Target Workforce State Report

BRONX PARTNERS FOR
HEALTHY COMMUNITIES

Delivery System Reform Incentive Payment Program

Workforce Strategy Deliverable

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BDO

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Exhibit List

I. Executive Summary

The goal of the Delivery System Reform Incentive Payment ("DSRIP") program is to reduce avoidable hospitalizations and Emergency Department ("ED") visits by the New York State ("NYS") Medicaid population by 25%. The DSRIP program aims to transform and redesign the existing health care system through the creation of integrated delivery systems across the care continuum, implement a value-based payment system, and facilitate workforce realignment and training to support system transformation, among other goals.
The Bronx Partners for Healthy Communities ("BPHC") engaged BDO Consulting ("BDO"), in collaboration with IHS, Inc. ("IHS"), as its workforce vendor to define the PPS's target workforce state. To achieve goals of the DSRIP program as well as to facilitate workforce planning needs, information on the PPS's target workforce state, including the demand for health care services and professionals, was projected to identify workforce needs and ultimately inform the PPS's overall DSRIP program planning and project implementation.
The Target Workforce State report identifies the PPS's projected workforce needs by the end of the DSRIP program in 2020 and will be leveraged by the PPS to identify gaps between the reported current workforce state and the projected target workforce state to inform the development of a workforce transition roadmap. The transition roadmap will be used by the PPS to inform workforce planning and training to address any identified workforce gaps as a result of the DSRIP program.

Development of the BPHC target workforce state was conducted in collaboration with the PPS's Executive Committee ("Workforce Governance Body") and included input from multiple stakeholders within the PPS's partner network as well as external data sources. External data sources included local, state and national surveys, medical claims databases, published literature and IHS's Health Care Demand Microsimulation Model (HDMM).

BPHC will implement ten projects under DSRIP, focusing on the provision of high quality, integrated primary, specialty and behavioral health care services in outpatient and community settings with acute care hospitals used primarily for emergent and acute care inpatient service delivery. Based on findings from the PPS-sponsored community needs assessment (CNA) the PPS selected three system transformation projects (Domain 2), four clinical improvement projects (Domain 3), and two population-wide prevention projects (Domain 4).

The primary research questions that guided modeling the workforce impact of each DSRIP project include:

I. How many patients will be affected by this intervention?
II. What are the current health care utilization patterns of affected patients, and how will this initiative change those care utilization patterns?
III. What mix of providers will be used to implement the intervention and meet future patient demand for services?
IV. Will the project as designed materially impact the region's healthcare delivery workforce?

II. Target Workforce State Summary Findings

As the DSRIP program progresses over the five years, the demand for health care workforce within the BPHC network will continue to evolve as DSRIP projects are implemented, impacts of those projects are realized, and as external factors outside of the DSRIP program evolve. As a result, it is worth noting that although this analysis was conducted using best efforts and project implementation assumptions to model workforce impacts over the DSRIP program, the target workforce state described within this report is a projection to inform BPHC workforce planning, and workforce needs will be continually reevaluated as project impacts are realized overtime.

Exhibit ES-1 below summarizes the estimated target workforce state staffing impacts by 2020 of both DSRIP-related projects and demographic and healthcare coverage changes independent of DSRIP across select BPHC care settings and key job categories. In some cases non-DSRIP related impacts offset or moderate the effects of DSRIP while in other cases they magnify DSRIP workforce impacts. Notable projected impacts across the BPHC PPS include:

- By 2020, the combined impacts of a growing and aging population, expanded medical insurance coverage under ACA, and DSRIP implementation will increase demand for health providers modeled by approximately 832.5 FTEs
    - Independent of DSRIP, workforce demand is projected to grow by approximately 620.5 FTEs
    - The projected impact of DSRIP implementation alone is estimated to increase demand for health providers modeled by approximately 212 FTEs
- The largest workforce impacts of both DSRIP and changes independent of DSRIP are projected to take place among registered nurses, and primary care providers and medical and administrative support staff in outpatient and community-based settings
    - Net demand for registered nurses is estimated to decrease by approximately 4.5 FTEs, as anticipated DSRIP related declines of about -213.5 FTEs (primarily in hospital inpatient settings), are offset by growth in demand of 209 FTEs for registered nurses due to non-DSRIP related environmental factors. DSRIP related demand for non-nursing care coordinators is projected to rise by about 266 FTEs due to staffing needs mostly associated with the Health Home at Risk Intervention initiative
    - An estimated additional 174 FTE administrative support staff and 144.5 FTE medical assistants also are likely to be required in non-acute care settings to support primary care providers, psychiatrists and other medical and behavioral health specialties in meeting both DSRIP related needs and those associated with population growth and aging
- The largest workforce impacts of DSRIP implementation alone are estimated to take place among non-nursing care coordinators. Estimated changes in demand among other health professions are less significant.
- Projected workforce impacts by 2020 associated with implementation of individual DSRIP programs vary greatly.

- The impact of the Health Home at Risk Intervention initiative on projected health care use and workforce demand is greater than the impact of any other BPHC DRSIP project due largely to the size of the population targeted which is currently estimated to grow from about 5,760 in 2017 to 57,600 by 2020
    - The most significant projected workforce impacts of this initiative include demand for an additional 235 FTE care coordinators accompanied by a decrease in demand for registered nurses in hospital inpatient settings of about -103 FTEs. This DSRIP-related decrease will be offset by increased demand for nurse coordinator leaders (46 FTEs) in other care settings and the effects of demographic shifts and other factors independent of DSRIP

In addition, for comparison purposes of the projected target workforce staffing impacts, *Exhibit ES-2* has been provided and details the reported current workforce state for the PPS pertaining to the job titles and categories being reported within *Exhibit ES-1* and throughout this report. However, the numbers being reported do not include the PPS's total reported workforce for all job titles. For reference, the PPS's current workforce state report provides further details around the reported current workforce with a reported workforce of 71,232 (by headcount) or 48,029 FTEs.

Exhibit ES-1: BPHC PPS Summary of Projected DSRIP Staffing Impacts

	Target State Analysis		
Setting and Job Category	Non-DSRIP Impacts	DSRIP-related Impacts	Total Impacts
Primary and Community-Based Settings			
Primary Care Providers	55.5	40.5	96
Cardiologists	8.5	4.5	13
Endocrinologists	2.5	2.5	5
Psychiatrists / Psychiatric Nurse Practitioners	8	4	12
Psychologists	37	-	37
Clinical Social Workers	-	42	42
Registered Nurses	28.5	-	28.5
Licensed Practical Nurses	9	24	33
Nurse Aides / Assistants	8.5	0	8.5
Medical Assistants	97	47.5	144.5
Administrative Support Staff	103	71	174
Emergency Department			
Emergency Physicians	2.5	-14.5	-12
Nurse Practitioners & Physician Assistants	1.5	-3	-1.5
Registered Nurses	20.5	-52.5	-32
Hospital Inpatient			
Hospitalists	3.5	-18	-14.5
Registered Nurses	160	-220	-60
Licensed Practical Nurses	21	-14.5	6.5
Nurse Aides / Assistants	36.5	-64	-27.5
Pharmacists	17.5	1	18.5
Care Managers / Coordinators / Navigators / Coaches			
Nurse Coordinator Leaders	-	46	46
RN Care Coordinators	-	13	13
Non-Nursing (Community Health Workers)	-	266	266
CVD Educators	-	15.5	15.5
Diabetes Educators	-	13	13
Asthma Educators	-	8	8
Total FTEs	**620.5**	**212**	**832.5**

Exhibit ES-2: BPHC PPS Current State Reported Workforce by Target State Corresponding Job Titles

Job Category	Reported Workforce (FTEs)
Primary and Community-Based Settings	
Primary Care Providers	331.8
Cardiologists	82.2
Endocrinologists	12
Psychiatrists / Psychiatric Nurses	250.2
Psychologists	125.4
Clinical Social Workers	1,339.5
Registered Nurses	4,352.3
Medical Assistants	10.3
Administrative Support Staff	1,627.8
Hospital Inpatient & Emergency Department	
Emergency Physicians	103.6
Primary Care Physicians	33.7
Specialists (except Psych)	846.6
Residents and Fellows	1,189
Physician Assistants	285.5
Registered Nurses	2,501.8
Licensed Practical Nurses	180.6
Nurse Aides	5
Nurse Practitioners	231.9
Care Managers / Coordinators / Navigators / Coaches	
Nurse Coordinator Leaders	48.1
RN Care Coordinators	120.6
Care Coordinators (non-RN)	929.3
Diabetes Educators	11
Asthma Educators	4.5
Total FTEs	**14,622.7**

III. Target Workforce State Summary Conclusions

As previously described, the purpose of the Target Workforce Report is to analyze and project the PPS's anticipated future workforce needs as a result of system transformation through the DSRIP program in addition to non-DSRIP related impacts.

The demand for health care services and providers within the BPHC network will change over time independent of any DSRIP impact. Independent of DSRIP, demand for physicians and other health professions in the Bronx and BPHC's service area will grow. As a result, these projections suggest that any DSRIP-related changes in demand need to be taken into account in the context of broader trends affecting the demand for health care services and providers within BPHC's service area. In some cases non-DSRIP impacts will likely offset or moderate the effects of DSRIP while in other cases they may magnify DSRIP workforce impacts.

Under DSRIP, large increases are anticipated in numbers of care coordinators, and primary care providers and support staff, which reflects the enhanced demand for these professions within a transformed delivery system. There will likely also be opportunities to redeploy and train hospital nursing and other staff currently in inpatient and ED settings, where demand is projected to decline, to assume roles in outpatient and community-based settings where demand is projected to grow.

Although the estimated workforce impacts of several DSRIP projects (e.g., asthma management) may be less significant than those cited above, they help explain how DSRIP goals, including reductions in inappropriate care use, might be achieved through counseling, improved access to primary and preventive health services, and better care management for patients with chronic conditions.

Therefore, based on available modeling inputs and assumptions, these modeling results suggest that implementing DSRIP as designed will likely materially impact the BPHC network and healthcare delivery workforce, especially when combined with the projected impacts of demographic shifts and expanded health insurance coverage. This information will be used to inform development of a gap analysis and workforce transition plan intended to guide achievement of the BPHC future state.

IV. Background & Purpose

The Bronx Partners for Healthy Communities (BPHC) Performing Provider System (PPS) is a coalition of over 200 Bronx-based organizations with two anchor hospitals, St. Barnabas Health System and Montefiore Medical Center. Within the PPS there are 40-plus community-based clinical provider organizations, 23 behavioral health/substance abuse centers, 20 home care services, 8 housing and homeless agencies, developmental disability providers, health plans and 20-plus non-licensed community-based organizations (CBOs). The partner organizations work collaboratively to increase patient access, care quality, and efficiency in healthcare delivery. Through the 10 DSRIP projects undertaken by BPHC, designed to meet the community's unique health needs, BPHC is building a coordinated, community-based healthcare system focused on the wellness of every Bronx resident. Located in the Bronx, the fiduciary sponsor, St. Barnabas Health System (SBH), along with its partner health system Montefiore and others, is committed to transforming health care delivery for the Bronx's Medicaid Population.

The purpose of this report is to describe the anticipated transformation of the existing health care system as BPHC implements the chosen DSRIP projects, and to quantify the anticipated implications on the PPS's workforce needs. The target workforce state analysis described here is part of the DSRIP Workforce Strategy Milestones. This analysis identifies new positions and staffing needs, and informs the PPS's overall workforce strategy throughout the five year program.

BPHC engaged BDO, in collaboration with IHS, to define the target workforce state through the analysis of workforce impacts as a result of system transformation and implementation of clinically integrated programs. The PPS's target workforce state was created in collaboration with the PPS's Workforce Governance Body and included input from partners within the PPS's partner network.

The target workforce state for BPHC, as defined within this report, has been developed to align with DSRIP program goals. It takes into consideration the current state of the workforce as well as the demand for health care services and providers in the PPS's Bronx service area as a result of general population growth and aging over the next five years. BPHC's target workforce state will be used to develop a detailed gap analysis between the PPS's identified current and target workforce state to inform development and implementation of the workforce transition roadmap. The approach used to define the PPS's target workforce state as well as summary findings, observations, and considerations are detailed within the body of this report and a technical Appendix.

The results of the target workforce are estimates that are based on a combination of inputs, including the PPS's estimates around potential staffing and anticipated project impacts, PPS patient population demographics and health care service utilization, as well as data points from the literature and published outcomes from similar demonstrations. Several DSRIP projects, however, are innovative and there is limited information on their possible effects. In such instances, assumptions around potential impacts were made in collaboration with the

PPS, based on the best information currently available. As such, the estimates in this report are based on assumptions that will most likely change over time, as they are dependent on successful project implementation and funding and budget considerations. Additionally, although the use of workforce models has been prevalent in estimating workforce planning, models have several limitations, one of which is that their results are based on data that doesn't reflect the real time environment of the scenario they are projecting. When the complexity of the market in the Bronx is taken into consideration as well, it must be understood that the findings of this report are simply estimates and are subject to change.

V. Overview of Target Workforce State Modeling Approach

Modeling the future workforce required to support and sustain DSRIP-related system transformation while factoring in other trends impacting the workforce was accomplished using a combination of existing workforce modeling tools, original data analysis, findings from published literature, information on the population served and current health care use patterns within New York State and BPHC provider area, and expert opinion from PPS project leads and the modeling team. The analysis modeled the likely impact of each DSRIP project individually and jointly (as BPHC's DSRIP projects overlap in terms of participating patients and health utilization goals). The modeling tools and analyses were adapted to reflect the characteristics of the DSRIP target population and the nature of each DSRIP project.

Four key dimensions for modeling the potential future workforce needs required under the target state include:

1. **Health care services providers and support staff.** The right mix of health care providers and support staff is needed to ensure that patients have access to services and the efficient delivery of such services. Hence, modeling efforts require understanding the types of services that patients will require and the staffing patterns for care delivery. The occupation categories modeled are defined by the Department of Labor's Standard Occupational Classification (SOC) system.

2. **Care delivery settings.** The level of services used and staffing by care delivery setting helps inform where providers and support staff are needed to meet patient service needs and help control health care costs. Key settings include hospital inpatient, emergency, and outpatient/clinic care; ambulatory care at provider offices; and home-based care.

3. **Geography.** The geographic location of providers should be consistent with patient needs to ensure access to care. For the BPHC PPS, the relevant geographic area covers the population living in the Bronx (with multiple PPS networks serving the Medicaid population in the Bronx).

4. **Evolving needs.** Workforce needs will evolve over time (2015 through 2020) as a result of general population growth and aging. Identifying how these needs will evolve helps to inform the appropriate timing for transitioning from the PPS's current state to the target workforce state.

While the PPS's performance metrics are measured on services provided to the Medicaid population, the PPS partner network (e.g. hospitals, clinics, participating physicians and other care settings) serves a broader patient population that encompasses Medicaid, Medicare, commercially insured, and uninsured/self-pay patients. Likewise, some DSRIP initiatives will impact both Medicaid and non-Medicaid patients as systematic changes in care delivery are implemented. Therefore, modeling future workforce needs requires an understanding of how both DSRIP and non-DSRIP trends will affect the entire patient population.

The target workforce state modeling effort was conducted in collaboration with the PPS's Workforce Governing Body, Project Leads, and Project Managers and included the review of supporting PPS literature, Community Needs Assessment ("CNA"), the PPS's DSRIP Project and Organizational Applications, and quarterly implementation reports submitted to the NYS Department of Health (SDOH). Through the synthesis and application of all collected data inputs, the target workforce state was modeled to project DSRIP impacts on the current workforce and identify future state workforce needs to reflect proposed PPS system transformation initiatives under DSRIP. Preliminary results were shared with PPS stakeholders and refined based upon informed feedback.

The complexity of this modeling effort required the use of data from multiple sources and modeling tools. Data used in the analysis comes from local, state and national surveys (e.g., Behavioral Risk Factor Surveillance System [BRFSS]), medical claims databases (e.g., New York's Statewide Planning and Research Cooperative System [SPARCS]), published literature, and IHS's Health Care Demand Microsimulation Model (HDMM). An overview of the HDMM and key data sources is provided below, with additional detail on modeling individual DSRIP projects discussed in a technical appendix.

A. Health Care Demand Microsimulation Model

The workforce model described within this subsection is unique in its approach and complexity. The model described applies a microsimulation approach where individual patients are the unit of analysis. This model is used by the Federal Bureau of Health Workforce to model physicians, advanced practice nurses, physician assistants, nurses, behavioral health providers, and other health occupations at the national and state level.[1]

[1] See various reports published at http://bhpr.hrsa.gov/healthworkforce/supplydemand/index.html

The model has been used by states to assess the adequacy of provider supply at the state, regional, and county level.[2]

The model has also been used by professional associations and other organizations to analyze trends and policies with workforce implications.[3] In addition, the model has been used at the local level to help hospitals and health systems with market assessment and workforce planning.

The HDMM models demand for health care services and providers. Demand is defined as the health care services (and workforce) that are likely to be used based on population characteristics, care use, and delivery patterns. The logic model describing the HDMM and a summary description of its major components are depicted below (*Exhibit 1*). The HDMM is comprised of three major components:

1. A population database with demographic characteristics, socioeconomic factors and information regarding health risks and disease prevalence for each person in a representative sample of the population being modeled (e.g., the population in the Bronx, NY).
2. Health care utilization patterns that reflect the relationship between patient characteristics and health care use.
3. Staffing patterns that convert estimates of health care service demand to estimates of provider demand.

[2] See, for example, *Florida Statewide and Regional Physician Workforce A: Estimating Current and Forecasting Future Supply and Demand*. Prepared for the Safety Net Hospital Alliance of Florida. 2015. http://safetynetsflorida.org/wp-content/uploads/Jan-28-IHS-Report-PDF.pdf

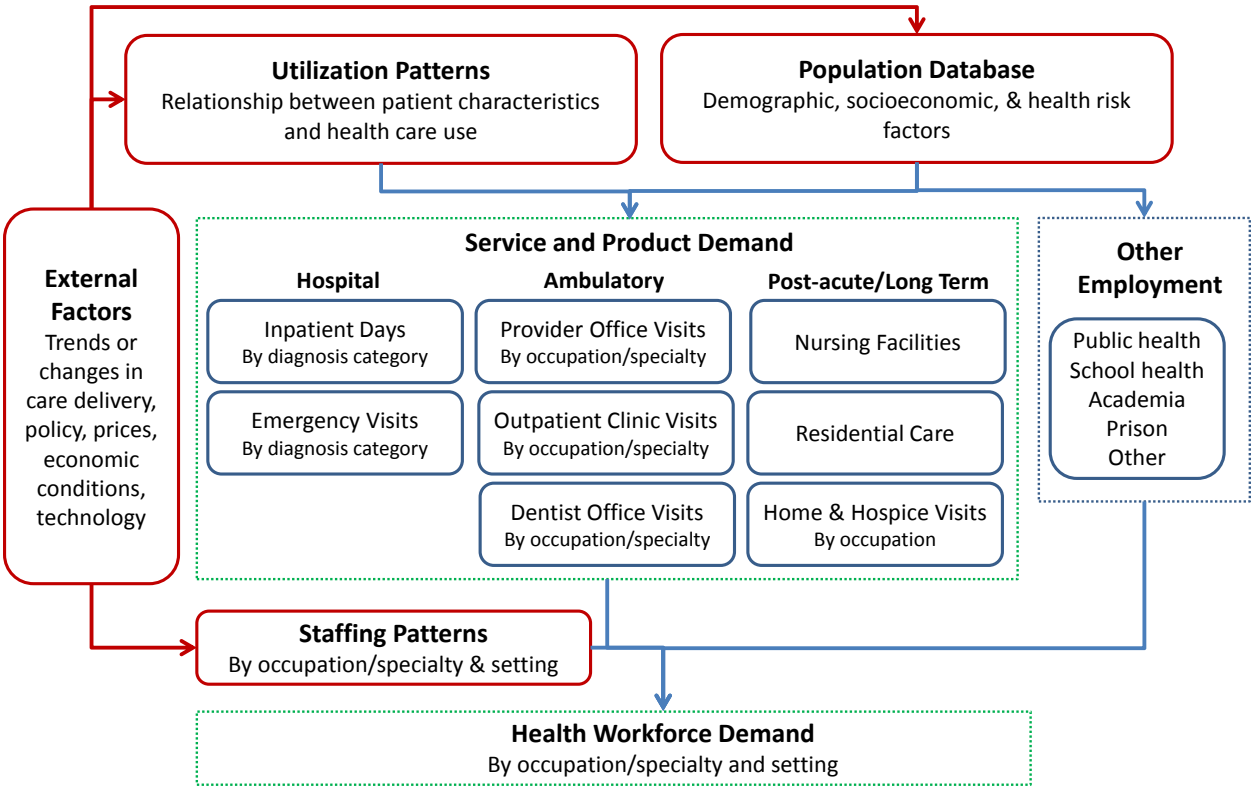
[3] Examples include: *The Complexities of Physician Supply and Demand: Projections from 2014 to 2025*. Prepared for the Association of American Medical Colleges. Washington, DC: Association of American Medical Colleges; 2016. https://www.aamc.org/download/458082/data/2016_complexities_of_supply_and_demand_projections.pdf

Dall TM, Gallo PD, Chakrabarti R, West T, Semilla AP, Storm, MV. An Aging Population and Growing Disease Burden Will Require a Large and Specialized Health Care Workforce by 2025. *Health Affairs*. 2013; 32:2013-2020.

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

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

Exhibit 1: Health Care Demand Microsimulation Logic Model



1. **Preparing the population database.** The database prepared for the HDMM contains a representative sample of the population in the Bronx. 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; presence of chronic disease (hypertension, coronary heart disease, diabetes, arthritis, and asthma); and history of adverse health events (heart attack, stroke, and cancer). For modeling purposes, estimates for the Medicaid population were scaled to the 133,117 Medicaid beneficiaries attributed to the PPS. Estimates for the Medicare, commercially insured, and uninsured populations were scaled using estimates of the PPS's market share for each payer type.

   Information to create and validate this database comes from both New York-specific sources such as EpiQuery: NYC Interactive Health Data, New York State's Department

of Health, and national sources such as the Center for Disease Control and Prevention's Behavioral Risk Factor Surveillance System (BRFSS)[4] and the Census Bureau's American Community Survey (ACS)[5]. Summary prevalence statistics of health risk factors for the created population file were compared to published sources to ensure the sample is representative of the population in the Bronx. Population projections (by county) through 2020 are from the Cornell Program on Applied Demographics in Ithaca, NY.[6]

2. **Developing health care utilization forecasting equations.** Patterns of health care services utilization behavior reflect patterns for people with similar demographics, insurance status and health risk factors in the pooled 2009-2013 files (n~169,000) of the Agency for Health Care Research and Quality's Medical Expenditure Panel Survey (MEPS). MEPS data is nationally representative of the U.S. non-institutionalized population. Several hundred prediction equations are built into the simulation model. Each prediction equation was estimated using regression[7] analysis, with separate prediction equations for each combination of care delivery setting, medical specialty, and children versus adults. The dependent variables in the regressions reflect annual use of health care services, while the explanatory variables consists of the demographic characteristics, health risk factors, medical conditions, and socioeconomic factors described previously. Applying these prediction equations to the population in the Bronx produces estimates of the current and projected future demand for health care services by care delivery setting, given the characteristics and health risk factors among the community modeled.

   Aggregating these estimates across individuals provides an estimate of the level of health care services that would be used by a national peer group of the population in the Bronx. Estimates of health care utilization from this national peer group were compared to actual health care use statistics to calibrate the model (reflecting that health care use patterns of people in the Bronx can differ from national patterns, controlling for demographics, disease prevalence, and other health risk factors). Additionally, the population in the Bronx might receive some care outside of the Bronx, and some care provided in the Bronx is for patients who reside outside of the Bronx.

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[4] http://www.cdc.gov/brfss/

[5] https://www.census.gov/programs-surveys/acs/

[6] https://pad.human.cornell.edu/counties/projections.cfm

[7] Poisson regression was used to model annual numbers of physician office and outpatient visits with a particular provider type, inpatient days per hospitalization and annual home health/hospice visits. Logistic regression was used to model annual probability of hospitalization and emergency department use for approximately 24 diagnosis categories defined by primary diagnosis code (e.g., hospitalization for a cardiovascular condition).

3. **Modeling full time equivalent (FTE) staffing to meet demand for health care services.** The number and mix of health care professionals required to provide the level of health care services demanded is influenced by how the care system is organized, how care is reimbursed, provider scope of practice requirements, economic constraints, and technology, as well as other factors. The HDMM applies staffing patterns measured in terms of provider-to-workload measures (e.g., FTE family physicians per 1,000 office visits, or FTE emergency physicians per 1,000 ED visits). The model was further adapted to New York State by calibrating (scaling) demand projections by physician specialty to equal the state average level of care in 2014. Hence, the baseline demand projections reflect the level and mix of services in each county if that county's population had care use and delivery patterns consistent with the average across New York State for a similar patient mix. Staffing levels associated with individual DSRIP projects, described later, came from the published literature and PPS documents.

B. Common Modeling Inputs and Assumptions across DSRIP Projects

While each DSRIP project has its unique modeling assumptions and data inputs, certain projects share common modeling assumptions and inputs. These include parameters for identifying the PPS's market share of service utilization and provider staffing patterns and productivity.

Parts of the future state analysis were modeled at the borough/county level due to availability of data on the population and prevalence of disease and other health risk factors. We calculated BPHC's market share by payer type (Medicaid, Medicare, and other) in the Bronx using inpatient discharge data from New York State's Statewide Planning and Research Cooperative System (SPARCS). *Exhibit 2* summarizes the PPS's market share of the Bronx inpatient discharges by payer. In lieu of information specific to utilization patterns in other care settings, a working assumption was made that a similar market share would be applied to other care delivery settings (e.g., emergency and ambulatory care).[8]

[8] During internal discussion amongst a PPS consortium it was agreed that the inpatient market shares are most likely not applicable to other settings but is currently the best available information to inform market share assumptions

Exhibit 2: Estimated BPHC Inpatient Market Share in the Bronx (2014)

Payer	BPHC Market Share	Inpatient Discharges
Medicaid	47%	46,155
Medicare	66%	33,500
Other(Self Pay/Uninsured/Commercial)	68%	21,223
Total	56%	100,878

Exhibit 3 summarizes information about anticipated staffing patterns and provider productivity used for modeling these impacts across DSRIP projects. The PPS was the primary data source used to model the workforce implications of various DSRIP projects. When PPS-specific data was unavailable, other data sources were used including the National Ambulatory Medical Care Survey (NAMCS, national data), the National Hospital Ambulatory Medical Care Survey (NHAMCS, national data), and the Medical Group Management Association (MGMA).

Exhibit 3: Model Inputs: PPS Provider Staffing Patterns and Productivity

Modeling Input	Parameter	Source
Proportion of primary care office visits seen by		
Primary care doctor	97.1%	1
Nurse practitioner	3.1%	1
Physician assistant	4.6%	1
Proportion of emergency department visits seen by		
Emergency physician	92.4%	2
Nurse practitioner	3.5%	2
Physician assistant	4.6%	2
Annual patient visits per FTE provider (productivity)		
Primary care doctor	3,741 (2,993*)	3
Office-based nurse practitioner	3,185 (2,548*)	3
Office-based physician assistant	3,670 (2,936*)	3
Emergency physician	1,973	3
ED-based nurse practitioner	2,572	3
ED-based physician assistant	1,910	3
Hospitalist (assume 1 patient encounter/day)	2,008	3
Annual ratio of total patient visits/days per FTE provider (note: not all patients will necessarily see this provider during their visit/stay)		
Office-based visits per FTE registered nurse	4,469	4
ED visits per FTE registered nurse	612	4
Inpatient days per FTE registered nurse	168	4
Inpatient days per FTE licensed practical nurse	2,939	4
Inpatient days per FTE nurse aide	667	4
Support staff		
Direct medical support (medical assistant)	1 x PCP	5
Direct medical support (LPN)	0.5 x PCP	5
Direct admin support (medical secretary/practice manager)	0.75 x BHP	5

Modeling Input	Parameter	Source
Care coordinators/managers		
Care coordinator per primary care provider	0.5 x PCP	5
Annual patients managed per care coordinator	250	5
Care coordinators per manager	5:1	5

Notes: FTE=full time equivalent, PCP=primary care provider, BHP=behavioral health provider. Sources: [1] 2012 National Ambulatory Medical Care Survey; [2] 2011 National Hospital Ambulatory Medical Care Survey; [3] 2014 Medical Group Management Association median visits/FTE provider (with * indicating the number was scaled to an average BHPC desired panel size of 1500). [4] National health care use (visits, days) ÷ FTE providers in that setting, 2013. [5] PPS-indicated staffing levels.

Based on analysis of the NAMCS, patients who visit a primary care provider are seen by a physician in 97.1% of visits, by a nurse practitioner (NP) in 3.1% of visits, and by a physician assistant (PA) in 4.6% of visits. Note that the sum of these percentages exceeds 100%, reflecting that some patients will be seen by multiple providers during the visit. Analysis of the NHAMCS provides estimates of the providers seen by a patient during each emergency department (ED) visit.

The MGMA reports that median patient encounters per year by one family medicine physician providing ambulatory services in the Eastern Region of the U.S. was 3,741. This number suggests that every 3,741 office visits equates to approximately one physician FTE.[9] Note that a general pediatrician in the Eastern Region has a similar number of annual patient encounters of 3,725 per year. Likewise, MGMA data suggest that the median number of patient encounters per emergency physician in the Eastern Region is 1,973 patient encounters per year. Estimates for NPs and PAs in primary care settings are based on MGMA estimates in the Eastern Region, while NP and PA productivity in emergency care settings are based on national medians as the sample size was too small to obtain estimates for the Eastern Region.

Feedback from PPS leadership found that the MGMA data might overstate the number of patient encounters in the PPS for primary care providers. First, patients cared for by PPS providers might have higher acuity than the typical patient panel of providers covered by the MGMA survey. Second, and related, the recommended panel size for the typical MGMA primary care physician is 1,900-2,000, whereas for PPS providers under a patient-centered medical home (PCMH) model the recommended panel size is 1,500-1,800. Hence, for modeling purposes, we scaled the MGMA productivity numbers for primary care providers by 80% to reflect that for BHPC PPS we modeled a panel size of 1,500.[10]

[9] Provider compensation: 2014 report based on 2013 data. Data extracted from MGMA DataDive.
[10]From BHPC provided documents: Care Delivery and Care Management Staffing Model

For some occupations we used national ratios to estimate staffing levels. For example, dividing total national office visits by estimates of FTE registered nurses (RN) practicing in an office setting suggests that one FTE nurse is required for every 4,469 visits (reflecting that not every patient visit will involve a nurse). Similar national ratios were estimated for staffing levels of nurses in hospital settings.

VI. Impact of External non-DSRIP Related Factors on Workforce

The demand for health care services and providers within the PPS network will change over time independent of the anticipated DSRIP impact. A growing and aging population will impact health care utilization and care delivery over time and will influence how the PPS and its partners provide care to patients within the network.

Leveraging the HDMM, the projected change in demand for physician specialties and other health occupations in four New York City boroughs was simulated based on projected population characteristics independent of DSRIP across all patients regardless of insurance status. These projections were then scaled to the BPHC PPS based on its estimated market share of Bronx discharges by payer. Much of the growth is driven by the growing and aging Medicare population.

Exhibit 4 summarizes the projected impact between 2015 and 2020 of changing borough-wide demographics on physician demand by specialty.[11] The projections illustrate that total physician demand in the Bronx is projected to grow about 6% (or by approximately 230 FTEs) between 2015 and 2020 independent of the effects of DSRIP.[12] Demand for primary care physicians in the Bronx is projected to grow about 6% during this period (or by approximately 68 FTEs). The PPS's share of total physician demand growth in the Bronx is projected to be approximately 149 FTEs and the PPSs demand for primary care specialties independent of DSRIP is projected to grow by approximately 43 FTEs based on current market share assumptions. These projections suggest that any DSRIP-related changes in physician demand need to be understood in the context of broader trends affecting the demand for health care services and providers.

[11] Inpatient market share was used as a proxy for total market share, as the PPS's outpatient and emergency department market share of borough-wide utilization were unavailable.
[12] This projected growth in physician workforce demand reflects the growing and aging population and was calculated using the Healthcare Demand Microsimulation Model.

Exhibit 4: Projected Impact of Changing Demographics on Physician Demand, 2015 to 2020

		Bronx Total Growth		BPHC PPS Impact
	Specialty	FTE Growth	% Growth	FTE Growth
Primary Care	Total primary care	68	7%	43
	Family medicine	21.5	7%	13.5
	Internal medicine	35	8%	23
	Pediatrics	10.5	3%	6
	Geriatrics	1	7%	0.5
	Hospitalists (primary care trained)	5.5	4%	3.5
Medical Specialties	Allergy & immunology	3	15%	2
	Cardiology	13	8%	8.5
	Critical care/pulmonology	3.5	6%	2
	Dermatology	3.5	9%	2.5
	Endocrinology	3.5	8%	2.5
	Gastroenterology	6.5	9%	4
	Infectious disease	1.5	4%	1
	Hematology & oncology	6	8%	4
	Nephrology	6	8%	4
	Pediatric subspecialty	2.5	2%	1.5
	Rheumatology	2.5	9%	1.5
Surgery	General surgery	6.5	8%	4
	Colorectal surgery	0	3%	0
	Neurological surgery	1.5	8%	1
	Ophthalmology	7.5	9%	5
	Orthopedic surgery	7	9%	4.5
	Otolaryngology	3.5	9%	2.5
	Plastic surgery	2	6%	1
	Thoracic surgery	1.5	8%	1
	Urology	4	8%	2.5
	Vascular surgery	1	7%	0.5
	Obstetrics & gynecology	14.5	6%	11.5
Other	Anesthesiology	6	6%	4
	Emergency medicine	3.5	2%	2.5
	Neurology	5	6%	3
	Other medical specialties	8	6%	5
	Pathology	1.5	2%	1
	Physical med & rehab.	4.5	7%	3
	Psychiatry	13	4%	7.5
	Radiology	14.5	10%	9.5
	Total	**230**	**6%**	**149**

Exhibit 5 summarizes projected growth in Bronx FTE demand between 2015 and 2020 for select health professions, as well as the growth in demand for providers in the BPHC PPS network. Similar to the approach for developing PPS-specific physician FTE demand projections, these also were scaled to the BPHC PPS based on its estimated inpatient market share.[13] Detailed information for the Bronx by care setting is provided in the appendix.

Independent of the effects of DSRIP, demand for registered nurses in the Bronx is projected to be strong, with estimations of growth by about 428 FTEs between 2015 and 2020. Significant growth in demand is also likely among nurses, home health aides, and various therapist and technologist titles. Applying the PPS market share to applicable settings, registered nurse demand will grow by about 227 FTEs. Smaller impacts on future PPS demand across care settings are likely to be seen for a range of health occupations (e.g., technicians, technologists, therapy aides and assistants). The table below provides an overview of the impact specific to the BPHC PPS network.

Exhibit 5: Projected Growth in Demand for Select Health Workers Between 2015 to 2020 Based on Changing Demographics and Expanded Insurance Coverage

Health Profession	Bronx Total	BPHC PPS Network				
		Inpatient	Emergency	Ambulatory	Home Health	Total
Registered nurse	428	160	20.5	28.5	17.5	226.5
Licensed practical nurse	117	21	0	9	4.5	34.5
Nurse aide	252	36.5	0	8.5	4	49
Home health aide	85	0	0	0	53.5	53.5
Pharmacist	25	0	6.5	11	0	17.5
Pharmacy technician	30	0	6.5	15	0	21.5
Pharmacy aide	4	0	0.5	2	0	2.5
Psychologist	59	0	0	37	0	37
Chiropractor	6	0	0	3.5	0	3.5
Podiatrist	2	0	0	1.5	0	1.5
Dietitian	10	2.5	0	1	0	3.5
Optician	4	0	0	2.5	0	2.5
Optometrist	3	0	0	1.5	0	1.5
Occupational therapist	75	32	0	11	1	44
Occupational therapist aide	13	5	0	2	0	7
Occupational therapy assistant	21	5	0	6.5	0	11.5
Radiation therapist	2	1	0	0.5	0	1.5
Radiological technologist	8	0	4	5	0	9
Respiratory therapist	11	3.5	0.5	1	0	5
Respiratory therapy technician	2	0.5	0	0	0	0.5

[13] Inpatient market share was used as a proxy for total market share, as the PPS outpatient and ED market share of borough-wide utilization were unavailable.

Health Profession	Bronx Total	BPHC PPS Network				
		Inpatient	Emergency	Ambulatory	Home Health	Total
Medical clinical technician	25	12	1	3	0	16
Medical clinical lab technologist	25	12	0	3	0	15
Medical sonographer	9	3.5	0	2	0	5.5
Nuclear medicine technologist	2	1	40	0.5	0	41.5

VII. Anticipated PPS Workforce Impacts by DSRIP Project

Based on findings from the BPHC community needs assessment (CNA), BPHC selected four system transformation projects (Domain 2), four clinical improvement projects (Domain 3), and two population-wide prevention projects (Domain 4). BPHC projects support the goals of NYS's DSRIP program by focusing on the provision of high quality, integrated primary, specialty and behavioral health care in outpatient and community settings with acute care hospitals used primarily for emergency and acute care service delivery.

A. Project 2.a.i: Creation of an Integrated Delivery System

In an effort to serve the Bronx's racially, ethically, and linguistically diverse population through culturally sensitive, evidence-based coordinated care, BPHC has committed to implementing an Integrated Delivery System ("IDS") and transforming healthcare delivery through an organized and collaborative network of primary, behavioral, specialty, long-term and post-acute care providers as well as through social service and community-based providers.

A review of the literature on this topic suggests that better integration can allow some services currently performed by specialists to instead be performed by generalists, and some services currently performed by physicians to instead be performed by non-physicians, and thus reduce duplication of tests.[14] For purposes of projecting target workforce needs, it was assumed that better integration of the delivery system does not have an independent effect on health workforce needs (other than the addition of Health Information Technology personnel to implement network integration). However, the IDS is necessary for the PPS's

[14] Weiner, JP, Blumenthal, D, Yeh, S. The Impact of Health Information Technology and e-Health on the Future Demand for Physician Services. Health Affairs. November 2013. 32:11 http://www.michigan.gov/documents/mdch/The_Impact_of_Health_Information_Technology_and_e-Health_on_the_Future_Demand_for_Physician_Services_441001_7.pdf

other DSRIP projects to be successful in identifying and risk stratifying patients to provide interventions and coordinate and manage care for these patients.

B. Domain 4 Projects: Strengthen Mental Health and Substance Abuse Infrastructure and Increase Early Access to, and Retention in, HIV Care

The analysis within this report does not separately model the two population-wide prevention projects. One project is strengthening mental health and substance abuse infrastructure. While this project is not explicitly modeled, the goals and impacts of this project are in some cases aligned with other clinical improvement projects that are modeled (e.g., integrating primary care and behavioral health services) including strengthening team settings and care coordination. Therefore the workforce impacts will be captured in these projects, detailed below. The workforce impact related to the increased access to and retention of HIV care has not been separately modeled in this analysis. Although Bronx Partners anticipates that Domain 4 projects will have some workforce impact (e.g. community based health workers involved in outreach to the population with HIV), it is assumed that some of these impacts will have been captured in other projects, and there is not enough information to make informed assumptions about Domain 4's potential independent impacts on the workforce at this time.

C. Approach to Modeling DSRIP Projects

Subsequent sections within Section V of this report describe the modeling approach and assumptions used to project the workforce impacts of BPHC remaining seven system transformation and clinical improvement projects. The Appendix also provides additional details regarding the data and assumptions leveraged to model workforce impacts. However, to inform the approach in modeling BPHC target workforce state, the following primary research questions were leveraged to guide the modeling of the projected workforce impacts for each DSRIP project:

1. How many patients will be affected by this intervention?
2. What are the current health care utilization patterns of affected patients, and how will this initiative change care utilization patterns?
3. What mix of providers will be used to implement the intervention and meet patient demand for services?

Within each section, the projected workforce impacts for each DSRIP project are calculated and summarized based on the utilization of health care services by the anticipated actively engaged patients likely to be impacted by each intervention, as well as the level of anticipated changes in how future care delivery will be staffed to meet patient care needs.

The results presented in this report have been calculated based upon project impact assumptions that the projects will be implemented in line with the PPS's submitted project

implementation plans. As such, any deviation from the plan will likely produce results different from those shared within this report. Additionally, although literature and clinical studies were leveraged to inform DSRIP project assumptions pertaining to the projected workforce impact, it is necessary to note that the published outcomes from these studies are not entirely in line with the project requirements within the DSRIP projects that the PPS has chosen to implement. Therefore the workforce impacts described throughout this report are estimations and leveraged to simulate estimated workforce needs within the PPS.

D. Project 2.a.iii: Health Home at Risk Intervention Program

Overarching project goals include proactive management of higher risk patients not currently eligible for Health Homes through access to high quality primary care and support services. The targeted population for this intervention includes patients with a single chronic illness who, based on their history of care plan adherence and/or social needs, are identified as at-risk and could benefit from care management and care coordination services. In particular, these include patients with cardiology, and respiratory conditions, who alone accounted for 40% of readmissions to SBH Health System and Montefiore Medical Center (MMC) in 2012.

Using the HDMM, preliminary estimates suggest that the number of actively engaged patients for this program will grow from approximately 5,760 in 2017 to 57,600 by 2020 assuming current phase-in assumptions remain unchanged (*Exhibit 6*). The following assumptions and inputs were used to model the workforce implications of this project:

- Participants in the project are **at moderate to high risk of becoming** Health Home eligible. We assume that individuals at low risk do not require the intensity of care that this project will provide
- For the following assumptions, results from the New York Chronic Illness Demonstration project were used as inputs, in particular, for the group with a risk score of 0.3 – 0.5 (representing a moderate risk population), and the results reported from year 2 of the demonstration (as there appears to be a higher degree of uncertainty associated with the year 1 results). Results from the demonstration suggest, in comparison to non-participants, that participants experience
    - A decline of 3.7% in inpatient days
    - A 4.2% decline in ED visits
    - A 1.8% increase in primary care visits
    - A 2% increase in specialty outpatient visits
- The analysis uses the following assumptions about care coordinator and nurse coordinator caseloads:
    - Each care coordinator will have an active case load of 65 patients; patients' active enrollment is 3 months during the year, so each care coordinator is responsible for approximately 250 patients per year
    - One nurse coordinator (assume an RN) oversees 5 care coordinators (assume non-RNs, including licensed practical nurses, social workers, and community health workers)

The distribution of staffing impacts by care settings and job titles most likely to be affected by 2020 include:

- A large infusion of 235 care coordinator FTEs and 46 nurse coordinator leader FTEs may potentially be required to support the level of care management called for under this initiative to serve 57,600 patients
- **In outpatient/office settings:** A possible increase of 11,500 primary care visits and 5,800 specialist visits could increase demand for primary care providers by 8-9 FTEs, specialist providers modestly, direct medical support by about 13 FTEs, and direct administrative support by 6-7 FTEs
- **In the ED setting**: A potential decline of 5,800 visits could reduce demand for emergency physicians modestly and reduce demand for RNs by about 9-10 FTEs
- **In the inpatient setting:** A potential decline of 17,300 inpatient days could contribute to a large decrease in FTE RNs (-103), nurse aides (-34), LPNs (-8) and hospitalists (-8)

Exhibit 6: Home Health at Risk Intervention Program: Projected BPHC PPS Impact

	2017	2018	2019	2020
Participants	5,760	28,800	57,600	57,600
Projected DSRIP impact				
Hospital inpatient days	-1,700	-8,600	-17,300	-17,300
Primary care visits	1,200	5,800	11,500	11,500
Specialist visits	600	2,900	5,800	5,800
Emergency visits	-600	-2,900	-5,800	-5,800
Workforce FTE Implications				
Office/outpatient				
Primary care providers	1	4	8.5	8.5
Direct medical support	1.5	6	13	13
Medical assistants	1	4	8.5	8.5
License practical nurses	0.5	2	4.5	4.5
Direct admin support	1	3	6.5	6.5
Specialist providers	0.5	1.5	3.5	3.5
Emergency department				
Emergency physicians	-0.5	-1.5	-2.5	-2.5
NPs and PAs	0	0	-0.5	-0.5
Staff registered nurses	-1	-4.5	-9.5	-9.5
Inpatient				
Hospitalists	-1	-4.5	-8.5	-8.5
Staff registered nurses	-10.5	-51.5	-103	-103
Licensed practical nurses	-0.5	-2	-4.5	-8
Nurse aides/assistants	-1.5	-8.5	-21	-34.5
Coordinators/educators				

Care coordinators	23.5	117	234.5	234.5
Nurse coordinator leaders	4.5	23	46	46

The analysis suggests that project 2.a.iii's greatest impact on the PPS workforce will be on the FTEs associated with care coordinators, with increases in office-based primary care and specialty care providers and direct support. Workforce FTEs in the ED and inpatient settings are anticipated to decline, with a greater impact on the inpatient setting and specifically on RNs, owing to this patient population achieving better control of their health.

E. Project 2.b.iii: Emergency Department Care Triage for At-Risk Populations

Many patients who visit the emergency department have non-urgent conditions that could have been treated in a less expensive setting. The goals of this initiative are to (1) identify ED patients who would be better served by a primary care provider who can provide continuity of care, (2) link patients without a primary source of care to a primary care provider (PCP), and (3) educate patients on appropriate use of ED services. The statewide target is to reduce avoidable ED use among the Medicaid population by 25% within five years. Working towards this goal, BPHC's focus for project 2.b.iii includes all patients who meet program criteria.

The target patient population modeled is all attributed patients with two or more ED visits within the previous six months (or 4+ in the last rolling 12 months) potentially appropriate for diversion or usually treated and released from the ED. This includes patients with ambulatory sensitive chronic conditions and at-risk patients requiring more intensive ED care management services post discharge. Program components include PPS connectivity to community PCPs, especially PCMHs, but also home health providers and other resources; and intensive ED care management provided to at-risk patients.

For patients without a primary care provider presenting with minor illnesses, patient navigators will assist the patient to secure an appointment with a primary care provider who is either Advanced Primary Care (APC) certified or has PCMH 2014 Level 3 recognition. For patients with a primary care provider, patient navigators will assist the member in receiving a timely appointment with their own provider.

> *Of all ER visits in 2013, up to 72% may have been impacted by poor quality of care or limitations in access to care according to 3M Potentially Preventable Emergency Room Visit (PPV) logic. This proportion does not necessarily indicate those visits that should not have been treated in the ER, only that they could have been the result of a deficiency in ambulatory care.*
>
> New York State Department of Health, March 2015. https://www.health.ny.gov/statistics/sparcs/sb/docs/sb8.pdf

For modeling, we use the following inputs and assumptions:

- Based on PPS input, we estimate approximately 10 FTE care coordinators (including half of the time of 8 care coordinators splitting their time between this project and project 2.b.iv)[15] In addition, another 2-3 care coordinators will be required in primary care physician offices to meet the increased demand for primary care visits.
- Numbers of Medicaid attributed lives that are targeted to take part in this program (from PPS)
- We assume that each participating patient has 4 ED visits per year, on average, and that annual ED visits will be reduced by 1 visit (25%) among engaged patients
- 50% of diverted ED visits will result in a primary care visit

This modeled impact on ED use is independent of other DSRIP projects (described later) that also will target many of the same patients to provide counseling, improved access to outpatient services, and better management of their chronic conditions.

By 2020 the net projected PPS impact associated with achieving this modeled reduction in ED visits may be the following (detailed in Exhibit 7):

- Approximately 19,600 fewer ED visits
- An additional 9,800 primary care visits (under our assumption that 50% of diverted ED visits will result in a visit to a PCP)

Exhibit 7: DSRIP ED Triage: Projected Workforce Impacts

	2017	2018	2019	2020
Engaged patients successfully and appropriately redirected to PCMH after triage	3,920	14,700	19,600	19,600
Avoided PPV visits (achieving DSRIP goal with phase-in)	-3,900	-14,700	-19,600	-19,600
Primary care visits impact	2,000	7,400	9,800	9,800
Workforce FTE implications				
Office/Outpatient				
Primary care providers	1	3.5	4.5	4.5
Direct medical support	1.5	5.5	7	7
Medical assistants	1	3.5	4.5	4.5
Licensed practical nurses	0.5	2	2.5	2.5
Direct admin support	1	2.5	3.5	3.5
Emergency Department				

[15] From BPHC Workforce Sub-Committee Meeting presentation: Applicable only to the SBH setting, 8 FTEs (2 RNs, 3 social workers, 3 non-nurse navigators) of the 11 FTEs for 2.b.iii will be cross trained, the remainder are dedicated to 2.b.iv., Montefiore has distinct FTEs for each project

	2017	2018	2019	2020
Emergency physicians	-2	-6.5	-9	-9
Nurse practitioners & physician assistants	-0.5	-1.5	-2	-2
Staff registered nurses	-6.5	-24	-32	-32
Care coordinators	2	9.5	12.5	12.5
Registered nurses	1	4	5	5
Social workers	0	1	1.5	1.5
Non-nurse navigators	1	4.5	6	6

Examining the FTE effects by setting, changes in utilization suggest that by 2020:

- **In the ED setting:** The PPS network may require approximately 9 fewer emergency physician FTEs, 32 fewer RN FTEs, as well as slight decreases in nurse practitioners and physician assistant FTEs
- **In the office/outpatient settings:** an estimated 4-5 additional primary care provider FTEs, 7 direct medical support FTEs, and several additional FTEs in direct administrative support may be required

F. Project 2.b.iv: Care Transitions to Reduce 30-Day Readmissions

The objective of project 2.b.iv is to reduce Potentially Preventable Readmissions (PPRs) to hospitals by providing a 30-day supported transition period after a hospitalization by patients at high risk of readmission due to lack of effective patient education, engagement in follow-up care and other risk factors.

At-risk patients will be identified using a standardized risk assessment tool, which will look at frequent admissions and re-admissions in the past year, and patients will be provided with more intensive care management through a two-pronged approach. First, evidence-based care transition models including Project RED, BOOST and others will be enhanced and extended to all PPS hospitals. Second, coordination of medical and social services outside the hospital walls will be strengthened with PCPs, post-acute providers and other CBOs. RED interventions provide comprehensive discharge planning, patient education, and post-discharge patient follow-up using designated discharge advocates who help patients reconcile their medicines and schedule follow-up appointments with their physicians.

To model the potential workforce implications of this DSRIP project we address the following questions:

a. What is the underlying rate of readmission for targeted patients in the absence of intervention?
b. By how much is the intervention anticipated to reduce readmissions?
c. By how much will total inpatient days be reduced due to reduced readmissions?
d. By how much will emergency department services be reduced due to readmissions (as some readmissions will be through the ED)?

e. What is the level and mix of providers to implement this intervention?

In a study by the Bronx Collaborative, patients who received two or more interventions by a dedicated care transition manager had a 17.6% readmission rate compared to a rate of 26.3% for patients who received the current standard of care (implying a 33% reduction in readmission probability).[16] These estimates are similar to the readmission probabilities and intervention impacts we calculated using information from the literature and reflecting the patient mix in the PPS network.

To support the project the PPS will hire, retrain and redeploy clinical (RN, SW and LPN) and non-clinical (unit clerks and/or medical assistants) staff as care managers, navigators, and care coordinators. Care managers will assist with arranging follow-up appointments with primary care providers through expanded and enhanced centralized scheduling systems.

We assume that this DRSIP project will be staffed with care coordinators similar to the Medicare Coordinated Care Demonstration (MCCD) programs.[17] The MCCD programs relied heavily on registered nurses (nurse coordinators), with assistance from social workers. At two successful programs the patient-to-coordinator ratios were 50:1 (for very high average severity patients) to 106:1. The median staffing ratio across 15 programs was 70:1. The two most successful MCCD programs report that about 10-15% of the care coordination caseload could be handled by social workers, with the remainder of the work performed by a combination of nurses and social workers.

For modeling we make the following assumptions:

- We assume a 17.6% readmission rate with care transition intervention compared to a rate of 26.3% without intervention, as informed by the Bronx Collaborative study
- The number and occupational mix of care coordinators was defined by the PPS

Furthermore, we assume that 50% of avoided readmissions would have been through the emergency department (thus having workload implications for the emergency department as well as workers in an inpatient setting). Exhibit 8 details the potential impact of this program, upon complete implementation, by 2020

- Readmissions may decrease by approximately 1,200
- Inpatient days may decline by approximately 6,400 days

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[16] Interventions Help Prevent Readmissions. Hosp Case Manag 2013 Sep;21(9):122, 127-8. http://www.ahcmedia.com/articles/64645-study-interventions-help-prevent-readmissions

[17] Mathematica Policy Research, Inc. THE PROMISE OF CARE COORDINATION: Models that Decrease Hospitalizations and Improve Outcomes for Medicare Beneficiaries with Chronic Illnesses. A Report Commissioned by the National Coalition on Care Coordination (N3C). March 2009. http://www.champ-program.org/static/BROWN%20FULL%20REPORT%203%2013%2009v2_ah2.pdf

- ED visits may be reduced by 600 visits

Exhibit 8: Impact of Care Transitions to Reduce 30 Day Readmissions Project

Year:	2017	2018	2019	2020
Number of actively engaged patients	0	9,555	14,700	14,700
Projected DSRIP impact				
Readmissions	0	-800	-1,200	-1,200
Inpatient days	0	-4,200	-6,400	-6,400
Emergency visits	0	-400	-600	-600
Workforce FTE implications				
Emergency Department				
Emergency physicians	0	-0.5	-0.5	-0.5
Nurse practitioners and physician assistants	0	0	0	0
Registered nurses	0	-1	-1	-1
Inpatient				
Hospitalists	0	-2	-3	-3
Registered nurses	0	-25.5	-38.5	-38.5
Licensed practical nurses	0	-1.5	-2	-2
Nurse aides	0	-6.5	-9.5	-9.5
Total care coordinators	0	10	16	16
Registered nurses	0	5	8	8
Licensed practical nurses	0	2	3	3
Pharmacists	0	0.5	1	1
Social workers	0	1	1.5	1.5
Other non-nurse navigators	0	1.5	2.5	2.5

Examining the FTE effect by setting, changes in utilization suggest the following:

- Approximately 16 care coordinator FTEs (with some care coordinators also assisting with ED triage)
- **In the ED setting**: Small decreases in workforce FTEs
- **In the inpatient setting:** FTE workload is projected to decline by about 39 RNs, 10 nurse aides, as well as several hospitalists and LPNs

According to the analysis, project 2.b.iv's greatest impact on workforce FTEs will be on the inpatient setting, and particularly on RNs and nurse aides, reflective of decreasing readmissions, which leads to a reduction in inpatient days. The impact on the ED is expected to be minimal, while care coordination efforts will require a combined 16 FTEs associated with care coordinators, nurse coordinators and social workers. Current shortfalls in staffing that may already be in the PPS network have not been taken into account.

G. Project 3.a.i: Integration of Primary Care & Behavioral Health Services

To address the needs of individuals with co-morbid physical and behavioral health needs, the BPHC intends to better integrate behavioral and physical health outcomes by pursuing three related models of primary care and behavioral health integration: (1) increasing the physical co-location of behavioral health providers into primary care sites; (2) increasing the physical co-location of primary care health providers into behavioral health sites; and (3) implementing the Improving Mood–Providing Access to Collaborative Treatment (IMPACT) model for depression across the PPS service area. The target population for the two models is Medicaid beneficiaries age 12 and older who receive primary care and/or behavioral health at committed partner sites.

The following assumptions and inputs are used in this analysis.

- We assume that approximately 10% of the Medicaid and uninsured population has unmet behavioral health needs (i.e., not receiving specialty mental health services), and these unmet needs largely consist of mild-to-moderate depressive/anxiety disorders or substance abuse.[18]
- We assume that 80% of the Medicaid population with unmet behavioral health needs visit a primary care provider during the year.[19]
- Absent DSRIP, 50% of patients with unmet behavioral health needs would have been successfully diagnosed by a PCP and referred to a behavioral health provider.[20] With this DSRIP project, PCPs will receive additional training and we assume 80% of patients with unmet needs will be diagnosed and referred.
- Absent DSRIP, 25% of referred patients will complete the referral.[21] Under DSRIP we assume this referral completion rate will double to 50%.[22]

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[18] IHS assumption: for modeling purposes, an estimate of the percentage of Medicaid population may have unmet behavioral health needs was required. Data from the literature around this metric is scarce, but indicates that a 10% may be conservative, as some estimate that 60% to 70% of patients with behavioral health issues leave medical settings without receiving behavioral health treatment http://www.commonwealthfund.org/publications/newsletters/quality-matters/2014/august-september/in-focus#/#4. 10% was chosen in order to avoid overestimating effects of the DSRIP program, but this number may underestimate unmet need

[19] 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 our the IHS assumption that 80% of the Medicaid population with unmet behavioral health needs will visit a PCP http://ftp.cdc.gov/pub/Health_Statistics/NCHS/NHIS/SHS/2014_SHS_Table_A-18.pdf

[20] Montano CB. Recognition and treatment of depression in a primary care setting. Journal of Clinical Psychiatry, Vol 55(12, Suppl), Dec 1994, 18-34.

[21] Becker AL. In some primary care offices: The social worker will see you now, Sep 8, 2015. http://ctmirror.org/2015/09/08/in-some-primary-care-offices-the-social-worker-will-see-you-now/

- We assume that 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).[23]
- Any care coordination services required by this population are modeled and reported under the Health Home at Risk Intervention Program.

This intervention will be phased-in over two years beginning in DY2 and aims to have 100% of patients actively engaged by DY3Q4. Projected changes in utilization by 2020 as a result of program implementation include (Exhibit 9):

- BH-related ED visits may decrease by about 500
- BH-related inpatient days may fall by about 800 days

By 2020 the net projected PPS-wide workforce impact associated with this DSRIP initiative will likely include:

- **In the outpatient/office setting**: approximately 42 FTE increase in licensed clinical social workers as well as a 35 FTE increase in direct administrative support FTEs
- **In the ED setting**: Minimal anticipated impact on the providers in this setting
- **In the inpatient setting**: 5 FTEs reduction in RNs, with modest projected FTE reductions in hospitalists, licensed practical nurses and nurse aides/assistants

Exhibit 9: Integration of Behavioral Health into Primary Care: Projected Impact

	2017	2018	2019	2020
Population modeled (Medicaid + Uninsured)	285,200	286,100	286,900	287,800
Population with unmet BH needs	28,500	28,600	28,700	28,800
Population with unmet BH needs visiting PCP	22,800	22,900	23,000	23,000
Population screening positive for BH needs absent DSRIP	11,400	11,400	11,500	11,500
Population screening positive for BH needs with DSRIP	18,300	18,300	18,400	18,400
Screened population completing BH referral absent DSRIP	2,900	2,900	2,900	2,900

[22] IHS assumption of PPS behavioral health referral completion target. New York State added 320,000 beneficiaries to Medicaid in 2014, and an estimated 48,000 (15%) had BH issues (though the portion of these beneficiaries whose BH issues were undiagnosed and unmet is not known).

[23] Source indicates caseloads of 100 – 150 patients. IHS chose the higher caseload 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

	2017	2018	2019	2020
Screened population completing BH referral with DSRIP	9,100	9,200	9,200	9,200
Change in population receiving BH counseling	900	4,200	6,300	6,300
Health care use impact of DSRIP				
Encounters with BH care manager	2,600	11,700	17,700	17,700
Primary care visits	300	1,400	2,100	2,200
BH-related ED visits	-100	-300	-500	-500
BH-related inpatient days	-100	-600	-800	-800
Workforce FTE implications				
Office setting				
Licensed clinical social worker	6.5	28	42	42
Psychiatrists/psych nurses	0.5	3	4	4
Primary care providers	0	0.5	1	1
Direct medical support	0	1	2	1
Direct admin support	6	23.5	35.5	35.5
Emergency Department				
Emergency physicians	0	0	0	0
Nurse practitioners or physician assistants	0	0	0	0
Staff registered nurses	0	-0.5	-1	-1
Inpatient				
Hospitalists	0	-0.5	-0.5	-0.5
Staff registered nurses	-1	-3.5	-5	-5
Licensed practical nurses	0	0	-0.5	-0.5
Nurse aides/assistants	0	-1	-1.5	-1.5

The project goals will increase access to behavioral health services and the results indicate a corresponding rise in demand for BH care providers and associated support staff FTEs. While a reduction in workforce FTEs in the ED and inpatient settings is also anticipated, the projected impact in these settings is small, as is the overall impact of the project, due primarily to the modest increases in numbers who receive BH counseling even after full project implementation. Additionally, the current shortfalls in BH providers have not been taken into account.

H. Project 3.b.i: Evidence-based Strategies to Improve Management of Cardiovascular Disease

BPHC will pursue a multi-pronged approach to address major cardiovascular disease (CVD) risk factors. This includes improving prescription and adherence to aspirin prophylaxis among eligible patients, improving blood pressure control by updating and strengthening implementation of hypertension (HTN) guidelines, improving cholesterol control by updating current cholesterol management and treatment guidelines, and increasing smoking cessation by enabling PCPs to distribute nicotine replacement therapy at the point-of-care. The targeted patient population will include all uniquely attributed adult patients (ages 18+ years) with cardiovascular conditions based on a defined set of ICD-9 diagnosis codes.

The following assumptions and inputs are used in this analysis:

- Care management will decrease CVD-related emergency visits by 20%
- Care management will decrease CVD-related inpatient hospital days by 39%
- Care management will increase visits to PCPs by 1 and cardiologists by 0.5 annually
- Any care coordination services required by this population are modeled under the Health Home at Risk Intervention Program.

Exhibit 10 below summarizes modeling results and projected impacts. By 2020 the net projected annual utilization impact associated with this DSRIP clinical initiative is the following:

- Emergency visits may decline by about 900
- Inpatient days may potentially decrease by about 5,100
- 30,800 additional urgent (unscheduled) visits to primary care providers is estimated
- 15,400 more visits to cardiologists may occur

Exhibit 10: CVD Management: Projected Workforce Impacts by Care Setting

	2017	2018	2019	2020
DSRIP initiative participants (with phase-in)	7,700	20,020	30,800	30,800
Projected DSRIP impact				
Emergency department visits	-200	-600	-900	-900
Inpatient days	-1,300	-3,300	-5,100	-5,100
Visits to primary care providers	7,700	20,000	30,800	30,800
Visits to cardiologists	3,900	10,000	15,400	15,400
Workforce FTE implications				
Outpatient/Office setting				
Primary care providers	4	10	15.5	15.5
Direct medical support	8	19.5	30	30
Medical assistants	5	13	20	20
Licensed practical nurses	2.5	6.5	10	10
Direct admin support	4	10	15	15
Specialists (Cardiologists)	1	3	4.5	4.5
Emergency Department				
Emergency physicians	0	0	-0.5	-0.5
Nurse practitioners and physician assistants	0	0	0	0
Staff registered nurses	-0.5	-1	-1.5	-1.5
Inpatient				
Hospitalists	-0.5	-1.5	-2.5	-2.5
Staff registered nurses	-7.5	-19.5	-30	-30
Licensed practical nurses	-0.5	-1	-1.5	-1.5
Nurse aides/assistants	-2	-5	-7.5	-7.5

	2017	2018	2019	2020
CVD health coaches	4	10	15.5	15.5
Care coordinators	2.5	6.5	10	10

The projected workforce impact includes:

- Approximately 15-16 additional CVD health coaches to provide counseling services to 30,800 patients
- **In outpatient/office settings:** an increase of 15-16 additional primary care providers and 4-5 additional cardiologists, supported by approximately 30 direct medical support staff and 15 direct administrative support staff
- **In the ED setting**: a slight decrease in emergency department staff
- **In inpatient settings:** a decrease in demand for hospital inpatient staff—including approximately 30 fewer RN FTEs

In terms of workforce implications, the analysis suggests that the greatest impact of this project on workforce will be in outpatient settings where most care management activities associated with this project will occur. The project also has impact on nursing staff in the inpatient setting. There is minimal workforce impact in the ED setting.

I. Project 3.c.i: Evidence-based Strategies to Improve Management of Diabetes

Diabetes was the single most frequently mentioned health issue in CNA key informant interviews. The PPS goal is to reduce progression of disease and lower hospital utilization rates. To achieve the reduction, BPHC will develop multidisciplinary care teams including PCPs, endocrinologists, cardiologists, nurses, social workers, pharmacists, diabetic educators, and others to fill current gaps in patient care and compliance.

Under this program, BPHC will also implement evidence-based protocols with guidelines on the diagnosis and management of diabetes and will develop educational programs to improve the community's knowledge of diabetic risk factors and diabetes management with focus on lifestyle modification, and self-management per evidence-based clinical guidelines.

The following assumptions and inputs are used in this analysis.

- **Participation in diabetes management will reduce total emergency visits per participant by 14.3% (regardless** of reason for visit).This estimate is based on a study of 27,188 participants in a diabetes management program by CIGNA Healthcare

compared to a matched parallel group of 12,104.[24] Participants who completed the diabetes management program experienced an even larger (22.8%) reduction in emergency department use. This finding is based on an intervention where patients with diabetes received repeated telephone outreach by trained nurses, dietitians, or health educators; Web-based education; remote monitoring devices; and reminders and educational mailings throughout the year.

For comparison, another study reported a 51% reduction in diabetes-related emergency visits based on patient outcomes in the year following participation in a nurse-directed diabetes care program among a minority population (n=331 patients who completed the intervention).[25] Also for comparison, an evaluation of Geisinger's diabetes care model implemented in routine primary care settings found that total inpatient costs were reduced by 29% following care management—with an average reduction of 29-41% in years 2-3 following intervention.[26] Hence, the 14.3% reduction in emergency visits may be conservative.

- **Diabetes management will reduce total inpatient days per participant by 11.6%.**[24] This assumption is based on the CIGNA HealthCare evaluation for all participants in diabetes management; the reduction was 21.7% for patients who fully participated in the care management program. This 11.6% reduction in bed days reflects a 23.8% reduction in admissions but a 16% longer average length of stay.
- **Diabetes management will reduce total office visits by 5.3%.**[24] This assumption is based on the CIGNA HealthCare evaluation for all participants in diabetes management. The study does not distinguish between visits to a primary care provider or a specialist.
- **We assume that participation in diabetes management will result in one extra primary care visit per year and an extra visit to an endocrinologist every fourth year**. The rationale for this assumption is that diabetes management programs place a focus on receiving preventive care for diabetes and common comorbidities (e.g., hypertension, hypercholesterolemia, heart disease). However, although Maeng et al. (2016) do not specifically report utilization impact, they do report that in the first year following care intervention, patient outpatient costs rose by 13% and professional service costs rose by 10%. Over the 5-year period analyzed, though, outpatient costs

[24] Villagra VG. Ahmed T. Effectiveness Of A Disease Management Program For Patients With Diabetes. Health Affairs, July 2004, vol 23(4):255-266.
[25] Davidson MB, Snsari A, and Karlan VJ. Effect of a Nurse-Directed Diabetes Disease Management Program on Urgent Care/Emergency Room Visits and Hospitalizations in a Minority Population. Diabetes Care, 2007, vol 30(2): 224-227. http://care.diabetesjournals.org/content/30/2/224.long
[26] Maeng et al. Value of Primary Care Diabetes Management: Long-Term Cost Impacts. American Journal of Managed Care. See more at: http://www.ajmc.com/journals/issue/2016/2016-vol22-n3/value-of-primary-care-diabetes-management-long-term-cost-impacts/P-3#sthash.9sB3VT7I.dpuf

averaged 5% higher and professional services averaged 1% lower than the comparison group without diabetes management.[26]

- **This analysis focused on the short-to-medium term impact of diabetes management on health care utilization**. Numerous studies report improvements in patient biometrics including reduced hemoglobin A1c, blood pressure, and cholesterol levels, and improvements in screening and testing for neuropathy, retinopathy, and other potential complications of diabetes.[27] These improvements in biometrics and early screening and treatment likely have benefits that extend beyond the year 2020 analysis period used for DSRIP evaluation.
- **Medicaid beneficiaries with diabetes in the Bronx currently average 2.19 inpatient days, 11 emergency visits, and 95 ambulatory visits (office plus outpatient) annually**. These estimates are based on the HDMM given the characteristics and prevalence of health risk factors (e.g., obesity and smoking prevalence, demographics) of the Medicaid population in the Bronx. These use rates average 2-2.5 times higher than rates for the commercially insured population with diabetes.
- Any care **coordination services** required by this population are modeled and reported under the Health Home at Risk Intervention Program.

By 2020 the projected annual health care use impacts associated with this initiative include the following (Exhibit 11):

- Approximately 3,500 fewer emergency visits (relative to no change in care use patterns)
- 6,400 fewer inpatient days
- 25,800 additional primary care visits
- 6,500 additional visits to an endocrinologist

The workforce impact by 2020 includes the following:

- Approximately 13 additional diabetes health coaches to provide services to an estimated 25,800 patients
- **In primary care settings:** an increase of 12-13 primary care providers, 22-23 additional direct medical support staff, and 11-12 direct administrative staff

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[27] See, for example, Piatt GA, Anderson RM, Brooks MM, Songer T, Siminerio LM, Korytkowski MM, et al. 3-year follow-up of clinical and behavioral improvements following a multifaceted diabetes care intervention: results of a randomized controlled trial. Diabetes Educ 2010;36(2):301–9.
Stroebel RJ, Gloor B, Freytag S, Riegert-Johnson D, Smith SA, Huschka T, et al. Adapting the chronic care model to treat chronic illness at a free medical clinic. J Health Care Poor Underserved 2005;16(2):286–96.
Liebman J, Heffernan D, Sarvela P. Establishing diabetes self-management in a community health center serving low-income Latinos. Diabetes Educ 2007;33(Suppl 6):132S–8S.

- **In the ED setting**: a slight decrease in emergency department staff (e.g., 5-6 RNs)
- **In inpatient settings:** a decrease in demand for hospital inpatient staff—including approximately 38 fewer RN FTEs, and 9-10 fewer nurse aides FTEs

Exhibit 11: Diabetes Disease Management: Projected Workforce Impacts

	2017	2018	2019	2020
DSRIP initiative participants (with phase-in)	12,900	25,800	25,800	25,800
Projected DSRIP impact				
Emergency department visits	-1,800	-3,500	-3,500	-3,500
Inpatient days	-3,200	-6,400	-6,400	-6,400
Visits to primary care providers	12,900	25,800	25,800	25,800
Visits to cardiologists	3,200	6,500	6,500	6,500
Workforce FTE implications				
Outpatient/Office setting				
Primary care providers	6	12.5	12.5	12.5
Direct medical support	11	22.5	22.5	22.5
Medical assistants	7	15	15	15
Licensed practical nurses	3.5	7.5	7.5	7.5
Direct admin support	6	11.5	11.5	11.5
Specialists (Endocrinologists)	1	2.5	2.5	2.5
Emergency Department				
Emergency physicians	-1	-1.5	-1.5	-1.5
Nurse practitioners and physician assistants	0	-0.5	-0.5	-0.5
Staff registered nurses	-3	-6	-5.5	-5.5
Inpatient				
Hospitalists	-1.5	-3	-3	-3
Staff registered nurses	-19	-38	-38	-38
Licensed practical nurses	-1	-2	-2	-2
Nurse aides/assistants	-5	-9.5	-9.5	-9.5
Diabetes health coaches	6.5	13	13	13
Care coordinators	3.5	7.5	7.5	7.5

In terms of workforce implications, the analysis suggests that the overall estimated impact of this DSRIP project is not significant. Primary care and inpatient settings will likely experience some change, while the emergency department will experience modest impacts. The primary Inpatient impacts include decreases in FTEs associated with staff RNs and other nursing staff. The results indicate that successful participation in the care management program also will impact primary care settings in the short-to-midterm, but current possible staffing shortfalls have not been taken into account.

J. Project 3.d.ii: Expansion of Asthma Home-based Self-Management Program

BPHC chose this project because addressing asthma is a high need in the Bronx based upon their CNA and analysis of NYS DOH Medicaid claims data. There is a high level of utilization associated with asthma in the Bronx, much of which is preventable. The target population for this project will be attributed beneficiaries with an asthma diagnosis. The PPS will actively engage a proportion of patients who either have had three or more PCP visits or an ED visit or hospital discharge with asthma as the primary diagnosis in the past year. To implement this project, BPHC will be contracting with a.i.r. nyc, a community-based organization (CBO) that has provided home-based services to families with asthma since 2001 for the implementation of its model. Strategies to be employed include:

1. Instituting evidence-based asthma management protocols for primary care providers (PCPs) to help reduce asthma exacerbations;
2. Conducting outreach to PCPs to ensure they are aware of and can easily refer asthma patients to the home-based visiting program;
3. Establishing protocols to link asthma patients who visit the ED with PCPs and care coordination services via PCMHs or the Health Home;
4. Establishing IT systems to transmit data from the CHWs back to the PCP to integrate the asthma action plan and data collected during asthma home visits into a care planning tool and the patient's medical record; and
5. Implementing clinical guidelines across PCMH partners modeled on the National Asthma Education and Prevention Program's guidelines.

The following assumptions and inputs are used in this analysis:

- Asthma management will decrease asthma-related emergency visits by 18%.[28]
- Asthma management will decrease asthma-related hospitalizations by 34%[29]
- Asthma management will decrease urgent primary care visits (i.e., unscheduled visits to a primary care provider) by 5% (approximately 1.8 visits/year) [30]
- Using SPARCS data we estimate that the average length of stay for Medicaid beneficiaries hospitalized for an asthma-related reason is 2.3 days.

Exhibit 12 summarizes modeling results and projected target state impacts of this DSRIP clinical improvement project. By 2020 the net projected annual utilization impact associated with this DSRIP clinical initiative is the following:

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[28] http://www.ncbi.nlm.nih.gov/pubmed/16740859
[29] http://www.nga.org/files/live/sites/NGA/files/pdf/031403DISEASEMGMT.pdf
[30] http://pediatrics.aappublications.org/content/117/6/2149?sso=1&sso_redirect_count=1&nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR:+No+local+token

- A reduction of 1,300 emergency visits
- 900 fewer inpatient days
- 2,800 fewer urgent (unscheduled) primary care visits

The projected workforce impact includes:

- Approximately 8 asthma health coaches to provide services to 15,500 patients
- **In primary care settings:** Very minimal change, with slight decreases in FTEs associated with providers in this setting
- **In the ED setting:** Minimal changes in demand for emergency department staff FTEs
- **In the inpatient setting:** A small decline in demand for hospitalists and other hospital inpatient staff FTEs (including 5-6 fewer RNs)

Exhibit 12: Asthma Management: Projected Workforce Impacts

	2017	2018	2019	2020
Number of actively engaged patients (children with asthma)	0	3,875	9,688	15,500
Projected DSRIP impact				
Emergency visits	0	-300	-800	-1,300
Inpatient days	0	-200	-600	-900
Urgent office visit to primary care provider	0	-700	-1,700	-2,800
Workforce FTE implications				
Office/Outpatient				
Primary care providers	0	-0.5	-1	-1.5
Direct medical support	0	-1	-2	-2.5
Direct admin support	0	-0.5	-1	-1
Care coordinators	0	-0.5	-0.5	-1
Emergency Department				
Emergency physicians	0	0	-0.5	-0.5
Nurse practitioners & physician assistants	0	0	0	0
Staff registered nurses	0	-0.5	-1.5	-2
Inpatient				
Hospitalists	0	0	-0.5	-0.5
Staff registered nurses	0	-1.5	-3.5	-5.5
Licensed practical nurses	0	0	0	-0.5
Nurse aides/assistants	0	-0.5	-1	-1.5
Asthma health coaches	0	2	5	8

The results of the analysis suggest that this DSRIP initiative will have only a small effect on workforce numbers and mix providing direct medical care to this asthma population.

VIII. Summary of Projected DSRIP and Non-DSRIP Related Workforce Impacts

Through 2020, the demand for health workers will change within the BPHC PPS provider network as individual DSRIP components are implemented and based on trends external to DSRIP (such as

changing demographics and expanded medical insurance coverage under the Affordable Care Act).

The combined impact of a growing and aging population and expanded medical insurance coverage will increase demand for health providers by approximately 3-6% for the population of the Bronx—with the amount differing by health occupation and medical specialty, and with much of this increase driven by the growing needs of the Medicare population. While the DSRIP projects are largely targeted at the Medicaid and uninsured populations, many providers in the PPS network also provide services to the Medicare and commercially insured populations.

In addition, DSRIP has the potential to increase demand for some types of providers (e.g., primary care and behavioral health); decrease demand for other types of providers (e.g., hospital-based providers); and increase demand for both licensed and unlicensed care coordinators, social workers, and health educators.

In this section we begin by summarizing the projected health workforce impact on the PPS from DSRIP-related activities. We then combine the estimated DSRIP impact with projected non-DSRIP impacts of changing demographics and expanded medical coverage under the Affordable Care Act to present a more comprehensive profile of health workforce demand by 2020.

IX. DSRIP Support Staffing

To support BPHC in the successful fulfillment of the DSRIP goals, the PPS has set up a central services organization ("CSO") to coordinate the provision of management services and provide clinical leadership. The CSO is led by the following executive team:

- Irene Kaufman – Executive Director
- Amanda Ascher, MD– Chief Medical Officer
- J. Robin Moon - Senior Director, Care Delivery & Practice Innovations

The CSO team currently consists of 32 team members.

X. Workforce Impact Summary

Exhibit 13 summarizes the estimated PPS health workforce impact of individual DSRIP projects across professions and settings.[31] The largest projected workforce impacts of DSRIP

[31] It excludes the ED triage goal associated with a decline in avoidable ED visits (to avoid double counting overlapping services).

may likely take place among nursing staff and care managers, licensed educators, and care coordinators/navigators. By 2020, the projections from this analysis indicates that demand for registered nurses may potentially fall by approximately 220 FTEs in inpatient settings, fall by approximately 53 FTEs in emergency settings, and rise by about 59 FTEs for nurse care coordinators/managers, for a potential net reduction of about 214 FTEs.

The analysis indicated a potential increased demand for non-RN care managers (e.g., community health workers, social workers, and LPNs) and licensed educators which reflect the important roles of these professions in a transformed healthcare environment. The demand for primary care providers will likely rise by about 40 FTEs and falls for hospitalists and emergency physicians by about 18 FTEs and 14 FTEs, respectively. In the behavioral health professions, demand is likely to increase by approximately 42 licensed clinical social workers (or similar occupations such as addiction counselors). There are significant increases in demand for care coordinator-related staff in ambulatory settings.

The results in the below exhibit have been made assuming the DSRIP project plans are carried out as outlined and the current preliminary assumptions that have informed the analysis in this report do not change. However, as the PPS implements each project some model inputs and assumptions may change.

Exhibit 13: Total BPHC PPS DSRIP Workforce Impact

Occupation and Setting	2017	2018	2019	2020
Primary care providers	12	30	41	40.5
Specialist Physicians				
Emergency physicians	-3.5	-10	-14.5	-14.5
Hospitalists	-3	-11.5	-18	-18
Cardiologists	1	3	4.5	4.5
Endocrinologists	1	2.5	2.5	2.5
Nurse practitioners and physician assistants				
Emergency department	-0.5	-2	-3	-3
Nursing				
Staff registered nurses	**-43.5**	**-144.5**	**-211**	**-213.5**
RN care coordinators[1]	5.5	32	59	59
Hospital inpatient	-38	-139	-218	-220
Emergency	-11	-37.5	-52	-52.5
Licensed practical nurses	**5**	**11.5**	**14**	**9.5**
Hospital inpatient	-2	-6.5	-10.5	-14.5
Office clinical support staff	7	18	24.5	24
Nurse aides/assistants				
Hospital inpatient	-8.5	-31	-50	-64
Clinical Support				
Medical Assistants	14	35.5	48	47.5
Administrative support staff	17	50	71	71
Behavioral health				
Psychiatrists/psychiatric nurses	0.5	3	4	4
Licensed clinical social workers	6.5	28	42	42
Pharmacists	0	0.5	1	1
Care managers/coordinators/navigators/coaches				

Occupation and Setting	2017	2018	2019	2020
RN coordinator leaders	4.5	23	46	46
RN care coordinators	1	9	13	13
Care coordinators (non-RNs, including social workers, community health workers, and licensed practical nurses)	30.5	141	266.5	266
Asthma educators/health coaches	0	2	5	8
Diabetes educators/health coaches	6.5	13	13	13
CVD educators/health coaches	4	10	15.5	15.5
Total FTEs	**39.0**	**131**	**231.5**	**212**

Note:[1] RN care coordinators are also listed under the care manager/coordinator/navigator/coach category

XI. DSRIP Target State Workforce Staffing Impact Analysis

Exhibit 14 below depicts the combined effects on BPHC workforce demand in 2020 of both the impacts of DSRIP and of changing demographics and expanded insurance coverage under the Affordable Care Act. In some cases non-DSRIP impacts offset or moderate the effects of DSRIP while in other cases they are additive to DSRIP workforce impacts.

Relative to 2015, the PPS network may require approximately 96 additional FTE primary care providers. This includes approximately 55 FTEs to meet the additional demand for services due to demographic and insurance trends external to system transformation by all patients (Medicaid, Medicare, commercial, uninsured/self-pay) and a potential 41 additional FTEs due to the DSRIP impact on the Medicaid population.

The microsimulation analysis suggests that an additional 209 registered nurses are needed within the network to meet demand for a growing and aging population and expanded medical insurance coverage under ACA (with much of this growth occurring among the Medicare population and in a hospital inpatient setting). The DSRIP impact on demand for registered nurses is a decline of -214 FTEs (with most of this decline in hospital inpatient settings), suggesting that between 2015 and 2020 the net impact is a decline in demand by about -5 FTE RNs (with the demands for a growing and aging population almost exactly offsetting the projected decline in demand associated with DSRIP). These numbers are independent of current unfilled vacancies.

There is substantial projected growth in demand for administrative and clinical support personnel in ambulatory settings to support growth in demand for primary care providers, behavioral health providers, and specialist physician offices.

Exhibit 14: Total Workforce Impact on FTE Demand (2020)

Occupation and Setting	Non-DSRIP impact on demand (FTEs)	DSRIP impact on demand (FTEs)	Total impact on demand (FTEs)
Primary care providers	55.5	40.5	96
Specialist physicians			
Emergency physicians	2.5	-14.5	-12
Hospitalists	3.5	-18	-14.5
Cardiologists	8.5	4.5	13
Endocrinologists	2.5	2.5	5
ED-based nurse practitioners and physician assistants	1.5	-3	-1.5
Nursing			
Staff registered nurses	**209**	**-213.5**	**-4.5**
RN care coordinators and managers[1]	0	59	59
Hospital inpatient	160	-220	-60
Emergency	20.5	-52.5	-32
Office/clinic	28.5	0	28.5
Licensed practical nurses	30	9.5	39.5
Hospital inpatient	21	-14.5	6.5
Office/clinic	9	24	33
Nurse aides/assistants	45	-64	-19
Hospital inpatient	36.5	-64	-27.5
Office/clinic	8.5	0	8.5
Clinical support			
Medical assistants	97	47.5	144.5
Administrative support staff	103	71	174
Behavioral health	**45**	**46**	**91**
Psychiatrist/psychiatric nurse	8	4	12
Psychologists	37	0	37
Licensed clinical social workers	0	42	42
Pharmacists	17.5	1	18.5
Care managers/coordinators/navigators/coaches	**0**	**361.5**	**361.5**
RN coordinator leaders	0	46	46
RN care coordinators	0	13	13
Care coordinators (non-RNs, including social workers, community health workers, and licensed practical nurses)	0	266	266
Diabetes educators/health coaches	0	13	13
Asthma educators/health coaches	0	8	8
CVD educators/health coaches	0	15.5	15.5
Total FTEs	**620.5**	**212**	**832.5**

Note:[1] RN care coordinators are also listed under the care manager/coordinator/navigator/coach category

XII. Conclusions and Implications of Target Workforce State Findings

The results presented in this report are conservative projections based, in part, on outcomes from literature that may not be completely generalizable to BPHC's patient population and assumptions that may change and are contingent on project implantation proceeding as planned. The findings of this report must therefore be examined while taking these influencing factors into account.

Defining the target workforce state in line with these DSRIP program goals requires information on the current health workforce supply in the PPS service area and how the demand for health care services and health professions is projected to evolve in relation to current supply, the development needs of DSRIP projects and external trends influencing healthcare delivery. Defining this target state and its workforce implications is essential to developing a detailed gap analysis between the current state assessment of the workforce and the projected future state under DSRIP, and a workforce transition roadmap for achieving the defined target workforce state.

The demand for health care services and providers within the PPS network will change over time independent of the anticipated DSRIP impact. Independent of DSRIP, this analysis projects that demand for physicians in the Bronx will grow about 6% between 2015 and 2020 (or by approximately 230 FTEs). Most of this growth stems from a growing and aging Medicare population. The projected PPS share of this borough-wide growth in physician demand is approximately 149 FTEs, of which about 43 FTEs will be primary care physicians. These projections suggest that any DSRIP-related changes in demand need to be understood in the context of broader trends affecting the demand for health care services and providers.

Although the estimated workforce impacts of several DSRIP projects (e.g., asthma management) may be less significant than others cited above, they help explain how DSRIP goals, including reductions in inappropriate care use, might be achieved through counseling, improved access to primary and preventive health services, and better care management for patients with chronic conditions. However, impact on FTEs may potentially be more pronounced in the numbers, mix and care settings of care managers, licensed educators, and care coordinators/navigators, reflecting the enhanced roles of these professions under DSRIP. As a result, there may potentially be opportunities to redeploy staff from inpatient settings where service demand is projected to decline to assume these types of roles.

A major contributor to achieving BPHC's DSRIP goals will likely be the Health Home at Risk Intervention Program. We calculate that implementing this model will have a potential impact on health care use and workforce demand greater than the calculated impact of any other PPS DRSIP project due to the large number of anticipated program participants.

This program also is a good example of the implications of shifts in workforce demand from hospital inpatient and ED settings to primary care and community-based care and the ability of the PPS to absorb what appear to be substantial DSRIP impacts on staffing. In this case we anticipate that many of the nursing staff currently employed in inpatient settings where

service demand is projected to decline may be redeployed to work in the non-acute care settings housing many of the new DSRIP projects.

As noted above, in some cases non-DSRIP impacts will likely offset or moderate the effects of DSRIP while in other cases they may magnify DSRIP workforce impacts. For example, PPS-wide full DSRIP project implementation is anticipated to reduce RN demand by approximately 213.5 FTEs. However, offsetting growth of approximately 209 RN FTEs will be required to meet the needs of a growing and aging population so the net impact is a projected 4.5 FTE decrease in RN demand. Strong anticipated increases in non-DSRIP related growth in nursing demand may, therefore, counterbalance DSRIP effects on nursing staff.

In conclusion, based on the best available modeling inputs and assumptions, these modeling results suggest that implementing DSRIP as designed will likely materially impact the BPHC network and healthcare delivery workforce, especially when combined with the projected impacts of demographic shifts and expanded health insurance coverage. This information will be used to inform development of a workforce transition plan and gap analysis intended to guide attainment of the BPHC future state.

XIII. Appendix 1: Technical Appendix

A. Healthcare Demand Microsimulation Model

This appendix provides technical documentation of the Health Care Demand Microsimulation Model (HDMM) developed by IHS Inc. with contributions to the model development from the Center for Health Workforce Studies at SUNY-Albany and the various organizations for which studies have been conducted using this model. This model was used for several parts of the DSRIP analysis—including estimation of the growing demand for health workers by occupation and medical specialty in the PPS service area independent of DSRIP (e.g., in response to population growth and aging across payer types) to help inform a gap analysis and forthcoming workforce transition roadmap. The model also provided information on average length of stay, average patient use of health care services by setting, and measures of provider productivity (e.g., provider-to-service use ratios) when data from the PPS providers was unavailable. This DSRIP analysis relies on a combination of use of the HDMM, information from the PPS regarding the number and characteristics of the Medicaid lives attributed to the PPS and the health care use patterns of this population, published findings in the literature, and data from external sources such as NY SPARCS.

We provide background information and an overview of the workforce model. Then, we document the data, methods, assumptions and inputs for the three main components of the demand model: the population file, the health care use equations, and the provider staffing parameters. The final section describes work to validate the model and model strengths and limitations. Additional documentation of the model is available online.[32]

This model is the primary source of workforce projections for the federal Bureau of Health Workforce for physicians, nurses, behavioral health providers, allied health providers, and other health occupations.[33] The model has also been adapted to make supply projections for many states (including ongoing work with the New York Department of Health in collaboration with the Center for Health Workforce Studies), health plans and hospital systems, and professional associations.[34]

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. The HDMM was designed to also run a limited set of scenarios around "need" for services. Need is defined as the health care services (and providers) required to provide a specified level of care given the prevalence of disease and other health risk factors. Need is defined in the absence of economic considerations or cultural considerations that might preclude someone from using available services.

The HDMM has three major components: (1) a population database with information for each person in a representative sample of the population being modeled, (2) health care use patterns that reflect the relationship between patient characteristics and health care use, and (3) staffing patterns that convert estimates of health care demand to estimates of provider demand. Demand for services is modeled by employment setting. Demand is also modeled by (a) diagnosis category for hospital inpatient care and emergency department visits, and (b) health care occupation or medical specialty for office and outpatient visits. The services demand projections are workload measures, and demand for each health profession

[32] The most detailed information on the model is available at https://cdn.ihs.com/www/pdf/IHS-HDMM-DocumentationApr2016.pdf.
[33] http://bhpr.hrsa.gov/healthworkforce/supplydemand/simulationmodeldocumentation.pdf
[34] An example of a recent application of the model is physician workforce projections for the Association of American Medical Colleges. https://www.aamc.org/download/458082/data/2016_complexities_of_supply_and_demand_projections.pdf

is tied to one or more of these workload measures. For example, current and future demand for primary care providers is tied to demand for primary care visits, demand for dentists is tied to projected demand for dental visits, etc. External factors—such as trends or changes in care delivery—can influence all three major components of HDMM.

B. Population Input Files

The population files contain person-level data for a representative sample of the population of interest. As adapted for modeling DSRIP, we created a population file for each New York county where for each person we identify their insurance type, demographics, and health risk factors. Creation of the population files starts with merging the following publicly available data:

- **Population files** for each county in New York and population projections through 2020 as obtained from the Cornell Program on Applied Demographics in Ithaca, NY.[35]
- **American Community Survey (ACS)**.[36] Each year the Census Bureau collects information on approximately three million individuals grouped into approximately one million households. For each person, information collected includes: demographics, household income, medical insurance status, geographic location (e.g., state and sub-state [for multi-year files]), and type of residency (e.g., community-based residence or nursing home). Each year HDMM is updated with the latest available file, and HDMM was updated with the 2014 ACS (n=3,132,610 observations) in November 2015. We used ACS data for the population in New York State.
- **Behavioral Risk Factor Surveillance System (BRFSS)**. [37] The Centers for Disease Control and Prevention (CDC) annually collects data on a sample of over 500,000 individuals. This survey is conducted in concert with each state's Department of Health. Similar to the ACS, the BRFSS includes demographics, household income, and medical insurance status for a stratified random sample of households in each state. The BRFSS, however, also collects detailed information on presence of chronic conditions (e.g., diabetes, hypertension) and other health risk factors (e.g., overweight/obese, smoking). One limitation of BRFSS is that as a telephone-based survey it excludes people in institutionalized settings (e.g., nursing homes) who do not have their own telephone. We combined the two latest BRFSS files (2013 and 2014) to create a joint file with close to one million individuals. HDMM was updated with the BRFSS files in November 2015. We used BFRSS data for the population in New York State.

[35] https://pad.human.cornell.edu/counties/projections.cfm
[36] https://www.census.gov/programs-surveys/acs/
[37] http://www.cdc.gov/brfss/

- **National Nursing Home Survey (NNHS)**.The Centers for Disease Control and Prevention collected data on a national sample of 16,505 nursing home residents in 2004 (the latest year for which individual data were collected). In addition to demographics, the NNHS collects information on chronic conditions and health risk factors of this population. Use of data on nursing home **residents** is important because this institutionalized population has much poorer health and different health care use patterns compared to their peers living in the community. The statistical match process that combines NNHS with the institutionalized population in ACS, as well as model calibration using current estimates of the size of the nursing home population helps ensure demographic representativeness of the current nursing home population.
- **EpiQuery: NYC Interactive Health Data**. EpiQuery is a web-based tool that provides access to health data collected by New York's Department of Health and other organizations. One of these sources is the New York City Community Health Survey—a telephone survey conducted annually by the DOHMH, Division of Epidemiology, Bureau of Epidemiology Services. This source provides data on the health and health risk factors of New Yorkers by borough. This information was used to calibrate the disease prevalence and health risk factor prevalence rates used in the HDMM.

The HWSM population database merges information from these sources using a statistical matching process that combines patient health information from the BRFSS and NNHS with the larger ACS file that has a representative population in New York. Using information on residence type, we stratified the ACS population into those residing in nursing facilities to be matched to people in the NNHS, and those not residing in nursing facilities to be matched to people in BRFSS (Exhibit A-1). For the non-institutionalized population, we statistically matched each individual in the ACS with someone in the BRFSS from New York from the same gender, age group (15 groups), race/ethnicity, insured/uninsured status, and household income level (8 levels). Individuals categorized as residing in a nursing home were randomly matched to a person in the NNHS in the same gender, age group, and race-ethnicity strata. 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. The metropolitan and non-metropolitan subsamples from this New York database were then combined with population data for each county based on demographics. Statistics for each county were generated for prevalence of chronic disease and behavioral risk factors, and compared to New York data (from EpiQuery) for model calibration.

Exhibit A-1: Population Database Mapping Algorithm

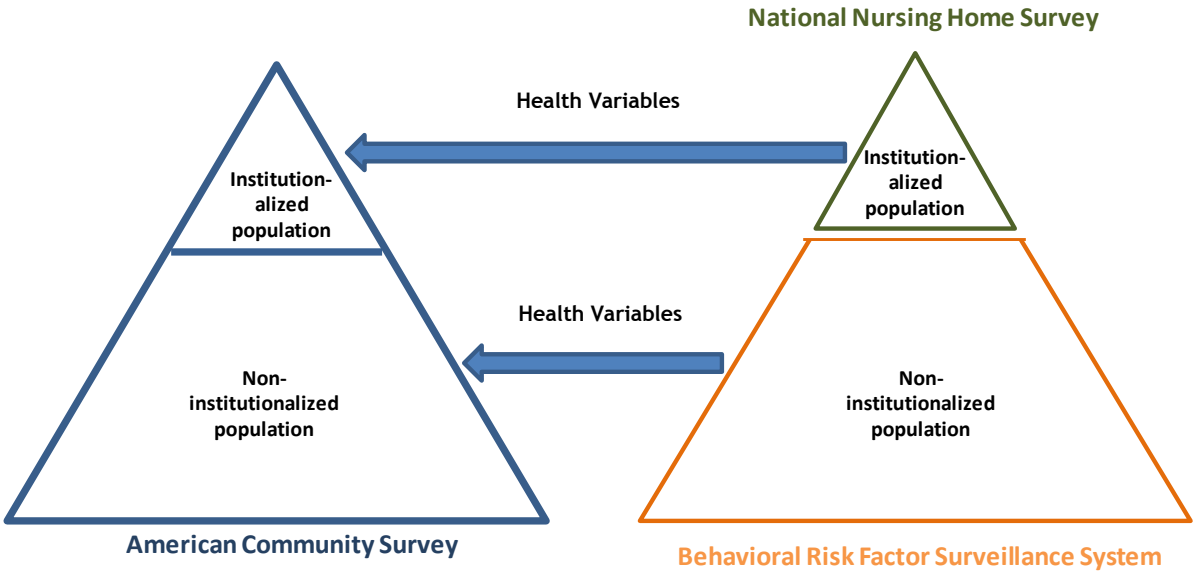

Exhibit A-2 summarizes the population characteristics in the final population database created for each county. This detailed information for each person captures systematic geographic variation in demographics, socioeconomic characteristics, and health risk factors (e.g., obesity, smoking, diabetes and cardiovascular disease prevalence).

Exhibit A-2: 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

C. Health Care Use

Projected future use of health care services, based on population characteristics and patterns of health-seeking behavior, produce workload measures used to project future demand for health care providers. HDMM uses prediction equations for health care use based on recent patterns of care use, but also can model scenarios where health care use patterns change in response to emerging care delivery models or other factors.

D. Demand Determinants and Prediction Equations

Health seeking behavior is generated from econometrically estimated equations using data from ~170,000 participants in the pooled 2009-2013 files of the Medical Expenditure Panel Survey (MEPS). We pooled multiple years of data to provide a sufficient sample size for regression analysis for smaller health professions and diagnosis categories. Over time, as a new year of data becomes available and is added to the analytic file the oldest year in the analysis file is dropped. We used the 2013 Nationwide Inpatient Sample (NIS), with ~8 million discharge records, to model the relationship between patient characteristics and length of hospitalization by primary diagnosis category.

Poisson regression was used to model annual office visits, annual outpatient visits, annual home health/hospice visits and inpatient days per hospitalization. These regressions were estimated separately for children versus adults. Separate regressions were estimated by physician specialty or non-physician occupations—e.g. dentists, physical therapists, psychologists—for office-based care. Likewise, separate regressions were estimated for occupations providing home health care. The dependent variable was annual visits (for office, outpatient, and home health) and inpatient days per hospitalization (for hospitalizations). The explanatory variables were the patient characteristics available in both MEPS or NIS for hospital length of stay and the constructed population file.

Exhibit A-3 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, have 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). 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-3: Sample Regressions: Adult Use of Cardiology Services

	Parameter	Office Visits	Outpatient Visits	Emergency Visits	Hospitalization
Race-Ethnicity	Hispanic	0.81**	0.73**	13	0.87**
	Non-Hispanic Black	0.78**	0.98	1.45**	1.41**
	Non-Hispanic White	10	10	10	10
	Non-Hispanic Other race	0.92**	0.82**	19	16
	Male	1.11**	1.48**	0.97*	17
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	10	10	10	10
	Smoker	0.74**	0.75**	1.11	16
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**	11	1.16**
	Arthritis	19**	1.23**	12	0.99
	Asthma	18**	1.10**	0.95	18
	History of cancer	18**	0.98	0.99	0.93
	Insured	2.48**	1.88**	0.89	12
	Medicaid	1.35**	1.42**	1.64**	1.71**
	Managed Care	0.97**	16**	11	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**	16	0.86	12
	$20,000 to < $25,000	0.84**	0.72**	1.15	19

	Parameter	Office Visits	Outpatient Visits	Emergency Visits	Hospitalization
	$25,000 to < $35,000	0.89**	18**	1.18**	15
	$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	10	10	10	10
Body Weight	Normal	10	10	10	10
	Overweight	16**	12	1.16**	1.22**
	Obese	1.11**	18**	1.13**	1.26**
	Metro Area	1.31**	12	14	0.89

Note: 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.

Logistic regression was used to model annual probability of hospitalization and annual probability of an emergency department visit for approximately two dozen categories of care defined by primary diagnosis code. The dependent variable for each regression is whether the patient had a hospitalization (or ED visit) during the year for each of the condition categories.

E. Estimating Health Care Use by Care Setting

As noted above, the HDMM generates health seeking behavior from econometrically estimated equations in the pooled 2008-2013 files of the Medical Expenditure Panel Survey. Forecasting equations for healthcare use are then applied to produce estimates of numbers of patient visits and hospitalizations by specialty, occupation and diagnosis by care setting. For example, when modeling demand for psychiatrists the HDMM projects current and future office and outpatient visits to a psychiatrist and emergency visits and hospitalizations for patients with ICD-9 primary diagnosis codes in the 290-319; and 94.1-.59 range under Major Diagnostic Category 19: Mental Diseases and Disorders.

These health care service demand projections, when combined with provider staffing and productivity estimates, provide the basis for estimating current demand and projecting future demand for FTE behavioral health and other health occupations modeled. To illustrate, below is presented information on methods, workload drivers and data sources for modeling hospital inpatient service demand.

F. Hospital Inpatient Service Demand

The 2008-2013 MEPS and the 2012 Nationwide Inpatient Sample (NIS) are used to model demand for hospital inpatient services in short-term general acute care hospitals as well as 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-4).

To model inpatient length of stay the 2012 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-4: Hospital Inpatient Demand Drivers by Condition Code and Profession

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/documents/ICD-10-for-Radiation-Oncology.pdf)	Radiation Oncology

Medical condition codes (ICD-9 CM)		Specialty/NPC Profession
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
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

G. Health Care Use Calibration

MEPS is a representative sample of the non-institutionalized population, and although the health care use prediction equations are applied to a representative sample of the entire U.S. population, parts of the model require calibration to ensure that the predicted health care use equals actual use. Applying the prediction equations to the population for 2011 through 2013 creates predicted values of health care use in those years (e.g., total hospitalizations, inpatient days, and ED visits by specialty category, and total office visits by physician

specialty). For model calibration, we compared predicted national totals to estimates of national total hospitalizations and inpatient days, by diagnosis category, derived from the 2013 NIS. National ED visits and office visits came from the 2011 NHAMCS and 2012 NAMCS, respectively. Multiplicative scalars were created by dividing national estimates by predicted estimates. For example, if the model under-predicted ED visits for a particular diagnosis category by 10% then a scalar of 1.1 was added to the prediction equation for that diagnosis category. Applying this approach to diagnosis/specialty categories, the model's predicted health care use was consistent with national totals for most settings. Setting/category combinations where the model predicted less accurately (and therefore required larger scalars) tended to cluster around diagnosis categories in the ED characterized by lower frequency of visits likely due to a combination of small sample size in both MEPS and NHANES.

For DSRIP modeling, the health care use patterns were further calibrated to the populations in each New York county modeled (using SPARCS data or data from the PPS where available) to reflect that patients in New York can have care use patterns that differ from national peer group.

H. Health Workforce Staffing Patterns

This section discusses the assumptions and methods used to convert demand for services into demand for health care workers. Demand for health care workers is derived from the demand for health care services. Services provided (e.g., visits, hospitalizations, procedures, or prescriptions written) or demand drivers for services for which there are no survey data (e.g., total population, population over age75, and school aged children) in each setting were compared with the number of providers working in that setting. 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.

Assuming that the base year demand for services in each setting was fully met by the available professionals in that setting, the base year staffing ratio was calculated by dividing the volume of service used by the number of health care professionals employed in each setting. For professions that provide services in a single setting, base year utilization was divided by the base year supply to derive the staffing ratio for that profession. The staffing ratio was then applied to the projected volume of services to obtain the projected demand for providers in every year after the base year.

The baseline scenarios in HDMM (used for modeling how care use in each New York county would change over time in the absence of DSRIP) assumed that care delivery patterns remained unchanged over time given the demand for health care services. However, the number and mix of health professionals required to provide the level of health care services demanded is influenced by how the care system is organized and care is reimbursed, provider scope of practice requirements, economic constraints, technology, and other factors. Emerging health care delivery models and advances in technology may alter future health care delivery, changing the relationship between patient characteristics and the probability

of receiving care in a particular setting. The DSRIP modeling used information from the published literature and from the PPS's internal planning documents) to identify how care delivery and staffing will change with implementation of individual DSRIP projects.

I. HDMM Validation

Model validation activities continue on an ongoing basis as a long term process of 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 submission of peer-reviewed manuscripts the model described here continues 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).

J. HDMM Strengths and Limitations

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.

XIV. APPENDIX 2: Additional Information

Project 2.b.iv: Care Transitions to Reduce 30-day Readmissions

The estimated volume of hospitalizations by diagnosis category for Medicaid beneficiaries through 2020 in the PPS service area and the average length per stay comes from the microsimulation model. To estimate underlying rates of readmission for high-risk patients, we used national rates for the top 10 conditions with the most all-cause 30-day readmission rates for Medicaid patients (see *Exhibit A-5*). Together these top 10 conditions account for about one third (34%) of total Medicaid readmissions. The rates range from a high of 30.4% readmission for patients with an original admission diagnosis of congestive heart failure (CHF), to 8.4% readmission for patients with an original diagnosis of "other complications of pregnancy."

Exhibit A-5: Ten conditions with the most all-cause, 30-day readmissions for Medicaid patients (aged 18-64 years)

Principal diagnosis for index hospital stay*	Number of all-cause, 30-day readmissions	Readmissions as % of total Medicaid readmissions	Readmission rate (per 100 admissions)
Mood disorders	41,600	6.2	19.8
Schizophrenia and other psychotic disorders	35,800	5.3	24.9
Diabetes mellitus with complications	23,700	3.5	26.6
Other complications of pregnancy	21,500	3.2	8.4
Alcohol-related disorders	20,500	3	26.1
Early or threatened labor	19,000	2.8	21.2
Congestive heart failure (CHF); non-hypertensive	18,800	2.8	30.4
Septicemia (except in labor)	17,600	2.6	23.8
Chronic obstructive pulmonary disease (COPD) and bronchiectasis	16,400	2.4	25.2
Substance-related disorders	15,200	2.2	18.5
Total	230,200	34.1	20

Similarly, we assessed the published literature on the potential impact of care transition interventions to reduce 30-day readmission—reviewing the literature on Project RED, BOOST and other successful care transition interventions **(**see *Exhibit A-6***).** When multiple studies showed findings for the same medical condition, we averaged the reduced readmission rate across studies to derive an estimate for modeling.

- **Cardiology-related readmissions** (heart failure, myocardial infarction): The percent reduction in readmission rate is 37% based on the averaged results from studies 1-4.
- **Pulmonology-related readmissions** (COPD, pneumonia): The percent reduction in readmission rate is 37% based on the averaged results from studies 5-8.

- **Diabetes-related readmissions**: The percent reduction in readmission rate is 31% based on study 9.
- **Behavioral health (mental health and substance abuse)**: The percent reduction in readmission rate is 23% based on the averaged results from studies 11-14.

The overall calculated intervention impact is a 30% reduction in readmission rates.

Exhibit A-6: Summary of 30-day Readmission Intervention Impact

Study #	Condition	Pre-Intervention Readmission Rate	Post-Intervention Readmission Rate	% Reduction in Readmission Rate	Source
1	CHF [1]	22.5%	7.7%	-66%	St. Mary's Medical Center (LB) http://www.ahrq.gov/policymakers/case-studies/201522.html
2	CHF [1]	7.6%	5.5%	-28%	St. Mary's Medical Center (SF) http://www.ahrq.gov/policymakers/case-studies/201522.html
3	CHF [1]	15.4%	9.1%	-41%	Memorial Hospital http://www.ahrq.gov/policymakers/case-studies/201507.html
5	CHF, acute myocardial infarction, and pneumonia [1]	26%	15%	-42%	VBMC-Harlington http://www.ahrq.gov/policymakers/case-studies/201420.html
4	CHF [1]		14-16%		
6	COPD [1]	19%	11.7%	-38%	Penn Medicine Chester County Hospital http://www.ahrq.gov/policymakers/case-studies/201506.html
7	COPD [1]	20.6%	11.8%	-43%	Memorial Hospital http://www.ahrq.gov/policymakers/case-studies/201507.html
8	Pneumonia [1]	10%	9.7%	-3%	Memorial Hospital http://www.ahrq.gov/policymakers/case-studies/201507.html
9	Diabetes	16%	11%	-31%	Healy et al. (2013) http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3781555/

Study #	Condition	Pre-Intervention Readmission Rate	Post-Intervention Readmission Rate	% Reduction in Readmission Rate	Source
10	Diabetes	1.79/patient	1.18/patient	-34%	Naylor et al. (2004)[38]
11	Mixed [1]			-32%	
12	Mixed [1]	18.6%	16.6%	-11%	Nacogdoches Memorial Hospital http://www.ahrq.gov/policymakers/case-studies/201501.html
13	Mixed [1]	23.3%	15%	-36%	VBMC-Brownsville http://www.ahrq.gov/policymakers/case-studies/201420.html
14	Mixed (All Payer) [1]	7.5%	6.5%	-13%	Bakersfield Memorial http://www.ahrq.gov/policymakers/case-studies/201522.html
15	Mixed (Medicare) [1]	25%	11.3%	-55%	Bakersfield Memorial http://www.ahrq.gov/policymakers/case-studies/201522.html

[38] The transitional care intervention developed by Naylor et al. (2004) targeted patients who were hospitalized for CHF and used highly trained advanced practice nurses (APNs) to administer the intervention.2 Naylor's intervention was highly structured and effective. The APNs met with patients in the hospital and in their home shortly after discharge to provide intense coaching and education on medications, self-care, and symptom identification. The intervention lasted a total of 12 weeks, and patients were followed for one year. http://www.champ-program.org/static/BROWN%20FULL%20REPORT%203%2013%2009v2_ah2.pdf