*VT Health Care Innovation Project*
*Health Care Workforce Work Group Meeting Agenda*
**Wednesday, May 17th, 2017; 3:00-5:00pm**
**WSOC Oak Conference Room, 280 State Drive, Waterbury, VT**

<mark>**This meeting will be held as a webinar and will not utilize the standard conference line. Please pre-register using the link below. After registering you will receive a confirmation email containing information about joining the webinar. If you are planning on attending the meeting in person, please RSVP Sarah Kinsler at Sarah.Kinsler@vermont.gov by Monday, May 15th.**</mark>

**Click HERE for webinar link**

| Item # | Time Frame | Topic | Presenter | Decision Needed? (Y/N) | Relevant Attachments |
|---|---|---|---|---|---|
| 1 | 3:00-3:05 | Welcome and Introductions | Mary Val Palumbo | N | • Attachment 1: 5-17-17 Meeting Agenda |
| 2 | 3:05-3:10 | Approval of Meeting Minutes | Mary Val Palumbo | Y | • Attachment 2: 2-22-17 Meeting Minutes |
| 3 | 3:10-3:20 | Updates:<br>- VDH provider reports on website<br>- SIM/post-SIM updates updates<br>- Other updates? | Mary Val Palumbo<br>Georgia Maheras<br>Group Discussion | N | |
| 4 | 3:20-4:10 | Presentation and Discussion: Draft Vermont Health Care Work Force Demand Modeling Report | Terry West, IHSMarkit<br>Tim Dall, IHSMarkit<br>Will Iaccobucci, IHSMarkit<br>Group Discussion | N | • Attachment 4a - Demand Modeling Projections Presentation<br>• Attachment 4b – DRAFT Demand Modeling Projections Report |
| 5 | 4:10-4:55 | Discussion: Mental Health/Substance Abuse Work Force<br>- Debrief from Governor's Summit on 4-17-17<br>- Next Steps for WFWG | Group Discussion | N | |
| 6 | 4:55-5:00 | Public Comment/Wrap Up/Next Steps | | N | |

# Attachment 2: Meeting Minutes, February 22, 2017

## *Vermont Health Care Innovation Project*
## *Health Care Work Force Work Group Meeting Minutes*

## *Pending Work Group Approval*

**Date of meeting:** Wednesday, February 22, 2017, 3:00-5:00pm, Oak Conference Room, Waterbury State Office Complex.

| Agenda Item | Discussion | Next Steps |
|---|---|---|
| **1. Welcome and Introductions** | Mary Val Palumbo called the meeting to order at 3:03. A roll-call attendance was taken and a quorum was present. | |
| **2. Approval of Meeting Minutes** | Charlie McLean moved to approve minutes from the December 2016 meeting by exception. Peggy Brozicevic seconded. The minutes were approved with no abstentions. | |
| **3. Updates: - Work group status update (role of work group in future, co-chair update) - Administration update - Others** | Georgia Maheras provided updates:<br>• The State has a new Director of Health Care Reform, Mary Kate Mohlman, who was previously a Health Services Researcher at the Blueprint for Health. The Office of Health Care Reform has also moved to the Agency of Human Services. The Executive Order that established this work group is still in force; the Administration is working to identify a new co-chair for this group.<br>• The Governor's inaugural address suggested a significant focus on substance use disorder and mental health services, as well as the new risk-based ACO contract through Medicaid, both of which move toward a whole-person, integrated care model across the care continuum. Work force and the economy are also priorities of Governor Scott.<br><br>Discussion:<br>• Does this group still report to both the Governor and the SIM project? Yes.<br>• Is there a date or deadline to present the Work Force Strategic Plan to the Green Mountain Care Board? Pat Jones and Melissa Miles will discuss this internally and report back.<br>Updates:<br>• Charlie McLean noted that the AHEC 5-year renewal grant is due next month, and includes a planned restructuring from 3 centers to 2 centers to support efficiency (though programming will not change), likely to start in the fall.<br>• John Olson noted that VDH has a number of grants in process. Re-licensure surveys are going smoothly. | |

| Agenda Item | Discussion | Next Steps |
|---|---|---|
| **4. Presentation and Discussion: All Payer Model, ACO-based health reforms** | Pat Jones and Melissa Miles presented on the All-Payer Model (Attachment 4).<br>• Accountable Care Organizations (ACOs): Provider-led organizations that work together to be accountable for quality and cost for a defined population. Provider participation in ACOs is voluntary, as is ACO participation in contracts with payers.<br>• All-Payer Model (APM) : Three major payers (Medicare, Medicaid, and commercial) will pay the ACO differently than through fee-for-service, so the ACO is accountable for cost as well as quality of care. Builds on the Blueprint for Health patient-centered medical home program, as well as the Vermont Medicaid and commercial Shared Savings Programs (SSPs). The APM aligns incentives across major payers, and pays prospectively, providing a predictable revenue source to allow for flexibility and investments to keep people healthy.<br>• APM Goals:<br>   o Financial: All-payer cost growth under 3.5% per year, Medicare at least 0.1-0.2% below national growth trend (per capita). This recognizes that Vermont is already a low-cost Medicare state, compared to others nationally.<br>   o Scale: Grow to 70% of all Vermonters and 90% of Vermont Medicaid beneficiaries by Performance Year 5 (2022). (Currently: ~55-65% of Vermonters under Blueprint and SSPs.)<br>   o Quality: Three overarching population health goals: 1) Improving access to primary care; 2) Reducing deaths from suicide and drug overdose; 3) Reducing prevalence and morbidity of chronic disease (COPD, diabetes, hypertension). These are well aligned with our State Health Improvement Plan. The quality framework includes 20 measures to support improvement in these goals, and aligns with measurement activities already underway to limit reporting burden, especially for primary care providers.<br>   o Note: No financial penalties if Vermont fails to meet these goals (though there is down-side risk for the ACO if ACO-specific financial targets are not met). Vermont isn't required to meet all of the targets in every area.<br>• APM Implementation: After signing the agreement, the next step is for the ACOs and payers to work together to develop ACO-level agreements, then for ACOs and providers to move toward delivery system implementation (establish ACO/provider agreements, improve care coordination and quality, meet scale targets).<br>   o DVHA recently signed a Medicaid ACO contract with OneCare Vermont for participation in a Vermont Medicaid Next Generation ACO program, which builds on the Medicaid SSP.<br>   o GMCB is responsible for regulatory implementation. Act 113 requires GMCB to certify ACOs, including review of ACO budgets and rate setting. GMCB is working to create an integrated regulatory approach across ACO regulation, hospital budgets, and more.<br>• This agreement provides flexibility that could cover currently non-billable services and provider types, and support innovative work force arrangements. It also continues funding for Medicare's contributions to the Blueprint and SASH programs for 2017 (they will be built into ACO payments starting in 2018). | ==Pat will share the APM quality measure specifications to this group.== |

| Agenda Item | Discussion | Next Steps |
|---|---|---|
| | Discussion: <br><br> • Are Medicare growth trend goals achievable for Vermont, as an already low-cost state? The State negotiated very hard on this item, understanding that dynamic – we want this target to be attainable. This goal is based on several years of actuarial modeling. <br><br> • Are ACOs accountable for their members' out of state expenses? Yes, but only if they fall within the services included in the total cost of care (roughly Medicare Part A and Part B-type services). Excluded services include prescriptions, for example. Molly Backup noted that this is a particular challenge for snowbirds. <br><br> • How is patient-reported data collected? Phone and mail surveys, like Behavioral Risk Factor Surveillance Survey (BRFSS – administered by VDH) or the Consumer Assessment of Healthcare Providers and Systems survey (CAHPS – administered by the ACO). <br><br> • How are the population health goals being worked on within State government? VDH is doing a lot of work to collect data and establish programs to improve results – but this effort incudes all of State government (including VDH, GMCB, DVHA, and others), providers, private payers, and others. <br><br> • Is there a target for participation in the prescription drug monitoring program? This is one of two measures without targets yet (the other is reductions in MH/SA ED visits) – data collected since last fall will support negotiations on these targets later this year. Molly noted that State law now requires all providers to use the Vermont Prescription Monitoring System for all opioid prescriptions. <br><br> • Asthma Medication Management measure: Molly observed that asthma among her patients tends to be more episodic and less severe than in many other places. She suggested that a measure like this should be specific to more severe cases where regular medication (rather than occasional medication as needed) is beneficial. Pat will share the measure specifications with the group. <br><br> • For Vermont Medicaid Next Generation Program: The Medicaid contract works to align as closely as possible with the Medicare services (Part A and B services) included in the APM agreement. Excludes services provided by non-DVHA AHS departments. Attribution for the pilot year is ~29,000 with primary care relationships in the initial four communities, and excludes dual eligibles, members with third party coverage, members with limited benefit packages, and members without any qualifying utilization in the two-year baseline period. <br><br> • Measure alignment to decrease provider burden is a key goal. In negotiations, we specifically argued for measures already being collected that support the high-level goals of this agreement, or that are based on claims data. However, many of these measures still sit with primary care. There are some cross-organization measures (e.g., ED follow-up), but most measurement development activity has been primary care-focused. <br><br> • The LADC issue (ie. Medicare covering MH/SUD services) is something that we want to discuss with CMS. Medicare does not currently allow for this because of the credentialing issue. Rick Barnett noted that there is another subset of providers that can bill for these services for Medicare already. That other work | |

| Agenda Item | Discussion | Next Steps |
|---|---|---|
| | force group, which is pretty substantial, can do this already.  Probably 500 providers in this state would be impacted by allowing this. Melissa: We are going to pursue this waiver.<br>• Is the data broken down by area? While we want to meet the standards for the whole state, maybe we want to focus on the areas that are further from the target to start with, to raise everyone up.<br>• Charlie commented that much of the strategic direction needs to come from the ACO, and emphasized that quality improvement is slow and requires continuous effort to product impactful change.<br>• Mary Val asked how providers know what their work force should look like? Until we have some high-performing examples to hold up, this is hard to move forward. We may not have the provider skills needed to do this work in a new way. Pat noted that the State has worked with the ACO to produce some new tools to support this work, and has given providers around the state a chance to test these tools out in learning collaborative settings; the ACO has indicated it hopes to continue this work. We are asking what would be helpful to practices on the ground, and encouraging the ACO to try to meet these needs. Georgia commented that Vermont has historically used incentives rather than penalties to motivate providers to change, and that the State would appreciate any thoughts about how to best balance these.<br>• Relationships between providers and ACO will be key – they will define which measures providers are responsible for, define what data providers will get and when, and more. Some measures will always be annual (i.e., BRFSS-based measures), but the bulk of claims runout is done within 3 months (appropriate for monitoring, though not for payment). It will be up to the ACO to provide this, in partnership with GMCB, and they have been making investments in analytics to support this.<br>• Mary Val asked who is measuring deaths by suicide and overdose and ED follow-up now, and suggested this might link to findings in the micro-simulation demand model that suggests we may need fewer ED nurses in the future. Pat noted that the ED measure is a claims-based measure – but this will be driven by delivery system reforms that change work force or workflow to increase follow-up rates. Molly noted that this measure ties into funding and work force issues in other parts of the system that are outside the ACO, like the Designated Agencies and others. These providers were excluded in part due to historic underfunding, to avoid putting underfunded providers within a financial cap that limits growth.<br>• Rick noted that despite major investments in opioid treatment over the past few years, overdose deaths are increasing. Pat agreed, and commented that we may not have reached the height of this epidemic. Preventing overdose deaths is complicated – overdoses are most common for new users or those who relapse, and this is hard to measure and target. Pat noted that Vermont's small size means that one bad batch of heroin can have a significant impact on the ability to meet this measure. | |
| **5. Discussion: Micro-Simulation Demand Modeling** | This agenda item was postponed for the next meeting. An update from IHS is expected in April, and will include a new scenario that includes lower chronic disease morbidity and longer lives, and the impact on work force needs. The April discussion will also include more discussion around mental health and substance use. | |
| **6. Public Comment** | There was no public comment. | |

| Agenda Item | Discussion | Next Steps |
|---|---|---|
| **7. Next Steps, Wrap Up and Future Meeting Schedule** | **Next Meeting:** Wednesday, April 26, 2017 – 3:00-5:00pm; Waterbury, VT | |

**Vermont Health Care Work Force Work Group: membership and delegate list**

*Updated 02.01.17*

① Charlie MacLean
② Peggy Brozicevic

| Member name | Contact Information | Delegate name (if any) | Delegate contact information |
|---|---|---|---|
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John Olson
Jessica Moore

# Attachment 4a:
# Demand Modeling Projections Presentation

# STUDY FINDINGS AND MODELING RESULTS

**Prepared for: Governor's Health Care Work Force Work Group**

# Vermont's Health Workforce: Demand Modeling

May 17, 2017                                                                                                    ihsmarkit.com

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# Meeting Agenda

- Vermont health workforce study goals and objectives

- Review of microsimulation demand modeling methods

- Vermont population and service demand projections

- Vermont health workforce demand projections

  - Physician FTE demand projections

  - Registered nurse, advanced practice nurse and physician assistant demand projections

  - Other health workforce demand projections

- Review scenarios modeling select components of a high-performing Vermont healthcare system

  - Methods and findings for new "population health" scenario

- Vermont demand modeling observations and implications

- Project next steps

# Study Goals and Objectives

- Model and analyze demand for Vermont's health workforce to inform State and local policy and planning

- Quantify current and future demand for health professions through 2030 statewide and by HSA and care setting under alternative scenarios reflecting:

  - Population characteristics and prevalence of disease/health risk factors

  - Changing healthcare market factors (e.g., greater integration of care delivery, emerging care models) and other trends

  - System redesign and changes in care delivery of interest to Vermont stakeholders (e.g., team-based care, evidence-based chronic disease management)
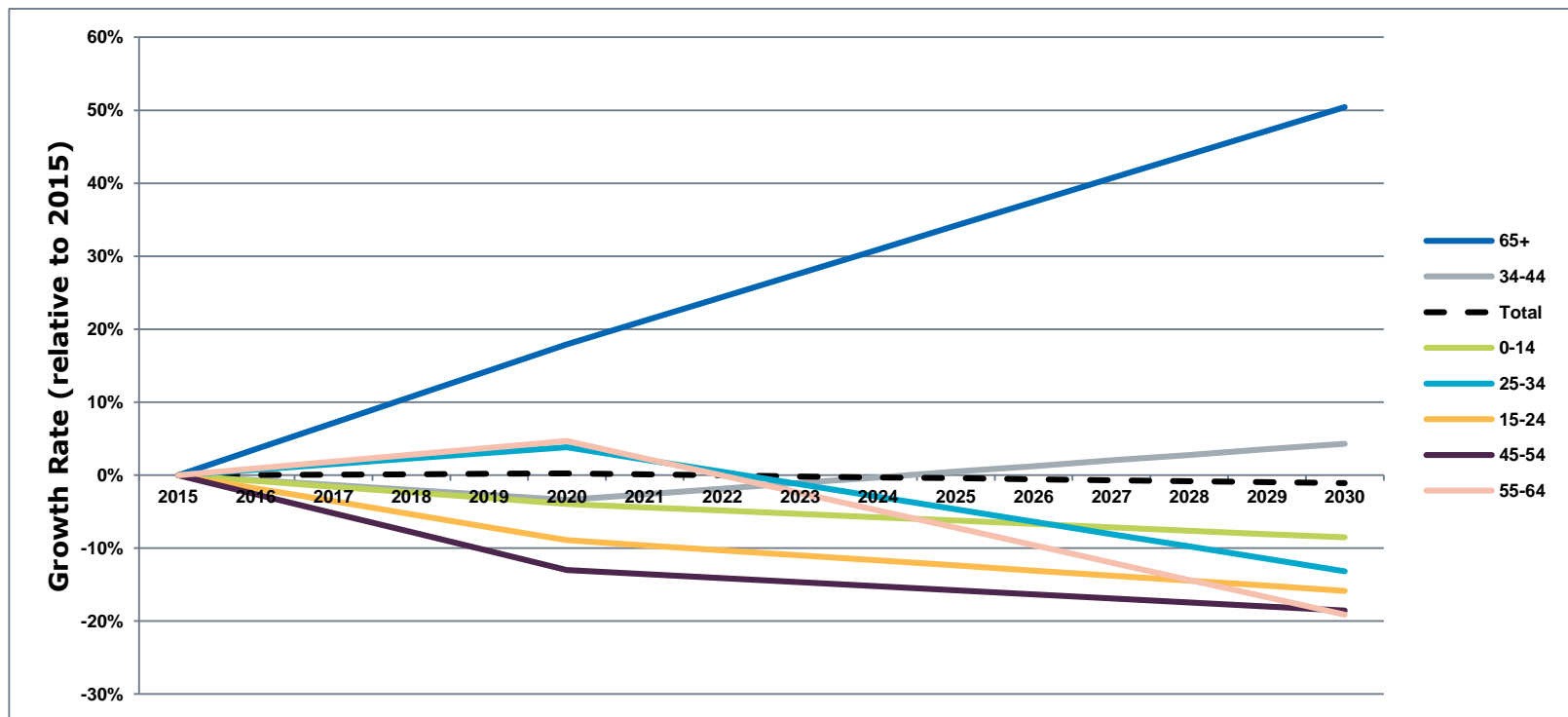
# Health Workforce Model
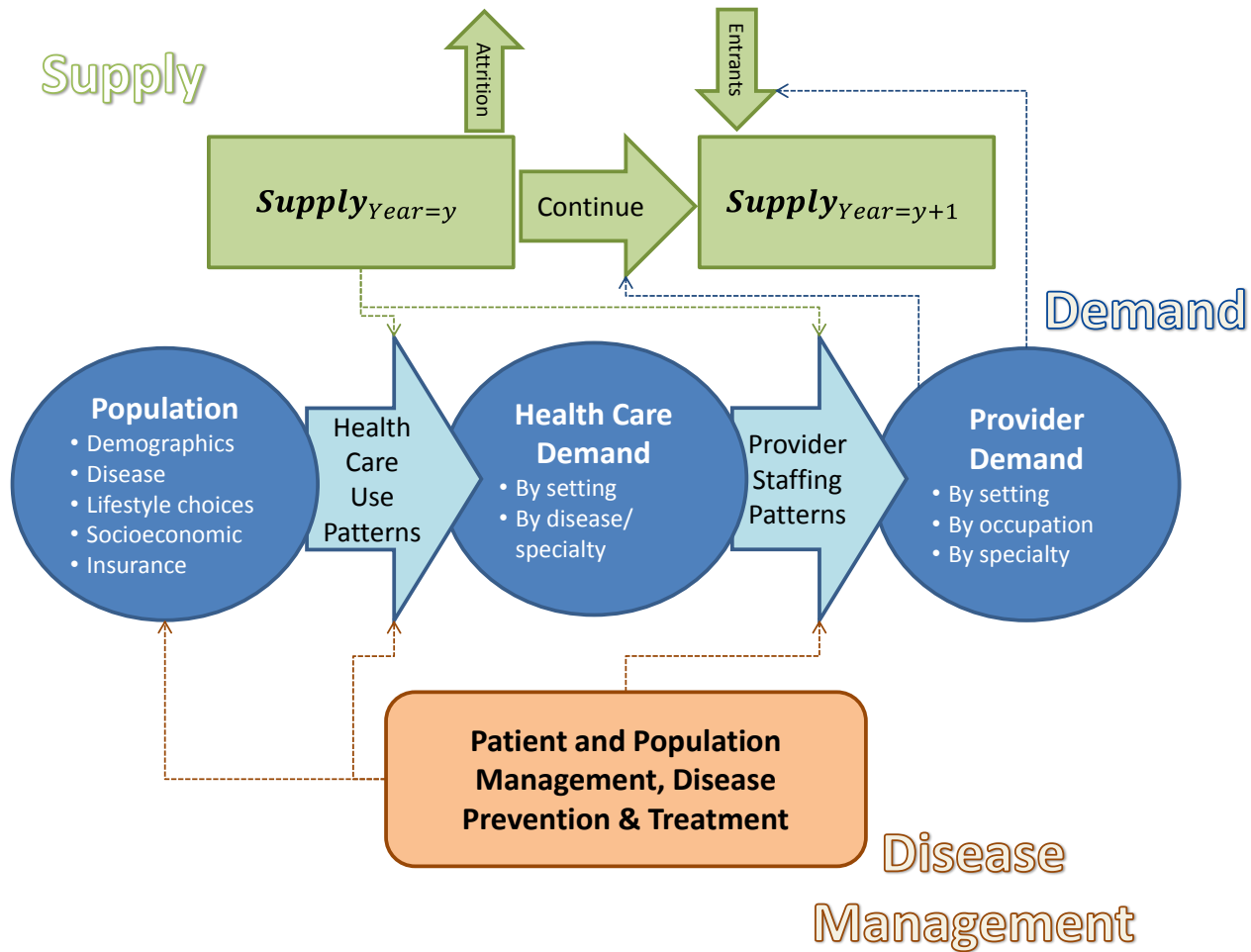
# Health Care Demand Modeling Data Sources

- Updated demand projections include data from the following sources:

  - US Census Bureau's American Community Survey (ACS): The latest ACS data include person-level demographic information about Vermont residents

  - Population projections from the Vermont Department of Labor

  - The Agency for Health Research Quality's Medical Expenditure Panel Survey (MEPS)

  - Vermont Behavioral Risk Factor Surveillance System (BRFSS)

  - Vermont Uniform Hospital Discharge Data Set (VHUDDS): Information from VUHDDS informs modeling assumptions surrounding Vermont health care use in hospital settings

  - Vermont Health Care Uniform Reporting and Evaluation System (VHCURES): Information from VHCURES informs modeling assumptions surrounding Vermont health care use in outpatient and physician office settings
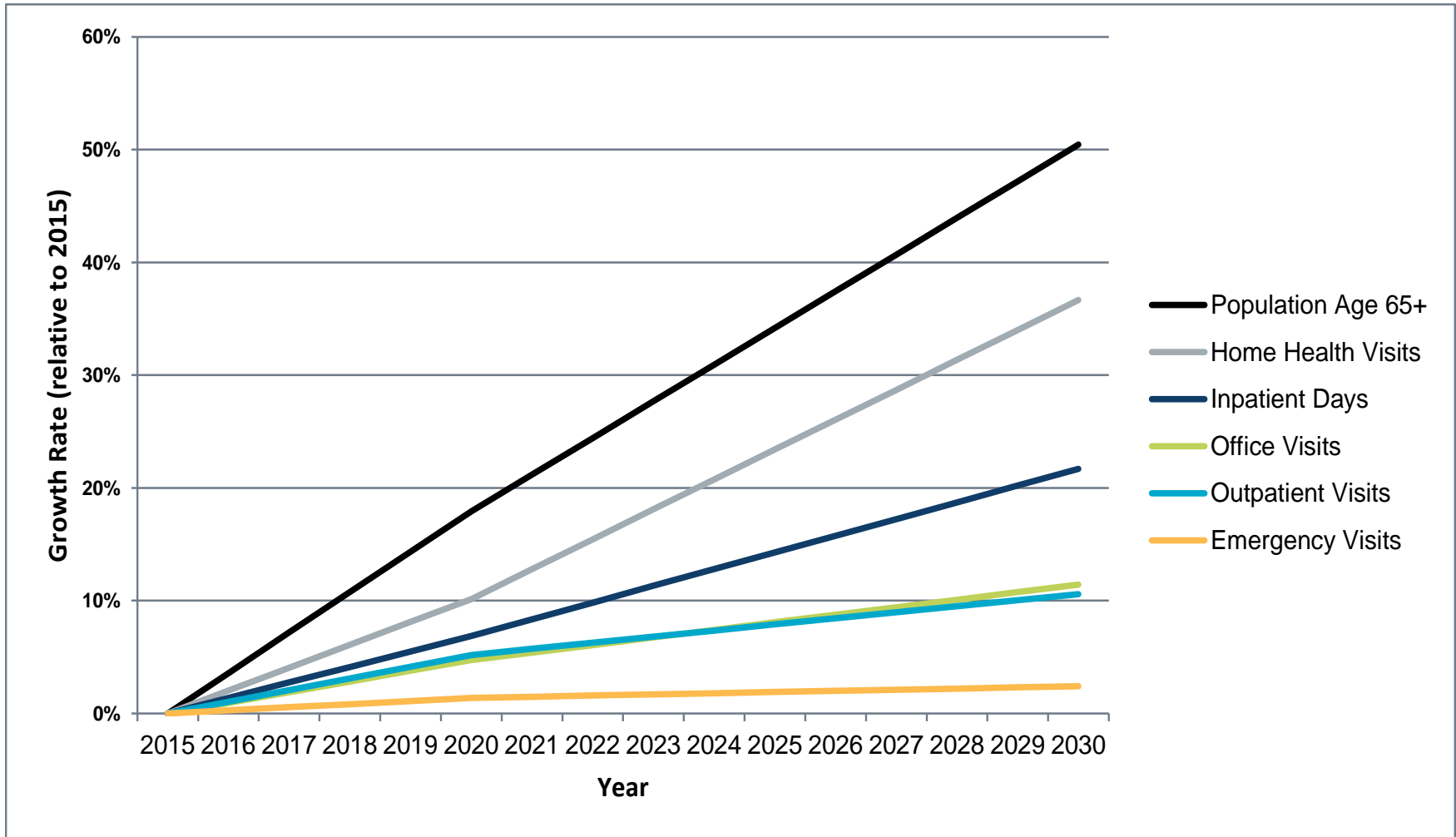
# Summary of Health Workforce Study Findings

**Population aging is the primary driver of projected Vermont health care service and workforce demand growth**

- State population projected to decline -0.9% by 2030, but grow 50% in the population age sixty-five and older-driving demand for care

# Projected Growth in Vermont Service Demand by Care Setting

# Summary of Health Workforce Study Findings

- **Despite overall population declines physician demand will grow**

  - Under current care delivery patterns demand is projected to grow by 210 FTEs (13%) by 2030, due largely to population aging

| Physician Specialty Category | 2015 | 2020 | 2025 | 2030 | Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| **Primary Care** | 707 | 733 | 755 | 776 | 69 | 10% |
| **Medical Specialties** | 237 | 256 | 273 | 290 | 53 | 22% |
| **Surgical Specialties** | 258 | 276 | 289 | 303 | 45 | 17% |
| **Other** | 412 | 430 | 441 | 453 | 41 | 10% |
| **Vermont Total** | **1,613** | **1,694** | **1,759** | **1,823** | **210** | **13%** |

# Physician Demand by Vermont Hospital Service Area (2030)
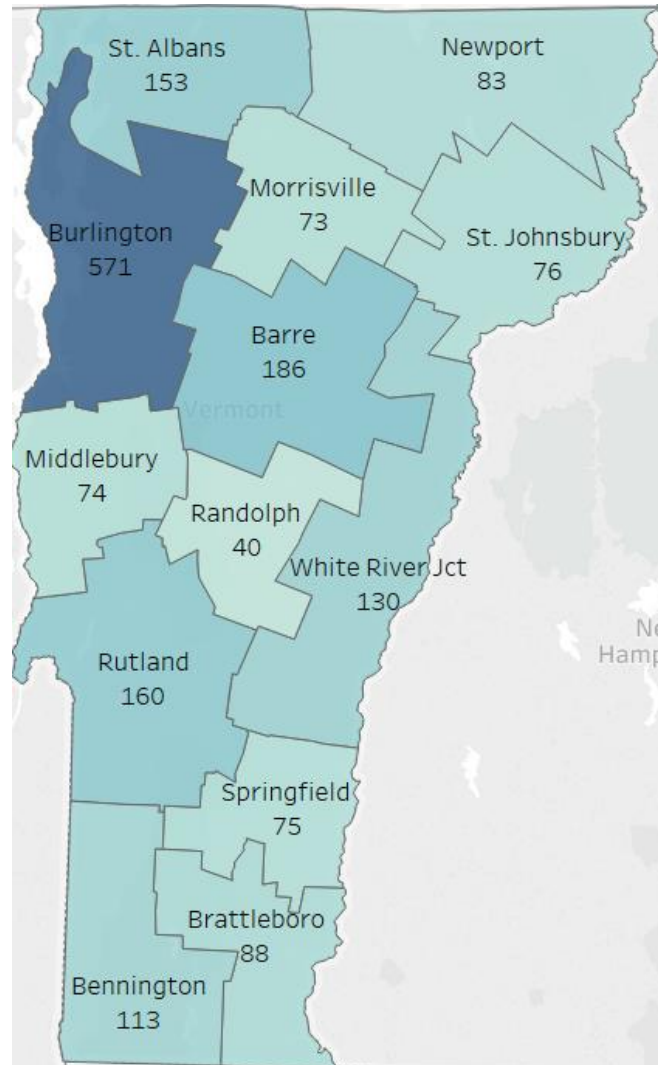
# Summary of Health Workforce Study Findings

- **By 2030 statewide demand for RNs will grow by about 1,421 FTEs (22%)**

  - Highest growth rates in nursing homes and residential care (69%);highest absolute growth in hospitals (784 FTEs) and nursing homes (267 FTEs)

| Care Setting | 2015 | 2020 | 2025 | 2030 | Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| **Office** | 477 | 500 | 516 | 532 | 55 | 12% |
| **Outpatient** | 228 | 240 | 246 | 252 | 24 | 11% |
| **Emergency** | 540 | 547 | 550 | 553 | 13 | 2% |
| **Inpatient** | 3,614 | 3,862 | 4,131 | 4,398 | 784 | 22% |
| **Home Health** | 534 | 595 | 675 | 755 | 221 | 41% |
| **Nursing Home** | 385 | 425 | 539 | 652 | 267 | 69% |
| **Residential Care** | 119 | 131 | 166 | 201 | 82 | 69% |
| **School** | 158 | 150 | 146 | 141 | -17 | -11% |
| **All Other** | 407 | 408 | 404 | 400 | -7 | -2% |
| **Vermont Total** | **6,462** | **6,858** | **7,372** | **7,883** | **1,421** | **22%** |

# Projected Growth in Vermont <u>Advanced Practice Nurse</u> (APN) FTE Demand by Profession

| APN Category | 2015 | 2020 | 2025 | 2030 | Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| **Nurse Practitioners** | **379** | **395** | **410** | **424** | **45** | **12%** |
| Primary Care | 236 | 244 | 252 | 259 | 23 | 10% |
| Medical Specialties | 54 | 58 | 62 | 66 | 12 | 22% |
| Surgical Specialties | 19 | 21 | 22 | 23 | 4 | 21% |
| Other | 71 | 72 | 74 | 76 | 5 | 7% |
| **CRNAs** | **109** | **117** | **122** | **128** | **19** | **17%** |
| **Nurse Midwives** | **30** | **29** | **28** | **27** | **-3** | **-10%** |
| **Vermont APN Total** | **518** | **541** | **560** | **580** | **62** | **12%** |

# Projected Growth in Vermont <u>Physician Assistant (PA)</u> FTE Demand by Specialty Category

| PA Specialty Category | 2015 | 2020 | 2025 | 2030 | Growth, 2015–2030 | % Growth, 2015–2030 |
|---|---|---|---|---|---|---|
| **Primary Care** | 108 | 112 | 116 | 120 | 12 | 11% |
| **Medical Specialties** | 32 | 35 | 37 | 40 | 8 | 25% |
| **Surgical Specialties** | 49 | 52 | 54 | 56 | 7 | 14% |
| **Other** | 48 | 49 | 50 | 51 | 3 | 6% |
| **Vermont Total** | **236** | **248** | **257** | **266** | **30** | **13%** |

# Summary of Health Workforce Study Findings

- **Demand for many other Vermont health professions modeled also will grow faster than overall projected population growth**

| Profession | 2015 | 2020 | 2025 | 2030 | Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| **Diagnostic Services** | | | | | | |
| Medical sonographers | 129 | 137 | 145 | 153 | 24 | 19% |
| Medical & clinical lab technicians | 355 | 377 | 399 | 422 | 67 | 19% |
| Medical & clinical lab technologists | 358 | 380 | 403 | 425 | 67 | 19% |
| Nuclear medicine technologists | 26 | 29 | 31 | 34 | 8 | 31% |
| Radiologic Technologists | 96 | 106 | 115 | 124 | 28 | 29% |
| **Direct Care Services** | | | | | | |
| Home health aides | 1,549 | 1,728 | 1,958 | 2,187 | 638 | 41% |
| Nurse aides | 2,710 | 2,942 | 3,467 | 3,991 | 1,281 | 47% |
| **Pharmacy Services** | | | | | | |
| Pharmacists | 397 | 416 | 429 | 441 | 44 | 11% |
| Pharmacy Technicians | 484 | 509 | 526 | 543 | 59 | 12% |
| Pharmacy Aides | 57 | 61 | 63 | 65 | 8 | 14% |
| **Vision Services** | | | | | | |
| Optometrists | 98 | 99 | 99 | 98 | 0 | 0% |
| Opticians | 153 | 155 | 154 | 154 | 1 | 1% |
| **Other Professions** | | | | | | |
| Dentists | 323 | 329 | 330 | 330 | 7 | 2% |
| Dietitians | 146 | 153 | 163 | 173 | 27 | 18% |
| Podiatrists | 20 | 22 | 24 | 27 | 7 | 35% |

# Modeling Components of a High Performing Vermont Health Care System

- Scenarios model future workforce demand implications of changing care use and delivery patterns, including effects of:

  - **Greater use of integrated care delivery models**

    - Impacts include increased demand for primary care physicians and surgical specialties and decreased demand for medical and other specialties

  - **Expanded access to mental health/substance use services through integrated team-based care**

    - Impacts include increased demand for clinical social workers and care managers in PCMH settings and lower demand for inpatient and ED nurses

  - **Improved care transitions to reduce avoidable ED use**

    - Impacts include much lower demand for ED RNs and much higher demand for primary care physicians and nurses

  - **Improved evidence-based chronic disease management**

    - Impacts include higher demand for PCPs, health coaches

# Modeling Components of a High Performing Vermont Healthcare System (Cont.)

- Scenarios model future workforce demand implications of changing care use and delivery patterns, including effects of:

  - **The Medicaid population having care use patterns of the privately insured**

    - Impacts include reduced demand for all provider types reflecting higher rates of healthcare utilization among the Medicaid population

  - **Improved Population Health**

    - Short term decrease in demand for providers due to improved health status; but long term increase in demand for providers as more people live to older ages

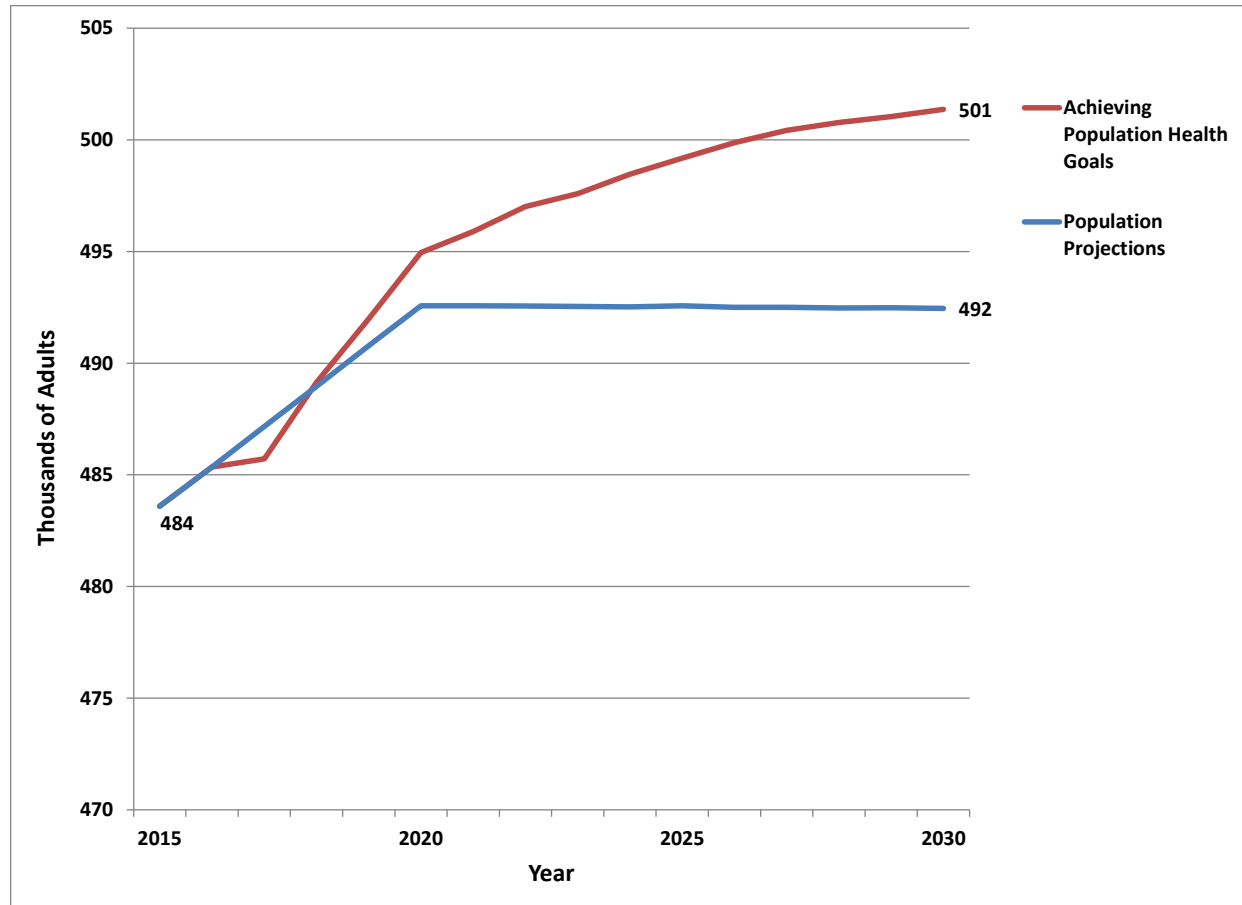# Population Health Demand Modeling Scenario – Modeling Assumptions

- Population health goals and many care delivery and reimbursement practices support the provision of timely and appropriate preventive care

- Potential scenario models the health workforce implications by 2030 of achieving

  - Sustained 5% body weight loss for overweight and obese adults

  - Improved blood pressure, cholesterol, and blood glucose levels for adults with elevated levels

  - Smoking cessation

# Population Health Demand Scenario Modeling Results

- Cumulative 2015 to 2030:

  - 13,900 fewer people with heart disease

  - 7,200 fewer strokes

  - 4,200 fewer heart attacks

- Population in 2030 would be 8,900 higher (1.8% higher) and mostly elderly

- In 2030, with 8,900 additional people alive

  - 21 additional doctors needed (breakout does not add due to rounding)

    - 8 needed in primary care

    - 2 needed in medical specialties

    - 4 needed in surgical specialties
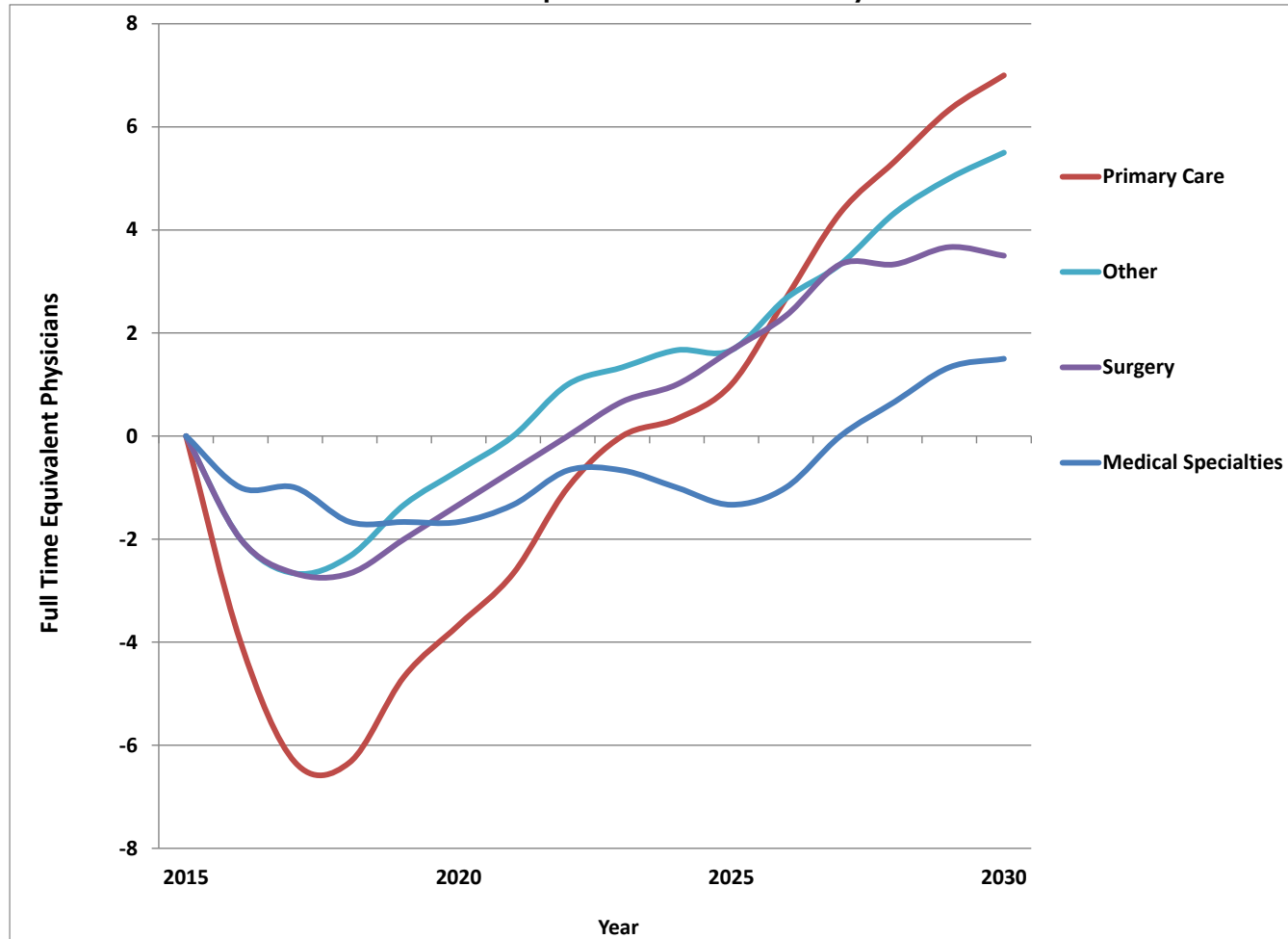
    - 6 needed in other specialties

# Population Health Demand Modeling Scenario – Population Projections



Scenario impact on Vermont Population

# Population Health Demand Modeling Scenario – Projections by Physician Category

## Scenario impact on FTE Physicians



- Primary Care
- Other
- Surgery
- Medical Specialties

# Population Health Demand Modeling Scenario Results

- Scenario modeling results suggest that as the health of Vermont's population improves:

  - Total demand for physician services dips in the short term but increases in the longer term as more people live into older ages and disease onset is delayed

  - Physician specialties most affected include endocrinology and geriatrics

    - Demand for endocrinologists is lowered due to population weight loss and improved blood glucose levels. It reaches the lowest point between 2023-2027, but begins to rise in 2028 reflecting delayed disease onset rather than complete prevention

    - Demand for geriatricians generally increases over time reflecting that more of Vermont's population is living to older ages

| Year | Endocrinology | Geriatrics |
|------|---------------|------------|
| 2016 | 0% | 0% |
| 2017 | -4% | -2% |
| 2018 | -6% | -1% |
| 2019 | -8% | 1% |
| 2020 | -9% | 1% |
| 2021 | -10% | 1% |
| 2022 | -10% | 2% |
| 2023 | -11% | 3% |
| 2024 | -11% | 3% |
| 2025 | -11% | 3% |
| 2026 | -11% | 4% |
| 2027 | -11% | 4% |
| 2028 | -10% | 4% |
| 2029 | -10% | 4% |
| 2030 | -9% | 5% |

# General Modeling Trends and Observations

- While Vermont's total population is expected to decline between 2015 and 2030, growth in demand for services will be driven by increases in the 65+ population

- In line with population changes, highest growth in demand for nursing and direct care services professions (RNs, nurse aides, home health aides)

- In line with projections of population aging, highest relative growth in nursing home and residential care settings; decreased demand in school settings

- In general, high growth in demand for providers in Burlington and St. Albans HSAs, consistent across provider types

- Expected changes in demand for physician specialties are also in line with population changes

  - Large demand decreases for pediatrics and OB/GYN (-10%)

  - Large demand increases for geriatrics (63%), hematology/oncology (33%), and cardiology (27%)

# Implications of Modeling Results and Future Research Directions

- Demand implications for the Vermont health professions of emerging care delivery models and other market factors currently are complex and unclear

  - Speed of adoption and growth among emerging care delivery models and their effects on organization and patterns of care will be important factors as will national and state policy developments

  - Examples of other factors likely to influence future demand for Vermont health professions include:

    - Extent of care migration from institutional to community and home-based settings spurred by new delivery models (e.g., ACOs)

    - Changing health care payment and coverage policies (e.g., ACA repeal??)

    - More effective chronic disease management (e.g., team-based care)

    - Economic developments: last recession (2008-2009) influenced supply and demand by slowing retirements and consumer demand for many services

# Implications of Modeling Results and Future Research Directions (Cont.)

- Potential future research directions in Vermont health workforce modeling include:

  - Looking more closely at specific professions that may experience or portend future shortages, including:

    - Generalist disciplines (e.g., mental health/substance use, primary care)

    - Professions focused in areas in which the illness burden is increasing (e.g., oncology, cardiology, pulmonology)

  - Integrating supply and demand projections to present a profile of the current and projected future size and characteristics of Vermont's health workforce together with future demand

# Next Steps

- Complete refining Vermont health workforce demand projections and scenarios, where appropriate, based on Work Force Work Group feedback

- Submit final Vermont Health Workforce Demand Modeling report

# Attachment 4b:
# DRAFT Demand Modeling Projections Report

# Current and Projected Future Health Care Workforce Demand in Vermont

**Draft Final Report**

**Prepared for:**

**State of Vermont Agency of Administration**

**Submitted by:**

**IHS Markit**

**May 11, 2017**

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# TABLE OF EXHIBITS

# ACRONYMS

| | |
|---|---|
| ACA | Affordable Care Act |
| ACO | Accountable Care Organization |
| ACS | American Community Survey |
| APRN | advanced practice nurse |
| BRFSS | Behavioral Risk Factor Surveillance System |
| DPMM | Disease Prevention Microsimulation Model |
| ED | emergency department |
| FTE | full-time equivalent |
| HDMM | Healthcare Demand Microsimulation Model |
| HSA | hospital service area |
| MEPS | Medical Expenditure Panel Survey |
| MH/SA | mental health and substance abuse |
| NNHS | National Nursing Home Survey |
| PA | physician assistant |
| PCP | Primary care provider |
| SIM | State Innovations Model |
| VHCURES | Vermont Health Care Uniform Reporting and Evaluation System |
| VUHDDS | Vermont Uniform Hospital Discharge Data Set |

# EXECUTIVE SUMMARY

Continuing on the path of health reform, Vermont has demonstrated a commitment to achieving affordable coverage, a strong primary care delivery system, a focus on disease prevention, and creating and sustaining a health care workforce sufficient in size and distribution to achieve these goals. To help support this agenda the Center for Medicare and Medicaid Innovation awarded Vermont a $45 million State Innovation Model (SIM) Testing Grant. The SIM initiative funds development and testing of new payment and service delivery models that have the potential to lower costs for the Medicare, Medicaid and Children's Health Insurance Programs.

Having an accurate picture of future statewide and local population demand for health care services and health professions is an essential enabler to successfully developing innovative and efficient service delivery models. The need to assess the capacity of Vermont's future health workforce is important for both public and private sectors to act and make the investments needed for a health care system that provides high-quality, cost-efficient care while also developing the workforce needed to transform the current system and to maximize population health. The pace of change in the world of health care delivery and finance necessitates an almost constant updating and improvement of workforce projections.

In 2016, the Vermont Health Care Innovation Project Health Care Workforce Work Group commissioned the information services firm IHS Markit (IHS) to develop projections of current and future demand for health workers and to help monitor changes in demand over time. This report describes the data and methods used to develop the demand projections and presents study findings. Working with Vermont stakeholders, IHS identified key trends likely to affect the demand for health care services and workforce over the next fifteen years and projected future statewide and hospital service area level physician and other health profession full-time equivalent (FTE) demand through 2030 under the status quo and multiple scenarios incorporating components of a high performing Vermont health care system.

## Synopsis of Study Methods and Data Sources

This study used a microsimulation approach to project the demand for health care services and health professions. The demand projection model has been used for health workforce modeling for federal and state governments, for trade and professional associations, and for health systems such as efforts to model the workforce implications of restructuring care delivery in New York as part of the Delivery System Reform Incentive Payment (DSRIP) Program. The demand projections are based on a representative sample of Vermont's population and simulated the implications of changing demographics as the population grows and ages, projected changes in disease prevalence, and other population health risk factors if health care use and delivery patterns remained unchanged. To reflect likely changes over the next fifteen years in care use and delivery patterns, modeled scenarios include assumptions about growth in integrated care delivery models, expanded use of chronic disease management, enhanced care coordination, expanded access to team-based primary care and coordinated mental health and substance abuse care, and improved population health.

The complexity of this modeling effort required the use of data from local, state and national surveys and other data sources. These sources include Vermont data from the Behavioral Risk Factor Surveillance System and the American Community Survey, national data from the Medical Expenditure Panel Survey supplemented with data from the Vermont Uniform Hospital Discharge Data Set (VUHDDS) and the Vermont Health Care Uniform Reporting and Evaluation System (VHCURES), population

projections from the Vermont Agency of Commerce and Community Development, and published literature. Computer simulations were conducted using IHS's Healthcare Demand Microsimulation Model (HDMM) and Disease Prevention Microsimulation Model (DPMM).

The study included the contributions of various stakeholders in Vermont, and input from members of the Health Care Workforce Work Group which included representatives from multiple government agencies.

## Key Study Findings

This study first projected future demand for health care services and providers from 2015 through 2030 under a status quo scenario based on changing demographics in the absence of health care system transformation. We summarize state-wide findings here, but projections varied across the thirteen hospital service areas modeled.

- **The growing elderly population in Vermont is the primary driver of increasing demand for health care services and the workforce required to meet the projected future demand for services**. Between 2015 and 2030, Vermont is projected to experience a slight overall population decline (-0.9%), but experience 50% growth in the "Baby Boomer" population age sixty-five. By comparison, the US population is projected to grow by about 12% with the population age sixty-five and older projected to grow by 46%.[1] This rapid growth in the elderly population suggests that a large portion of the increase in demand for health workers will primarily be among those professions and in care delivery settings that predominantly serve the elderly.
- **Physician demand continues to grow in Vermont**. Despite a small projected population decline, the aging population suggests demand for physicians will grow between 2015 and 2030 by approximately 210 FTEs (13%).
    - In absolute terms, statewide demand growth is highest for general internal medicine (54 FTEs) and family medicine (29 FTEs).
    - In percentage terms demand growth is highest for specialties serving an older population, including geriatric medicine (63%), hematology and oncology (33%), vascular surgery (33%), and urology (32%).
    - Projected decline in demand for pediatrics and obstetrics & gynecology (-10%) and neonatal-perinatal medicine (-13%) reflects negative population growth among younger age cohorts.
- **Demand for physician assistants and nursing professions will grow approximating the same rate as overall physician demand**.
    - Demand for advanced practice nurses will grow by about 62 FTEs (12%), with the majority of growth taking place among nurse practitioners (45 FTEs).
    - Total physician assistant demand will grow by about 30 FTEs (13%) reaching 266 FTEs, with about 41-45% employed in primary care.
    - Statewide demand for registered nurses will grow by about 1,421 FTEs (22%), with the highest growth rates expected in nursing home and residential care settings (69%), and home health (41%). Hospitals will continue to be the largest employer of registered nurses.
- **The rate of growth in demand for other health occupations modeled varies widely**. Slow growth occupations include optometrists, opticians and dentists with about 0-2% cumulative growth between 2015 and 2030. High growth occupations include nurse aides (47% growth) and home health aides (41% growth).

## Modeling Components of a High Performing Vermont Health Care System

After modeling the implications of changing demographics in the absence of system transformation, we modeled the workforce implications of efforts to improve care coordination and delivery.

- **Increased use of integrated care statewide can shift care to lower cost settings**. Greater integration of care is projected to have little impact on overall demand FTE demand for physicians and advanced practice nurses. However, demand would shift away from medical specialties and towards primary care.
- **An initiative which diverts non-emergent visits to the emergency department into primary care settings shifts demand for health providers**. Reducing avoidable emergency department use among the Medicaid population by 25% could, by 2030, reduce demand for registered nurses based in the emergency departments (-50 FTEs) and emergency physicians (-8 FTEs), but increase primary care physician demand by 38 FTEs and RN and LPN demand in ambulatory settings by 18 FTEs by 2030, compared with the status quo scenario.
- **Integrating mental health and substance abuse services into primary care practices to improve screening and access, reduce care fragmentation, and better manage co-morbid physical and mental health or substance abuse needs would increase demand for behavioral health providers**. The modeled scenario focuses on the Medicaid population, and could lead to 4,600 additional patients receiving counseling by 2030 compared to the status quo. To support the additional patients receiving screening, Vermont's workforce would require 31 additional licensed clinical social workers and 3 additional psychiatrists or psychiatric nurses.
- **Efforts to better manage disease and achieve population health goals can increase demand for health professions in some settings and increase demand in others**. Overall demand for providers would likely increase, but would result in reduced mortality and improved quality of life.
  - A cardiovascular disease management program focusing on Vermont's population with cardiovascular conditions could require 42 additional primary care providers, 31 additional registered nurses, and 14 additional cardiologists in ambulatory settings, and would slightly reduce demand for providers in inpatient and emergency settings.
  - Initiatives for improved population health could include targets such as smoking cessation, weight loss among obese and overweight adults, and improved control of blood pressure, cholesterol, and blood sugar for individuals with elevated levels. If such population health improvements were achieved statewide, demand for physicians and other health professions is projected to fall in the short run due to a healthier population and increase in the medium-to-long run as more residents are alive and live into older age groups. Projected growth in demand for physicians in 2030 under these assumptions is 21 FTEs (2%) higher than under status quo assumptions, as the health care system would be support an additional 8,900 residents who otherwise would not be alive in 2030.

## Conclusion and Potential Future Directions in Research

Although Vermont's population is projected to decline slightly between 2015 and 2030, the elderly population is projected to grow substantially thus contributing to an overall increase in demand for health care services and providers. Efforts to improve care coordination and delivery under a High Performing Vermont Health Care System will have mixed effects on demand for health workers. Some initiatives likely will shift care to lower cost settings (e.g., from emergency departments to primary care offices), to lower cost providers (e.g., from specialists to primary care providers), or to the future (e.g., by reducing mortality).

This study focused solely on trends and initiatives that likely will affect demand for health care services and providers. A more complete picture would require supply projections for comparison to determine the projected future adequacy of health workforce supply both at the state level and across hospital services areas and communities. National studies suggest that demand for physicians is growing faster than national supply—suggesting that Vermont will face increasing pressures from other states to attract and retain physicians.[2] On the other hand, the national supply of registered nurses, advanced practice nurses, and physician assistants is growing rapidly suggesting Vermont might find it easier to attract and retain professionals in these occupations over time. Occupations projected to experience rapid growth in demand include nurse aides and home health aides—occupations that have low entry barriers to the profession but also high exit rates.

Health workforce demand projections are challenged by the pace and often unpredictable ways in which health care is changing. Uncertainties include shifting policy priorities, emerging care delivery models and changing care practices might affect workforce demand, and how clinicians and care settings will respond to economic and other trends.

- **The pace of care migration from inpatient and institutional to outpatient, community and home-based settings:** Shifts in care settings and modalities spurred by development and expansion of Accountable Care Organizations, the patient-centered medical home, and other new delivery models will continue to shift health workforce demand from high cost hospitals and emergency departments (ED) to other appropriate care settings.
- **More effective management of chronic disease**: Chronic disease management is transitioning to team-based care management and patient education conducted in community and home settings. These activities are likely to increase workforce demand for case managers, social workers and other health occupations trained in carrying out these activities. Team based care will also support expanding scope of practice for registered nurses, nurse practitioners and physician assistants.
- **Changing health care payment and coverage policies**: These have the potential to significantly influence patterns of demand for health care services and occupations.
- **Economic developments**: National and state trends in unemployment may influence the health occupations and trigger the need to update projections. The last economic downturn (2008-2009) appeared to influence supply and demand by slowing retirements and consumer demand for many discretionary services.

These uncertainties underscore the importance of ongoing research on potential implications of the evolving health care system for Vermont's health workforce. Efforts to monitor the adequacy of health workforce supply across Vermont will help inform strategies to ensure access to high quality, affordable care.

# I. INTRODUCTION

The use of services and care delivery patterns across Vermont's health care sector continues to evolve based on changing demographics, emerging care delivery models, new technologies, economic circumstances, and policies such as requirements of the federal Affordable Care Act (ACA) or its possible replacement under the new Administration. The ACA, in particular, refocuses program priorities to expand efforts to link the quality and efficiency of health care services to payment for those services through new payment and delivery models and initiatives. These include new health care delivery models such as Accountable Care Organizations (ACOs), and bundled payment initiatives intended to promote better coordination of services and greater efficiency.

Continuing on the path of health reform, Vermont has demonstrated a commitment to achieving affordable coverage, a strong primary care delivery system, a focus on disease prevention, and creating and sustaining a health care workforce sufficient in size and distribution to achieve these goals. To help support this agenda, the Center for Medicare and Medicaid Innovation awarded Vermont a $45 million State Innovation Model (SIM) Testing Grant. The SIM initiative funds development and testing of new payment and service delivery models that have the potential to lower costs for the Medicare, Medicaid and Children's Health Insurance Programs. Having an accurate picture of future statewide and local population demand for health care services and health professions is an essential enabler to successfully developing innovative and efficient service delivery models.

The primary purpose of this project is to help Vermont achieve these goals through the use of a demand-based health workforce microsimulation model. This simulation model supports analyses quantifying and assessing current and projected future demand for health care services and the derived demand by medical specialty, health occupation, and care delivery setting. Demand projections include a status quo scenario if patterns of care use and delivery remain unchanged but taking into consideration changing demographics, and alternative scenarios reflecting possible interventions to transform the health care system and improve care management and delivery under an "ideal" high performing Vermont health care system.

This study examines the demand for health care services and providers at the state and Hospital Service Area (HSA) levels annually from 2015 through 2030. As a policy tool, such projections could allow the State to develop recruitment and training strategies to meet identified needs.

The goal of this project was not simply to develop one-time projections, but also to develop a forecasting process that Vermont can use to track developments annually over time and to update projections as new information and data becomes available or as new policies are considered. Study outcomes are intended to inform state policies and influence decisions made by educational institutions and individuals deciding whether to enter a health occupation. Most importantly, it is intended that study outcomes will help the state meet its goal of improved access to high quality affordable care for the people in Vermont.

The complexity of this modeling effort required the use of data from local, state and national surveys and other data sources. These sources include Vermont data from the Behavioral Risk Factor Surveillance System and the American Community Survey, national data from the Medical Expenditure Panel Survey supplemented with data from the Vermont Uniform Hospital Discharge Data Set (VUHDDS) and the Vermont Health Care Uniform Reporting and Evaluation System (VHCURES), population

projections from the Vermont Agency of Commerce and Community Development, and published literature. Computer simulations were conducted using IHS's Healthcare Demand Microsimulation Model (HDMM) and Disease Prevention Microsimulation Model (DPMM).

The remainder of this study is organized to present an overview of demand modeling data and methods (Chapter II), projections of future health services demand (Chapter III), projections of health workforce demand under the status quo scenario (Chapter IV), and the health workforce implications of transformation initiatives that change care use and delivery patterns (Chapter V). Chapter VI discusses key findings and suggests possible directions for refinement and future research. A Technical Appendix provides additional detail on modeling data and methods.

## II.     MODELING APPROACH AND DATA

The Healthcare Demand Microsimulation Model used for this analysis is the primary source of workforce projections for the federal Bureau of Health Workforce covering physicians, nurses, behavioral health providers, allied health providers, and other health occupations.[3, 4] The model has also been adapted to make supply projections for states, health plans, hospital systems and professional associations.[2, 5, 6] This projections in this report relied on a combination of use of the HDMM, information from state and national sources, published findings in the literature, and data on actual health care utilization in the state from Vermont's VUHDDS and VHCURES databases. Additional documentation of the HDMM is provided in a technical appendix and available in more detail online.[3, 7]

### A.     Model Overview

The HDMM, as its name implies, models demand for health care services and providers. Demand is defined as the level and mix of health care services (and providers) that are likely to be used based on population characteristics and economic considerations, such as price of services and people's ability and willingness to pay for services. While the nuances of modeling health workforce demand may differ for individual health occupations or medical specialties, the basic framework is the same across health professions. The demand model has three major elements (Exhibit 1).

1. It is built on a **population database** that contains demographic, socioeconomic, and health risk behavior and factors that are correlated with utilization of different types of services. The population database is built at the county level because of data availability, but using market share information the health workforce demand projections are reported at the HSA-level or aggregated to the state level.
2. The model includes **forecasting equations** that relate an individual's characteristics and health risk factors to utilization of services by type of service, care delivery setting, and occupation.
3. The model has input tables and parameters with **staffing patterns** to determine the number and mix of occupations to provide the level and mix of services demanded.

Using the model, different scenarios can be simulated by modifying model inputs or assumptions about how care is used or delivered.

**Exhibit 1: Health Care Demand Microsimulation Model Overview**
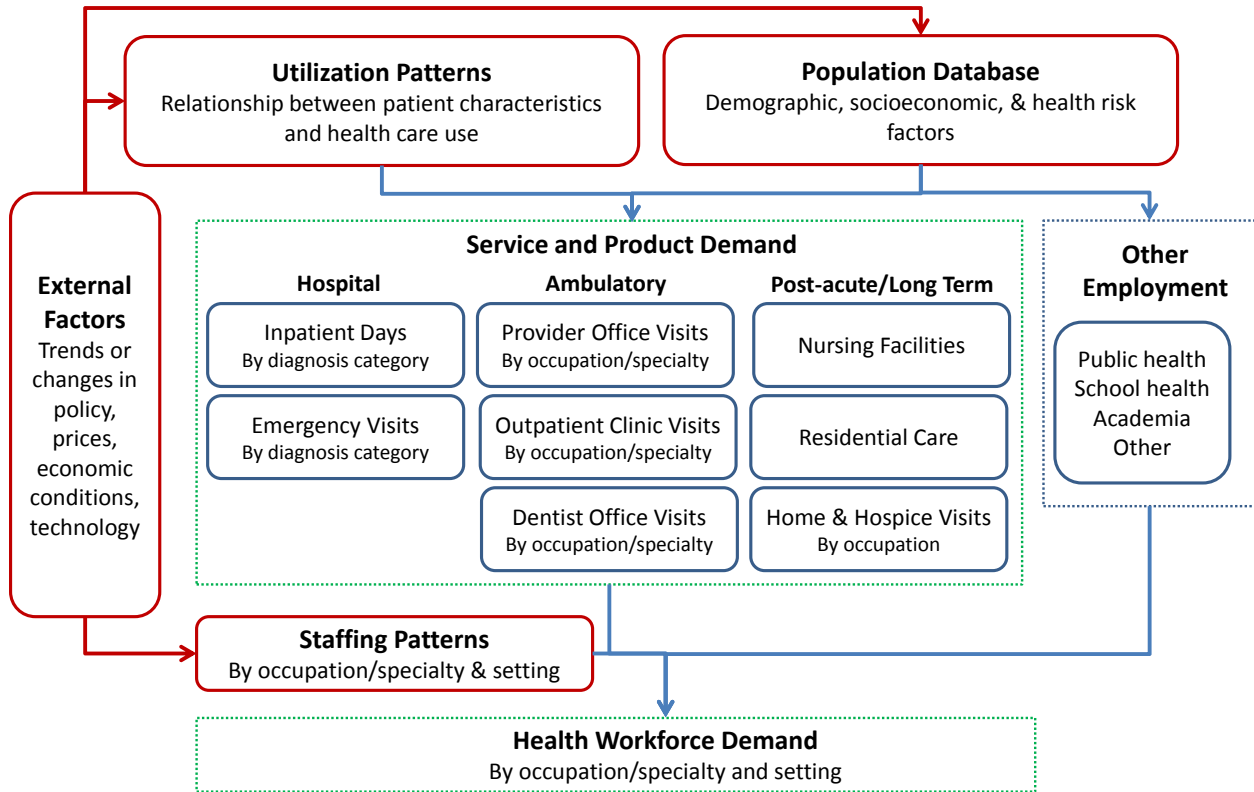


## B.     Creating the Population Database

The demand model uses a microsimulation framework where a population file constructed for each Vermont county contains demographics, health risk factors, and socioeconomic data on each person in a representative sample of the population in that county. Aggregated data published by the U.S. Census Bureau reports demographics of the population in 2014 by county (i.e., the number of people in each combination by individual age, sex, and race/ethnicity), which are used as the initial step in the population file creation process.

This county-level data was used to draw a representative sample of individuals from a file that merged Vermont data from the 2014 American Community Survey (ACS) and the 2013 & 2014 Behavioral Risk Factor Surveillance System (BRFSS) to provide a more complete profile of the socioeconomic and health characteristics of the population.  To create the matched ACS-BRFSS file covering the non-institutionalized population, we statistically matched each Vermont individual in ACS with a Vermont individual in BRFSS with the same gender, age group (15 groups), race/ethnicity, medical insured/uninsured status, and household income level (8 levels). For nursing home residents, information from the 2004 National Nursing Home Survey (NNHS) was used to reflect that residents of nursing homes have higher prevalence of disease than do people of similar demographic residing in the community (as reflected in BRFSS).

The sampling process generally ensures that the resulting combination of age, sex, and race/ethnicity match the estimates published by the Census. Under this approach, some BRFSS or NNHS individuals might be matched multiple times to similar people in the ACS, while some BRFSS or NNHS individuals might not be matched. In a small number of instances the sample size of Vermont residents in an uncommon demographic group from ACS was too small to generate a reliable sample. In these instances ACS records from nearby states (New Hampshire, Maine, and Massachusetts) that matched the demographic combination in question were used to increase sample size. The metropolitan and non-metropolitan subsamples from this Vermont database were then combined with population data for each county based on demographics.

The population creation process allows us to create a file that is representative of the demographic distribution in Vermont, with a health risk profile for each individual containing the risk factors that will be used to predict health care use. For model calibration we compared predicted prevalence of chronic disease (diabetes, hypertension, cancer, asthma, and arthritis) and other risk factors (smoking, obesity) to county-level published estimates. Estimates for county-level disease prevalence come from data from the Centers for Disease Control and Prevention and Vermont data sources such as the Vermont BRFSS (Exhibit 2).

### Exhibit 2: Data Sources for Vermont Disease and Risk Factor Calibration

| Condition/Risk Factor | Year | Geography | Source |
|---|---|---|---|
| Arthritis | 2012-2013 | County-level | Vermont Department of Health Data Atlas [i] |
| Asthma | 2012-2013 | | |
| Cancer (any) | 2012-2013 | | |
| Smoker | 2012-2013 | | |
| Hypertension | 2011, 2013 | | |
| Diabetes | 2013 | County-level | CDC [ii] |
| Obesity | 2013 | County-level | CDC [iii] |

Notes: [i] http://healthvermont.gov/research/brfss/IA/ChronicConditions/County/atlas.html, http://healthvermont.gov/hv2020/
[ii] www.cdc.gov/diabetes/atlas/countydata/DMPREV/vermont.xlsx [iii] www.cdc.gov/diabetes/atlas/countydata/OBPREV/vermont.xlsx

Projections of Vermont population growth and aging come from the Vermont Agency of Commerce and Community Development.[8] This report produced two sets of scenarios projecting population change: a high growth scenario projecting a 7.1% growth rate between 2010 and 2030, and a low growth scenario projecting a -0.8% population decline over the same time period. The low population growth scenario was selected as an input for projecting population change and aging over time since the observed rate of population change to date have more closely reflected this set of projections.

The database prepared for the HDMM contains a representative sample of the population in each Vermont county and HSA. The population profile in this representative sample is comprehensive of all insurance types (Medicare, Medicaid, commercial, and uninsured); population demographics (age, sex, race, and ethnicity); household income level; health risk factors including body weight status (normal, overweight, and obese); current smoker status; and presence or history of chronic disease

(hypertension, coronary heart disease, diabetes, arthritis, asthma, history of heart attack, history of stroke, and history of cancer).

## C.    Developing Health Care Use Forecasting Equations

Patterns of health seeking behavior were generated by regression analysis using data from approximately 169,000 participants in the pooled 2009-2013 files of the Medical Expenditure Panel Survey (MEPS). There are several hundred prediction equations in the simulation model, with separate regressions by care delivery setting, health occupation and/or medical specialty, and children versus adults. Equation were estimated using either Poisson regression to model annual number of physician office visits, outpatient visits, or home health visits with a particular provider type; or using logistic regression to model annual probability of hospitalization or emergency department visit for one of approximately 24 diagnosis categories (e.g., hospitalization for a cardiovascular condition).

The dependent variable reflects annual use of health care services, while the explanatory variables consist of the demographic characteristics, health risk factors, medical conditions, and socioeconomic factors described (see Appendix Exhibits A-1 and A-2). We pool multiple years of data to provide a sufficient sample size for regression analysis. Applying the prediction equations to the current and projected future population produced estimates of the growth in demand for health care services by specialty and care delivery setting given the characteristics of the population and community.

The microsimulation model estimates of statewide health care use were calibrated to estimates of health care use derived from Vermont Data to reflect that health care use patterns in Vermont can differ from national patterns even after accounting for differences in demographics, disease prevalence and other health risk factors. Counts of hospital discharges and visits with providers came from the Vermont Uniform Healthcare Discharge Dataset (VUHDD) and Vermont Health Care Uniform Reporting and Evaluation System (VHCURES). VUHDD data were used to calibrate model estimates of physician visits inpatient and emergency department settings, by physician specialty. VHCURES data were used to calibrate the model's estimate of the total number of Vermont office visits. While VHCURES is a claims database and one claim does not always equal one physician visit or encounter, the data were cleaned and subsequently analyzed using an algorithm which was used to estimate the number of physician office visits in the state. This estimate was then used to scale the model's original estimate of physician office visits to the observed value.

## D.    Modeling Full Time Equivalent Staffing to Meet Health Services Demand

The number and mix of health professions 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 FTE staffing we determine how each unit of service demanded (e.g., psychiatrist office visits and hospital inpatient days) 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).

For example, demand for cardiologists is linked primarily to office visits to a cardiologist, cardiology-related inpatient days (for hospital rounds), outpatient visits to a cardiologist, and cardiology-related emergency visits with a physician consult.

Data on provider productivity to estimate the portion of a staff FTE associated with patient encounters in different care settings come from numerous sources. Examples include the American Medical Association (for non-physician occupations), Medical Group Management Association's Physician Compensation and Production Survey, the American Board of Internal Medicine Practice Characteristics Survey, and surveys and workforce studies conducted for individual health professions. For professions that provide services across a wide array of setting (e.g., nurses and therapists), information on the employment distribution of the care providers in the base year from the BLS was used to determine the number of individuals working in each setting.

**Exhibit 3: Workload Metrics for Staffing Ratios**

| Employment/Care Delivery Setting | Workload Metric |
|---|---|
| Academia | Annual graduates within that occupation |
| Home health | Annual home health visits |
| Inpatient | Annual inpatient days by primary diagnosis category |
| Office | Annual visits by occupation and/or medical specialty |
| Other health care | Total population |
| Outpatient | Annual visits by occupation and/or medical specialty |
| Public health | Total population |
| Residential care | Residents |
| School health | Total population age 6 to 17 |
| Nursing facilities | Residents |

## III.  VERMONT POPULATION AND SERVICE DEMAND PROJECTIONS

A key dynamic affecting future service and health workforce demand in general is rapidly shifting population demographics. Nationally, high rates of projected population growth, especially among the elderly "Baby Boomer" population, portend rapidly growing demand for health care services with highest growth expected for those specialties that disproportionately serve the elderly. In Vermont, total population size is expected to decrease slightly by 2030, though the elderly population is growing in size. Demographic shifts in race and ethnicity also inform projected changes over time in population characteristics related to chronic disease prevalence and other health risk factors that are determinants of health care service use.

Between 2015 and 2030, the US population is projected to grow by about 30 million people (9.5%).[1] The population age sixty-five and older is projected to grow by over 20 million (46%) during this period—driving demand for those care settings and services used predominantly by the elderly. This contrasts with state of Vermont population projections which forecast a slight overall population decline (-0.9%) between 2015 and 2030.[8] However, consistent with national projections, Vermont's "Baby Boomer" population age sixty-five and older is projected to grow by about 50% (Exhibit 4) while almost all other age cohorts experience negative growth. These demographic trends portend rapidly growing demand for health care services for those specialties and occupations that disproportionately serve the elderly.

**Exhibit 4: Vermont Projected Population Growth by Age Cohort (2015- 2030)**
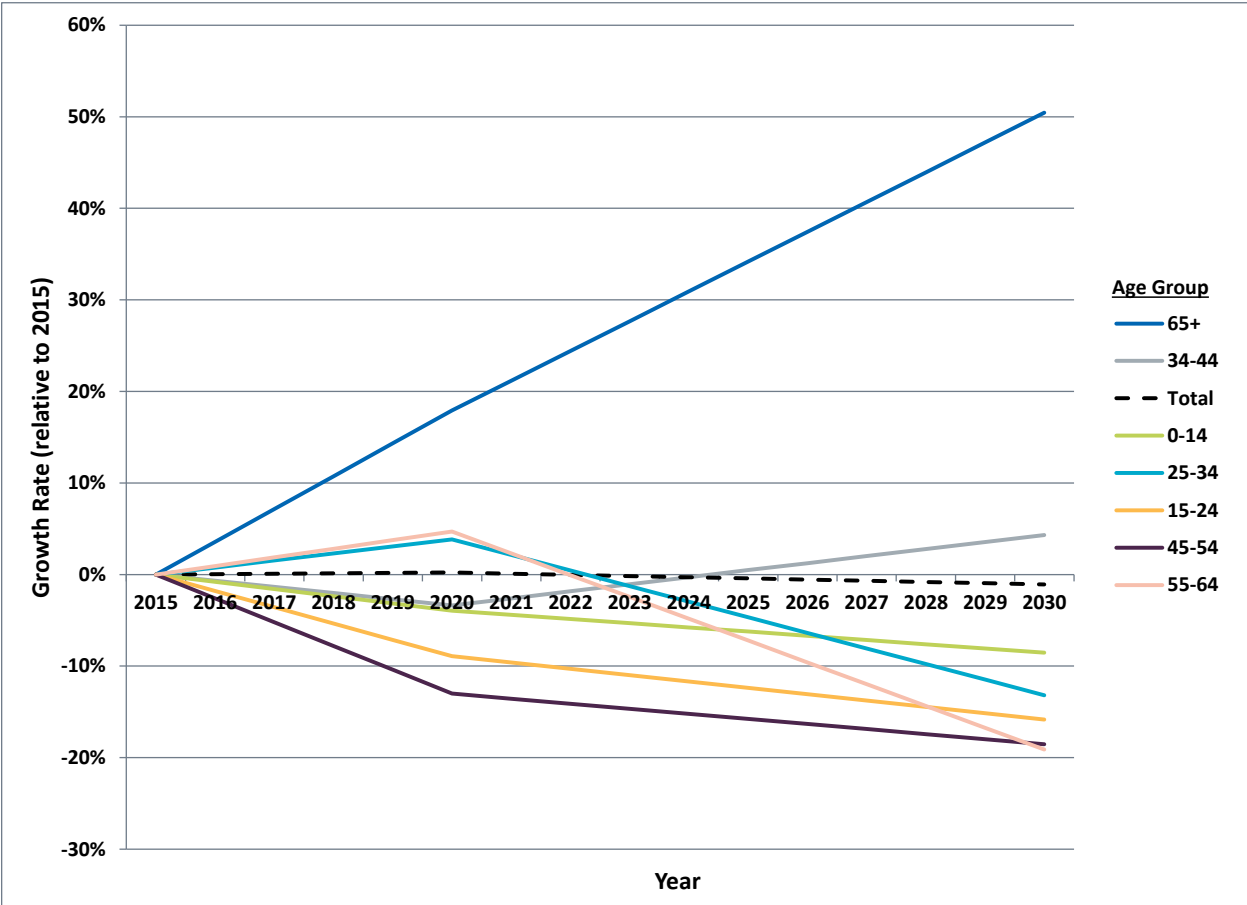


Population growth varies by county, with Rutland county projected to have the largest population decline and Franklin county projected to have the largest population increase (Exhibit 5).

**Exhibit 5: Vermont Projected Population Change by County**

| County | 2015 | 2020 | 2025 | 2030 | Change, 2015-2030 | % Change, 2015-2030 |
|---|---|---|---|---|---|---|
| Addison | 37,000 | 35,800 | 35,000 | 34,100 | -2,900 | -8% |
| Bennington | 36,300 | 36,500 | 35,800 | 35,000 | -1,300 | -4% |
| Caledonia | 30,800 | 32,200 | 32,400 | 32,500 | 1,700 | 6% |
| Chittenden | 161,400 | 161,800 | 162,400 | 163,000 | 1,600 | 1% |
| Essex | 6,200 | 6,000 | 5,700 | 5,500 | -700 | -11% |
| Franklin | 48,800 | 49,300 | 50,000 | 50,700 | 1,900 | 4% |
| Grand Isle | 6,900 | 6,800 | 6,600 | 6,400 | -500 | -7% |
| Lamoille | 25,200 | 25,300 | 25,500 | 25,600 | 400 | 2% |
| Orange | 28,900 | 28,900 | 28,700 | 28,400 | -500 | -2% |
| Orleans | 27,100 | 27,400 | 27,200 | 27,000 | -100 | 0% |
| Rutland | 59,700 | 58,500 | 56,300 | 54,200 | -5,500 | -9% |
| Washington | 58,600 | 60,000 | 60,000 | 60,000 | 1,400 | 2% |
| Windham | 43,400 | 44,400 | 44,000 | 43,600 | 200 | 0% |
| Windsor | 55,700 | 55,800 | 55,100 | 54,400 | -1,300 | -2% |
| **Vermont Total** | **626,000** | **628,700** | **624,700** | **620,400** | **-5,600** | **-1%** |

Note: Projections of Vermont's projected population growth and aging are from: Jones and Schwarz (2013).[8]

Demand for health services is defined as the level and mix of services that consumers are able and willing to purchase at current prices given epidemiological and economic considerations. Current demand, therefore, is equivalent to the quantity of services utilized plus any services not utilized because provider shortages prevented patients from accessing care. Demand for services does not equal "need," where need is based on a clinical definition taking into account patient epidemiological considerations combined with an assessment of appropriate patient care—regardless of ability to pay for services.

Projected service demand growth between 2015 and 2030 varies across delivery settings (Exhibit 6). Demand projections suggest that the effects of changing demographics will have a greater influence on future service demand than will the effects of other known factors and will vary across care settings. For example, based on changing demographics alone, demand for home health services is projected to grow by about 37% with about 22% growth in hospital inpatient days, 11% growth in both physician office visits outpatient visits, and 2% growth in emergency department visits.

**Exhibit 6: Projected Growth in Vermont Service Demand by Care Setting**
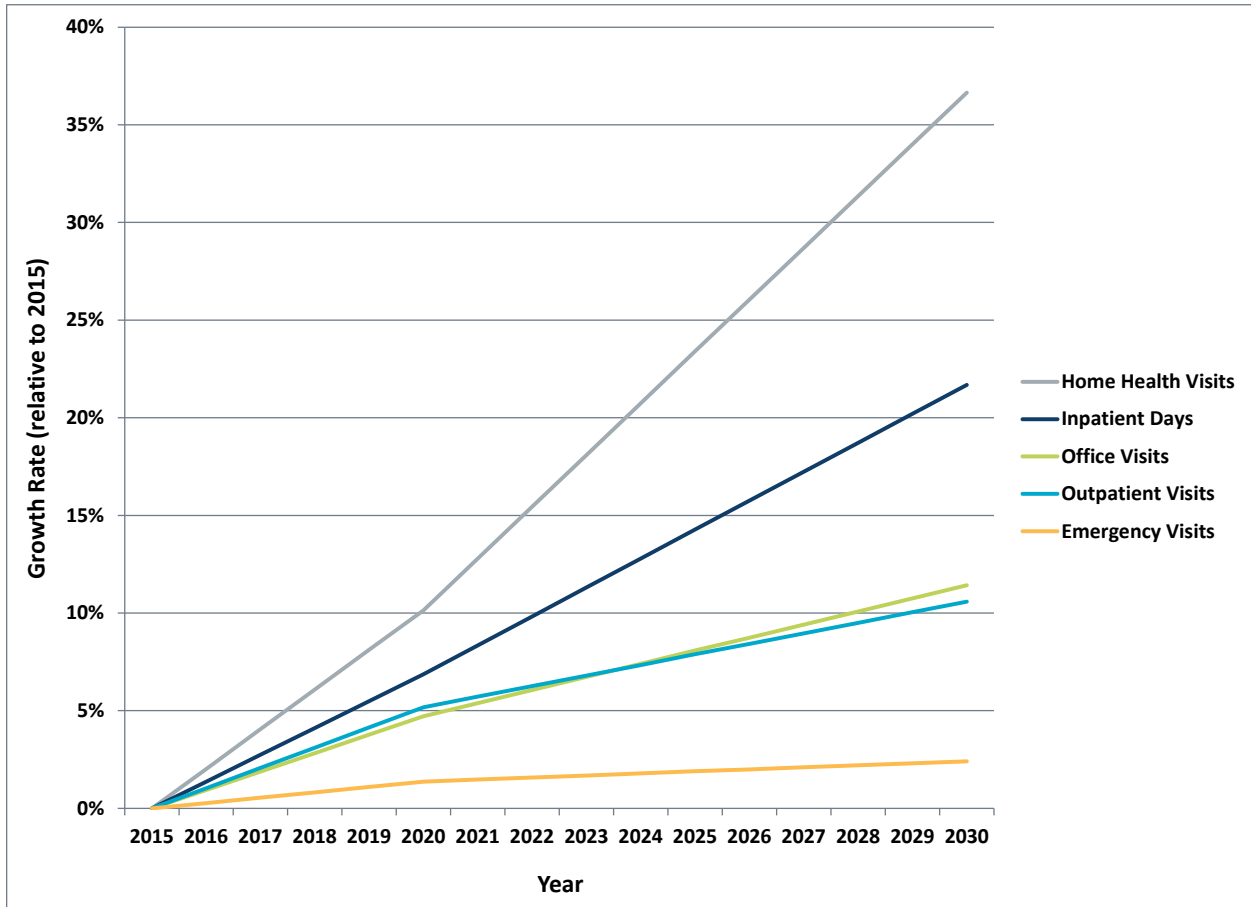


The high percentage growth in hospital inpatient days, relative to ambulatory care, may appear counterintuitive given that hospitalization rates have been declining over the past two decades. However, the burden of disease and rates of hospitalization increase with age. For example, in 2009 the hospitalization rate was 198 hospitalizations per 1,000 diabetes patients under age 45, but 480 hospitalizations per 1,000 diabetes patients age 75 or older (a 142% increase).[9]

Reflecting the rapidly growing elderly Vermont population, the projected percentage increase in demand for services is particularly high for geriatric medicine, nephrology, hematology & oncology and cardiology (Exhibit 7). By comparison, projected demand for services utilized by younger age cohorts will grow much more slowly (e.g., pediatrics, obstetrics & gynecology, and neonatal-perinatal medicine).

**Exhibit 7: Projected Growth in Service Demand by Specialty & Setting, 2015-2030**

| Specialty | Total Care | Office Visits | Outpatient Visits | Emergency Visits/Consults | Inpatient Days |
|---|---|---|---|---|---|
| Allergy & Immunology | -3% | -3% | -3% | -4% | NA |
| Anesthesiology | 18% | 18% | 6% | NA | NA |
| Cardiology | 30% | 30% | 17% | 17% | 36% |
| Colorectal Surgery | 12% | NA | NA | NA | 12% |
| Dermatology | 22% | 22% | 23% | NA | 23% |
| Endocrinology | 16% | 15% | 14% | 12% | 23% |
| Gastroenterology | 10% | 12% | 8% | 3% | 21% |
| General & Family Practice | 14% | 10% | 9% | NA | 22%[i] |
| General Internal Medicine | 23% | 22% | 15% | NA | 24%[i] |
| General Surgery | 14% | 18% | 9% | -1% | 23% |
| Geriatric Medicine | 69% | 64% | 63% | NA | 69%[i] |
| Hematology & Oncology | 41% | 47% | 38% | 17% | 33% |
| Infectious Diseases | 16% | NA | NA | -4% | 28% |
| Neonatal-perinatal Medicine | -10% | NA | NA | NA | -10% |
| Nephrology | 28% | 26% | 20% | NA | 43% |
| Neurological Surgery | 9% | NA | NA | -2% | 13% |
| Neurology | 11% | 13% | -2% | 4% | 22% |
| Obstetrics & Gynecology | -9% | -8% | -7% | -7% | -11% |
| Ophthalmology | 24% | 24% | 28% | -3% | 11% |
| Orthopedic Surgery | 12% | 12% | 8% | 4% | 32% |
| Other | 17% | 18% | 4% | -1% | 11% |
| Otolaryngology | 8% | 10% | -2% | -6% | 7% |
| Pediatrics | -9% | -9% | -9% | NA | -11%[i] |
| Physical Medicine & Rehab | 25% | 9% | 22% | NA | 32% |
| Plastic Surgery | 13% | 17% | 16% | -7% | -6% |
| Psychiatry | -4% | -6% | -8% | -1% | -1% |
| Pulmonology | 16% | 27% | 12% | 1% | 32% |
| Radiology | 30% | 32% | 24% | NA | NA |
| Rheumatology | 18% | 20% | 18% | 8% | 28% |
| Thoracic Surgery | 6% | 28% | 10% | 5% | NA |
| Urology | 22% | 29% | 20% | 5% | 34% |
| Vascular Surgery | 22% | NA | NA | NA | 22% |
| **Vermont Total** | **15%** | **11%** | **11%** | **2%** | **22%** |

Note: [i] Reflects hospital rounds by primary care physicians as well as primary care-trained hospitalists.

# IV.    VERMONT HEALTH WORKFORCE DEMAND PROJECTIONS

The status quo demand projections presented below take into consideration population change, aging, disease prevalence and health risk factors. The status quo projections, therefore, reflect the continuation of current patterns of care use and delivery in Vermont.

However, care use and delivery patterns will change over time but how they will change is uncertain. For example, efforts to make consumers and providers more cost conscious likely will reduce demand for specialist care. Potential productivity gains from health information technology could reduce demand for physicians, but these same technologies could increase demand for physicians by removing access barriers. The remainder of this chapter discusses current and projected future demand for physician specialties and select clinical and non-clinical health professions and occupations under status quo modeling assumptions. The subsequent chapter models the potential workforce implications of health system transformation or other changes in care delivery.

## A.    Physicians, Advanced Practice Nurses and Physician Assistants

This report chapter presents state and HSA-level demand projections for physicians, advanced practice registered nurses (APRNs), physician assistants (PAs) and other select health occupations from 2015 through 2030.

### 1.    Physicians

Physician demand modeling took place at both the specialty level for individual physician specialties and aggregated into four broad categories for reporting: primary care, medical specialties, surgical specialties, and "other" specialties.[a] Based on analyses from the Association of American Medical Colleges on physician billing records, a portion of the primary care physicians are likely working as hospitalists—which for Vermont would equate to about 65 primary care physicians (most trained in general internal medicine, but some trained in family medicine or pediatrics).[2]

Statewide projected growth in physician demand to 2030 reflecting changing demographics, disease prevalence, health risk factors, and current national patterns of care use and delivery is summarized in Exhibit 8 and Exhibit 9. Statewide physician demand will grow by about 210 FTEs (13%) between 2015 and 2030 including 69 FTE primary care providers.

However, the impacts of changing demographics and other factors noted above will differ substantially across specialty categories. In absolute terms, demand growth is highest for primary care (61 FTEs) and medical specialties (48 FTEs). In percentage terms, overall demand growth is highest for medical specialties (22%) and surgical specialties (18%).

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[a] **Primary care** consists of general & family practice, general internal medicine, general pediatrics, geriatric medicine, and obstetrics & gynecology. **Medical specialties** consist of allergy & immunology, cardiology, critical care, dermatology, endocrinology, gastroenterology, hematology & oncology, infectious diseases, neonatal-perinatal medicine, nephrology, pulmonology, and rheumatology. **Surgical specialties** consist of general surgery, colorectal surgery, neurological surgery, , ophthalmology, orthopedic surgery, otolaryngology, plastic surgery, thoracic surgery, urology, and vascular surgery. The **Other specialties** category consists of anesthesiology, emergency medicine, neurology, pathology, physical medicine & rehabilitation, psychiatry, radiology, and all other specialties.

**Exhibit 8: Projected Growth in Statewide Physician FTE Demand, 2015-2030**

| Physician Specialty Category | 2015 | 2020 | 2025 | 2030 | FTE Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| Primary Care | 707 | 733 | 755 | 776 | 69 | 10% |
| Medical Specialties | 237 | 256 | 273 | 290 | 53 | 22% |
| Surgical Specialties | 258 | 276 | 289 | 303 | 45 | 17% |
| Other | 412 | 430 | 441 | 453 | 41 | 10% |
| **Vermont Total** | **1,613** | **1,694** | **1,759** | **1,823** | **210** | **13%** |

The impacts of changing demographics and other factors also will differ substantially across individual physician specialties. In absolute terms, statewide demand growth is highest for general internal medicine (48 FTEs) and general and family practice (25 FTEs). In percentage terms, overall demand growth is highest for specialties that predominantly serve an older population. Specialties with the highest anticipated growth in demand include geriatric medicine (71%), hematology and oncology (32%), cardiology (27%) and pulmonology (29%). Projected shrinkage in statewide demand for pediatrics (-10%) and OB/GYN (-10%) reflects the expectation that younger age cohorts are projected to shrink more rapidly than the general population.

**Exhibit 9: Projected Growth in Statewide Physician FTE Demand by Specialty, 2015-2030**

| Physician Specialty | 2015 | 2020 | 2025 | 2030 | FTE Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| **Primary Care** | **707** | **733** | **755** | **776** | **69** | **10%** |
| Family Medicine | 282 | 295 | 303 | 311 | 29 | 10% |
| General Internal Medicine | 220 | 239 | 256 | 274 | 54 | 25% |
| Geriatric Medicine | 8 | 9 | 11 | 13 | 5 | 63% |
| Obstetrics & Gynecology | 113 | 111 | 107 | 102 | -11 | -10% |
| Pediatrics | 84 | 80 | 78 | 76 | -8 | -10% |
| **Medical Specialties** | **237** | **256** | **273** | **290** | **53** | **22%** |
| Allergy & Immunology | 8 | 8 | 8 | 7 | -1 | -13% |
| Cardiology | 62 | 68 | 74 | 79 | 17 | 27% |
| Dermatology | 26 | 28 | 30 | 32 | 6 | 23% |
| Endocrinology | 14 | 15 | 15 | 16 | 2 | 14% |
| Gastroenterology | 31 | 33 | 34 | 35 | 4 | 13% |
| Hematology & Oncology | 24 | 26 | 29 | 32 | 8 | 33% |
| Infectious Disease | 12 | 13 | 14 | 15 | 3 | 25% |
| Neonatal-Perinatal Medicine | 8 | 7 | 7 | 7 | -1 | -13% |
| Nephrology | 18 | 20 | 22 | 23 | 5 | 28% |
| Pulmonology | 23 | 25 | 27 | 29 | 6 | 26% |
| Rheumatology | 12 | 13 | 14 | 15 | 3 | 25% |
| **Surgical Specialties** | **258** | **276** | **289** | **303** | **45** | **17%** |
| Colorectal Surgery | 1 | 1 | 1 | 1 | 0 | 0% |

| | | | | | | |
|---|---|---|---|---|---|---|
| General Surgery | 57 | 60 | 63 | 66 | 9 | 16% |
| Neurological Surgery | 10 | 11 | 11 | 12 | 2 | 20% |
| Ophthalmology | 54 | 59 | 63 | 67 | 13 | 24% |
| Orthopedic Surgery | 64 | 68 | 71 | 73 | 9 | 14% |
| Otolaryngology | 24 | 25 | 26 | 26 | 2 | 8% |
| Plastic Surgery | 15 | 16 | 17 | 17 | 2 | 13% |
| Thoracic Surgery | 7 | 7 | 8 | 8 | 1 | 14% |
| Urology | 22 | 24 | 27 | 29 | 7 | 32% |
| Vascular Surgery | 3 | 3 | 4 | 4 | 1 | 33% |
| **Other Specialties** | **412** | **430** | **441** | **453** | 41 | 10% |
| Anesthesiology | 112 | 120 | 126 | 131 | 19 | 17% |
| Emergency Medicine | 85 | 86 | 87 | 87 | 2 | 2% |
| Neurology | 41 | 43 | 44 | 46 | 5 | 12% |
| Physical Medicine & Rehab | 26 | 28 | 30 | 32 | 6 | 23% |
| Psychiatry | 103 | 102 | 100 | 97 | -6 | -6% |
| Radiology | 45 | 50 | 55 | 59 | 14 | 31% |
| **Total** | **1,613** | **1,694** | **1,759** | **1,823** | **210** | **13%** |

Exhibit 10 shows that across the state's HSAs there is substantial geographic variation in projected growth in physician demand between 2015 and 2030. Projected growth in physician demand ranges from 4% in Rutland to 18% in St. Albans. Absolute demand growth ranges from 4 FTEs in Randolph to 71 FTEs in Burlington. Compared to other Vermont HSAs, Burlington is a sizable metropolitan area with large concentrations of health care settings, physicians and other health care providers.

**Exhibit 10: Projected Physician Demand by Vermont HSA, 2015-2030**

| Hospital Service Area | 2015 | 2020 | 2025 | 2030 | Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| Barre | 164 | 172 | 179 | 186 | 22 | 13% |
| Bennington | 103 | 107 | 110 | 113 | 10 | 10% |
| Brattleboro | 78 | 82 | 85 | 88 | 10 | 13% |
| Burlington | 491 | 520 | 546 | 571 | 80 | 16% |
| Middlebury | 67 | 70 | 72 | 74 | 7 | 10% |
| Morrisville | 63 | 67 | 70 | 73 | 10 | 16% |
| Newport | 73 | 77 | 80 | 83 | 10 | 14% |
| Randolph | 36 | 37 | 38 | 40 | 4 | 11% |
| Rutland | 155 | 158 | 159 | 160 | 5 | 3% |
| Springfield | 69 | 72 | 74 | 75 | 6 | 9% |
| St. Albans | 130 | 138 | 146 | 153 | 23 | 18% |
| St. Johnsbury | 66 | 70 | 73 | 76 | 10 | 15% |
| White River Jct. | 118 | 123 | 126 | 130 | 12 | 10% |
| **Vermont Total** | **1,613** | **1,694** | **1,759** | **1,823** | **210** | **13%** |

Under a status quo scenario, statewide physician demand across care delivery settings is projected to grow at approximately the same rate as growth in demand for health care services. The highest absolute

and percent growth in physician demand will likely occur in physician office (154 FTEs and 13%) and hospital inpatient (42 FTEs and 16%) settings; with the lowest growth in emergency departments (4 FTEs and 4%) settings (Exhibit 11).

**Exhibit 11: Projected Physician Demand by Vermont Care Setting, 2015-2030**

| Setting | 2015 | 2020 | 2025 | 2030 | FTE Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| Office | 1,158 | 1,221 | 1,266 | 1,312 | 154 | 13% |
| Outpatient | 92 | 96 | 99 | 101 | 9 | 10% |
| Inpatient | 262 | 274 | 289 | 304 | 42 | 16% |
| Emergency | 102 | 104 | 105 | 106 | 4 | 4% |
| **Vermont Total** | **1,613** | **1,694** | **1,759** | **1,823** | **210** | **13%** |

## 2. Advanced Practice Registered Nurses

National projections such that demand for health care services based largely on changing demographics in many specialties is growing faster than physician supply, but that the growth in supply of APRNs and PAs will help to blunt a projected growing shortfall of physicians.[2] The majority of care will continue to be provided by physicians over the foreseeable future, but if current trends continue then a growing proportion of care will be provided by APRNs and PAs.

Several trends suggest that the proportion of health care services provided by APRNs will continue to rise. One trend is the rapid growth in supply of APRNs. Other trends are states' willingness to expand the legal scope of practice for NPs, emerging models of care, and financial pressures to control rising medical costs. Twenty-three states, including Vermont and the District of Columbia have enacted into law and implemented full practice authority for NPs.[10] Two emerging models of care delivery, the patient-centered medical home and the nurse managed health center, use a provider mix that is richer in NPs and PAs than current models for care delivery.[11]

Vermont statewide projected growth in APRN demand to 2030 under a status quo scenario was developed for three categories of APRNs: nurse practitioners (NPs), certified registered nurse anesthetists (CRNAs), and nurse midwives. Projections suggest that statewide demand will grow by about 55 FTEs (12%) by 2030 (Exhibit 12). This compares to projected demand growth of 17% nationally for these professions.

The majority of Vermont's APRN growth will likely take place among NP specialties. NP demand projections for four broad specialty categories are summarized below. Overall, NP demand in Vermont is projected to grow by 45 FTEs (12%) between 2015 and 2030. When looking at the specialty distribution of these NPs, approximately half the growth will be in primary care. By comparison, statewide demand for nurse midwives will likely fall over time (-11%) reflecting population decline among women of child bearing age.

**Exhibit 12: Projected Vermont APRN FTE Demand by Profession, 2015-2030**

| Profession Category | 2015 | 2020 | 2025 | 2030 | FTE Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|

| | 2015 | 2020 | 2025 | 2030 | FTE Growth | % Growth |
|---|---|---|---|---|---|---|
| **Nurse Practitioners** | **379** | **395** | **410** | **424** | **45** | **12%** |
| Primary Care | 236 | 244 | 252 | 259 | 23 | 10% |
| Medical Specialties | 54 | 58 | 62 | 66 | 12 | 22% |
| Surgical Specialties | 19 | 21 | 22 | 23 | 4 | 21% |
| Other | 71 | 72 | 74 | 76 | 5 | 7% |
| **CRNAs** | **109** | **117** | **122** | **128** | **19** | **17%** |
| **Nurse Midwives** | **30** | **29** | **28** | **27** | **-3** | **-10%** |
| **Vermont Total** | **518** | **541** | **560** | **580** | **62** | **12%** |

Demand for virtually all APRN professions modeled, except nurse midwives, is growing at rates faster than projected Vermont population growth between 2015 and 2030. This pattern also holds true across Vermont HSAs (Exhibit 13) and primarily reflects both population growth/decline and aging.

**Exhibit 13: Projected Vermont APRN FTE Demand by HSA, 2015-2030**

| Hospital Service Area | 2015 | 2020 | 2025 | 2030 | FTE Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| Barre | 51 | 54 | 56 | 58 | 7 | 14% |
| Bennington | 32 | 33 | 34 | 34 | 2 | 6% |
| Brattleboro | 25 | 26 | 26 | 27 | 2 | 8% |
| Burlington | 164 | 173 | 182 | 190 | 26 | 16% |
| Middlebury | 21 | 22 | 22 | 23 | 2 | 10% |
| Morrisville | 20 | 21 | 22 | 23 | 3 | 15% |
| Newport | 23 | 24 | 25 | 25 | 2 | 9% |
| Randolph | 11 | 12 | 12 | 12 | 1 | 9% |
| Rutland | 48 | 49 | 49 | 49 | 1 | 2% |
| Springfield | 22 | 22 | 23 | 23 | 1 | 5% |
| St. Albans | 44 | 46 | 49 | 51 | 7 | 16% |
| St. Johnsbury | 21 | 22 | 23 | 24 | 3 | 14% |
| White River Jct. | 37 | 38 | 39 | 40 | 3 | 8% |
| **Vermont Total** | **518** | **541** | **560** | **580** | **62** | **12%** |

### 3.      Physician Assistants

Physician Assistants are state-licensed to practice medicine. PAs in primary care obtain medical histories conduct physical examinations, diagnose and treat illnesses, prescribe medication, order and interpret lab tests, and provide patient education and counseling. PAs are licensed to practice and authorized to prescribe medication in all 50 states and the District of Columbia.

Statewide, PA demand will grow by about 30 FTEs (13%) between 2015 and 2030, reaching 266 FTEs (Exhibit 14). Projected growth in PA demand includes 12 FTE primary care providers, with an additional 18 FTEs among the three non-primary care specialties.

Despite projected growth in demand, between 2015 and 2030 there will be little change in the distribution of PAs across specialties. By 2030 approximately 45% of PAs will work in primary care; 21% will work in surgical subspecialties; 15% will work in internal medicine subspecialties, and the remainder will work in other practice areas.

**Exhibit 14: Projected Vermont Physician Assistant FTE Demand by Specialty, 2015-2030**

| Specialty Category | 2015 | 2020 | 2025 | 2030 | FTE Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| Primary Care | 108 | 112 | 116 | 120 | 12 | 11% |
| Medical Specialties | 32 | 35 | 37 | 40 | 8 | 25% |
| Surgical Specialties | 49 | 52 | 54 | 56 | 7 | 14% |
| Other | 48 | 49 | 50 | 51 | 3 | 6% |
| **Vermont Total** | **236** | **248** | **257** | **266** | **30** | **13%** |

Projected PA demand and growth in demand varies geographically based on the size and characteristics of the population in each HSA. Exhibit 15 shows that projected growth in HSA-specific demand between 2015 and 2030 ranges from no growth in Randolph to 11 FTEs in Burlington.

**Exhibit 15: Projected Vermont Physician Assistant FTE Demand by HSA, 2015-2030**

| Hospital Service Area | 2015 | 2020 | 2025 | 2030 | Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| Barre | 25 | 26 | 27 | 28 | 3 | 12% |
| Bennington | 16 | 16 | 17 | 17 | 1 | 6% |
| Brattleboro | 12 | 13 | 13 | 13 | 1 | 8% |
| Burlington | 67 | 71 | 75 | 78 | 11 | 16% |
| Middlebury | 10 | 11 | 11 | 11 | 1 | 10% |
| Morrisville | 10 | 10 | 11 | 11 | 1 | 10% |
| Newport | 11 | 12 | 12 | 13 | 2 | 18% |
| Randolph | 5 | 6 | 6 | 6 | 1 | 20% |
| Rutland | 24 | 24 | 24 | 24 | 0 | 0% |
| Springfield | 11 | 11 | 11 | 12 | 1 | 9% |
| St. Albans | 18 | 19 | 20 | 21 | 3 | 17% |
| St. Johnsbury | 10 | 11 | 11 | 12 | 2 | 20% |
| White River Jct. | 18 | 19 | 19 | 20 | 2 | 11% |
| **Vermont Total** | **236** | **248** | **257** | **266** | **30** | **13%** |

## B.    Nurses

Registered nurses (RNs) and licensed practical nurses (LPNs) are critical to the effective and efficient delivery of health care services across a wide array of settings, including hospitals, nursing homes, ambulatory care centers, physician offices, hospice programs, home health agencies, schools, and some non-patient care settings such as public health, academia, insurance companies, and government.

## 1. Registered Nurses

Under a status quo scenario, projected demand for RNs in Vermont care delivery settings is projected to grow between 2015 and 2030 by 1,421 FTEs (22%) reaching about 7,883 RNs in 2030 (Exhibit 16). The highest RN growth rates are expected to occur in nursing homes and residential care settings (69%) and home health (41%). Absolute growth is highest in hospital inpatient settings (784 FTEs), nursing homes (267 FTEs) and home health (221 FTEs).

**Exhibit 16: Projected Vermont RN FTE Demand by Care Setting, 2015-2030**

| Setting | 2015 | 2020 | 2025 | 2030 | FTE Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| Office | 477 | 500 | 516 | 532 | 55 | 12% |
| Outpatient | 228 | 240 | 246 | 252 | 24 | 11% |
| Emergency | 540 | 547 | 550 | 553 | 13 | 2% |
| Inpatient | 3,614 | 3,862 | 4,131 | 4,398 | 784 | 22% |
| Home Health | 534 | 595 | 675 | 755 | 221 | 41% |
| Nursing Home | 385 | 425 | 539 | 652 | 267 | 69% |
| Residential Care | 119 | 131 | 166 | 201 | 82 | 69% |
| School | 158 | 150 | 146 | 141 | -17 | -11% |
| All Other | 407 | 408 | 404 | 400 | -7 | -2% |
| **Total** | **6,462** | **6,858** | **7,372** | **7,883** | **1,421** | **22%** |

Similar to other health professions modeled, projected growth in RN demand between 2015 and 2030 varies by HSA (Exhibit 17). HSAs with the highest absolute in RN demand are Burlington (432 FTEs), Barre (164 FTEs) and St. Albans (111 FTEs).

## Exhibit 17: Projected Vermont FTE RN Demand by HSA, 2015-2030

| Hospital Service Area | 2015 | 2020 | 2025 | 2030 | Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| Barre | 692 | 736 | 796 | 856 | 164 | 24% |
| Bennington | 455 | 478 | 507 | 536 | 81 | 18% |
| Brattleboro | 338 | 359 | 386 | 413 | 75 | 22% |
| Burlington | 1,738 | 1,861 | 2,016 | 2,170 | 432 | 25% |
| Middlebury | 285 | 303 | 328 | 353 | 68 | 24% |
| Morrisville | 265 | 284 | 306 | 329 | 64 | 24% |
| Newport | 319 | 342 | 368 | 394 | 75 | 24% |
| Randolph | 153 | 162 | 174 | 185 | 32 | 21% |
| Rutland | 666 | 691 | 724 | 756 | 90 | 14% |
| Springfield | 303 | 319 | 339 | 358 | 55 | 18% |
| St. Albans | 447 | 476 | 517 | 558 | 111 | 25% |
| St. Johnsbury | 288 | 307 | 335 | 362 | 74 | 26% |
| White River Jct. | 512 | 540 | 576 | 611 | 99 | 19% |
| **Vermont Total** | **6,462** | **6,858** | **7,372** | **7,883** | **1,421** | **22%** |

## 2. Licensed Practical Nurses

A large portion of LPNs work in long term care settings that are projected to experience high rates of demand growth (Exhibit 18). Overall, between 2015 and 2030 demand for LPNs is projected to grow by about 773 FTEs (39%), with most of that growth occurring in nursing homes (428 FTEs), home health (122 FTEs) and residential care facilities (121 FTEs).

## Exhibit 18: Projected Vermont LPN FTE Demand by Care Setting, 2015-2030

| Setting | 2015 | 2020 | 2025 | 2030 | FTE Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| Office | 264 | 277 | 285 | 294 | 30 | 11% |
| Outpatient | 51 | 54 | 55 | 57 | 6 | 12% |
| Inpatient | 326 | 349 | 373 | 397 | 71 | 22% |
| Home Health | 296 | 330 | 374 | 418 | 122 | 41% |
| Nursing Home | 618 | 683 | 864 | 1,046 | 428 | 69% |
| Residential Care | 174 | 192 | 244 | 295 | 121 | 70% |
| All Other | 229 | 230 | 228 | 226 | -3 | -1% |
| **Vermont Total** | **1,959** | **2,114** | **2,423** | **2,732** | **773** | **39%** |

High growth rates in demand are projected across all counties. Burlington County alone accounts for over a quarter (28%) of Vermont's projected growth in demand for LPNs (Exhibit 19).

**Exhibit 19: Projected Vermont FTE LPN Demand by HSA, 2015-2030**

| Hospital Service Area | 2015 | 2020 | 2025 | 2030 | Growth 2015-2030 | % Growth 2015-2030 |
|---|---|---|---|---|---|---|
| Barre | 211 | 228 | 264 | 300 | 89 | 42% |
| Bennington | 148 | 157 | 176 | 195 | 47 | 32% |
| Brattleboro | 106 | 114 | 132 | 150 | 44 | 42% |
| Burlington | 500 | 546 | 631 | 715 | 215 | 43% |
| Middlebury | 86 | 95 | 111 | 128 | 42 | 49% |
| Morrisville | 79 | 86 | 99 | 111 | 32 | 41% |
| Newport | 100 | 109 | 125 | 141 | 41 | 41% |
| Randolph | 47 | 51 | 58 | 66 | 19 | 40% |
| Rutland | 208 | 219 | 245 | 271 | 63 | 30% |
| Springfield | 97 | 103 | 117 | 131 | 34 | 35% |
| St. Albans | 126 | 135 | 155 | 175 | 49 | 39% |
| St. Johnsbury | 90 | 96 | 113 | 130 | 40 | 44% |
| White River Jct. | 161 | 172 | 196 | 220 | 59 | 37% |
| **Vermont Total** | **1,959** | **2,114** | **2,423** | **2,732** | **773** | **39%** |

Looking to the future, many factors will continue to affect the nurse workforce. These include demand-related trends such as the aging of the population, overall economic conditions, and new models of care. Policies designed to improve access to care and emphasizing disease management and prevention are providing new opportunities and roles for nurses within the health care delivery system.[12] Supply-related issues (outside the scope of this report) including an aging nurse workforce.

It is too early to definitively tell whether emerging care delivery models will contribute to a new growth in demand for nurses (e.g., with nurses taking on new roles in preventive care and care coordination), or a net decline in demand for nurses by reducing use of hospital and emergency services. The scenarios modeled later in the report may help inform the staffing implications of some of these emerging care delivery models. Uncertainties regarding how emerging care delivery models might affect demand (and supply) for nurses, uncertainties of how nurses and their employers will respond to economic and other trends and improvements in data collection efforts underscore the importance of ongoing research on the potential implications of the evolving health care system on demand for nurses and other health professionals. One area for future research, though, is given the negative projected population growth among adults of working age in Vermont, will there be a sufficient supply of nurses and other health workers to meet future demand.

## C.    Other Health Professions

This section of the report summarizes statewide modeling results for additional health professions modeled that reflect Vermont's interests and data availability. The professions modeled fall under five occupational categories (Exhibit 20):

- Select **pharmacy occupations**: pharmacists, pharmacy technicians, and pharmacy aides
- Select **diagnostic services**: medical and clinical laboratory technologists and technicians, diagnostic medical sonographers, nuclear medicine technologists, and radiologic technologists
- Select **direct care occupations**: home health aides and nursing aides

- Select *vision care occupations*: optometrists and dispensing opticians
- Select *other occupations*: dentists, dieticians, podiatrists, and psychologists

In addition, we briefly discuss naturopathic medicine—which was identified as an occupation of interest for this study.

The occupations summarized in Exhibit 20 provide services across the spectrum of care delivery settings. For example, the demand for many technician, technologist and aide occupations is tied to patient use of hospital services (inpatient, outpatient, and ED), physicians' offices, nursing home and residential care, home health, and the receipt of diagnostic tests and procedures across care settings. Demand for home health aides and other occupations that visit people in their home is tied to demand for different types of home health services. Demand for pharmacy-related occupations is tied to number of prescriptions filled, which in turn is influenced by patient visits to provider offices, outpatient clinics, hospitals and emergency departments. Additional detail on the HDMM models demand for these occupations is provided online.[7]

### Exhibit 20: Projected FTE Demand for Select Health Professions, 2015-2030

| Profession | 2015 | 2020 | 2025 | 2030 | FTE Growth, 2015-2030 | % Growth, 2015-2030 |
|---|---|---|---|---|---|---|
| **Pharmacy Services** | | | | | | |
| Pharmacists | 397 | 416 | 429 | 441 | 44 | 11% |
| Pharmacy technicians | 484 | 509 | 526 | 543 | 59 | 12% |
| Pharmacy aides | 57 | 61 | 63 | 65 | 8 | 14% |
| **Diagnostic Services** | | | | | | |
| Medical & clinical lab technicians | 129 | 137 | 145 | 153 | 24 | 19% |
| Medical & clinical lab technologists | 355 | 377 | 399 | 422 | 67 | 19% |
| Medical sonographers | 358 | 380 | 403 | 425 | 67 | 19% |
| Nuclear medicine technologists | 26 | 29 | 31 | 34 | 8 | 31% |
| Radiologic Technologists | 96 | 106 | 115 | 124 | 28 | 29% |
| **Direct Care Services** | | | | | | |
| Home health aides | 1,549 | 1,728 | 1,958 | 2,187 | 638 | 41% |
| Nurse aides | 2,710 | 2,942 | 3,467 | 3,991 | 1,281 | 47% |
| **Vision Services** | | | | | | |
| Optometrists | 98 | 99 | 99 | 98 | 0 | 0% |
| Opticians | 153 | 155 | 154 | 154 | 1 | 1% |
| **Other Professions** | | | | | | |
| Dentists | 323 | 329 | 330 | 330 | 7 | 2% |
| Dietitians | 146 | 153 | 163 | 173 | 27 | 18% |
| Podiatrists | 20 | 22 | 24 | 27 | 7 | 35% |
| Psychologists | 215 | 207 | 203 | 198 | (17) | -8% |

Demand for most of the occupations modeled is growing at rates faster than projected Vermont population growth between 2015 and 2030. For most of the health professions modeled, FTE demand is projected to grow by 11-35% over this period. However, projected growth for home health aides and nurse aides is 41% and 47%, respectively. The demand for vision service providers is projected to experience virtually no growth. Demand for psychologists is projected to decline slightly based on changing demographics—as the population of youth and young adults who are the primary users of psychologist services is projected to decline. (However, to the extent that there is unmet need for mental health services, then healthcare system transformation initiatives to remove barriers to receiving care could cause demand to rise—as discussed in the next Chapter).

Projections of FTE demand under the status quo scenario assume that the current national ratio of providers-to-workload drivers remains unchanged over time. Therefore, projected growth in FTE demand mirrors the projected growth in demand for health care services—taking into account the distribution of each occupation across care delivery settings and different rates of growth in demand for services in each setting. Because growth in demand for some occupations (e.g., pharmacists and pharmacy technicians) is tied to the same growth drivers, these occupations will have similar growth in demand. Growth rates may differ, however, if related occupations have different employment distributions across care delivery settings, as demand for some care delivery settings is projected to increase more rapidly than in others.

**Naturopathic Medicine Physicians**

Naturopathic medicine is a distinct primary health care profession, emphasizing prevention, treatment, and optimal health through the use of therapeutic methods and substances that encourage individuals' inherent self-healing process.[13] Naturopathic physicians are becoming more widespread and popular in Vermont. Since 1996, they have been licensed to practice in Vermont and are trained as primary care practitioners at accredited naturopathic medical schools. Four-year doctoral programs provide training in the basic medical sciences and in conventional diagnostic and treatment methods. Extensive coursework in naturopathic therapeutic approaches combined with supervised training in comprehensive integrated health care are also provided. With the exception of Medicare, out-of-state plans and certain self-insured employers, due to a law passed by the Vermont Legislature in 2007, all insurance companies regulated by the state must reimburse for the services of a naturopathic physician.

Currently, the ability to project statewide or sub-state FTE demand for this specialty is challenged by data limitations. These include small sample sizes for naturopaths reported in the Medical Expenditure Panel Survey (MEPS) and small numbers of providers and patients due, in part, to the relatively short period of time since the specialty was licensed to practice in Vermont. However, given their level of training, looking to the future naturopaths are likely to be part of the solution in meeting growing statewide demand for primary care providers. Therefore, a conservative projection of growth in naturopathic FTE demand to 2030 might be in the 10-25% range—about the same as the range of projected growth in demand for family medicine and general internal medicine physicians. Given current data limitations building capacity to model demand for this specialty is an important issue to monitor over time.

Efforts to control costs could have large positive and negative implications for the health occupations modeled. For some professions, there may be economic pressures to shift delivery of some services from higher-cost to lower-cost providers and settings. For some diagnostic occupations, for example, there may be additional pressures to demonstrate value and/or reduce use of certain tests and

procedures. Cost pressures could shift the delivery of care from some workers (e.g., hospital-based occupations) to less expensive settings such as workers in ambulatory and home health settings. Changes in technology can both increase and decrease demand for health workers. Innovation may allow more treatments to be provided—thus increasing demand for health workers. Improvements in productivity could also allow health workers to each take care of more patients.

# V. MODELING COMPONENTS OF A HIGH PERFORMING VERMONT HEALTH CARE SYSTEM

The focus of this chapter is the potential workforce demand implications of changing care use and delivery patterns consistent with an "ideal" high-performing Vermont health care system. Modeled scenarios reflect both changing demographics and assumptions and inputs of how care delivery might change over time. Scenarios modeled feature:

- Greater integration of care delivery
- Enhanced care transitions to reduce avoidable emergency department use
- Improved integration of mental health and substance use services with primary care
- Improved evidence-based chronic disease management
- Improved population health

In addition, we quantify differences in health care use patterns between the Medicaid population and a comparison group of similar patients who are commercially insured. We describe each scenario, modeling inputs and assumptions, and the workforce implications.

## A. Integrated Care Delivery Model

A variety of integrated care delivery models are being implemented for use with both publicly and privately insured populations. Integrated care delivery attempts to coordinate patient care across delivery settings. Goals include improving the coordination and quality of patient care, reducing inefficiencies and eliminating redundancy, shifting care to lower cost settings and providers as appropriate, improving preventive care efforts, and better controlling medical expenditures.

Looking historically at the effect of these delivery models on use of services provides insights on what might happen if other integrated care models gain greater prominence in Vermont. This scenario models the current and future implications for FTE physician demand if 100% of the Vermont population were enrolled in integrated care entities compared to the status quo. To model this scenario we simulate if patients in a fee-for-service type arrangement had care use patterns of similar patients in a managed care plan.

Under this scenario, by 2030 shifting the state population to an integrated care model is associated with a slight increase in total physician demand compared to the status quo (Exhibit 18). However, shifts among specialty categories are projected compared to the status quo. These include increased demand for primary care physicians and obstetrics and gynecology (which is categorized under surgical specialties) and decreased demand for medical and other specialties.

**Exhibit 21: Integrated Care Scenario: Projected Impact on VT Physician Demand**

| Workforce FTE Impacts | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| **Total Physicians** | **21** | **20** | **20** | **19** |
| Primary care | 38 | 39 | 40 | 40 |
| Medical specialties | -8 | -9 | -10 | -10 |
| Surgical specialties | 8 | 9 | 9 | 10 |
| Other specialties | -17 | -19 | -19 | -20 |

## B.    Improved Care Transitions: Emergency Department Care Triage for At Risk Populations

Many patients visit the emergency department with non-urgent conditions treatable in an ambulatory setting. Under this scenario, patients presenting with non-urgent conditions in the ED would be identified and linked to care managers and community PCPs for follow up. The assumed statewide target is to reduce avoidable ED use among the Medicaid population by 25% by 2030. The target patient population is patients with one or more ED visits potentially appropriate for diversion. This includes patients with chronic conditions and at-risk patients requiring more intensive ED care management services post discharge.

The general modeling approach for this scenario involves identifying emergency room diagnoses that could be considered potentially preventable, calculating the percentage of visits for each category of emergency visit (cardiology, gastroenterology, etc.) that are potentially preventable, and scaling down the status quo modeling projections by 25% of this number of visits.

Researchers at New York University have categorized ICD-9 diagnosis codes into four categories: non-emergent, emergent – primary care treatable, emergent – ED care needed- preventable/avoidable and emergent – ED care needed – not preventable/avoidable. For each diagnosis code, the proportion of ED cases with the diagnosis falling into each category is reported. For example, ED headache diagnoses are categorized as follows: 78% non-emergent, 9% emergent but primary care treatable, 0% emergent with ED care needed but preventable, and 13% emergent with ED care needed but not preventable. The Lewin Group expanded on the NYU algorithm, using the NYU proportions for each diagnosis to create three categories for each diagnosis: ED Avoidable, ED Questionable, and ED Required.[14] The state of Vermont has indicated that the Lewin methodology is preferred to the NYU methodology for the purposes of classifying ED visits, so the Lewin methodology was used for modeling this scenario.[a]

By 2030, the net projected statewide impact associated with a 25% reduction in ED use among Medicaid patients is an increase in primary care providers by about 81 FTEs and a decrease in emergency department providers by about 62 FTEs compared to the status quo (Exhibit 22). Most notably, the shift from the ED to primary care settings would result in a need for about 38 additional primary care

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[a] **ED Required**: Sum of the probability that each claims was (Emergent - ED Care Needed - Preventable/Avoidable) and (Emergent - ED Care Needed - Not Preventable/Avoidable) was greater than or equal to 50%.

**ED Avoidable**: Sum of the probability of (Non-emergent) and (Emergent/Primary Care Treatable) is greater than or equal to 80%.

**ED Potentially Avoidable**: Sum of the probability of (Non-emergent) and (Emergent/Primary Care) Treatable is greater than 50% but less than 80%.

physicians and 50 fewer ED RNs by 2030. While interventions to divert avoidable ED use to a primary care setting might increase overall demand for health workers, the shift would be from higher cost to lower cost settings and place patients in a situation where more extensive counseling and follow-up care could be provided.

**Exhibit 22: ED Triage Scenario: Projected Vermont FTE Staffing Impact**

| Ambulatory Care (FTEs) | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| **Primary Care Offices** | **74** | **77** | **79** | **81** |
| Primary care physicians | 35 | 36 | 37 | 38 |
| Nurse practitioners | 14 | 15 | 15 | 15 |
| Physician assistants | 9 | 9 | 9 | 10 |
| RN or LPN | 16 | 17 | 18 | 18 |
| **Emergency Department** | **-61** | **-61** | **-62** | **-62** |
| Emergency physicians | -8 | -8 | -8 | -8 |
| Nurse practitioners | -1 | -1 | -1 | -1 |
| Physician assistants | -3 | -3 | -3 | -3 |
| Registered nurses | -49 | -49 | -50 | -50 |

## C.    Improved Team-Based Care: Integration of Primary Care and Mental Health/Substance Use Services

The primary objective of this scenario is to model the workforce demand implications of better integrating into primary care settings a defined scope of mental health and substance abuse services to improve coordination of care for both services. This includes integrating mental health/substance abuse specialists into primary care clinics supporting the patient centered medical home model. This team-based care scenario focuses on individuals with co-morbid physical and mental health/substance abuse health needs. The target population includes Medicaid and uninsured primary care patients with mild-to-moderate depressive/anxiety disorders or substance abuse who are not currently receiving specialty mental health and substance abuse (MH/SA) services. The project goals include increasing access to MH/SA services and enhancing collaboration and team work among PC and MH/SA providers.

Modeling assumptions were selected from tested and published examples of primary care integration with behavioral health services. The following assumptions and inputs were used to model the workforce effects of integration of primary care and mental health & substance abuse services:

- The population of Vermonters on Medicaid is the target population. Vermonters not on Medicaid see no change in health care use.
- Approximately 10% of the Medicaid population has undiagnosed behavioral health needs, and these needs largely consist of mild-to-moderate depressive/anxiety disorders or substance abuse.[a]

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[a] Modeling assumption: For modeling purposes, an estimated percentage of the Medicaid population that may have undiagnosed behavioral health needs was required. Data from the literature around this metric is scarce, but indicates that 10% may be conservative, as some estimate that 60% to 70% of patients with behavioral health issues leave medical settings without receiving

- Approximately 80% of the Medicaid population with unmet behavioral health needs visits a primary care provider annually.[a]
- Absent of the integration initiative, approximately 50% of patients with unmet behavioral health needs would have been successfully diagnosed by a PCP and referred to a behavioral health provider.[15] As a result of the initiative impacts, PCPs will receive additional training and it is assumed that 80% of patients with unmet behavioral health needs will be diagnosed and referred.
- Absent of the initiative, 25% of referred patients will complete the referral.[16] As a result of the initiative, it is assumed that referral completion rates will double to 50%.[17]
- Behavioral health services will be provided by a Licensed Clinical Social Worker and each provider will manage approximately 75 active patients for approximately 6 months (or approximately 150 patients annually).[b16]
- Behavioral health-related ED visits may decrease by approximately 130 visits.
- Behavioral health-related inpatient days are reduced by 0.14 days per person that receives behavioral health services as a result of the integration for a total reduction of approximately 210 days.[c]

Based on modeling assumptions developed from the literature, a change in the population receiving MH/SA counseling under this initiative of about 4,638 by 2030 was assumed. Annual projected health care use impacts include the following:

- 213 fewer ED visits
- 343 fewer Inpatient days
- 1,577 additional primary care visits
- 12,985 additional encounters with MH/SA care managers

Workforce implications of health care use impacts: Modeling results indicate a corresponding rise in mental health/substance abuse care providers in primary care settings, which in 2030 includes an additional 31 FTE clinical social workers and 3 FTE psychiatrists or psychiatric nurses, and additional support staff (Exhibit 23). (The modeled intervention assumes mental health care provided primarily by licensed clinical social workers with some referrals for psychiatric care, but some care could be provided by other types of mental health workers including psychologists or substance abuse counselors). While this scenario anticipates a reduction in workforce FTEs in the ED and inpatient settings, the projected impact in these settings is small, as is the overall impact of the initiative. This is due primarily to the modest increase in numbers of patients receiving counseling even after full project implementation.

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behavioral health treatment http://www.commonwealthfund.org/publications/newsletters/quality-matters/2014/august-september/in-focus#/#4. Thus, 10% was chosen in order to avoid overestimating the effects of the initiative.

[a] Nationwide, 86.5% of adult and 93.5% of child Medicaid beneficiaries had contact with a health care professional in the past year. This information is used to guide the assumption that 80% of the Medicaid population with unmet behavioral health needs will visit a primary care provider. http://ftp.cdc.gov/pub/Health_Statistics/NCHS/NHIS/SHS/2014_SHS_Table_A-18.pdf

[b] Source indicates caseloads of 100 – 150 patients. For modeling, the higher caseload was used as the project focuses on population without serious mental health issues, and in that case, presumably, providers are able to see more patients. https://aims.uw.edu/collaborative-care/team-structure/care-manager

[cc] Co-location and navigator services have helped the Genesee Health System health center and Hope Network achieve drops in psychiatric inpatient admissions (pre intervention average: 1.95 per person, post intervention average: 0.48 per person) http://kff.org/report-section/integrating-physical-and-behavioral-health-care-promising-medicaid-models-issue-brief/

**Exhibit 23: Integration of Primary Care and Mental Health & Substance Abuse Services: Projected Workforce Impact**

| Population modeled | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| **Population modeled** | | | | |
| Population with unmet MH/SA needs (15% of Vermont Uninsured/Medicaid Pop) | 23,748 | 23,001 | 22,045 | 21,080 |
| Population with unmet MH/SA needs visiting PCP (80%) | 18,998 | 18,401 | 17,636 | 16,864 |
| Population screening positive for MH/SA needs absent Integration (50%) | 9,499 | 9,200 | 8,818 | 8,432 |
| Population screening positive for MH/SA needs with Integration (80%) | 15,199 | 14,721 | 14,109 | 13,491 |
| Screened population completing MH/SA referral absent Integration | 2,375 | 2,300 | 2,204 | 2,108 |
| Screened population completing MH/SA referral with Integration | 7,599 | 7,360 | 7,054 | 6,746 |
| Change in population receiving MH/SA counseling | 5,225 | 5,060 | 4,850 | 4,638 |
| **Health care use impact of Integration** | | | | |
| Encounters with MH/SA care manager | 14,629 | 14,169 | 13,580 | 12,985 |
| Primary care visits | 1,776 | 1,720 | 1,649 | 1,577 |
| MH/SA-related ED visits | -240 | -233 | -223 | -213 |
| MH/SA-related inpatient days | -387 | -374 | -359 | -343 |
| **Workforce FTE implications** | | | | |
| *Office setting* | | | | |
| Licensed clinical social worker | 35.0 | 33.5 | 32.5 | 31.0 |
| Psychiatrists/psych nurses | 3.5 | 3.5 | 3.5 | 3.0 |
| Primary care providers | 1.0 | 0.5 | 0.5 | 0.5 |
| Direct medical support | 2.0 | 1.0 | 1.0 | 1.0 |
| Direct admin support | 15.5 | 14.5 | 14.0 | 13.5 |
| Staff registered nurses | 0.5 | 0.5 | 0.5 | 0.5 |
| *Emergency Department* | | | | |
| Emergency physicians | 0.0 | 0.0 | 0.0 | 0.0 |
| Nurse practitioners or physician assistants | -2.0 | -2.0 | -2.0 | -1.5 |
| Staff registered nurses | -0.5 | -0.5 | -0.5 | -0.5 |
| *Inpatient* | | | | |
| Hospitalists | 0.0 | 0.0 | 0.0 | 0.0 |
| Staff registered nurses | -2.5 | -2.0 | -2.0 | -2.0 |
| Licensed practical nurses | 0.0 | 0.0 | 0.0 | 0.0 |
| Nurse aides/assistants | -0.5 | -0.5 | -0.5 | -0.5 |

## D.    Evidence-Based Strategies to Improve Management of Cardiovascular Disease

The Cardiovascular disease management scenario assumes adults with cardiovascular disease (CVD) become better at self-managing their condition with assistance from health coaches and primary care providers. Better self-management includes: improving prescribing and adherence to aspirin prophylaxis among eligible patients, improving blood pressure control by updating and strengthening implementation of hypertension guidelines, improving cholesterol control by updating current cholesterol management, supporting adherence to current treatment guidelines, and increasing smoking cessation by enabling PCPs to support adherence to standard counseling and treatment for tobacco use disorder.

The following assumptions and inputs are used in this analysis:

- We assume that half of Vermonters who are 18 or older with cardiovascular conditions participate in the program
- Quality improvement in primary care management will decrease CVD-related emergency visits by 20%[18]
- Quality improvement in primary care management will decrease CVD-related inpatient hospital days by 39% [19]
- Quality improvement in primary care management will increase visits to PCPs by 1 and cardiologists by 0.5 annually[17]
- Health coaches in this program will be used in a ratio of 1:2000 patients

Exhibit 24 summarizes statewide modeling results and projected impacts. By 2030 the net projected annual utilization impact associated with this disease management initiative is the following:

- 1,043 fewer emergency department visits
- 2,034 fewer Inpatient days
- 92,042 additional primary care visits
- 46,041 additional visits to cardiologists

The projected 2030 workforce impact includes:

- An increase of about 46 FTE CVD educators/health coaches
- **In outpatient/office settings:** an increase of about 42 additional primary care FTEs, 167 direct medical and administrative support staff FTEs, 31 additional staff RN FTEs, and 14FTE cardiologists
- **In ED settings**: a slight decrease in emergency department staff
- **In inpatient settings:** a decrease in demand for hospital inpatient staff—including approximately 12 fewer RN and 3 fewer nurse aides/assistants FTEs

In terms of workforce implications, the analysis suggests that the greatest impact of this project on workforce will be in outpatient settings. When the additional FTE requirements associated with primary care providers, cardiologists, direct medical and administrative support staff and staff RNS are combined, approximately 254 FTEs may be needed in 2030. The project also has impact in the inpatient setting, with staff RN FTEs decreasing by approximately 12. There is minimal projected impact in the ED

and hospital inpatient settings.  This scenario reflects an example where improved access to care might improve patient quality of life, but have minimal impact on reducing use of hospital-based care.

**Exhibit 24: CVD Chronic Disease Management Initiative Workforce Impacts**

|  | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| Number of actively engaged patients | 73,400 | 81,100 | 86,600 | 92,000 |
| Projected Care Use Impacts |  |  |  |  |
| Emergency visits | -900 | -1,000 | -1,000 | -1,000 |
| Inpatient days | -1,700 | -1,900 | -2,000 | -2,000 |
| Additional visits to primary care provider | 73,400 | 81,100 | 86,600 | 92,000 |
| Additional visits to cardiologists | 36,700 | 40,600 | 43,300 | 46,000 |
| **Workforce FTE implications** |  |  |  |  |
| *Outpatient/Office setting* |  |  |  |  |
| Primary care providers | 33.5 | 37 | 39.5 | 42 |
| Direct medical support | 77.5 | 86 | 91.5 | 97.5 |
| Direct admin support | 55.5 | 61.5 | 65.5 | 69.5 |
| Staff registered nurses | 24.5 | 27 | 29 | 31 |
| Specialists (cardiologists) | 11 | 12 | 13 | 13.5 |
| *Emergency Department* |  |  |  |  |
| Emergency physicians | -0.5 | -0.5 | -0.5 | -0.5 |
| Staff registered nurses | -1.5 | -1.5 | -1.5 | -1.5 |
| *Inpatient* |  |  |  |  |
| Hospitalists | -1 | -1 | -1 | -1 |
| Staff registered nurses | -10.5 | -11 | -11.5 | -12 |
| Licensed practical nurses | -0.5 | -0.5 | -0.5 | -0.5 |
| Nurse aides/assistants | -2.5 | -3 | -3 | -3 |
| ***Health Coaches 1:2,000 patients*** | **36.5** | **40.5** | **43.5** | **46.0** |

## E.    Physician Demand Implications of Achieving Population Health Goals

Population health goals and many care delivery and reimbursement practices support the provision of timely and appropriate preventive care. Among the nation's Healthy People 2020 Goals are (1) improving the percentage of adults with hypertension whose blood pressure is under control, (2) improving blood glucose control of people with diabetes, (3) improving cholesterol levels for adults with hypercholesterolemia, (4) reducing prevalence of obesity by encouraging improved nutritional intake and increased physical activity, (5) reduced prevalence of smoking, and (6) many other goals related to receiving preventive care and improving health-related behavior.[20] Progress towards achieving many of these goals has been strengthened by changes in policy and treatment guidelines.

Examples of policies designed to help meet these goals include US Preventive Services Task Force (USPSTF) recommendations for intensive behavioral counseling to individuals who are obese or who are

at high risk for developing cardiovascular disease or diabetes to promote a healthful diet and physical activity[21, 22]; Medicare reimbursement for intensive behavioral counseling to reduce diabetes and cardiovascular disease prevalence[23]; and provisions in the Affordable Care Act to cover counseling and treatment related to smoking cessation and improving clinical metrics such as blood pressure, cholesterol levels, hemoglobin A1c levels.[24]

We modeled a hypothetical, but achievable, scenario of the potential impact on patient health and the resulting statewide demand for health care services and providers of achieving the following population health improvements:

- **Sustained 5% body weight loss for overweight and obese adults**: The recommendation is for obese patients to lose 10% body weight or more, and numerous studies have shown that 5% or more weight loss is achievable.[25, 26] However, sustaining weight loss is a challenge but could be achieved using a medical home model where patients continue to receive counseling and support over time.
- **Improved blood pressure, cholesterol, and blood glucose levels for adults with elevated levels**: Clinical trials have shown that that appropriate adherence to medicine and counseling can help patients with hyperlipidemia reduce total blood cholesterol by 34.42 mg/dL[27]; patients with uncontrolled hypertension can reduce systolic blood pressure by 14.5 mm Hg and diastolic blood pressure by 10.7 mm Hg[28]; and patients with elevated hemoglobin A1c levels can reduced A1c (modeled as 1 percentage point decline annually until diabetes control is reached at A1c of 7.5%).[29]
- **Smoking cessation**: Patients who stop smoking can, over time, reduce risk for various cancers and other medical conditions.[30]

This modeled scenario is identical to analysis covering the national physician workforce published by IHS and sponsored by the Association of American Medical Colleges.[2]

The Disease Prevention Microsimulation Model (DPMM) used for modeling this scenario simulates onset of disease and other risk factors between 2015 and 2030 under a status quo scenario which assumes the status quo in terms of patient health outcomes under normal care, and compares outcomes to simulation results if the above lifestyle and clinical outcomes were achieved. These modeling results from the DPMM were then used as inputs into the Healthcare Demand Microsimulation Model to project levels of health care use and provider FTE demand under both the status quo and intervention modeling assumptions. The difference in health care use and FTE demand between the sets of assumptions reflects the impact of the intervention.

The DPMM uses a Markov-based microsimulation approach that has been described in detail elsewhere.[25, 26, 31, 32] DPMM prediction equations came from clinical trials and published studies. The simulation used a representative sample of Vermont adults constructed using the 2013-2014 National Health and Nutrition Examination Survey (NHANES) combined with Vermont population projections. The modeled intervention focused on adults who are overweight or obese; have elevated blood pressure, cholesterol, or blood glucose levels; or who smoke.

Modeling outcomes for Vermont suggest that achieving these lifestyle and clinical goals would (cumulative between 2015 and 2030) result in 13,900 fewer cases of heart disease, 7,200 fewer strokes, 4,200 fewer heart attacks, and reduced incidence of cancer and other diseases. On a per capita basis, demand for health care services and physicians would decline by about 1-2% with the impact differing by care delivery setting and medical specialty.

Achieving these population health goals would reduce mortality such that in the future more people would be alive and require physician care. Achieving modeled outcomes could raise the 2030 population by 8,900 adults (+1.8%)—most of whom would be elderly. As a result, by 2030 statewide demand for physicians would be approximately 21 FTEs *higher* because the number of physicians needed to support these additional 8,900 adults more than offsets the reduced demand associated with a healthier population (Exhibit 25).

The demand impact varies by physician specialty category (Exhibit 26). The specialty projected to experience the largest percentage increase in demand by 2030 attributed to achieving these population health goals is geriatricians (8% increase in demand associated with more elderly still living), while the specialty projected to experience the largest percentage decrease in demand is endocrinologists (9% decrease associated with fewer patients with diabetes and diabetes-related complications).

**Exhibit 25: Projected Scenario Impact on Size of Vermont Adult Population, 2015-2030**

**Exhibit 26: Physician Net Demand Implications of Achieving Modeled Population Health Goals**
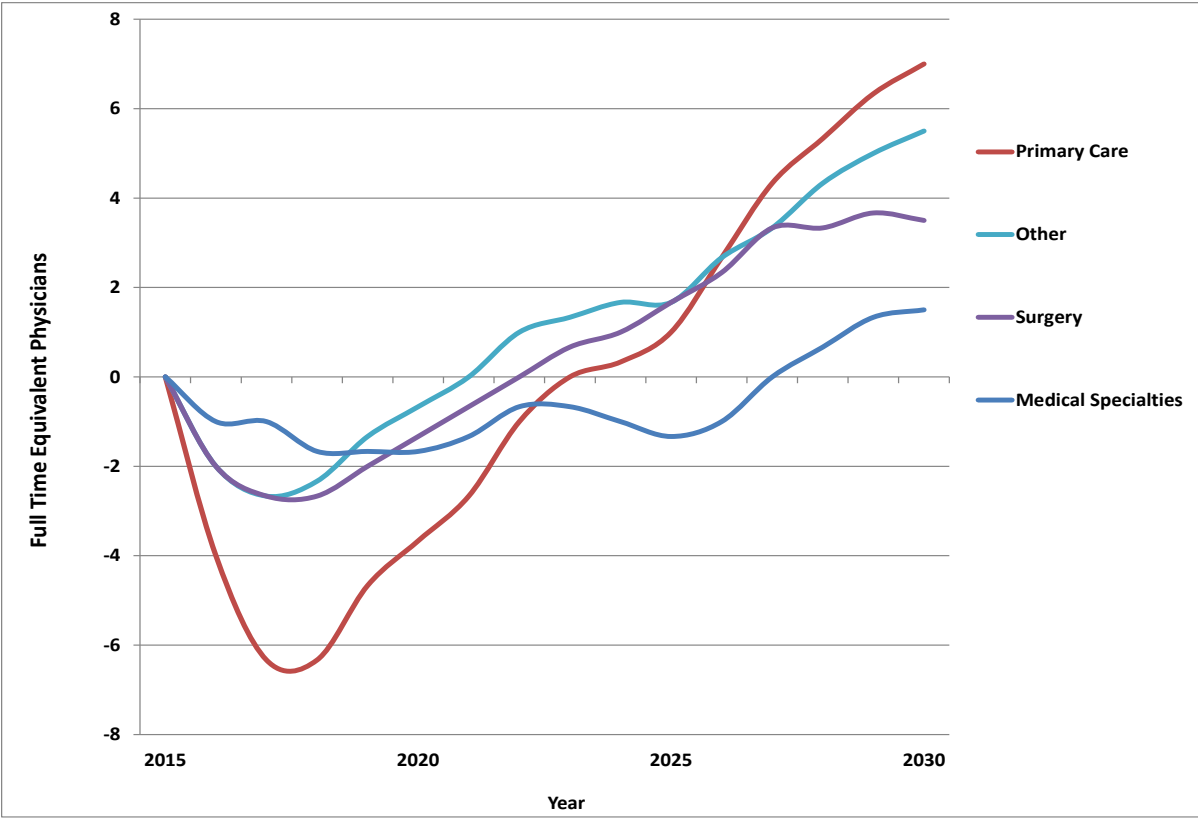


Note: This chart compares projections of Vermont physician demand if the modeled population health goals are achieved versus demand under a continuation of the status quo.

The main conclusion to draw from this scenario is that in the long run achieving select population health goals will not necessarily decrease total physician demand—although it might decrease demand for select physician specialties and shift care across delivery settings. Achieving population health goals reduces morbidity and increases longevity and quality of life, but the demand for health services associated with increased longevity appears to more than offset the declines in service use associated with improved health under the scenario modeled.

The net effect is a slight (1%) decline in physician demand in the initial years after achieving these goals and a slight (2%) increase in physician demand by 2030. Similar results are found for nurses and many other health occupations resulting in higher demand for health workers to support a larger and older population when mortality is reduced. We modeled only a subset of the state's population health goals, but meeting goals related to improved cancer screening, reduced alcohol abuse, and other population health goals would likely achieve similar implications of increased physician demand to care for a larger population partially offset by decreased demand associated with a healthier population.

## F. Alternative Payer Scenario: Examining the Workforce Impact of a Medicaid Population with Use Patterns of the Privately Insured Population

This scenario models the workforce impacts of a change in the health care use patterns of the Medicaid population to match the health care use patterns of those insured by private insurance (controlling for demographics and other risk factors such as disease prevalence). For modeling purposes, the Vermont Medicaid population was passed through the microsimulation model as if they had private insurance instead of Medicaid. Given that the Medicaid population uses health care services at higher rates than those with private insurance, these modeling assumptions result in lower utilization and FTE demand projections compared to the status quo.

This scenario highlights the differences in health care use between the Medicaid and the privately insured populations that are unexplained after controlling for differences in observable health risk factors such as demographics, disease prevalence and lifestyle choices. This scenario does not necessarily suggest that the population of Vermonters would reduce their health care use by these levels if they were covered by private insurers as the state's Medicaid population may have characteristics that are associated with higher health care use but not captured in the model's prediction equations. Thus, caution should be exercised when interpreting the results of this scenario.

### Exhibit 27: Alternative Payer Scenario Workforce Impacts

| Workforce FTE Impacts | 2015 | 2020 | 2025 | 2030 |
|---|---|---|---|---|
| Total Physicians | -103 | -101 | -96 | -90 |
| Primary care | -24 | -24 | -23 | -21 |
| Medical specialties | -13 | -13 | -12 | -11 |
| Surgical specialties | -5 | -5 | -5 | -4 |
| Other specialties | -61 | -60 | -57 | -53 |
| Advanced practice nurses | -40 | -40 | -37 | -35 |
| Physician assistants | -10 | -9 | -9 | -8 |
| Registered nurses | -539 | -529 | -498 | -467 |

The projected 2030 workforce impact of the state's Medicaid population having health care use patterns similar to the state's privately insured population includes:

- Lower demand for physicians (90 FTE), including 21 primary care physicians and 53 from the "other specialties" category—of which half are psychiatrists (likely representing systematic differences between the Medicaid and commercially insured populations in mental health conditions not controlled for in our simulation model
- Overall reduced demand for registered nurses (-467 FTEs)
- Demand for psychologists projected to fall by 56 FTEs

## VI.   CONCLUSION

This study combined data on the demographics, socioeconomics, and health risk factors of the population in Vermont, data from national sources on patient care use and delivery patterns, and health workforce simulation models of demand to estimate the current and future demand of physicians and other health professions in Vermont through 2030. In this section we discuss the key findings and their implications. We also discuss study strengths and limitations.

### A.   Key Findings and Implications

This study first projected future demand for health care services and providers from 2015 through 2030 under a status quo scenario based on changing demographics in the absence of health care system transformation.

- **The growing elderly population in Vermont is the primary driver of increasing demand for health care services and the workforce required to meet the projected future demand for services**. Between 2015 and 2030, Vermont is projected to experience a slight overall population decline (-0.9%), but experience 50% growth in the "Baby Boomer" population age sixty-five. By comparison, the US population is projected to grow by about 12% with the population age sixty-five and older projected to grow by 46%.[1] This rapid growth in the elderly population suggests that a large portion of the increase in demand for health workers will primarily be among those professions and in care delivery settings that predominantly serve the elderly.
- **Physician demand continues to grow in Vermont**. Despite a small projected population decline, the aging population suggests demand for physicians will grow between 2015 and 2030 by approximately 210 FTEs (13%).
  - In absolute terms, statewide demand growth is highest for general internal medicine (54 FTEs) and family medicine (29 FTEs).
  - In percentage terms demand growth is highest for specialties serving an older population, including geriatric medicine (63%), hematology and oncology (33%), vascular surgery (33%), and urology (32%).
  - Projected decline in demand for pediatrics and obstetrics & gynecology (-10%) and neonatal-perinatal medicine (-13%) reflects negative population growth among younger age cohorts.
- **Demand for physician assistants and nursing professions will grow approximating the same rate as overall physician demand**.
  - Demand for advanced practice nurses will grow by about 62 FTEs (12%), with the majority of growth taking place among nurse practitioners (45 FTEs).
  - Total physician assistant demand will grow by about 30 FTEs (13%) reaching 266 FTEs, with about 41-45% employed in primary care.
  - Statewide demand for registered nurses will grow by about 1,421 FTEs (22%), with the highest growth rates expected in nursing home and residential care settings (69%), and home health (41%). Hospitals will continue to be the largest employer of registered nurses.
- **The rate of growth in demand for other health occupations modeled varies widely**. Slow growth occupations include optometrists, opticians and dentists with about 0-2% cumulative growth between 2015 and 2030. High growth occupations include nurse aides (47% growth) and home health aides (41% growth).

After modeling the implications of changing demographics in the absence of system transformation, we modeled the workforce implications of efforts to improve care coordination and delivery.

- **Increased use of integrated care statewide can shift care to lower cost settings**. Greater integration of care is projected to have little impact on overall demand FTE demand for physicians and advanced practice nurses. However, demand would shift away from medical specialties and towards primary care.
- **An initiative which diverts non-emergent visits to the emergency department into primary care settings shifts demand for health providers**. Reducing avoidable emergency department use among the Medicaid population by 25% could, by 2030, reduce demand for registered nurses based in the emergency departments (-50 FTEs) and emergency physicians (-8 FTEs), but increase primary care physician demand by 38 FTEs and RN and LPN demand in ambulatory settings by 18 FTEs by 2030, compared with the status quo scenario.
- **Integrating mental health and substance abuse services into primary care practices to improve screening and access, reduce care fragmentation, and better manage co-morbid physical and mental health or substance abuse needs would increase demand for behavioral health providers**. The modeled scenario focuses on the Medicaid population, and could lead to 4,600 additional patients receiving counseling by 2030 compared to the status quo. To support the additional patients receiving screening, Vermont's workforce would require 31 additional licensed clinical social workers and 3 additional psychiatrists or psychiatric nurses.
- **Efforts to better manage disease and achieve population health goals can increase demand for health professions in some settings and increase demand in others**. Overall demand for providers would likely increase, but would result in reduced mortality and improved quality of life.
  - A cardiovascular disease management program focusing on Vermont's population with cardiovascular conditions could require 42 additional primary care providers, 31 additional registered nurses, and 14 additional cardiologists in ambulatory settings, and would slightly reduce demand for providers in inpatient and emergency settings.
  - Initiatives for improved population health could include targets such as smoking cessation, weight loss among obese and overweight adults, and improved control of blood pressure, cholesterol, and blood sugar for individuals with elevated levels. If such population health improvements were achieved statewide, demand for physicians and other health professions is projected to fall in the short run due to a healthier population and increase in the medium-to-long run as more residents are alive and live into older age groups. Projected growth in demand for physicians in 2030 under these assumptions is 21 FTEs (2%) higher than under status quo assumptions, as the health care system would be support an additional 8,900 residents who otherwise would not be alive in 2030.

## B.     Potential Areas for Future Research

The primary strengths of this study are the use of the latest data and modeling methods for health workforce analysis. The study reflects the most recent population projections published by the State of Vermont, and recent data on the health risk characteristics of the population and the relationship between these risk characteristics and use of health care services. To the extent possible national patterns of care use and delivery were calibrated to reflect use and delivery patterns in Vermont through analysis of the VUHDD and VHCURES data.

This study focused solely on trends and initiatives that likely will affect demand for health care services and providers. A more complete picture would require supply projections for comparison to determine

the projected future adequacy of health workforce supply both at the state level and across hospital services areas and communities. National studies suggest that demand for physicians is growing faster than national supply—suggesting that Vermont will face increasing pressures from other states to attract and retain physicians.[2] On the other hand, the national supply of registered nurses, advanced practice nurses, and physician assistants is growing rapidly suggesting Vermont might find it easier to attract and retain professionals in these occupations over time. Occupations projected to experience rapid growth in demand include nurse aides and home health aides—occupations that have low entry barriers to the profession but also high exit rates.

Health workforce demand projections are challenged by the pace and often unpredictable ways in which health care is changing. Uncertainties include shifting policy priorities, emerging care delivery models and changing care practices might affect workforce demand, and how clinicians and care settings will respond to economic and other trends.

- **The pace of care migration from inpatient and institutional to outpatient, community and home-based settings:** Shifts in care settings and modalities spurred by development and expansion of Accountable Care Organizations, the patient-centered medical home, and other new delivery models will continue to shift health workforce demand from high cost hospitals and emergency departments (ED) to other appropriate care settings.
- **More effective management of chronic disease**: Chronic disease management is transitioning to team-based care management and patient education conducted in community and home settings. These activities are likely to increase workforce demand for case managers, social workers and other health occupations trained in carrying out these activities. Team based care will also support expanding scope of practice for registered nurses, nurse practitioners and physician assistants.
- **Changing health care payment and coverage policies**: These have the potential to significantly influence patterns of demand for health care services and occupations.
- **Economic developments**: National and state trends in unemployment may influence the health occupations and trigger the need to update projections. The last economic downturn (2008-2009) appeared to influence supply and demand by slowing retirements and consumer demand for many discretionary services.

These uncertainties underscore the importance of ongoing research on potential implications of the evolving health care system for Vermont's health workforce. Efforts to monitor the adequacy of health workforce supply across Vermont will help inform strategies to ensure access to high quality, affordable care. Such research might include a heightened focus on modeling workforce supply and overall adequacy of supply, as an adequate supply of health professionals is essential to meeting Vermont's goal of providing access to high quality, affordable care for an aging population. Supply projections would consider the demographics of the current workforce, numbers of health professionals being trained, retirement patterns and numbers of hours worked in patient care. Integrating supply and demand projections at state and HSA-levels would present an accurate picture of the current and projected future size, specialty mix and characteristics of Vermont's health workforce and an accurate profile of future demand for services and FTE health professionals. Integrating supply and demand projections is important to identify disparities in access to care and to inform health care policy making.

In addition to evolving care delivery models and reimbursement, each year new data become available on population characteristics and risk factors, and care use patterns. Key data sources used in the model

are summarized in Exhibit 28. Since the commencement of this study, 2015 data for many of the sources has now become available.

## Exhibit 28: Health Workforce Demand Data Sources and Uses

| Data Source | Use in HWSM | Data Used |
|---|---|---|
| *Population Database* | | |
| American Community Survey | Create state and national population files; also potential to model at sub-state level using 5-year file | 2014 |
| Behavioral Risk Factor Surveillance System | Health risk factors and other data used to create state and national population files | 2013,2014 |
| National Nursing Home Survey | BRFSS-type data, but for residents of nursing homes | 2004 |
| U.S. Census Population Projections | National population projections (by demographic) | 2014 |
| State Population Projections | Individual state and county-level population projections (by demographic) | Various |
| *Health Care Use* | | |
| Medical Expenditure Panel Survey | Estimate health seeking behavior | 2009-2013 |
| Nationwide Inpatient Sample | Estimate hospital length of stay; model calibration for annual hospital visits | 2013 |
| National Ambulatory Medical Care Survey | Model use of non-physician services during office visits; model calibration for annual office visits | 2012 |
| National Hospital Ambulatory Medical Care Survey | Model use of non-physician services and physician consults during ED visits; model calibration for annual ED visits | 2011 |
| *Health Care Provider Staffing* | | |
| Bureau of Labor Statistics, Occupational Employment Statistics | Estimate provider staffing ratios by health occupation (excluding physicians) | 2014 |
| American Medical Association Masterfile | Estimate physician staffing ratios by specialty | 2014 |
| Health profession surveys | From various professional and trade associations such as MGMA | Various |

# TECHNICAL APPENDIX

This appendix provides additional technical documentation of the Health Care Demand Microsimulation Model (HDMM) developed by IHS Markit. Detailed documentation is available online.[3, 7]

Exhibit A-1 summarizes the population characteristics in the final population database created for each county. This detailed information for each person captures systematic geographic variation in demographics, insurance and socioeconomic characteristics, health risk factors, and disease prevalence.

### Exhibit A-1: Summary of Population Characteristics

| |
|---|
| Race-Ethnicity: Hispanic, Non-Hispanic black, Non-Hispanic white, Non-Hispanic other race |
| Gender |
| Age Group: 0-2, 3-5, 6-12, 13-17, 18-34, 35-44, 45-64, 65-74, 75+ years |
| Current smoker |
| Diagnosed with or history of: |
|     Arthritis |
|     Asthma |
|     Coronary heart disease |
|     Diabetes |
|     History of cancer |
|     History of heart attack |
|     History of stroke |
|     Hypertension |
| Insured (from any source) |
| Medicaid (insured through Medicaid) |
| Managed care (insurance plan type) |
| Family 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 or higher |
| Body Weight: Normal, Overweight, Obese |
| Metro area |

Exhibit A-2 is provided as an example of the regression specifications, with this example showing how patient characteristics are correlated with use of cardiology-related health care services by care delivery setting. The numbers in this table reflect rate ratios (for office and outpatient visits, or inpatient days) or odds ratios (for ED visits and hospitalizations). For all types of cardiology-related care there is a strong correlation with patient age (controlling for other patient characteristics modeled) and being in Medicaid. Having any medical insurance is associated with much greater use of ambulatory care, and if the insurance is Medicaid then there is even greater use of cardiology services across all care delivery settings.

For example, compared to their commercially insured counterparts with similar demographics and health risk factors, patients with Medicaid average 35% more office visits to a cardiologist annually, 42% more cardiology-related outpatient visits, 64% higher odds of a cardiology-related emergency visit, and have 71% higher odds of a cardiology-related hospitalization. These estimates for the Medicaid

population are statistically different from 1 (where a ratio of 1 would indicate no statistical difference with the comparison category).

Obesity increases use of cardiology-related services. Smoking is associated with fewer office and outpatient visits to a cardiologist but higher rates of ED visits (likely reflecting correlation rather than causality in the case of ambulatory care, as smoking is a risk factor for heart disease but could be correlated with aversion to visit a doctor). Reflecting access issues lower income is associated with less use of ambulatory care and more use of ED visits and hospitalization.

 The presence of chronic medical conditions—and especially heart disease, hypertension, and history of heart attack—are associated with much greater use of cardiology services across care delivery settings. When modeling the Medicaid population in each county the HDMM takes into consideration that the Medicaid population often has much greater prevalence of a host of chronic conditions and risk factors relative to their non-Medicaid peer group.

## Exhibit A-2: Sample Regressions: Adult Use of Cardiology Services

| | Parameter | Office Visits | Outpatient Visits | Emergency Visits | Hospitalization |
|---|---|---|---|---|---|
| Race-Ethnicity | Hispanic | 0.81** | 0.73** | 1.03 | 0.87** |
| | Non-Hispanic Black | 0.78** | 0.98 | 1.45** | 1.41** |
| | Non-Hispanic White | 1.0 | 1.0 | 1.0 | 1.0 |
| | Non-Hispanic Other race | 0.92** | 0.82** | 1.09 | 1.06 |
| | Male | 1.11** | 1.48** | 0.97* | 1.07 |
| Age | 18-34 years | 0.12** | 0.13** | 0.63** | 0.37** |
| | 35-44 years | 0.23** | 0.52** | 0.98 | 0.80** |
| | 45-64 years | 0.52** | 0.74** | 1.10 | 1.14* |
| | 65-74 years | 0.87** | 0.95* | 1.12 | 1.57** |
| | 75+ years | 1.0 | 1.0 | 1.0 | 1.0 |
| | Smoker | 0.74** | 0.75** | 1.11 | 1.06 |
| Diagnosed with | Hypertension | 1.56** | 1.15** | 3.85** | 2.71** |
| | Coronary heart disease | 8.54** | 9.60** | 2.93** | 3.96** |
| | History of heart attack | 1.69** | 1.63** | 2.41** | 2.59** |
| | History of stroke | 1.11** | 1.18** | 3.11** | 2.97** |
| | Diabetes | 1.11** | 1.37** | 1.01 | 1.16** |
| | Arthritis | 1.09** | 1.23** | 1.02 | 0.99 |
| | Asthma | 1.08** | 1.10** | 0.95 | 18 |
| | History of cancer | 1.08** | 0.98 | 0.99 | 0.93 |
| | Insured | 2.48** | 1.88** | 0.89 | 1.02 |
| | Medicaid | 1.35** | 1.42** | 1.64** | 1.71** |
| | Managed Care | 0.97** | 1.06** | 1.01 | 0.99 |
| Household Income | <$10,000 | 0.84** | 15 | 1.20** | 1.16** |
| | $10,000 to <$15,000 | 0.89** | 0.72** | 1.10 | 1.11 |
| | $15,000 to < $20,000 | 0.90** | 1.06 | 0.86 | 1.02 |
| | $20,000 to < $25,000 | 0.84** | 0.72** | 1.15 | 1.09 |
| | $25,000 to < $35,000 | 0.89** | 1.08** | 1.18** | 1.05 |
| | $35,000 to < $50,000 | 0.89** | 0.96** | 0.92 | 0.94 |
| | $50,000 to < $75,000 | 0.93** | 1.24** | 0.89 | 0.82** |
| | $75,000 or higher | 1.0 | 1.0 | 1.0 | 1.0 |
| Body Weight | Normal | 1.0 | 1.0 | 1.0 | 1.0 |
| | Overweight | 1.06** | 1.02 | 1.16** | 1.22** |
| | Obese | 1.11** | 1.08** | 1.13** | 1.26** |
| | Metro Area | 1.31** | 1.02 | 1.04 | 0.89 |

Note: Analysis of the 2000-2013 files of the Medical Expenditure Panel Survey. Estimates for office and outpatient visits reflect rate ratios from Poisson regression. Emergency and hospitalization reflect odds ratios from logistic regression. ** indicates statistically different from 1 at the 01 level, and * indicates statistically significant at the 05 level.

To model hospital inpatient service demand we analyzed the 2013 National Inpatient Sample (NIS) which contains discharges from short-term general acute care hospitals and specialty hospitals. Logistic regression quantifies the probability of a person with given characteristics experiencing hospitalization during the year for a wide range of medical conditions, including mental health and substance abuse conditions based on ICD-9 primary diagnosis code groupings (Exhibit A-3).

To model inpatient length of stay the 2013 NIS discharge records were analyzed. Because of the large sample size (over 8 million hospital stays) estimates derived from the NIS are stable. Estimated Poisson regressions generated the expected number of days spent in the hospital conditional on a hospitalization. Explanatory variables consisted of patient age group, sex, race/ethnicity, insurance type, presence of chronic diseases and risk factors among the diagnosis codes, and residence in a metropolitan area. Separate regressions were estimated for each of the mental health and substance abuse condition categories. Combining information on condition specific hospitalization risk and length of stay per hospitalization, HDMM computed each person's expected number of inpatient days during the year for different types of medical conditions.

### Exhibit A-3: Hospital Inpatient Demand Drivers by Condition Code and Specialty

| Medical condition codes (ICD-9 CM) | | Specialty/NPC Profession |
|---|---|---|
| Allergy & immunology | 001-139, 477, 995.3 | Allergy & immunology |
| Diseases of the circulatory system | 390-459; 745-747; 785 | Cardiology |
| Diseases of the circulatory system | 426, 427, 780, 785; 3726 <= pr02 <=3734 | Clinical Cardiac Electrophysiology |
| Diseases of the circulatory system | pr02 IN (0060, 3600, 3950) | Interventional Cardiology |
| Colon & rectal surgery | 17.31-17.36, 17.39, 453, 45.26, 45.41, 45.49, 45.52, 45.71-45.76, 45.79, 45.81-45.83, 45.92-45.95, 463, 464, 46.10, 46.11, 46.13, 46.14, 46.43, 46.52, 46.75, 46.11, 46.13, 46.14, 46.43, 46.52, 46.75, 46.76, 46.94, 153-154 | Colon & rectal surgery |
| Diseases of the skin and subcutaneous tissue | 680-709; 757; 782 | Dermatology |
| Endocrine, nutritional and metabolic diseases, and immunity disorders | 240-279; 783 | Endocrinology |
| Diseases of the digestive system | 520-538; 555-579; 751; 787; 42-54 | Gastroenterology |
| General surgery | 860-869; 870-904; 925-939; 958-959; 996-999 | General surgery |
| Neoplasms, diseases of the blood and blood-forming organs | 140-239, 280-289; 790 | Hematology & oncology |
| Neoplasms, diseases of the blood and blood-forming organs | 195.2, 188.9, 174.9, 156, 164.1, 209.24, 155, 162.9, 183; 92.2 (http://www.donself.com/do | Radiation Oncology |

| Medical condition codes (ICD-9 CM) | | Specialty/NPC Profession |
|---|---|---|
| | cuments/ICD-10-for-Radiation-Oncology.pdf) | |
| Infectious and parasitic diseases | 001-139, 477, 40.11, 40.3, 40.9 | Infectious diseases |
| Nephrology | 580-589; 55.2-55.8 | Nephrology |
| Conditions originating in perinatal period | 760-779 | Neonatal-perinatal medicine |
| Neurological surgery | 850-854; 950-957; 01-05; 89.13 | Neurological surgery |
| Diseases of the nervous system and sense organs | 320-359; 742; 781; 784; 800-804 | Neurology |
| Complications of pregnancy, childbirth, and the puerperium | 614-679, V22,V23,V24, 72-75 | Obstetrics & gynecology 72-75 |
| Ophthalmology | 360-379; 8-16; 95-95.4 | Ophthalmology |
| Diseases of the musculoskeletal system and connective tissue; injury and poisoning | 710-719; 720-724; 730-739; 805-848; 754-756; 76-84 | Orthopedic surgery |
| Otolaryngology | 380-389; 744; 18-29 | Otolaryngology |
| Plastic surgery | 904-949; 749; 18.7, 21.8, 25.59, 26.49, 27.5, 27.69, 29.4, 31.7, 33.4, 46.4, 64.4, 78.4, 81-81.99, 82.7, 82.8, 83.8, 85.8, 86.84 | Plastic surgery |
| Mental disorders | 290-319; 94.1-.59 | Psychiatry |
| Diseases of the respiratory system | 460-519; 748; 786; 35-39 | Pulmonology |
| Diseases of the musculoskeletal system and connective tissue | 725-729 | Rheumatology |
| Thoracic surgery | 426, 427, 780, 785); 32.6, 34.9, 40.6, 90.4, 35-37 | Thoracic surgery |
| Diseases of the genitourinary system | 590-608; 753; 788; 789; 791; 55-64 | Urology |
| Vascular surgery | 440-448; 0.4-00.5, 17.5, 35-39 | Vascular surgery |
| Physical Medicine/Rehabilitation | 0.4-00.5, 17.5, 35-39; 93 | Physical Medicine/Rehabilitation |

Source: Analysis of the 2013 National Inpatient Sample.


## HDMM VALIDATION, STRENGTHS, AND LIMITATIONS

Model validation activities continue on an ongoing basis as a long term process evaluating the accuracy of the model and making refinements as needed. For each of four primary types of validation deployed, key short term and long term activities include the following:

- **Conceptual validation**: Through reports, presentations at professional conferences and publication of peer-reviewed manuscripts the model described here continue to undergo a peer-review evaluation of its theoretical framework. Contributors to these models include health economists, statisticians and others with substantial modeling experience; physicians,

nurses, behavioral health providers and other clinicians; health policy experts; and professionals in management positions with health systems. Conceptual validation requires transparency of the data and methods to allow health workforce researchers and modelers to critique the model. This report is an attempt to increase the transparency of these complex workforce projection models where work is ongoing to improve the theoretical underpinnings, methods, assumptions, and other model inputs.

- **Internal validation**: The model runs using SAS software. As new capabilities are added to the model and data sources updated, substantial effort is made to ensure the integrity of the programming code. Internal validation activities include generating results for comparison to published statistics used to generate the model (e.g., ensuring that population statistics for the input files are consistent with published statistics).
- **External validation**: Presenting findings to subject matter experts for their critique is one approach to externally validate the model. Intermediate outputs from the model also can be validated. For example, the HDMM has been used to project demand for health care services for comparison to external sources not used to generate model inputs. Results of such comparisons across geographic areas indicate that more geographic variation in use of health care services occurs than is reflected geographic variation in demographics, presence of chronic disease, and health risk factors such as obesity and smoking.
- **Data validation**: Extensive analyses and quality review have been conducted to ensure data accuracy as model data inputs were prepared. Most of the model inputs come from publically available sources (e.g., MEPS, BRFSS, and ACS).

The main strengths of the HDMM includes use of recent data sources and a sophisticated microsimulation approach that has substantial flexibility for modeling changes in care use and delivery by individuals or by the health care system. Compared to population-based modeling approaches used historically, this microsimulation model takes into account more detailed information on population characteristics and health risk factors when making national and state-level demand projections.

For example, rates of disease prevalence and health related risk factors and household income can vary significantly by geographic area. Such 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.

HDMM simulates care use patterns by delivery setting. Certain populations have disproportionately high use of specific care delivery settings (e.g., emergency care) and lower use of other settings. Setting-specific information on patient characteristics and use rates provides insights for informing policies that influence the way care is delivered. Because the microsimulation approach uses individuals as the unit of analysis, the HDMM 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. This information also leads to more accurate projections at state and local levels. The microsimulation approach also provides added flexibility for modeling the workforce implications of changes in policy and emerging care delivery models under ACA, important areas of ongoing research.

Limitations of the workforce model largely stem from current data limitations. For example, one limitation of the BRFSS as a data source for modeling demand is that as a telephone-based survey it tends to exclude people in institutionalized settings who typically do not own telephones. Hence, when creating the population files that underlie the demand projections BRFSS data is combined with National Nursing Home Data. Other current data limitations associated with these models include: (1) information on the influence of provider and payer networks on consumer service demand and migration patterns, and (2) information on how care delivery patterns might change over time in response to emerging market factors.

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