is estimated to have supply adequate to meet 109% of demand at baseline levels of care.

To the extent that people from surrounding regions travel to Central Maryland (with Baltimore's premier hospitals) for care, demand is underestimated, and the estimated 109% RN adequacy overstated. Additionally, if licensure files contained both the nurses' home and work locations, then nurse work commuting patterns could be better understood, improving the accuracy of the supply estimates used to determine adequacy. Commuting patterns and time/distance to work heavily impact the nurse workforce because nurses are disproportionately female so (as echoed in the focus groups) face disproportionate household responsibilities, including child care and elder care, restricting manageable commute distances.

Exhibit 14 contains an analogous graph for 2035. In 2035, the bubbles generally have shifted down slightly and to the left considerably relative to the graph for 2021, meaning RN adequacy generally is somewhat less, while LPN adequacy is substantially less. The Central region bubble is centered on 97% RN adequacy, projecting supply to be approximately adequate to meet demand in the region, with the caveats discussed above.

**Exhibit 13. % LPN Adequacy (2021) versus % RN Adequacy (2021), by 2021 Region Population**

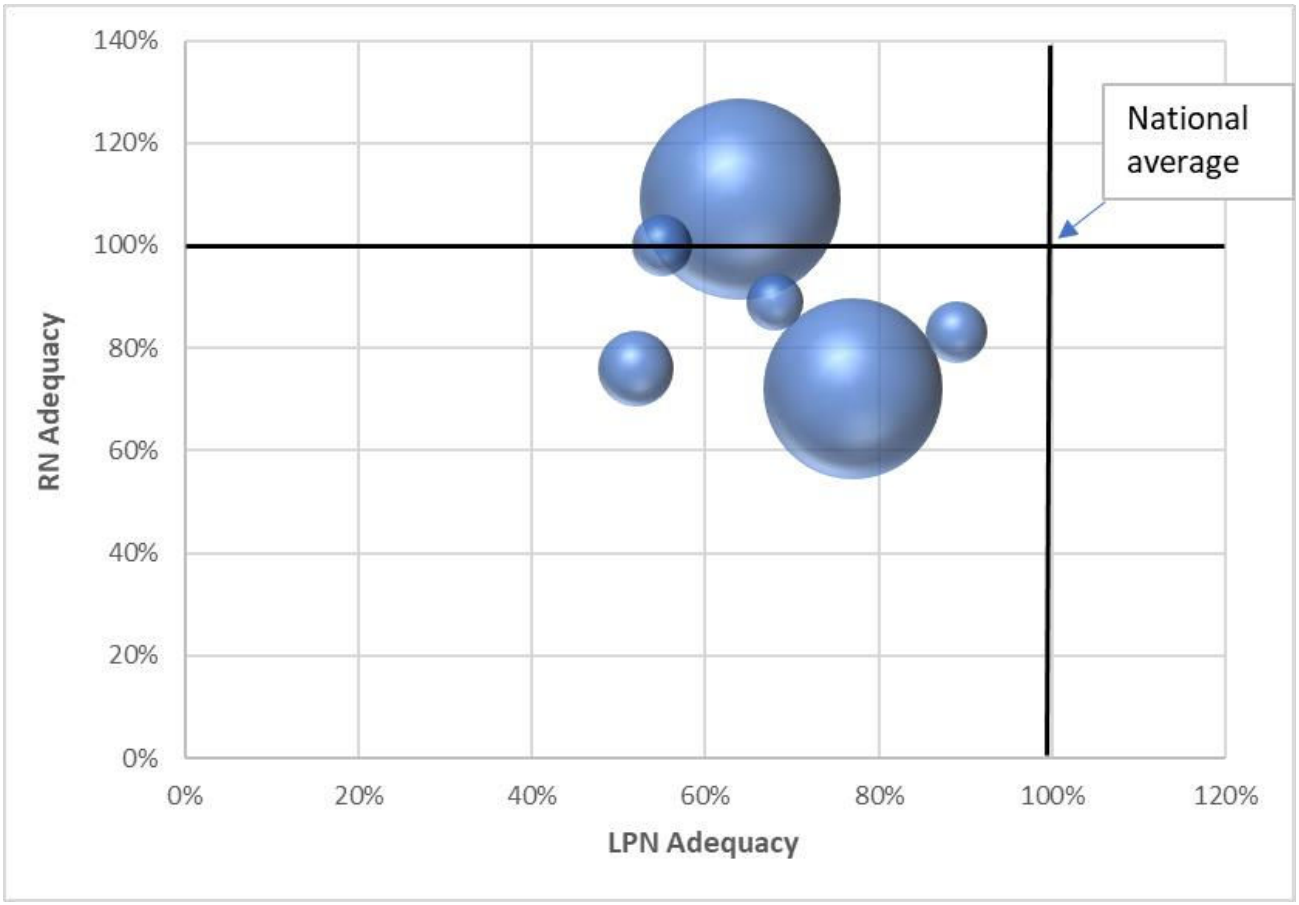


**Exhibit 14. % LPN Adequacy (2035) versus % RN Adequacy (2035), by 2035 Region Population**

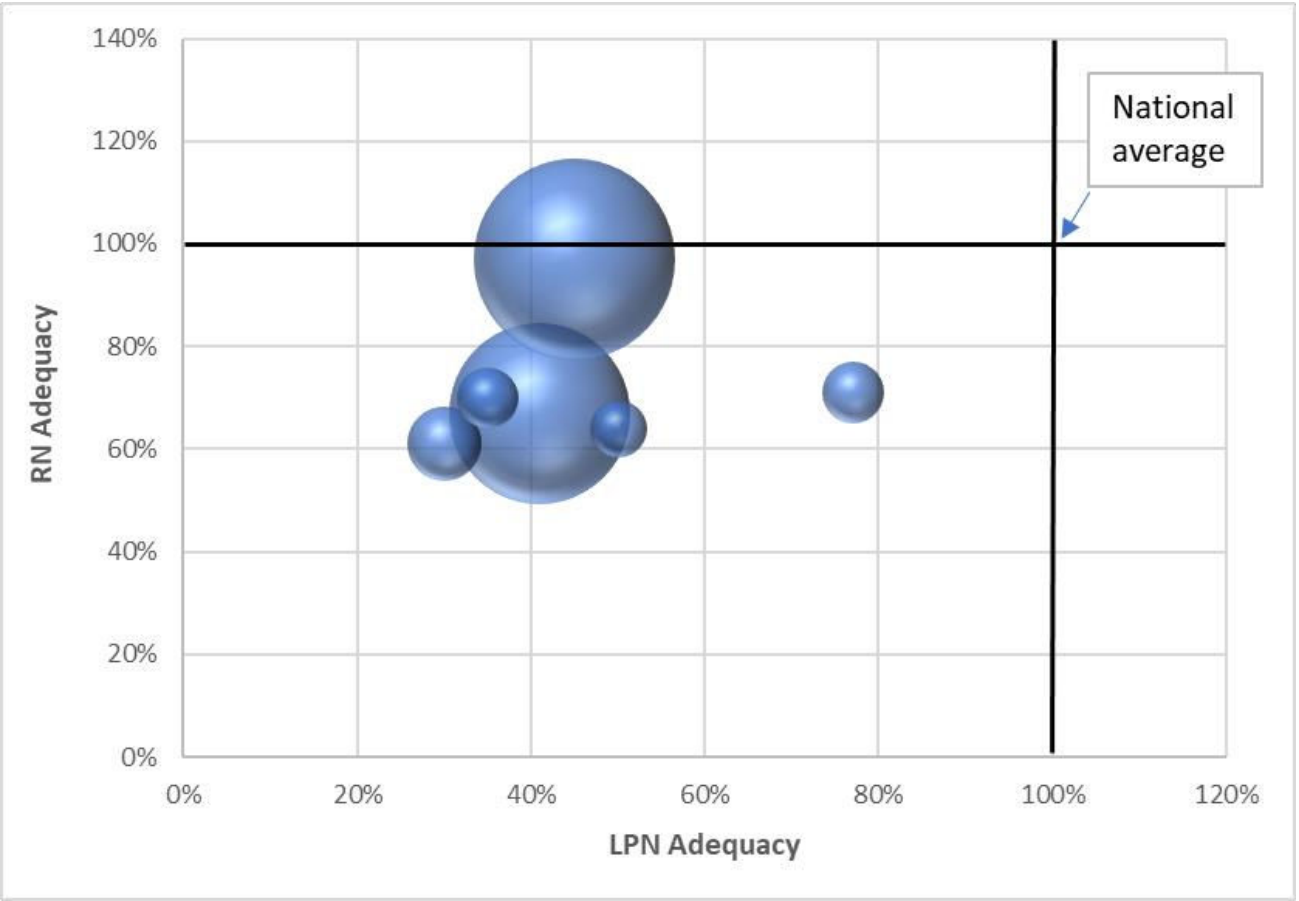



Exhibit 15 and Exhibit 16 contain maps showing region-level RN supply adequacy in 2021 and 2035, respectively. RN adequacy in 2021 generally is lowest in counties bordering northern Virginia and Washington DC, which may reflect residents of those counties receiving considerable amounts of their healthcare in Virginia and DC. Adequacy generally is highest in the Central and Upper Eastern Shore regions. Projected future RN adequacy declines in all regions by 2035 to approximately 60-70%, apart from Central Maryland staying close to 100%.

Exhibit 17 and Exhibit 18 show region-level LPN supply adequacy in 2021 and 2035, respectively. Adequacy in 2021 generally is lowest in Southern Maryland and the Upper Eastern Shore, and highest in Western Maryland. By 2035, shortages are 30-50% in all regions except Western Maryland, which is projected to experience nearly 80% adequacy.

**Exhibit 15. Estimated Maryland RN Supply Adequacy by Region (2021)**

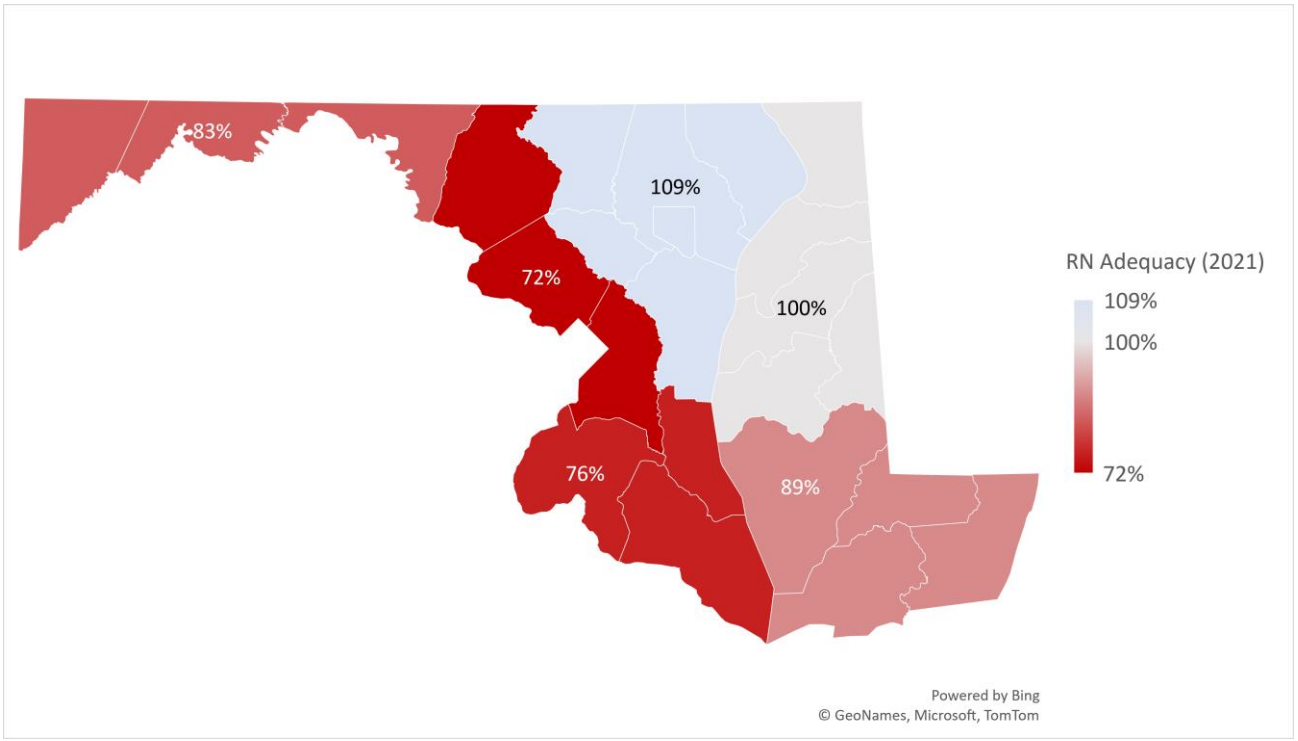



**Exhibit 16. Estimated Maryland RN Supply Adequacy by Region (2035)**

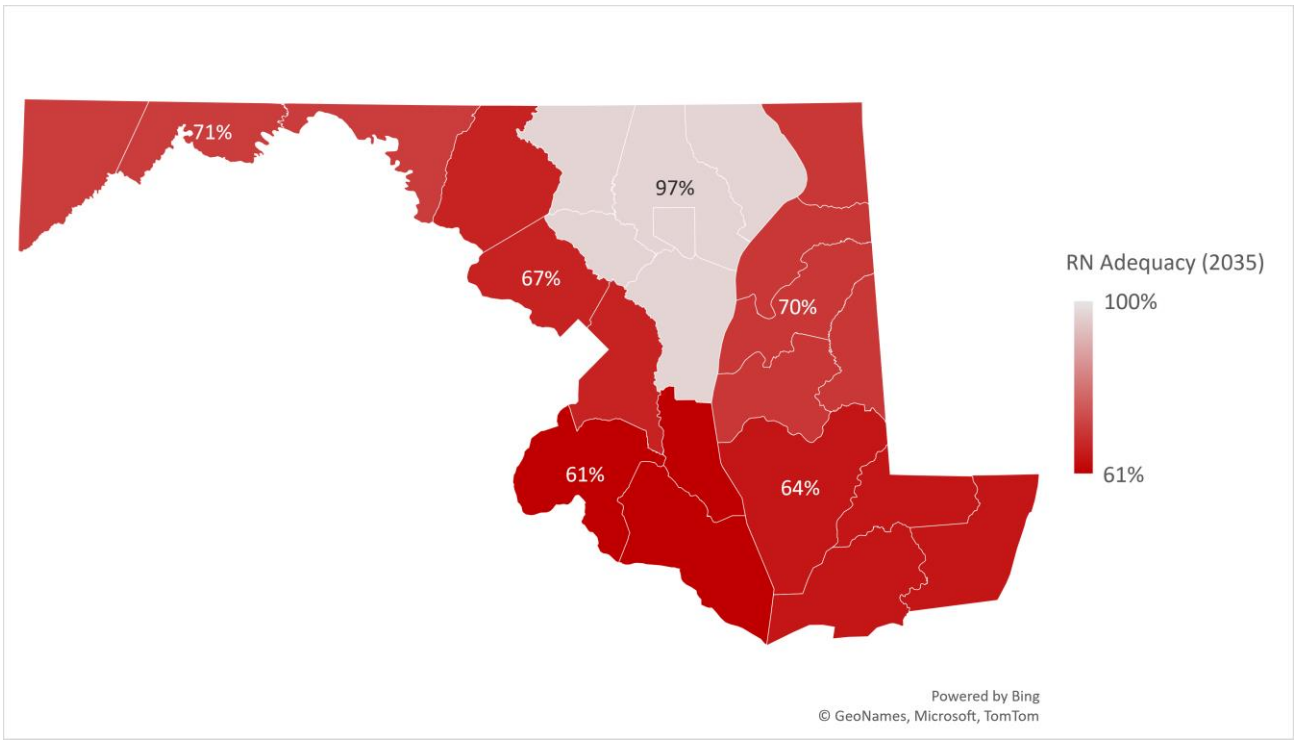


**Exhibit 17. Estimated Maryland LPN Supply Adequacy by Region (2021)**

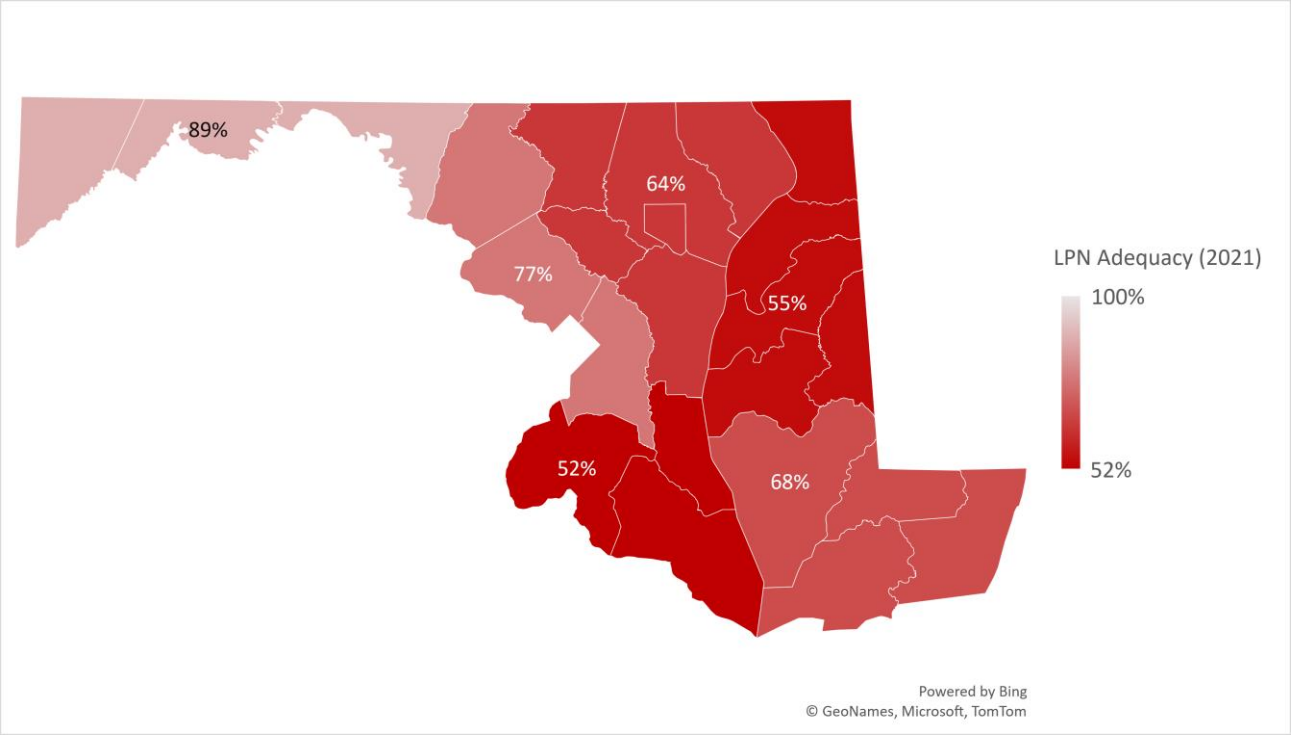
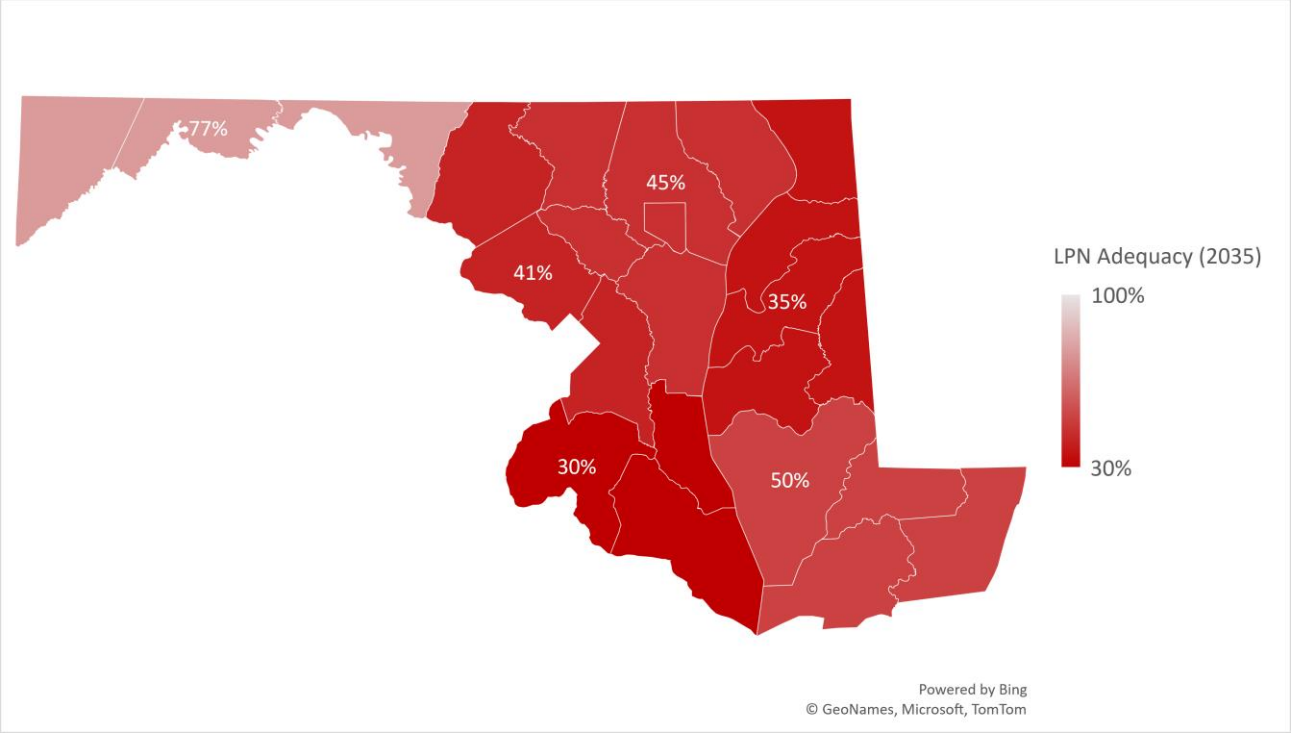



**Exhibit 18. Estimated Maryland LPN Supply Adequacy by Region (2035)**



# Summary of Nurse Focus Groups

The health workforce models used for this study did not originally contain components to help understand the impact of COVID, and definitive data about the pandemic's impact are still being generated. As a result, to inform updates to the model and contextualize study findings, meetings with healthcare practitioners from the occupations and geographic locations being modeled are conducted to better understand ***from them*** the impact that COVID – as well as other recent developments in healthcare – are having on providers.

Three one-hour focus groups were convened with nurses from Maryland hospitals and health systems on April 21 and 22, 2022. The Maryland Hospital Association organized and hosted these events, which were attended by approximately 30 nurses from a range of rural and urban hospitals as well as a variety of hospital units and job types. Participants provided a wealth of thoughtful feedback.

The overarching message of the focus groups is that COVID greatly exacerbated the issues that were already troubling the labor market for nurses pre-pandemic. The reasons for this, of course, are complex, involving the interplay of many factors. The feedback received regarding these market dynamics is organized here into 3 main (but still overlapping) themes, with 3 sub-themes that fit under the main themes but have sufficient complexity and impact to warrant separate discussion.

The first main take-away is that, even pre-pandemic, **conditions in the nurse labor market** were resulting in nursing shortages, creating challenges for nurse staffing. Specific conditions and pathways include:

- Nurses, feeling overworked and under-appreciated, were burning out and leaving the field in a negative feedback loop that increased shortages, understaffing, a perception of being overworked, burnout, and more attrition. (More detail is presented below regarding how this dynamic intensified during COVID.)
- Shortages in allied health occupations were also contributing to increasing nurse workload. For example, participants offered accounts of nurses drawing blood, stripping beds, interfacing with insurance companies, etc. before the pandemic. The heightened shortages across these other occupations after COVID's arrival only worsened the impact on nurses.
- Pay compression, and trends away from pensions and other workforce retention incentives, were already creating challenges pre-COVID for attracting and retaining experienced staff. The wage inequity caused by the dramatic increase in the use of travel nurses (discussed in more detail below), exacerbated this issue.
- Participants expressed a perception that LPNs were not being used efficiently pre-pandemic, for example, in direct patient care. This meant that LPNs generally were not already trained to step in and help during COVID, and nurses who were already overburdened with COVID patients did not have the time or other resources to train them to take a hand.

A second main area identified by the focus groups as impacting the market for nurses is related to **generational differences**. The two central pathways of impact are summarized below.

- As has been widely reported – in general, not just in nursing – younger workers are putting a greater emphasis on work-life balance than older generations. This has exacerbated staffing challenges, especially for less desirable shifts, but also for the more stressful units and settings.
- Additionally, even before COVID, nurse education was de-emphasizing in-person training and increasingly emphasizing more academic and leadership training. As a result, new nurses were

looking to spend as little time as possible at the bedside, expecting to move quickly to leadership/management positions. (How existing shortages and COVID were catalysts for these trends to disrupt the market is discussed in more detail below.)

A third main influence impacting the market for nurses, as is well-reported, is the devastating effects of COVID on nurses. While COVID further inflamed other issues smoldering since before the pandemic, it also had its own direct impacts as well, including:

- Most prominently at the beginning of the pandemic, some nurses close to retirement (and among the most experienced) facing increased risk (to themselves or their family members of severe COVID) retired, thus decreasing supply and the overall experience level of the nursing staff.
- As hospitals in areas experiencing COVID spikes increasingly filled vacancies with travel nurses, this caused a vicious cycle of spiking wages, staff nurses becoming travelers, increased shortages, and further increased need for travel nurses.
- With schools, daycare, and elder care closed, and nursing homes seeming unsafe, many nurses had to offer fewer work hours to take care of family obligations. Such conditions also made the flexibility of both travel nursing and less demanding care settings relatively more attractive, further depleting bedside staff.
- At the beginning of the pandemic, when healthcare professionals were seen as heroes, interest in nursing increased. However, as social media highlighted the abuse taken by nurses as attitudes to the pandemic and healthcare workers changed, interest in nursing is reported to have fallen off both for attracting prospective nurses to training programs as well as attracting nurses to work at the bedside.
- Relatedly, because hands-on training with patients was not practical during the worst of the pandemic, many new nurses started their careers without bedside experience, and, as a result, many felt overwhelmed. Given the dearth of experienced staff and mentors, numerous orientations failed and thus continued to aggravate the bedside nurse shortage.
- The explosion in telehealth usage during COVID allowed more nurses to move away from the bedside to a setting with less disease exposure and pressure. This not only intensified the shortage of bedside nurses but is also fueling the issues—discussed in more detail below—regarding the quick career progression of nurses without gaining experience bedside.

The nurse shortages and resulting overworked nurses (that existed even pre-pandemic, but worsened during COVID), were a topic of much discussion during the focus groups, and the myriad ways they perpetuate the nurse shortage and related issues merit further explanation.

- The most direct impact is the negative feedback loop of shortages, which lead to overworked nurses, which lead to increased nurse stress, moral injury, and burnout, which leads to staff turnover, which worsens shortages, starting the cycle again.
- The shortages also are leading to training issues that in turn compound the shortages. Overworked nurses have little time to orient and monitor new nurses. The lack of direct patient experience and mentorship for these new nurses increases the likelihood of failed orientations, which contributes to leaving bedside care. This loss of new nurses from bedside care affects not only current staffing but also has implications for the level of staff experience into the future.
- New nurses lacking direct patient experience and feeling overwhelmed sought opportunities to move to an outpatient setting or other position with less stress as soon as possible. Focus group participants noted that new nurses are moving to outpatient and travel nursing as quickly as possible with little training. This increases wage compression and inequity, increasing the turnover among the crucial senior staff.

- Finally, while nurses noted the availability of resilience programs to address high levels of stress and burnout, they saw little impact and believed more was needed, given the evidence that burnout is a systemic issue, not largely a matter of individual resilience.

The ways the dramatic increase in the use of travel nurses precipitated by COVID are impacting hospital workplace dynamics also are worth closer examination, especially in light of focus group respondents' beliefs that these impacts are not expected to fade with COVID but are here to stay.

- The increase in travel nurses (like existing shortages) also creates a negative feedback loop, continually compounding the problem. That is, the higher the demand for travel nurses, the higher are travel nurse wages, so the more attractive travel nursing becomes. As nurses leave staff positions to become travel nurses, staff shortages worsen, increasing the demand for travel nurses. And around it goes.
- Additionally, the large differential between the wages of staff nurses and travel nurses increases the perceived inequity of wages of staff nurses, leading to higher staff turnover, particularly among the senior staff. This, in turn, increases shortages and demand for travel nurses.
- Further, the increased use of travel nurses means fewer nurses in any hospital with institution-specific knowledge of procedures, policies, and other team members. Focus group members described whole teams of nurses with little work experience and no experience in the current hospital, and therefore no knowledge of the culture, policies, and personalities governing their work environment. Nurses expressed their concern that working on teams with little experience in their current hospital increases stress, moral injury, and burnout among staff, contributing to higher turnover and worse shortages.

Finally, evolving nurse education approaches and career expectations were discussed. Many focus group participants noted the differences in nurse education today relative to when they were in school – specifically that today's nursing programs are de-emphasizing hands-on experience and encouraging more academic study and leadership preparation.

- As a result, insufficient preparation for working directly with patients leads to more failed orientations and movement to other areas of nursing (or out of nursing) and is contributing to lower overall levels of bedside experience among staff.
- The emphasis on leadership training encourages new entrants to move to management positions as soon as possible, further degrading the amount of experience at all levels. This also increases concerns of patient safety and burnout as well as produces more pay compression, both of which increase staff turnover. This loops back to the dynamic above of fewer senior staff meaning fewer trainers and higher turnover of junior staff.
- In tandem with the mindset instilled in school to become leaders, the increasing nurse shortages are also aggravating the situation. With large numbers of job openings, young nurses can easily compress the timeline of their career progression, leaving them without sufficient bedside and other crucial experiential skills, and further aggravating bedside and mentor shortages as well as pay compression issues.

The overall impression left by the focus groups is that nursing, and hospitals trying to staff nurses, face significant challenges at the moment.

# Discussion

## 1.6 Key Findings and Implications

Study findings suggest shortages of approximately 5,000 RN FTEs and 4,000 LPN FTEs existed in Maryland in 2021. The nurse workforce at the time was sufficient to meet about 91% of RN demand and 69% of LPN demand at national levels of care. Without changes in the market dynamics, these shortages are projected to worsen in the future, with shortfalls by 2035 expected to reach 13,800 RNs (supply sufficient to meet about 80% of demand at baseline national levels of care) and 9,200 LPNs (supply sufficient to meet 44% of demand at baseline national levels of care). Supply adequacy appears to vary considerably by county and region of the state, when using addresses in the licensure files to determine nurse county. However, the lack of data on nurse work location hinders making definitive statements about geographic variation in supply adequacy across counties or regions within Maryland. State shortfalls could place additional pressures on provider organizations in areas already struggling to attract and retain nurses. Study findings support Maryland Hospital Association's goals of improving recruitment, training, retention, and the efficient use of Maryland nurses.

As the pandemic is ongoing and much of the data used in the supply and demand models employed in this study are collected with a lag, the long-term impacts of the COVID pandemic are not yet fully quantifiable, so the projections presented in this report cannot fully account for the effects of COVID. While adjustments were made for impacts of COVID on mortality and natality through 2021, many characteristics of the pandemic are not reflected. For example, the 2021 estimates do not capture the spikes in demand for COVID-related care corresponding to spikes in COVID-related infections and hospitalizations. Additionally, the projections do not reflect potential impacts of "long COVID" on future demand for healthcare services or COVID's effect on interest in nursing after pervasive social media postings illustrated the abuse taken by nurses as attitudes toward healthcare workers sour over the course of the pandemic.

## 1.7 Study Strengths and Limitations

The study approach and data used have many strengths. The microsimulation models used to produce the supply and demand projections have been developed and refined for over ten years and have been documented in peer-reviewed journals and presented at national conferences. The results of these models have been trusted for both health workforce and strategic planning by the federal government and state governments, hospitals and health systems, healthcare associations, and other stakeholders.

Where possible, Maryland-specific data sources were used as modeling inputs. For supply modeling, nurse licensure data was obtained from the Maryland Board of Nursing, including information on the base year supply of nurses, and the number and characteristics of new entrants to the workforce. Hours worked patterns were estimated from Maryland nurses who responded to the 2018 NSSRN and 2015-2019 ACS. For demand modeling, Maryland-specific data were used to provide population characteristics (e.g., demographics, disease and health behavior prevalence, and socioeconomic information) by county, as well as information regarding the expected size and demographics of the future population in the state.

The model creates supply and demand projections at the county level, which allows for sub-state analysis of the adequacy of projected nurse supply. Further, the model has the flexibility to adjust modeling assumptions to assess both supply- and demand-side what-if scenarios that reflect possible changes in the nurse labor market that have not yet happened or are not yet quantifiable.

Focus groups were conducted with a diverse group of nurses working in Maryland to provide insights into their experience, especially regarding how COVID is impacting workforce dynamics. As the pandemic is ongoing and much of the data used in the supply and demand models employed in this study are collected with a lag, the impacts of COVID are not yet fully quantifiable. As such, the projections presented in this report cannot fully account for the effects of COVID.

Modeling and projecting into the future involve simplifying assumptions and data limitations that preclude perfect precision in forecasting. Even with careful optimization of models, data, and study approach employed, the results must be interpreted within the context of necessary limitations. Study limitations reflect both data gaps and uncertainty of how care use and delivery patterns as well as nurse career decisions might change in the future. Key limitations are the following:

- **National data was used to fill gaps in Maryland-specific data.** National data sources employed in supply modeling include the ACS and NSSRN datasets, which were used to provide information on nurse retirement, and migration patterns. While responses from Maryland resident nurses were used from these surveys where possible, such as to model hours worked patterns, the small sample size of the Maryland-specific data may limit the reliability of some estimates such as retirement patterns based on this information. National data sources were used for demand modeling to provide information regarding population health care use patterns as well as nurse staffing patterns. To the extent that the Maryland population uses services at a different rate than the national average or Maryland providers staff nurses at levels different from the national average, error may be introduced into Maryland nurse supply and demand projections.

- **Information regarding locations of nurses' places of employment was not available.** The licensure data for Maryland nurses includes an address for each nurse that seems to be a home address instead of where the nurse works. As such, supply is projected largely within the counties where nurses live, with an unknown degree of correlation between where nurses live and work. To the extent that nurses commute to other counties or regions for work, county- and region-level projections of FTEs supplied and supply adequacy are impacted. Likewise, to the extent that Maryland resident nurses commute to other states or the District of Columbia for work, state-level supply and supply adequacy may be impacted (although some of this effect may be offset by nurses living in other states or Washington, DC and working in Maryland).

- **Projections do not account for regional differences in staffing and service delivery.** Results are presented by counties and regions within Maryland, though data limitations necessitated modeling health care use and delivery patterns for the state as a whole. To the extent that care utilization and delivery and/or staffing patterns vary within the state, county and region projections may be impacted. In general, the state-level workforce projections tend to be more accurate than sub-state-level projections.

- **Demand projections model the continuation of baseline levels of healthcare use and delivery patterns.** Projections into the future do not capture shifts in factors such as technological innovations, national or state-level health policies, patient preferences, or payer or provider policies that change the way care is consumed or delivered. In reality, these patterns will continue to evolve over time, but in ways that cannot be known at the time of the modeling. For example, if the pandemic has accelerated the trend of shifting hospital care from inpatient to outpatient settings, any staffing implications due to this acceleration would not be accounted for in the projections reported here. Similarly, increased use of telemedicine services, more rigorous discharge planning and other changes to the way care is delivered due to the pandemic may not factor into the projections. Recently published work on the physician workforce indicates that some components of an evolving care delivery system increase demand for healthcare services (e.g., increased access to care) while other components decrease demand (e.g., increased

emphasis on preventive care and efforts to redirect inpatient care to appropriate ambulatory settings).[16] Thus, the net effect of evolving care delivery on demand might be small.

- **Workforce implications resulting from COVID are still unclear.** The pandemic is still developing and thus it is impossible to know with certainty what workforce implications will arise as a result. COVID may change amounts of demand (e.g., due to increased healthcare needs of people with "long COVID"), and/or affect the way care is delivered (e.g., increased use of telehealth). Likewise, COVID might have long-term implications on nursing supply (e.g., if the public's treatment of nurses during the pandemic made nursing less attractive to potential nurses). The supply scenarios modeled reflecting early and delayed nurse retirement, as well as increased and decreased new graduates, may provide insights into the potential effects of possible long-term pandemic-related changes to retirement and new graduates.

- **The numbers of RNs and LPNs entering the workforce annually are assumed to be constant over the projection period.** The *Status Quo* supply scenario models the implications if the number of nurses entering the workforce remains constant over time. The scenario does not allow for market forces that help correct surpluses and shortages over time. Rather, this scenario helps inform policies to increase the education pipeline of new nurses being trained. If Maryland's nursing shortage becomes too severe relative to national levels, the increased job opportunities could increase the net inflow of nurses from other states.

Despite these limitations, the workforce projections presented offer best estimates given the information available. Understanding that the supply of nurses in Maryland is projected to grow slower than demand for nursing services in the state can inform nurse workforce planning as well as highlight career opportunities for people considering nursing as a career. Nurse workforce modeling aids in determining whether existing workforce programs and policies are producing a sufficient supply of nurses to provide patients with access to high quality care. In light of the limitations described and an ever-changing healthcare system, workforce projections should be updated periodically to use the most current data and other updated information.

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# Appendix: Additional Tables and Maps

**Exhibit 19. Maryland RN Supply, Demand, and Supply Adequacy by Projection Period Year**

| Year | Supply | Demand | Adequacy (#) | Adequacy (%) |
|---|---|---|---|---|
| **2021** | 52,900 | 57,900 | -5,000 | 91% |
| **2022** | 52,400 | 58,700 | -6,300 | 89% |
| **2023** | 52,000 | 59,400 | -7,400 | 88% |
| **2024** | 51,800 | 60,200 | -8,400 | 86% |
| **2025** | 51,800 | 61,000 | -9,200 | 85% |
| **2026** | 51,900 | 61,800 | -9,900 | 84% |
| **2027** | 52,100 | 62,600 | -10,500 | 83% |
| **2028** | 52,200 | 63,400 | -11,200 | 82% |
| **2029** | 52,500 | 64,200 | -11,700 | 82% |
| **2030** | 52,900 | 65,000 | -12,100 | 81% |
| **2031** | 53,300 | 65,800 | -12,500 | 81% |
| **2032** | 53,800 | 66,600 | -12,800 | 81% |
| **2033** | 54,100 | 67,400 | -13,300 | 80% |
| **2034** | 54,600 | 68,100 | -13,500 | 80% |
| **2035** | 55,100 | 68,900 | -13,800 | 80% |

**Exhibit 20. Maryland LPN Supply, Demand, and Supply Adequacy by Projection Period Year**

| Year | Supply | Demand | Adequacy (#) | Adequacy (%) |
|---|---|---|---|---|
| **2021** | 8,700 | 12,700 | -4,000 | 69% |
| **2022** | 8,500 | 12,900 | -4,400 | 66% |
| **2023** | 8,400 | 13,100 | -4,700 | 64% |
| **2024** | 8,300 | 13,400 | -5,100 | 62% |
| **2025** | 8,200 | 13,600 | -5,400 | 60% |
| **2026** | 8,100 | 13,900 | -5,800 | 58% |
| **2027** | 8,000 | 14,100 | -6,100 | 57% |
| **2028** | 7,800 | 14,400 | -6,600 | 54% |
| **2029** | 7,700 | 14,600 | -6,900 | 53% |
| **2030** | 7,600 | 14,900 | -7,300 | 51% |
| **2031** | 7,500 | 15,200 | -7,700 | 49% |
| **2032** | 7,400 | 15,500 | -8,100 | 48% |
| **2033** | 7,300 | 15,800 | -8,500 | 46% |
| **2034** | 7,200 | 16,000 | -8,800 | 45% |
| **2035** | 7,100 | 16,300 | -9,200 | 44% |

**Exhibit 21. Projected Maryland RN Supply and Demand Growth and Adequacy by Scenario**

| Scenario | 2021 | 2035 | Growth | % Growth |
|---|---|---|---|---|
| **Demand** | | | | |
| *Status quo* | 57,900 | 68,900 | 11,000 | 19% |
| *Reduced barriers* | 61,400 | 73,500 | 12,100 | 20% |
| **Supply** | | | | |
| *Status quo* | 52,900 | 55,100 | 2,200 | 4% |
| *10% Fewer Graduates* | 52,900 | 51,900 | -1,000 | -2% |
| *10% More Graduates* | 52,900 | 58,300 | 5,400 | 10% |
| *Early Retirement* (2 years earlier) | 52,900 | 53,900 | 1,000 | 2% |
| *Delayed Retirement* (2 years later) | 52,900 | 56,500 | 3,600 | 7% |
| **Supply Adequacy vs. Status Quo Demand** | | | | |
| *Status quo* | -5,000 | -13,800 | | |
| *10% Fewer Graduates* | -5,000 | -17,000 | | |
| *10% More Graduates* | -5,000 | -10,600 | | |
| *Early Retirement* (2 years earlier) | -5,000 | -15,000 | | |
| *Delayed Retirement* (2 years later) | -5,000 | -12,400 | | |
| **Supply Adequacy vs. Reduced Barriers Demand** | | | | |
| *Status quo* | -8,500 | -18,400 | | |
| *10% Fewer Graduates* | -8,500 | -21,600 | | |
| *10% More Graduates* | -8,500 | -15,200 | | |
| *Early Retirement* (2 years earlier) | -8,500 | -19,600 | | |
| *Delayed Retirement* (2 years later) | -8,500 | -17,000 | | |

**Exhibit 22. Projected Maryland LPN Supply and Demand Growth and Adequacy by Scenario**

| Scenario | 2021 | 2035 | Growth | % Growth |
|---|---|---|---|---|
| **Demand** | | | | |
| *Status quo* | 12,700 | 16,300 | 3,600 | 28% |
| *Reduced barriers* | 13,400 | 17,200 | 3,800 | 28% |
| **Supply** | | | | |
| *Status quo* | 8,700 | 7,100 | -1,600 | -18% |
| *10% Fewer Graduates* | 8,700 | 6,700 | -2,000 | -23% |
| *10% More Graduates* | 8,700 | 7,400 | -1,300 | -15% |
| *Early Retirement* (2 years earlier) | 8,700 | 6,900 | -1,800 | -21% |
| *Delayed Retirement* (2 years later) | 8,700 | 7,300 | -1,400 | -16% |
| **Supply Adequacy vs. Status Quo Demand** | | | | |
| *Status quo* | -4,000 | -9,200 | | |
| *10% Fewer Graduates* | -4,000 | -9,600 | | |
| *10% More Graduates* | -4,000 | -8,900 | | |
| *Early Retirement* (2 years earlier) | -4,000 | -9,400 | | |
| *Delayed Retirement* (2 years later) | -4,000 | -9,000 | | |
| **Supply Adequacy vs. Reduced Barriers Demand** | | | | |
| *Status quo* | -4,700 | -10,100 | | |
| *10% Fewer Graduates* | -4,700 | -10,500 | | |
| *10% More Graduates* | -4,700 | -9,800 | | |
| *Early Retirement* (2 years earlier) | -4,700 | -10,300 | | |
| *Delayed Retirement* (2 years later) | -4,700 | -9,900 | | |

**Exhibit 23. Estimated Maryland RN Supply, Demand, and Supply Adequacy by County and Region (2021)**

| Region | County | RN Supply (2021) | RN Demand (2021) | Adequacy (#) | Adequacy (%) |
|---|---|---|---|---|---|
| Capital | | 14,874 | 20,646 | -5,772 | 72% |
| | Frederick | 2,621 | 2,498 | 122 | 105% |
| | Montgomery | 6,592 | 9,432 | -2,839 | 70% |
| | Prince George's | 5,661 | 8,716 | -3,055 | 65% |
| Central | | 28,690 | 26,352 | 2,338 | 109% |
| | Anne Arundel | 5,248 | 5,517 | -269 | 95% |
| | Baltimore | 9,865 | 8,345 | 1,519 | 118% |
| | Baltimore city | 3,589 | 5,394 | -1,805 | 67% |
| | Carroll | 2,318 | 1,669 | 648 | 139% |
| | Harford | 4,009 | 2,528 | 1,481 | 159% |
| | Howard | 3,661 | 2,897 | 764 | 126% |
| Lower Eastern Shore | | 2,011 | 2,264 | -253 | 89% |
| | Dorchester | 291 | 369 | -78 | 79% |
| | Somerset | 167 | 255 | -88 | 66% |
| | Wicomico | 1,004 | 1,023 | -19 | 98% |
| | Worcester | 550 | 617 | -68 | 89% |
| South | | 2,670 | 3,512 | -842 | 76% |
| | Calvert | 774 | 908 | -135 | 85% |
| | Charles | 1,141 | 1,597 | -456 | 71% |
| | St. Mary's | 755 | 1,006 | -251 | 75% |
| Upper Eastern Shore | | 2,567 | 2,559 | 8 | 100% |
| | Caroline | 264 | 348 | -85 | 76% |
| | Cecil | 1,135 | 1,018 | 117 | 111% |
| | Kent | 148 | 225 | -77 | 66% |
| | Queen Anne's | 591 | 521 | 70 | 114% |
| | Talbot | 430 | 447 | -17 | 96% |
| West | | 2,128 | 2,552 | -424 | 83% |
| | Allegany | 669 | 701 | -31 | 96% |
| | Garrett | 302 | 332 | -30 | 91% |
| | Washington | 1,157 | 1,520 | -362 | 76% |
| Maryland | | 52,940 | 57,885 | -4,944 | 91% |

**Exhibit 24. RN Supply Adequacy by Maryland County, 2021**

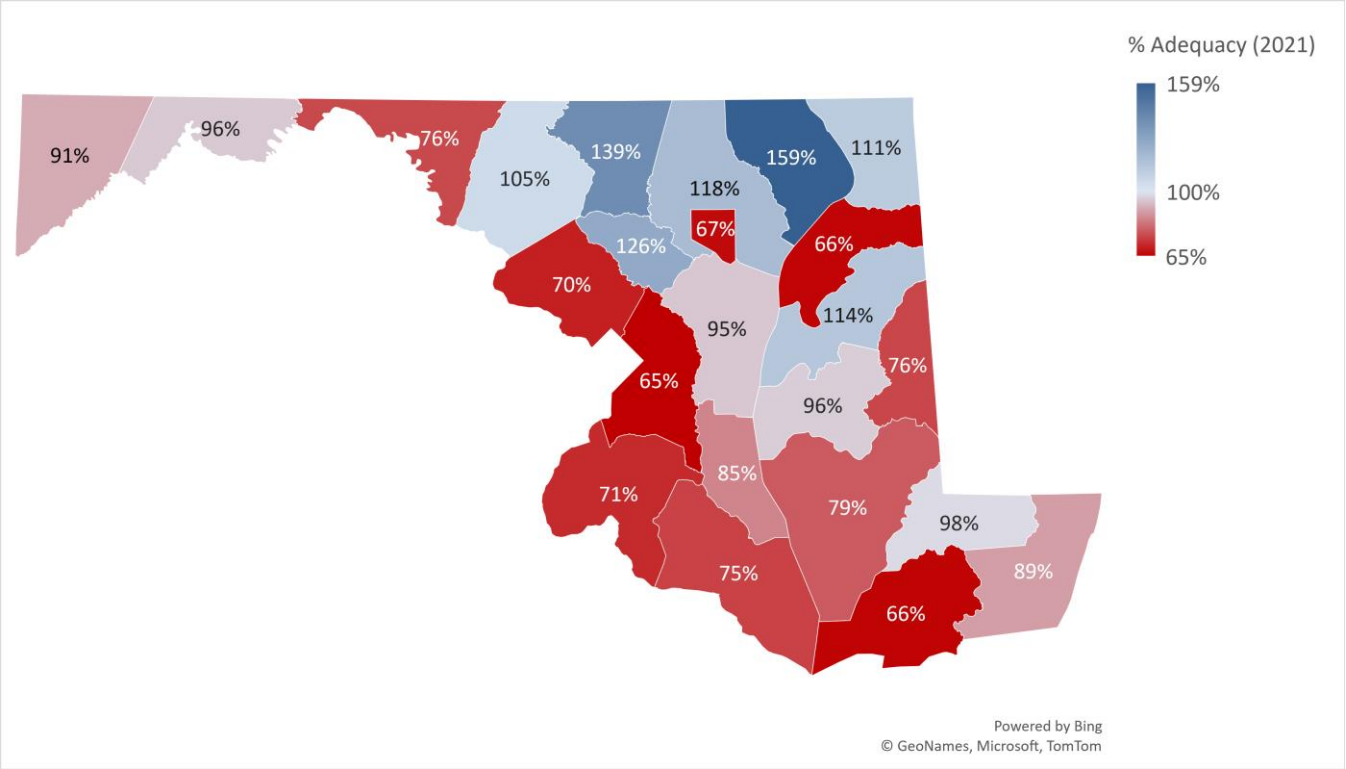

**Exhibit 25. Projected Maryland RN Supply, Demand, and Supply Adequacy by County and Region (2035)**

| Region | County | RN Supply (2035) | RN Demand (2035) | Adequacy (#) | Adequacy (%) |
|---|---|---|---|---|---|
| Capital | | 16,609 | 24,902 | -8,294 | 67% |
| | Frederick | 2,719 | 3,293 | -573 | 83% |
| | Montgomery | 7,739 | 11,260 | -3,521 | 69% |
| | Prince George's | 6,151 | 10,350 | -4,199 | 59% |
| Central | | 29,473 | 30,421 | -947 | 97% |
| | Anne Arundel | 5,569 | 6,423 | -854 | 87% |
| | Baltimore | 9,135 | 9,391 | -257 | 97% |
| | Baltimore city | 5,327 | 5,930 | -603 | 90% |
| | Carroll | 1,961 | 2,052 | -90 | 96% |
| | Harford | 3,723 | 3,051 | 672 | 122% |
| | Howard | 3,758 | 3,573 | 185 | 105% |
| Lower Eastern Shore | | 1,780 | 2,764 | -983 | 64% |
| | Dorchester | 228 | 449 | -221 | 51% |
| | Somerset | 158 | 297 | -139 | 53% |
| | Wicomico | 947 | 1,264 | -317 | 75% |
| | Worcester | 448 | 754 | -307 | 59% |
| South | | 2,773 | 4,565 | -1,792 | 61% |
| | Calvert | 764 | 1,107 | -343 | 69% |
| | Charles | 1,234 | 2,132 | -898 | 58% |
| | St. Mary's | 776 | 1,327 | -551 | 58% |
| Upper Eastern Shore | | 2,279 | 3,250 | -971 | 70% |
| | Caroline | 227 | 455 | -228 | 50% |
| | Cecil | 1,106 | 1,315 | -209 | 84% |
| | Kent | 122 | 280 | -158 | 43% |
| | Queen Anne's | 476 | 673 | -197 | 71% |
| | Talbot | 349 | 528 | -178 | 66% |
| West | | 2,159 | 3,032 | -873 | 71% |
| | Allegany | 662 | 769 | -107 | 86% |
| | Garrett | 317 | 383 | -66 | 83% |
| | Washington | 1,180 | 1,880 | -700 | 63% |
| Maryland | | 55,074 | 68,934 | -13,861 | 80% |

**Exhibit 26. RN Supply Adequacy by Maryland County, 2035**

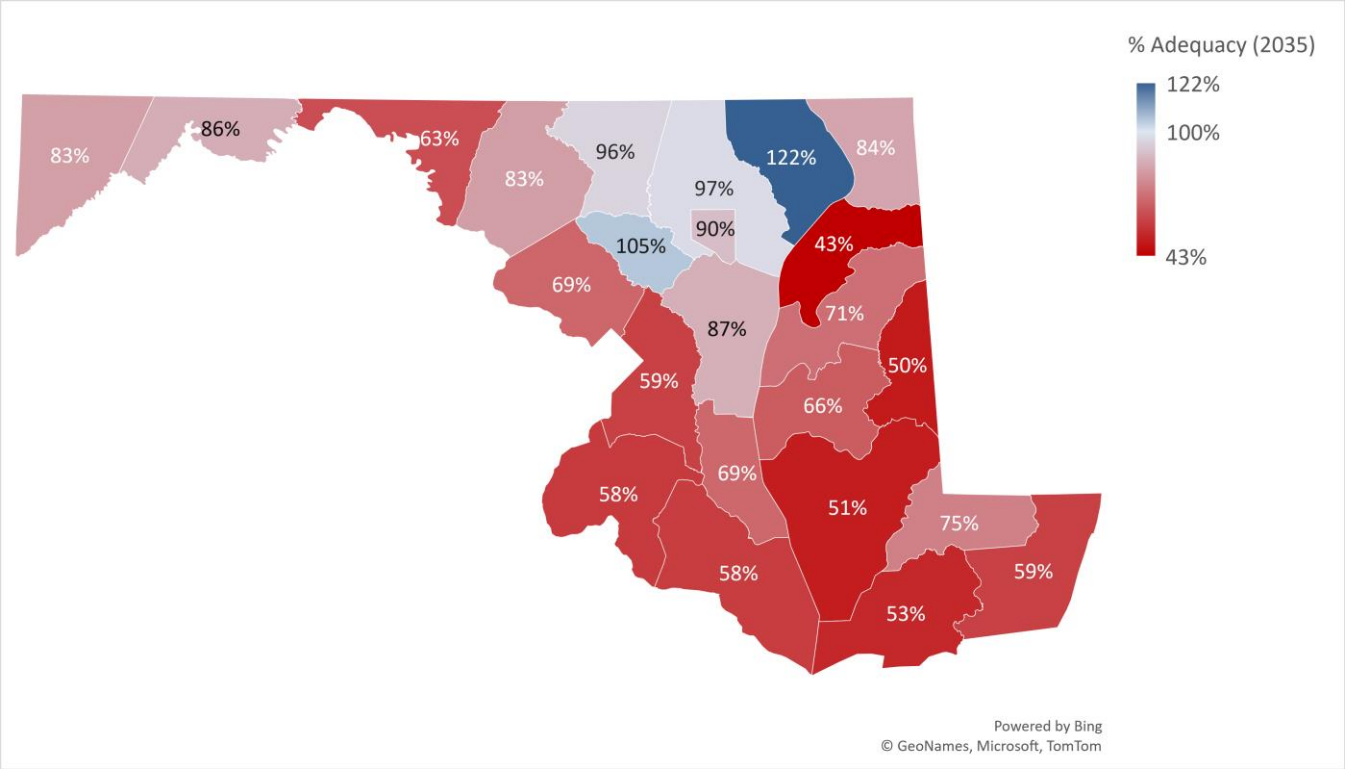

**Exhibit 27. Estimated Maryland LPN Supply, Demand, and Supply Adequacy by County and Region (2021)**

| Region | County | LPN Supply (2021) | LPN Demand (2021) | Adequacy (#) | Adequacy (%) |
|---|---|---|---|---|---|
| Capital | | 3,440 | 4,472 | -1,032 | 77% |
| | Frederick | 295 | 552 | -257 | 53% |
| | Montgomery | 1,099 | 2,158 | -1,059 | 51% |
| | Prince George's | 2,047 | 1,762 | 284 | 116% |
| Central | | 3,693 | 5,795 | -2,102 | 64% |
| | Anne Arundel | 652 | 1,196 | -543 | 55% |
| | Baltimore | 1,499 | 1,892 | -393 | 79% |
| | Baltimore city | 591 | 1,144 | -554 | 52% |
| | Carroll | 243 | 380 | -137 | 64% |
| | Harford | 341 | 557 | -216 | 61% |
| | Howard | 367 | 626 | -259 | 59% |
| Lower Eastern Shore | | 352 | 516 | -165 | 68% |
| | Dorchester | 53 | 84 | -31 | 63% |
| | Somerset | 54 | 57 | -3 | 95% |
| | Wicomico | 177 | 223 | -46 | 79% |
| | Worcester | 68 | 153 | -85 | 45% |
| South | | 386 | 741 | -355 | 52% |
| | Calvert | 82 | 199 | -117 | 41% |
| | Charles | 201 | 324 | -123 | 62% |
| | St. Mary's | 103 | 218 | -115 | 47% |
| Upper Eastern Shore | | 314 | 574 | -261 | 55% |
| | Caroline | 47 | 73 | -26 | 64% |
| | Cecil | 169 | 220 | -51 | 77% |
| | Kent | 27 | 54 | -26 | 51% |
| | Queen Anne's | 40 | 119 | -79 | 33% |
| | Talbot | 30 | 108 | -78 | 28% |
| West | | 525 | 593 | -68 | 89% |
| | Allegany | 147 | 169 | -22 | 87% |
| | Garrett | 65 | 74 | -9 | 88% |
| | Washington | 313 | 350 | -37 | 89% |
| Maryland | | 8,709 | 12,692 | -3,982 | 69% |

**Exhibit 28. LPN Supply Adequacy by Maryland County, 2021**

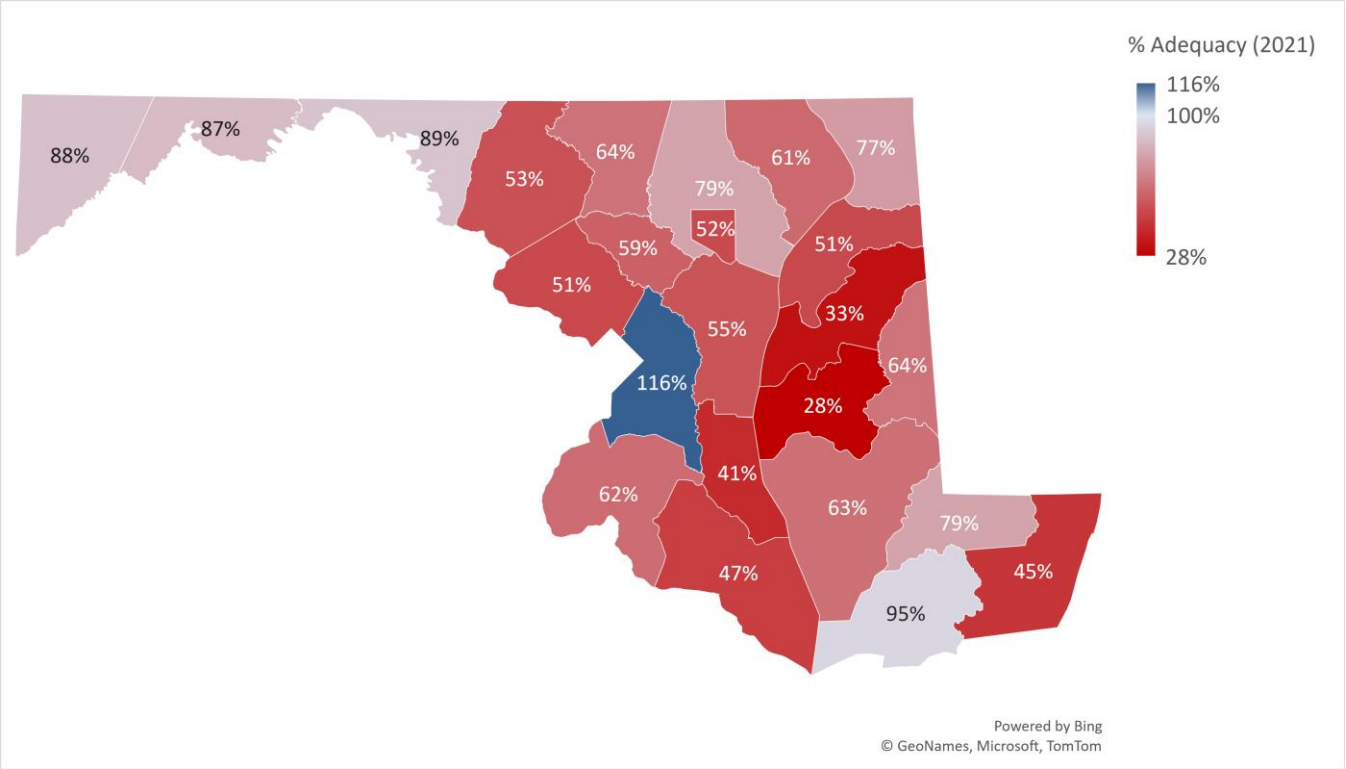

**Exhibit 29. Projected Maryland LPN Supply, Demand, and Supply Adequacy by County and Region (2035)**

| Region | County | LPN Supply (2035) | LPN Demand (2035) | Adequacy (#) | Adequacy (%) |
|---|---|---|---|---|---|
| Capital | | 2,394 | 5,905 | -3,511 | 41% |
| | Frederick | 241 | 795 | -553 | 30% |
| | Montgomery | 833 | 2,780 | -1,947 | 30% |
| | Prince George's | 1,320 | 2,330 | -1,010 | 57% |
| Central | | 3,199 | 7,180 | -3,981 | 45% |
| | Anne Arundel | 553 | 1,499 | -946 | 37% |
| | Baltimore | 1,309 | 2,236 | -927 | 59% |
| | Baltimore city | 558 | 1,310 | -752 | 43% |
| | Carroll | 195 | 530 | -335 | 37% |
| | Harford | 270 | 738 | -468 | 37% |
| | Howard | 315 | 867 | -553 | 36% |
| Lower Eastern Shore | | 331 | 667 | -336 | 50% |
| | Dorchester | 27 | 108 | -82 | 25% |
| | Somerset | 45 | 70 | -25 | 64% |
| | Wicomico | 178 | 291 | -113 | 61% |
| | Worcester | 81 | 197 | -116 | 41% |
| South | | 310 | 1,046 | -736 | 30% |
| | Calvert | 66 | 268 | -202 | 25% |
| | Charles | 150 | 465 | -314 | 32% |
| | St. Mary's | 93 | 313 | -220 | 30% |
| Upper Eastern Shore | | 277 | 784 | -508 | 35% |
| | Caroline | 35 | 99 | -63 | 36% |
| | Cecil | 172 | 311 | -138 | 56% |
| | Kent | 17 | 72 | -54 | 24% |
| | Queen Anne's | 29 | 168 | -139 | 17% |
| | Talbot | 23 | 135 | -113 | 17% |
| West | | 572 | 742 | -170 | 77% |
| | Allegany | 174 | 194 | -20 | 90% |
| | Garrett | 90 | 92 | -2 | 98% |
| | Washington | 309 | 457 | -148 | 68% |
| Maryland | | 7,082 | 16,324 | -9,241 | 43% |

**Exhibit 30. LPN Supply Adequacy by Maryland County, 2035**